



**2023
DEMAND-SIDE
MANAGEMENT
& BENEFICIAL
ELECTRIFICATION
PLAN**

Electric and Natural Gas

Public Service Company of Colorado

Proceeding No. 22A-XXXEG

July 1, 2022

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Document Layout

The Plan has four major sections, summarized below:

1. **Executive Summary** – provides a high-level overview of the strategic direction of the overall 2023 Demand-Side Management and Beneficial Electrification Plan; provides program and product level forecasts and budgets; identifies budgets by cost category; and addresses customer participation.
2. **Program and Product Summaries** – a high-level summary of each program area followed by specifics of each product offering.
3. **Cost-Benefit Analyses** – provides the electric and natural gas Portfolio and Program cost-benefit analysis results for the Company’s 2023 Demand-Side Management and Beneficial Electrification offerings.
4. **Appendices** – presents a list of acronyms; key terms; product rankings; description of budget categories; avoided costs; natural gas Demand Side Management \$/Therm and Acknowledgement of Lost Revenue methodology; electric load shape documentation; and the technical reference manual (deemed savings and forecast technical assumptions).

Executive Summary: Plan Overview

Public Service Company of Colorado (“Public Service” or “the Company”) hereby submits this combined electric and natural gas 2023 Demand-Side Management (“DSM”) and Beneficial Electrification (“BE”) Plan (“2023 DSM & BE Plan” or “Plan”) to the Colorado Public Utilities Commission (“Commission”). This Plan is the result of an extensive effort by the Company to assess market potential in our Colorado service territory and devise a plan to reach the Commission-approved annual energy savings goal by offering an inclusive and cost-effective DSM+BE portfolio, delivered to customers via proven marketing techniques.

The Company’s 2023 DSM & BE Plan is grounded in a continuance of preceding years’ successful approaches, in combination with necessary adjustments made to improve the Company’s existing DSM and BE offerings to reflect market shifts and integrate emerging technologies, while being responsive to the Commission’s Decision¹ in the 2017 DSM Strategic Issues Proceeding (Proceeding No. 17A-0462EG). That decision resulted in increased energy savings goals for 2019-2023,² an electric energy efficiency budget of \$78 million with the flexibility to exceed the budget by 20 percent, and modifications to the Company’s financial incentive mechanism to encourage goal achievement.³

This Plan meets the requirements of relevant Commission decisions and Rules,⁴ while striving to maintain cost-effectiveness in a dynamic environment of volatile natural gas prices, increasing renewable energy generation, and increasingly stringent codes and standards. Additionally, this Plan addresses the new legislative requirements set forth in Senate Bill 21-246 (“SB 21-246”), which relate to BE. In the interests of building on successful implementation of current existing BE offerings made available through the Company’s last 2021-22 DSM plan, Public Service is filing this Plan as a combined DSM and BE Plan for calendar year 2023.

To pursue the Commission-approved goals for its the DSM portfolio (set forth in the 2017 DSM Strategic Issues proceeding), Public Service has developed the 2023 DSM & BE Plan with the following key objectives in mind:

- Leveraging robust project queues (for products with long planning/construction cycles, such as New Construction);
- Continuing the use of midstream rebate approaches (Cooling and Lighting Efficiency);
- Advancing and refining promising new pilots (for example, Residential Battery Demand Response and Dynamic Electric Vehicle (“EV”) Optimization); and,
- Accelerating market penetration for BE technologies through increased promotions and trade channel development.

¹Decision No. C18-0417 in Proceeding No. 17A-0462EG.

²The previous electric energy saving goals were approved Decision No. C14-0731, where the goal was set at 400 GWh annually.

³Beginning in 2019, the Company is eligible for a performance incentive of 40% of incremental net benefits above 280 GWh up to 550 GWh upon achievement of at least 400 GWh.

⁴Commission’s Decision Nos. C11-0442 and C11-0645 issued in Proceeding No. 10A-554EG, Decision No. C14-0731 issued in Proceeding No. 13A-0686EG, and Decision No. C14-0731 in Proceeding No. 13A-0686EG; and Rules 4750 to 4760 of the Commission’s Rules Regulating Gas Utilities and Pipeline Operators (the Gas DSM Rules).

Public Service is optimistic that successful implementation of this Plan will be attributable, at least in part, to active participation by stakeholders. These stakeholders include customers, the Colorado Energy Office (“CEO”), Commission Staff, the Utility Consumer Advocate, local governments, environmental and energy efficiency advocates, external consulting groups, efficient equipment manufacturers, distributors and vendors, installation contractors, customer advocates, and other interested stakeholders. Each of the Company’s DSM and BE products offers its own opportunities for stakeholder involvement and feedback. In addition, Public Service will continue to host quarterly DSM Roundtable Meetings as a forum for open dialogue and discussion.⁵

2023 DSM & BE Plan

In this filing, Public Service forecasts to achieve annual energy savings of approximately 491 gigawatt hours (“GWh”) of electric energy savings and 874,462 dekatherms (“Dth”) of natural gas savings in 2023, at forecasted budget of \$92.3 million (electric) and \$23.5 million (gas), respectively. The 2023 electric energy savings forecast is short of the 500 GWh goal established by the Commission in Proceeding No. 17A-0462EG (Decision No. C17-0417) and was informed by current market conditions, recent portfolio results, and the approved budget set in the 2017 Strategic Issues proceeding. The Company will nonetheless strive to meet and exceed the Commission-approved goal if possible. The Plan is also designed to achieve incremental electric demand reduction from energy efficiency, totaling 100 MW in 2023 compared to the annual demand reduction goal of 75 MW from energy efficiency.⁶ As a combined DSM and BE plan, the Company’s forecasted budgets, achievements, and participation for the Company’s BE offerings are included in these forecasts and are included within their parent DSM product forecast throughout this Plan. Cumulative demand reduction impacts expected from the Company’s demand response (“DR”) programs and pilots and compliance with Commission-approved DR goals are discussed in the Demand Response Program section of the Plan. Table 1 below provides a summary of the budgets, energy savings forecasts, and demand savings associated with the Company’s overall portfolio of energy efficiency and DR programming with BE incorporated.

⁵The quarterly DSM Roundtable meetings have been held since the 2009/2010 Plan. The meetings offer a chance for interested stakeholders to review and discuss DSM achievements and any programmatic changes with the Company.

⁶Decision No. C18-0417 in Proceeding No. 17A-0462EG. This demand reduction goal was not modified as part of Decision No. C18-0743.

Table 1: 2023 DSM & BE Plan Budgets & Forecasted Energy and Demand Savings

	Budget	Incremental Demand Forecast (Gen kW)	Energy Savings Forecast (Gen kWh or Dth)
2023 – Electric			
Energy Efficiency Programs	\$ 84,144,443	99,961	488,315,883
Energy Efficiency Indirect Program	\$ 8,183,861	-	-
Total 2023 Electric EE	\$ 92,328,303	99,961	488,315,883
Demand Response Program	\$ 21,543,677	104,778	2,713,524
Demand Response Indirect Program	\$ 3,086,176	-	-
Total 2023 Electric DR	\$ 24,629,853	104,778	2,713,524
2023 Electric TOTAL	\$ 116,958,156	204,739	491,029,407
2023 – Natural Gas			
Energy Efficiency Programs	\$ 21,473,319	0	874,462
Indirect Program	\$ 2,007,310	0	0
2023 Natural Gas TOTAL	\$ 23,480,629	0	874,462
2023 TOTAL	\$ 140,438,785	204,739 kW	491,029,407 kWh 874,462 Dth

Modifications in 2023

While many of the DSM products included in this Plan are the same as those that have been implemented since 2009, products have naturally evolved since that time to promote cost-effectiveness, adapt to the marketplace, and incorporate increasing policy interest in BE. The evolution of products has been documented through previous DSM plans, as well as through the 60-Day Notice process first established in the 2009/2010 Plan Stipulation approved in Proceeding No. 08A-366EG, to afford the Company discretion to make mid-year changes to DSM plans in order to achieve the greatest level of energy savings.⁷

This year’s Plan also reflects several additional noteworthy changes, including:

- Updated avoided costs and technical assumptions to reflect current data including use of EnCompass modeling for the avoided cost of energy.
- New product additions to the portfolio launched via 60-Day Notice under the 2021-22 DSM Plan and continued in the 2023 DSM & BE Plan, including the Income Qualified (“IQ”) BE Pilot.
- Modified BE measures in the Residential Heating & Cooling offering, including increased rebates and updated efficiency requirements.
- Continued evaluation of BE projects for Commercial and Industrial customers through the Custom Efficiency product.
- Continuation and expansion of EV charging management offerings under the EV Optimization product.

⁷ Decision No. R08-1243. Per the Settlement Agreement, 60/90-Day Notices are required for any proposal to add a new DSM product, reduce rebate levels, adopt new or discontinue existing measures, or change technical assumptions or eligibility requirements. Details of 60-Day Notices are posted at:

https://www.xcelenergy.com/company/rates_and_regulations/filings/colorado_demand-side_management.

- The addition of several new offerings, including to the following products:
 - ENERGY STAR New Homes;
 - Home Lighting & Recycling
 - Lighting Efficiency;
 - Multifamily Buildings;
 - Multifamily Weatherization;
 - Non-Profit;
 - Residential Demand Response;
 - Residential Heating & Cooling;
 - Single-family Weatherization;
 - Small Business Energy Solutions;
 - Small Commercial Building Controls;
 - Strategic Energy Management; and,
 - Whole Home Efficiency (formerly Home Performance with ENERGY STAR).
- Continuation of consolidated, holistic products introduced in the 2021-22 DSM Plan including:
 - Business HVAC+R Systems;
 - Small Business Energy Solutions; and,
 - Residential Heating & Cooling.
- Continuation of Geo-targeting pilot.

The Company further notes that natural gas program expenditures have increased relative to the 2021-22 DSM Plan to approximately \$23.5 million. This is more than twice the minimum spend requirement, therefore the Company is seeking a variance to authorize it to operate under an increased budget.

Last, the Company further notes that SB 21-246 established a number of new labor standards with respect to its BE offerings. Notably, the bill applies to “all necessary mechanical, plumbing, and electrical work performed in connection with a project undertaken pursuant to a beneficial electrification program ... and for which a customer of an investor-owned electric utility applies for a rebate directly from the utility.” The statute allows utility employees to conduct the list, and also directs the Company to publish a Certified Contractor List. Public Service is aware of these provisions and will implement them as appropriate. More information will be made available on its DSM website at:

https://www.xcelenergy.com/company/rates_and_regulations/filings/colorado_demand-side_management.

2023 Energy and Demand Savings Forecasts by Program

Public Service continues to offer a full portfolio of electric and natural gas DSM and BE products and offerings that serve all customer segments. Public Service will market its energy efficiency and BE offerings to each customer segment based on the number of customers, relative size of each customer, and amount of conservation potential at a customer site.

The energy and demand savings forecasts, and budgets, for these programs are summarized below.

Business Electric and Gas Programs

Energy efficiency sales to the Business Programs are achieved through Public Service's Account Managers, end-use equipment vendors, and energy service companies ("ESCOs"), as well as our Business Solutions Center. Proposed forecasts and budgets for the Business Program in 2023 are:

Business Electric Program

- Electric budget \$52,670,954
- Electric savings 71,225 Net Gen. kW and 351.1 Net Gen. GWh

Business Natural Gas Program

- Natural gas budget \$1,823,152
- Natural gas savings 146,062 Dth

Although economies of scale enable the business segment to offer a comparably lower cost of DSM per unit of energy saved, business DSM has proven to be some of the most difficult savings to achieve over time. This is the case because business customers tend to require very short paybacks on investments and do not readily respond to traditional mass-market appeals. Further, on the natural gas side, the majority of large customers, who present some of the largest energy efficiency potential, are gas transport customers who will neither pay into the Demand-Side Management Cost Adjustment ("DSMCA"), nor be eligible to participate in the program offerings.

Residential Electric and Gas Programs

Public Service has approximately 1.4 million electric and 1.4 million natural gas customers in its residential market in Colorado.⁸ The Residential Program includes single-family homes, town homes, apartments, and condominiums. Public Service developed its Plan to recognize that the residential market requires choices of conservation opportunities that accommodate various lifestyles, convenient participation, and information to make wise energy choices presented in useable and understandable forms and formats. The energy savings and demand forecasts and budgets for the Residential Program in 2023 are:

Residential Electric Program

- Electric budget \$26,622,147
- Electric savings 24,696 Net Gen. kW and 107.9 Net Gen. GWh

Residential Natural Gas Program

- Natural gas budget \$13,089,724
- Natural gas savings 631,108 Dth

IQ Electric and Gas Programs

The primary objective of the IQ Program is to reduce energy consumption in IQ customers' homes and thereby reduce customer bills. The energy savings and demand forecasts and budgets for the IQ Program in 2023 are:

IQ Electric Program

- Electric budget \$4,851,342
- Electric savings 4,040 Net Gen. kW and 29.3 Net Gen. GWh

IQ Natural Gas Program

- Natural gas budget \$6,560,443
- Natural gas savings 97,292 Dth

Indirect Products and Services

The Company's Indirect Products and Services, for the most part, support the direct products in the DSM & BE portfolio. The Education/Market Transformation area includes seven customer-facing products for providing education, training, and product demonstration, and marketing DSM rebates and incentives. The Planning and Research area includes four services to support the DSM portfolio: Planning and Administration; Program Evaluation, Measurement, and Verification; Market Research; and, Product Development. While the majority of the Indirect Products and Services do not have savings forecasts, the Company plans to continue offering its energy efficiency Geo-targeting Pilot; however, it does not result in incremental energy or demand savings. Proposed budgets for Indirect Products and Services in 2023 are:

Indirect Products & Services Electric

- Electric budget \$8,183,861

Indirect Products & Services Natural Gas

- Natural gas budget \$2,007,310

⁸ Electric and natural gas customers as January 2022.

Market Transformation and Customer Education

In this Plan, Public Service is continuing to place increasing emphasis on programs and services that help to redefine the energy efficiency and beneficial electrification marketplace through market transformation and customer education. In the Company's experience, market transformation and customer education remain some of the lowest cost ways to influence customer decisions and behaviors for the long term.

Public Service defines market transformation as a strategy for influencing the adoption of new techniques or technologies by consumers. The objective is to overcome barriers within a market through coordinating tactics such as education, training, product demonstration, and marketing, often conducted in concert with rebates or other financial incentives.

Activities for which the Company will not attempt to measure savings have an assumed Modified Total Resource Cost ("MTRC") ratio of 1.0.⁹

Pilot Products

In Proceeding No. 07A-420E, the Commission distinguished pilots from existing or continuing DSM products. These would be products that are testing unproven delivery methods, markets, or technologies; and for any of these reasons, pilot products may not necessarily achieve an MTRC ratio equal to or greater than 1.0. For market transformation programs, such as pilots, for which the Company intends to claim savings to count against energy savings or demand reduction goals, the Commission requires detail on how the measurement and verification of such savings will be accomplished, and how those efforts are linked to credit for savings.¹⁰

Public Service plans to offer three pilots in 2023 that are fully described in the Indirect Products & Services and Demand Response sections of this Plan, including the Company's overall pilot requirements. These pilots include:

- IQ Beneficial Electrification Pilot (2023 – BE)
- DSM Geo-targeting Pilot (2023 – distribution investment deferral)
- Residential Battery DR Pilot (2023 – DR)

Competitive Acquisition of DSM Resources: Third-Party Providers

As a result of the Commission's order in Proceeding No. 10A-554EG, Public Service is required to identify the specific products that are open to competitive bidding for implementation.¹¹ Additionally, Public Service is to set forth the specific criteria by which these bids will be evaluated.¹² Public Service evaluates all bids in two phases, the Pre-qualification phase and the Bid Evaluation phase. The Pre-qualification phase ensures that request for proposal ("RFP") respondents meet minimum requirements to conduct business on the Company's behalf. Respondents are evaluated on safety, financial health, terms and conditions adoption, and prior

⁹ The MTRC test measures the net costs of a demand-side management program as a resource option based on the total costs of the program, including both the participants' and the utility's costs. The presumed MTRC of 1.0 for indirect market transformation programs was approved by the Commission in Decision No. C08-0560 in Proceeding No. 07A-420E, at ¶141 and reaffirmed by Decision No. C11-0442 in Proceeding No. 10A-554EG, at ¶99.

¹⁰ Decision No. C11-0442 in Proceeding No. 10A-554EG, at ¶99.

¹¹ Decision No. C11-0442.

¹² Decision No. C11-0442, at ¶81 in Proceeding No. 10A-554EG.

experience. These are also factors in the Bid Evaluation phase but have lower weightings due to the initial evaluation. This helps to ensure business risk to the Company is as low as possible.

The Bid Evaluation phase is based upon up to eight factors and is the phase where the risk of the supplier performing is weighed against the cost to perform. These factors and their weighting are detailed below. Weighting may be adjusted based on specific business needs.

Table 2a: Bid Evaluation Factors and Weighting

Evaluation Factors	Explanation	Weighting
Cost	<ul style="list-style-type: none"> • Cost transparency • Total cost of ownership • Bid amount 	45% - 65%
Ability To Perform	<ul style="list-style-type: none"> • Prior experience • Feasible plan • Quality of project team • Ability to meet schedule 	30% - 50%
Safety	<ul style="list-style-type: none"> • Historical safety record 	5% - 15%
Terms & Conditions	<ul style="list-style-type: none"> • Adherence to Xcel Energy standards 	5% - 10%
Financial Health	<ul style="list-style-type: none"> • Pre-qualifier in RFP. 	Pre-qual only
Diversity	<ul style="list-style-type: none"> • Firm’s commitment to diversity and inclusion. 	0% - 15%
Green Business Practices	<ul style="list-style-type: none"> • Firm’s commitment to environmental sustainability. 	0% - 15%
Project Specific Needs	<ul style="list-style-type: none"> • Dependent on project. <i>Examples:</i> field presence in jurisdiction, expertise with specific market segment, unique or proprietary software, etc. 	0% - 15%

The table below identifies all products that have a third-party implementer and further identifies which of these products may have new contracts bid or be sole-sourced in 2023. Contracts may be sole-sourced for a variety of reasons, such as the contracted party having unique access to market players or proprietary tools that another firm would not have. Public Service tracks and reports within its Annual DSM/BE Status Reports the administrative costs that are incurred when conducting RFPs and any additional costs for managing third-party providers, as required in Decision No. C11-0645.¹³

¹³ Decision C11-0645 at ¶14 in Proceeding 10A-554EG.

Table 2b: 2023 Products with Third-Party Implementers

Program	RFP Anticipated*	Existing Contract Type
Business Energy Analysis		Sole-sourced (2020)
Business Energy Assessments (Building Assessment & Targeted Building Assessment)	2022	Competitive Bid (2021)
Business Energy Assessments (Commercial Streamlined Assessment)		Sole-sourced (2020)
Business HVAC+R Systems (Cooling Midstream)	2023	Sole-sourced (2022)
Critical Peak Pricing		Competitive Bid (2018)
Data Center Efficiency (New Construction)	Sole-sourced 2023	Sole-sourced (2021)
Electric Vehicle Optimization (Dynamic)		Competitive Bid (2021)
Electric Vehicle Optimization (Static)		Competitive Bid (2021)
Energy Efficient Showerhead	2023	Sole-sourced (2020)
Energy Savings Kit	2023	Competitive Bid (2020)
ENERGY STAR New Homes		Competitive Bid (2020)
Home Energy Audits	2023	Competitive Bid (2012)
Home Energy Insights (Energy Feedback)	2022	Competitive Bid (2019)
Home Energy Squad	2023	Competitive Bid (2015)
Home Lighting & Recycling	Sole-sourced 2023	Sole-sourced (2020)
Home Performance with ENERGY STAR	2023	Competitive Bid (2012)
Lighting Efficiency (Midstream)	Sole-sourced 2022	Sole-sourced (2021)
Multifamily Buildings	2022	Competitive Bid (2019)
Multifamily Weatherization		Sole-sourced (2015)
New Construction	2022	Competitive Bid (2015)
Non-Profit		Sole-sourced (2015)
Partners in Energy		Competitive Bid (2022)
Peak Partner Rewards		Competitive Bid (2018)
Refrigerator & Freezer Recycling	Sole-sourced 2022	Sole-sourced (2019)
Residential Battery Demand Response		Competitive Bid (2019)
Residential Demand Response (Saver's Switch & AC Rewards)		Sole-sourced (2021)
Residential Demand Response (Smart Water Heaters)		Sole-sourced (2021)
School Education Kits	Sole-sourced 2023	Competitive Bid (2013)
Single-Family Weatherization		Competitive Bid (2014)
Small Business Solutions		Sole-sourced (2020)
Small Commercial Building Controls		Sole-sourced (2020)
Strategic Energy Management	2023	Competitive Bid (2018)
Whole Home Efficiency	2023	Competitive Bid (2012)

*Note: Dates reflect current estimates and are subject to change. RFPs may be conducted in anticipation of Commission approval of the 2023 DSM & BE Plan; any awarded contracts will be modified or voided as needed to reflect the terms of the final approved Plan.

History of The Company’s DSM and BE Activity in Colorado

Over the last 20 years, Public Service has entered into several regulatory settlements involving DSM in conjunction with its integrated resource/least-cost planning process. The following table identifies those significant to its DSM programming:

Table 3a: Regulatory Settlements Involving DSM and Resource Planning

Proceeding	Proceeding No.	Decision No.	Summary
1999 Integrated Resource Plan	00A-008E	C00-1057	<ul style="list-style-type: none"> • 124 MW (~21 MW) of DSM resources • \$75 million
2003 Least Cost Resource Plan	04A-214E	C05-0049	<ul style="list-style-type: none"> • 320 MW (Avg. of 40 MW per year) • 800 GWh (Avg. of 100 GWh per year) • \$196 million • 2006 – 2013
2008 CPCN at Fort St. Vrain Generation Station	07A-469E	C08-0369	<ul style="list-style-type: none"> • Expansion of ISOC and Saver’s Switch programs • Initiation of Third-Party Demand Response Program
2011 Electric Resource Plan	11A-869E	C13-0094 & C13-0323	<ul style="list-style-type: none"> • Informed the methodologies and values for avoided costs

In addition, legislation and the regularly filed Strategic Issues proceedings at the Public Utilities Commission have addressed major policy issues for the Company’s DSM and BE programs. The following table identifies the applicable legislation and proceedings:

Table 3b: Legislative and Regulatory Policy Directives for DSM

Proceeding	Proceeding No.	Decision No.	Summary
House Bill 07-1037	N/A	N/A	<ul style="list-style-type: none"> • Established intent of DSM programs • Established ten-year goals for energy and demand
2010 Strategic Issues	10A-554EG	C11-0442	<ul style="list-style-type: none"> • Established energy and demand savings goals • Established incentive mechanism • Defined program administration requirements

Table 3b: Legislative and Regulatory Policy Directives for DSM (con't)

Proceeding	Proceeding No.	Decision No.	Summary
2013 Strategic Issues	13A-0686EG	C14-0731	<ul style="list-style-type: none"> • Increased energy and demand savings goals • Modified the incentive mechanism • Established budget cap
House Bill 17-1227	N/A	N/A	<ul style="list-style-type: none"> • Extended energy and demand savings goals though 2028
2017 Strategic Issues	17A-0462EG	C18-0417	<ul style="list-style-type: none"> • Increased energy savings goals and budget • Modified incentive mechanism • Grandfathering of ISOC customers
Senate Bill 19-236	N/A	N/A	<ul style="list-style-type: none"> • Established the valuation and application of the Social Cost of Carbon for Electric DSM
Senate Bill 21-246	N/A	N/A	<ul style="list-style-type: none"> • Established intent of BE programs • Established regulatory process to develop BE goals
Senate Bill 21-1238	N/A	N/A	<ul style="list-style-type: none"> • Established the valuation and application of the Social Cost of Carbon and the Social Cost of Methane for Gas DSM
Winter Storm Uri	21A-0192EG	R22-0279 ¹⁴	<ul style="list-style-type: none"> • Requires evaluation of economic-based and winter-specific Demand Response programs

¹⁴ The Commission's final written decision in Proceeding 21A-0192EG is still pending at time of filing of this Plan; Public Service will update its 2023 DSM & BE Plan if necessary and/or appropriate in the future.

The following Figures 1 and 2 below show Public Service’s electric and natural gas savings and expenditures over the past fourteen years.

Figure 1: Historical Electric Program Savings and Expenditures

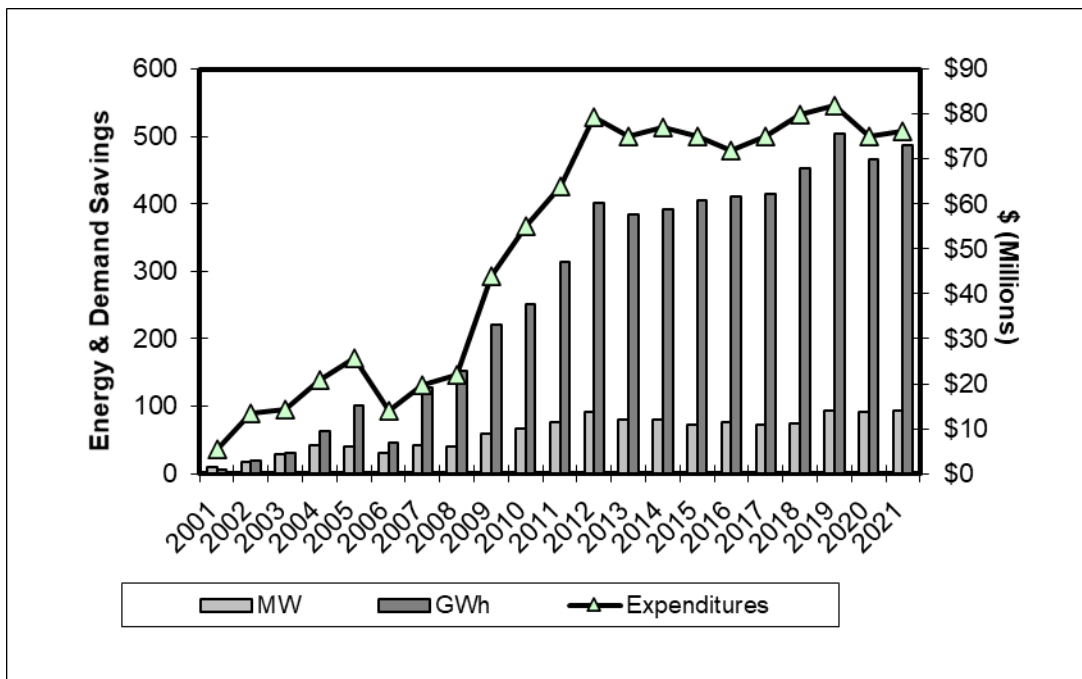
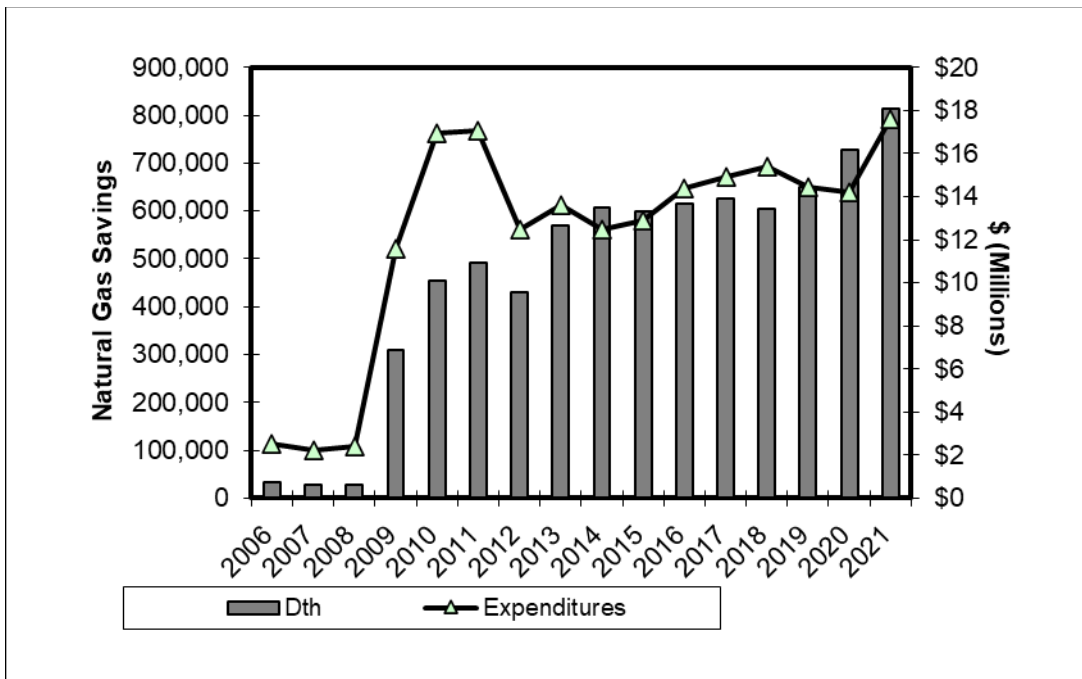


Figure 2: Historical Natural Gas Program Savings and Expenditures



Executive Summary: Electric DSM & BE Tables

The following tables summarize the forecasted impacts of the Company’s proposed electric DSM & BE portfolio for 2023, including anticipated expenditures, energy savings, demand response, costs by budget category, and MTRC test ratios.

Table 4a: Public Service’s 2023 Electric DSM & BE Budgets and Forecasts

2023	Electric Budget	Net Generator kW	Net Generator kWh	Electric MTRC Test Ratio	Lifetime Emissions Savings (Tons CO2)	SCC Benefits	Electric MTRC Test Ratio with SCC
Business Program							
Business Energy Assessments	\$1,384,139	1,677	13,529,508	1.23	65,201	\$4,013,956	2.07
Business HVAC+R Systems	\$8,339,664	13,253	40,002,225	2.00	243,804	\$14,367,111	2.78
Compressed Air Efficiency	\$1,041,412	923	5,545,422	1.41	31,697	\$1,842,213	2.16
Custom Efficiency	\$819,502	895	5,031,324	1.21	32,193	\$1,865,781	1.37
Data Center Efficiency	\$1,936,995	3,213	20,118,427	1.97	136,547	\$7,785,409	3.14
Energy Management Systems	\$623,611	271	1,855,262	1.05	11,306	\$673,502	1.58
LED Street Lighting	\$0	0	1,762,527	1.40	13,850	\$774,381	3.25
Lighting Efficiency	\$12,460,648	14,844	90,111,017	1.37	570,558	\$32,943,988	2.16
New Construction	\$10,680,049	16,010	60,004,226	1.44	416,916	\$23,670,607	2.08
Self Direct	\$1,452,092	2,407	10,763,228	1.15	65,704	\$3,861,162	1.71
Small Business Energy Solutions	\$3,983,114	6,421	35,352,991	1.87	168,897	\$10,286,870	2.90
Strategic Energy Management	\$9,149,252	11,311	67,054,950	1.71	325,037	\$19,712,574	2.68
General Advertising-Bus	\$800,476						
Business Program Total	\$52,670,954	71,225	351,131,109	1.52	2,081,711	\$121,797,554	2.27
Residential Program							
Energy Efficient Showerhead	\$58,754	98	1,209,631	13.19	4,948	\$318,403	17.39
Energy Star New Homes	\$3,500,421	2,180	5,463,848	1.00	40,539	\$2,282,507	1.26
Home Energy Insights	\$3,494,539	3,674	22,704,371	1.19	27,038	\$2,091,229	1.79
Home Energy Squad	\$1,408,037	998	5,209,656	1.38	26,766	\$1,604,989	2.17
Home Lighting & Recycling	\$3,723,413	6,257	38,977,355	2.76	193,957	\$11,593,806	4.48
Insulation & Air Sealing	\$212,760	354	436,281	0.73	2,780	\$163,579	0.87
Multifamily Buildings	\$2,199,147	1,278	10,201,176	1.33	61,069	\$3,554,917	2.08
Refrigerator & Freezer Recycling	\$1,089,261	304	3,938,032	1.09	13,401	\$887,333	1.91
Residential Heating & Cooling	\$7,437,854	7,318	5,562,373	1.76	36,734	\$2,170,115	1.93
School Education Kits	\$2,376,217	1,940	13,438,378	2.13	76,151	\$4,398,801	3.24
Whole Home Efficiency	\$308,754	295	789,686	0.78	4,525	\$270,454	1.02
General Advertising-Res	\$812,990						
Residential Program Total	\$26,622,147	24,696	107,930,789	1.62	487,909	\$29,336,132	2.25
Low-Income Program							
Energy Savings Kit	\$349,621	297	2,528,481	3.40	13,957	\$827,178	5.28
Multifamily Weatherization	\$1,419,936	276	2,170,088	0.91	14,912	\$849,084	1.21
Non-Profit	\$1,200,929	366	1,617,893	0.94	10,649	\$614,317	1.20
Single-Family Weatherization	\$1,880,856	3,102	22,937,524	5.35	158,899	\$9,256,854	8.36
Income Qualified Program Total	\$4,851,342	4,040	29,253,986	2.60	198,416	\$11,547,433	3.91

Table 4a: Public Service’s 2023 Electric DSM & BE Budgets and Forecasts (cont’d)

2023	Electric Budget	Net Generator kW	Net Generator kWh	Electric MTRC Test Ratio	Lifetime Emissions Savings (Tons CO2)	SCC Benefits	Electric MTRC Test Ratio with SCC
Indirect Products & Services							
Education/Market Transformation							
Business Education	\$176,000	0	0		0	\$0	
Business Energy Analysis	\$1,082,852	0	0		0	\$0	
Consumer Education	\$943,500	0	0		0	\$0	
Energy Benchmarking	\$139,462	0	0		0	\$0	
Energy Efficiency Financing	\$96,833	0	0		0	\$0	
Home Energy Audit	\$484,503	0	0		0	\$0	
Partners in Energy	\$1,229,973	0	0		0	\$0	
Education/Market Transformation Total	\$4,153,123	0	0		0	\$0	
Planning and Research							
EE Market Research	\$474,400	0	0		0	\$0	
EE Evaluation, Measurement & Verification	\$1,075,545	0	0		0	\$0	
EE Planning & Administration	\$570,581	0	0		0	\$0	
EE Product Development	\$1,886,139	0	0		0	\$0	
Geo-targeting Pilot - EE	\$24,073	0	0	2.83	0	\$0	2.83
EE Product Development Total	\$1,910,212	0	0		0	\$0	
EE Planning and Research Total	\$4,030,737	0	0		0	\$0	
EE Indirect Products & Services Total	\$8,183,861	0	0		0	\$0	
EE PORTFOLIO TOTAL	\$92,328,303	99,961	488,315,883	1.53	2,768,036	\$162,681,119	2.25
Demand Response Program							
Critical Peak Pricing	\$334,642	34,270	1,269,542		730	\$56,498	
Electric Vehicle Critical Peak Pricing	\$154,260	1,094	0		0	\$0	
Electric Vehicle Optimization	\$1,185,000	3,727	0	0.70	1,072	\$82,902	0.77
Peak Day Partners	\$531,460	16,253	364,431		210	\$16,218	
Peak Partner Rewards	\$1,207,209	24,560	407,032		457	\$33,699	
Residential Battery Demand Response	\$568,478	408	-15,634	1.25	-75	-\$4,821	1.24
Residential Demand Response	\$17,011,000	21,965	121,250	1.71	677	\$41,875	1.71
Small Commercial Building Controls	\$551,629	2,500	566,903	2.11	2,375	\$153,185	2.29
DR Program Total	\$21,543,677	104,778	2,713,524	2.09	5,446	\$379,555	2.10
Planning and Research							
DR Planning & Administration	\$77,562	0	0		N/A	\$0	
DR Program Evaluations	\$344,966	0	0		N/A	\$0	
DR Product Development	\$2,311,103	0	0		N/A	\$0	
Geo-targeting Pilot - DR	\$352,544	0	0	6.07	N/A	\$0	6.07
DR Planning and Research Total	\$3,086,176	0	0		N/A	\$0	
DR PORTFOLIO TOTAL	\$24,629,853	104,778	2,713,524	1.94	5,446	\$379,555	1.95
PORTFOLIO TOTAL	\$116,958,156	204,739	491,029,407	1.57	2,773,482	\$163,060,674	2.22

Table 4b: Public Service's 2023 Electric DSM & BE Costs by Category

2023	Program Planning & Design	Administration & Program Delivery	Advertising & Promotion	Participant Rebates and Incentives	Equipment & Installation	Measurement and Verification	Total
Business Program							
Business Energy Assessments	\$ -	\$ 504,659	\$ -	\$ 879,480	\$ -	\$ -	\$ 1,384,139
Business HVAC+R Systems	\$ -	\$ 4,272,816	\$ -	\$ 4,020,920	\$ -	\$ 45,929	\$ 8,339,664
Compressed Air Efficiency	\$ -	\$ 212,787	\$ 94,800	\$ 701,425	\$ -	\$ 32,400	\$ 1,041,412
Custom Efficiency	\$ -	\$ 472,849	\$ -	\$ 342,653	\$ -	\$ 4,000	\$ 819,502
Data Center Efficiency	\$ -	\$ 182,832	\$ 25,000	\$ 1,714,163	\$ -	\$ 15,000	\$ 1,936,995
Energy Management Systems	\$ -	\$ 263,468	\$ -	\$ 260,143	\$ -	\$ 100,000	\$ 623,611
LED Street Lighting	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Lighting Efficiency	\$ -	\$ 2,668,422	\$ 1,215,000	\$ 8,527,226	\$ -	\$ 50,000	\$ 12,460,648
New Construction	\$ -	\$ 2,309,455	\$ 3,000	\$ 7,820,997	\$ -	\$ 546,598	\$ 10,680,049
Self Direct	\$ -	\$ 85,943	\$ -	\$ 1,366,149	\$ -	\$ -	\$ 1,452,092
Small Business Energy Solutions	\$ -	\$ 940,572	\$ 10,000	\$ 3,001,542	\$ -	\$ 31,000	\$ 3,983,114
Strategic Energy Management	\$ -	\$ 2,990,371	\$ 75,100	\$ 5,510,776	\$ -	\$ 573,005	\$ 9,149,252
General Advertising-Bus	\$ -	\$ 65,476	\$ 735,000	\$ -	\$ -	\$ -	\$ 800,476
Business Program Total	\$ -	\$ 14,969,649	\$ 2,157,900	\$ 34,145,472	\$ -	\$ 1,397,932	\$ 52,670,954
Residential Program							
Energy Efficient Showerhead	\$ -	\$ 42,900	\$ -	\$ 15,854	\$ -	\$ -	\$ 58,754
Energy Star New Homes	\$ -	\$ 449,554	\$ 165,000	\$ 2,885,867	\$ -	\$ -	\$ 3,500,421
Home Energy Insights	\$ -	\$ 3,494,539	\$ -	\$ -	\$ -	\$ -	\$ 3,494,539
Home Energy Squad	\$ -	\$ 167,070	\$ 155,000	\$ 436,194	\$ 647,273	\$ 2,500	\$ 1,408,037
Home Lighting & Recycling	\$ -	\$ 745,786	\$ 665,000	\$ 2,312,627	\$ -	\$ -	\$ 3,723,413
Insulation & Air Sealing	\$ -	\$ 38,000	\$ -	\$ 171,760	\$ -	\$ 3,000	\$ 212,760
Multifamily Buildings	\$ -	\$ 489,607	\$ -	\$ 1,709,540	\$ -	\$ -	\$ 2,199,147
Refrigerator & Freezer Recycling	\$ -	\$ 706,011	\$ 75,000	\$ 298,250	\$ -	\$ 10,000	\$ 1,089,261
Residential Heating & Cooling	\$ -	\$ 1,492,932	\$ 367,000	\$ 5,520,922	\$ -	\$ 57,000	\$ 7,437,854
School Education Kits	\$ -	\$ 774,594	\$ 5,000	\$ 1,596,623	\$ -	\$ -	\$ 2,376,217
Whole Home Efficiency	\$ -	\$ 53,000	\$ -	\$ 175,754	\$ -	\$ 80,000	\$ 308,754
General Advertising-Res	\$ -	\$ 54,990	\$ 758,000	\$ -	\$ -	\$ -	\$ 812,990
Residential Program Total	\$ -	\$ 8,508,984	\$ 2,190,000	\$ 15,123,391	\$ 647,273	\$ 152,500	\$ 26,622,147
Income Qualified Program							
Energy Savings Kit	\$ -	\$ 159,986	\$ 100,000	\$ 89,634	\$ -	\$ -	\$ 349,621
Multifamily Weatherization	\$ -	\$ 191,036	\$ 40,000	\$ 1,152,900	\$ -	\$ 36,000	\$ 1,419,936
Non-Profit	\$ -	\$ 229,132	\$ 31,000	\$ 880,797	\$ -	\$ 60,000	\$ 1,200,929
Single-Family Weatherization	\$ -	\$ 201,254	\$ 190,000	\$ 1,339,602	\$ -	\$ 150,000	\$ 1,880,856
Income Qualified Program Total	\$ -	\$ 781,408	\$ 361,000	\$ 3,462,934	\$ -	\$ 246,000	\$ 4,851,342

Table 4b: Public Service’s 2023 Electric DSM & BE Costs by Category (cont’d)

2023	Program Planning & Design	Administration & Program Delivery	Advertising & Promotion	Participant Rebates and Incentives	Equipment & Installation	Measurement and Verification	Total
Indirect Products & Services							
Education/Market Transformation							
Business Education	\$ -	\$ 76,000	\$ 100,000	\$ -	\$ -	\$ -	\$ 176,000
Business Energy Analysis	\$ -	\$ 112,852	\$ 250,000	\$ 720,000	\$ -	\$ -	\$ 1,082,852
Consumer Education	\$ -	\$ 298,500	\$ 645,000	\$ -	\$ -	\$ -	\$ 943,500
Energy Benchmarking	\$ -	\$ 139,462	\$ -	\$ -	\$ -	\$ -	\$ 139,462
Energy Efficiency Financing	\$ -	\$ 64,197	\$ 4,000	\$ 28,636	\$ -	\$ -	\$ 96,833
Home Energy Audit	\$ -	\$ 222,832	\$ 28,719	\$ 195,193	\$ -	\$ 37,759	\$ 484,503
Partners in Energy	\$ -	\$ 1,229,973	\$ -	\$ -	\$ -	\$ -	\$ 1,229,973
Education/Market Transformation	\$ -	\$ 2,143,816	\$ 1,027,719	\$ 943,829	\$ -	\$ 37,759	\$ 4,153,123
Planning and Research							
EE Market Research	\$ -	\$ 474,400	\$ -	\$ -	\$ -	\$ -	\$ 474,400
EE Evaluation, Measurement &	\$ -	\$ 80,970	\$ -	\$ -	\$ -	\$ 994,575	\$ 1,075,545
EE Planning & Administration	\$ -	\$ 570,581	\$ -	\$ -	\$ -	\$ -	\$ 570,581
EE Product Development	\$ -	\$ 1,886,139	\$ -	\$ -	\$ -	\$ -	\$ 1,886,139
Geo-targeting Pilot - EE	\$ -	\$ 3,735	\$ 3,735	\$ 11,000	\$ -	\$ 5,603	\$ 24,073
EE Product Development Total	\$ -	\$ 1,889,874	\$ 3,735	\$ 11,000	\$ -	\$ 5,603	\$ 1,910,212
EE Planning and Research Total	\$ -	\$ 3,015,825	\$ 3,735	\$ 11,000	\$ -	\$ 1,000,178	\$ 4,030,737
EE Indirect Products & Services Total	\$ -	\$ 5,159,641	\$ 1,031,454	\$ 954,829	\$ -	\$ 1,037,937	\$ 8,183,861
EE PORTFOLIO TOTAL	\$ -	\$ 29,419,681	\$ 5,740,354	\$53,686,626	\$647,273	\$ 2,834,369	\$ 92,328,303
Demand Response Program							
Critical Peak Pricing	\$ -	\$ 284,642	\$ 25,000	\$ -	\$ -	\$ 25,000	\$ 334,642
Electric Vehicle Critical Peak Pricing	\$ -	\$ 52,910	\$ 5,000	\$ -	\$96,350	\$ -	\$ 154,260
Electric Vehicle Optimization	\$ -	\$ 840,000	\$ 60,000	\$ 285,000	\$ -	\$ -	\$ 1,185,000
Peak Day Partners	\$ -	\$ 48,460	\$ -	\$ 483,000	\$ -	\$ -	\$ 531,460
Peak Partner Rewards	\$ -	\$ 263,485	\$ 105,000	\$ 813,724	\$ -	\$ 25,000	\$ 1,207,209
Residential Battery Demand Response	\$ -	\$ 255,978	\$ -	\$ 312,500	\$ -	\$ -	\$ 568,478
Residential Demand Response	\$ -	\$6,500,500	\$ 976,000	\$9,404,500	\$ -	\$ 130,000	\$ 17,011,000
Small Commercial Building Controls	\$ -	\$ 193,300	\$ 52,500	\$ 285,829	\$ -	\$ 20,000	\$ 551,629
DR Program Total	\$ -	\$ 8,439,275	\$ 1,223,500	\$ 11,584,553	\$ 96,350	\$ 200,000	\$ 21,543,677
Planning and Research							
DR Planning & Administration	\$ -	\$ 77,562	\$ -	\$ -	\$ -	\$ -	\$ 77,562
DR Program Evaluations	\$ -	\$ 19,966	\$ -	\$ -	\$ -	\$ 325,000	\$ 344,966
DR Product Development	\$ -	\$ 1,811,103	\$ -	\$ 500,000	\$ -	\$ -	\$ 2,311,103
Geo-targeting Pilot - DR	\$ -	\$ 56,257	\$ 46,265	\$ 180,625	\$ -	\$ 69,397	\$ 352,544
DR Planning and Research Total	\$ -	\$ 1,964,888	\$ 46,265	\$ 680,625	\$ -	\$ 394,397	\$ 3,086,176
DR PORTFOLIO TOTAL	\$ -	\$ 10,404,163	\$ 1,269,765	\$ 12,265,178	\$ 96,350	\$ 594,397	\$ 24,629,853
PORTFOLIO TOTAL	\$ -	\$39,823,844	\$ 7,010,119	\$ 65,951,804	\$743,623	\$ 3,428,766	\$ 116,958,156

Executive Summary: Natural Gas DSM & BE Tables

The following tables summarize the forecasted impacts of the Company’s proposed natural gas DSM & BE portfolio for 2023, including anticipated expenditures, energy savings, costs by budget category, and MTRC test ratios.

Table 5a: Public Service’s 2023 Natural Gas DSM & BE Budgets and Forecasts

2023	Gas Budget	Net Annual Dth Savings	Annual Dth/\$M	Gas MTRC Test Net Benefits	Gas MTRC Test Ratio	Lifetime Carbon Emissions Savings (Tons CO2)	SCC Benefits	Lifetime Methane Emissions Savings (Tons CH4)	SCM Benefits	Gas MTRC Test Ratio with SCC & SCM
Business Program										
Business Energy Assessments	\$18,213	4,209	231,091	\$140,852	4.41	2,512	\$168,166	1.30	\$2,403	8.54
Business HVAC+R Systems	\$538,275	21,575	40,081	\$469,388	1.48	18,584	\$1,160,599	9.70	\$16,880	2.69
Custom Efficiency	\$68,096	6,626	97,307	\$122,228	1.35	6,590	\$397,617	3.40	\$5,830	2.52
Energy Management Systems	\$29,833	1,343	45,012	\$11,483	1.13	1,178	\$73,293	0.60	\$1,067	1.99
New Construction	\$1,013,957	100,109	98,731	\$11,547,605	3.28	116,065	\$6,710,638	60.50	\$99,339	4.62
Small Business Energy Solutions	\$68,363	12,200	178,463	\$1,798,191	16.42	6,464	\$440,571	3.40	\$6,266	20.26
General Advertising-Bus	\$86,414	0				N/A	N/A	N/A	N/A	
Business Program Total	\$1,823,152	146,062	80,115	\$14,003,333	3.08	151,393	\$8,950,886	78.90	\$131,786	4.43
Residential Program										
Energy Efficient Showerhead	\$390,211	44,150	113,145	\$7,406,997	14.59	25,828	\$1,734,840	13.50	\$24,769	17.81
Energy Star New Homes	\$4,841,273	145,698	30,095	-\$2,230,273	0.86	165,928	\$9,643,824	86.40	\$142,599	1.46
Home Energy Insights	\$1,104,806	137,456	124,416	\$758,642	1.69	17,910	\$1,357,084	9.30	\$18,766	2.93
Home Energy Squad	\$594,442	20,449	34,400	\$751,189	2.08	11,957	\$803,170	6.20	\$11,467	3.26
Insulation & Air Sealing	\$429,099	22,510	52,459	-\$478,694	0.77	19,459	\$1,214,322	10.10	\$17,664	1.36
Multifamily Buildings	\$1,082,996	19,998	18,465	\$1,909,260	2.12	11,990	\$802,062	6.20	\$11,463	2.60
Residential Heating & Cooling	\$3,526,380	170,357	48,309	-\$1,421,017	0.89	165,360	\$10,037,475	86.10	\$146,978	1.67
School Education Kits	\$699,495	59,605	85,212	\$9,340,301	11.22	34,869	\$2,342,117	18.20	\$33,439	13.82
Whole Home Efficiency	\$207,263	10,885	52,516	-\$257,976	0.76	10,826	\$653,185	5.60	\$9,578	1.38
General Advertising-Res	\$213,759	0				N/A	N/A	N/A	N/A	
Residential Program Total	\$13,089,724	631,108	48,214	\$15,564,670	1.41	464,127	\$28,588,079	241.80	\$416,722	2.18
Income Qualified Program										
Energy Savings Kit	\$275,385	31,781	115,404	\$5,640,983	14.59	18,592	\$1,248,778	9.70	\$17,829	17.64
Multifamily Weatherization	\$1,395,835	15,262	10,934	-\$386,138	0.86	12,525	\$790,695	6.50	\$11,469	1.15
Non-Profit	\$861,222	7,592	8,816	-\$234,726	0.86	7,076	\$433,928	3.70	\$6,339	1.12
Single-Family Weatherization	\$4,028,000	42,658	10,590	-\$484,821	0.93	37,848	\$2,347,923	19.70	\$34,203	1.26
Income Qualified Program Total	\$6,560,443	97,292	14,830	\$4,535,298	1.37	76,040	\$4,821,323	39.60	\$69,841	1.77
Indirect Products & Services										
Education/Market Transformation										
Business Education	\$19,600	0				0	\$0	0.00	\$0	
Business Energy Analysis	\$210,070	0				0	\$0	0.00	\$0	
Consumer Education	\$73,500	0				0	\$0	0.00	\$0	
Energy Benchmarking	\$43,278	0				0	\$0	0.00	\$0	
Energy Efficiency Financing	\$50,957	0				0	\$0	0.00	\$0	
Home Energy Audit	\$652,772	0				0	\$0	0.00	\$0	
Partners in Energy	\$163,051	0				0	\$0	0.00	\$0	
Education/Market Transformation	\$1,213,227	0				0	\$0	0.00	\$0	
Planning and Research										
EE Market Research	\$197,990	0				0	\$0	0.00	\$0	
EE Evaluation, Measurement &	\$269,597	0				0	\$0	0.00	\$0	
EE Planning & Administration	\$127,762	0				0	\$0	0.00	\$0	
EE Product Development	\$198,733	0				0	\$0	0.00	\$0	
EE Product Development Total	\$198,733	0				0	\$0	0.00	\$0	
EE Planning and Research Total	\$794,083	0				0	\$0	0.00	\$0	
EE Indirect Products & Services	\$2,007,310	0				0	\$0	0.00	\$0	
EE PORTFOLIO TOTAL	\$23,480,629	874,462	37,242	\$32,608,909	1.56	691,561	\$42,360,288	360.20	\$618,348	2.29

Table 5b: Public Service's 2023 Natural Gas DSM & BE Costs by Category

2023	Program Planning & Design	Administration & Program Delivery	Advertising & Promotion	Participant Rebates and Incentives	Equipment & Installation	Measurement and Verification	Total
Business Program							
Business Energy Assessments	\$ -	\$ 8,328	\$ -	\$ 9,885	\$ -	\$ -	\$ 18,213
Business HVAC+R Systems	\$ -	\$ 352,146	\$ 2,494	\$ 173,635	\$ -	\$ 10,000	\$ 538,275
Custom Efficiency	\$ -	\$ 25,499	\$ -	\$ 42,147	\$ -	\$ 450	\$ 68,096
Energy Management Systems	\$ -	\$ 16,733	\$ -	\$ 13,100	\$ -	\$ -	\$ 29,833
New Construction	\$ -	\$ 175,316	\$ -	\$ 740,768	\$ -	\$ 97,873	\$ 1,013,957
Small Business Energy Solutions	\$ -	\$ 30,320	\$ -	\$ 38,043	\$ -	\$ -	\$ 68,363
General Advertising-Bus	\$ -	\$ 6,714	\$ 79,700	\$ -	\$ -	\$ -	\$ 86,414
Business Program Total	\$ -	\$ 615,056	\$ 82,194	\$ 1,017,578	\$ -	\$ 108,323	\$ 1,823,152
Residential Program							
Energy Efficient Showerhead	\$ -	\$ 244,000	\$ -	\$ 146,211	\$ -	\$ -	\$ 390,211
Energy Star New Homes	\$ -	\$ 449,554	\$ 165,000	\$ 4,226,719	\$ -	\$ -	\$ 4,841,273
Home Energy Insights	\$ -	\$ 1,104,806	\$ -	\$ -	\$ -	\$ -	\$ 1,104,806
Home Energy Squad	\$ -	\$ 163,419	\$ 150,000	\$ 88,559	\$ 189,964	\$ 2,500	\$ 594,442
Insulation & Air Sealing	\$ -	\$ 40,500	\$ -	\$ 385,099	\$ -	\$ 3,500	\$ 429,099
Multifamily Buildings	\$ -	\$ 528,544	\$ -	\$ 554,452	\$ -	\$ -	\$ 1,082,996
Residential Heating & Cooling	\$ -	\$ 316,452	\$ 7,000	\$ 3,184,928	\$ -	\$ 18,000	\$ 3,526,380
School Education Kits	\$ -	\$ 482,726	\$ 2,500	\$ 214,269	\$ -	\$ -	\$ 699,495
Whole Home Efficiency	\$ -	\$ 36,000	\$ -	\$ 141,263	\$ -	\$ 30,000	\$ 207,263
General Advertising-Res	\$ -	\$ 20,259	\$ 193,500	\$ -	\$ -	\$ -	\$ 213,759
Residential Program Total	\$ -	\$ 3,386,260	\$ 518,000	\$ 8,941,500	\$189,964	\$ 54,000	\$13,089,724
Income Qualified Program							
Energy Savings Kit	\$ -	\$ 91,570	\$ 44,000	\$ 139,815	\$ -	\$ -	\$ 275,385
Multifamily Weatherization	\$ -	\$ 104,587	\$ 28,000	\$ 1,248,248	\$ -	\$ 15,000	\$ 1,395,835
Non-Profit	\$ -	\$ 76,383	\$ 21,000	\$ 743,839	\$ -	\$ 20,000	\$ 861,222
Single-Family Weatherization	\$ -	\$ 177,856	\$ 60,000	\$ 3,674,544	\$ -	\$ 115,600	\$ 4,028,000
Income Qualified Program Total	\$ -	\$ 450,397	\$ 153,000	\$ 5,806,447	\$ -	\$ 150,600	\$ 6,560,443
Indirect Products & Services							
Education/Market Transformation							
Business Education	\$ -	\$ 10,000	\$ 9,600	\$ -	\$ -	\$ -	\$ 19,600
Business Energy Analysis	\$ -	\$ 13,070	\$ 17,000	\$ 180,000	\$ -	\$ -	\$ 210,070
Consumer Education	\$ -	\$ 35,500	\$ 38,000	\$ -	\$ -	\$ -	\$ 73,500
Energy Benchmarking	\$ -	\$ 43,278	\$ -	\$ -	\$ -	\$ -	\$ 43,278
Energy Efficiency Financing	\$ -	\$ 28,539	\$ 2,500	\$ 19,918	\$ -	\$ -	\$ 50,957
Home Energy Audit	\$ -	\$ 227,500	\$ 61,281	\$ 313,000	\$ -	\$ 50,991	\$ 652,772
Partners in Energy	\$ -	\$ 163,051	\$ -	\$ -	\$ -	\$ -	\$ 163,051
Education/Market Transformation	\$ -	\$ 520,937	\$ 128,381	\$ 512,918	\$ -	\$ 50,991	\$ 1,213,227
Planning and Research							
EE Market Research	\$ -	\$ 197,990	\$ -	\$ -	\$ -	\$ -	\$ 197,990
EE Evaluation, Measurement &	\$ -	\$ 20,947	\$ -	\$ -	\$ -	\$ 248,650	\$ 269,597
EE Planning & Administration	\$ -	\$ 127,762	\$ -	\$ -	\$ -	\$ -	\$ 127,762
EE Product Development	\$ -	\$ 198,733	\$ -	\$ -	\$ -	\$ -	\$ 198,733
EE Product Development Total	\$ -	\$ 198,733	\$ -	\$ -	\$ -	\$ -	\$ 198,733
EE Planning and Research Total	\$ -	\$ 545,433	\$ -	\$ -	\$ -	\$ 248,650	\$ 794,083
EE Indirect Products & Services Total	\$ -	\$ 1,066,370	\$ 128,381	\$ 512,918	\$ -	\$ 299,641	\$ 2,007,310
EE PORTFOLIO TOTAL	\$ -	\$ 5,518,083	\$ 881,575	\$ 16,278,443	\$189,964	\$ 612,564	\$23,480,629

DSM & BE Participation

Decision No. C14-0731 in the 2013 DSM Strategic Issues (Proceeding No. 13A-0686EG) directed the Company to “*collect, define, and analyze participant and non-participant rates. In future DSM plan filings, the Company shall explain how these data were collected and used for each program.*”¹⁵ Furthermore, the Commission clarified in Decision No. C14-0997 that “*we also require that the Company set forth proposals for tracking participants and non-participants for specific programs and measures and to provide estimates of participant and non-participant counts in its DSM Plans. While we recognize that, for certain programs or measures it may be difficult or prohibitively expensive to collect such data, it is reasonable for the Commission to consider plans for tracking participation and non-participation when programs and measures are proposed in a DSM Plan filing and when we review the cost-effectiveness and ratepayer impacts of those programs and measures.*”¹⁶

Tracking Participants / Non-Participants

To most effectively comply with the above-referenced decision, Public Service has determined that participant counts should be collected at the customer level (rather than at the premise level as had been done in the past) and provided by DSM product and by customer class. Because customers may participate in more than one product within a single year, the total number of portfolio participants will not be a direct summation of the individual product participation counts. In order to identify the non-participants, the Company will provide the number and percentage that the portfolio participation count makes up of total Public Service customers (eligible for DSM).¹⁷ Going forward, the Company will begin to identify the number of customers participating in each product in a given year within the Annual DSM/BE Status Report. Additionally, within the Status Report, a portfolio participation and non-participation count will be provided.

The Company believes a thorough analysis of participants and non-participants must go beyond a counting of participation each year. It must also consider the amount of cumulative consumption savings realized by individual customers each year, due to the participation in DSM products over several program years. To this end, the Company will also identify the estimated percentages of business and residential customers by their range of consumption savings attributable to DSM participation since the expansion of the DSM programs in 2009. The extent of individual participation can further be compared to the cumulative rate impacts of DSM programs since 2009. The combination of these factors results in the level and distribution of bill savings among business and residential customers. This additional participation data analysis is included in the Annual DSM/BE Status Reports.

¹⁵Decision No. C14-0731, at ¶115 in Proceeding No. 13A-0686EG.

¹⁶Decision No. C14-0731, at ¶24 in Proceeding No. 13A-0686EG.

¹⁷Public Service gas transport customer classes are not eligible to participate in DSM.

Key Assumptions

Participation data is provided with the following key assumptions:

- A participant will be “one individual customer” (based on account number) participating in DSM/BE in a given year.¹⁸ Customers may have multiple premises,¹⁹ multiple projects, and/or participate in multiple DSM/BE products across multiple years. (This represents a shift from historical reporting of “participant” which was based on premises).
- Some participation related data analysis is provided only at the portfolio level, such as non-participant²⁰ data; this approach ensures that the endeavor is not undertaken in a manner that is costly or extensively laborious.
- Downstream products’ participation counts will be actual customer counts based on tracked participation data (means of tracking as identified in Tables 6b and 6c).
- Where mid/upstream products do not track participation at the customer level, counts will be an estimate within both the DSM/BE plans and the Annual DSM/BE Status Reports, unless otherwise noted, given the nature of the approach and difficulty and cost associated with specific customer tracking.

Product-Specific Considerations

Products with unique participant tracking approaches are described below:

Cooling – Midstream: The participant tracking mechanism for the midstream rebate portion of the product will be determined in conjunction with the selected third-party implementer. The data will either be directly uploaded into Salesforce—the Company’s tracking software—or tracked separately and manually added to the Salesforce data for the third-party implemented portion of product participation.

Lighting Efficiency and Small Business Solutions – Midstream Lighting: Product participation for the midstream component of the product is derived through monthly sales reporting from the third-party implementer. This data is manually entered into Salesforce and is also tracked separately.

Energy Efficient Showerhead: Public Service uploads a participation report from the third-party implementer into Salesforce; however, a manual calculation needs to be completed (given current Salesforce configuration) to identify the total number of unique customers that receive a showerhead.

ENERGY STAR New Homes: Upstream participation is based on the number of unique new home builders participating in the product each year and is tracked by the third-party implementer. Downstream participation is based on the number of homes completed in the product by that

¹⁸Within the Detailed Technical Assumptions table at the end of [Appendix H: Technical Reference Manual](#) of this Plan, the Company identifies “units,” which differ from “participants.” Units are the total number of equipment installed by measure.

¹⁹A premise is an individual physical location where a customer is served; a customer may have multiple premises associated with their one account, and vice versa a premise could have multiple customer accounts. For tracking participants, individual customer accounts will be tracked as one participant.

²⁰A non-participant is a Public Service customer who is eligible to participate in DSM but has not chosen to do so. This type of data point can be tracked based on total Public Service customers and/or Public Service customers by class (business or residential).

smaller number of builders. In other words, each home is purchased and occupied by a unique customer and no customer is assumed to own more than one participating home during the product year. Therefore, participation estimates included herein will reflect the number of homes.

Home Lighting & Recycling: This product is wide-reaching with a significant number of bulbs sold and distributed across both the Residential and Business populations. Because the product achieves the vast majority of participation through retail outlets that do not track information on the customers purchasing the bulbs in the product, some estimation of the breadth of participation—based on average bulbs per customer, total installed bulbs, and the product saturation rate—has been performed.

Multifamily Weatherization and Multifamily Buildings: Participants are considered to be both residents living within housing units that receive energy-efficiency measures (regardless of whether they paid for improvements or received them as a direct-install measure), as well as the building and/or equipment owners, who may not represent the metered, bill-payer given the nature of multifamily building units.

School Education Kits: The Company presumes one customer account per kit. However, it is possible that there may be very limited circumstances where a customer could receive two or more kits in one program year and/or multiple kits over the course of several program years (not unlike potential duplicate participation in other DSM/BE products), but these instances cannot be tracked.

Class Participation Calculations

To estimate the count of unique customers participating within each segment (Business or Residential), calculations must be made to estimate the duplication of participation across the individual products. Summing the participation across products and then applying adjustments to account for duplicate participation results in an accurate measure of the breadth of participation within each segment. The methods to estimate duplicate participation across various types of products are described below:

Individually-Tracked Products: To estimate the amount of duplicate participation expected to occur in the 2023 program year, the ratio of the sum of unique participation within each product observed in the 2021 program year over the unique participation within the Business or Residential segment is calculated. For instance, for the Business class of customers in the 2021 program year, individually-tracked products had a sum of 10,389 unique accounts within products, but these represented only 4,291 unique accounts within the Business class. This results in a factor of 41.30% to account for duplicate participation across the individually tracked products.

Non-Individually-Tracked Products: For the Home Lighting & Recycling product it is not feasible to track the individual participation. Home Lighting & Recycling includes an upstream delivery model that represents very large participation and does not provide an opportunity to identify the individual participants. For 2023, behavioral products for both the Business and Residential classes will be applied to a large fraction of the population, with the individual participants not yet determined. For these products, duplicate participation is estimated by multiplying the fraction of population represented by each product by each other. For instance, if in 2023, the Home Lighting & Recycling product is expected to reach 25% of the Residential class population, and the

Residential Behavioral product is expected to reach 40% of the Residential class, the duplicate participation is estimated at 10% ($25\% * 40\%$) of the Residential class. The total fraction of the Residential class population participating in either of these products is estimated by summing the total fraction of the two products at 65% ($25\% + 40\%$) and then subtracting the duplicate participation fraction (10%) to get a fraction of 55% of the Residential class population participating in at least one of these products.

Participation Tables

The following tables included in this Plan present the Company’s best estimates for participation and non-participation in its DSM & BE offerings and products in 2023, based on the methodology for estimating participation described above.

- 6a: 2023 Electric Participant & Non-Participant Estimates, Percentage
- 6b: 2023 Electric Participation Estimates, Average Rebate and Savings by Product
- 6c: 2023 Natural Gas Participation Estimates by Product

Table 6a: 2023 Electric Participant & Non-Participant Estimates, Percentage

	Total Unique Participants		Total PSCo Customers		PSCo Customers Participating in DSM		PSCo Customers Not Participating in DSM/BE	
	Count	%	Count	%	Count	%	Count	%
2023 Total	650,102	100%	1,443,362	100.00%	650,102	45.04%	793,260	54.96%
Business	9,043	1.39%	104,487	7.24%	9,043	8.65%	95,444	91.35%
Residential	641,059	98.61%	1,338,875	92.76%	641,059	47.88%	697,816	52.12%

**Table 6b: 2023 Electric Participation Estimates,
 Average Rebate and Savings by Product**

Product	2023 Estimated Participants	Average Rebate Per Customer	Average kWh Savings Per Customer
Business Program			
Business Energy Assessments	150	5,863	90,197
Business HVAC+R Systems	1,590	2,528	25,153
Compressed Air Efficiency	123	5,716	45,193
Custom Efficiency	36	9,518	139,759
Data Center Efficiency	24	71,423	838,268
Energy Management Systems	10	26,014	185,526
LED Street Lighting	4	0	440,632
Lighting Efficiency	2,466	3,458	36,541
New Construction	355	22,062	169,262
Self Direct	11	124,195	978,475
Small Business Energy Solutions	7,441	403	4,751
Strategic Energy Management	245	22,493	273,694
Residential Program Total			
Energy Efficient Showerhead	8,753	2	138
Energy Star New Homes	19,066	151	287
Home Energy Insights	728,581	0	31
Home Energy Squad	3,480	125	1,497
Home Lighting & Recycling	119,022	19	327
Insulation & Air Sealing	958	179	455
Multifamily Buildings	1,914	893	5,329
Refrigerator & Freezer Recycling	6,000	50	656
Residential Heating & Cooling	24,097	229	231
School Education Kits	48,750	33	276
Whole Home Efficiency	699	251	1,130
Income Qualified Program			
Energy Savings Kit	3,915	23	646
Multifamily Weatherization	46	25,301	47,623
Non-Profit	39	22,470	41,275
Single-Family Weatherization	27,592	49	831
Indirect Products & Services			
Business Education	1,379	0	0
Business Energy Analysis	450	1,601	0
Consumer Education	26,735	0	0
Energy Benchmarking	391	0	0
Energy Efficiency Financing	24	1,177	0
Home Energy Audit	2,058	95	0
Partners in Energy	N/A		
Demand Response			
Critical Peak Pricing	54	0	23,510
Electric Vehicle Critical Peak Pricing	235	0	0
Electric Vehicle Optimization	4,400	65	0
Peak Day Partners	6	80,500	60,739
Peak Partner Rewards	58	14,030	7,018
Residential Battery Demand Response	250	1,250	0
Residential Demand Response	17,050	552	7
Geo-targeting Pilot - DR	1,737	104	0

Table 6c: 2023 Natural Gas Participation Estimates by Product

Product	2023 Natural Gas DSM Participation Estimated
Business Program	
Business Energy Assessments	13
Business HVAC+R Systems	168
Compressed Air Efficiency	0
Custom Efficiency	9
Data Center Efficiency	0
Energy Management Systems	3
LED Street Lighting	0
Lighting Efficiency	0
New Construction	112
Self Direct	0
Small Business Energy Solutions	181
Strategic Energy Management	0
Residential Program Total	
Energy Efficient Showerhead	80,447
Energy Star New Homes	35,370
Home Energy Insights	728,581
Home Energy Squad	3,480
Home Lighting & Recycling	0
Insulation & Air Sealing	960
Multifamily Buildings	573
Refrigerator & Freezer Recycling	0
Residential Heating & Cooling	22,526
School Education Kits	48,750
Whole Home Efficiency	801
Income Qualified Program	
Energy Savings Kit	10,873
Multifamily Weatherization	51
Non-Profit	57
Single-Family Weatherization	2,259
Indirect Products & Services	
Business Education	592
Business Energy Analysis	321
Energy Benchmarking	209
Energy Efficiency Financing	76
Home Energy Audit	58
Partners in Energy	N/A
Demand Response	
Critical Peak Pricing	0
Electric Vehicle Critical Peak Pricing	0
Electric Vehicle Optimization	0
Peak Day Partners	0
Peak Partner Rewards	0
Residential Battery Demand Response	0
Residential Demand Response	0
Small Commercial Building Controls	0
Geo-targeting Pilot - DR	0

Business Program

A. Description

The Business Program offers prescriptive and custom DSM/BE products to commercial and industrial customers in the Colorado service territory.²¹ The Company has a total of 278,828 gas and electric commercial and industrial customer premises in Colorado.²² A breakdown of business premises by type is shown in the table below.

Table 7: Business Premise Counts by Type²³

	Natural Gas Only	Electric Only	Both Gas & Electric	Total
Commercial	40,262	160,854	74,736	275,852
Industrial	2,530	357	89	2,976
Total	42,792	161,211	74,825	278,828

The Company divides business customers into three sub-segments for marketing purposes: (1) large customers and (2) small- and (3) medium-sized customers. Large customers are typically single or aggregated electric customers with demand usage of over 500 kW, natural gas customers with annual loads of 5,000 Dth or more, and/or national customers, such as fast-food chains. The Company assigns an Account Manager to large customers to serve as a liaison on a variety of energy topics. Small- and medium-sized business customers work with the Company’s Business Solutions Center (“BSC”) to answer any questions they may have on their accounts and to discuss Company resources for potential energy efficiency projects.

Products

An extensive portfolio of products is planned for the Business Program in 2023 including twelve electric and six natural gas products. All natural gas products coincide with their electric counterparts such as Custom Efficiency where electric, natural gas, or electric and natural gas savings can be analyzed. The Business product rankings are shown in Table 8 below.

²¹ Most of the Company’s high natural gas consumption customers are transportation-only customers that do not purchase gas directly from the Company, and therefore those customers are exempt from the DSMCA and ineligible to participate in the Company’s energy efficiency products.

²² Premise counts as of January 1, 2022.

²³ Natural gas transportation-only customers are excluded.

Table 8: Business Program Product Rankings²⁴

2023	Rank
Lighting Efficiency	2
Small Business Energy Solutions	4
Business HVAC+R Systems	7
Strategic Energy Management	8
New Construction	10
Data Center Efficiency	14
LED Street Lighting	16
Business Energy Assessments	17
Compressed Air Efficiency	20
Self Direct	21
Custom Efficiency	22
Energy Management Systems	24

The newest products being launched for the Colorado market are:

Business HVAC+R Systems – This product combines heating efficiency, motor/drive and pump efficiency, cooling efficiency, and refrigeration products into a common marketing platform, to better align with products and technologies in market.

Business Energy Assessments - This product combines and expands on Recommissioning and Engineering Assistance products included in previous DSM Plans.

Small Business Solutions – This program combines previous plan offerings for Small Business Lighting and Commercial Refrigeration, and expands the types of measures and support available, including a facility walk-through audit.

B. Forecasts, Participants & Budgets

Forecasts and Participants

The Business Program is anticipated to contribute 351.1 GWh and 146,062 Dth in 2023. This is approximately 72 percent and 17 percent, respectively, of the Company’s 2023 planned achievements. Each of the product forecasts were reviewed by the Company’s energy efficiency team for reasonability and appropriateness based on market potential.

²⁴All products in the DSM portfolio were ranked through the same process and the full results can be found in [Appendix C](#) of this Plan.

The product’s energy savings and participation, and corresponding budgets, are shown in Tables 9a through 9b below.

Table 9a: 2023 Electric Business Program Budgets and Forecasts

2023	Electric Budget	Net Generator kW	Net Generator kWh	Electric MTRC Test Ratio	Lifetime Emissions Savings (Tons CO2)	SCC Benefits	Electric MTRC Test Ratio with SCC
Business Program							
Business Energy Assessments	\$1,384,139	1,677	13,529,508	1.23	65,201	\$4,013,956	2.07
Business HVAC+R Systems	\$8,339,664	13,253	40,002,225	2.00	243,804	\$14,367,111	2.78
Compressed Air Efficiency	\$1,041,412	923	5,545,422	1.41	31,697	\$1,842,213	2.16
Custom Efficiency	\$819,502	895	5,031,324	1.21	32,193	\$1,865,781	1.37
Data Center Efficiency	\$1,936,995	3,213	20,118,427	1.97	136,547	\$7,785,409	3.14
Energy Management Systems	\$623,611	271	1,855,262	1.05	11,306	\$673,502	1.58
LED Street Lighting	\$0	0	1,762,527	1.40	13,850	\$774,381	3.25
Lighting Efficiency	\$12,460,648	14,844	90,111,017	1.37	570,558	\$32,943,988	2.16
New Construction	\$10,680,049	16,010	60,004,226	1.44	416,916	\$23,670,607	2.08
Self Direct	\$1,452,092	2,407	10,763,228	1.15	65,704	\$3,861,162	1.71
Small Business Energy Solutions	\$3,983,114	6,421	35,352,991	1.87	168,897	\$10,286,870	2.90
Strategic Energy Management	\$9,149,252	11,311	67,054,950	1.71	325,037	\$19,712,574	2.68
General Advertising-Bus	\$800,476						
Business Program Total	\$52,670,954	71,225	351,131,109	1.52	2,081,711	\$121,797,554	2.27

Table 9b: 2023 Natural Gas Business Program Budgets and Forecasts

2023	Gas Budget	Net Annual Dth Savings	Annual Dth/\$M	Gas MTRC Test Net Benefits	Gas MTRC Test Ratio	Lifetime Carbon Emissions Savings (Tons CO2)	SCC Benefits	Lifetime Methane Emissions Savings (Tons CH4)	SCM Benefits	Gas MTRC Test Ratio with SCC & SCM
Business Program										
Business Energy Assessments	\$18,213	4,209	231,091	\$140,852	4.41	2,512	\$168,166	1.30	\$2,403	8.54
Business HVAC+R Systems	\$538,275	21,575	40,081	\$469,388	1.48	18,584	\$1,160,599	9.70	\$16,880	2.69
Custom Efficiency	\$68,096	6,626	97,307	\$122,228	1.35	6,590	\$397,617	3.40	\$5,830	2.52
Energy Management Systems	\$29,833	1,343	45,012	\$11,483	1.13	1,178	\$73,293	0.60	\$1,067	1.99
New Construction	\$1,013,957	100,109	98,731	\$11,547,605	3.28	116,065	\$6,710,638	60.50	\$99,339	4.62
Small Business Energy Solutions	\$68,363	12,200	178,463	\$1,798,191	16.42	6,464	\$440,571	3.40	\$6,266	20.26
General Advertising-Bus	\$86,414									
Business Program Total	\$1,823,152	146,062	80,115	\$14,003,333	3.08	151,393	\$8,950,886	78.90	\$131,786	4.43

Budgets

Achievement forecasts were developed as a result of an organic participation and energy savings estimation process for each product, which was rolled up to the Business Program total. Similarly, budgets for each product were developed based on the anticipated level of achievement and cost of market penetration, including review of historical data for the past several years and experience with similar products in Minnesota.

Rebate budgets were established according to the desired number of product participants and estimated average project size. Next, budget components, such as advertising and promotion, were developed as part of the product planning process. Then, product delivery budgets, including Company labor and external resources, were calculated. The resulting budgets from this planning process are shown in the executive summary section of the Plan.

The Company will continue to closely manage its DSM/BE expenditures due to concerns about reduced cost-effectiveness of its DSM/BE products given fluctuating gas commodity prices, supply chain challenges, lingering effects of the pandemic, increases in renewable energy generation, and the rate impact on non-participating customers.

Additional details are presented in the product descriptions that follow this overview section.

C. Application Process

Application processes vary by product. See individual product summaries following this overview for more information.

D. Market Objectives & Strategies

Market analysis shows that the commercial segment had the highest potential for energy savings within indoor and outdoor lighting, cooling and ventilation, data servers, and refrigeration end-uses. In the industrial market segment, pumps, lighting, compressed air, fans, cooling, and drives show the greatest end-use potential.

Transactional research is also conducted by the Company to identify who is participating in our DSM/BE products. Specific detail from our rebate applications, including customer name, vendor, type of equipment, etc., is collected on each transaction and added to a database. This information is monitored to determine metrics such as: participation/non-participation in DSM/BE products, market segments utilized, and equipment types our customers use. By analyzing specific end-use data, the Company can continue to shape the Business Program to further meet the needs of the market.

Trade allies, end-use equipment vendors, energy services companies, and the Company's Account Managers and marketing team work individually and collaboratively to drive participation in the Business Program. While coordination of DSM/BE participation by the largest business customers typically requires regular personal communication and site visits, the Company also utilizes newsletters, customer events, direct mail, email communications, and awareness advertising to reach Business Program customers. A challenge in marketing energy efficiency is that it's not always a topic at the top of customers' minds – they are busy managing the core aspects of their businesses, particularly for those who do not have dedicated onsite energy managers. Customers tend to focus on purchase price (or "first costs") rather than lifetime costs and are often unlikely to replace equipment prior to failure. Customers may also not be aware of energy efficient equipment and process options available to them when the need arises to make purchase decisions. Yet, opportunities are growing in marketing energy efficiency to customers as awareness of conservation, climate change, and the environment increases leading to an affinity for energy-saving actions. To support marketing efforts, the Company employs an integrated approach to marketing communications, where the tactics are designed to work in concert with each other and reinforce key messages over time.

Strategy

The Company follows the "AIDA" (awareness, interest, desire, action) process for encouraging customers to participate in DSM/BE products. The following are the steps in this process:

1. Create awareness of electricity and/or natural gas impacts on bottom-line profits and quantify potential cost savings and available rebates.
2. Promote interest in DSM/BE products by providing more information about the offerings, including payback examples and case studies, through a variety of customer touchpoints.

3. Instill the desire for participation in DSM/BE products by quantifying the impacts of a bundle of potential energy savings technologies and processes, based on specific product and industry information for each targeted market segment.
4. Move the customer toward action by offering a variety of product options with varying degrees of financial commitment and/or long-term customer involvement.

Key Messages and Target Audience

When communicating with customers, the Company uses several overarching key messages including:

- Energy efficiency reduces operating costs and improves the bottom line.
- Xcel Energy helps lower energy bills by offering rebates and incentives for installing highly efficient equipment, using energy-saving building designs, and optimizing existing equipment to maximize comfort and energy savings.
- Rebates and incentives shorten payback periods for energy-efficient equipment and systems, providing lasting savings for years to come.
- Energy efficiency helps reduce environmental impacts.

The Company also markets its products differently to the various business sub-populations, depending on the target audience. Each of these target audiences are identified by key shared characteristics before analyzing their motivations. Once motivations are identified, the Company can adjust the above key messages to meet the customers' specific needs.

Small- and Medium-Sized Businesses

Small and medium-sized business customers traditionally own or work in buildings in segments such as offices, retail, healthcare, education, lodging, light manufacturing, and grocery. They are motivated differently than larger businesses and are busy trying to keep their businesses successful and running smoothly which means energy is a low-interest category. Small business owners are motivated by how to save money and how to make things more convenient. Key messages used to address these needs include:

- Energy savings go right to profits.
- Partnering with the property manager (where applicable) to employ energy savings can lower energy costs, improve ambiance, and increase the owner's property value.

Large Businesses

Large commercial customers traditionally own or work in buildings in segments such as office, retail, education, healthcare, restaurants, auto dealerships, and congregations. These customers recognize the value of environmental responsibility and sustainability efforts; but in doing so want to weave these efforts into their long-term financial strategies. Industrial manufacturing in Colorado is most concentrated in the areas of food and beverage, chemicals, computers and electronics, and machinery. They are highly engaged in getting the most production from every unit of energy, to keep operating costs low and eliminate waste. In all, these customers are the most energy-savvy and are constantly monitoring their equipment and processes. Key messages used to address both these customer groups include:

- Energy is a large part of the operating budget.
- Rebates help reduce up-front costs, shorten payback periods, and provide ongoing savings for years to come.

- Energy savings go right to the bottom line as increased profits.
- Investing in energy savings is a smart decision.
- Energy-efficient equipment and systems help increase reliability while decreasing maintenance costs.
- Saving energy helps reduce environmental impacts and meet sustainability goals.

Marketing Tactics

Marketing tactics center on product-specific promotions, solutions-based marketing, and a variety of communications vehicles.

Product-specific Promotions: Product-specific marketing efforts tie back to the overriding message, offering specific examples of concrete ways to do more. These examples show customers and trade partners the direct, personal impacts of their efforts, offering examples of energy savings, paybacks and lifetime savings or personal rewards.

Solutions-based Marketing: These communications focus on product combinations that offer solutions for a specific customer segment (e.g., schools) or solutions that address common customer concerns (e.g., weather, energy costs, environment) rather than marketing a single product.

Communications Vehicles:

- Product collateral, including feature sheets, applications, customer case studies, savings calculators, participating vendor lists and cross-product energy-savings guides.
- Newsletters for specific products or cross promotion, such as the Energy Exchange for trade partners and Energy Solutions for customers.
- Websites.
- Direct mail campaigns for specific product end uses announcing new incentives or for customer education, as well as general direct mail pieces targeted at specific market segments.
- Events, including product and technical training, customer education and customer recognition.
- Speaking opportunities in local industry meetings, business events (i.e., Chambers, National Association of Industrial and Office Properties, and Building Owners and Managers Association) and local conferences.
- Media relations, including free placement in appropriate media, focusing primarily on customer stories and product information and changes.
- Advertising in business magazines, newspapers, the internet, and radio spots.

E. Program-Specific Policies

The Company has adopted several general policies that are followed across products in the Business Program. Individual products may have additional unique policies as noted in each of the product summaries that follow. The general policies provide guidelines; however, they may be altered under specific circumstances and/or for specific periods of time when warranted for promotional events or other purposes.

The Company defines all-electric, electric-only, and gas-only customers as follows:

- All-electric: customers who only receive electric service from the Company and space conditioning and water heat with electricity;
- Electric-only: customer who receive electric service from the Company and natural gas service from another provider for use in space conditioning and/or water heating; and
- Gas-only: customer who receive natural gas service from the Company and electric service from another provider.

The program-level policies include:

- *Proof of installation:* All products require documentation of installation, such as proof-of-purchase (e.g., invoices) or a site verification.
- *Payback requirements:* The payback policy for custom conservation products:
 - a. Rebates may be paid on projects with payback of at least 1 year.
 - b. Project payback must be less than the project lifetime, which varies by product and technology.
- *Studies:* Study funding cannot exceed 75% of the study cost and studies must be completed within three months.
- *Load Shifting:* Load shifting occurs when a measure shifts energy and demand usage to an off-peak period, without necessarily reducing the total load served over a defined time period. Potential load shifting projects need to meet all existing eligibility requirements of the applicable product as well as additional persistence requirements.
- *Study-Driven Savings:* If a customer implements measures identified in a study that are less than a one-year payback, they will not receive a rebate, but the Company will claim the study-driven savings regardless. The Company believes that our financial and technical help in identifying and/or analyzing energy efficiency measures provides sufficient influence on the customer's decision to implement those measures.

F. Stakeholder Involvement

Since 2009, the primary avenue for external party involvement has been the quarterly DSM Roundtable Meetings. The Roundtable Meetings are open to all interested parties who want more information on the Company's DSM products and would like to provide feedback into the design, planning, and implementation of the products. These stakeholder meetings will also be used to discuss BE offerings and solicit feedback on the Company's BE offerings.

Beyond the Roundtable Meetings, each DSM product manager involves applicable trade allies and other stakeholder groups, as needed, in the development of the Company's products. The Company also participates in regional and national efforts to design and develop the best DSM products for business customers. For example, participation in the Consortium for Energy Efficiency's ("CEE") planning and research efforts to promote energy efficiency technologies.

In 2014, the Company launched the *Partners in Energy* product to support communities in developing and implementing comprehensive energy action plans. The Company continues to work with local community partners through this initiative and reaches out to businesses to support

them in reducing their energy consumption by participating in the Company's DSM/BE products. This innovative approach gives local businesses greater access to DSM/BE resources through non-traditional channels and leverages joint marketing opportunities and community momentum to drive additional customer participation.

G. Rebates & Incentives

Business rebates are offered for custom and prescriptive products to promote high efficiency technology implementation. Rebates and incentives vary by product and can be offered to customers, vendors, distributors, and manufacturers. The Company may also deem it prudent to offer bonus rebates to customers and/or trade partners to boost participation if implementation lags and budgets allow.

Indirect products, such as Business Energy Analysis and Business Education support participation in business DSM/BE products.

H. Evaluation, Measurement & Verification

The specific product measurement and verification plans are described in the EM&V section of this Plan; and products that will undergo comprehensive evaluations in 2023 are also noted that section.

➤ Business Energy Assessment

A. Description

The Business Energy Assessments product offers study funding and electric and natural gas implementation rebates to commercial and industrial customers who improve their building performance through an energy assessment.

The product's main offerings include the following:

- Subsidized assessment options that identify energy-saving opportunities. Customers pay a portion of the assessment cost based on their size.
- Operationally-focused rebates for implementing recommissioning or building system tune up measures identified through a study; and
- Prescriptive rebates for the end-uses rebated in our other prescriptive products;
- Custom rebates for any energy-saving opportunities eligible for rebates under our other custom products;
- Free implementation services to help customers implement energy-saving opportunities.
- Tuition Rebates to off-set the cost of Building Operator Certification training.

Assessments Suite

Customers signing up for an assessment through the Business Energy Assessments product will receive a whole-building energy analysis. This assessment includes a utility bill analysis, a thorough walkthrough of the entire facility and a list of energy-saving strategies with savings estimates, as well as associated cost and rebate values. The assessment options are listed below:

1. *Commercial Streamlined Assessment Implementation* – Advising support will be provided during and after a Commercial Streamlined Assessment to implement identified system tune-ups and savings opportunities.
2. *Building Assessment* – Previously filed as Recommissioning, this assessment focuses on optimizing existing equipment within facilities. Prescriptive and Custom energy-saving opportunity rebates will be identified where applicable.
3. *Targeted Building Assessment* – Additional replacement for Recommissioning product, this offering encompasses the same components as the Building Assessment but at a greater depth. A detailed, comprehensive assessment that will be tailored to highly-engaged customers that have an expectation of building an on-going relationship with their study provider and utility.

Implementation Services

The product offers a variety of services that customers may choose from depending on their specific needs to help them implement their projects. The intent of adding an implementation consultation is to improve the conversion rate on energy-saving opportunities identified in our study offerings. Services include, but are not limited to:

- Attending internal stakeholder customer meetings to obtain approval;

- Assistance with prioritizing projects;
- Financial analysis of implementing measures;
- Bidding process review;
- Coordination of implementation;
- Verification of installation; and
- Paperwork compilation and rebate submission.

B. Forecasts, Participants & Budgets

Forecasts and Participants

Energy savings and participation forecasts were determined by looking at historical performance as well as projects currently in the pipeline.

Budgets

Budgets were developed commensurate with the energy savings forecasts, based on historical costs. Most of the budget is driven by the number of studies completed and number of customers who implement projects in a given year.

The main budget drivers include the following:

- *Administration* – This budget includes labor estimates which are based on historical spending.
- *Third-Party Customer Services* – This budget includes scoping and project management services provided directly to the customer.
- *Advertising and Promotion* – A promotional budget includes outreach tactics to generate awareness of the new assessment offerings and encourage participation.
- *Participant Incentives* – This budget reflects the assumed participation across multiple end-use products based on the average project implementation numbers from the last three years.

C. Application Process

An application process will be made available to customers and trade partners that is structured to guide participants to the best-fit assessment to serve their needs and operations.

D. Marketing Objectives & Strategies

Customers learn of the product through their Public Service Account Manager, Business Solutions Center representative, direct marketing efforts and *via* the Business Energy Assessment trade partners.

The marketing strategy is to educate customers and trade partners on the benefits of a Building Energy Assessment. Due to the long sales cycle, it is important to continually build the study pipeline to meet future year's forecasts. To build the pipeline and to attract customers and trade

partners, various marketing tactics such as educational seminars, in person meetings, case studies and the product website are utilized.

E. Product-Specific Policies

Building Energy Assessments has a few policies that are specific to the product, which include:

- *Study/analysis driven credit*: If a customer implements measures that are less than a one-year payback or over a seven-year payback, they will not receive a rebate, but Public Service will claim the study/analysis-driven savings. The Company believes that our help identifying and/or analyzing energy efficiency measures provide sufficient influence on the customer's decision to implement those measures.
- *Maintenance*: The Assessment product may claim energy savings for major maintenance measures identified and implemented through the recommissioning process.
- *Rebate/energy savings validity*: If at least two years has passed since a project was approved, the technical staff re-analyzes it with current rates to determine if the savings/payback has changed. This re-analysis is conducted prior to issuing a rebate.
- *Customer eligibility*: The product is available to retail business customers with both electricity and natural gas service, or electricity only service. Electric customers with transportation natural gas will receive identification of gas energy conservation opportunities. Gas only service customers are not eligible for this product.

F. Stakeholder Involvement

The Company values feedback from customers and trade partners and makes an effort to gather their input to ensure the product is effective. As ideas are generated from stakeholders, they will be reviewed and implemented, if feasible. The Company will meet with our active trade partners to discuss product specifics and to obtain feedback. Continuous communication with this group through informal conversations and project work provides opportunities to keep this feedback channel open.

G. Rebates & Incentives

A range of subsidized assessments will be offered to identify energy-saving opportunities. Customers pay a portion of the assessment cost based on their size. Assessments will identify operational and equipment (capital expense) energy-saving opportunities. Public service will pay for implementing recommissioning or building system tune up measures identified through an assessment, as well as rebates for both prescriptive and custom end-use products. In addition, the Company will pay rebates for peak coincident kW reduction achieved, kWh saved, and Dth saved for recommissioning measures identified in assessments, up to a maximum of 60% of the measure costs that are identified in assessments. Finally, Public Service will pay a tuition rebate to off-set the cost of Building Operator Certification training.

➤ **Business HVAC+R Systems**

A. Description

The Business Heating, Ventilation, Air Conditioning, and Refrigeration (“HVAC+R”) Systems product combines Heating Efficiency, Cooling Efficiency, and Motors, Drives and Pumps, and C&I Refrigeration measures into an integrated demand-side management product. The Business HVAC+R Systems product encourages Public Service gas and electric business customers to consider high-efficiency options when choosing to replace existing mechanical systems. The Business HVAC+R Systems product will focus on customer needs which will drive deeper penetration of energy efficiency measures and provide opportunities to integrate demand management and load management strategies.

The product offers a broad range of prescriptive rebates and midstream incentives for high-efficiency equipment options. The product will leverage the custom measure to evaluate demand management opportunities. Such projects are evaluated under the Custom Efficiency analysis and must follow the rules of the Custom Efficiency product.

Prescriptive participants receive rebates to help buy down the initial capital cost and shorten the payback period. The new equipment also provides better reliability and lower maintenance costs, as well as lower utility bills via energy savings. The Company currently follows the guidelines of the International Energy Conservation Code (“IECC”) 2018 for equipment definitions, standard formulas, and minimum recommended efficiencies. These sources, along with Public Service’s historical experience, allowed the Company to develop influential prescriptive rebates that encourage the most efficient choice of equipment in the majority of equipment categories.

Midstream measures under this product are designed to deliver incentives to market actors who sell qualifying high-efficiency HVAC equipment by increasing stocking levels and upselling. The Midstream measures are designed to adapt to market changes, and the Company will continue working with relevant industry players to enhance the product to include new midstream incentives for equipment.

B. Forecasts, Participants & Budgets

Forecasts and Participants

Forecasts are based on the achievements of past years, estimates of market penetration, and a review of potential cooling, heating, motors and drives, and refrigeration technology efficiency improvements.

Participation was derived from prior years’ (2020 and 2021) performance. Additional factors included feedback from trade partners, product participation trends, average project size, and historical participation.

Budgets

Historical cost and participation information was analyzed to project expenditures. External resources and discussions with local stakeholders were used to ascertain expenditures and market equipment cost. Comparative spending analysis of past-year activity is generally conducted but is not the determining factor, since other external variables like promotions, materials, and staffing influence future costs. The Business HVAC+R Systems product will have an integrated budget.

Rebates, incentives, labor, and promotions influence the budget:

- *Rebates:* Developed using the average project rebate cost from the detailed technical assumptions, multiplied by anticipated participation levels.
- *Administration:* Determined by estimating the number of full-time employees needed to manage the product and execute the marketing strategy and rebate process, including Account Management and BSC support.
- *Promotions:* The estimated promotional budget anticipates several customer and trade partner communications and events during the year.

For the midstream offering, external resources and discussions with local stakeholders are leveraged to establish the market potential for HVAC equipment. Incentives and third-party implementer costs influence the budget:

- *Incentives:* Midstream incentives to participating distributors influence the sale of high-efficiency products to contractors, thereby increasing the availability of these products for customers in the marketplace.
- *Administration:* A third-party implementer will facilitate recruiting and management of distributors, design and management of the web-based paperless rebate application, and process individual applications. Internal administration and advertising costs are minimal; Account Management and BSC budgets are not required. Rebate Operations costs are minimal.

C. Application Process

Prescriptive Measures:

Online and paper applications for the product are available on Xcel Energy's website.²⁵ Customers may apply for rebates by completing an application and providing a detailed purchase invoice for the newly installed equipment. The equipment must be new and meet all the qualifications detailed in the online application. After the customer has installed the equipment, the online application and invoice must be submitted to Public Service within 24 months of the invoice date. Once the online application is processed, rebate checks will be mailed to the customer, or alternate recipient, as indicated on the application, within six to eight weeks.

Midstream Incentive:

A critical component of the midstream measure is its use of a web-based paperless application for participating distributors. A paperless system is critical for ease of participation and for reducing the cost per kWh saved. Incentives will be paid to participating distributors on a bi-weekly basis.

²⁵https://www.xcelenergy.com/programs_and_rebates/business_programs_and_rebates/equipment_rebates

The distributor must submit the following information into an online application in order to receive the incentive:

Qualifying Equipment Information:

1. Manufacturer
2. Model
3. Number of units installed
4. Unit Serial numbers

Installation Site Information:

5. Business name and address where the equipment is to be installed
6. Contact information (customer, or contractor, or installer)

Sales Information:

7. Invoice number and date

D. Marketing Objectives & Strategies

The Business HVAC+R Systems product creates a base level of knowledge in the marketplace through newsletters and direct communications to customers and trade allies. These tactics make customers aware of the key benefits of energy efficiency and its applicability to Business HVAC+R Systems and gives the trade a platform from which to educate customers on high-efficiency solutions for their particular applications. The product provides literature and tools for the customers and trade to evaluate rebates and incorporate them into purchase decisions. In addition, customers are served by Public Service's Account Managers and BSC who educate them on energy efficiency, evaluating rebate potential, and the rebate application process. The trade can find similar assistance through the Trade Relations Manager. The Business HVAC+R Systems product also benefits from opportunities identified for participants via the Company's Business Energy Assessments product.

Marketing communications will revolve around the benefits of energy efficiency through paybacks, lifecycle costs, and environmental benefits. Newer equipment is typically more efficient, more reliable and may have more effective controls than an older system providing both energy and non-energy benefits to the end user. Public Service uses generally-accepted information from sources such as ENERGY STAR[®], the American Society of Heating, Refrigeration and Air-conditioning Engineers ("ASHRAE"), the Federal Energy Management Program ("FEMP"), and others to educate customers on no- and low-cost ways to save energy, such as performing regularly scheduled maintenance and simple tune-up tips to ensure systems are operating optimally.

E. Product-Specific Policies

The product does not rebate back-up equipment or portable equipment. Qualifying equipment must be new and permanently installed at the end-use customer.

VFDs must automatically control the speed of existing or new motors.

Gas Transport Only customers cannot participate in rebates for the heating efficiency measures.

Participating customers must be a business retail natural gas, electric, or a combination electric and gas customer of Public Service Company of Colorado.

Qualifying Midstream Distributors: A qualifying distributor is an entity that purchases qualifying equipment directly from the manufacturer and sells such equipment to be installed at a qualifying customer's facility. A vendor who purchases equipment from a distributor does not qualify. Under certain circumstances, a manufacturer and/or a manufacturer's representative may serve as its own distributor and sell directly to the end-use customer. In this case, the manufacturer/distributor can qualify.

Applications for rebates must be submitted within 24 months of invoice date.

F. Stakeholder Involvement

Because HVAC+R Systems can be very complex, trade partner relationships are imperative to achieving the product's energy savings and participation forecasts. The Company has engaged trade allies in product design and improvement through focused trainings and outreach events. Members include manufacturer's representatives, and equipment contractors. The Company targets distributors for several reasons, including:

1. Distributors control equipment stocking and sales.
2. Influence contractors' purchase decisions which influence customer purchases.
3. Minimize downstream markups and lost opportunities.
4. Fewer market actors enable lower implementation costs.
5. Meets customer's demand for immediate replacement.
6. Distributors influence majority of equipment sales.
7. Most qualified sales staff with financial, technical, and sales skills.

The product will explore adding additional measures for contractors as a part of the midstream offering. Trade Partners have constant interaction with Business HVAC+R Systems during installation and maintenance services. This puts them in a unique position to identify potential system improvements and ensure quality throughout the system.

G. Rebates & Incentives

Generally, Public Service has set the minimum qualifying efficiency at a point that nominally exceeds the IECC 2018 minimum efficiency requirements to encourage customers to purchase the most efficient equipment, while ensuring that manufacturers have equipment that meets the criteria of the product.

The proposed rebate level averages approximately 60% of the incremental cost. This level balances the cost-effectiveness of the product with the incentive needed to motivate the customer to purchase efficient equipment, achieving a payback of less than five years in most cases. Rebates are designed to buy down the incremental cost of purchasing efficient equipment, which is increasing with the stricter code requirements in the market.

The midstream approach provides distributor incentives based on the size of the unit in tons.

➤ **Compressed Air Efficiency**

A. Description

The Compressed Air Efficiency product helps customers address inefficiencies in their compressed air systems. The product encourages repair and redesign of existing systems and encourages the purchase of efficient options for new and replacement systems. The product has three components:

1. Prescriptive rebates for the most common high-efficiency options such as no-loss air drains, cycling dryers, purge controls, mist eliminators, and for certain variable frequency drive (“VFD”) compressors;
2. Rebates for studies that help customers identify efficiency opportunities from fixing leaks as well as from redesign or replacement of system components; and
3. Custom rebates for implementation of unique improvements identified by studies; improvements can include capital purchases such as qualifying compressors, and “process” changes such as piping modifications or horsepower (“hp”) reductions.

Rebates are available for any size of compressed air equipment through the product’s custom component. For equipment over 10 hp, customers are advised to complete a system study prior to submitting an application for a custom efficiency rebate. Such projects are evaluated under the Custom Efficiency analysis and must follow the rules of the Custom Efficiency product.

Examples of equipment replacement that may qualify for the custom rebate include:

- Replacing a 40 hp compressor with a 50 hp compressor;
- After completing a compressed air study, replacing an existing 150 hp air compressor with two 75 hp compressors and controls; and
- After completing a compressed air study, replacing an existing 150 hp air compressor with a 150 hp VFD compressor.

The Compressed Air Efficiency product is available to all electric commercial and industrial customers within the Company’s service area. The primary participants are mid-sized business customers that have some or all of the following characteristics:

- Demand of 100+ kW; and/or
- Operate within energy-intensive industries (*e.g.*, food processing, mining, etc.).

In addition, there is a secondary target of small business customers that may have some or all of the following characteristics:

- Limited internal resources to purchase, install and finance projects;
- Limited technical expertise; and/or
- A focus on short-term paybacks.

Members of the trade are also targeted to increase product education and engagement, including equipment manufacturers and installers, as well as design engineers and electricians.

B. Forecasts, Participants & Budgets

Forecasts and Participants

Participation and savings forecasts were established in light of recent product trends and experience, including performance from 2016 through 2019. Trade feedback, an evaluation of potential customers within the Colorado service territory, and results from the product's 2014 comprehensive evaluation also informed forecasting.

Budgets

Historical budgets were analyzed to project the product budget for 2023. Other factors such as planned promotions, trainings, and staffing influenced deviations from historical trends. The budget is largely driven by rebates and internal labor, as well as consulting fees. Specifically:

- *Rebates* – The budget for rebates is established by estimating participation for the product and applying the rebate amounts per kW and kWh.
- *Internal labor* – Compressed Air Efficiency is a labor-intensive product. It is one of the few products in Colorado that has prescriptive, study-based, and custom components. The study and custom components require Company staff to conduct detailed analysis for approval of each project. Labor is typically 25% to 30% of the product cost.
- *Consulting* – A consultant provides measurement and verification (“M&V”) services, as needed.

C. Application Process

Customers can learn about the product through various channels, including from a Public Service Account Manager, compressed air vendor, website literature, or product advertising. Applications must be signed by the customer but can be submitted by customer representatives including building owners, contractors, engineering firms, energy services companies, and equipment vendors. Typically, the customer or a vendor selling to the customer identifies a project and starts the application process described below.

Compressed Air Prescriptive Measures

For prescriptive measures, the application process is similar to other prescriptive products:

- Customers may apply for rebates by completing and signing the application and providing an itemized invoice for the installed equipment. The equipment must be new and meet all the qualifications detailed on the application. The customers may submit a rebate application within twelve months after the invoice date. Once the paperwork is completed and submitted, rebate checks are mailed to the customer, or alternative rebate recipient, within six weeks, as indicated on the application.
- The replacement of compressors must be for a new variable speed drive compressor(s) with hp that is less than or equal to that of the replaced load/no-load compressor(s). If the retrofit is not a reduction in hp or involves additional compressor types, customers may apply for preapproval through the custom product.
- The replacement or installment of a new cycling dryer must be 75 SCFM to 2799 SCFM and must not be used as backup. Non-cycle or refrigerating dryers are not eligible. The

replacement or installment of a new mist eliminator filter must be 500 SCFM to 2299 SCFM and must not be used as backup. The rated pressure drop of all mist eliminators must be 0.75 pounds per square inch gage or less over the lifetime. The installment of only new dryer purge controls must be for systems that are 90 SCFM to 2499 SCFM and cannot be used as backup. Dryers must have a dew point sensor at discharge to monitor demand and only desiccant heatless dryers are eligible.

Compressed Air Studies

In order to begin the study process, the customer will select a participating compressed air vendor/contractor to conduct their study. A list of eligible participating providers and trade partners is available on the Company's website.²⁶ The customer submits the Compressed Air Efficiency study application to a Company Account Manager. Maximum study funding is based on system horsepower, and up to 100% of study costs are rebated if the cost of the study is equal to or less than the maximum funding. The eligible operating system horsepower has been expanded to include smaller systems between 10 and 49 hp. To receive preapproval, the study application must propose to include the following components:

- An ultrasonic leak survey to locate and tag air leaks, and estimate the cost of inefficiencies due to system leaks and misuses;
- An efficiency report with system recommendations and estimate of energy cost savings due to each recommendation;
- Characterization of major compressed air system components including:
 - Compressor ID, model, manufacturer, nameplate hp, motor nameplate hp, type, capacity, pressure rating in psig, age, and control type;
 - Compressor motor size, efficiency, and age;
 - Type, capacity, and age of dryers and other conditioning equipment;
 - Type of automatic compressor controls, if any;
 - Description of major compressed air end uses;
 - Location and layout of piping and major system components; and
 - Inspection of compressed air system components and identification of problem areas.
- Identification of system loading of major compressed air users including size, frequency, and duration of use;
- Measurement of power, pressure and flow for a minimum of seven days for systems 50hp and above, and for an appropriate length of time for smaller systems;
- Summary of the results of the leak and unregulated demand inspection, including the location and approximate size of each leak;
- Summary of the execution steps and cost estimate to repair the leaks, unregulated end-uses and inefficient compressed air applications;
- Recommendations for improvements to customer's maintenance procedure and equipment retirement/replacement schedules; and
- Recommendations for follow-up actions to improve operation and efficiency, including the installation of new equipment.

²⁶<https://www.xcelenergy.com/staticfiles/xe-responsive/Programs%20and%20Rebates/Business/CO-Compressed-Air-Contractor-List.pdf>

To receive the study rebate, the completed study report must show data was collected on the preapproval date or within the allotted preapproval timeframe. The customer must repair at least 75% of the air loss due to leaks as identified by the study and included in the completed report. Once the customer has repaired the leaks, the customer will inform their Account Manager. The customer and Account Manager review the list of identified leaks and note the repair status of each leak. The customer and Account Manager both sign the verification section of the application and submit it to the product manager along with copies of invoices and other required information as stipulated in the preapproval letter.

Custom Compressed Air

If the customer chooses to implement recommended capital improvements to the compressed air system that do not qualify for prescriptive rebates, they may apply for preapproval of their project through the Company's Custom Efficiency product application process. Please see the [Custom Efficiency](#) product section of this Plan for a description of the process to be followed. The Compressed Air product offers higher custom rebates for customers who have received a study prior to custom project completion.

D. Marketing Objectives & Strategies

Account Managers and compressed air vendors are the primary marketing conduits for this product and will market the product through their direct relationships with customers. In addition, the following strategies will help meet product forecasts in 2023:

Targeting Industrial Customers – Industrial customers make up a sizeable market that has the potential to bring in large compressed air projects. The Company targets these customers with direct contact (which may include mailings, email blasts, etc.) to create awareness and answer questions about the product.

Leveraging Trade Partners – The trade partners operating in Colorado are a significant factor in the success of this product. Working directly with these trade partners helps to identify potential participants early in the planning stages of a project. The Company continually strives to demonstrate how incorporating incentives into trade partners' bids can be a benefit to their businesses.

Competition amongst the small group of vendors is high due to the mid-to-large industrial/manufacturing markets targeted. Therefore, the Company trains each trade partner individually. Throughout 2023, training with trade partners will continue. The trainings provide a forum to review the vendor's work, make recommendations for a better end-product, and solicit feedback on the effectiveness of the Compressed Air product.

Delivering Marketing Collateral – Marketing collateral is an important tool to provide customers with useful, easy to follow guidelines for the product. The Company continuously solicits feedback from customers and trade partners to improve these materials. Collateral is available for customers, trade partners, and others. Customers and trade partners can request

hard copies of the material or they can access material on Xcel Energy's website. The collateral includes:

- *Compressed Air Information Sheet* – Helps describe the product to customers and trade partners. Provides examples of projects that may qualify, business reasons to participate, and a summary of the procedures to follow.
- *Compressed Air Application (for qualifying prescriptive measures)* – Lists qualifying prescriptive measures. The customer fills out several sections including technical information related to the proposed and existing equipment.
- *Compressed Air Study Application* – A document that customers fill out to start the process of participation. The customer or vendor is asked to fill out several sections including information about the location, applicable rates, project description, equipment supplier, technical information about existing and proposed equipment, and project verification.
- *Participating Study Providers List* – A list of trade partners who have submitted studies in the past or expressed an interest in participating in the product. The list is provided for the convenience of customers who do not have a working relationship with a vendor. The Company does not endorse any particular provider over another and is willing to amend or add partners as the market changes.
- *Compressed Air Study Template* – A detailed example of a study that is comprehensive and provides value to customers' energy saving efforts.

E. Product-Specific Policies

Compressed Air studies require preapproval prior to implementation. Custom projects are evaluated under the Custom Efficiency analysis and must follow the rules of the Custom Efficiency product. These processes help to minimize free ridership and ensure the technical and financial soundness of projects that are awarded rebates. All compressed air equipment projects must have a payback period over one year.

The system requirements include:

- Electrically driven compressed air systems;
- Minimum 10 hp total installed air compressor capacity (excluding backup equipment); and
- Systems must operate at least 40 hours per week (2,000 hours per year).

F. Stakeholder Involvement

Customers, trade partners, and other stakeholders are currently engaged at the specific project level. Feedback is garnered individually from each participant and once a trend develops (positive or negative), the Company makes a change to the product design. If it is a small change, it is then discussed internally and possibly with a few key trade partners and, if deemed acceptable, implemented. A larger change would possibly involve review by the product's external technical resources or other third-party.

G. Rebates & Incentives

The Compressed Air Efficiency product helps customers lower operating costs by offering rebates on compressed air studies and by providing rebates on compressed air equipment. Rebates apply to new and leased equipment, but not to used equipment. All rebates are subject to Product-Specific Policies (Section E above) and Business Program Policies.

Study rebate levels are described in [Appendix H: Technical Reference Manual](#) and are described in the study funding application as well as on the Company's website.

Prescriptive rebates for compressed air equipment are available for no-loss air drains, cycling dryers, mist eliminators, dew point controls, and select variable speed drive compressors. Prescriptive rebate levels are shown in the [Appendix H: Technical Reference Manual](#), on the rebate application, and on the Company's website.

➤ **Custom Efficiency**

A. Description

The Custom Efficiency product offers rebates to electric and natural gas business customers who implement energy saving projects that do not fit the requirements of prescriptive products. The product is marketed to all business customers regardless of size using direct contact with customers via our sales representatives, the internet, and trade channels.

This product also offers study funding to help customers determine project viability and energy savings potential.

Energy-saving non-prescriptive projects include installing new equipment, replacing existing equipment, retrofitting equipment, or improving processes that lower a customer’s electric or natural gas use. The project list includes, but is not limited to, the following:

Equipment	Application
Compressed Air	New equipment, reduction in hp of compressors, storage, vacuum pumps, and variable speed drive compressors, reduction of compressor run time
Controls	CO ₂ based ventilation, compressed air, and refrigeration controls
Cooling	Heat recovery, process cooling, and controls
Lighting	Lumen output changes, exterior lighting, light-emitting diode (“LED”) and daylighting, retrofits (not one-to-one)
Miscellaneous	Energy efficient windows (film, argon, Low E), humidification, insulation, printing presses, and welders
Motors & Drives	Motors > 200 hp, Drives > 200 hp, any motor type outside the prescriptive parameters, and Drives for non-fan, non-pump processes
Refrigeration	Ammonia compressors, freezer doors, and evaporative condensers
Process Changes	<ul style="list-style-type: none"> • New system produces more output than the old system while using the same amount of energy as the old system • New system produces the same output as the old system using less energy • Reconfigure system layout
Load Shifting	Ice Storage and other load shifting technologies

B. Forecasts, Participants & Budgets

Forecasts and Participants

The energy savings and participant forecasts were determined by looking at both historical performance and projects that are currently in the product pipeline, as well as consideration of current economic conditions.

Budgets

Historical cost and participation information is tracked and analyzed to project future expenditures. For the Custom Efficiency product, administration and customer rebates are the primary budget drivers.

- *Administration:* Custom Efficiency is a labor-intensive product due to the pre-approval process and analysis components.
- *Rebates:* The budget for rebates is established based on an estimation of participation levels, multiplied by the rebate per kW amount in the technical assumption models.

C. Application Process

The application process for custom projects is more involved than those for prescriptive measures. Each custom project must meet specific eligibility requirements. This process can be broken into distinct steps: Application Submission, Project Analysis, Project Acceptance or Ineligibility, and Project Completion.

Application Submission:

Public Service Account Managers and/or a BSC representative work with a customer and their vendor to identify a project with energy efficiency opportunities and start the application process. In addition to the application, which must be signed by the customer, an electronic “workbook” is filled out with a detailed description of the project.

Project Analysis:

Engineers review the project information and enter pertinent data into a MTRC test model to determine the projected energy savings, benefit/cost ratio and payback. The model calculates energy savings for various end-uses (lighting, motors, cooling, compressed air, etc.) to ensure consistency in analysis from one project to another. All calculations are based on approved ASHRAE methods or other similar industry standards. Based on the modeled results, the project either passes or fails.

Project Acceptance or Ineligibility:

Once the engineers have completed the analysis, an approval or not rebate eligible letter is sent to the customer. The letter provides critical information regarding the project, including: rebate amount, project description and costs, energy savings, and any conditions that must be met to receive the rebate (e.g., measurement and verification). Should a project be ineligible for a rebate, a letter is sent to the customer with an explanation as to why the project was not approved.

Project Completion:

When a project is completed, the customer will inform their Account Manager or BSC representative. The customer will sign the verification section of the application and submit it along with copies of invoices and other required information as stipulated in the approval letter. If the final documentation matches the approved project information, the project the paperwork is submitted to Rebate Operations for issuance of the rebate.

Occasionally, projects must undergo re-analysis because the final project parameters do not match the original project application. This may be due to minor changes in project scope, cost, or technology. In these cases, the actual project information will be given to the technical staff for review and re-analysis. The original analysis will be updated with the new information to determine if the project still meets passing criteria. A passing project will be awarded a rebate based on the calculated savings from the updated analysis. A project that fails on re-analysis will not be issued a rebate.

D. Marketing Objectives & Strategies

Marketing is conducted primarily by Account Managers, leveraging their direct relationships with customers. In addition, the Company will use the following strategies to achieve the product's energy savings forecasts in 2023:

- *Target Industrial Customers*: Colorado's industrial base is relatively small, but these few customers offer substantial opportunity. Many of the opportunities will come from specialized applications or processes requiring a greater insight into the individual customer's operations. To achieve this, the Company relies heavily on leads from Account Managers and outreach to the vendor community.
- *BSC Representatives*. The BSC provides direct support to non-managed commercial customers.
- *Use of Collateral*: Public Service has developed a broad range of marketing collateral for the product; this information is available in electronic format on Xcel Energy's website²⁷ and in hard copy format for customers, trade allies, and internal Public Service staff as needed. This material is continually reviewed and revised based on feedback from participants and as changes are made to the product. The key collateral includes:
 - Custom Efficiency Brochure – This is the primary tool for Account Managers that helps describe the product to customers and trade allies. It provides examples of projects that may qualify; business reasons to participate; and a summary of the procedures to follow.
 - List of Potential Projects – Project types that have fared well in Colorado and Minnesota serve as the basis for this list. The list includes both electric and natural gas conservation measures.
 - Trade Partner Website²⁸ – This resource was designed specifically for the Company's trade allies. It includes all the materials indicated above and other helpful information.
 - Energy Exchange – A quarterly email newsletter that goes out to all trade allies who have registered to be part of the trade ally network.
 - Custom Specific Workshops – Workshops will be conducted for vendors and/or customers to communicate project opportunities specific to custom end-use situations.

²⁷https://www.xcelenergy.com/programs_and_rebates/business_programs_and_rebates/equipment_rebates/custom_efficiency

²⁸https://www.xcelenergy.com/working_with_us/trade_partners

E. Product-Specific Policies

All custom projects must have an MTRC ratio of equal to or greater than 1.0, and a simple payback of over one year, and less than the estimated life of the product to be eligible for a rebate. Rebates are capped at 60 percent of the incremental project cost.

F. Stakeholder Involvement

Customers, trade allies, and other stakeholders are engaged at the project level to gather input regarding best practices, methods, and support for evaluating new technologies.

G. Rebates & Incentives

Rebates apply to new and leased equipment. Used or portable equipment is not eligible. To determine eligibility for a rebate, all projects are analyzed as described in the application process. Rebates are calculated based on the demand reduction (kW) yielded by the project. Additional details are identified in the Electric and Natural Gas Forecast Technical Assumptions within [Appendix H: Technical Reference Manual](#). For 2023, Public Service will offer an incentive level of \$500.00 per peak coincident kW and \$100.00 per off-peak kW for electric energy savings projects and \$4 per Dth for natural gas savings project.

➤ Data Center Efficiency

A. Description

The Data Center Efficiency product helps customers address energy conservation opportunities in both new and existing data centers, as well as other computing spaces. This specialized product was designed in response to the significant energy savings potential of these customers and the projected growth in energy use in data centers and computing spaces.

There are numerous ways data centers can become more energy efficient, including:

- High efficiency servers;
- Airflow improvements;
- Electrical equipment;
- High-efficiency cooling;
- Humidification;
- Power systems;
- High-efficiency lighting;
- Plate and frame heat exchangers; and,
- Virtual Desktop Infrastructures (“VDI”).

Any size data center or computing space may participate. The product encourages a holistic approach to energy efficiency within the data center, data closet, or computing space.

For existing facilities, the product provides funding towards an on-site evaluation and analysis and rebates based on the energy savings resulting from implementation. Such projects are evaluated under the Custom Efficiency analysis and must follow the rules of the Custom Efficiency product. However, prescriptive rebates for high-efficiency computer room air conditioner (“CRAC”) units, plate and frame heat exchangers, servers and VDI equipment are available. Data center customers can also apply for prescriptive equipment rebates from other products offered in the Company’s DSM portfolio. Data Center prescriptive equipment rebates will also be available to non-data center customers.

For new facilities, the product delivers expert knowledge and resources to help data center owners optimize the efficiency of their facilities during the design, early construction and operation stages of the new data center. Aligned closely with the design of the Energy Design Assistance (“EDA”) offering within New Construction (for commercial new construction projects), this Data Center offering will provide free consulting during the design phases of new data center construction projects and provide financial incentives to offset the increased costs of more advanced energy systems. The product commences with the customer’s first discussions with the Company regarding siting of a new data center and ends after construction and occupancy of the last in-scope portion of the data center.

Public Service maintains a list of approved study providers to perform data center studies and analysis. Study paths leverage the study providers, who have been provided training on Company tools, to conduct the analysis.

Fifteen-minute interval data could show an operator if cooling is adjusting properly to match changes in IT load. It could also be used as a basic indication if fan speeds, compressors or free cooling are adjusting as IT load or outside air changes.

B. Forecasts, Participants & Budgets

Forecasts and Participants

Electric energy savings and participation forecasts were determined by looking at historic participation and identified projects from the last several years.

Budgets

Budgets were developed commensurate with the electric energy savings forecast, based on historical cost of achievements. The largest cost in the budget is for energy efficiency project implementation and study rebates.

C. Application Process

Customers learn about the product through a variety of channels, including: the product website, Account Managers and trade partners or study providers. In addition, the Company will identify data center experts to help with the education of the product to customers. Product applications are available through all of these channels. Customers may submit an application through their Account Manager or trade partner or send it via mail or email to Public Service. A digital application is available for the prescriptive equipment rebates.

Customers building a new data center need to submit their application in the early phases of design to ensure recommended strategies are included in final design plans. The data center design study is similar to the New Construction product's Energy Design Assistance guidance for facilities.

Pre-approval is required to receive rebates for studies. Prescriptive measures do not require pre-approval and will be rebated for implemented projects. Custom rebates are available for energy saving measures that are not included under the prescriptive rebate category. Such projects are evaluated under the Custom Efficiency analysis and must follow the rules of the Custom Efficiency product.

D. Marketing Objectives & Strategies

The marketing strategy for Data Center Efficiency leverages a variety of channels including Account Managers, trade relations managers, professional organizations and direct customer communications. The goal of the Data Center Efficiency product is to build and/or retrofit data centers and computing spaces, with their copious electronic equipment, to be as efficient as

possible. Because the market for this product is so specific, Public Service will have Account Management focus on recruiting data center customers to participate. Account Management and a product engineer will work together to maintain contact with data center customers from identification of potential energy saving measures through implementation of the recommended measures. Face-to-face contact with our customer base is necessary to engage them in the product.

The Company will also conduct meetings with study providers and design firms to provide rebate information and other support for customer engagement. The Company will use these meetings to discuss new potential energy saving measures and best practices to encourage energy efficiency in a data center. Additional study providers will be sought after to help data center customers identify potential energy saving strategies at their location.

Soliciting Data Center Efficiency participation has typically required significant marketing effort to influence customers; many are reluctant to make changes to their mission-critical operations and upgrades require agreement across many function areas.

Public Service will offer on-site walkthrough audits of a customer's data center by a product engineer to help identify energy efficiency opportunities. Once the walkthrough audit is complete, the customer will receive a report that describes the identified opportunities and the possible paths for earning a rebate. This offer is intended to generate awareness of the product to data centers that have not previously participated in the product.

As part of our strategy to increase participation in demand response products, this product will provide opportunities for customers to participate in Critical Peak Pricing ("CPP"), Peak Partner Rewards ("PPR"), and Interruptible Service Option Credit ("ISOC"). Further details are provided in the technical assumptions.

E. Product-Specific Policies

Existing Facilities

Customers may perform a study by selecting a pre-qualified study provider²⁹. If they select a provider who is not on the Company's list, the new provider will be required to submit qualifications prior to receiving study funding approval.

The Company typically evaluates measures identified within a study as one project, based on the customer's indication to implement all measures included in the project. Pre-approved projects must be cost-effective. If at least two years has passed since a project was approved, the technical staff will re-analyze it to determine if the savings/payback has changed. This re-analysis is conducted prior to issuing a rebate check.

Studies, once pre-approved, need to be submitted to Public Service within three months of issuance of the pre-approval letter.

²⁹<http://www.xcelenergy.com/staticfiles/xcel/PDF/Marketing/CO-BUS-Data-Center-Efficiency-Provider-List.pdf>

New Facilities

To participate in this measure, customers will work directly with contracted agents of the Company who will facilitate the integrated design and modeling components of the measure. The choice of contracted providers is influenced primarily by the fact that the new Data Center market is highly dynamic and complex. To manage the risk introduced by this complexity, the Company chose to move forward with a limited provider delivery model. As the market evolves, the Company will evaluate the potential to open the consulting services of this measure up to other providers in a manner similar to the existing Data Center Efficiency studies and EDA offerings.

Computing Spaces

For prescriptive VDI measures and prescriptive high efficiency servers, all equipment rebated through the measure must be new and meet all measure rules and requirements. A minimum of 10 units must be purchased in order to qualify for the rebate. The application must be submitted within twelve months of the invoice date.

F. Stakeholder Involvement

The Company continues to develop collateral and educational materials to support the product. As participant feedback is received, suggestions will be evaluated for feasibility of incorporating changes.

The Company has been an active participant in the CEE Data Centers and Servers Initiative³⁰. The initiative focuses on collaboration among utilities striving for energy efficiency standards for data center equipment, including knowledge sharing of data center efficiency product development.

Xcel Energy is also a member of the Association for Computer Operations Management (“AFCOM”)³¹, the leading association of data center and facilities management providers, and 7x24 Exchange³², a not-for-profit organization for the mission critical industry.

G. Rebates & Incentives

Study rebate: Data Center Efficiency studies for existing facilities will be rebated up to 75% of the data center study cost, not to exceed \$25,000. This cap will be re-evaluated if a very large data center is being reviewed.

Custom rebate: Rebates are calculated based on the demand reduction (kW) yielded by the custom project. For 2023, Public Service will offer an incentive of \$500 per peak coincident kW and \$100 per off-peak kW.

³⁰<http://www.cce1.org/content/committee-work>

³¹<http://www.afcom.com>

³²<http://www.7x24exchange.org>

Prescriptive rebate: Rebates are available for High Efficiency CRAC units, Plate and Frame Heat Exchangers, VDI, and High Efficiency Servers. Prescriptive rebate levels are shown on the rebate application and on the Company's website.

Data Center New Construction rebate: The product will provide rebates on the actual savings of a project based on the times of day the project saves energy compared to the modeled baseline.

➤ Energy Management Systems

A. Description

The Energy Management Systems (“EMS”) product offers customers rebates for installing systems that control and reduce a building’s energy usage both on- and off-peak. Electric and natural gas customers are eligible for participation.

An EMS is a computer system designed specifically for the automated, centralized control of electromechanical functions within a customer’s facility. Typically, the EMS controls a building’s heating, cooling, ventilation, or lighting. The system may be referred to as a building automation system or the more general term of direct digital controls (“DDC”). EMS and DDC may sometimes refer to systems that control the customers’ process-related equipment for the purpose of energy reduction or demand management.

The product’s scope includes only existing buildings or process equipment. For such buildings or equipment, the product incentivizes a new EMS and the replacement of a non-functional or obsolete EMS. Adding functionality or control points for demand management to an existing system and software or programming will also yield incentives. The product is focused on reducing a building’s on and off-peak energy usage through sensors and controls that are centrally operated and optimized to save energy without compromising occupant comfort. Through automation, the systems may control heating, cooling, or ventilation functions. The product includes lighting controls only when they are integrated with the control system. Examples of measures encouraged by the product are shown in the following table:

EMS Control Strategies

<p>Resets</p> <ul style="list-style-type: none"> • Supply air/discharge air temperature • Entering condenser water temperature • Chilled water supply temperature VAV fan duct pressure and flow • Chilled water pressure • Hot water supply temperature 	<p>Scheduling</p> <ul style="list-style-type: none"> • Peak Coincident kW reduction • Holiday scheduling • Zonal scheduling • Override control and tenant billing • Night setup/setback • Optimum start/stop • Morning warm up/-cool-down
<p>Ventilation Control</p> <ul style="list-style-type: none"> • Occupancy Sensors • Supply air volume/outside/air damper compensation routines • Carbon dioxide sensing • Exhaust fans • Typical air-side 	<p>Lighting</p> <ul style="list-style-type: none"> • Lighting controls only when they are integrated with the control system
<p>Miscellaneous</p> <ul style="list-style-type: none"> • Simultaneous heating/cooling control • Zone-based HVAC control • Variable Speed Drive control 	<p>Demand Control</p> <ul style="list-style-type: none"> • Demand limiting or load shedding • Sequential startup of equipment • Duty cycling • Pre-cooling • Occupied setpoint setups

Future opportunities in EMS exist due to building occupancy patterns becoming more variable and less predictable. A properly running control system is now more important in managing energy. In addition, when buildings have reduced capacity, demand control ventilation can manage lower and varying occupancy rates, thus helping buildings that remain unoccupied.

B. Forecasts, Participants & Budgets

Forecasts and Participants

EMS savings and participation forecasts were established considering recent product trends, average project size, typical project costs, and the product’s historical performance. The resulting forecasted participation has decreased significantly in the past three years due to the following:

- Trade partners have shifted their focus from system implementation to ongoing performance contracting;
- The COVID-19 pandemic has presented lingering challenges including low building occupancy, tighter budgets, reduced efficiency investments, and supply chain constraints; and
- Trade partner focus on the territory's booming new construction market.

The target for EMS's marketing activities includes the owners or managers of existing commercial or manufacturing business that:

- Has not installed or upgraded controls systems for at least seven years;
- Has one entity that incurs the energy costs (without individually metered tenants);
- Are of sufficient size to likely have acceptable energy savings compared to costs, which tend to be buildings of at least 100,000 ft²; and,
- Has load shifting opportunities to decrease energy usage during peak coincident hours.

The Company will implement only those adjustments that are designed to be cost-effective and meet established engineering standards.

Budgets

Anticipated participation levels guided budget development. Historical costs were also considered, and promotional costs were minimized. The product's budget is driven by two costs:

- Rebates – The budget for rebates is estimated using historical data and analyzing anticipated payouts per kWh, PCkW, and Dth; and,
- Internal labor – EMS is a labor-intensive product due to the analysis components of the product. As the product includes demand control measures more analysis may be necessary to validate savings, thus requiring measurement and verification.

C. Application Process

The application process for the EMS product is the same as the Custom Efficiency product.

D. Marketing Objectives & Strategies

Marketing is primarily conducted by Account Managers, leveraging their direct relationships with customers. In addition, the following strategies will help meet energy savings forecasts:

1. Trade Partner Communications – EMS is substantially marketed to and through trade partners, which primarily consists of equipment manufacturers and distributors; electrical contractors; and mechanical contractors. The Company provides training sessions for these trade partners. The Company has hired Trade Channel Managers who work closely with Trade Partners to inform them on products. The "Energy Exchange", a quarterly email newsletter also goes out to all trade partners who have registered to be part of the Company's trade ally network. Communications may also include links to tools that will help with project analysis such as U.S. Department of Energy ("DOE") resources.

2. Collateral – Customers and trade partners can access material electronically on Xcel Energy’s website.³³ Marketing materials include:
 - *Product Information Sheet* – The primary tool for sales staff that helps describe the product to customers and vendors. It provides examples of qualifying projects, business reasons to participate, and a summary of procedures.
 - *Case studies - outlining specific savings and benefits achieved through EMS.*
 - *Product Application and Worksheet* – The document for customers to fill out to start the process of participation by gathering all of the necessary information about the project and the building.
3. Target Market – All commercial and industrial facilities within the Company’s service area are eligible to participate. The bulk of energy management systems are installed in commercial facilities (office buildings, schools, etc.). The product focus is on managed accounts and large unmanaged accounts. Approximately 80% of these customers are concentrated within the Denver metro area, thus marketing campaigns are focused in this area. Systems for new buildings are eligible only to the extent that they have extensive control strategies that exceed all codes and standards.

The primary targets for marketing activities are the owners or managers of existing commercial buildings that:

- Have not installed or upgraded controls systems for at least seven years;
- Have one entity incurring the energy costs (no individually metered tenants); and
- Are of sufficient size to likely have acceptable energy savings compared to costs, which tend to be buildings of at least 100,000 ft².
- Buildings or industries that have high load factors during the peak coincident time period.

E. Product-Specific Policies

Information pertaining to minimum requirements is included on the application. As with the Custom Efficiency product, the EMS projects require:

- Project pre-approvals follow the rules of the Custom Efficiency product. A cost-effective metric ratio equal to or greater than one; and
- A payback between one and fifteen years based on the analysis.

As part of our strategy to increase participation in demand response products, this product will work directly with the Demand Response products to offer an incentive for demand response controls and collaborate more closely with the Peak Partner Rewards, Critical Peak Pricing, or other Demand Response products. Rebate amounts are based on the project performance and cost-effectiveness. Further details are provided in the technical assumptions.

³³ <https://co.my.xcelenergy.com/s/business/lighting-equipment-rebates/energy-management-systems>

F. Stakeholder Involvement

Customers, trade partners, and other stakeholders are currently engaged at the project level, and a product development team has been formed to improve the product. The Company has actively worked with stakeholders to identify product trends that may require changes to product design. The Company will also discuss potential changes with trade partners or third-party implementers.

G. Rebates & Incentives

EMS offers rebates of up to \$700 per peak coincident kW saved, plus up to \$0.035 per annual kWh saved. EMS also offers Public Service natural gas customers up to \$4 per Dth saved.

➤ LED Street Lighting

A. Description

The Company's LED Street Lights product captures energy savings for local municipalities on the Street Lighting Service ("SL") Rate by replacing legacy Company-owned streetlights with LED fixtures.

The Company owns approximately 95,000 cobrahead-style streetlights across its service territory with nearly three-fourths of those lights being concentrated within a small number of larger municipalities. Replacement of the current bulbs (70-Watt, 100-Watt, 150-Watt, 250-Watt, and 400-Watt fixtures) with more efficient LED fixtures will result in significant energy savings. Cobrahead replacements offered through this voluntary product will be provided to customers who opt-in to the new SL Rate to transition to LED technology, for both retrofits and new installations. The Company intends to replace 100% of cobrahead fixtures within 10 years of the new rate offering.

B. Forecasts, Participants & Budgets

Forecasts and Participants

The Company is forecasting replacement of 4,000 Company-owned cobrahead street light fixtures—through retrofits and new installations—in 2023. The replacement schedule is tied to an energy savings forecast of approximately 1.8 GWh which represents the annual savings estimates.

Budgets

Equipment and labor costs for LED installation are not being recovered through the DSMCA and therefore are not included in the DSM Plan budget for this product.

C. Application Process

Customers are required to submit their preference for the Option A or Option B rate.

D. Marketing Objectives & Strategies

The product will have a marketing budget to develop customer communications, case studies, and allow for customers who many have opted out to now participate.

E. Product-Specific Policies

Voluntary product participation is available for only Public Service customers on the SL Rate. The upgraded street lighting infrastructure will remain under Public Service ownership.

Note: The Company offers separate rebates for customer-owned street lighting within the Lighting Efficiency product.

F. Stakeholder Involvement

Local municipalities on the Company's SL Rate are the primary product stakeholders. The Company consulted with local municipalities regarding this product through several outreach meetings starting fall of 2014 through 2020. Collaboration will continue as implementation continues.

G. Rebates & Incentives

No rebates are offered for this product because the Company is the equipment-owner. SL ratepayers will benefit from the ability to transition to the new technology under the new, lower rate enabled by the lower energy consumption and competitive cost of the LEDs.

➤ **Lighting Efficiency**

A. Description

The Lighting Efficiency product offers prescriptive and custom rebates to Xcel Energy electric business customers who install qualifying energy-efficient lighting equipment in existing Rebates are offered to encourage customers to purchase energy-efficient lighting by lowering the upfront costs associated with this equipment.

The product's main offerings include the following:

- Prescriptive rebates for qualifying lighting measures and projects³⁴ that save energy such as:
 - LED fixtures that replace inefficient systems, including incandescent, HID and fluorescent. LED measures include both interior and exterior fixtures, retrofit kits, and lamps for retrofit applications;
- Custom rebates for energy-saving lighting projects that do not fall within the requirements of the prescriptive rebate;
- Midstream LED lamp rebates called Business LED Instant Rebate; and
- Networked Lighting Control Rebates for qualifying systems controlling LED technology and rebates for indoor LED horticultural lighting projects.

Prescriptive Lighting Rebates

The product offers rebates for qualifying lighting equipment that is more efficient than existing equipment in retrofit situations. Lighting measures applicable to a prescriptive rebate format are ones that are commonly installed in the marketplace and have an easily identifiable means to determine energy savings.

Custom Lighting Rebates

The product pays custom rebates for qualifying energy saving measures that are not included under the prescriptive rebate category. Such projects are evaluated under the Custom Efficiency analysis and must follow the rules of the Custom Efficiency product. Requirements include that the customer obtains and provides all information needed to analyze the energy savings potential of the project. In addition, for advanced lighting controls projects all equipment must be new and the control retrofit must be for an existing building.

Additionally, as the importance of managing peak demand continues to grow, the Company will explore ways to incentivize and incorporate load management technologies and strategies. Interval data from advanced meters will help the Company better identify strategies to shift energy use from peak to off-peak periods.

³⁴http://www.xcelenergy.com/Save_Money_&_Energy/Rebates/Lighting_Efficiency_-_CO

Business LED Instant Rebates

The product offers upfront rebates to customers on qualifying LED screw-in or pin-based lamps and downlight retrofit kits and fixtures that are purchased from distributors participating in the LED Instant rebate product.

B. Forecasts, Participants & Budgets

Forecasts and Participants

The product's participation and energy savings forecasts were determined by looking at historical participation levels, as well as the large number of LED products that are expected to be commercially available during the time period of this Plan. Previous project characteristics, including equipment type/mix, were also used to develop projected average cents-per-kWh rebate for each measure.

Budgets

Historical expenditures were analyzed to project the budget. The main budget drivers include:

- *Participant Incentives* – The vast majority of the budget is allocated for rebates. This budget reflects the new rebate levels and projected customer participation in each measure, which was based on 2019 and some of 2020 participation across the offerings.
- *Administration* – These budgets are based on past product performance with a slight increase built in for expanded product offerings, engineering, and account management involvement. The budget also includes third-party implementer costs for the implementation of Business LED Instant Rebate efforts, technical assistance with complex lighting projects, and preparing rebate paperwork
- *Advertising and Promotion* – A promotional budget was developed based on historical expenditures on marketing activities. Promotions and paid advertising are targeted to customers and trade partners and typically focus around activities such as new or revised product offerings, case studies featuring successful projects, educational opportunities such as events, and bonus rebates.

C. Application Process

The Company promotes the Lighting Efficiency product through several channels, including the Company's website, advertising, direct mail, email promotions or through the lighting trade. Account Managers work directly with the Company's largest customers to help them identify energy saving opportunities in lighting and BSC representatives are available for all business customers, particularly small- and mid-sized business customers, who need information on lighting rebate products.

Lighting Efficiency Retrofit Application

The application process for the prescriptive retrofit product is similar to other prescriptive products. Customers may apply for rebates by completing the application and providing a detailed invoice for the newly installed equipment. The customers may submit a rebate application after the equipment has been purchased and installed. The replacement of fixtures must provide equivalent lighting levels between the baseline and proposed scenarios and result in energy savings.

The equipment must be new and meet all the qualifications detailed on the application form. After the customer has installed the equipment, the application and invoice must be submitted to the Company within 24 months of the invoice date for retrofit projects. Once the paperwork is completed and submitted, rebate checks will be mailed to the customer as indicated on the application within six to eight weeks.

Business LED Instant Rebates

At the point of sale, participating distributors validate that the end-use customer is an active customer within Xcel Energy electric service territory. Participating distributors will apply an incentive to the retail price to decrease the qualified product cost. Customers will not be required to submit a rebate application as the participating distributor will provide the sales data to the utility.

Custom Efficiency Lighting

Applications for energy saving lighting projects that do not fit into the prescriptive paths may be reviewed using the Custom Efficiency or Advanced Lighting Control product application and the accompanying Lighting Evaluation Worksheet.

D. Marketing Objectives & Strategies

The key marketing objective is to raise awareness, interest and participation in the Lighting Efficiency product, contributing to goals for energy savings and demand reduction.

Marketing Strategy

Lighting Efficiency is primarily promoted through Company Account Managers, BSC representatives via inbound and outbound telemarketing, through Colorado's lighting and electrical trade via the Company's Channel Managers, and by traditional marketing vehicles such as advertising, mailings, Web content and tools, email and other sales promotions.

Significant market segments for potential Lighting Efficiency savings include: office buildings, manufacturing sites, retail establishments, schools, and 24-hour facilities. Marketing campaigns targeted to those customer segments are executed during one-on-one Account Manager meetings, BSC scripted calls, and/or customer direct marketing that drive inquiries to the Company's inbound phone center.

Marketing to Trade Partners

The Company's outreach and relationship building with lighting and electrical trade, professional engineers, architects and lighting designers is another key strategy to reach important business segments and indirectly influence the purchase and installation of energy-efficient lighting systems. The Company establishes and maintains contact with this audience by:

- In-person training and presentations by the Channel Managers at industry events and trade shows, such as the Energy Efficiency Expo, for both customers and trade allies;
- The Lighting Advisory Board, described in section *F. Stakeholder Involvement* below;
- *Energy Exchange*, an email that is sent to the trade discussing energy efficiency lighting applications, case studies, product changes, and other pertinent topics; and

- Trade website,³⁵ including specific brochures and informational pieces directed toward the trade, and updates on product offerings.

Marketing to Small Business Customers

The Company accesses this harder-to-reach market primarily through direct mail, email, and the BSC, as well as via outreach conducted by the Company's Small Business Solutions third-party implementer.

In addition, several marketing pieces are available on the Company's website³⁶ or viewing or download. These pieces are targeted to large-, medium- and small-sized business customers, as well as trade partners. The website offers information on lighting technologies, case studies of successful lighting upgrades, and external sources highlighting reasons to pursue lighting upgrades or implement efficient lighting sources.

- *Prescriptive Rebate Applications* – Applications detail product requirements, rebate levels and additional information to help customers complete the form and submit it for rebate with accompanying invoices and equipment specifications.
- *Resource Documents* – The Lighting Efficiency webpage links to several documents on energy efficient lighting technologies, written by outside organizations such as the DOE, that further identify lighting efficiency sources and opportunities.

E. Product-Specific Policies

Lighting Efficiency has a number of product-specific policies:

- All rebated equipment must be new, meet all product rules and requirements, and the application must be submitted within 24 months of the invoice date for retrofit projects.
- Non-DLC and non-ENERGY STAR® products must meet the DLC or ENERGY STAR® product eligibility category definitions.
- Customers who purchase lights in bulk can earn rebates on select LED lamps for stocking purposes. Lamps in storage must remain on the premises.
- In cases where the customer is unable to obtain an equipment invoice, the Company will send an Account Manager to complete an onsite field verification to confirm that equipment was installed as stated on the application.

F. Stakeholder Involvement

Stakeholder involvement in the Lighting Efficiency product comes through a Lighting Advisory Board and the quarterly DSM Roundtable Meetings. The Lighting Advisory Board was formed as a collaborative effort between several key lighting professionals and the Company's management team. The objectives of the board are to identify gaps in the Company's product offerings, suggest areas of improvement, and to offer a forum for open discussion of lighting topics. Several recommendations from the board have been addressed through the Company's product

³⁵<https://co.my.xcelenergy.com/s/partner-resources>

³⁶http://www.xcelenergy.com/Save_Money_&_Energy/Rebates/Lighting_Efficiency_-_CO

development process and incorporated into the product. The Board will continue to meet on a regular basis, or as long as needed.

G. Rebates & Incentives

The Lighting Efficiency product offers rebates through the retrofit prescriptive component, and/or Custom Efficiency and Advanced Lighting Controls, and/or the Business LED Instant Rebate component.

The Company will use the most appropriate rebate channel to implement rebates.

➤ New Construction

A. Description

The New Construction product influences building owners, architects, and engineers to include energy efficient systems and equipment in their design for new construction and/or major renovation projects. With regards to the New Construction product offering, new construction is defined as a new building, addition to an existing building, or renovation/redesign. Since the Company services building owners of different areas and size, the whole-building New Construction product offers four core components:

1. Energy Design Assistance (“EDA”)
2. Energy Efficient Buildings (“EEB”)
3. New Construction Lighting
4. Codes and Standards Compliance

All components are available to non-residential customers in Public Service’s electric and natural gas service territory.

Energy Design Assistance

The EDA offering provides a source of energy expertise to encourage energy efficient building design and construction practices. EDA offers design assistance in support of integrated design process by providing comprehensive computer modeling of the planned design, funding to offset the cost of design time associated with the increased energy analysis, financial incentives to improve the cost-effectiveness of a package of energy-efficient measures, and field verification to ensure that the strategies are installed per the design intent. Public Service covers the average energy modeling cost of an EDA project for customers.

According to *Best Practices Benchmarking for Energy Efficiency Programs*³⁷, it is crucial for new construction DSM products to engage early in the design process and utilize integrated design modeling. The report states that, “Integrated design adds value because cost-effective energy savings opportunities decline as the project progresses through the various design stages.” EDA uses computer energy models and a well-established, collaborative method for exchanging information with design professionals, contractors, developers, and building owners throughout the integrated design process. Important information is provided at critical points in the design process about the value and application of strategies for reducing peak demand and energy use. By analyzing integrated systems in the beginning of the design process, customers can make a building significantly more efficient, more comfortable for the occupants, and less costly to operate in the future.

In addition to technical assistance, Public Service provides financial incentives to building owners to improve the cost-effectiveness of energy efficient materials and equipment. Incentives

³⁷National Energy Efficiency Program Best Practices Study, Quantum Consulting Inc., Dec. 2004, pg. NR8-2. Available: http://aceee.org/files/proceedings/2004/data/papers/SS04_Panel5_Paper21.pdf.

are paid only after a verification process is completed, which typically occurs within three months of building occupancy. Verification ensures that the measures were installed as proposed and provides an added degree of confidence in the project's calculated energy savings.

EDA will increase its focus on technologies and strategies that mitigate peak loads and reduce revenue requirements on the system. As technologies such as electricity storage become more economically viable for developers, EDA will encourage customers to incorporate them into building designs, as they can be used to support load shifting improvements. By increasing focus on system peak reductions, the product aims to identify and incentivize strategies that will maximize economic and environmental benefits for participants. As part of our strategy to increase participation in demand response products, this product offering Peak Partner Rewards and AC Rewards. Further details are provided in the technical assumptions.

EDA offers three tracks for customer involvement:

Basic Track

The Basic track is for Public Service customers interested in the opportunity to participate in a collaborative design process and identify energy savings opportunities using new technologies and energy methodology. The following requirements apply to the Basic track:

- Square footage: Greater than 50,000 square feet (new construction, major renovation or addition)
- Design phase: Schematic design or early design development
- Energy Savings: minimum of 15% peak coincident demand savings and 15% natural gas savings achieved in the FEA Stage; and
- For major building renovations, building must include significant renovations to at least two of the following three systems: building envelope, lighting/electrical, or mechanical systems.

Enhanced Track

The Enhanced track is for Public Service customers interested in obtaining sustainable building certifications, such as the U.S. Green Building Council's Leadership in Energy and Environmental Design ("LEED®")³⁸. The Enhanced track allows for further analysis in daylighting, lighting, and mechanical system comparison and building orientation. The following requirements apply to the Enhanced track:

- Square footage: Greater than 50,000 square feet (new construction, major renovation or addition)
- Design phase: Pre-design or early schematic design
- Energy Savings: minimum of 30% peak coincident demand savings and 15% natural gas savings achieved in the FEA Stage; and
- For major building renovations, building must include significant renovations to at least two of the following three systems: building envelope, lighting/electrical, or mechanical systems.

³⁸USGBC, LEED, <http://www.usgbc.org/leed>.

Express Track

The Express track is for Public Service customers whose projects are of a common type (such as multifamily, office, school, etc.) and draws on results from previous modeling experience of similar building types and systems to calculate hourly building simulations of the actual project. The following requirements apply to the Express track:

- Square footage: Greater than 50,000 square feet (new construction, major renovation or addition);
- Design phase: Schematic design or early design development (same as basic track);
- Energy Savings: minimum of 15% peak coincident demand savings and 15% natural gas savings achieved in the FEA Stage; and
- For major building renovations, building must include significant renovations to at least two of the following three systems: building envelope, lighting/electrical, or mechanical systems.

Public Service administers EDA using third-party implementers to help identify product candidates, facilitate meetings with the design teams (including the owner), and complete energy modeling activities. Energy modelers are chosen based on a set of qualification criteria to become a third-party implementer of EDA services. Qualification opportunities are open as Public Service deems appropriate. Third-party implementers are paid on a pay-for-performance basis. The EDA offering will open a Request for Qualification by the fourth quarter of 2022 to allow additional energy modeling candidates to apply to become an approved Xcel Energy EDA Provider.

Energy Efficient Buildings

The EEB offering is intended to provide a simplified approach to optimizing energy efficiency options in new construction or major renovations. This component addresses the portion of the new construction market not suited for the full-scale energy modeling offered through EDA. Projects must be a minimum of 10,000 square feet. Projects are also generally less than 70,000 square feet and have passed the schematic design stage of new construction. However, any size project above 10,000 square feet may qualify provided the project has not awarded bids for equipment.

Focusing on the needs of small building owners, the EEB offering provides a comprehensive list of typical energy efficiency measures that can be incorporated into the new/major renovation building design, as well as the rebate amount available for each measure. Incentives are provided for heating and cooling, lighting, building envelope, electric motors, refrigeration, and custom opportunities. Customers will receive a rebate tailored to their building after the project has been constructed and onsite verification completed.

Public Service administers EEB using both internal and external resources to review the calculations and rebates and verify installation. The EEB offering is managed by a third-party implementer to assist the customer with the EEB process.

New Construction Lighting

The New Construction Lighting offering will replace the prescriptive measure offered under the Lighting Efficiency product and is intended for customers that either do not meet the size and

timing requirements of the other two New Construction offerings and for customers whose scope only includes lighting systems in their new buildings, additions, and major renovations.

Like the EEB offering, New Construction Lighting will focus on energy saved over the 2018 IECC baseline, using lighting ComCheck documents to identify allowed wattage versus proposed wattage based on Lighting Power Density.

Codes and Standards

The Company will pro-actively encourage and support jurisdictions to adopt the latest building codes within the residential and commercial new construction products. In addition, it will give those communities the tools to improve the compliance with the new codes and ultimately help them reach their energy performance and economic development goals. This support will be designed to meet each jurisdiction where they are in the code adoption cycle and address current gaps in new code adoption across the state including: a lack of resources, lack of knowledge, and internal and external opposition to increasing code standards. Specific strategies include, one on one support for local officials, marketing materials available through various channels, and trainings designed to support awareness and implementation.

B. Forecasts, Participants & Budget

Forecasts and Participants

Participation is estimated using actual historical product data. All non-residential customer segment types are eligible to participate in EDA; however, typical projects fall in the sectors of office, schools, retail, multifamily, and healthcare. The EDA energy savings forecasts were estimated based on the average energy savings of participating buildings when compared to the usage of a baseline building. The baseline building is defined as a building compliant with the ASHRAE 90.1 standards, or the local jurisdiction's code, whichever is more stringent.

Budgets

Once forecasts were established, the budget was developed based on historical cost and participation information. Average project modeling drives the budget, construction incentives, M&V, and promotional expenses. The following are the specific budget drivers:

- *Consulting Payments:* Much of the product delivery budget is associated with the cost of modeling for customer projects. Modeling costs are estimated to be approximately \$100 per kW saved for all three tracks. Modeling costs are then split between the year modeling begins and the year in which the project will be completed due to final as-built modeling being used in rebate calculations. There are also minimal dollars allocated for EEB for a third-party implementer. New Construction Lighting will not incur modeling or consulting costs.
- *Incentives:* Incentives are calculated based on the marginal value of energy saved by the as-modeled and as-verified building compared to the utility load shape of its baseline design.
- *M&V:* Completed in two steps for the offering and described in the M&V section of this Plan. Cost estimates are based on construction documentation and site review and are analyzed on a per-project basis. Projects in the New Construction Lighting measure will have M&V activities performed on a sample of completed projects.

- *Promotions, Advertising and Customer Education:* Promoting the product through specific advertising campaigns, trade alliances, trade shows, and training opportunities is an important part of New Construction and aids in shifting the market towards higher efficiency. As such, historical data was used to determine the appropriate level of expenditure on product marketing.

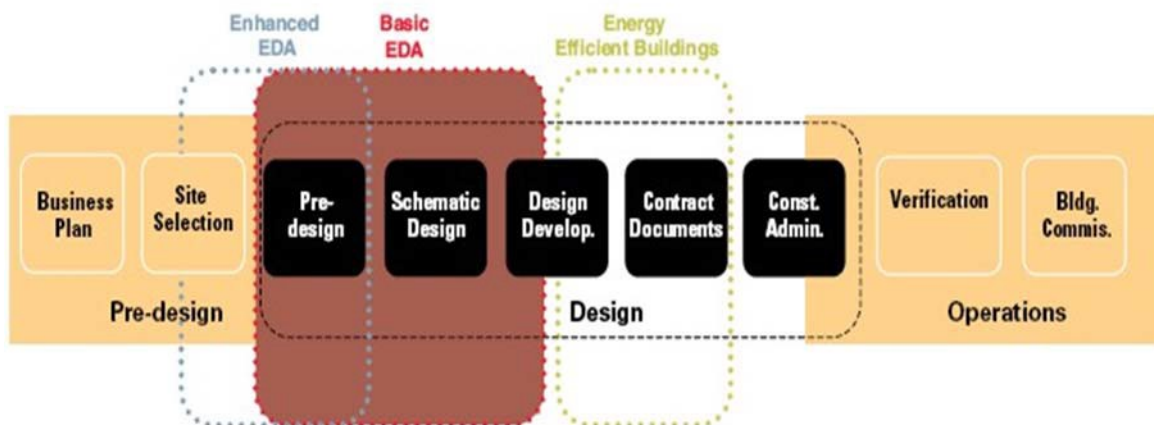
C. Application Process

The rebate application process differs between EDA and EEB.

Energy Design Assistance

The application process for EDA is more involved than for prescriptive products and follows the design schedule of a new construction project as outlined in the diagram below.

Building Design Process



The average timeframe for project completion can range from two to five years depending on project schedules. For example, projects beginning modeling in 2019 will likely be completed in 2021 or beyond.

The application steps for the product include:

1. *Application Submittal:* Each project is evaluated by Public Service and the third-party implementers to ensure the project meets eligibility requirements. Customers who are interested in participating in the product must meet the design schedule requirements. Once approved to participate in the EDA offering, the customer receives an email approving the project and explaining next steps.
2. *Introductory Meeting:* An introductory meeting with the customer, design team, the third-party implementer, the Public Service Account Manager, and other key parties, takes place within two weeks of approval, depending on the design schedule. This meeting sets the tone for the collaborative approach, by explaining how the process works, who is involved,

and what results should be expected. Initial project details, such as baseline systems, are collected during this meeting.

3. *Preliminary Analysis*: Using project details and costs from the design team, the third-party implementer begins the modeling process. Analysis is completed using a whole-building energy simulation computer program. Modeling software and protocols are established by Public Service, with reference to ASHRAE 90-1 standards, or the local jurisdiction's code, whichever is more stringent. Further analysis under the Enhanced track, if applicable, is also completed using the relevant modeling program and code base.

Within this analysis, different energy efficiency opportunities are explored that fit into the project criteria—payback analysis, energy expectations, and original design strategy. A meeting is then held to review these strategies to find the ones that meet the original project criteria and which ones should be considered moving forward.

4. *Final Energy/Strategy Analysis*: Energy efficiency opportunities are then packaged together in design alternatives to show expected building energy savings, paybacks and incentives. A whole-building approach is used to identify the net effect of multiple strategies on a project. This approach provides opportunity for more energy savings impact, by trading less-effective ideas that may be in the budget for more effective, new concepts. The packaging of design alternatives also provides protection against pitfalls in the value-engineering phase of the design/construction process, which typically cuts individual elements of projects based on their first-cost and impact on the tangible elements of the building, with little regard for ongoing energy use. These energy alternatives are then presented to the design team and the customer to choose the best approach for their project.
5. *Construction Document Review*: Once the design team completes construction documents (“CDs”), a third-party implementer reviews the CDs and adjusts the energy model as needed. This energy model is used to determine the expected incentives from Public Service and to verify compliance with the energy savings intent of the customer. A review of the CDs energy analysis is completed before construction.
6. *Verification*: The final step in the EDA offering occurs when Public Service completes an onsite verification of the energy alternative addressed within the energy model. Equipment and systems are logged to evaluate performance variables as appropriate to verify consistency with modeling assumptions. The actual results are compared to the estimated savings to determine the final customer rebate.

Energy Efficient Buildings

The application process is similar to other Public Service prescriptive products; however, preapproval is required to allow for calculations of energy-efficient measures, review of construction documents for verification of project design, and final verification of actual installation.

The first step in the process is for the customer to submit a preapproval application and agreement to Public Service. Once received, Public Service will review the project to confirm the project timeline, building square footage, and customer interest in energy efficiency options. Once the application is preapproved, the customer will receive an email from Public Service's consultant explaining the terms of the EEB offering and processes. An introduction meeting invitation will be extended to the customer to provide energy efficiency advice. The building owner will then submit the project data throughout the construction of the project, and upon completion, for review by Public Service. The customer will receive the final construction rebate once the project and onsite verification have been completed.

New Construction Lighting

The application is similar to other Public Service prescriptive products. Customers may apply for rebates by completing the application and providing a lighting ComCheck and detailed invoice for the newly installed equipment. The customers may submit a rebate application after the equipment has been purchased and installed. The equipment must be new and meet all the qualifications detailed on the application form. After the customer has installed the equipment, the application and invoice must be submitted to the Company within 24 months of the invoice date.

The first step in the process will be for the customer to submit a completed preapproval application, lighting ComCheck, and equipment invoice to Public Service. Once the paperwork is completed and submitted, rebate checks will be mailed to the customer as indicated on the application within six to eight weeks.

D. Marketing Objectives & Strategies

The New Construction product is primarily marketed through the Company's sales team and external third-party implementers to reach architects, engineers, general contractors, and Public Service customers, as detailed below. The Company fosters a collaborative approach, meeting with design teams to show how the product works and how it is beneficial to customers. Marketing strategies used within the product scope include trade shows, electronic newsletters, face-to-face meetings, advertising, and participation with various trade organizations including American Institute of Architects, Association of General Contractors, U.S. Green Building Council, and ASHRAE. A secondary market is building owners and developers. The EEB offering, on the other hand, is primarily marketed to developers and customers.

Primary Market – General Contractors, Architects, Mechanical and Electrical Engineers:

- Implement energy efficiency strategies
- Influence customer/developer decisions
- Trusted by owner
- Often suggest New Construction product to owners and developers
- Key to actual inclusion of strategies and cooperation

Secondary Market – Owners and Developers:

- Make initial decision on budget

- Hire and contract with an architect, engineers, and general contractor(s)
- Initiate conversations on energy efficiency
- Make final decision on equipment choices
- Key to moving general contractors to energy efficiency strategies within a limited budget

Public Service continually works to improve and update the information available to customers on the website and/or for events. There are several pieces of collateral used for the New Construction product:

- *Product Feature Sheet*: explains the features and the benefits of the product;
- *Case Studies*: provides examples of how various customers have benefited from participating in the product;
- *Process Flow Chart*: detail information on the product processes; and
- *White Papers*: explain different options for energy efficiency in lighting, heating, cooling, envelope, and other measures.

The EEB offering provides Public Service with the opportunity to conduct a larger marketing effort for New Construction. Customers may hear of the EEB offering through several channels, including Account Managers, the Business Solutions Center, architects and engineers, general contractors, or equipment trade partners. Several strategies are used, such as:

- *Product Feature Sheet*: Explains the features and the benefits of the product;
- *Trade and Customer Seminars*: In-person opportunities to educate customers and trade partners on the benefits of new construction; an important part of the marketing strategy;
- *Conferences and Exhibits*: In-person expertise to help customers determine what product best fits their needs, as well as guidance on the EEB and EDA processes; and
- *E-newsletters*: Another avenue to educate the market on the product and benefits of reviewing new construction projects for energy efficiency opportunities.

The New Construction Lighting offering provides Public Service with the opportunity to conduct a larger marketing effort for customers whose needs were previously met by the prescriptive new construction measure under the Lighting Efficiency product.

E. Product-Specific Policies

New code adoption only impacts new EDA project starts. Since the sales cycle for EDA is typically two to five years—from project initiation and design to the completion and occupancy of a physical building—many of the projects expected to finish in 2023 have already been identified by the Company and third-party implementers. The following policies are in place for the New Construction product:

- *Natural Gas Impacts*. In taking the whole-building approach, there are times when an efficiency measure may cause a decrease in one fuel consumption, but an increase in consumption of another fuel. In these situations, Public Service will account for both the

decreases (energy savings) and increases in fuel consumption and will issue the rebate accordingly.

- *Completion of several opportunities.* The EEB offering will require installation of new equipment in both the electrical and mechanical sections of the building. Buildings that only require adjustments to one “section” will be referred to the Company’s other prescriptive products.
- *Ineligibility for additional products.* The New Construction product is a holistic approach to whole-building energy efficiency. For this reason, customer participation in whole-building New Construction offerings (EDA or EEB) will preclude customer’s participation in Xcel Energy’s prescriptive and custom (component) rebate products.
- *Design Team Incentive deadlines.* Design Teams in the EDA offering may submit design team incentive request applications as late as two years after the project has finished (Construction completed and M&V performed).
- *Technological eligibility.* Technologies such as fluorescent lighting and metal-halide lighting will not be eligible for rebates in the New Construction product.

F. Stakeholder Involvement

Customers, trade allies, and other stakeholders are engaged at the project level. Feedback is garnered individually from participants and when feedback trends are identified, Public Service will develop recommended changes for consideration in product design. Public Service will also discuss potential changes with trade partners or third-party implementers.

The Company continues to coordinate with other utilities and organizations to improve and effectively deliver the New Construction offerings. In addition, surveys are used to gather feedback from participants to continually improve the product.

G. Rebates & Incentives

EDA provides rebates to customers based on the times of day the above-code measures included in the project are saving energy compared to the modeled baseline. Public Service also reimburses design team members to offset the incremental cost of their participation from \$8,000 to \$12,000 per project, depending on the square footage of the building. Design Teams can claim these incentives as late as two years after project completion. The EEB offering covers analysis of measure opportunities and provides both prescriptive and custom rebates for measures above code. The New Construction Lighting offering provides rebates for lighting designs that perform above code.

➤ Self Direct

A. Description

The Self Direct product provides large commercial and industrial customers a holistic approach and the opportunity to control all stages of their project's rebate application process. Participating customers will identify, engineer, implement, and commission qualifying energy efficiency projects to receive rebates for implementing those projects. The dollar value of the rebates will be calculated based on the incremental energy savings achieved.

A fundamental principle and differentiating factor of the Self Direct product is that the customer performs all of the work and incurs all of the costs for the identification study, design, engineering, M&V, and reporting work associated with their holistic approach energy saving projects. Large customers with energy saving evaluation resources may choose to participate in the Self Direct product because they believe that it is beneficial for them to perform more of the administrative and engineering activities, and in doing so, receive a higher rebate over Public Service's other DSM products.

Participation in the Self Direct product will generally follow this sequence:

1. Public Service pre-qualifies customers who are eligible for participation.
2. Once pre-qualified, a customer identifies energy savings opportunities of assorted mixed technologies, then develops and submits a project proposal.
3. Public Service provides confirmation of application receipt, reviews the project proposal, and requests additional information as necessary.
4. Public Service notifies the customer of pre-approval or denial of the application, including the estimated rebate and energy savings from the project, and finalizes a mutually agreed upon M&V plan.
5. Public Service encourages the customer to attend a project planning meeting to discuss final rebate application preparation and project details.

If the customer chooses to implement the pre-approved project, they must follow the requirements detailed in the M&V plan. Any data required for pre-installation monitoring detailed in the M&V plan should be submitted to the Company and approved before the customer implements the energy efficiency measures. Upon acceptance, the customer can proceed and perform follow-up monitoring as described in the M&V plan.

Once the project is operational and all necessary M&V is completed, the customer will submit their project completion report. Public Service will review the report, request any additional data, and calculate the final rebate.

B. Forecasts, Participants & Budgets

Forecasts and Participants

Energy savings and participation forecasts have been estimated based on projects currently in the pipeline, as well as analysis of historical performance.

Budgets

The product budget was estimated based on the project pipeline and historical participation. No M&V costs are budgeted because customers incur these costs. Budget dollars are focused on customer rebates as customers are responsible for managing the project from start to finish.

C. Application Process

The Company promotes the Self Direct product through Account Managers and trade partners. Customers must be pre-qualified for participation before submitting a project application. The customer is responsible for providing the Company with justification for eligibility (pre-qualification). Justification must include, but is not limited to, a list of the customer's account numbers, locations, and meter numbers to be aggregated (to meet the minimum aggregated peak load requirement – see Section E below).

Once pre-qualified, the customer will submit a project application for each Self Direct project. The project applications may contain a combination of multiple mixed technology measures at a single, or multiple customer sites. All energy conservation measures must be at customer locations that receive electric service from the Company. The aggregation of a sole common/conventional technology, whether prescriptive or custom, will be applicably redirected.

Project Application

The project application must include the following components:

- Description of the customer, including electric and gas rate classifications, business activities at involved sites, names and roles of personnel involved in the project, and those personnel's history of and expertise with energy efficiency projects.
- Description of the proposed project(s) including technology, locations, implementation schedule, expected measure life, how the project fits into the customer's operations, and a description of previous implementations of similar technology or projects. The project description should include product specification sheets, white papers, quotes from vendors to validate cost estimates, and other supporting documentation.
- For new buildings, the application must contain computer energy modeling specific to the planned building to forecast the base case and efficient energy use. Computer modeling

should be in accordance with the protocol specified within the Energy Design Assistance approach of the New Construction product.

- Engineering calculations to forecast energy and demand savings, participant O&M benefits and costs, and the estimated rebate.
- Benefit-cost calculations to determine the MTRC test ratio, including a discussion of the sensitivity of the MTRC and payback to various inputs, and the perceived accuracy of the inputs.
- Description of the controls the customer will use to reduce the likelihood of project cost and schedule overruns.
- Description of the proposed monitoring activities that will be used to track and document energy and demand savings. Pre- and post-installation metering and verification will be required for all projects with predicted energy savings greater than 0.25 GWh, unless the Company and customer agree upon another methodology. The Company reserves the right to require data measurement and verification for projects of any size.
- Any information reasonably requested by the Company to document and support the application.

Project Completion Report

The format of the project completion report must include the following components:

- Description of all deviations from the application package including equipment substitution, cost adjustments, operating procedures, etc.;
- Documentation of all actual costs incurred including invoices, internal labor, incremental operation and maintenance costs, etc.;
- Raw monitoring results and engineering calculations to demonstrate actual energy and demand savings based on monitoring results;
- Requested rebate amount; and
- Any information reasonably requested by the Company to document and support the project completion report.

D. Marketing Objectives & Strategies

The Self Direct product is marketed to large customers who have expressed an interest in overseeing their own energy efficiency improvement projects and typically have their own in-house engineering capabilities. The product will also be marketed to engineering and design companies. Other marketing efforts will focus on potential participants based on customer energy use, conservation potential, and in-house experience and expertise with energy efficiency improvement projects.

E. Product-Specific Policies

The Self Direct product is open to Public Service commercial and industrial electric customers who have an aggregated peak load of at least 2 MW in any single month and an aggregated annual energy consumption of at least 10 GWh. The customer of record must be the same for all aggregated meters to qualify for this product. New customers, or existing customers with new

facilities, that demonstrate predicted demand and usage above the minimum requirements, may participate in the Self Direct product.

The MTRC test ratio for each application will be calculated based on the combination of all measures proposed in the application. The Company will provide an MTRC calculator to facilitate the calculation. The customer will again use the MTRC calculator to calculate the final project MTRC value and include this in the project completion report using the actual implementation costs, energy conservation data, non-energy costs and/or benefits and the calculation methodology provided by the Company. The Company will verify the MTRC for the completed project upon review of the project completion report.

Participants in the Self Direct product will be allowed to participate in other DSM products offered by the Company but will not receive a rebate for the same energy efficiency measure through two different DSM products. No funding will be paid by Public Service for the identification (study) of projects that receive a rebate through the Self Direct product. Customer may enroll their new facilities in either the Self Direct product or the New Construction product. If the customer chooses to participate in the Self Direct product for a new building project, the design work and energy modeling shall follow the protocol established in the New Construction product; however, the customer will be required to pay for all energy modeling costs.

F. Stakeholder Involvement

Customers, trade allies, and other stakeholders are currently engaged at the project level. Feedback is garnered individually from participants. The Company will evaluate trends for product improvement and, after discussion with key stakeholders and/or third-party consultants, will implement potential changes (*via* 60-Day Notice, as needed).

G. Rebates & Incentives

Self Direct provides rebates on the actual savings of a project based on the times of day the project will save energy compared to the baseline, commensurate with the customer's management of all stages of the project. Rebates will be limited to 50% of the incremental costs of the project. Rebates will apply to new and long-term leased equipment, but not to used equipment. The maximum lifetime and payback for a measure is limited to the lease duration. All measures submitted in a Self Direct project application will be combined for calculation of financial tests and rebate levels. Rebates will not be given for applications with expected paybacks of less than one year. Rebate levels will be adjusted downward so that no project (with rebates included) has a payback less than one year.

➤ **Small Business Energy Solutions**

A. Description

The Small Business Energy Solutions product is designed to engage small business customers in deploying DSM measures that will lower their energy consumption and demand. The product offers rebates and support for energy efficient upgrades to Public Service's small- and mid-sized business customers with annual peak demand of up to 400 kW.

The product aims to overcome specific barriers that often prevent small businesses from investing in energy efficiency and demand management measures, including:

- Lack of knowledge of energy and bill savings potential in system upgrades;
- Lack of time to complete all the necessary steps to upgrade systems;
- Lack of capital to make improvements;
- Uncertainty of value when facility is not owner-occupied; and
- Limited access to qualified contractors due to small margins on some projects.

To address these issues, the product offers the following components:

1. *Outreach* - Intensive outreach to bring resources to the customer, rather than relying on the customer to seek them out.
2. *Onsite Audit* – Each customer will be offered a facility walk-through audit. The audit is designed to be a simple, one-stop service that keeps customer time requirements to a minimum. The customer will receive a report that outlines the recommended efficiency upgrades with associated rebates, energy savings, and demand reduction.

Substantial rebates are offered to offset the cost of installing qualifying energy efficient equipment, as follows:

Direct Install for Immediate Savings – Customers with an annual peak demand of less than 100 kW will qualify for participation in the direct install (“DI”) component of the product. During the walk-through audit, the third-party implementer will perform free installation of the following energy savings measures, where applicable.

- a. Select screw-in LED lamps;
- b. Aerators in restrooms and kitchen sinks;
- c. Select ENERGY STAR® certified smart thermostats;
- d. LED exit signs or retrofit kits;
- e. Strip curtains for freezers;
- f. Auto-close doors for coolers and freezers;
- g. Pipe Insulation;
- h. Water conservation showerheads;
- i. Water conservation kitchen spray valves;
- j. Select LED tubes; and
- k. Other cost-effective measures to be identified.

Customers with an annual peak demand greater than 100 kW can also receive a direct installation of select ENERGY STAR® smart thermostats; however, additional costs to the customer may apply.

Prescriptive Rebates – See savings calculations and rebates available from the Company’s prescriptive products deemed technical assumptions.

Custom Rebates – See savings calculations and rebates available from the Company’s Custom Efficiency model.

3. *Connect with a contractor* – The product will connect the customer to participating contractors and provide intensive outreach and training for contractors so that they can accurately and effectively market to customers.
4. *Install energy efficient upgrades* – The third-party implementer serves as a liaison between the customer and the contractor, maintaining engagement with the customer to ensure recommended measures get implemented.
5. *Processing Application* – The third-party implementer will assist the customer in reviewing and submitting their applications(s) for rebate

With the transition to smart meters and Time of Use (“TOU”) rates, this product will also provide support to customers by providing education on how energy is used in their facilities. Further education on TOU and coordinated marketing strategies will help these customers make informed decisions on how they can change energy usage and save money with the rates available.

B. Forecasts, Participants & Budgets

Forecasts and Participants

The forecasts for this product were derived from historical data, market data, and equipment deemed savings values in Colorado.

Budget

The forecasted expenditures for this product are based on projected participation levels, promotion, and administrative expenses. The majority of the product costs are customer rebates, third-party implementation costs and promotional expenses.

C. Application Process

The third-party implementer offers and conducts a free walk-through audit at the customer's facility and provides a written report of the energy saving findings. At the time of the audit, customers with an annual demand of 100 kW or less may qualify for direct installation of specific measures (as outlined above). Throughout the process, the third-party implementer will assist customers in applying for rebates for qualifying equipment, reviewing completed applications, and ensuring that there is a detailed invoice for the newly installed equipment.

The third-party implementer will also assist customers in applying for a Custom Efficiency rebate for projects that do not fit into the prescriptive rebate offerings. Such projects are evaluated under the Custom Efficiency analysis and must follow the rules of the Custom Efficiency product.

After the customer has installed the equipment, the rebate application and invoice must be submitted to the Company within 12 months of the invoice date. Once the paperwork is completed and submitted, rebate checks will be mailed to the customer as indicated on the rebate application.

D. Marketing Objectives & Strategies

The key marketing objective is to raise awareness, interest and participation in the product, contributing to achievement of the Company's energy savings and demand reduction goals. The product is marketed primarily through the third-party implementer—they are required to meet the implementation targets for which they are contracted, and they will deliver the marketing strategies needed to meet them. Secondary outreach is likely to occur through the Company's BSC, contracted trade allies, and/or other marketing efforts such as mailings, newsletters, and the Company website.

E. Product-Specific Policies

Small Business Energy Solutions has several product-specific policies:

- The product is for customers with peak electricity demand of 400kW or less; customers with an annual demand of 100 kW or below may qualify for free direct installation of specific measures.
- All rebated equipment must meet all product rules and requirements, and the application must be submitted within 24 months of the invoice date.
- Once completed paperwork is submitted, rebate payments are usually issued in six to eight weeks.

- The product pays custom rebates for qualifying energy saving measures that are not included under the prescriptive rebate category. Such projects are evaluated under the Custom Efficiency analysis and must follow the rules of the Custom Efficiency product. The customer has up to 24 months after the preapproval date to implement the project. Custom projects that exceed that timeframe, or have significant equipment deviations from the original plan, require reanalysis and approval.

F. Stakeholder Involvement

The third-party implementer has considerable influence on the success of the product, as they will be the face of the Company to potential participants. The Company expects that the third-party implementer will engage stakeholders in the implementation of this product.

Trade partners are an important stakeholder as they will be performing the retrofits and upgrades as well as promoting the product to customers. The Company expects the third-party implementer to maintain and grow the trade partner list of qualified contractors. Trade partners on this list will have a vested interest in the product's success, as they will benefit from the work generated by the audits.

G. Rebates & Incentives

The product provides eligible direct-install measures for qualifying participants and direct rebates for eligible projects based on savings calculations from the Company's prescriptive products deemed technical assumptions and Custom Efficiency model.

As part of our strategy to increase participation in demand management, this product will provide opportunities for customers to participate in the Small Commercial Building Controls Demand Response product.

➤ Strategic Energy Management

A. Description

Strategic Energy Management (“SEM”) is a holistic approach to managing energy for persistent savings and continuous improvement. In addition to capital equipment improvements for energy efficiency, the product also stresses system-level operational change as well as cultural change from customers’ senior management, mid-management, and other personnel.

The product provides customers with a Strategic Energy Management Consultant (“SEMC”). The SEMC will typically be sourced by the Company’s third-party contractor.

Due to the magnitude and complexity of this holistic approach:

- SEMC costs vary greatly from customer to customer. Costs are often not determinable until later phases of the customer’s activity.
- Significant internal Company resources are required for completing project analyses and verifying adherence to all M&V requirements.
- Where feasible, additional providers who are experts in the field of strategic energy management, or who are experts in the operation of the customer’s processes, may augment the SEMC’s activities.
- Lastly, the Company provides support, in partnership with trade allies, to customize the offering to match customer needs.

SEM engagements guide customers through a series of steps designed to improve energy performance. Where possible, each step adheres to the “SEM Minimum Elements” established by the Consortium for Energy Efficiency³⁹. The steps fall into three broad categories:

1. Gaining customer commitment
2. Demonstrating how to plan, prioritize, socialize, and implement improvements
3. Ensuring regular measurement, analysis, and reporting of energy performance

Initially, the SEMC guides the customer through creating an “Energy Team” with defined roles including that of “Energy Champion”. The SEMC also conducts an Energy Management Assessment (“EMA”), to understand the organization’s communication and decision-making processes. The EMA:

- Typically reviews management practices, including project budgeting and capital allocation, policies and communications related to energy use
- Measures past progress in energy management and, where possible, benchmarks that progress against firms in similar industries
- Analyzes interval data, conducts personnel interviews, and provides an operational overview
- Establishes energy performance objectives and develops Energy Performance Indicators
- Develops a map of major energy end uses and costs

³⁹ <https://cee1.org/content/cee-program-resources>

The SEMC conducts a facility-wide Energy Scan for efficiency opportunities, and for most engagements, a detailed study of one or more major processes or systems. Depending on customer-specific needs, the initial focus may be on capital improvements or may be on systemic operational improvements. A report of findings includes estimates of project costs and rebates to support the projects. The report also incorporates data visualization techniques designed to improve the understanding of how decisions affect energy performance.

After initial steps, the SEMC works with energy team on a number of iterative activities to drive customer implementation. The activities are performed on a regular, repeated basis to instill best practices within the customer's decision-making processes. The activities include:

- Produce, maintain, revise, and prioritize an energy plan, including a register of opportunities; facilitate conversations and actions related to implementation barriers; and justify projects by modeling expected outcomes,
- Engage and influence the operators of major systems and help educate non-operators. Interactions with employees encourage their ideas and input about continuous improvement,
- Support project implementation with analysis, estimation of incentives, and prompting the team's interactions with Trade Partners,
- Document new measures as they are discovered and implemented,
- Support supplemental sub-metering and data-logging as necessary to confirm assumptions of the energy analysis,
- Periodically reassess performance, priorities, goals and plans,
- Ensure the existence of a system for measuring and reporting, including:
 - A repository for data, and
 - The measurement, analysis, and dissemination of results at consistent and frequent intervals.
- Help the customer interpret usage patterns, identify opportunities for savings, and ultimately verify energy savings.

Annually, the team will compile an analysis delineating savings achievement from each measure category. Subject to cost-benefit criteria, incentives will be awarded to offset costs incurred for the implementation, measurement, or verification of measures. The SEMC then reprioritizes the project register and implementation plan, and gains customer alignment for continued improvement.

Depending on customer need, additional optional consulting helps customers automate part or all of their performance measurement systems. Sometimes described as "Energy Management Information Systems ("EMIS"), or Energy Analytical Systems, they collect data and accurately depict the energy performance of the customer's processes. The SEMC assists the customer in defining an EMIS implementation scope, including:

- End-use targets, metering points, and depth of metering
- Preferences about EMIS characteristics
- Communication needs
- Existing sources of data
- Assistance in designing the EMIS solution

For the EMIS, the customer can choose from a wide range of suppliers. The Company has determined minimum EMIS requirements to ensure that the M&V protocol for savings will be consistent from customer to customer. The Company has pre-qualified a growing number of EMIS tools that meet those requirements. For an EMIS of qualifying scope and the Company will pay an installation incentive to help defray the upfront cost of the system.

Measure Categories

To ensure persistence of savings, the Company will follow appropriate monitoring guidelines and participants will be held to those requirements in return for eligibility toward incentives related to energy-efficiency activities pursued. The table in the EM&V section of this Plan describes the protocols for verifying savings from each of the measure categories.

The product may encourage, measure, and validate four categories of measures:

- Capital equipment or process automation measures – Including purchases of new equipment that is more efficient than baseline conditions. Savings relating to new system purchases will be analyzed and incentivized using the traditional “bottom-up” analysis methods through the Company’s prescriptive and custom products. Equipment rebates for this product include both prescriptive and custom measures, adhering to applicable policies and rebate levels for those project types.
- Recommissioning-type measures – Consist of low- and no-cost Recommissioning opportunities addressing failure or underperformance of installed systems and equipment that can be fixed by making small adjustments, typically not requiring new equipment.
- Systemic Operational and Maintenance (Systemic O&M) measures - Process automation measures that consist of equipment and processes where automation capabilities don’t currently exist or are underutilized. Systemic O&M measures are typically more robust and reliable than behavioral measures, and may include:
 - Automated operation – the installation, programming, or reprogramming of automated functions for improved energy efficiency.
 - Standardized procedures – significant changes to documented standard operating procedures, with formalized management directive and assigned accountabilities, for the purpose of more efficient process operation.

Examples of Systemic O&M measures are: programming reduced system pressure or lower condensing pressure, scheduled precooling, optimizing pump variable frequency drive controls, or tying variable air volume operation to occupancy sensors.

- Behavioral measures - Measures that require manual intervention with repeated decision-making to achieve energy savings that may not be feasible through system automation. Behavioral measures rely on the choice of individuals to change the way they use equipment. Behavioral savings is the reduction in energy use by customer personnel that is statistically attributable to behavioral measures conducted as part of the product. Examples of behavioral measures include workshops and targeted training sessions, gamification, competitions, dash-boarding, and the placement of informational kiosks.

Empower Facilities Optional Path

To further broaden participation, a secondary option may be offered to customers who lack the commitment or resources to secure project implementation. They may not have available capital for the project, even net of DSM rebates. Additionally, they may not have enough staff to ensure that the equipment is properly installed and maintained. Where applicable the implementor will offer financing and payment options and related project-management services. Customers may use their preferred equipment provider if they have one, or the product will assist them with selecting a qualified trade partner.

Components of the Empower Facilities path include:

- The product will fund the SEM engagement and opportunity identification activities. Activities include initial customer meetings and most of the initial steps described above for traditional SEM projects. An Energy Scan will be performed, resulting in prioritized efficiency recommendations. Additionally, *options* for implementation services, ongoing maintenance services, and financing will be developed.
- Implementation services, on-going maintenance services, and financing arrangements are each completely optional for the customer. If the customer chooses to proceed with any of the Empower Facilities options:
 - A Company-contracted provider will provide the service.
 - The services will be entirely funded by fees charged to the customer by the implementer. Service commitments and financial arrangements are between the customer and the implementer.
 - Fees collected from the customer may exceed the actual expenses for providing the service. Any such funds remitted to the Company will be credited to DSM accounts as an offset DSM spending. The Company expects such funds to be negligible during this plan period. In the longer term and with a high-level of customer adoption, these amounts will help reduce the cost of DSM to all customers.

DSM expenses related to SEM-Empower Facilities, as well as funds remitted back to DSM accounts, will be detailed in the Company's annual DSM/BE Status Report Filings.

B. Forecasts, Participants & Budgets

The participation forecast is based on a substantial increase in new enrollments as well as a best-in-industry rate of projects per enrollee.

The budget was developed by applying historical implementer and incentive costs per enrollee and per project. The budget's administrative costs were based on that of the prior years, with minimal additions for planned staffing and for additional, identified marketing strategies.

C. Application Process

Application for enrollment in the product consists of customer interviews, bill analysis, interval usage analysis where available, and an in-person "expectations" meeting. If both parties agree, the

meetings culminate in the signing of a Memorandum of Understanding (“MOU”) between the Company and the customer. The MOU defines each phase of the path and is customized to reflect the customer’s specific need. By signing the MOU, the customer formally acknowledges influence of, and participation in the product. Once the SEMC begins onsite meetings and the MOU is signed, conditional preapproval is established for measures the customer subsequently pursues.

D. Marketing Objectives & Strategies

The product is resource-intensive, and its potential depends on the customer’s level of engagement. Therefore, the Company’s Account Management and Product Management teams will market the product, with the assistance of the Company’s third-party implementers.

SEM engagements have proven to be effective for large industrial customers as well as large “institutional” customers, such as hospitals and schools. During the plan period, the Company will evaluate the potential for using interval usage data to better engage medium-sized customers, as well as single-tenant commercial locations.

For prospective enrollees annually consuming between 1 GWh and 6 GWh, and for whom the technical opportunity and/or management interest is unknown, the Company may offer a “SEM Qualification Assessment”. The Qualification Assessment involves a streamlined version of an EMA, an Energy Scan, and a report. The report lists any efficiency opportunities found and recommends whether a full SEM engagement is a good fit for the prospect. The product will record the savings from implemented projects that were influenced by the assessment and its report.

The Company primarily delivers SEM via engagements with individual customers. If applicatory, the Company may enroll groups of similar customers in a SEM Cohort. SEM Cohort is a group of enrolled customers, who are guided through the SEM steps as a collaborative group. A Cohort may be offered where its delivery cost per unit of potential achievement is lower than that of individual SEM engagements. The Company may also leverage existing industry or trade organizations to not only recruit enrollments, but to also drive SEM concepts and activities.

Participants often have interest in projects or technologies that fall outside of DSM’s traditional scope. “Non-Traditional” project examples include on-site storage, EV charging, and beneficial electrification. Customers seldom distinguish between traditional energy efficiency and other energy-related projects. To provide comprehensive services, and to encourage the continual integration of energy efficiency into business practices, SEM engagement may help customers investigate these “non-traditional” projects. The SEM engagement will support the discussion, assessment, and coordination of non-traditional projects. Project implementation costs will continue to be borne by the customer.

E. Product-Specific Policies

Quantifying Energy Savings

Quantifying energy savings from Systemic O&M measures, Behavioral measures, and certain other measures that did not qualify for rebates, will involve calculations using a “top-down” method of statistical modeling of the individual customer’s actual data. To avoid double-counting, the Company will reduce the savings implied by the regression model by the amount of the achievements associated with any rebated Capital Equipment and rebated Recommissioning measures, where applicable.

Top-down modeling may include a variety of techniques, including multi-variable regression analysis. The modeling will meet or exceed the validity requirements similar to those within the “BPA MT&R Reference Guide”.⁴⁰

A “bundle”, or combination of measures, can be evaluated and qualified for a rebate as a whole. For example, this allows a measure with a short payback to be leveraged with longer payback projects, as to influence the implementation of an entire bundle.

The product uses extensive resources to identify and scope ways to drive energy efficiency into how a customer does business. Additionally, savings relating to new system purchases will be analyzed using the traditional “bottom-up” analysis methods through the Company’s prescriptive and custom products.

Eligibility

Eligible customers for SEM must have an annual consumption of more than 1 GWh within a location or contiguous premises. The Company will screen candidates’ usage, demand, energy intensity if available, history of implementation, and management receptiveness to energy efficiency goals. Because the product is resource intensive, not all large customers will qualify.

As part of our strategy to increase participation in demand response products, this product will be offering customers the opportunity to participate in Peak Partner Rewards, Critical Peak Pricing, or other demand management measures. Further details are provided in the technical assumptions.

F. Stakeholder Involvement

Although trade partners cannot enroll customers, the customer may use any trade partner to install measures or provide customer-contracted services. Primary stakeholders include the customers, third-party subcontractors, and Company representatives. The Company works with these stakeholders to identify product trends and potential changes to product design.

⁴⁰<https://www.bpa.gov/EE/Policy/IManual/Documents/MTR-Reference-Guide-Rev6.pdf>

G. Rebates & Incentives

For implemented Capital equipment measures, the Company will award rebates equivalent to the prescriptive or custom rebates the customer would have received had the customer not enrolled in the SEM product.

For packages of opportunities that are both highly beneficial and unlikely to otherwise be implemented, the product may incorporate additional rebate bonuses for implementation of the entire package.

Annualized adjusted Systemic O&M and Behavioral measures may qualify for incentives, subject to cost-benefit criteria. The incentives are intended to motivate the customer to collect and share data such as production, occupancy, or shift scheduling information.

For optional EMIS installations, the Company offers an incentive of up to 30% of the EMIS in-scope installation costs. Qualifying scopes must be jointly developed by the Company, the SEMC, and the enrolled customer; exclude 3rd-party system consulting charges; and exclude systems implemented before product enrollment.

To influence customer commitment, participation expense may include a small proportion of customer contribution, up to \$7,500.

Residential Program

A. Description

Public Service will continue to offer a wide range of product offerings to serve residential customers in 2023. Public Service has a total of 1,756,632 gas and electric residential customer premises in Colorado.⁴¹ A breakdown of residential premises by type is shown in the table below.

Table 10: Residential Premise Counts by Type⁴²

	Natural Gas Only	Electric Only	Both Gas & Electric	Total
Premise Count	376,000	377,457	1,003,175	1,756,632

The DSM/BE products that make up the Residential Program will be available to all residential customers based on the services they receive from the Company. These customers traditionally reside in single-family homes, multi-family homes, and apartments/condominiums. To address this varied set of customers, the Company will offer a unique set of products targeted to reach the vast majority of the residential market and provide customers with multiple opportunities to participate.

While the Business Program focuses on customers with large energy savings projects, the Residential Program is truly a mass-market program that will touch tens of thousands of customers annually. The products are implemented in a manner that enables large numbers of customers to participate and benefit from the products.

The residential DSM/BE products focus on educating customers on energy efficiency and giving them simple ways to participate, encouraging long-term commitment to reduce energy use. The Company offers a comprehensive set of products including prescriptive rebates for heating and cooling equipment, home lighting, whole house solutions for new or existing homes, lessons on energy efficiency to school-aged children, energy savings through behavior change, and refrigerator recycling.

Products

A thorough portfolio of residential products is planned for 2023 including 11 electric and nine natural gas products. Like the Business Program, all of the natural gas products coincide with their electric counterparts. The Residential product rankings are shown in Table 11 below.

⁴¹Premise count as of January 1, 2022.

⁴²Natural gas transportation-only customers are excluded.

Table 11: Residential Program Product Rankings⁴³

2023	Rank
Home Lighting & Recycling	1
School Education Kits	3
Home Energy Insights	6
Energy Efficient Showerhead	9
Home Energy Squad	11
Multifamily Buildings	12
Residential Heating & Cooling	15
Energy Star New Homes	18
Refrigerator & Freezer Recycling	19
Insulation & Air Sealing	23
Whole Home Efficiency	25

In developing and refining the portfolio of products, Public Service worked closely with external consultants familiar with residential and IQ products nationally. This included assessing possible new products, developing technical assumptions for new energy efficiency measures, evaluating the Colorado climate and energy code impacts, and performing an initial cost-effectiveness analysis. The Company researched other utility offerings to learn about new products, understand their challenges, and discover how the existing products could be improved. The Company worked with industry consultants and vendors such as E-Source, ACEEE, and CEE to learn about energy efficiency activities across the nation. In addition, Public Service spoke with local energy industry members to shape and refine products and discuss partnership opportunities.

B. Forecasts, Participants & Budgets

Forecasts and Participants

The Company’s residential DSM/BE products have a large reach to customers and provide a wide portfolio of offerings that will allow all customers to participate. The Residential Program is anticipated to contribute 107.9 GWh and 631,108 Dth in 2023. This is approximately 22% and 72% respectively of the 2023 achievements.

⁴³All products in the DSM portfolio were ranked through the same process and the full results can be found in [Appendix C](#) of this Plan.

Table 12a: 2023 Electric Residential Program Budgets and Forecasts

2023	Electric Budget	Net Generator kW	Net Generator kWh	Electric MTRC Test Ratio	Lifetime Emissions Savings (Tons CO2)	SCC Benefits	Electric MTRC Test Ratio with SCC
Residential Program							
Energy Efficient Showerhead	\$58,754	98	1,209,631	13.19	4,948	\$318,403	17.39
Energy Star New Homes	\$3,500,421	2,180	5,463,848	1.00	40,539	\$2,282,507	1.26
Home Energy Insights	\$3,494,539	3,674	22,704,371	1.19	27,038	\$2,091,229	1.79
Home Energy Squad	\$1,408,037	998	5,209,656	1.38	26,766	\$1,604,989	2.17
Home Lighting & Recycling	\$3,723,413	6,257	38,977,355	2.76	193,957	\$11,593,806	4.48
Insulation & Air Sealing	\$212,760	354	436,281	0.73	2,780	\$163,579	0.87
Multifamily Buildings	\$2,199,147	1,278	10,201,176	1.33	61,069	\$3,554,917	2.08
Refrigerator & Freezer Recycling	\$1,089,261	304	3,938,032	1.09	13,401	\$887,333	1.91
Residential Heating & Cooling	\$7,437,854	7,318	5,562,373	1.76	36,734	\$2,170,115	1.93
School Education Kits	\$2,376,217	1,940	13,438,378	2.13	76,151	\$4,398,801	3.24
Whole Home Efficiency	\$308,754	295	789,686	0.78	4,525	\$270,454	1.02
General Advertising-Res	\$812,990						
Residential Program Total	\$26,622,147	24,696	107,930,789	1.62	487,909	\$29,336,132	2.25

Table 12b: 2023 Natural Gas Residential Program Budgets and Forecasts

2023	Gas Budget	Net Annual Dth Savings	Annual Dth/\$M	Gas MTRC Test Net Benefits	Gas MTRC Test Ratio	Lifetime Carbon Emissions Savings (Tons CO2)	SCC Benefits	Lifetime Methane Emissions Savings (Tons CH4)	SCM Benefits	Gas MTRC Test Ratio with SCC & SCM
Residential Program										
Energy Efficient Showerhead	\$390,211	44,150	113,145	\$7,406,997	14.59	25,828	\$1,734,840	13.50	\$24,769	17.81
Energy Star New Homes	\$4,841,273	145,698	30,095	-\$2,230,273	0.86	165,928	\$9,643,824	86.40	\$142,599	1.46
Home Energy Insights	\$1,104,806	137,456	124,416	\$758,642	1.69	17,910	\$1,357,084	9.30	\$18,766	2.93
Home Energy Squad	\$594,442	20,449	34,400	\$751,189	2.08	11,957	\$803,170	6.20	\$11,467	3.26
Insulation & Air Sealing	\$429,099	22,510	52,459	-\$478,694	0.77	19,459	\$1,214,322	10.10	\$17,664	1.36
Multifamily Buildings	\$1,082,996	19,998	18,465	\$1,909,260	2.12	11,990	\$802,062	6.20	\$11,463	2.60
Residential Heating & Cooling	\$3,526,380	170,357	48,309	-\$1,421,017	0.89	165,360	\$10,037,475	86.10	\$146,978	1.67
School Education Kits	\$699,495	59,605	85,212	\$9,340,301	11.22	34,869	\$2,342,117	18.20	\$33,439	13.82
Whole Home Efficiency	\$207,263	10,885	52,516	-\$257,976	0.76	10,826	\$653,185	5.60	\$9,578	1.38
General Advertising-Res	\$213,759									
Residential Program Total	\$13,089,724	631,108	48,214	\$15,564,670	1.41	464,127	\$28,588,079	241.80	\$416,722	2.18

Budgets

Achievement forecasts were developed as a result of a participation and energy savings estimation process for each product, which was rolled up to the Residential Program total. Similarly, budgets for each product were developed based on the anticipated level of achievement and cost of market penetration, including review of historical data for the past three and half years, and experience with similar products in Minnesota.

Market Analysis

The Company’s Residential Program reflects the primary market opportunities for residential energy savings in four areas: whole home and building envelope, HVAC, education and behavior change, and common measures.

1. *Whole Home and Building Envelope:* With increased awareness of energy costs, interest in conservation, and varied energy performance of existing homes, there continues to be good energy efficiency opportunities for residential customers in new or existing homes. Products: ENERGY STAR New Homes, Whole Home Efficiency, Insulation & Air Sealing
2. *HVAC:* Public Service believes evaporative cooling is an excellent low-cost source for cooling in the Colorado climate. The Company also realizes that customers are looking for central air conditioning and heating options. To address this demand, the Company offers products focused on quality installation of new units and replacement of inefficient,

existing systems. Additionally, to promote beneficial electrification, the Company offers dual fuel heat pumps and heat pump water heaters.

Products: Residential Heating & Cooling

3. *Education and Behavior Change:* The Company funds initiatives to educate customers, enhance participation in direct impact products, and influence market transformation.

Products: Home Energy Insights and School Education Kits

4. *Common Measures:* The Company supports rebates and incentives for prescriptive, energy-saving measures focused on the most common household equipment.

Products: Home Energy Squad, Home Lighting & Recycling, Refrigerator & Freezer Recycling, Energy Efficiency Showerhead, and Residential Heating & Cooling.

C. Application Process

Application processes vary by product. See individual product summaries following this overview for more information.

D. Marketing Objectives & Strategies

Trade allies, end-use equipment vendors, energy services companies, Public Service's call center representatives and marketing team are the primary drivers for realization of the planned achievements in the Residential Program. The Company utilizes newsletters, customer events, direct mail, telemarketing, email communications, and awareness advertising to reach customers. A challenge in marketing energy efficiency is that it's not a topic on the top of customers' minds. Customers tend to focus on purchase price (or "first costs") rather than lifetime costs and are unlikely to replace equipment prior to failure. Customers may also not be aware of energy efficient equipment options available to them when the need arises to make purchase decisions. Yet, opportunities are growing in marketing energy efficiency to customers because energy costs and climate change have led to increased awareness and affinity for energy-saving actions. To support marketing efforts, Public Service employs an integrated approach to marketing communications, where the tactics are designed to work in concert with each other and reinforce key messages over time.

Furthermore, residential DSM product managers and product developers periodically meet with the Company's residential Customer Care Centers and energy efficiency specialists to determine how the energy efficiency products and services are being received in the marketplace and solicit ideas for existing product improvement or new product introduction.

Strategy

Public Service follows the "AIDA" (awareness, interest, desire, action) process for encouraging customers to participate in DSM/BE products. The following are the steps in this process:

1. Create awareness of electric and/or gas prices and potential savings from energy efficiency offerings.

2. Promote interest in DSM/BE products by providing information about the offerings across a variety of customer touch-points.
3. Instill the desire for participation in DSM/BE products by showing how customers can reduce their “first costs” via rebates in the near-term and reduce their monthly energy bills in the long-term with energy-efficient appliances and equipment.
4. Move the customer toward action by providing a wide range of product offerings to address one or more of their needs.

Key Messages and Target Audience

When communicating with customers, Public Service uses several overarching key messages including:

- Energy efficiency reduces monthly energy bills due to lower operating costs.
- Public Service helps lower energy bills by offering rebates and incentives for installing highly efficient equipment.
- Energy efficiency helps reduce environmental impacts.

E. Program-Specific Policies

There are several general policies that apply to Public Service’s Residential Program. Individual products may have additional, unique policies as noted in each of the product summaries that follow.

The Company defined all-electric, electric-only, and gas-only customers as follows:

- All-electric: customers who only receive electric service from the Company and space condition and water heat with electricity;
- Electric-only: customer who receive electric service from the Company and natural gas service from another provider for use in space conditioning and/or water heating; and
- Gas-only: customer who receive natural gas service from the Company and electric service from another provider.

Residential Program policies include:

- *Proof of installation:* Nearly all residential DSM/BE products in the Company’s portfolio require documentation of installation through either proof of purchase (i.e. detailed invoices) or by measurement and verification.
- *Installation date:* Determines rebate eligibility and amount. Other products may have more specific requirements to qualify for a rebate.
- *Load Shifting:* Load shifting occurs when a measure shifts electrical energy and demand usage to an off-peak period, without necessarily reducing the total load served over a defined time period. Potential load shifting projects need to meet all existing eligibility requirements of the applicable product as well as additional persistence requirements.

F. Stakeholder Involvement

Throughout the product development process, Public Service has discussions with key external parties. The discussions are often initiated via work groups, public forums like the quarterly DSM Roundtable Meetings, one-on-one meetings, phone calls, and/or brainstorming sessions. In developing this Plan, the Company had discussions with local stakeholders, including: City/County of Boulder, City of Denver, CEO, Colorado Department of Public Health and Environment, EEBC and Denver Water.

In addition to discussion with Colorado area contacts, Xcel Energy had also worked with national organizations in the past when developing many of its DSM/BE products, including: ACEEE, CEE, DOE, U.S. Environmental Protection Agency (“EPA”), E Source, and the Southwest Energy Efficiency Project (“SWEEP”).

These organizations continue to provide feedback on the Company’s DSM/BE products to suggest areas for future improvement.

Additionally, as the Company explores new ways to reach the residential market, we continue to work with local communities as key partners. In 2014, the Company launched the *Partners in Energy* product to support communities in developing and implementing comprehensive energy action plans. Local energy plans are a platform to drive participation in the Company’s DSM/BE products. In 2023, the Company will continue to support and grow community partnerships through *Partners in Energy*, by configuring our DSM/BE products and resources to support the unique energy goals and markets of individual communities.

G. Rebates & Incentives

Residential rebates are prescriptive and vary by product.

Indirect Products such as Consumer Education, Energy Efficiency Financing, and Home Energy Audits support customer learning, and influence participation in residential prescriptive products.

H. Evaluation, Measurement, & Verification

The specific product measurement and verification plans are described in the EM&V section of this Plan; and products that will undergo comprehensive evaluations in 2023 are also noted that section.

➤ Energy Efficient Showerhead

A. Description

The Energy Efficient Showerhead product is designed to offer year-round natural gas and electric savings to Public Service customers. Residential natural gas and combination gas and electric customers are eligible to receive free (or discounted) energy-efficient showerheads and faucet aerator kits to help reduce their energy and water use.

Eligible customers are contacted and offered multiple kit options based on their past participation in the Energy Efficient Showerhead product. Kit combinations may include one or more of the following units:

- 1.5GPM showerhead
- 0.5GPM bathroom faucet aerator
- 1.5GPM kitchen faucet aerator

The free kit is mailed to customers who make the decision to request the energy efficiency measures within the promotional period. In addition to the showerheads and aerators, the kits include Teflon tape and illustrated installation instructions. Participants receive one kit per household. In the future, we intend for customers visiting the Xcel Energy Store to see triggers alerting them to their eligibility to receive a free kit, engaging customers when they are already in an energy efficiency and purchasing mindset while eliminating some additional promotional costs.

Customers may also purchase showerheads and aerators individually through the Xcel Energy Store, which are mailed to the customer. Rebates are available for eligible customers and are applied at the point of purchase. In many cases, these rebates cover the full cost of the equipment. Limits on the number of showerheads and aerators per customer are the same as if the customer had ordered a kit.

The Company contracts with third-party implementers to manage customer requests and distribute the kits and individual equipment. Customer participation is tracked and provided to the Company following the distribution of the kits or individual equipment.

Showers heads target year-round energy savings during time of use peaks use allowing customers to reduce hot water usage during high usage winter morning hours towards reducing gas consumption and evening peak hours for electricity. Customers can be encouraged to utilize pre-heating to take advantage of off-peak rates if their equipment allows.

B. Forecasts, Participants & Budgets

Forecasts and Participants

The Company set the product forecasts for participation and energy savings based on past performance of the product. Actual savings will be driven by the customer's water heater energy source and service type (electric and/or natural gas) and customer installation rates.

Budgets

The product budget was developed based upon the cost of reaching the proposed energy savings forecasts – using 2021 product performance as a guide for the cost of the showerheads/aerators, fulfillment charges, postage, and all necessary marketing efforts.

C. Application Process

Customers are notified of this product through direct to customer, social media and Xcel Store promotions. Customers have a limited amount of time (approximately 45 to 60 days for direct mail and one to two weeks for email) to respond to the third-party implementer only to encourage action. Once the customer responds to the offer, they are shipped one free energy-savings kit within six weeks. If a customer orders their products from the Xcel Energy store, the products are shipped within 2-6 business days, however, these customers are required to pay the cost of shipping if the total cost of the order is under \$49.

In addition to the direct mail and email campaigns, Public Service will continue to seek out or consider proposed partnerships with other organizations or cities to distribute free energy efficient showerheads and/or aerators.

D. Marketing Objectives & Strategies

An average of 3.2 percent of customers who received a direct mail or email offer in 2021 requested the product. Based on this data, the Company has developed a marketing plan utilizing multiple channels to engage customers and reach the participant goal. The marketing collateral requests the customer to indicate whether their water heater runs on gas or electricity. In 2023, the Company will begin offering free kits to eligible customers on the Xcel Store.

E. Product-Specific Policies

Natural gas and combination gas and electric customers who have not previously participated are eligible for the offer. Additionally, past participants may be offered additional or replacement units through follow-up marketing offers based on when they last participated. If an eligible customer who did not receive the offer becomes aware of the product and would like a free kit, they will receive one if budget allows.

F. Stakeholder Involvement

In past program years, Public Service has partnered with local cities and counties on their water efficiency initiatives. The Company plans to continue its support of these types of products in 2023.

G. Rebates & Incentives

The product generally provides free energy efficient equipment rather than a rebate to the customer—the price for that equipment is classified as a rebate in the product budget. While the majority of participants choose this option, the product also offers more expensive showerheads with additional features (handheld showerheads, for instance) at a discounted price. In these cases, the rebate covers only a portion of the cost of the equipment and is subtracted directly from the cost at the point of purchase.

➤ **ENERGY STAR New Homes**

A. Description

The ENERGY STAR® New Homes (“ESNH”) product provides builders of single-family and small multifamily homes with an incentive to exceed local building codes and elementary construction practices. Homebuilders are encouraged to look at the house as a system when considering deployment of energy saving and load reducing construction methods and installation of energy-efficient appliances. Homeowners benefit with lower energy bills, fewer maintenance concerns, higher resale value, and a more comfortable, quiet home. With interval data, homeowners will also see how efficient their home is starting out and gain a deeper appreciation and understanding of that efficiency.

The current product structure gives builders the flexibility to mix and match efficient technologies and building practices to meet the product requirements and qualify for a rebate. To qualify for a rebate, participants are required to build homes that exceed local building jurisdictions’ energy codes by at least 10%. To measure this, a rating must be completed on each home by a Residential Energy Services Network (“RESNET”) certified Home Energy Rating System (“HERS”) rater. The HERS rater provides a valuable service by consulting with the homebuilder during the construction phase and ensures the designed energy efficiency measures have been properly installed in the home. HERS raters will complete the rating for each home using a RESNET accredited software approved by the Company and will provide select informational details to the Company’s third-party implementer for evaluation. Energy savings are determined individually for each home based on the difference between the energy used by the reference home (or baseline home; modeled to match the local jurisdictional energy code) and the energy used by the new as-built home. The Company will continually evaluate this product structure to determine necessary adjustments to help the product remain cost-effective while adapting to accommodate higher energy codes.

The product also encourages and supports jurisdictions to adopt the latest building codes within the residential new construction sector. It gives those communities the tools to improve the compliance with updated energy codes and ultimately helps them reach their energy performance and economic development goals. This support meets each jurisdiction where they are in the code adoption cycle and address current gaps in new code adoption across the state including: a lack of resources, lack of knowledge, and internal and external opposition to progressing energy codes. The Company utilizes a third-party implementer to work with code enforcement jurisdictions.

The Company utilizes a third-party implementer that works directly with local HERS raters to get homes enrolled in the product. HERS raters in the state of Colorado have established strong relationships with the builder community. HERS rating companies have the flexibility to participate in this product by completing a standard scope of work administered and managed by the Company’s third-party implementer. The HERS rater will model each home and test the home to measure the level of energy efficiency achieved. Once the home is completed, the HERS rater provides the required information to the third-party implementer who then determines if the home meets the product requirements and is eligible for a rebate. The third-party implementer is

responsible for reviewing the information submitted by the rater, working with the rater to correct or provide missing information and then reporting it to the Company. The third-party implementer provides product training for the rater and will assist with builder training as needed.

This product also helps manage utility bills for customers on time-of-use rates. As building assemblies improve and builders qualify for higher incentives, electric and natural gas use decreases and loads smooth. Thus, comfortable indoor temperatures can be maintained for a longer period of time, so shifting load to hours of lower energy can be done without affecting customer comfort. As control systems improve, this can be done automatically with imperceptible effects on occupants.

B. Forecasts, Participants & Budgets

Forecasts and Participants

The product forecasts builders who construct single-family and small multi-family homes up to four units. Energy savings and participation forecasts are based on historical product performance and growth forecast assumptions in the residential new construction marketplace. New construction growth continues to improve and barring any significant impacts to the general economy, the Company anticipates this growth will continue to occur around 5% year over year. As predicted in the prior filing, advancing IECC codes adoption has continued throughout Company service territory, resulting in heaviest participation in the lowest performance tiers. The Company has evaluated the incentives based on fuel type, mechanicals, and technological innovation and set the incentive levels accordingly. The goal is to continue to shift participation toward advanced performance tiers and more electric-only development, enabling decarbonization in the new construction sector.

Budgets

The product budget is primarily driven by forecasted participation for 2023 and established rebate levels are designed to shift participation to more desired fuels and performance tiers. Additional costs include product administration, promotional and outreach activities, and measurement and verification. Product administration costs include Company labor and third-party implementer services. Builder rebates and energy rater rebates comprise the majority of the product budget, followed by measurement & verification and advertising/promotion.

C. Application Process

Enrollment for this product is typically completed by the HERS raters on behalf of their clients (builders). HERS raters have strong, long-established relationships with most of the builders operating within the Company's Colorado service territory. To initiate the enrollment process, HERS raters will contact builders to encourage their participation, or the builder will contact a rater and express interest in constructing an energy-efficient home. The rater will explain the product offering and potential rebates available, review the home's blueprints and building schedule, and enter the home details into the third-party implementer's tracking database. The rater

consults with the builder throughout the construction phase to build a home that qualifies for the product rebate.

When the home is completed, the HERS rater will perform an air-tightness test on the house and determine the energy impacts using an accredited RESNET rating software that has been approved for use by the Company. This information is submitted to the third-party implementer who will review and approve each home. The builder will receive a rebate based on the local energy code requirement and the percent savings beyond the code (“BTC”) achieved. Specific gas and electric energy savings are determined by the Company using the HERS rater’s modeling information. There is no rebate application for the builder or rater to complete since all required information is entered by the HERS rater into the third-party implementer’s database using a web portal interface. The third-party implementer reviews and ensures all information is accurate and captured and works directly with the energy rater to correct any omissions or errors. Once the data is deemed complete, the third-party implementer is responsible for entering selected portions of the collected data for each home into the Company’s database.

D. Marketing Objective & Strategies

The Company will update existing builder and homebuyer marketing materials and make them available to participants. ESNH has been very successful for the last two years. As a result, marketing efforts will change from enrolling builders in the product to encouraging builders to build better homes. The objective of some of the builder marketing material is to increase product awareness and effectively communicate product benefits (energy savings, economics, and comfort/durability) along with the requirements for participation. The homebuyer collateral will continue to be an aid for builders to easily explain the benefits of an energy efficient home to their potential clients. A certificate of completion demonstrates the home successfully completed the product requirements and contains useful information such as the HERS index achieved and who rated the home. New, highly targeted direct to consumer marketing will highlight the primary benefits of efficient construction of comfort, durability, and resiliency, while highlighting the best builders in the product.

Following the relaunch of the ESNH website in 2022, the product will engage in direct-to-consumer digital advertising. The objective of these ads is to direct customers to the product web page, where customers can get information on product builders and learn more about the benefits & features of high-performance housing. Channels will include limited social media, digital display ads, and paid search advertising.

The Company’s third-party implementer will engage in outreach activities with participants and stakeholders. The outreach objectives are intended to maintain good working relationships with builders and raters, ensuring they are satisfied with the product offering and to provide education and training support where needed. The third-party implementer will initiate monthly product update communications to all participants and hold in-person and conference-call meetings with raters along with routine email and phone communications.

The third-party implementer will provide training to participants (primarily raters) on the product requirements, the Company approved modeling software and use of their database system to

improve efficiency and ensure more accurate data reporting. These activities are expected to encourage energy-efficient building practices resulting in increased energy savings. The Company is seeking partnerships with national organizations to extend the impact that energy efficiency measure implementation can have on market value of homes.

The Company is also considering how renewable and electric vehicle products and the ESNH product may be jointly marketed to customers. Other types of training will be identified with the assistance of the product participants, key stakeholders and the third-party implementer who will be responsible for developing specific outreach plans. Key stakeholders include organizations such as local homebuilder associations, the CEO, the Colorado Code Compliance Collaborative and other related industry organizations.

To assist in building code compliance, the Company will continue and improve its one-on-one support for local officials, marketing materials available through various channels, and trainings designed to support awareness and implementation.

E. Product-Specific Policies

This product currently applies to builders of residential single-family buildings, small multifamily buildings and townhomes that receive combined electric and natural gas service, natural gas-only service, or year-round electric space conditioning from Public Service. Structures that have common conditioned space such as hallways and elevator shafts are not eligible to participate in the product. Additional product requirements are:

1. Raters must be RESNET certified and use the RESNET modeling software approved by the Company to model each home.
2. Raters must provide a RESNET-registered HERS rating for each home. Sample ratings are not accepted. Under some circumstances, projected ratings of the as-built home may be accepted.
3. Raters must complete a Rater Field Checklist and the home must pass the applicable sections.
4. Builders will receive a rebate based on the local energy code requirement and the percent BTC. The percent improvement is determined using the Company approved modeling software to model the energy used by the reference home (or baseline home; modeled to match the local jurisdictional energy code) and the energy used by the new as-built home. The energy use is converted to MMBTU and the following formula is used to determine

the percent improvement: $\text{Ref_Home_MMBTU} - \text{As-Built_Home_MMBTU} / \text{Ref_Home_MMBTU}$.

5. Homes that achieve ENERGY STAR® certification and receive a percent BTC rebate (as detailed in Section G below) may be eligible for an additional \$100 rebate.
6. Natural gas-only participants are not eligible to receive the rebates for ENERGY STAR® radon fans or heat pump water heater measures.
7. Homes qualifying for a product rebate are not eligible for Company's *separate prescriptive* rebates under the following products; Insulation & Air Sealing and Residential Heating & Cooling.
8. Impacts from on-site generation, energy storage, or other renewable generation systems credited to the home will not be included in the percent BTC improvement (rebate) or energy savings calculations.

F. Stakeholder Involvement

The Company maintains ongoing relationships with the EPA and DOE, which jointly oversee the national ENERGY STAR® program. The Company is an active Sponsor and participant in the national program, recognizing the strong customer awareness of the ENERGY STAR® brand, and has received several ENERGY STAR® awards for this product.⁴⁴

This product has received significant interest and input from external Colorado stakeholders in preparation of Plan filings and through quarterly stakeholder meetings. This input has been valuable and taken under consideration for the product design.

The Company serves on the new home construction committee of the Consortium for Energy Efficiency, which meets regularly and works closely with the EPA. The third-party implementer attends RESNET conferences on behalf of the Company.

Public Service will strive to work with and engage Colorado stakeholders, such as the Colorado Energy Office, Southwest Energy Efficiency Project, Energy Efficiency Business Coalition, the Colorado Energy Code Collaborative, the City of Denver and others to partner when possible and continue the product's success. The Company is also seeking partnerships with national organizations like the Energy & Environmental Building Alliance to bring top class training and events to Colorado builders.

The Company will issue monthly communications to participating builders and energy raters, providing year-to-date product updates on participation, achievement, expenditures, and other important product information as it arises. The Company's third-party implementer communicates regularly with participating energy raters and builders, including requests for their input on training and education gaps related to energy efficiency and more specifically, how the product can assist filling those gaps.

⁴⁴ View the ENERGY STAR Awards Archive: <https://www.energystar.gov/about/awards/awards-archive>

G. Rebates & Incentives

Builders with qualifying homes are eligible to receive a rebate based on the local energy code requirement and the percent BTC improvement achieved (see *Product-Specific Policies* for details). A builder’s home must achieve a minimum 10% BTC improvement to qualify. The Company has eliminated the incentive tiers for homes in jurisdictions with energy codes earlier than IECC 2012. Homes in these jurisdictions will be baselined to an IECC 2012 reference home to determine incentive levels.

Combo Homes - Rebate Levels – 2018 IECC or Lower and Percent BTC

Percent BTC	Rebate
10% - 14.999%	\$250
15% - 19.999%	\$400
20% - 24.999%	\$600
25% - 29.999%	\$900
30% - 34.999%	\$1,300
35% - 39.999%	\$2,000
40% and higher	\$2,550

Combo Homes - Rebate Levels – 2021 IECC and Percent BTC

Percent BTC	Rebate
10% - 14.999%	\$300
15% - 19.999%	\$550
20% - 24.999%	\$1,000
25% - 29.999%	\$1,500
30% - 34.999%	\$2,500
35% - 39.999%	\$4,000
40% and higher	\$4,750

Gas Only Homes - Rebate Levels – 2018 IECC or Lower and Percent BTC

Percent BTC	Rebate
10% - 14.999%	\$125
15% - 19.999%	\$200
20% - 24.999%	\$300
25% - 29.999%	\$450
30% - 34.999%	\$650
35% - 39.999%	\$1,000
40% and higher	\$1,275

Gas Only Homes - Rebate Levels – 2021 IECC and Percent BTC

Percent BTC	Rebate
10% - 14.999%	\$150
15% - 19.999%	\$275
20% - 24.999%	\$500
25% - 29.999%	\$750
30% - 34.999%	\$1,250
35% - 39.999%	\$2,000
40% and higher	\$2,375

All-Electric Homes - Rebate Levels – 2018 IECC or Lower and Percent BTC

Percent BTC	Rebate
10% - 14.999%	\$500
15% - 19.999%	\$800
20% - 24.999%	\$1,200
25% - 29.999%	\$2,800
30% - 34.999%	\$3,900
35% - 39.999%	\$5,200
40% and higher	\$6,700

All-Electric Homes - Rebate Levels – 2021 IECC and Percent BTC

Percent BTC	Rebate
10% - 14.999%	\$600
15% - 19.999%	\$1,100
20% - 24.999%	\$2,000
25% - 29.999%	\$3,000
30% - 34.999%	\$5,000
35% - 39.999%	\$8,000
40% and higher	\$9,500

To qualify for all-electric homes rebates, builders must meet two criteria. First, participating homes must have a ground-source heat pump sized for heating load or an air-source heat pump that meets Company cold climate heat pump criteria. Second, participating homes must have electric water heat.

Incentives for all product homes with electric resistance water heaters will be capped at the lowest appropriate performance tier incentive for the home. This new backstop intends to encourage implementation of higher efficiency electric water heating.

HERS raters who consult on qualifying homes are eligible to receive a rebate based on the rated home’s performance better than local energy code. As with builder incentives, the rated home must achieve a minimum of 10% BTC for Raters to qualify.

Rater Incentives – All codes and Percent BTC of Rated home

Percent BTC	Rebate
10% - 19.999%	\$75
20% - 29.999%	\$150
30% and higher	\$225

The ENERGY STAR® certified rebate is an *add-on* rebate available to qualifying homes that have earned ENERGY STAR® certification and meet the following:

- a) Home must have both electric and gas service from Public Service or year-round electric space conditioning. Gas-only homes or electric-only homes that heat with gas from another company or delivered heating fuel are not eligible;
- b) Home must qualify for a percent BTC rebate;
- c) HERS rater verifies the home meets all national ENERGY STAR® certification requirements and;
- d) ENERGY STAR® label is applied to the home’s electrical breaker box.

ENERGY STAR® Certified Rebate

ENERGY STAR® certified	\$100
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The table below lists prescriptive rebates as another *add-on* rebate available to qualifying homes that have earned a percent BTC rebate and installed one or any combination of the qualifying measures listed below. Homes that receive natural gas-only service from the Company are not eligible for rebates associated with electric measures.

Appliance Rebate Levels for Qualifying Homes

Appliance	Rebate
ENERGY STAR® Clothes Washer	\$40
ENERGY STAR® Clothes Dryer	\$30
Heat Pump Water Heater	\$600
Heat Pump Water Heater with CTA2045 port	\$800
ENERGY STAR® certified Smart Thermostat ⁴⁵	\$50
ENERGY STAR® radon fan	\$20

Marshall Fire Recovery

In its continued effort to help the communities affected by the Marshall Fires of 2021, the Company continues to offer incentives for high-performance housing. Upon completion of the home and following final inspection, the paperwork verifying the performance threshold is submitted to the company and the customer in the home receives the rebate. To qualify, a home must be built on a premise that was once occupied by a home that was a total loss in the Marshall Fire. The Company has a comprehensive list of eligible premises and is actively working with local officials to double check eligibility. Customers qualify for one of the incentives below.

⁴⁵ To qualify for the rebate, the device must be a certified ENERGY STAR® connected thermostat and be compatible with the Company’s Residential Demand Response program requirements.

Homes that meet multiple performance criteria qualify for the highest incentivized performance tier.

Customer Incentives – Rebuilding Customers

Building Standard	Rebate
IECC 2021 Code Compliant ⁴⁶	\$7,500
ENERGY STAR® New Homes version 3.2	\$10,000
Department of Energy Zero Energy Ready Homes version 2.0	\$12,500
ENERGY STAR® New Certification Program	\$17,500
Passive House (PHI or PHIUS compliant)	\$37,500

Customer Incentives – Non-rebuilding Customers

Building Standard	Rebate
ENERGY STAR® New Homes version 3.2	\$1,250
Department of Energy Zero Energy Ready Homes version 2.0	\$2,500
ENERGY STAR® New Certification Program	\$5,000
Passive House (PHI or PHIUS compliant)	\$15,000

Rebuilding customers are defined as customers who, prior to the Marshall Fire, lived in a premise that was destroyed in the Fire and is moving into a new home on a premise that was destroyed by the Fire. Non-rebuilding customers are defined as a customer who did not live in a home destroyed by the Marshall Fire but are moving into a new home on a premise that was destroyed in the fire.

The incentives are paid directly to the customer. Incentives for rebuilding residents are higher to acknowledge the disruption to their lives and rebuilding challenges that new residents didn't and don't have to experience. Incentivizing identical performance tiers for both rebuilding and new residents hopes to leverage economies of scale for builders to construct multiple houses – some for new residents and some for rebuilding residents – to similar specification.

⁴⁶ To qualify for the code compliance incentive, the home must be built on a premise where the performance standards of IECC 2021 is the enforced energy code. Homes built on premises where IECC 2021 is not the enforced energy code are ineligible for this incentive but are eligible for the higher performance tiers.

➤ Home Energy Insights

A. Description

Home Energy Insights (“HEI”) is a free service offered by Xcel Energy to influence the everyday actions of residential customers in a manner that will help them save energy and money. The product engages customers through a report compares a customer’s energy consumption to similar nearby households for benchmarking an individual household’s performance. The report is sent to eligible customers that are enrolled in the product. HEI provides personalized tips to demonstrate how much customers can save by changing their behavior. Participants receive free monthly emails or quarterly printed reports. All Xcel Energy customers also can log on to the My Energy website where they can take a home audit, customize an action plan and get energy efficiency tips. To administer the HEI product, Xcel works with a third-party company that helps utilities meet their efficiency goals through effective customer engagement. This product currently serves 621,863 Colorado customers.

HEI energy savings are derived by comparing the energy usage of a control group to communication recipients (treatment) group. The treatment group receives reports with tips and suggestions along with alerts, based on their actions, to speed up the adoption of energy saving opportunities. The control groups improve energy consumption more organically based on both Xcel and other external influences. While equipment improvements provide longer and less volatile energy savings, behavioral savings require consistent support to the customer through reminders to act on energy savings tips. The goal of report delivery and improvement, alerts and the tools in the web portal is to improve the quality of the energy efficiency behavioral recommendations and the customer experience towards increase energy savings. Generally, realized energy savings increase gradually over time as behavior is impacted by treatment, then begin a long slow decline as the control group efficiency catches up. Product savings are measured and reported to the Company each month by the third-party implementer.

When implemented by the vendor, HEI will include Time of TOU recommendations towards bill reductions based off the daily usage profile for customers with advance metering infrastructure (“AMI”) meters on the monthly reports and within My Energy. Graphs for usage and costs can be color coded to educate customers on TOU implications. Likewise, AMI will provide the potential to make behavioral recommendation to make TOU adjustment on specific appliances including timely alerts after a customer takes an action that may result in higher on-peak charges. Additional targeted alerts can be configured as direct communications to customers that meet specific TOU criteria; typically alerts of this nature are an added cost to the product. At a rudimentary level, compared to the possibilities with AMI for electric meters, HEI can educate and make recommendations towards reducing gas usage during peak consumption times, but cannot target specific equipment or make more timely recommendations based on actual customer actions.

The product’s main offerings include the following:

Personalized Home Energy Reports (“HER”)

These individualized reports are paper-mailed, emailed, or updated on the Web portal. Reports provide:

- Customer’s energy use compared to other nearby houses with similar home characteristics (square footage, home type, etc.);
- Targeted efficiency recommendations based on home profile data available; and
- Other information such as consumption graphs.

Recipients are selected from the Company’s residential customers and may “opt out” of the product at any time upon request. Through the duration of this Plan, the Company anticipates attrition-initiated customer additions to the treatment groups as needed to ensure savings forecasts and to maintain participation levels.

Online Portal

This feature is available to all of the Company’s residential customers when historical information is available. It provides the same information as energy usage reports on demand, energy saving recommendations and more, all with greater timeliness. When going to the web portal, customers can:

- See their neighbor comparison on their last report PDF;
- See graphs showing energy consumption by fuel type by bill period or day (for electric AMI customers);
- Earn rewards redeemable for gift cards for energy savings activities;
- Complete a Home Energy Assessment which guides insights into how energy is used in the home as well as more accurate and actionable energy saving recommendations;
- Receive tips and recommendations for a wide array of energy savings measures, from low- and no-cost improvements to major upgrades of building envelope and mechanical systems; and
- See electric disaggregated energy usage by technology and end use. This will be initially based on general information, and as AMI meters and data become more widespread and as customers complete Home Energy Assessments, the accuracy of this disaggregation will improve.

Customers are encouraged to visit My Energy through their email and paper mailed reports the use of emails, targeted messaging, and social channels. Customers who engage in the online portal are compared to similar customers who have not accessed the portal, in order to determine energy savings resulting from customers’ use of the tools. Savings from customers who are part of the HER Treatment Group who also use online tools will have all savings measured as part of their HER savings calculation. Only savings from customers who are not part of the HER Treatment Groups will be counted as attributable to online savings.

High Bill Alerts

The Company will develop a service to contact customers before the end of a billing cycle that are trending to have a high bill. Customers will be able to opt out of receiving High Bill Alerts.

The high bill alert product will alert customers during their billing cycle if their projected bill is more than 30% higher than the same billing period the previous year. The system does bill

comparison checks on the sixth and sixteenth day of each billing period. Enrolled customers will receive an email alert around mid-billing cycle if their projected bill is over 30% higher than the same billing period last year. Eligible customers will be automatically enrolled to the 30% Alert and have the ability to opt-out via the My Energy portal.

Eligibility requirements:

- High Bill Alert is only available to electric customers
- Customers must have MyAccount so they can access product preferences via MyEnergy portal
- Customers with Average Monthly Payments are not able to participate.
- To participate in high bill alerts, a customer must have 12-months of bill history for bill comparison.
- To perform projection calculations, a customer needs to have a smart meter
- Customers must be on one of the following rates:
- Residential General, Residential Demand, Residential Demand-Time Differentiated Rates, Residential Energy Time-of-Use

B. Forecasts, Participants & Budgets

Forecasts and Participants

The Company has developed specific energy savings and participation forecasts for each product component:

- *Home Energy Report*: Participants in the 2022 product will carry over and remain in the print and email groups for 2023.
- *Online Portal*: All residential customers have access to the online portal; however, customers must sign up for My Account in order to access it.

The online portal follows an opt-in model where customers will receive targeted marketing messages encouraging them to access it and actively participate. This differs from the HERs, where customers are randomly selected to receive reports unless they opt out. Some participants may be single-fuel service customers while others may receive both natural gas and electric service from The Company. Therefore, each fuel service counts as a “participant,” meaning a dual-fuel customer will count as a gas participant and also as an electric participant.

Budgets

The majority of the product’s budget is allocated to third-party implementation services, which includes preparing and sending the HERs, data analytics, marketing and conducting an ongoing regression analysis of Treatment and Control Group participants to determine the electric and natural gas savings. Administrative costs for customer data extraction and product administration to be completed by the Company are based on costs derived from previous product years.

The multi-state budget for the online portal is largely fixed due to the information technology and delivery method and does not change as more customers use the tools and services. A share of the online portal license fees is apportioned to this product’s budget based on customer counts for each state and fuel type.

C. Application Process

There is no customer application for this product. Participants for the print and email Treatment Groups are secured using a random selection process administered by the third-party implementer. New participants will be informed of their selection at the beginning of treatment and will be given the opportunity to opt-out from receiving the Treatment Group communications (HERs) at any time. Appropriately-sized Control Groups are identified by the third-party implementer and enable isolation of effects attributable to each Treatment Group. The Control Group customers have not and will not be directly contacted or targeted by the Company or third-party implementer's marketing efforts regarding this product. The online portal is opt-in. Customers become participants once they log onto My Account and go to the online tool.

D. Marketing Objectives & Strategies

The product is a behavior change effort focusing on energy and demand conservation to lower customer bills. The primary objective is to educate customers on their energy use and encourage change that results in savings behaviors. A secondary benefit of the product is that customers who receive HERs may choose to participate in other DSM/BE products, and this becomes more likely when a specific DSM/BE product is cross promoted on the HER itself. The Company plans to continue to utilize this effective marketing channel for targeted promotion of other energy-saving DSM/BE products and services.

E. Product-Specific Policies

Customer confidentiality and data privacy practices will be stringently applied in accordance with the Company's Privacy Policy, available on the Company's website.⁴⁷ Customer assistance will be provided to participants and non-participants in the same manner.

F. Stakeholder Involvement

The Company is coordinating efforts with stakeholders for the adoption of multiple language, especially Spanish, capabilities within residential products. The Home Energy Insights product was identified as a starting point and the new online portal offering has a google translate toggle which includes Spanish. The Company will continue to evaluate how language preferences can be incorporated further into the product as a part of the overall language strategy.

G. Rebates & Incentives

Rebates are not offered as part of the product.

⁴⁷ <https://www.xcelenergy.com/staticfiles/xcel/Admin/Xcel%20Online%20Privacy%20Policy.pdf>

➤ Home Energy Squad®

A. Description

The Home Energy Squad product offers delivery and direct installation services of energy conservation measures to customers who seek to improve their home's energy efficiency, increase their comfort, and lower their utility bills. The Company pays for the cost of the measures and installation, while customers pay a fixed trip charge. Customers may also purchase additional measures that are priced individually.

The Home Energy Squad team will install a number of moderate-impact, low-cost measures for customers. The product seeks to enhance customer knowledge and assist customers in overcoming barriers related to making energy improvements, including: customer confusion about product choices, varying costs, and locating qualified installers.

The main product offerings include:

- Electric conservation measures:
 - LED bulbs of various types and wattages
 - Installation of a new, or temperature setback of an existing, programmable or smart thermostat
 - Advanced power strips
- Electric conservation measures, available for customer purchase:
 - Installation of additional programmable thermostats
 - Installation of additional or premium smart thermostats
- Natural gas conservation measures:
 - High efficiency showerheads
 - Low flow faucet aerators for the kitchen and bathroom
 - Installation of a new, or temperature setback of an existing, programmable or smart thermostat
 - Weather-stripping of one exterior door
 - Insulation blanket for the water heater
 - Temperature assessment and setback of the water heater
- Natural gas conservation measures, available for customer purchase:
 - Weather-stripping of additional doors
 - Installation of additional programmable thermostats
 - Installation of additional or premium smart thermostats

The product also offers virtual visits as a way to facilitate participation. Virtual visits are conducted via a videoconferencing tool provided by the third-party implementer, with a Home Energy Squad technician remotely accompanying a customer on a walkthrough of their home. Virtual visits are intended to lead to follow-on interactions, such as an in-home installation visit from the Home Energy Squad, a Home Energy Audit, or participation in other Company products. If such follow-on services have an associated customer co-pay or fee, the customer would pay them in accordance with the guidelines of the follow-on services.

The product will be another tool to help customers identify behavioral changes that may impact their energy rates. The product technicians will help customers identify smart meters, answer questions regarding time-of-use rates, and access online and phone resources provided by the Company.

B. Forecasts, Participants & Budgets

Forecasts and Participants

The product participation and savings forecasts were developed based on Colorado residential market size, historical participation, and experience with similar products in the Company's other jurisdictions.

Budgets

Budgets were determined by evaluating vendor cost estimates and potential participation levels in Colorado. A marketing budget is included for advertising, promotion, and outreach to generate awareness and drive participation in targeted areas. Primary budget drivers are:

- *Administration* – administration costs for the third-party implementer; internal labor and administrative costs; and the installation costs associated with energy efficient measures installed in customer homes.
- *Customer Incentives* – materials costs associated with the energy efficient measures installed in customer homes
- *Advertising and Promotion* – print, radio, broadcast, direct mail, interactive media, and event promotion.

C. Application Process

Customers sign up for a visit through the third-party implementer. During an in-home visit, the Home Energy Squad technician will work directly with the customer to determine which energy-saving measures will make their home more energy efficient. The customer pays a trip charge and if needed and desired receives a suite of energy-saving items such as LED light bulbs, high efficiency showerheads and aerators, etc. The installation labor and materials costs are paid to the third-party implementer by the Company. The third-party implementer reports the installation of energy-saving measures to the Company; therefore, the customer does not need to submit a post-project rebate application.

Customers may also sign up for a virtual visit, during which the Home Energy Squad technician will work directly with the customer to identify and prioritize energy-saving opportunities in their home.

D. Marketing Objectives & Strategies

Marketing objectives will focus on building awareness and product interest, in addition to driving customer participation. The Company intends to utilize an array of marketing channels for this product, including: bill onserts, email, newsletters/blogs, radio, social media, the Company

website, door hangers, sweepstakes, and/or promotional incentives, depending on participation rates. Targeted direct mail and telemarketing tactics may also be used. Call Center agents will direct any customers inquiring about this product to contact the third-party implementer using their toll-free number or website.

Local outreach products, such as Partners in Energy, are an important channel for building awareness and driving participation. Participating trade partners from other products are another important channel.

Cross-marketing opportunities exist with other products such as Whole Home Efficiency, Refrigerator Recycling, Home Energy Insights and School Education Kits. Concurrent appointments with a Home Energy Audit product technician are another opportunity for cross-promoting multiple products to increase awareness and drive stronger customer participation.

This product continues to explore Spanish-language marketing collateral and channels to reach a significant portion of the Company's customers who might not otherwise be aware of the product.

E. Product-Specific Policies

The Company will connect customers with the third-party implementer to begin the product engagement.

The technical assumptions will largely reflect those of other residential products such as Home Lighting & Recycling, Energy Efficient Showerheads, and Residential HVAC to consistently report measure costs and energy savings. Where technical assumptions from other residential products do not apply in direct install situations, direct installation-based technical assumptions will be utilized.

The Company is looking into ways to provide a more comprehensive experience for our residential customers that simplifies the process of installing capital intensive energy efficient equipment. This may include an end-to-end solution where the customer chooses from any, or all, of the following as applicable:

- Advice and analysis of the available equipment options
- Financing
- Enrollment in Demand Management products
- Assistance with choosing qualified contractors
- Enrollment in green programs and/or warranty services.

F. Stakeholder Involvement

The Company will partner with its existing array of customer and trade stakeholders regarding product design and implementation, awareness building and ongoing product feedback. This may include partnering with other utilities where the Company is the electric-only or gas-only provider, and customers are receiving gas or electric service from that other utility provider.

G. Rebates & Incentives

A customer co-pay will be required to receive direct-installed energy-saving items such as LEDs, high efficiency showerheads, etc. The customer co-pay covers the technician trip charge. This process differs from most prescriptive rebate products where the customer submits a rebate application after equipment is installed and operational. The third-party implementer will report the installed measures to the Company, and the Company pays the implementer directly for the equipment and installation costs. Therefore, the customer does not need to submit a post-project rebate application.

➤ Home Lighting & Recycling

A. Description

The Home Lighting & Recycling product provides resources for customers to purchase energy-efficient light bulbs and to dispose fluorescents in an environmentally-friendly manner. Using energy-efficient bulbs is an easy and inexpensive way for customers to save electricity. The Company provides an avenue for customers to purchase discounted energy-efficient bulbs through local retailers. Customers can also recycle compact-fluorescent lights (“CFLs”) free of charge.

Bulb Discounts

The Company motivates customers to purchase LEDs by offering in-store retail discounts through an upstream incentive model. An instant rebate is provided through Company collaboration with bulb manufacturers and retailers, enabling customers to purchase a variety of energy-efficient bulb models at a discounted price. The Company partners with retailers such as Home Depot, Walmart, Costco, Ace Hardware, and Dollar Tree. Customers receive the discounted price at the register; there is no mail-in rebate form.

CFL Recycling

The CFL Recycling component of the product provides an environmentally-friendly method for customers to dispose of CFLs. The Company maintains a partnership with Ace Hardware to serve as the retail arm for CFL recycling. Customers can bring spent CFLs to participating Ace Hardware stores and recycle them free of charge. The retailer then stores the bulbs in a covered bin until it is full. Then they ship the bulbs to the recycler in the postage paid bin. The Company covers the cost to ship and recycle the bulbs that are submitted for recycling at participating retailers within the Company’s service territory.

B. Forecasts, Participants & Budgets

Forecasts and Participants

The energy savings forecast for the product was derived by analyzing the market potential and historical sales data, while considering new technologies, available retail channels and participating customer segments. All Company electric customers are eligible to participate in the Home Lighting & Recycling product.

Budgets

The main budget drivers include the following:

- Rebates – includes the discounts offered at retail stores as well as bulbs distributed at community events.
- Promotion and Advertising – includes costs for home lighting specific advertising campaign as well as in-store signage displays and fees for participating in community events.
- Consulting – includes product administration labor to manage the product.

C. Application Process

Customers do not need to apply to participate in the Home Lighting & Recycling product. The Company works with retailers and manufacturers to provide a discounted price on bulbs through upstream incentives. The incentive varies depending on the type of bulb and the manufacturer/retailer partner. The customer receives the discounted price at the cash register. Incentives are paid upstream, and the discounts are passed on to the customer.

D. Marketing Objectives & Strategies

The objective of the Home Lighting & Recycling product is to motivate customers to purchase energy-efficient bulbs and encourage them to recycle CFLs when they burn out. The Company will focus marketing dollars on building awareness and sales of LED bulbs, in addition to helping educate customers about the product benefits. The Company will use various media channels to reach customers including television, radio, in-store signage, publications, bill inserts, social media, internet and sponsorship of local events. The peak sales period for energy efficient bulbs is in the fall and winter, as such, promotions are focused during these buying time periods.

The Company uses an RFP process each year to select participating retailers and endeavors to enable partnership with a variety of retailers (including big box, mass merchandiser, dollar stores, and hardware and grocery outlets) to ensure optimal pricing and to help reduce free-ridership.

The Company plans to review rebate discounts and product offerings in relation to market conditions. The Company plans to monitor the availability of inefficient lighting technology at stores to determine which technologies to discount to prevent backsliding. As of the timing of this filing, manufacturers still plan to stock inefficient technologies on store shelves as there continues to be a market for those bulbs.

CFL Recycling is marketed locally through the local retail partner, Ace Hardware. The Company also markets recycling through the Company's website.

E. Product-Specific Policies

The Company selects retailers within its electric service territory and assumes that the customers purchasing the discounted bulbs live within the given area. If a store is within one mile inside of our territory boundary, the Company only claims 75% of the savings for sales at those stores.

The third-party implementer will be responsible for delivering the calculated savings, actual high efficiency product sales details, including the location, types and quantities of bulbs sold each year to be used in the Company's annual DSM/BE status report.

The Company currently uses a third-party implementer for CFL recycling. The selected implementer separates the CFL components by hand to ensure that hazardous materials do not end

up in the ground soil or water. The third-party implementer also provides bins made of recycled material and recycles the bins that the bulbs are shipped in. In addition, they provide certificates of proper recycling.

F. Stakeholder Involvement

The Company collaborates with several organizations to monitor and incorporate best practices into lighting product design. These activities include: member of the Consortium for Energy Efficiency, annually attending the national ENERGY STAR® Product Partners meeting, and monitoring information published by lighting manufacturers, E-Source, the ACEEE, the EPA, and the DOE.

G. Rebates & Incentives

The upstream markdown incentives typically account for up to 75% of the incremental cost, depending on the bulb. The cost savings are passed on to the customer as an instant rebate.

➤ **Insulation & Air Sealing**

A. Description

The Insulation and Air Sealing Rebate product offers rebates for installing qualifying insulation and air sealing measures in existing single-family homes or properties with four units or fewer. Eligible customers must be those with a combination of residential electric and natural gas service, gas-only service, or electric-only service residences who heat with electricity and also have central air-conditioning.

The Insulation and Air Sealing Rebate product also offers rebates for installing qualifying cellular shade measures in existing single-family homes. Eligible customers must be those with a combination of residential electric and natural gas service with central AC, or electric-only who are electrically-heated or have central AC.

Public Service will rebate the following qualifying measures:

- Air sealing with a 20% reduction in air leakage based on blower door results;
- Attic insulation to a minimum R-value of 49 (where pre-improvement insulation is R-15 or less);
- Wall insulation to a minimum R-value of 13 (pre-improvement existing exterior wall cavities must be empty); and
- Cellular shades that are listed with the Attachments Energy Rating Council and certified with the following:
 - Warm Climate rating of at least 35
 - Cool Climate rating of at least 5

B. Forecasts, Participants & Budgets

Forecasts and Participants

Participation forecasts and rebate amounts are aligned with marketing and trade partner education plans to encourage participation from customers who will benefit from the product.

Budgets

Budgets for the insulation and air sealing measures are based on 2020 and 2021 product performance. The air sealing incremental costs include the costs to the customer for bypass attic air sealing, weatherization and envelope air leakage reduction, and additional costs of blower door testing. M&V costs are based on a percentage of the installations to ensure they meet quality installation standards and achieve the expected energy savings.

Budgets for the cellular shade measure are based on internal analysis and input from industry; rebates are the single largest expense component.

Typically, this product is promoted through the Company's website, communications to local area insulation and air sealing contractors, interior design contractors, community events and by the

Company's Consumer Education team. The product requires a minimal budget for promotion and marketing purposes. The Company has allocated some budget for contractor trainings and educational opportunities for the trade community.

C. Application Process

The Company must receive a completed rebate form and a copy of a dated invoice detailing the work performed. Applications will be reviewed and processed according to company policy and rebates are generally issued within eight weeks. The Company will issue the rebate directly to the customer, or an alternate rebate recipient if appropriately designated on the rebate application form.

For Insulation measures, participating trade partner companies must have a technician on staff that is currently certified in one of the following: BPI – Building Analyst, Envelope Professional, Residential Whole House Air Leakage Control Installer, Air Leakage Control Installer, Quality Control Inspector, Crew Leader or Energy Auditor certification. The Company reserves the right to expand the list of certifications accepted for contractor participation.

A technician's certification may not be used by another trade partner company to meet the product requirements. All contractor companies must register to participate in the product, which includes terms of the Company's trade partner agreement and meeting BPI requirements.

D. Marketing Objectives & Strategies

The Company will market the Insulation and Air Sealing product through a variety of channels such as the Home Energy Audit product, the Company's website, communication with participating contractors, and events. The Company may support the overall marketing strategy with email efforts, advertising, and social media. Historically, this strategy has been implemented during the key heating months of December, January, and February, and also during the summer months.

Additionally, the Company will incorporate communication activities to participating contractors to facilitate proper education of customers on the features and benefits of the product.

Finally, the Company may initiate cross-marketing efforts with our other natural gas rebate products. Other, emerging strategies may also be incorporated.

The Company is looking into ways to provide a more comprehensive experience for our residential customers that simplifies the process of installing capital intensive energy efficient equipment. This may include an end-to-end solution where the customer chooses from any, or all, of the following as applicable:

- Advice and analysis of the available equipment options
- Financing
- Enrollment in Demand Management products
- Assistance with choosing qualified contractors

- Enrollment in green programs and/or warranty services

E. Product-Specific Policies

For insulation measures, the customer must use a registered contractor. These contractors have agreed to the terms of the Company's trade partner agreement and met the requirements of the product. The cellular shades measure does not require customers to use a registered contractor.

Air sealing Natural Air Changes per Hour ("NACH") airflow reductions of at least 20% are required for each install, unless the home has a pre-improvement rating of 0.50 NACH or lower, based on the Company's calculation formula found on the rebate form. Pre and post blower door tests are required for these homes.

For homes that do not meet the .50 NACH but need less than a 20% reduction to achieve .50 NACH; participation in the insulation measure will be allowed and pre and post improvement blower door tests are required. These customers are not eligible for air sealing rebates.

For homes that achieve a pre-improvement rating of less than .50 NACH; participation in the insulation measure will be allowed, and the NACH reduction requirement and the post improvement blower door test will be waived. These customers are not eligible for air sealing rebates.

Combustion Appliance Zone ("CAZ") testing is required for all insulation measures.

Customer, or Do-It-Yourself, installations, as well as installations done by non-registered contractors do not qualify for rebates.

This product excludes new residential construction, new residential additions, insulation of doors, garages, sheds, workshops, below-grade walls, mobile homes, projects with pre-improvement R-values that exceed product minimums, and residential properties with more than four units. To qualify for a rebate, all insulation must be installed to the manufacturer's specifications and meet all state and local codes and federal regulations. All measures must follow industry-accepted practices. For areas being treated, where there is a risk of asbestos, or other hazardous materials becoming airborne, blower door diagnostic tests may not be performed. In these situations, the contractor is required to safely complete air sealing measures to the best of their abilities and note the invoice that the presence of a hazardous material prevented a blower door test from being completed. These customers will not be eligible for an air-sealing rebate.

The Company reserves the right to inspect installations before or after issuing a rebate. Rebates will not be issued if the same improvement has already been rebated through other Public Service rebate products. Customers are eligible for one rebate per calendar year.

F. Stakeholder Involvement

The quarterly DSM/BE Roundtable Meetings will provide a forum for stakeholder involvement and feedback regarding this product. The Company continues to conduct meetings with interested trade partners and stakeholders to improve and implement this product. The Company will continue to engage stakeholders for product feedback.

G. Rebates & Incentives

All insulation measures are rebated at 30% of project costs, up to the measure cap. Prescriptive rebates on cellular shades are 71% of incremental costs.

➤ Multifamily Buildings

A. Description

The Multifamily Buildings product is designed to engage multifamily building equipment owners⁴⁸ in deploying DSM measures that will lower customers' energy consumption. The product encourages DSM participation in this market segment by offering assistance in identifying energy efficiency improvement opportunities, both in-unit and in common areas. The product offering has a three-stage approach.

Stage 1: Energy Assessment

The first step is to complete a virtual or on-site energy assessment. Virtual assessments have been added as an option to reach customers in outlying areas of the Company's service territory where participation has been historically low due to added time and expense for travel. The assessment will identify opportunities for improving building energy efficiency via a specific set of direct-install measures (eligible measures are listed below under Stage 2). The assessment will include an inspection of a sample of units within each building, typically one of each unit type (e.g., 1 studio, 1 one-bedroom, 1 two-bedroom), as well as larger, capital-intensive projects for the whole building (Stage 3). The assessment is offered at no cost to the customer.

Stage 2: Direct-Install

The second stage of participation is direct installation of energy savings measures identified in the energy assessment. Installation is completed by the Company's third-party implementer. There are six eligible measures for Stage 2 that will be installed for no cost to customers:

- LED lamps
- Low-flow showerheads
- Kitchen and bathroom sink faucet aerators
- LED exit signs
- Eligible smart thermostats⁴⁹
- Other cost-effective measures to be identified

Participants will work with the third-party implementer to schedule installation.

Stage 3: Prescriptive or Custom Energy Efficiency Improvements

The third stage for participants involves the completion of prescriptive or custom energy-efficiency improvement projects such as HVAC upgrades, common-area lighting upgrades, or other projects currently eligible through the Company's prescriptive offerings or Custom Efficiency product.

⁴⁸Equipment owner could be the building owner, the tenant, or other third-party.

⁴⁹Eligible smart thermostats will be installed at no additional cost as long as the equipment is enrolled in the Company's Demand Management product upon completion of installation.

Implementation of Stage 3 projects may be challenging for several reasons: lack of ownership willingness, long sales cycle, capital constraints, market economics, etc. to overcome these barriers the third-party implementer will provide participants with advice on selecting a contractor and reviewing bids as well as periodically provide follow up consultations. Access to AMI interval data would help the third-party implementer during these consultations if they could show customers how their energy usage may affect their energy costs and what the savings might look like after energy efficiency upgrades.

The third-party implementer is crucial to the success of the product, as a consistent point of contact for participants. The third-party implementer will be responsible for advertising and recruiting participants, delivering the Stage 1 on-site energy assessment and Stage 2 measure installations, and successfully converting participants into Stage 3 projects in conjunction with the Company's Product Managers or BSC representatives.

With the installation of smart meters and the transition to the TOU rate in Colorado, the Company will work with the third-party implementer on bilingual educational efforts regarding the smart meter, new rate, and how customers may save money by shifting electricity use to off-peak hours when rates are the lowest.

B. Forecasts, Participants & Budgets

Forecasts and Participants

The participation forecasts for energy assessments, direct installs, and larger energy efficiency projects for 2023 are based on forecasts provided by the third-party implementer along with historical participation within the product.

Budgets

The bulk of the product expenditures will be for product administration and incentives to customers in the form of energy assessments and direct-installation of energy-efficient equipment. The budget also includes costs for prescriptive and custom rebates from Stage 3 projects.

Direct-install costs were developed based on the actual costs contracted between the Company and the third-party implementer and the forecasted participation. Rebates for Stage 3 are estimated by the third-party implementer based on deemed values from the anticipated mix of prescriptive and custom DSM measures.

C. Application Process

The product is available to multifamily buildings that are Public Service electric and/or natural gas customers. To participate, customers must apply through the third-party implementer, who will review applications and approve participants. Applications will be reviewed on a first-come, first-served basis. Upon meeting the qualifications for participation, customers will work with the implementer to schedule a virtual or on-site assessment (Stage 1).

D. Marketing Objectives & Strategies

The third-party implementer will recruit customers by leveraging their existing customer relationships and market expertise. Options for direct promotion by the Company may include the following:

- Marketing materials and brochures;
- A Webpage to educate interested customers, explaining how to participate and the benefits of participating;
- Attending multifamily events in the Company's service territory; and/or
- Co-hosting educational events with the third-party implementer.

E. Product-Specific Policies

All multifamily buildings must be Public Service electric and/or natural gas customers with five or more units per building to participate in this product. This primarily includes market-rate qualified buildings.⁵⁰ If a property has multiple buildings and at least 80 percent of the buildings qualify, the entire property may participate in the product.

F. Stakeholder Involvement

Initially, the Company worked closely with several external stakeholders to design this product initially. Today, the product has ongoing relationships with:

- Platte River Power Authority
- Energy Efficiency Business Coalition
- Ft. Collins Utility
- Southwest Energy Efficiency Project
- Colorado Energy Office
- City and County of Denver
- City of Boulder
- Boulder County
- ACEEE
- Colorado PUC Staff

The Company has also been active with national multifamily working group efforts to research successful utility multifamily programs and network with those program managers and staff. Primarily, the Company has participated in ACEEE's Utility Multifamily Working Group and E Source's Multifamily Leaders Group.

The Company has also worked with third-party implementers and other vendors to understand the tools and services available to this customer segment.

⁵⁰Low income qualified buildings should participate in the Low-Income Multifamily Weatherization product. If for some reason a building doesn't qualify for low income, the property can qualify for the market rate program.

G. Rebates & Incentives

The product provides a virtual or on-site energy assessment (Stage 1) and eligible direct-install measures (Stage 2) to participants at no additional cost. The product will provide direct rebates for eligible projects completed in Stage 3 based on savings calculations from the Company's Custom Efficiency model and prescriptive products deemed technical assumptions.

➤ Refrigerator & Freezer Recycling

A. Description

The Refrigerator & Freezer Recycling product strives to decrease the number of inefficient refrigerators, freezers, and room air conditioners in use, and by doing so, deliver electric energy savings and peak demand reduction. The product is designed to encourage customers to upgrade to a more-efficient unit, and/or choose to decommission their operable, inefficient unit rather than give it to the second-hand market, by providing a convenient way to dispose of their units in an environmentally safe and compliant manner. Eligible customers include electric customers in the Company's service territory. Residential and business customers with qualifying units will receive an incentive for their participation and will not be directly responsible for any costs associated with pick-up, transportation, disposal, and proper recycling of their unit. The Company will use the services of a qualified third-party implementer to perform the following:

- Refrigerator/Freezer/Room air conditioner collection, transportation and storage;
- Verification of eligibility of the appliance at time of scheduled pick-up;
- Appliance processing and materials recycling;
- Issuing the customer incentive payment;
- All customer service aspects related to above activities;
- Product tracking and reporting; and
- Supporting M&V requirements.

The implementer will be required to comply with all local, state and federal requirements. This includes maintaining all permits and licenses required for any facilities, equipment and personnel used for this product. Adherence to this process will ensure that recycled units will not re-enter the secondary or primary market and be placed back on the Company's grid.

B. Forecasts, Participants & Budgets

Forecasts and Participants

Participation and energy savings levels for this product were developed based on historical product performance

Budgets

The 2023 budget is based on forecasted participation and recycling costs. Recycling-related expenditures account for approximately 55 percent of the overall budget. The projected rebates account for 30 percent of the budget. Marketing, M&V and administrative expenses make up the remaining budget.

C. Application Process

Customers will either call-in to the third-party implementer's toll-free service number or schedule this service online.⁵¹ The third-party implementer will qualify the customer and will schedule an appointment to pick up the unit. Customers will be called one to two days prior to their scheduled pick-up date in order to confirm their appointment and remind them to turn on their unit and make sure it is empty. Customers will receive their incentive check within six to eight weeks after their unit has been picked up by the implementer.

D. Marketing Objectives & Strategies

The target market consists of customers who are disposing of their primary (usually located in the main kitchen) or secondary refrigerator (usually located in a garage or basement area), or freezer units (usually located in a garage or basement). Generally, these customers have single-family homes with two or more individuals in the household. Customer interest in this type of product is seasonal, usually occurring in the spring, summer and early fall seasons (prior to the Thanksgiving holiday). Product demand often peaks in the summer months, which is associated with customer home improvement periods. Deployment of promotional tactics will coincide with these seasonal time periods.

The Company will utilize several marketing channels for this product, including bill inserts, newsletters/blogs, social media, and the Company's website. Additional tactics may include direct mail, telemarketing, sweepstakes or promotional incentives, depending on participation rates. Cross-marketing opportunities exist with other products such as Home Energy Squad, Home Energy Insights, Saver's Switch, School Education Kits and other products and services the Company offers. Call Center agents will direct any customers inquiring about this product to contact the third-party implementer using their toll-free number or website.

This product will also explore Spanish-language marketing collateral and channels in order to reach a significant portion of the Company's customers who might not otherwise be aware of the product.

⁵¹ <http://www.xcelenergy.com/fridge>

E. Product-Specific Policies

All refrigerator, freezer, and room air conditioner units must meet the following requirements to qualify for this product:

- Must be operational. “Operational” is defined as in working order. Refrigerators must be capable of freezing water; freezers must be capable of freezing.
- Appliances will be categorized as follows for reporting purposes:
 - *Secondary*: Used as a secondary unit for at least two months prior to pick up
 - *Primary*: Used as the primary unit in the home at the present time
 - *Freezer*: Used separately from the primary refrigerator and is a standalone unit.
- Refrigerator/Freezer must be plugged in the night before the pick-up date (customer will receive a call from the implementer, reminding them to do this). This is to ensure full operation (cooling/freezing water for a refrigerator; freezing capability for a freezer) when inspected at the time of pick-up.
- Refrigerator/Freezer must be no smaller than 10 cubic feet or no larger than 30 cubic feet.
- There will be a limit of two refrigerators and/or freezers per household per year.
- Room air conditioners may be picked up if the third-party implementer is already at a customer’s home to collect a refrigerator or freezer.

F. Stakeholder Involvement

The Company is a proud partner of the EPA’s Responsible Appliance Disposal (“RAD”) Program. This voluntary partnership program began in 2006 to help protect the ozone layer and reduce emissions of greenhouse gases through the responsible disposal of appliances.

The Company has been responsibly recycling appliances for many years. The Company’s voluntary participation in the RAD Program further underscores its commitment to helping customers make responsible technology and appliance choices. The Company has been published within the RAD annual report and recognized at annual events for product accomplishments.

G. Rebates & Incentives

Participants will receive an incentive to remove their inefficient primary and/or secondary refrigerators and freezers. The primary and secondary refrigerator or freezer will be removed and properly recycled at no cost to the customer.

➤ Residential Heating & Cooling

A. Description

The Residential Heating & Cooling product provides incentives to the Company's customers who purchase a variety of qualifying heating and cooling equipment for residential use, including air conditioners, evaporative coolers, heat pumps, natural gas furnaces, natural gas boilers, natural gas water heaters, electric heat pump water heaters, smart thermostats, and the Western Cooling Control device.

The Residential Heating & Cooling product combines offerings from several existing products – Evaporative Cooling, High Efficiency Air Conditioning, Residential Heating, Thermostat Optimization, and Water Heating. This new, holistic approach to residential customers' heating and cooling needs is designed to improve the experience for customers and trade partners, in order to improve participation, energy savings, and customer satisfaction. The smart thermostat offering can also assist customers in managing the timing of their energy usage, to assist customers in saving money on the Company's new Time of Use rates.

The Company is looking into ways to provide a more comprehensive experience for our residential customers that simplifies the process of installing capital intensive energy efficient equipment. This may include an end-to-end solution where the customer chooses from any, or all, of the following as applicable:

- Advice and analysis of the available equipment options
- Financing
- Enrollment in Demand Management products
- Assistance with choosing qualified contractors
- Enrollment in green programs and/or warranty services.

As part of our strategy to increase participation in demand response products, this product will be offering AC Rewards. Further details are provided in the technical assumptions.

More details regarding the specific types of equipment rebated in this product are provided below:

- **Standard AC or ASHP systems with Quality Installation ("QI")** - 13 to 14.99 Seasonal Energy Efficiency Ratio ("SEER") – Defined as new central Air Conditioning ("AC") or Air Source Heat Pump ("ASHP") systems with "matched" indoor and outdoor components, in new or existing homes. Approximately 75 – 80% of new AC systems purchased are in this efficiency range.

According to energy.gov, approximately 27% of the rated efficiency of a new system can be achieved through Quality QI. QI is a process, based on standards developed by the Air Conditioning Contractors of America ("ACCA") which contractors must follow to ensure that the total energy savings potential of newly installed equipment is realized. QI includes sealing all visible ducts, providing at least 400 cubic feet per minute ("CFM") of air flow per cooling ton, applying ACCA's Manual J (load calculation) and Manual S (equipment

sizing) standards to determine the right size and type of equipment for each customer's unique home, and charging the new system with refrigerant to within 3 degrees of the manufacturer's recommended sub-cool target temperature. Only participating trade partners who have a technician with Company approve certifications and/or licenses can offer this rebate.

- **High Efficiency AC or ASHP systems with Quality Installation** – Defined as new central Air Conditioning and Air Source Heat Pump systems with “matched” indoor and outdoor components, and with thermostatic expansion valves, in new or existing homes, that meet certain energy efficiency standards as outlined in Section G below, are eligible for a rebate. The intent of the rebate is to encourage consumers to purchase units that meet or exceed the high efficiency standard of at least a.) 15 SEER and 11.5 Energy Efficiency Ratio (“EER”) for air conditioners or b.) 15 SEER, 11.5 EER, and 9 HSPF for heat pumps. Trade partners who have met the AC or ASHP participation requirements can offer this rebate. To be eligible for a cold climate heat pump rebate, units must have an 18 SEER, 9.5 HSPF, and the heating BTU at 5 degrees Fahrenheit must be at least 70% of the heating BTU at 47 degrees Fahrenheit.
- **Evaporative Coolers** - Qualifying equipment must be new, permanently installed evaporative cooling units. Portable coolers or systems with vapor compression backup are not eligible, neither is used or reconditioned equipment.
- **Mini-Split Heat Pumps (“MSHP”)** – The mini-split heat pump equipment serves residential customers who either cannot install traditional split, central air conditioning systems, or have hard-to-heat/cool areas of their homes, or who simply prefer this technology. To be eligible to participate, residential electric customers must purchase and install a unit that has a rated efficiency of 15 SEER, 11 EER, and 9 Heating Seasonal Performance Factor (“HSPF”). Variable-speed systems which meet these requirements are eligible for a rebate. The unit must be used for cooling and heating purposes. There is not a QI component, and certification is not a requirement. Any trade partner can offer this rebate. To be eligible for a cold climate heat pump rebate, units must have an 18 SEER, 9.5 HSPF, and the heating BTU at 5 degrees Fahrenheit must be at least 70% of the heating BTU at 47 degrees Fahrenheit.
- **Ground Source Heat Pump with Quality Installation (“GSHP”)** – The Ground Source Heat Pump equipment measure serves a small market niche of consumers who seek out the most highly efficient technology. To be eligible to participate, residential electric customers must purchase and install a unit that is ENERGY STAR® certified. The ENERGY STAR® certified GSHP performance criteria are a minimum of 3.3 Coefficient of Performance (“COP”) and 14.1 EER. Equipment must be Air-Conditioning, Heating, and Refrigeration Institute (“AHRI”) performance-certified at standard rating conditions. Rebates will be given for GSHPs that are installed as closed loop systems and are used for both heating and cooling. Trade partners who are registered participating contractors for the AC rebates may offer this rebate.

- **Natural Gas Furnaces** – Furnace rebates are offered for a minimum furnace efficiency of 95% Annual Fuel Utilization Efficiency (“AFUE”). Equipment must be AHRI performance-certified at standard rating conditions.
- **Natural Gas Boilers** – Boiler rebates are offered for a minimum boiler efficiency of 95% AFUE. Equipment must be AHRI performance-certified at standard rating conditions. Higher rebates are available for boilers with a sidearm water heater.
- **Water Heaters** - The product is applicable only for the purchase of qualifying new natural gas standard storage tank water heaters, natural gas tankless water heaters or electric heat pump water heaters installed in new or replacement applications. Qualification for an incentive is a minimum efficiency of 0.64 Uniform Energy Factor (“UEF”) for medium draw standard tanks, 0.68 UEF high draw standard tanks, 0.87 UEF tankless natural gas water heaters. ENERGY STAR® electric heat pump water heaters also qualify for an incentive. In recognition of future demand response opportunities, heat pump water heaters that are CEA/ANSI enabled will receive a higher incentive. For natural gas water heaters, customers may choose their own independent residential water heating contractor or installer or install the unit themselves. Electric heat pump water heaters must be installed by a registered contractor.
- **Smart Thermostat** - The concept of realizing energy savings by programming a thermostat is straight-forward: scheduling temperature setting changes (setbacks) during times when home occupants are away or asleep ensures no energy is wasted when no one is home or awake. Thermostats meeting the ENERGY STAR® Connected Thermostat specification have demonstrated the ability to achieve energy savings through HVAC equipment runtime reductions, specifically an 8% or higher reduction in heating equipment runtime and a 10% or higher reduction for cooling equipment runtime.

These runtime reductions are achieved by smart thermostats through a variety of methods, starting with the ease of scheduling. These devices make it easier to program efficient setback schedules compared to their non-communicating predecessors.

In addition to ongoing product innovations by thermostat manufacturers, software firms have begun to provide additional optimization functionality that promises to proactively manage customer thermostats for deeper energy efficiency and demand management functionality without negatively impacting customer comfort.

- **Western Cooling Control** – The Western Cooling Control (“WCC”) device effectively increases the capacity of a central AC or ASHP unit by capturing cooling energy left in the refrigerant within, as well as the water condensed on, the cooling coil after a cooling cycle has completed. Many newer cooling units have built-in features that provide similar benefits to the WCC device; therefore, this measure is available only to customers with

units installed in 2009 or prior. There is not a QI component to this measure. Any trade partner can offer this rebate.

B. Forecasts, Participants & Budgets

Forecasts and Participants

Participation and energy savings levels for this product are based on 2018-2019 participation, as well as increased marketing efforts to the most cost-effective equipment within the product and working through trade partners and stakeholders to engage customer participation.

Budgets

The budget forecast is based upon forecasted participation, and the majority of the budget is for direct customer incentives. For some equipment, contractors and/or retailers are also paid an incentive, to further encourage their support of these products. The budget also includes costs for verifying a percentage of the new equipment installations in the field to ensure they meet expected energy savings, including (where applicable) ACCA standards for quality installation; for advertising and marketing; and for other administrative expenses including labor and contractor training.

C. Application Process

The typical sales cycle begins with a customer hiring a contractor, learning about energy efficient models, and purchasing and installing the unit. Following installation, the customer or trade partner submits a completed Company rebate application and equipment invoice. Invoices must reflect the same information provided on the application form, specifically the model number, serial number, installation address, and purchase date. Other information gathered on the application form includes the customer's account number, mailing address if different from installation address, customer signature, trade partner signature and information related to the equipment such as efficiency ratings, heating and cooling capacity, and size.

The Company is pursuing a more comprehensive rebate application form to minimize paperwork for the customer and trade partners while still collecting all of the information needed to thoroughly review and process the applications as quickly as possible. The Company's online application tool will remain available and will comply with these requirements. The Company may also offer "instant rebates" for certain types of equipment through various retail and wholesale distribution partners, including (but not limited to) an online, Company-branded marketplace.

All information requested on the rebate applications must be provided for the rebate process to be completed. Information needed on the invoice is specified on the back of each rebate application form; this information must be provided in order for the rebate process to be completed.

Equipment eligibility is determined by using the AHRI Directory of Certified Product Performance, the list of ENERGY STAR® Qualified Products on the ENERGY STAR® website, or on the list of qualified model numbers maintained by the Company and available on the

Company's web site, as specified on the rebate application for the particular type of equipment. Rebates are typically mailed within eight weeks.

The Company reviews each rebate application and verifies that all the required data has been provided and that all product requirements have been met. When corrections are needed to rebate applications, the Company sends a request to the contractor. Applications may be resubmitted. Customers applying for instant rebates enter information that is verified through a third-party vendor partner's software, which validates the customer's premise, type of service, and eligibility before the instant rebate coupon is generated.

D. Marketing Objectives & Strategies

The Residential Heating & Cooling product seeks to increase awareness and the demand for a variety of heating and cooling products within the Company's service area, help customers and participating contractors offset costs associated with high efficiency equipment and quality installation practices, reduce customers' energy costs, meet customers' environmental goals (such as reducing carbon emissions), and increase their comfort. To support these goals, the Company plans to implement the following marketing strategies to increase product awareness:

- Use of the HVAC contractor community as the primary marketing channel. The Company's Channel Manager is responsible for conducting trade partner training, meetings, telephone calls, emails, and sending newsletters to keep the trade informed and engaged in the product. In addition, a qualified contractor list is available on the Company's website and participating contractors are expected to assist in promoting the product. The Company provides brochures for contractors to distribute to customers as well.
- Company marketing and advertising strategies will be used to create customer awareness. This may include, but is not limited to, e-mail, bill inserts, direct mail, bundled marketing campaigns, community newsletters, webinars, promotional booths at public events, radio and/or television advertising, sponsorships.
- The Company's website also includes information regarding the product and is updated as needed to more effectively reach customers. This includes information on product details, quality installation practices, and where to find qualified contractors. The site also hosts webpages designed specifically for contractors to obtain information about the product.
- When appropriate for a particular type of equipment, the Company will provide Point of Purchase displays at big box stores and appliance retailers.

E. Product-Specific Policies

Contractors who do not comply with the product requirements and guidelines are not allowed to participate in the product. Requirements may include taking and passing Company-provided training classes, for the purpose of increasing the energy savings and/or increasing customer satisfaction with the rebate process.

These rebates are available to residential Xcel Energy account holders, with electric or natural gas service (depending on the type of equipment) provided by Xcel Energy. All equipment must be new and permanently installed. Used or reconditioned equipment is not eligible for a rebate.

For the following types of equipment, customers must have residential electric service with Xcel Energy: AC, ASHP, Electric Heat Pump Water Heaters replacing electric resistance water heater, Evaporative Coolers, MSHP, GSHP, and WCC.

For the following types of equipment, customers must have residential natural gas service with Xcel Energy: Natural Gas Furnaces, Natural Gas Boilers, Natural Gas Water Heaters.

For participants who are replacing natural gas water heating equipment with a heat pump water heater, the customer must have residential electric and natural gas service with Xcel Energy.

To be eligible for the Smart Thermostat offering, participants must be a residential customer of the Company. For customers with electric service, participants must have central air conditioning; for gas-only customers, participants must have central gas heating. Customers with electric and gas service must have central air conditioning and/or central gas heating.

To be eligible for Standard AC or ASHP equipment with QI or High-efficiency AC/ASHP equipment with QI rebates:

- The customer must use a registered contractor for the installation of the new system and who annually pass required online classes. These contractors have agreed to the terms of the product and meet the requirements related to quality installation practices. A list of registered contractors can be found on the Xcel Energy website.
- The “matched system” must be listed in AHRI’s Residential Directory. This directory is used to identify product classification, determine efficiency ratings, and confirm matched systems.
- In order to verify that the equipment has been properly installed, the equipment must be installed and tested as specified in the Xcel Energy QI guidelines based on ACCA standards. The equipment installation and testing for QI must be completed before the rebate application is submitted for processing by the Company.
- The use of a furnace’s variable speed fan to increase the SEER rating above the nominal rating is allowed for determining rebate eligibility, provided that the overall furnace and

air conditioning combination rating can be found in the AHRI's Residential Directory (www.ahridirectory.org). The furnace does not have to be new, in order to use it for an increased efficiency rating. The homeowner or contractor must supply the furnace model number and serial number on the application and invoice.

To be eligible for a Mini-Split Heat Pump rebate, the unit must be used for cooling and heating purposes; therefore, mini-split air conditioners (cooling only units) do not qualify. The AHRI certificate must be in the residential category of "Variable-speed Mini-Split and Multi-Split Heat Pumps." Multiple head mini-split systems qualify.

To be eligible for the WCC device rebate, the existing furnace must have been installed in 2009 or prior.

To be eligible for an evaporative cooler rebate, qualifying equipment must be a permanently installed direct, indirect, or two-stage evaporative cooling unit. Customers can replace an existing evaporative cooler or central AC system, or purchase a first-time installed evaporative cooling unit, to qualify for a rebate.

There are three equipment tiers available for evaporative coolers:

- Standard Evaporative Coolers: Qualifying evaporative cooling units with airflow output of 2,500 CFM or greater.
- Premium Evaporative Coolers: Qualifying evaporative cooling units with media saturation effectiveness of 85% or greater. The units must be manufactured with remote thermostat control and periodic purge water control (e.g. purge pump) or have these two items purchased and included on an invoice.
- Multi-Ducted Evaporative Coolers: In addition to 85% saturation effectiveness, remote thermostat control and periodic purge water control, qualifying evaporative cooling units must be indirect/directly cooling the whole house with a minimum of three supply ducts installed, and at least one of the supply ducts must be newly installed along with the new cooler.

To be eligible for a natural gas storage water heater rebate, the storage tank must be no larger than 55 gallons.

To be eligible for a 95% AFUE natural gas furnace rebate, an AHRI certificate must be available.

To be eligible for a 95% AFUE natural gas boiler rebate, an AHRI certificate must be available.

To be eligible for a heat pump water heater rebate, the customer must use a registered contractor for the installation of the new system. These contractors have agreed to the terms of the product.

A list of registered contractors can be found on the Xcel Energy website. To be eligible for the higher rebate for a "grid-enabled" water heater, the customer must purchase and install a water heater eligible to participate in the Company's demand management products for water heaters.

The Company maintains a list of eligible model numbers, which is available on the Company's web site.

To be eligible for a smart thermostat rebate, the customer must install a thermostat which meets the ENERGY STAR® Connected Thermostat standard and which is eligible to participate in the Company's demand management products for smart thermostats, AC Rewards. The Company maintains a list of eligible model numbers, which is available on the Company's web site.

F. Stakeholder Involvement

The Company considers its stakeholders for the Residential Heating and Cooling product to be contractors, distributors, manufacturers, retailers, SWEEP, EEBC, CEO, local municipalities within the service area, and other environmental organizations. Stakeholders are able to share their product suggestions during the Company's quarterly DSM Roundtable Meetings. In addition, the Company is a member of the CEE, and monitors its initiatives related to residential heating and cooling equipment.

G. Rebates & Incentives

Rebates are payable to residential account holders with electric or natural gas service (depending on the type of equipment), or to an alternate rebate recipient of their choosing. All types of equipment must meet all requirements to receive the rebate. For rebates which are based upon multiple measures of efficiency, the rebate is paid according to the lesser value of the technical requirements of the various measures, including SEER, EER, HSPF, and COP. The rebate amount shall not exceed the purchase price.

For certain types of equipment, the Company will also pay incentives associated with customer rebates to participating, registered contractors or retailers in good standing.

Homeowners may receive the equipment rebate directly or may provide written permission for the rebate to be paid directly to the contractor or to another designated alternate rebate recipient. Builders, as the original purchaser of equipment, are eligible to receive an equipment rebate; however, the rebate will only be issued once so builders should coordinate with the homeowners as to who will receive the rebate. Contractor incentives are paid to the contractor company at the same time that the associated rebate is paid to the account holder or alternate rebate recipient. Retailer incentives are paid on a quarterly basis.

Customers, contractors, or retailers who receive an incentive through another DSM product (e.g., Whole Home Efficiency or ENERGY STAR® New Homes) for the same equipment are not eligible to receive a rebate through this product. By accepting a rebate, the customer agrees to reasonably accommodate M&V consultants.

➤ **School Education Kits**

A. Description

The School Education Kits product offers a multi-component kit that combines classroom activities and in-home projects to teach students and parents about energy and water conservation. The kits include energy efficiency and water conservation measures for students to install in their home. The primary School Kits product is targeted for fifth or sixth grade students, with a secondary Innovation Kits product targeted for high school students, in Public Service's electric and natural gas service territory. The Company works with a third-party implementer to implement this product. The third-party implementer will recruit and train teachers, provide associated educational materials, and track participation by the students and teachers.

Along with various classroom materials, each School Kit participant receives a kit containing the following:

- LED bulbs
- High Efficiency Showerhead;
- Kitchen Faucet Aerator;
- Bathroom Faucet Aerator;
- LED Night Light;
- Furnace Filter Whistle;
- Digital Water / Air Thermometer; and
- Parent Evaluation Card.

Each Innovation Kit participant receives a kit containing the following:

- LED bulbs
- High Efficiency Showerhead;
- Bathroom Faucet Aerator;
- Advanced Power Strip;
- LED Night Light; and
- Digital Water / Air Thermometer.

This product has many advantages – it enables an educational product to have direct impacts on energy conservation, it helps build awareness of energy conservation among children, and it can impact customers at all income levels. Similar products are offered in the Company's New Mexico and Minnesota service territories.

The Company will work with the third-party implementer to provide a number of "bonus" kits. These bonus kits will contain a variety of specialty LED light bulbs, which will provide customers

an opportunity to conserve more energy in additional rooms in their homes and will also allow the Company to evaluate new items for potential inclusion in School Kits in the future.

B. Forecasts, Participants & Budgets

Forecasts and Participants

School enrollment data has identified approximately 58,000 students in the service territory served by the Company. Historical data indicated that approximately 71% of teachers offered participation in the product choose to participate. School districts within the electric and gas territory served by the Company are eligible to participate. Participation forecasts for School Kits are verified by market research conducted by the product vendor.

Budgets

Kit costs are all-inclusive, made up of not only the kit items but also the curriculum support materials for the teacher, the pre- and post-surveys, teacher incentives, marketing and outreach to teachers, and third-party implementer administrative cost and website support. The product budget was developed based on participation forecasts and the cost per kit. Internal labor and administration costs have been added to the budget. M&V of installation will be conducted by the third-party implementer and those costs are included in the kit cost as well.

C. Application Process

Teachers may enroll through various means (*i.e.* phone, email, direct mail, or *via* the website). If the response to enrollment calls is insufficient, the third-party implementer will redesign the marketing materials and/or offer incentives to teachers to participate. Examples of incentives may be gift cards to select retailers.

Upon enrollment, the teachers indicate to the third-party implementer the time during the school year at which they would like to use the product materials and will subsequently provide enrollment/participant numbers. The third-party implementer will send the teachers the School Education Kit materials in advance of the selected product date. Third-party implementer staff will remain in contact with the teachers via phone, email and mail at various times throughout the product to provide support for the teachers and to request return of audit forms. Participants are provided with a toll-free number to call if they need help.

The Company receives the results from participating schools in a summary report from the third-party implementer at the end of each school semester.

D. Marketing Objectives & Strategies

The third-party implementer will manage all aspects of marketing and outreach for the product, including:

- Identifying the schools that are within the Company's service territory and determining the approximate number of eligible teachers and students
- Sending out customized marketing materials to help enroll the classrooms. These materials explain the product, and the fact that it is offered free of charge to their classroom thanks to the sponsoring agency (the Company); and
- The third-party implementer will work with the Company to determine the eligibility of interested schools.

E. Product-Specific Policies

Only those schools that participate in the product can distribute the School Education Kits. All kits must come directly from the Company's third-party implementer.

F. Stakeholder Involvement

In the past the Company has worked with the third-party implementer to conduct focus groups to gather feedback around the kits and the associated classroom materials.

G. Rebates & Incentives

The Company will fund 100% of the cost of the School Education Kits. Teachers may be offered an incentive to participate if enrollment is slow, or an incentive may be offered to encourage completion of student installation surveys. Examples of incentives include gift cards to select retailers for teachers or energy-themed toys for students.

➤ Whole Home Efficiency

A. Description

The Whole Home Efficiency product is targeted toward existing single-family homes in need of multiple energy efficiency improvements. By providing these customers with rebate incentives, the Company is able to incorporate a bundled, whole home approach to energy efficiency. Whole Home Efficiency is available to residential Xcel Energy account holders with combination electric and natural gas, electric only, or gas only service. Eligibility is dependent on the type of equipment installed.

The concept of the product is to provide the customer with one-stop for all of their home efficiency needs. This comprehensive approach requires an energy audit as a prerequisite which is then used to generate a list of recommendations. The customer may choose to complete this prerequisite through the Home Energy Audit product or a Home Energy Squad Plus visit. The contractor, who may also be the auditor, reviews the recommended improvements and completes the work. Some projects may receive an independent verification of the improvements after completion if a Quality Control inspection is performed. The contractor and homeowner may also request advice on recommended upgrades and rebates from the Energy Advising service offered through the Home Energy Audit product. Since this product requires an audit and deeper engagement from the customer, AMI interval data would greatly enhance the conversation and allow auditors to give customers an even better analysis of the energy usage within their home.

Trade contractors must complete the appropriate contractor trainings depending on the services they offer.

These trainings provide contractors with information on the product components, process, and diagnostic testing required as part of the efficient measure installations. All participating contractors must become a participating trade partner within Whole Home Efficiency before providing installations for participants in the product. A random sample of 10% of the contractor's jobs will be inspected and verified. Once contractors have completed all necessary trainings and signed the agreement, they will be included on the approved contractor list, which is included in the customer packet and on the Company's website.⁵²

B. Forecasts, Participants & Budgets

Forecasts and Participants

The product forecasts were developed based on the 2021 product results and the Company's forecasted assumptions for increased participation as a result of the product redesign.

⁵²www.xcelenergy.com/cotrades

Budgets

The budget for this product is based on the 2021 expenditures and includes costs for third-party implementation, software, measurement and verification inspections, trade incentive rebates, and minimal product promotion.

C. Application Process

Customers interested in participating in Whole Home Efficiency must first complete a Home Energy Audit with blower door test or a Home Energy Squad Plus visit. The customer will be provided information on the Whole Home Efficiency product, tying the specific product requirements into the audit recommendations. The customer may then sign up for Whole Home Efficiency through their auditor at the time of the audit or any time thereafter using the online signup form. The customer will have two years from the Whole Home Efficiency enrollment date to complete the equipment installs and submit applications for rebates.

The Whole Home Efficiency product information, approved contractor list, and signup form are on the Company's website. Customers can only receive applications through their registered and approved contractor. Customers may also contact the Residential Customer Care center to request product information or guidance on how to obtain rebates.

D. Marketing Objectives & Strategies

The Company will provide product information through the website and implement low-cost marketing tactics when available. The Company will also provide Whole Home Efficiency information to the Customer Education team to promote at several "green" community events throughout the year. Trade partners may also be incentivized to identify participants that may not be aware of the "whole house option" through Whole Home Efficiency.

Other products such as the Company's Home Energy Audit product and Home Energy Squad Plus offering will offer information on Whole Home Efficiency. The Company will monitor product participation on a monthly basis and implement additional marketing tactics if necessary, to achieve the year-end forecast.

In addition, the Company will attempt to utilize the trade partners who have been trained and contracted to deliver this product to customers. This is viewed as the most important marketing channel for building awareness and participation in the product. As a result, the Company is offering incentives to participating installation contractors designed to increase the number of projects performed. These incentives provide contractors with additional motivation to promote the Whole Home Efficiency product.

E. Product-Specific Policies

The Whole Home Efficiency product leverages the Company's Home Energy Audit and Home Energy Squad Plus offerings, requiring an advanced in-home blower door audit as a prerequisite

to product participation. Customers are eligible for a Home Energy Audit every two years. The Company will provide the customer a list of contractors participating in the product; however, the Company does not guarantee the contractor's expertise or warrant any of the products or services, nor is one contractor promoted over another. The Company shall have no liability for contractor work or negligence. After the customer completes the audit and meets the product eligibility requirements, the customer may sign up to participate in Whole Home Efficiency.

Customers will receive the standard prescriptive rebate for all installed measures, with the exception of insulation product envelope measures. The Company is proposing that envelope measures be based on savings achieved. The Company is developing a rebate structure to encourage deeper weatherization retrofits that are based on tiered savings. If a customer installs three or more qualifying measures, the customer will receive an additional bonus rebate of 10% of the prescriptive rebate amount for each measure completed within the two-year time period. The bonus rebate is a one-time offer for each measure completed.⁵³ The Company will not rebate pre-existing efficient equipment. Self-installations or installations done by non-registered contractors do not qualify for rebates.

The Company is looking into ways to provide a more comprehensive experience for our residential customers that simplifies the process of installing capital intensive energy efficient equipment. This may include an end-to-end solution where the customer chooses from any, or all, of the following as applicable:

- Advice and analysis of the available equipment options
- Financing
- Enrollment in Demand Management products
- Assistance with choosing qualified contractors
- Enrollment in green programs and/or warranty services.

F. Stakeholder Involvement

The Company periodically meets with the Cities of Boulder, Fort Collins, Greeley, and Colorado Springs, the Center for Resource Conservation, the Platte River Valley Authority, the Colorado Energy Office, the EPA, the DOE, Electric & Gas Industries Association, and the EEBC for product feedback. The Company plans to continue meeting with these organizations, and other stakeholders, for feedback to improve the product.

G. Rebates & Incentives

Whole Home Efficiency product rebates are prescriptive, with the exception of insulation product envelope measures and based on the specific measures installed. The rebate amounts and eligibility requirements will be communicated through the Whole Home Efficiency collateral including the rebate application.

⁵³Qualifying equipment is subject to change and customer must participate under current product rules designated by the current year in which the install the additional measures.

Income Qualified Program

A. Description

The IQ Program includes Public Service’s energy efficiency and education products targeted to income-qualified customers. Public Service continues to make a substantial commitment to both gas and electric energy efficiency for IQ customers in 2023. The Company recognizes that income qualified products offer a unique opportunity to both substantially improve the efficiency with which customers use energy and provide other non-energy related benefits like health, safety, and comfort. Reductions in IQ customers’ utility bills can have a significant, beneficial effect on household income as compared to market rate customers because a larger percentage of income qualified customer’s income is spent on energy.

With these factors in mind, Public Service will continue to offer the same four products included in the 2023 DSM & BE Plan intended to reach a large percentage of the IQ community while leveraging resources already in place to serve this customer group.

Products

The IQ Program consists of the following four products serving electric and natural gas customers:

- Energy Savings Kit
- Multifamily Weatherization
- Non-Profit
- Single-Family Weatherization

The IQ product rankings are shown in Table 13 below.

Table 13: IQ Program Product Rankings⁵⁴

2023	Rank
Single-Family Weatherization	5
Energy Savings Kit	13
Multifamily Weatherization	26
Non-Profit	27

In response to the COVID-19 pandemic, the Company and its third-party implementation partners put additional guidelines and protocols in place when entering homes, apartment units and facilities to ensure the safety of customers and workers.

⁵⁴All products in the DSM portfolio were ranked through the same process and the full results can be found in [Appendix C](#) of this Plan.

B. Forecasts, Participants & Budgets

Forecasts and Participants

The Company developed participation and energy savings forecasts based on historical experience with these products. Participation rates were established in partnership with CEO, EOC, IQ agencies, and vendors to further refine the forecasts and budgets.

Public Service relies on customers who request and qualify for energy assistance on their energy bills to determine eligibility. Customers applying for other benefits, such as medical, Supplemental Nutrition Assistance Program, cash assistance or other State of Colorado benefits can also apply for energy assistance through the Colorado PEAK application, providing another source of potential income-qualified energy efficiency participants.

Budgets

Budgets for IQ DSM/BE products will continue to be significantly higher than the 2019-2020 DSM Plan and are consistent with Commission guidance received in Decision No. C18-0417⁵⁵ as well as the BE minimum spend/budget requirements outlined in SB 21-246.

Table 14a: 2023 Electric IQ Program Budgets and Forecasts

2023	Electric Budget	Net Generator kW	Net Generator kWh	Electric MTRC Test Ratio	Lifetime Emissions Savings (Tons CO2)	SCC Benefits	Electric MTRC Test Ratio with SCC
Income Qualified Program							
Energy Savings Kit	\$349,621	297	2,528,481	3.40	13,957	\$827,178	5.28
Multifamily Weatherization	\$1,419,936	276	2,170,088	0.91	14,912	\$849,084	1.21
Non-Profit	\$1,200,929	366	1,617,893	0.94	10,649	\$614,317	1.20
Single-Family Weatherization	\$1,880,856	3,102	22,937,524	5.35	158,899	\$9,256,854	8.36
Income Qualified Program Total	\$4,851,342	4,040	29,253,986	2.60	198,416	\$11,547,433	3.91

Table 14b: 2023 Natural Gas IQ Program Budgets and Forecasts

2023	Gas Budget	Net Annual Dth Savings	Annual Dth/\$M	Gas MTRC Test Net Benefits	Gas MTRC Test Ratio	Lifetime Carbon Emissions Savings (Tons CO2)	SCC Benefits	Lifetime Methane Emissions Savings (Tons CH4)	SCM Benefits	Gas MTRC Test Ratio with SCC & SCM
Income Qualified Program										
Energy Savings Kit	\$275,385	31,781	115,404	\$5,640,983	14.59	18,592	\$1,248,778	9.70	\$17,829	17.64
Multifamily Weatherization	\$1,395,835	15,262	10,934	-\$386,138	0.86	12,525	\$790,695	6.50	\$11,469	1.15
Non-Profit	\$861,222	7,592	8,816	-\$234,726	0.86	7,076	\$433,928	3.70	\$6,339	1.12
Single-Family Weatherization	\$4,028,000	42,658	10,590	-\$484,821	0.93	37,848	\$2,347,923	19.70	\$34,203	1.26
Income Qualified Program Total	\$6,560,443	97,292	14,830	\$4,535,298	1.37	76,040	\$4,821,323	39.60	\$69,841	1.77

C. Application Process

Application processes vary by product. See individual product summaries following this overview for more information.

⁵⁵ Decision No. C18-0417, at ¶42 in Proceeding No. 17A-0462EG (Attachment A).

D. Marketing Objectives & Strategies

The IQ Program aims to educate income qualified customers on the importance of and value provided by energy efficiency. The Company will work with IQ providers, cities/counties and other community organizations to promote all available services, including Percentage of Income Payment Plan enrollment. Marketing and promotion activities will occur primarily through partners with collateral material developed by Public Service. This tends to be the most effective way to target the low to moderate-income customers, as other targeting methods are limited. Xcel Energy's call center agents are also trained to provide useful information with which to direct potentially eligible customers to participate in the program's products.

To help further reduce carbon emissions, lower customer costs and support the efficient use of the power grid, the IQ Program will engage with implementers, stakeholders and industry partners to promote the electrification of end uses like space heating, water heating, and other applications.

E. Program-Level Policies

Customers participating in the Energy Savings Kit and Single-Family Weatherization products must purchase retail electricity or gas from Public Service on a residential tariff. Participants in the Multifamily Weatherization product must manage or own multi-family buildings whose units are a minimum 66% occupied by customers identified as income qualified per product guidelines. Non-Profit participants must purchase electric or gas service from Public Service. Specific products within the Program may have different eligibility requirements depending on the services offered, funding partners or customers served.

The Company defined all-electric, electric-only, and gas-only customers as follows:

- All-electric: customers who only receive electric service from the Company and space condition and water heat with electricity;
- Electric-only: customer who receive electric service from the Company and natural gas service from another provider for use in space conditioning and/or water heating; and
- Gas-only: customer who receive natural gas service from the Company and electric service from another provider.

F. Stakeholder Involvement

Public Service received significant input and assistance in originally developing and modifying products for the IQ Program and will rely heavily on stakeholders to deliver successful product offerings. Perhaps more than any other Program, the IQ Program depends on outside expertise in the form of government agencies and non-profits to provide product benefits to customers. In this sense, Public Service is the facilitator that provides financial and energy efficiency resources to complement the services provided by state and local organizations.

The Company will continue to work with the CEO, EOC, vendors, outside consultants, Commission Staff, and local weatherization organizations to ensure that its IQ Program products

are delivering promised benefits and producing effective results. These interactions will also guide mid-year performance adjustments that may be necessary to keep products on track.

G. Rebates & Incentives

IQ rebates are unique in that the incentive level assigned for the measures offered under these four DSM products covers up to 100% of the incremental capital cost.

H. Evaluation, Measurement & Verification

The specific product measurement and verification plans are included in the EM&V section of this Plan.

➤ Energy Savings Kits

A. Description

The Energy Savings Kit product provides bundled home energy efficiency measures for income-qualified customers. The kits offer electricity and natural gas saving measures and customer education materials to help lower customer bills and improve the comfort and safety of their dwellings.

IQ customers will receive an offer through email, mail, or community partners informing them of their eligibility to receive a free Energy Savings Kit. The offer details the contents of the kit and how much money they could save on their energy bill if they install all the measures provided. If the customer chooses to receive a kit, they will send their response to the third-party implementer. Customers will receive a kit within six to eight weeks.

The Energy Savings Kits will include the following electric and natural gas efficiency measures:

- Eight (8) LED bulbs
- One (1) 1.5 gpm High Efficiency Showerhead
- One (1) 1.5 gpm Kitchen Faucet Aerator
- One (1) 1.0 gpm Bathroom Faucet Aerator
- One (1) 0.5 LED Night Light

Keeping bills low is very important to IQ customers. With the installation of smart meters and the transition to the TOU rate in Colorado, the product will include a bilingual educational insert on the smart meter, new rate, and how to save money by shifting electricity use to off-peak hours when rates are the lowest.

The Company will continue to pursue offering of a secondary kit in 2023 to better serve the customers' needs. Customers will have the option of ordering a certain number of additional items, including specialty lightbulbs.

B. Forecasts, Participants & Budgets

Forecasts and Participants

The Company set the participation forecast (number of kits to be sent out) based on historical product performance and participation projections. Energy savings forecasts were developed based on the installation rate of the kit measures in 2020.

Budgets

The budget is based on the number of forecasted kits. The budget includes the costs of kit contents, production, distribution, and fees from the third-party implementer. The budget also includes costs for labor, marketing materials and M&V.

C. Application Process

Customers who have received Low Income Home Energy Assistance Program (“LIHEAP”) funding, any energy assistance funding (including county assistance and fuel fund assistance), Low-Income Energy Assistance Program (“LEAP”) funding, or other state assistance programs and live in the Public Service electric and/or natural gas service territory will be sent an offer to receive the kit. The third-party implementer will track customer participation so that customers do not receive more than one kit. This tracking information will also be provided to the Company on a regular basis.

D. Marketing Objectives & Strategies

The overall objective of the product is to increase and expand education among the income-qualified customers on the importance of energy efficiency and the value of acting to improve efficiency in their homes. The Company will work with local and state agencies to obtain customer mailing lists to reach more customers annually.

E. Product-Specific Policies

In order to participate, customers must receive LIHEAP, LEAP, energy assistance funding (including county assistance and fuel fund assistance), other state assistance programs, or be identified as eligible using other reliable data sources.

F. Stakeholder Involvement

The Company will continue to work with local and state agencies to identify eligible customers and determine additional kit content needs.

G. Rebates & Incentives

The Company will fund 100% of the cost of the Energy Savings Kits. There will be no rebate provided to customers.

➤ Multifamily Weatherization

A. Description

The Multifamily Weatherization product is designed to provide funding for a wide variety of equipment and process improvements for electric and natural gas efficiency measures in income-qualified multifamily buildings. This offering differs from the Single-Family Weatherization product in that these dwellings have common areas, greater overall square footage, more appliances, other potential energy-saving and demand-reduction measures.

The product will be implemented in partnership with EOC. EOC works jointly with several government and non-profit partners to identify and qualify multifamily units for participation. Details of measures, rebates, reporting processes, and M&V procedures will be evaluated on a per-project basis using a detailed engineering analysis.

In addition to these measures, customer education is offered with this product. EOC staff provides educational materials, historical energy usage information, and bill analysis to these customers during the weatherization process to help them identify additional changes they can make in their day-to-day lives to further reduce energy use and demand in their building. With the installation of smart meters and the transition to the TOU rate in Colorado, the Company will work with EOC on bilingual educational efforts regarding the smart meter, new rate, and how customers may save money by shifting electricity use to off-peak hours when rates are the lowest.

B. Forecasts, Participants & Budgets

Forecasts and Participants

Participation and energy savings forecasts were developed by evaluating past project completions and information provided by EOC on anticipated participants. Participation can vary from building to building as many properties are master metered.

Budgets

Historical project costs and participation information were tracked and analyzed to develop a budget estimate. The majority of the budget is allocated to electric and natural gas rebates benefiting tenants in income qualified multifamily buildings. Other external variables contributing to costs, such as outreach, material costs and staffing, were also evaluated.

C. Application Process

To participate in the product, customers must submit an application to EOC. Applications are reviewed by EOC and once approved; a comprehensive audit is performed on the building. IQ households must comprise at least 66% of the building's total households for the building to be eligible to apply. EOC will determine which applicant locations have the greatest need for

weatherization services. In some cases, if the need is very high, the application may be approved for buildings that are occupied by 50% IQ households.

D. Marketing Objectives & Strategies

The overall marketing objective is to increase education among IQ customers and building owners on the importance of energy efficiency, thereby driving product participation. Public Service will also work to educate customers on the value of taking further actions to improve efficiency in their homes in conjunction with EOC and other low-income customer advocates.

E. Product-Specific Policies

Eligible customers for this product are building owners or property managers of multifamily housing complexes with at least 66% of the rental units occupied by IQ customers whose income is below 80% of the local area median as defined by the Colorado Housing and Finance Authority. Customers meeting the DOE Weatherization Assistance Program funding guidelines,⁵⁶ as determined by the CEO, EOC, local governments, or their agencies, are automatically deemed income eligible.

F. Stakeholder Involvement

When designing the plan, Public Service worked with EOC to determine forecasts, budgets and participation based on current pipeline and future opportunities. Public Service will continue to evaluate historical projects with EOC to determine measure implementation and needs trending.

G. Rebates & Incentives

The product does not provide a rebate to customers, but rather provides project funding in the form of grants. The estimated average incentive amounts for electric and natural gas energy improvements can be found in [Appendix H: Technical Reference Manual](#).

Public Service will evaluate each project on a custom basis to determine funding levels using a detailed engineering analysis. Engineers review the project information to determine the projected energy savings, demand reduction, benefit/cost ratio and payback. Projects will be bundled in order to pass the MTRC test ratio for the product. Testing, study, engineering, and project management fees may be included in the project costs.

The Company will continue the BE pilot, which was implemented in Q1 2022 and designed to fund the full cost of mini-split heat pumps, air source heat pumps, and heat pump water heaters. The pilot focuses on expanding participation for these technologies within the IQ portfolio of

⁵⁶ <http://energy.gov/eere/wipo/where-apply-weatherization-assistance>

products. The study will review a portion of completed projects for post-installation bill impacts, identify best practices for minimizing energy burden, and assess various scenarios for heat pump installation. Installation scenarios will include heat pumps with gas back up, full system replacements, heat pumps with electric resistance back up, and heat pumps with boiler back up.

➤ **Non-Profit**

A. Description

The Non-Profit product is designed to provide funding on a wide variety of equipment and process improvements for electric and natural gas efficiency measures to qualified non-profit organizations within the Company's Electric and Natural Gas service territory. The product's focus is on helping organizations that serve IQ individuals, such as shelters, safe houses, and residential treatment centers.

The product will be implemented in partnership with EOC. EOC utilizes funding through their existing Non-Profit Energy Efficiency Program grants targeting non-profits. EOC works to identify and qualify non-profit facilities for the product. Details of energy-saving and demand-reduction measures, rebates, reporting processes, M&V procedures will be evaluated on a per project basis using a detailed engineering analysis.

In addition to these measures, customer education is included with this product. EOC staff provides educational materials, historical energy usage information, and bill analysis to these customers during the weatherization process to help them identify additional changes they can make in their day-to-day lives to further reduce energy use and demand in their facility. With the installation of smart meters and the transition to the TOU rate in Colorado, the Company will work with EOC on bilingual educational efforts regarding any applicable information for the smart meter, new rate, and how customers may save money by shifting electricity use to off-peak hours when rates are the lowest.

B. Forecasts, Participants & Budgets

Forecasts and Participants

Participation and energy savings forecasts were developed by evaluating past project completions and information provided by EOC on anticipated participants.

Budgets

Historical costs and participation information were tracked and analyzed to develop a budget estimate. The majority of the budget is allocated to electric and natural gas rebates benefiting non-profit facilities. Other external variables contributing to costs, such as outreach, material costs, and staffing were also evaluated.

C. Application Process

Customers can learn about the product through information that is available on EOC's website⁵⁷ and also Xcel Energy's website⁵⁸. EOC reaches out to those customers who may not be aware of funding and educates them on the benefits of an energy-efficient retrofit improvement. Customers who are interested in the product can apply online through the EOC website. The online application must be completed and includes a description of existing equipment in the facility, confirmation of building ownership/facility usage, proof that the building is registered with the Colorado Secretary of State as a 501(c)(3) and documentation showing the financial stability of the organization. A committee made up of non-profit industry leaders then determines the applicant's needs and how EOC and Public Service funding can help.

D. Marketing Objectives & Strategies

The overall marketing objective is to increase and expand education among IQ customers and building owners on the importance of energy efficiency, thereby driving product participation. Public Service will also work to educate customers on the value of taking further actions to improve efficiency at the facility. EOC markets the product through various channels, including communications through non-profit association literature, community resource center announcements, and local IQ foundations.

E. Product-Specific Policies

To receive funding, the following customer and facility eligibility requirements must be met:

- Customers must receive electricity and/or natural gas from Public Service;
- Customer must operate the non-profit facility on a property they own and for which they pay energy bills, or have a long-term lease that requires only non-profits to occupy the space with plans to be in current location for at least the next ten years; and
- The property must provide services to vulnerable populations including but not limited to: transitional housing, homeless shelters, affordable housing, domestic violence shelters and day shelters, organizations that provide services (substance abuse, health and mental health services, child care, education and/or emergency services) for special needs populations, including IQ families, the disabled, senior, and youth communities.

In addition, the following project requirements must be met:

- Be recommended by an independent energy auditor based on energy conservation calculations that are available for review; and
- Reduce the use of energy or demand (electricity, natural gas, or both) provided by Public Service to the facility.

⁵⁷ <https://www.energyoutreach.org/programs-for-organizations/non-profit-energy-efficiency/>

⁵⁸ https://www.xcelenergy.com/programs_and_rebates/business_programs_and_rebates/income_qualified_rebate_programs_for_buildings

Participating income qualified agencies must agree to the following:

- Installation of an energy use monitoring and reporting system;
- A comprehensive energy audit by a qualified entity;
- Set forecast energy use goals for each facility;
- Consider installation of all qualifying efficiency measures;
- Engage appropriate contractors and manage the installation and completion of efficiency measures;
- Provide a summary project report at the completion of the installations;
- Provide all insurance and legal protections requested by Public Service; and
- Annually review the energy use of the retrofitted facility and formulate a plan for further improvement using available and appropriate assistance.

F. Stakeholder Involvement

When designing the plan, Public Service worked with EOC to determine appropriate product forecasts, budgets and participation based on current pipeline and opportunities. Public Service will continue to evaluate historical projects with EOC to determine specific measure trends.

G. Rebates & Incentives

The product does not provide a rebate to customers, but rather provides project funding in the form of grants. The estimated average incentive amounts for the energy improvements can be found in [Appendix H: Technical Reference Manual](#).

Public Service will evaluate each project on a custom basis to determine funding levels using a detailed engineering analysis. Engineers review the project information to determine the projected energy savings, demand reduction, benefit/cost ratio and payback. Projects will be bundled in order to ensure that the product passes the MTRC test ratio. Testing, engineering and project management fees may be included in the project costs.

The Company will continue the BE pilot, which was implemented in the first quarter of 2022 and designed to fund the full cost of mini-split heat pumps, air source heat pumps, and heat pump water heaters. The pilot focuses on expanding participation for these technologies within the IQ portfolio of products. The study will review a portion of completed projects for post-installation bill impacts, identify best practices for minimizing energy burden, and assess various scenarios for heat pump installation. Installation scenarios will include heat pumps with gas back up, full system replacements, heat pumps with electric resistance back up, and heat pumps with boiler back up.

➤ **Single-Family Weatherization**

A. Description

The Single-Family Weatherization product targets IQ customers who are receiving assistance on their energy bills. The product works with weatherization agencies and contractors around the state to provide this at-risk customer segment with free or low-cost home audits and electric and/or natural gas efficiency measures. Public Service offers significant rebates toward the incremental cost of these upgrades including:

Natural Gas Measures

- Efficient furnace
- Wall insulation
- Attic insulation
- Crawl space insulation
- Water heaters
- Storm windows
- 1.5 GPM showerheads
- 1.5 GPM aerators
- 0.5 GPM aerators
- Air Sealing
- Thermostat Installation and Programming
- Other cost-effective measures to be determined

Electric Measures

- Refrigerator replacements
- LEDs (A-19 and BR-30 bulbs)
- Cooling savings for building shell measures
- Water heater blanket
- Evaporative Coolers
- Heat Pump Water Heaters
- Air Source, Mini-Split Heat Pumps
- Other cost-effective measures to be determined

In addition to these measures, a major focus of this product is customer education. Auditors will provide educational materials, historical energy usage information, and bill analysis to these customers during the weatherization process to help them identify additional changes they can make in their day-to-day lives to further reduce energy use and demand in their home. Furthermore, the implementer will offer educational workshops in collaboration with local housing authorities, and other engaged community organizations.

Keeping bills low is very important to serving IQ customers. With the installation of smart meters and the transition to the TOU rate in Colorado, the Company will work with the third-party

implementer on bilingual educational efforts regarding the smart meter, new rate, and how customers may save money by shifting electricity use to off-peak hours when rates are the lowest.

The Single-Family Weatherization product is delivered in partnership with a third-party implementer. The third-party implementer will work to secure public grants and private funds to match with Public Service funds. They will also develop annual contracts with weatherization agencies in the Public Service electric and gas service territories. Processes for reporting measure detail, rebates, and M&V are managed by the third-party implementer.

B. Forecasts, Participants & Budgets

Forecasts & Participants

Energy savings and participation forecasts were established in partnership with the third-party implementer using historical product participation as a guide. Recommendations from the third-party implementer on expected workflow were also considered when developing energy savings forecasts and participation rates.

Budgets

Budgets for the product were developed based on the cost of measures installed in IQ homes. The Company also allocated funds for necessary health and safety upgrades in special situations; these funds will be used at the discretion of the third-party implementer with proper documentation.

C. Application Process

Participating customers must receive residential electricity and/or natural gas from the Company and have a household income below 80% of the area median income, which varies by county. Customers will be informed of the Single-Family Weatherization product when they sign up for Colorado LEAP, among other outreach avenues. LEAP qualification is, currently, at 60% of State Median Income, while the DOE Weatherization Assistance Program allows for 200% Federal Poverty Level. Other reliable data sources may be used to determine eligibility.

Once the customer's income and energy assistance status are verified, they will be qualified by their local weatherization agency, and the third-party implementer, to receive weatherization services.

D. Marketing Objectives & Strategies

The primary marketing objective of this product is to deliver energy savings and demand reduction which help IQ customers reduce energy costs and increase comfort in their homes. A secondary objective is to provide IQ customers with access to materials and workshops educating them on the importance of energy efficiency and the value of taking action to improve efficiency in their homes. The Company will work with IQ providers, such as local weatherization agencies and

community organizations, to promote available services. Customers can find information on local weatherization agencies on Xcel Energy's website⁵⁹.

E. Product-Specific Policies

The third-party implementer will contract with subcontracted agencies to perform weatherization services. All contractors will be trained to follow BPI installation requirements for weatherization services. These contractors receive funding from the third-party product implementer and other state funding and have agreed to weatherize homes following state regulations and guidelines.

F. Stakeholder Involvement

When designing the product, the Company worked with external consultants to define energy savings measures to help customers save money on their energy bills, while also improving the comfort of their home. The product is delivered in partnership with federal, state, and nonprofit IQ weatherization organizations. The Company collaborated with EOC on the development of weatherization forecasts and budgets.

G. Rebates & Incentives

The Company will pay rebates toward the equipment and installation costs of predetermined electric and natural gas energy efficiency measures available to income-qualified, single-family customers. The Company will also pay for necessary health and safety upgrades associated with the installation of these weatherization measures which may include fixing gas leaks, updating electrical, or adding ventilation.

The Company will continue the BE pilot, which was implemented in Q1 2022 and designed to fund the full cost of mini-split heat pumps, air source heat pumps, and heat pump water heaters. The pilot focuses on expanding participation for these technologies within the IQ portfolio of products. The study will review a portion of completed projects for post-installation bill impacts, identify best practices for minimizing energy burden, and assess various scenarios for heat pump installation. Installation scenarios will include heat pumps with gas back up, full system replacements, heat pumps with electric resistance back up, and heat pumps with boiler back up.

⁵⁹https://www.xcelenergy.com/programs_and_rebates/residential_programs_and_rebates/affordable_energy/income-qualified_weatherization_program

Indirect Products & Services

A. Description

Indirect Products and Services support planning, analysis, administration, and evaluation of products with direct savings impacts as well as development and implementation of the Plan. Most of these indirect products and services are not independently evaluated for cost-effectiveness, with the exception of pilots with measured savings impacts that are being assessed for potential future transition to a product—those do undergo a cost-benefit evaluation. Pilot implementation and evaluation approaches are fully discussed in each written pilot summary, following the Product Development description. All of the Indirect Products and Services costs are included in the overall DSM portfolio cost-benefit analysis.

Indirect Products and Services play a critical role in ensuring that the overall DSM portfolio is effectively researched, managed, and operated. These products and services provide valuable information and support for the direct impact products and offer innovative approaches for inciting change in the DSM marketplace. These innovative approaches, manifested in education and market transformation products, may not produce readily quantifiable energy and demand savings, but still play a very important role in shifting markets and attitudes to be more energy efficiency and demand reduction oriented.

There are two main areas of Indirect Products & Services:

1. Education/Market Transformation and
2. Planning and Research.

Education/Market Transformation

The Company offers seven customer-facing education and market transformation products, including: Business Education, Business Energy Analysis, Consumer Education, Energy Benchmarking, Energy Efficiency Financing, the Home Energy Audit, and Partners in Energy. The definition of market transformation in the Public Service gas DSM Rulemaking is:

...a strategy for influencing the adoption of new techniques or technologies by consumers. The objective is to overcome barriers within a market through coordinating tactics such as education, training, product demonstration and marketing, often conducted in concert with rebates or other financial incentives.⁶⁰

Planning and Research

The Company will operate four internal DSM services: Product Evaluations, Measurement, and Verification; Market Research; Planning & Administration; and Product Development.

⁶⁰Rule 4751(n)

B. Forecasts, Participants & Budgets

Forecasts and Participants

Most indirect products and services do not have savings or participation forecasts, with the exception of some pilots, whose energy savings and participation forecasts are described within each pilot’s written summary which follows this section.

Budgets

Because the majority of Indirect Products and Services do not directly produce energy and demand savings and, therefore, may reduce the overall cost-effectiveness of the DSM/BE portfolio, there is a natural tendency to limit activity and spending in this area to only the most essential elements. The Company will not limit its spending in this area to a specific percentage of the overall portfolio but will remain vigilant about limiting the Indirect Products and Services overall size.

The budget consists primarily of labor, educational material, and study costs. Most studies are conducted by outside experts, generally selected through a competitive bid process. Tables 15a through 15b provide the overall Indirect products and services energy savings and participation forecasts, if applicable, and budgets, broken out by each product / service.

Table 15a: 2023 Electric Indirect Products & Services Budgets and Forecasts

2023	Electric Budget	Net Generator kW	Net Generator kWh	Electric MTRC Test Ratio	Lifetime Emissions Savings (Tons CO2)	SCC Benefits	Electric MTRC Test Ratio with SCC
Indirect Products & Services							
Education/Market Transformation							
Business Education	\$176,000	0	0		0	\$0	
Business Energy Analysis	\$1,082,852	0	0		0	\$0	
Consumer Education	\$943,500	0	0		0	\$0	
Energy Benchmarking	\$139,462	0	0		0	\$0	
Energy Efficiency Financing	\$96,833	0	0		0	\$0	
Home Energy Audit	\$484,503	0	0		0	\$0	
Partners in Energy	\$1,229,973	0	0		0	\$0	
Education/Market Transformation Total	\$4,153,123	0	0		0	\$0	
Planning and Research							
EE Market Research	\$474,400	0	0		0	\$0	
EE Evaluation, Measurement & Verification	\$1,075,545	0	0		0	\$0	
EE Planning & Administration	\$570,581	0	0		0	\$0	
EE Product Development	\$1,886,139	0	0		0	\$0	
Geo-targeting Pilot - EE	\$24,073	0	0	2.83	0	\$0	2.83
EE Product Development Total	\$1,910,212	0	0		0	\$0	
EE Planning and Research Total	\$4,030,737	0	0		0	\$0	
EE Indirect Products & Services Total	\$8,183,861	0	0		0	\$0	

Table 15b: 2023 Natural Gas Indirect Products & Services Budgets and Forecasts

2023	Gas Budget	Net Annual Dth Savings	Annual Dth/\$M	Gas MTRC Test Net Benefits	Gas MTRC Test Ratio	Lifetime Carbon Emissions Savings (Tons CO2)	SCC Benefits	Lifetime Methane Emissions Savings (Tons CH4)	SCM Benefits	Gas MTRC Test Ratio with SCC & SCM
Indirect Products & Services										
Education/Market Transformation										
Business Education	\$19,600	0	0			0	\$0	0.00	\$0	
Business Energy Analysis	\$210,070	0	0			0	\$0	0.00	\$0	
Consumer Education	\$73,500	0	0			0	\$0	0.00	\$0	
Energy Benchmarking	\$43,278	0	0			0	\$0	0.00	\$0	
Energy Efficiency Financing	\$50,957	0	0			0	\$0	0.00	\$0	
Home Energy Audit	\$652,772	0	0			0	\$0	0.00	\$0	
Partners in Energy	\$163,051	0	0			0	\$0	0.00	\$0	
Education/Market Transformation Total	\$1,213,227	0	0			0	\$0	0.00	\$0	
Planning and Research										
EE Market Research	\$197,990	0	0			0	\$0	0.00	\$0	
EE Evaluation, Measurement & Verification	\$269,597	0	0			0	\$0	0.00	\$0	
EE Planning & Administration	\$127,762	0	0			0	\$0	0.00	\$0	
EE Product Development	\$198,733	0	0			0	\$0	0.00	\$0	
EE Product Development Total	\$198,733	0	0			0	\$0	0.00	\$0	
EE Planning and Research Total	\$794,083	0	0			0	\$0	0.00	\$0	
EE Indirect Products & Services Total	\$2,007,310	0	0			0	\$0	0.00	\$0	

C. Application Process

Most indirect products and services do not have rebate applications, with the exception of some pilots, whose rebate applications and/or participation parameters are described within each pilot’s written summary which follows this section.

D. Marketing Objectives & Strategies

Indirect Products & Services serve all markets addressed by Public Service’s direct impact products. During 2023, market research activities will be focused on customer and market characterization. Each process evaluation conducted by Market Research includes: the quantification of product penetration, provides segment and target market information, determines trends and barriers affecting participation, and investigates best practices observed by peer utility programs. This information provides a basis from which product and program decisions can be made.

Through membership in consultative organizations such as E Source, Market Research receives vendor-neutral and reliable market intelligence overall, and specific to a product/program or by targeted segments. Other general research provides demographic and firmographic data about the characteristics of our customer base, attitudinal and awareness information which informs market strategy, and levels of customer satisfaction which address program vitality.

Marketing, advertising, and promotion activities under Indirect Products and Services are primarily focused on the Education/Market Transformation area. The very nature of these products suggests that they will use customer contacts in the form of newsletters, bill inserts, community events, energy efficiency workshops, direct mail and email campaigns, and communications to new residents, and advertising through radio, television and print to educate customers and

transform markets. Promotional costs are also budgeted to create awareness and generate enrollments in the Home Energy Audit and Business Energy Analysis products.

E. Program-Specific Policies

The Company will make every effort to focus its Education and Market Transformation messages and promotions on Public Service customers, yet there will likely be spillover benefits to non-Public Service customers particularly with those activities that convey information to general audiences (like the Company website, partnerships with regional agencies, and community-based events).

F. Stakeholder Involvement

Indirect Products and Services rely heavily on input from internal and external stakeholders, and, as such, manage the Company's interaction with "official" stakeholder groups such as the DSM/BE Roundtable. Market Research and Education/Market Transformation activities actively engage internal and external stakeholders including employees, customers, trade allies, and vendors to ensure that product objectives are met.

G. Rebates & Incentives

Most indirect products and services do not have energy savings forecasts or offer rebates, with the exception of some pilots, whose rebates and incentives are described within each pilot's written summary which follows this section.

H. Evaluation, Measurement and Verification

The Indirect offering includes the Company's Evaluation, Measurement and Verification ("EM&V") plan for 2023, which describes the EM&V approach for all of the DSM/BE products included in the Plan. The majority of Planning and Research services themselves are not subject to EM&V, with the exception of pilots, where their EM&V is described within each pilot's written summary which follows this section.

The DSM Planning & Administration group is responsible for developing and implementing the EM&V methodologies. These efforts are described in more detail within the EM&V and Market Research sections below.

➤ **Business Education**

A. Description

The Business Education product focuses on creating awareness of energy efficiency and providing business customers with information about what they can do to reduce energy use in their buildings. The product encourages customers to make Xcel Energy their first contact when considering equipment or process upgrades and engages customers to make changes that lower their energy use. It focuses on removing the barriers to adoption of energy efficiency measures by educating customers and their employees on the impacts of their energy use and offering information on how to take action to achieve long-term energy savings.

The product is primarily marketed to small and mid-sized business customers through sponsorships, customer outreach and advertising campaigns.

The product's main offerings include the following:

- Sponsorship and Customer Outreach; and
- Digital Communications

B. Forecasts, Participants & Budgets

Forecasts and Participants

The Business Education product targets small- to mid-sized Colorado customers *via* a variety of community events, sponsorships, workshops and business expos to promote energy efficiency rebates and energy conservation strategies to a wide range of business customers. These opportunities allow for in-person, one-on-one customer outreach which is critical to driving onsite customer leads and product signups.

Budgets

The product's participation forecasts and budgets were determined by estimating, educational material requests, community outreach events and sponsorships.

The main budget drivers include the following:

- *Administration* – This category represents the labor needed for product planning and implementation.
- *Advertising and Promotion* – This budget includes funds for printed materials, community outreach events, sponsorships, and digital advertising.

C. Application Process

This product does not include an application process.

D. Marketing Objectives & Strategies

The primary objective of Business Education is to heighten business customers' awareness about energy efficiency and conservation empowering customers to take proactive steps to reduce energy consumption by upgrading to high efficiency measures.

E. Product-Specific Policies

This indirect product has no specific policies.

F. Stakeholder Involvement

The Company will create and leverage strategic partnerships and alliances with governmental, non-governmental, and trade partners to reach target businesses in Colorado.

G. Rebates & Incentives

This indirect product does not offer customer rebates.

➤ **Business Energy Analysis**

A. Description

The Business Energy Analysis product is an indirect impact product that offers analysis services to identify energy saving opportunities for Colorado business and industrial customers. The goals of this product are to provide a method and entry way for commercial and industrial customers to learn how their businesses use energy today and to identify measures that will help them save energy and reduce operating costs in the future. This service is a first step for customers to uncover energy saving opportunities with little capital investment and risk. Audits have the capability to use interval usage data to identify opportunities where customers can shift their energy usage from peak to off-peak periods. Public Service representatives have and continue to use this as a selling point for engagement in other energy efficiency products. Participation is heavily dependent on promotion by internal Public Service representatives, as well as the trade partners and outside business customer assistance programs.

The Business Energy Analysis product offers two types of assessments: walk-through audits, and Commercial Streamlined Assessments, which vary in customer involvement. The reports in the assessments provide varying levels of detail about costs and paybacks, which will assist in creating a business case to make energy efficiency upgrades.

- *Walk-through energy audit:* Public Service has an energy advisor from a contracted third-party vendor conduct an audit of the customer's facility to provide an overview of the customer's energy usage and energy conservation opportunities. The customer receives a simplified report including energy conservation opportunities with the associated payback, savings, cost, and available rebates. Customers with an annual peak demand of less than 100 kW may qualify for free direct install services through the Small Business Energy Solutions ("SBES") product, to be completed by the third-party implementer during the audit. Customers with an annual peak demand greater than 100 kW can also receive a direct installation of select ENERGY STAR® smart thermostats through the SBES product, however additional costs to the customer may apply.

Commercial Streamlined Assessment: Public Service sends an energy advisor from a contracted third-party vendor to a customer's facility to conduct an ASHRAE Level 1 energy audit, which is a comprehensive audit of the facility and its energy use. Additionally, this audit will include building commissioning measures for energy management systems. The customer receives a detailed report including energy conservation opportunities with the associated payback, savings, cost, and available rebates. Qualified third-party contractors are selected through an RFP process to perform the onsite energy audits. Customers with an annual peak demand of less than 100 kW may qualify for free direct install services through the SBES product, to be completed by the third-party implementer during the audit. Customers with an annual peak demand greater than 100 kW can also receive a direct installation of select ENERGY STAR® smart thermostats through the SBES product, however additional costs to the customer may apply.

B. Forecasts, Participants & Budgets

Forecasts and Participants

The forecasts were developed by analyzing historical participation data, and the commercial and industrial customer market segment.

Budgets

The budget was developed based on historical data, auditor pricing, forecasted participation and the presumed size and location of participating buildings, to estimate an average assessment cost.

Labor, promotions, and consulting drive the budget level:

- *Consulting*: Developed using average auditor pricing and participation forecast.
- *Labor Charges*: Estimated costs for product management, execution of the marketing strategy, and rebate processing.
- *Promotions and Advertising*: The estimated promotional budget anticipates several customer and trade communications during the year and support for general energy efficiency advertising campaigns.

C. Application Process

Customers may become aware of this product through their Account Manager or the Business Solutions Center, contracted trade allies, external customer assistance products, and/or marketing efforts including mailings, emails, newsletters, and the Company's website. All avenues are essential for increasing product awareness in conjunction with marketing efforts.

Walk-through audits do not require preapproval. Customers under 400 peak demand kW may request a walk-through audit on the Company's website or by contacting the third-party implementer over the phone. Once the customer has submitted their request an auditor will be assigned to assess the building. The customer will typically receive their audit report within two weeks of their audit to allow for creation of the report and internal processing.

Commercial Streamlined Assessments require preapproval prior to project initiation. Customers may access the onsite audit preapproval application on the Company's website⁶¹ and work with Public Service to complete the process by collecting their billing history information. Once the application is complete with customer and building information, an auditor will be assigned to assess the building. The customer will typically receive their final report from the engineer within three months of applying for preapproval. This time allows for internal processing, onsite engineer walkthrough of the facility, creation of the report, and a final review by Public Service internal engineering staff, as needed.

⁶¹<https://www.xcelenergy.com/staticfiles/xcel/PDF/Marketing/CO-Bus-Energy-Audits-Applicaton.pdf>

D. Marketing Objectives & Strategies

The main goal of the Business Energy Analysis product is to raise awareness and knowledge of Public Service's other energy efficiency products. The Company will rely heavily on trade partners and stakeholder resources, such as city- and county-driven projects throughout Colorado, to increase awareness of the Business Energy Analysis product. Though the target markets will differ by assessment type, walk-through audits and Commercial Streamlined Assessments are popular with small business customers. Methods used to reach and educate customers include:

- *Company website*: Provides a description of the product offering, and links product collateral and study brochures;
- *Collateral*: Product brochure, case studies, applications, frequently asked questions, and study templates that give the customer an idea of the resources they will receive by participating;
- *Direct mailings*: Informational piece to gain awareness and understanding of the product offerings;
- *Email campaigns*: Brief email from Public Service representatives to gain interest in the product from customers;
- *Newsletters*: Another medium to gain customer awareness and participation in the product; and
- *Customer seminars*: Educate customers about the product offering and benefits.

E. Product-Specific Policies

Products in the Company's Indirect Program, such as Business Energy Analysis, have no immediate savings attributed to them. Business Energy Analysis is meant to open the door for customers to participate in Public Service's other energy efficiency offerings and rebates that have direct impacts that contribute to achievement of goals. Once the onsite walk-through or Commercial Streamlined Assessment report is complete, the customer will receive a summary of energy efficiency opportunities available in their facility. When a customer moves forward with implementation, they follow the guidelines of the specific product in which they participate (i.e. Motor & Drive Efficiency), based on the opportunities identified in the report.

F. Stakeholder Involvement

Public Service worked closely with the contracted audit trade partners to develop and streamline the audit process. The Company also receives recommendations and feedback from stakeholders via the DSM/BE Roundtable.

G. Rebates & Incentives

Customers do not receive a rebate for participation in the Business Energy Analysis product, but they do receive study funding assistance. Business Energy Analysis offers two types of study funding based on whether a walk-through or Commercial Streamlined Assessment was completed.

Walk-through audits are free and available for small business customers under 400 peak demand kW. Commercial Streamlined Assessment participants with facilities under 50,000 square feet receive the audit free of charge, while larger square footages may be responsible for paying a small fee dependent on square footage.

➤ Consumer Education

A. Description

The Consumer Education product is an indirect-impact product that provides residential customers with the information and resources to reduce their energy usage. Because the residential segment is demographically varied, the Company employs a variety of resources to communicate the conservation message.

Communication strategies include:

- Annual community and conservation events and local community outreach;
- Digital media;
- Direct mail marketing to communicate energy conservation messages;
- Sponsorship of local events that support the mission of protecting our environment, such as Earth Day events; Sponsorship of local conservation publications;
- Publication of reference materials;
- Sponsorship of seminars and conferences supporting residential conservation and energy efficiency; and,
- Power and Draft Check tools available at local libraries.

The product focused on renewing existing partnerships that have provided consistent customer participation and engagement as well as building new relationships that have the potential to engage underserved segments, such as income qualified customers. In addition, the product employs digital media strategies to drive active engagement in energy efficiency. By continuing to diversify the communication channels, the product increases residential customer knowledge base and provides a greater variety of resource options and services.

B. Forecasts, Participants & Budgets

Forecasts and Participants

Consumer Education is widely targeted to all Colorado natural gas and electric residential customers. The product will target a variety of high traffic events throughout the year to reach a wide-ranging demographic of the Company's customers. Events include professional and regional sports games, county fairs, arts and cultural festivals and a variety of other community events.

Budgets

The product budgets were developed through identification of customer segments, costs to produce materials, and event and sponsorship costs. The participation forecasts were established through targeted outreach to customer segments and use of multiple channels for delivery of energy efficiency messaging. Budgets reflect the expansive reach and impact of digital media and sponsorships—with the Company's premier partnerships and community partnerships yielding direct product participation leads.

The main budget drivers include the following:

- Administration – This category represents the labor needed for product planning and implementation.
- Advertising and Promotion – This budget includes funds for printed materials, community outreach events, sponsorships, and digital advertising.

C. Application Process

This product does not include an application process.

D. Marketing Objectives & Strategies

The primary objective of the Consumer Education product is to heighten residential customers' awareness about energy efficiency and conservation and empower them to proactively take steps to reduce their energy consumption. The Consumer Education product drives awareness and education to the Company's direct impact products with the intention of increasing product signups to support the energy efficiency portfolio.

Our strategy will continue to utilize a wide variety of communications channels including social media, print and event outreach. The product will use engaging event activations to provide information and resources that help residential customers reduce their energy usage at home. The common theme, in messaging, will convey the importance of everyone's role in becoming more energy efficient.

E. Product-Specific Policies

This product has no specific policies.

F. Stakeholder Involvement

The Company will create and leverage strategic partnerships and alliances with governmental, non-governmental, and trade partners to reach residential customers in Colorado.

G. Rebates & Incentives

This product does not offer customer rebates.

➤ Energy Benchmarking

A. Description

Energy Benchmarking of commercial and multi-family buildings is an established and growing trend in the energy efficiency sector. Through the City of Denver’s City Energy Project and several local efforts, building owners in Colorado are especially engaged in the practice, which allows building owners, policy makers, and product administrators to more effectively target buildings with the highest energy efficiency potential by identifying those properties that are performing below a portfolio average, or benchmark. According to the DOE:

Energy benchmarking is a standardized process of measuring building energy efficiency. Benchmarking helps building owners identify cost-effective energy upgrades, realize the energy and cost savings benefits from those upgrades, document the savings achieved, and communicate these accomplishments to stakeholders. A 2012 study found that energy performance benchmarking prompted energy efficiency investments through improved energy management processes (62% of those who participated in a benchmarking product) or building upgrades and behavioral efficiency projects (84% of benchmarking participants).

To date, more than a quarter-million buildings representing almost 30 billion square feet have been benchmarked. This number continues to grow thanks to multiple drivers, including the private sector adoption of benchmarking, state and local voluntary benchmarking initiatives, utility energy efficiency products incorporating benchmarking, and state and local legislation requiring that buildings be benchmarked and that the results be disclosed to the public.

As more building owners begin benchmarking, these building owners seek streamlined, consistent processes for obtaining whole building energy usage data. Building owners and managers want easy, automated ways to get utility data into their benchmarking software. In addition, many owners of multi-tenant commercial buildings and multifamily buildings cannot access energy consumption data for their entire building due to separately metered tenant spaces.⁶²

In response to this need, the Company offers an Energy Benchmarking product which includes Community Energy Reports.

Energy Benchmarking

The Company participated in a DOE effort under the Better Buildings Initiative titled the Energy Data Accelerator⁶³ which is designed to bring utilities and municipal leaders together to “demonstrate streamlined, best-practice approaches for building owners to access whole-building energy usage data—with a specific focus on providing building owners with aggregated energy

⁶²Factsheet associated with the Company’s participation in the DOE Energy Data Accelerator

⁶³For more information, visit <http://www1.eere.energy.gov/buildings/betterbuildings/accelerators/energy.html>

usage information across multiple tenants.” The Company learned valuable insights from both its municipal partners, as well as from DOE Facilitators and Utility collaborators across the country. The design implemented by the Company is a product of these accumulated insights and is representative of best practices identified through this effort.

Key features of the Energy Benchmarking product include Building Owner Authorization, Tenant Identification, Data Privacy Rule Implementation, Consumption Data Aggregation and Normalization, and Automated Data Transfer to the ENERGY STAR® Portfolio Manager (“ESPM”). Each of these elements is discussed in more detail below.

Building owner authorization

Upon registration to an online portal, building owners or their contracted agents will be verified using publicly available records as well as information available within the Company’s Customer Information System.

Tenant Identification

Using the property address, the Company will return a list of tenants (premises) that appear to be associated with the building. If verified as accurate by the building owner, this list will be used to permanently associate those premises to the property in the Company’s Customer Information Systems.

Data Privacy Rule Implementation

The system is designed to implement thresholds based on either the tenant count, individual tenant usage percentage, or both, as is currently the cast under Commission Rule 3034⁶⁴. No energy data will be shared with the building owner until these rules have been satisfied.

Consumption Data Aggregation and Normalization

Acknowledging that most building owners seek whole-building aggregate data, the company will automatically combine data across meter readings and normalize those readings to a common calendar month cycle. Building owners will also have the ability to request data for individual tenants, or sub-sets of tenants as desired; however, these requests will be subject to aggregation methodologies outlined in Commission Rule 3034 and will be more likely to require individual tenant consent.

Automated Data Transfer to ENERGY STAR® Portfolio Manager

The service relies upon ESPM to standardize the transfer of energy data from the company’s systems. This decision was made primarily from the fact that ESPM is well-established as the industry standard tool to perform energy benchmarking, and that this standard further allows a consistent, free, robust option for building owners to gain valuable information about their buildings.

Community Energy Reports

The Community Energy Reports product produces publicly available city, county, and state level energy consumption, CO2 emission, and renewable program participation data on an annual basis. Cities with a census population of 50,000 or more and counties with a population of 100,000 or

⁶⁴<https://puc.colorado.gov/electricrules>

more are automatically enrolled in the product. Cities or counties not automatically enrolled can request to be enrolled at www.xcelenergy.com/community_energy_reports.

The product's reports comprise of the following sections.

- Utility System Characteristics
 - CO2 per MWh and CO2 per Therm
 - Resource mix by generation type
- Energy Consumption Data
 - Broken down by commercial, industrial, residential, and street lighting
 - Number of Customers
 - kWh Consumption
 - Therms Consumption
 - Carbon Emissions
 - Revenues Billed
- Programmatic Data
 - Broken down by residential and business community and state level
 - Windsource
 - On-site Solar (Solar*Rewards)
 - On-site Solar (non-Solar*Rewards)
 - Solar Gardens (PV)
 - Energy Conservation
 - Load Management (Demand Response)
 - Demand-Side Management

B. Forecasts, Participants & Budgets

Forecasts and Participants

The Energy Benchmarking product does not have any specific participation, energy, or demand savings forecasts because this product does not measure direct savings. The Company plans to promote this offering to building owners in the Commercial and Multi-Family sectors. The Company will coordinate with local stakeholders to ensure training materials and Energy Efficiency product offerings are communicated to building owners as they complete the task of Benchmarking. Building owners subject to local Benchmarking ordinances make up a majority of product participants.

Budgets

The budget was derived from historical costs as well as future building count estimates from new or expanded benchmarking ordinances. It is used to support marketing, promotion, and the administrative activities required to facilitate building owners in setting up data transfer as well as interpreting and using the results to identify cost-effective energy-saving measures.

C. Application Process

Any building owner or contracted agent of the building owner is eligible for participation in the product. Users will register via the Company's web portal and be granted access to property-specific information once their status has been verified.

D. Marketing Objectives & Strategies

The Company will employ a variety of strategies to promote the product. Many municipalities and corporations encourage the practice of energy benchmarking to their constituents. The Company plans to work closely with these entities to ensure appropriate training and promotional materials are shared. More broadly, the Company will market the product via its public website and through participants or interested participants in its existing Energy Efficiency products. Through the practice of Benchmarking, the Company plans to promote its existing Commercial and Multi-Family building products.

E. Product-Specific Policies

The product will follow the regulations identified in Commission Rule 3034.

F. Stakeholder Involvement

Throughout development of the product as well as during the formal hearing process, which resulted in Commission Rule 3034, the Company solicited and received input to inform the design of the system.

The Company continues to engage with customers and municipal implementers to continuously improve the capabilities and performance of the product.

G. Rebates & Incentives

As an indirect impact product, no rebates are proposed. Rebates for projects resulting from the product will be delivered through the established direct impact products.

➤ Energy Efficiency Financing

A. Description

Energy Efficiency Financing is an indirect impact product offering aimed at increasing the availability of financing to overcome economic barriers to customer participation in the Company's other energy efficiency products. As an indirect impact product, no direct attributable energy or demand savings are recorded, but the product plays an important role in shifting markets and attitudes toward greater energy efficiency implementation.

The Energy Efficiency Financing product encourages residential and commercial customers to participate in existing direct impact rebate products by making sure financing options are available to reduce monetary barriers. The Company facilitates the financing of these projects through partnerships with Elevations Credit, CEO, and the National Energy Improvement Fund ("NEIF"). The Company is not presently providing capital or servicing loans in connection with this product.

Through our partnerships we focus on assistance in marketing to drive financing options and project identification. These partners appreciate the fact that the Company is offering a competing loan product, but is also enhancing the existing marketplace by driving business to these partners for financing energy efficiency projects.

The Company will actively market selected loan products to targeted customer segments, including leveraging lender relationships, using the following channels:

- Contractor Training at workshops and *via* webinars;
- Direct Outreach and Marketing;
- Web Links including on-line financing portals for trade partners;
- Rebate Integration into existing Xcel Energy provided studies and audits; and,
- Loan Customer Case Studies.

The Company has identified loan products that best match the financing needs of customers, including:

1. Residential Loans – Products like the Colorado RENU Loan are appropriate for short-term, reactive needs as well as long-term, proactive investments. Participants in the Whole Home Efficiency, Insulation and Air Sealing, or Residential Cooling and Heating products would be ideal for this product.
2. Business Loans or Leases – This type of financing requires a quick turnaround from the lender. Having the loan or lease available may drive the customer to make the improvement immediately. Participants in the Business HVAC+R Systems, Lighting Efficiency or Small Business Solutions products could be interested in this type of loan or lease.

3. Colorado Property Assessed Clean Energy (“C-PACE”™) - C-PACE enables owners of eligible commercial and industrial buildings to finance up to 100% of energy efficiency, renewable energy and water conservation eligible improvements. Financing is provided by private capital providers at competitive rates with repayment terms up to 20 years. This product is one of the offerings through NEIF within our commercial loan program.

B. Forecasts, Participants & Budgets

Forecasts and Participants

The primary goal of this product is to drive incremental participation in existing direct impact energy efficiency products that include:

- Business Products:
 - Business HVAC+R Systems
 - Custom Efficiency
 - Lighting Efficiency
 - Recommendations from various study / audit products
- Residential Products:
 - Whole Home Efficiency
 - Insulation and Air Sealing
 - Residential Heating and Cooling
 - Recommendations from Home Energy Audits

Budgets

Public Service’s 2023 budgets for this product were determined through estimates of outside vendor expenses, product design, software licensing & development, customer promotions, labor, and past activities in Colorado.

C. Application Process

Customers are made aware of financing options at the same time they become aware of rebates. Awareness may be driven by Account Managers, the BSC, trade partners, external customer assistance programs, and/or marketing efforts including mailings, newsletters, and the Company’s website.

Residential customers will be directed to one or more lending allies suited to their needs. Loan applications will be completed by the customer and submitted directly to the participating lender. Billing and payment processing will also be between the customer and the participating lender without the Company’s involvement.

Commercial trade partners use our website to request a no cost, no obligation financing proposal which they can include in their customer proposal/bid. Proposals include multiple financing options, including cash flow positive resulting in a monthly loan payment, which is less than the total energy savings for their project.

D. Marketing Objectives & Strategies

The product's marketing objective is to identify customers that want to implement more energy efficiency but require financial assistance, linking those customers with the most appropriate rebates and loan products.

Direct and indirect marketing strategies will be employed. Direct marketing will be done in partnership with the Product Managers of the targeted direct impact products. Indirect Marketing involves broad communication that spans multiple (or all) direct impact products. The best example is trade partner training and education. Understanding that many customers interact primarily or exclusively with a trade partner, the Company will ensure that interested trade allies are armed with the knowledge, expertise, and collateral to educate customers about the best available financing option for their situation.

The Company will use the partners listed above who are knowledgeable about financial loan offerings to assist in qualifying additional lenders, as needed.

E. Product-Specific Policies

This product has no product specific policies.

F. Stakeholder Involvement

Public Service worked closely with stakeholders to develop this product. Channels for this involvement have included the following:

- *Political Engagement* – Public Service's Government Affairs group has been actively involved in liaising with legislative interests related to energy and energy efficiency.
- *Consultant Services* -- The Company has used partnerships with financial program providers to refine product specific details and will continue to do so as needed.
- *DSM/BE Roundtable Meetings* – Product updates have been presented and discussed at past quarterly DSM Roundtable Meetings. Based on stakeholder input, the Company added external Web site links to C-PACE and Colorado RENU loans to encourage their use.
- *Stakeholder working group* – The Company initiated an On Bill Financing (“OBF”) Workgroup in mid-2021 as a settlement item in its 2021-2022 DSM Biennial Plan (Proceeding No. 20A-0287EG) to evaluate the potential for an on-bill financing offering (tariffed OBF or other model). The Company will pursue a tariff-based financing offering for energy efficiency and/or beneficial electrification upgrades included in its DSM portfolio through the 2022 DSM Strategic Issues proceeding. Pending the outcome of the that proceeding, the Company intends to modify the financing product through a 60-Day Notice in 2023 or as part of a future DSM/BE Plan filing.

G. Rebates & Incentives

No customer rebates are offered through this product. Zero per cent financing and deferred payment options are available for trade partners to use and the cost is incurred by them.

H. Evaluation, Measurement, & Verification

Basic product operations will be monitored and reported regularly. Metrics reported in preparation for the quarterly DSM/BE Roundtable Meetings include loan participation and product expenditures.

➤ Home Energy Audit

A. Description

The Home Energy Audit product offers the Company's residential customers a rebate on three types of auditing services: a Standard Audit, a Standard Audit with Blower Door Test, and an Infrared Audit. The purpose of this product is to educate homeowners and renters about their homes and identify energy saving opportunities and equipment upgrades that will help them save money on their energy bills.

Standard Audit

The essential elements of the in-home Standard Audit are:

- Customer energy bill analysis
- Client assessment and education
- Shell assessment
- Mechanical and electrical equipment review
- Energy savings recommendations derived from energy modeling software

The audit includes a review and analysis of billing history since this is often an indication of what the customer may need to address first. The auditor will also discuss any concerns or questions the customer may have regarding their home's energy usage and related comfort. Once the areas of concern are identified, the auditor initiates the home inspection. This process includes a shell assessment of the exterior of the home, identifying cracks, exterior signs of air leakage or maintenance needs. The process also includes an interior evaluation with inspection of the attic or crawl space. This determines what insulation has been installed prior to the audit, and any upgrades the customer should consider. Suggested upgrades could include items such as additional insulation and sealing bypass areas.

The auditor will review the home's heating and/or air conditioning systems for efficiency ratings and discuss maintenance best practices. The auditor will also inform the customer about how to implement suggested maintenance options — like changing air filters — on a regular basis. As the audit moves through the home, they will continue to educate the customer on how they can implement energy efficiency measures. The auditor will inspect and provide information on the efficiency of their appliances, as well as on possible replacement options that are ENERGY STAR®-qualified.

Finally, the Standard Audit ends with a review of the top three to five recommendations to the homeowner and a final review of the customer's questions and concerns. The auditor will email the completed report and scope of work to the customer and email or leave behind efficiency product collateral on relevant rebate products. If appropriate technology is available, and if the Company's requirements are met, the Standard Audit may be completed in-person or remotely through video conferencing services.

Standard Audit with Blower Door Test

The Standard Audit with Blower Door Testing includes all components listed above, as well as a blower door test and a CAZ test. The blower door test will be conducted in those homes where there is no risk of asbestos or other hazardous materials becoming airborne and the CAZ test will be performed only if atmospherically vented appliances are present.

The blower door test is a diagnostic tool designed to measure the air tightness of a home and identify air leakage locations. The test includes use of a calibrated fan for measuring the airflow rate and a pressure-sensing device to measure the pressure created by the fan's airflow. The combination of this pressure and the fan's airflow measurements are used to determine a home's air tightness. Before the test is performed, customers must go through their home closing and locking all exterior windows. Once the fan is turned on, a vacuum effect is created, and customers can then check windows and interior bypasses by holding up their hands and feeling the airflow created. Because this test provides such a visual image for customers, they are often motivated to address air sealing opportunities they may have overlooked prior to the testing. This tool can also identify potential venting issues around a home's heating system.

If appropriate technology is available, and if the Company's requirements are met, the Standard Audit portion of this service may be completed remotely through video conferencing services, with the Blower Door and CAZ testing done in-person at the customer's home.

Infrared Audit

The Infrared Audit includes all Standard Audit with Blower Door Test components as well as an infrared scan. The infrared scan evaluates internal structures such as drywall and insulation, and determines temperature differences where insulation is present, missing, or not working effectively. Blower door testing is also a mandatory part the Infrared Audit. Benefits of infrared testing include: identifying insulation needs, air leakage paths within walls, attics, windows and doors; it also provides a quality check on existing insulation. Infrared testing, along with the required blower door test, gives customers a visual understanding and detailed list of structural conservation improvements available to them through non-invasive testing — thus identifying additional savings potential. The Infrared Audit rebate will be available to natural gas customers and to electric-only customers with electrically-heated homes. Electric-only customers with gas provided by another utility for heating or customers who use propane as a heat source are not eligible for the Infrared Audit rebate because it is primarily used as an inspection to detect where the home is losing heat. As with the Standard Audit, customers receive a cash rebate from the Company and pay the auditor directly.

If appropriate technology is available, and if the Company's requirements are met, the Standard Audit portion of this service may be completed remotely through video conferencing services, with the Blower Door and CAZ testing done in-person at the customer's home.

The Company uses the Home Energy Audit product to support and drive participation in the Whole Home Efficiency product. Customers must begin the Whole Home Efficiency process with a home audit to identify areas for improvement and to educate them as to whether or not their house is a good candidate for participation. If they are a good candidate, customers may sign up

for the Whole Home Efficiency product through their auditor. The audit also assists in developing a scope of work for their project and encourages completion of the recommended improvements.

B. Forecasts, Participants & Budgets

Forecasts and Participants

The Home Energy Audit product includes a participant forecast, but no energy or demand savings forecasts because this product does not measure direct savings.

Budgets

The Home Energy Audit budget was developed based upon the desired participation level, associated product software, and administration costs. Using the product's previous years' performance and marketing needs as a proxy, the cost of the rebate, product collateral, and all necessary marketing efforts are included.

C. Application Process

The customer will contact the third-party implementer and speak with an Energy Advisor or visit the Company's website⁶⁵ to find a qualified and participating auditor. The customer contacts the auditor to schedule the appointment. Once the audit is complete and the customer has received the audit report, the customer or the auditor submits the rebate paperwork to the Company with proof of purchase. A rebate takes at least six to eight weeks to process once the application is received. Customers are limited to one audit per two-year period, unless they move to a new address.

The customer may also choose to schedule their audit in tandem with a visit from the Home Energy Squad, which can be scheduled through the third-party implementer at the customer's request.

D. Marketing Objectives & Strategies

This product will be marketed primarily through seasonal bill inserts, social media, trade partners, media relations, and bundled residential campaigns. Further, the Company will market this product through general customer inquiries regarding their energy bill and cross-marketing efforts with other Company residential energy efficiency products, especially the Home Energy Squad product. In addition, the Company will identify "green event" opportunities within the community and provide product collateral. Product activity will be monitored monthly to quickly implement the above strategies, if warranted.

The Company will offer customers Energy Advising as additional support toward completing retrofits. The purpose of the advising is to encourage customers to complete and implement findings within their Home Energy Audit reports, regardless of the product they participate in (e.g., Whole Home Efficiency, Saver's Switch, Refrigerator & Freezer Recycling, etc.). The Energy Advising service has achieved a consistent 50% conversion rate in helping homeowners make

⁶⁵http://www.xcelenergy.com/Save_Money_&_Energy/Residential/Energy_Audits/Home_Energy_Audit_-_CO

upgrades and homeowners rate this service very highly. By necessity, the Energy Advising service provides rebate assistance to Standalone as well as Whole Home Efficiency rebates.

E. Product-Specific Policies

To qualify for the product, participants must be residential customers living in the Company's Colorado service territory. Infrared Audit customers must be residential customers that receive natural gas service or electric service with electric heat from the Company to qualify for participation. Qualifying customers may receive an audit rebate once every two years.

Participating trade partner companies must have a technician on staff with a minimum of a BPI or certification and training/in-field experience to provide audit services for this product. All auditors are also required to attend product training, which includes training on the product modeling software. There will be a \$150 per auditor membership fee which is allocated to costs associated with software and quality assurance provided by the third-party; this one-time fee will be paid directly to the software vendor. An auditor's certification may not be used by another trade partner company to meet the product requirements. All registered contractor companies must also be listed on the Company's trade partner website.⁶⁶ These contractors have agreed to the terms of the Company's trade partner agreement and meet the requirements related to quality installation practices per BPI.

Auditors will be required to utilize the scope of work tool within the software to deliver actionable recommendations to the customer. This is a critical part of the product as the third-party administrator will be tracking the conversion rate of audit-to-improvements. To maintain consistency, training, audit quality, and overall quality assurance between the auditors, the Company will require auditors to use a specific energy modeling software package.

The Company is looking into ways to provide a more comprehensive experience for our residential customers that simplifies the process of installing capital intensive energy efficient equipment. This may include an end-to-end solution where the customer chooses from any, or all, of the following as applicable:

- Advice and analysis of the available equipment options
- Financing
- Enrollment in Demand Management products
- Assistance with choosing qualified contractors
- Enrollment in green programs and/or warranty services

F. Stakeholder Involvement

The Company collaborates with trade allies such as the EEBC, CEO, other utilities, local communities, and contractors. The Company also provides updates to interested parties at the quarterly DSM/BE Roundtable Meetings.

⁶⁶ www.xcelenergy.com/cotrades

G. Rebates & Incentives

To simplify product participation for homeowners, the Company offers the following audit rebate schedule:

Audit type	% of cost
Infrared Audit	60% up to \$200 rebate
Blower Door Audit	60% up to \$160 rebate
Standard Audit	60% up to \$100 rebate

*Rebate amounts determined by the average audit cost for the Colorado market.

The Company understands the actual price for an in-home audit will vary based on the location and complexity of the residence, but the purpose of this product is to provide customers with a straight-forward process to improve their knowledge on energy efficiency and options they have within their home.

➤ Partners in Energy

A. Description

Partners in Energy is an indirect product that provides community leaders and stakeholders the opportunity to jointly develop and implement energy conservation, demand management, electrification, and renewable energy goals that are community specific and integrates them into action plans that incorporate strategies that target municipal sites, commercial & industrial facilities and homes within the community's boundaries. The Company works with a third-party consultant who provides tools and resources to enable community-driven energy planning and implementation that influences market transformation and drives participation in our direct impact products.

The Partners in Energy product team works with each community stakeholder team to develop an individualized plan to engage municipal, commercial and residential constituents in energy-related activities, and to help identify project funding via rebates, financing and other sources.

Delivery of Partners in Energy to participating communities includes:

1. Establishing a baseline of community-specific energy information including Company-provided municipal, commercial, industrial and residential data and decision-making tools to:
 - a. Profile existing energy use and historic product participation;
 - b. Benchmark against other communities;
 - c. Set goals;
 - d. Identify and prioritize opportunities; and
 - e. Forecast potential product participation, energy savings, and GHG reductions to the community.
2. Facilitating stakeholder workshops to:
 - a. Help community workgroups identify and develop short- and long-term energy reduction targets;
 - b. Prioritize energy conservation activities – for example, best return-on-investments first; and
 - c. Identify target markets within the community and potential outreach channels to engage each market.
3. Supporting the communities through development of the plan document, building consensus and obtaining approval from community stakeholders and leaders and implementation of energy-related initiatives.
4. Providing plan implementation support through joint marketing, project management, subject matter expertise, and organized education and networking opportunities with other product participants.
5. Measuring, tracking and reporting results to the community workgroups and facilitating communications to the community's key constituents.

With the installation of smart meters and the transition to the TOU rate in Colorado, the Company will work with the third-party consultant on educational efforts regarding the smart meter, new

rate, and how customers can save money by shifting electricity use to off-peak hours when rates are the lowest.

B. Forecasts, Participants & Budgets

Forecasts and Participants

The Company will target up to three new participating Partners in Energy communities, for a total of six annually, in a twice-per-year application process. In the 2023 DSM & BE Plan year, the Company will onboard and commence the planning phase of Partners in Energy for new communities as well as follow through with plan implementation for the various cohorts of Partners in Energy communities who began the process in prior years.

The product's target market consists of communities that have not initiated a comprehensive energy planning process or those who have stalled in their past planning and implementation efforts – both groups can benefit from the structured and facilitated Partners in Energy process. An additional market has emerged in those communities that previously participated in Partners in Energy and now want to expand or update their work to reach their energy goals.

Budgets

The product's budget is primarily administration and product delivery – community facilitation, planning, implementation, measurement and reporting including third-party consulting services – with a smaller proportion dedicated to customer education and promotion. Some Partners in Energy projects may involve higher rebate and incentive levels on a promotional basis to drive targeted, increased energy efficiency participation. The 2023 budget is determined based on the number of communities participating and the level of time, effort and resources necessary to deliver the product to new communities as well as follow through with the implementation phase of previous cohorts.

C. Application Process

Community leaders interested in working with Partners in Energy must submit an application detailing:

1. Community profile;
 - a. Population, counts of businesses and homes
 - b. Geographic boundaries and area
2. Utility providers including the Company and others, if applicable;
3. Energy-related issues facing the community (*e.g.* population growth, aging housing stock or infrastructure);
4. Community approvals needed to begin the planning process (examples: City Council, economic development, City departments or committees);
5. Past or current-active energy action plans, initiatives or policies;
6. Community resources, including paid staff, who would be involved in energy initiatives and could act as the main point person during the planning and implementation phases; and
7. Other potential community representatives such as city or town staff members, local businesses, non-profits, schools, government officials and citizens.

D. Marketing Objectives & Strategies

The product's primary marketing objective is to drive increased levels of DSM/BE participation, energy savings, demand reduction, societal benefits and market transformation through community-driven energy planning and implementation.

Once the Partners in Energy communities are established through a twice-per-year application process, marketing efforts including personalized municipal and business customer outreach, residential mailings, email, social media outreach and community events designed to raise awareness of and participation in DSM/BE offerings.

Past Partners in Energy community workgroups have identified opportunities to partner with a community's existing communication channels and planned events to get the word out about rebates, studies and other services available to municipal, business and residential customers.

Marketing approaches that have been effective are:

1. Presentations to local business development organizations, trade groups, chambers of commerce or other networking opportunities;
2. Incorporating Partners in Energy goals, available rebates & incentives and timing in community newsletters and news releases to increase awareness and interest;
3. Including product messaging in the community's existing social media networks, outreach and forums;
4. Personalized direct mailings and email campaigns to increase DSM/BE awareness and participation;
5. In-person tabling events, demonstrations, giveaways and special offers coordinated with the community's calendar of events and meetings;
6. Developing local business recognition for increased DSM/BE participation; and,
7. Facilitating conference calls and online forums for participating Partners in Energy communities to exchange useful information and share best practices.

E. Product-Specific Policies

Partners in Energy does not have any specific policies.

F. Stakeholder Involvement

Current and potential communities participating in Partners in Energy choose their key decision makers to give input and help facilitate energy planning and implementation. Examples of key decision makers and key community points of contact include:

1. Economic Development & Business Services;
2. Representatives of large local businesses and employers;
3. Community Development;
4. Public Works;
5. City Manager's or Mayor's office;

6. Representatives from equity based non-profits or social service organizations;
7. Interested and engaged citizens; and
8. Community members of boards & commissions.

G. Rebates & Incentives

Generally, rebates and incentives for the product's participating communities are paid by the Business, Residential and/or IQ products that are targeted for increased participation via Partners in Energy's planning and implementation process. Some community-targeted projects may involve higher rebate and incentive levels on a promotional basis to drive targeted, increased DSM/BE participation.

➤ Evaluation, Measurement, & Verification

A. Description

The Company's EM&V plan was developed to evaluate, measure, and verify direct savings for electric and natural gas DSM/BE products. The Company's EM&V approach is separated into performance year and post-performance year activities. Performance year activities are conducted during the reporting year, as products are in operation, and may include rebate application validation, field inspections, on-site or remote verification of equipment installation, and engineering calculation review. Post-performance year activities include verified savings calculation and reporting; comprehensive product evaluations; and portfolio-wide technical assumption evaluations. Section I of this document describes our performance year EM&V activities in greater detail. Section II of this document describes our post-performance year EM&V activities further. [Table 16](#) at the end of the EM&V Plan summarizes each product's planned EM&V. The Company will report any modifications to this EM&V plan in a 60-Day Notice posted to the Xcel Energy website. Notifications of new DSM/BE products (or pilots that will claim savings), launched via 60-Day Notice, will include a detailed EM&V process consistent with the approach described herein.

Section I – Performance Year M&V

M&V is conducted on an ongoing basis on measures implemented throughout the product performance year. These ongoing M&V activities ensure that rebate application forms contain complete and correct information, the specified equipment is installed, and the claimed energy savings are accurate. These performance year activities include:

Rebate Application Validation

This validation procedure applies to residential and business products (electric and gas) offered in Colorado. The procedure is comprised of the following two steps, both performed by Rebate Operations:

Step 1: Front-End Validation – Rebate Operations reviews prescriptive business and residential product rebate applications and vendor invoices, including those for indirect impact products. They check the customer information, equipment eligibility, and proper rebate amounts. If information is missing or incorrect, the Rebate Operations Specialist communicates with the account representative, customer or trade partner to resolve the discrepancy. For custom products, engineering staff reviews the project documentation to verify customer information, equipment eligibility, and proper rebate amounts, and delivers final numbers to Rebate Operations.

Step 2: Daily Audit – Rebate Operations audits business and residential applications to verify the information was correctly entered. This is the final review prior to issuing the rebate. If errors or issues are found, they are corrected. The daily audit report is re-run after the problems are corrected and filed for permanent storage.

Ongoing M&V of Savings

Ongoing M&V of savings differs between prescriptive products, custom products, upstream/midstream approaches, behavioral change and pilots. The following sections describe the general M&V methods that will be used for each. (In addition, products having characteristics requiring unique M&V approaches are detailed below).

1. Prescriptive DSM Product M&V

For direct impact prescriptive products, the Company contracts with third-party verification contractors (“VCs”) and third-party implementers to perform M&V. VCs will use remote or onsite verification information gathered between November 1 and October 31 to verify energy efficiency measure installation rates for each calendar year (reported in the Annual DSM/BE Status Reports). Using an offset calendar will allow the VC to provide the required information in sufficient time for it to be incorporated into the Annual DSM/BE Status Report each year.

Prescriptive products use stipulated or deemed technical assumptions assigned to each measure in order to calculate energy and demand savings. The VCs will follow a deemed savings approach when conducting verification activities for prescriptive products, where the primary goal of M&V is to use field or remote inspections to sample projects to determine that the measures are properly installed and have the potential to generate savings. This approach corresponds to the basic rigor method outlined in the International Performance Measurement and Verification Protocol (“IPMVP”) – *Option A: Retrofit Isolation: Key Parameter Measurement*.

Information gathered at customer sites or remotely will vary based on the product and sector but will generally confirm that the installed equipment matches equipment listed on rebate application. For example, as applicable, the VC may confirm the manufacturer, model number, efficiency rating, equipment size, capacity or output, application of measure (e.g. motors that run fans versus pumps, versus other mechanical systems), business sector (e.g. restaurant versus college, versus office building), quantity (e.g. number of light bulbs), or any concerns regarding the operation of the fixtures or deviations from the customer application.

For most prescriptive products, the VC will select a statistically valid number of projects to verify through field inspections or phone surveys. The sample size is designed to achieve accuracy levels of between 10% and 20% given a confidence level of 90% around the “realization rate,” and is weighted to select larger projects. The number of randomly selected participants in the sample may increase or decrease during the year in order to ensure that the realization rate accuracy exceeds the accuracy goal for the product. Sampling bias will be reduced using a random selection of sample points. Rebate forms notify all customers that their respective premises and measures are subject to verification inspections.

The “realization rate” for a project is the ratio of the verified savings to the savings reported on the rebate application. The realization rate for the measure type is the ratio of total verified savings to the total rebate reported savings. The realization rate is applied to gross savings to determine gross product impacts. The net-to-gross (“NTG”) factor is then applied to the verified gross savings to yield net product impacts. The following products, or prescriptive components of these products, adhere to the prescriptive M&V process:⁶⁷

⁶⁷These products may have both prescriptive and custom components, in which case they will be subject to both prescriptive and custom M&V.

Business Products

- Business HVAC+R Systems
- Compressed Air Efficiency
- Data Center Efficiency
- Lighting Efficiency
- Small Business Solutions

Residential Products

- Insulation & Air Sealing
- Residential Heating and Cooling

The general M&V process for the following prescriptive products, or prescriptive components of products, is outlined below.

1(a). General Prescriptive DSM & BE Project M&V Process

General prescriptive M&V includes validation of individual rebate applications as well as ongoing M&V.

Rebate Application Validation

1. Customer submits rebate application and required documentation to Public Service after measure is installed.
2. Rebate Operations reviews the business and residential product rebate application and associated vendor invoices, checking the customer information, equipment eligibility and proper rebate amounts. If information is missing or incorrect, the application is sent back to the account representative or customer to make changes.
3. If the project qualifies for rebate, Rebate Operations enters rebate application data into Salesforce (customer relationship management system) and authorizes rebate payment. Prior to authorizing rebates, all applications are verified in a daily audit.

Ongoing M&V

4. Public Service will send the VC a list of projects completed to-date on an agreed to schedule.
5. The VC will select a statistically valid sample of projects to inspect, weighted towards the larger projects. The sample size is designed to achieve 90% confidence with 10-20% precision.
6. The VC will contact each customer to schedule the inspection or complete the phone survey.
7. The VC will visit or remotely contact each customer site and verify the savings factors or checkpoints for that measure.
8. The VC will use the verified savings factors to calculate the project's verified energy savings and realization rate ("RR"), which is calculated by dividing the recalculated or verified savings by the reported or rebated savings. At 1.0 or 100%, the verified and rebated savings are equal.
9. The VC will calculate the product's RR, which is the sum of all verified savings divided by the sum of all rebated savings for all projects in the product sample. The product's RR is applied to the rebate application savings captured in Salesforce to determine gross verified savings.
10. NTG factors are applied to the gross verified savings to determine net savings.

1(b). Exceptions to the Prescriptive Product M&V Process

Certain prescriptive products have special design elements that require verification processes unique to those particular products. The following products, or components of these products, require exceptions to the prescriptive M&V process:⁶⁸

Business Products

- Data Center Efficiency
- Multifamily Buildings
- Strategic Energy Management

Residential Products

- Energy Efficient Showerhead
- ENERGY STAR New Homes
- Home Energy Squad
- Home Performance with ENERGY STAR
- Refrigerator & Freezer Recycling
- Residential Heating and Cooling (high efficiency air conditioning component)
- School Education Kits

Low-Income Products

- Energy Savings Kits
- Multifamily Weatherization
- Non-Profit
- Single-Family Weatherization

The unique M&V processes for these products are described below:

Data Center Efficiency

For verification of the High Efficiency CRAC units measure installation, the VC will maintain a log of any refusals for site entry for M&V and will subsequently seek out and document verbal confirmation of installation from the customer and/or installer.

Energy Efficient Showerhead

The third-party implementer will report on the quantity of showerheads distributed. Xcel Energy will utilize the third-party survey platform or another independently contracted company to survey customers for the purpose of determining the installation rate of each kit component.

ENERGY STAR New Homes

The ENERGY STAR New Homes product utilizes the HERS raters' report outputs as the basis for product M&V. The third-party implementer conducts Quality Assurance/Quality Control ("QA/QC") of the HERS raters' results. Each project is verified by a HERS rater and the third-party product implementer prior to issuing a rebate to the builder using the following process:

1. Builder contacts HERS rater to express interest in building an energy efficient home and participating in the ENERGY STAR New Homes product.

⁶⁸These products may have both prescriptive and custom components, in which case they will be subject to both prescriptive and custom M&V.

2. HERS rater works with builder to construct the home to meet or exceed the ENERGY STAR New Homes product requirements. The HERS rater visits the home during construction to inspect the building method used and the equipment installed.
3. Once the home is completed, the HERS rater performs a blower door test on the house and then calculates the final HERS Index. The HERS rater models the home by entering the individual home characteristics into the RESNET accredited REM/Rate modeling software or a RESNET accredited modeling software approved by the Company. When the rating of the home is completed, the REM/Rate files for the modeled house are submitted to the rater's HERS provider. RESNET sets forth the role of the provider, provides accreditation and requires that HERS providers perform quality assurance on 10% of each rater's building files and fully replicate 1% of the home ratings annually. The HERS provider performing the QA must not be the same individual that rated the home.
4. The rater submits the specific REM/Rate reports and the final HERS Index to the Company's third-party product implementer, at which point the implementer performs QA/QC. The builder's rebate is calculated based on the percent by which the new home exceeds the local building jurisdictions energy code requirements, which has a direct correlation to gas and electric savings. There is no rebate application for this product. The rater, acting on behalf of their builder client, submits the required REM/Rate files, reports and other supporting information to the third-party product implementer. The submitted data is used to determine each individual home's rebate amount. The third-party product implementer ensures that all the information entered by the HERS rater into their database system is correctly entered and tracked. The third-party product implementer then enters the required information into Salesforce, including the key REM/Rate output data. The REM/Rate data is used by the Company to calculate the energy savings achieved for each home.
5. Public Service tracks and stores key parameters in Salesforce such as the home address, square footage, builder name and address, HERS Index, blower door test score, gas and electric energy saved, date completed, and rebate amount paid to the builder. Additional data for each home such as a photograph of the installed gas meter and the submitted REM/Rate files are retained by the third-party implementer.

Home Energy Squad

The third-party implementer will verify and report implemented measures (and baseline equipment being replaced, where applicable) to the Company. The Company will track this information in Salesforce. Due to the direct installation nature of this product, the realization and installation rates are set at 100%.

Home Performance with ENERGY STAR

The Home Performance with ENERGY STAR product is designed to take a whole house approach to improving the energy efficiency of existing single-family homes. Contractors will have their first five completed projects inspected and then 10% of their completed projects thereafter. The M&V process for Home Performance with ENERGY STAR is as follows:

1. Customer receives a Home Energy Audit with blower door test.
2. Customer submits product application form.

3. Within one year of enrollment in the product, the customer installs the required measures. As required depending on the number of the projects completed by the contractor, the contractor schedules a final verification inspection with our selected third-party implementer.
4. During the verification inspection, the VC performs a blower door test and a CAZ test and verifies that the homeowner has performed all of their planned energy efficiency improvements. If the contractor tests out of this requirement (for their first five projects), a random inspection of 10% of projects completed thereafter will be conducted by the third-party implementer.
5. When the inspection is completed, the third-party implementer and/or contractor submit a rebate form to the Company, along with copies of invoices for all of the completed improvements.

Multifamily Buildings

The third-party implementer of the Multifamily Buildings product will report the number of direct installation measures completed to the Company. This information will be entered and tracked in Salesforce.

Refrigerator and Freezer Recycling

The Refrigerator & Freezer Recycling third-party implementer will send monthly reports to Public Service of all customers who participated in the product. The VC will conduct phone surveys to verify removal of each unit and that the refrigerator/freezer was operable at time of removal.

Residential Heating and Cooling (high efficiency air conditioning measures)

The air conditioning measures have three energy saving components that are calculated and rebated separately, including:

- New Equipment – Purchase of high efficiency equipment.
- Quality Installation – The proper installation of new standard or high efficiency residential air-conditioning equipment.
- Trade-Ins – Replacement of low efficiency units with high efficiency units.

The M&V process for the New Equipment and trade-in components will follow the standard prescriptive product M&V process above.

The Quality Installation component requires slight deviations from the standard prescriptive process. To verify a quality installation, the VC will verify that a Public Service-approved load calculation was performed, that the unit is sized properly, and that refrigeration charge, airflow, and duct leakage are within acceptable ranges. Each component of the savings calculation for Quality Installation will be verified independently. The process includes the following steps:

1. Public Service will send the VC a list of projects completed to-date on an agreed to schedule.
2. The VC will select a statistically valid sample of projects to inspect. The sample size is designed to achieve 90% confidence with 10-20% precision.
3. The VC will contact each customer to schedule the inspection.

4. The VC will verify that a Company-approved load calculation was used to size the equipment.
5. The VC will visit the customer site and test the loaded, equilibrium performance of installed air conditioning equipment for proper refrigerant charge and air flows.
6. The VC will verify duct sealing by observation of sealing mastic or other ACCA-approved sealing means on accessible joints.
7. The VC will compare airflow, refrigerant charge, and duct leakage results to the range of values deemed acceptable for the specified equipment. If the actual values are within the acceptable range, the verified savings are considered to be 100% of the rebated values. If the actual values are outside of the acceptable range, the savings will be reduced according to the deviation from the acceptable range. Details on the savings reductions are provided in the Deemed Savings Technical Assumptions sheets within the Technical Reference Manual (see [Appendix H](#)).
8. The VC will input the verified savings factors into an M&V calculator spreadsheet to calculate the project's verified energy savings.
9. The VC will calculate the project's RR by dividing the recalculated or verified savings by the reported or rebated savings. At one or 100%, the verified and rebated savings are equal.
10. The VC then will calculate the product's RR, which is the weighted average RR of all projects in the product sample. The product's RR is applied to the rebate application savings captured in Salesforce to determine gross verified savings. For purposes of determining and applying the RR, the M&V calendar year will run from November 1 to October 30 of each product year. The realization rate determined for this 12-month period will be applied to the product values for the calendar year corresponding to the September 30th date (as described above).
11. NTG factors will be applied to the gross verified savings to determine net savings.

School Education Kits

The School Education Kits third-party implementer will send follow-up surveys to a sample of the participants to determine the equipment installation rates which are then applied to the gross savings for the calendar year.

Energy Savings Kit (IQ)

The Company will use a survey provider or other third-party partner to conduct phone and/or web surveys with a sample of participants for the purpose of determining the installation rate of each kit component.

Single-Family Weatherization (IQ)

The Single-Family Weatherization product offers standard payments to the product's third-party implementer for the installation of specific, predetermined prescriptive energy efficiency measures. Verification is built into the product design, as the third-party implementer and its subcontracted agencies actually install the measures. The specific product process, including verification, is outlined below.

1. The third-party implementer guides IQ customer to sign up for weatherization services.
2. The third-party implementer arranges for an energy auditor to visit the customer's home to identify savings opportunities.

3. The crew returns to the home within 14 days to implement the identified measures.
4. The third-party implementer submits documentation of the measures that were installed to the Company, along with a request for payment for the installed measures.
5. Public Service reviews the documentation and issues payment for the installed measures.

Multifamily Weatherization (IQ)

The Multi-Family Weatherization product offers payments to the third-party implementer for the installation of custom energy efficiency measures. Verification is built into the product design, as the contracted weatherization agency actually installs the measures. The specific product process, including verification, is outlined below.

1. IQ customer (multi-family building owner) signs up for weatherization services through the third-party implementer.
2. The third-party implementer arranges for the contracted consultant to visit the building and identify savings opportunities.
3. Consultant produces an audit report outlining savings opportunities and potential savings.
4. Public Service engineer reviews project specifications as provided by the consultant.
5. The third-party implementer arranges for the weatherization crew to install measures approved by Public Service.
6. The third-party implementer arranges for the contracted consultant to visit the building to verify measure installation and calculate final savings.
7. Contracted consultant submits completed audit report with final savings to the third-party implementer.
8. The third-party implementer submits this documentation to Public Service, along with a request for payment for the installed measures.
9. Public Service reviews the documentation and issues payment for the installed measures.

Non-Profit (Income Qualified)

The Non-Profit Energy Efficiency product provides funding for energy efficiency retrofit improvements to qualified non-profit organizations within the Company's service territory. Verification is built into the product design, as the contracted weatherization agency actually installs the measures. The specific product process, including verification, is outlined below:

1. IQ customer signs up for weatherization services through third-party implementer.
2. The third-party implementer arranges for the contracted consultant to visit the building and identify savings opportunities.
3. Consultant produces an audit report outlining savings opportunities and potential savings.
4. Public Service engineer reviews project specifications as provided by the consultant.
5. The third-party implementer arranges for the weatherization crew to install measures approved by Public Service.
6. The third-party implementer arranges for the contracted consultant to visit the building to verify measure installation and calculate final savings.
7. Contracted consultant submits completed audit report with final savings to the implementer.

8. The implementer submits this documentation to Public Service along with a request for payment for the installed measures.
9. Public Service reviews the documentation and issues payment for the installed measures.

2. Custom DSM Product M&V

Custom products use technical assumptions that are specific to each project in order to calculate the energy and demand savings. For all Custom projects, the Company's energy efficiency engineers will calculate the demand and energy savings at the pre-approval stage. Senior and managing engineers will audit the pre-approval calculations for all projects, as outlined in Step 3 of the General Custom Project M&V Process below. In addition, a random sample of all pre-approved projects will be sent to an outside engineering firm for review, as shown in Step 4 below.

All measures with anticipated savings greater than or equal to 1 GWh or 20,000 Dth require a project-level M&V plan, outlining the scope and methods of the M&V activities at the specific facility. The methods, such as pre- and post-metering, will be aligned with the appropriate IPMVP options. The duration of the metering will vary depending upon the load variability or project complexity, but typically, these projects will be metered for a minimum of two weeks pre- and post-installation. If metering is too costly or physically impossible, engineering modeling or building simulation modeling may be substituted.

Metering also may be used to verify savings of smaller projects at the discretion of the engineer. Typically, metering is performed on smaller projects with new or uncommon technologies, or where the calculated energy savings or rebate is significantly impacted by assumptions for which there is not ample supporting information at the time of pre-approval.

The general Custom project approval process is described below and applies to the following products, or certain custom components of these products:

Business Products

- Business HVAC+R Systems
- Compressed Air Efficiency
- Custom Efficiency
- Data Center Efficiency
- Energy Management Systems
- Lighting Efficiency
- Multifamily Buildings
- Small Business Solutions
- Strategic Energy Management

Low-Income Products

- Multifamily Weatherization
- Non-Profit

2(a). General Custom Project M&V Process:

The general custom project M&V process includes pre-approval, M&V onsite or remote verification, rebate approval and payment.

Pre-Approval Process:

1. Customer submits custom application describing the proposed project, purpose, and potential for energy savings.
2. A Public Service energy efficiency engineer or outside engineering firm will review the application and calculate the anticipated energy and demand savings based on the technical assumptions specific to that measure and the potential rebate. Calculations on small projects completed by Public Service energy efficiency engineers may proceed to Step 4 without review from a senior energy efficiency engineer if the engineer conducting this step has been approved by Public Service for direct sign-off for the particular type and size of project in question.
3. Public Service senior energy efficiency engineer reviews the calculations completed by external engineers.
4. Public Service randomly selects a sample of all projects to send to an outside engineering firm (if Public Service engineer performed Step 2) to review the calculations.
5. If the outside engineering firm disagrees with the Public Service engineer's analysis, they discuss the project and reach consensus on the calculations.
6. Public Service sends out a pre-approval or rejection letter stating the pre-approved demand and energy savings along with the rebate amount.

Monitoring & Site Verification:

1. If monitoring is required, a Public Service energy efficiency engineer will draft a project-specific M&V plan, which is sent out for customer review and signature.
2. If the customer does not have the appropriate meter structure, an outside engineering firm will install metering equipment and collect the pre-data as set forth in the project-specific M&V Plan and forward the data to Public Service.
3. After the designated pre-monitoring period, the customer will complete the project installation and submits all required documents.
4. Outside engineering firm collects post-installation monitoring data and sends post data to Public Service.
5. For managed accounts, the customer's account manager confirms project installation, which may include visiting the site or reviewing invoices and other project documentation. The project documentation is then submitted to Public Service.
6. For non-managed customers completing custom projects, the Company's Business Solutions Center and Program Manager will review project documentation.

Savings Reconciliation:

1. For non-metered projects, final documents are reviewed for compliance with the initial pre-approval. If the project costs or the project savings vary by greater than 10%, the project is reevaluated.
2. For metered projects, Public Service's energy efficiency engineer, or outside engineering firm, determines actual savings based on metering results. All metered projects previously reviewed only by internal engineers will be sent to an outside engineering firm for review. If the outside engineering firm disagrees with Public Service engineer's analysis, they will discuss the project and reach consensus on the calculations.

3. If the post-project kW and kWh savings and incremental cost are within 10% of the pre-approved values, values, the preapproved rebate will be paid. If the post-project quantities are not within 10% of the pre-approved values, then the rebate will be based on the post-M&V results. In all cases, the post M&V results for kW, kWh, Dth, and incremental cost will be booked for the project.

2(b). Exceptions to Custom Product M&V

The following Business products, having special design elements, are verified using processes unique to the product or component:

- Business Energy Assessments
- New Construction
- Self-Direct
- Strategic Energy Management

The M&V process for each of these products is described below:

New Construction

The New Construction product is comprised of two components: Energy Design Assistance and Energy Efficient Buildings.

The Energy Design Assistance component provides design assistance to the architects and engineers designing new buildings. Public Service contracts with a third-party product implementer to complete the energy modeling and measurement and verification. The rebate is not paid until project savings are verified. The specific product process, including verification, is outlined below.

1. Customer submits an application describing the proposed project.
2. The third-party implementer conducts an introductory meeting with the design team/customer.
3. The third-party implementer completes energy modeling to identify efficiency opportunities.
4. The third-party implementer reviews construction documents for qualifying energy efficiency measures identified through the energy model. The design team and customer are notified whether or not these measures were found within these documents.
5. The third-party implementer provides Public Service with a verification plan for each project.
6. The third-party implementer visits site or remotely verifies that specified measures were installed. Equipment and systems are monitored for a two-week timeframe, as appropriate, to evaluate performance variables against modeling assumptions.
7. For projects with individual measures that have savings greater than or equal to 1.0 GWh or 20,000 Dth per year, data logging is required for a time period of four weeks.
8. The actual results are compared to the estimated savings to determine the final rebate. If the actual results are not within 15% of the energy savings identified within the

previous model, the consultant completes an as-built model to determine final energy savings.

9. Rebate is issued to customer based on final savings.

The Energy Efficient Buildings component provides customers a review of their new construction, major renovation or additions for potential energy efficiency measure opportunities before the building is built. The specific product process, including verification, is outlined below.

1. Customer submits an application describing the proposed project.
2. Third-party implementer conducts an introductory meeting with the design team/customer.
3. Customer applies for rebates based on the energy efficiency measures they have incorporated into their design plans.
4. Third-party implementer reviews construction documents compared to application submitted.
5. Third-party implementer visits site or remotely verifies that specified measures were installed.
6. For projects with individual measures that have savings greater than or equal to 1.0 GWh or 20,000 Dth per year, data logging is required for a time period of four weeks.
7. Third-party implementer determines final savings based on data logging and verification.
8. Rebates are issued to customer based on final savings.

Business Energy Assessments (recommissioning component)

The Business Energy Assessments product identifies existing functional systems that can be “tuned up” to run as efficiently as possible through low- or no-cost improvements. The specific product process, including verification, is outlined below.

Implementation & Approval

Xcel will identify a mutually acceptable methodology for identifying and implementing low- and no-cost savings opportunities with the RFP-selected vendor(s). Vendor(s) in the closed network will follow this methodology, resulting in pre-approval of the savings.

Self-Directed Custom Efficiency

The Self-Directed Custom Efficiency product provides rebates to customers who identify, scope, and verify the energy savings for qualifying projects to offset their costs to implement energy efficiency projects. The specific product process, including verification, is outlined below.

1. Public Service pre-qualifies customers who are eligible for participation in the Self-Directed Product.
2. Once pre-qualified, a customer identifies the opportunity, then develops and submits a project application. For projects over 250,000 kWh, the customer is required to develop a project-level M&V plan and submit it with their application. Specific components of the plan will be determined by the customer and agreed upon by Public Service. At a

minimum, the plan should employ sound engineering judgment and follow standard industry practices such as the IPMVP.

3. Public Service provides confirmation of application receipt, reviews the application, and asks for additional information if necessary. Public Service notifies the customer of approval or denial of the application, expected rebate, and mutually agreed on M&V plan.
4. If the customer chooses to implement the pre-approved project, they must follow the requirements detailed in their M&V plan and conduct all necessary steps in order to verify energy savings. Any data required for pre-installation monitoring detailed in their M&V plan should be submitted to the Company and approved before the customer implements the efficiency measures. Upon acceptance of the data, the customer can then implement the measures and perform any follow-up monitoring as described in their M&V plan.
5. The customer then submits a project completion report. Public Service reviews the report, requests any additional data, and calculates the final rebate. The rebate is paid upon completion of project and Public Service’s approval of project completion report.
6. A random sample of all pre-approved projects will be selected by the Company and sent to an outside engineering firm for metering and verification.

Strategic Energy Management Custom Efficiency

The SEM product, which offers visualization and analysis of real-time energy data from across a customer’s facility to capture low-cost recommissioning opportunities as well as behavioral and operational energy savings, will use the following unique Custom M&V processes:

M&V for SEM Measures

Measure Categories	Description	M&V Protocol
New system or process automation	Measures that consist of equipment and processes whose automation capabilities don’t currently exist or are underutilized. By identifying and applying appropriate control measures, incremental energy savings can be achieved.	Follow General Custom M&V Process
Low cost / no cost recommissioning	Measures that address failure or underperformance of installed systems and equipment that can be fixed by making small adjustments, typically not requiring new equipment.	Follow the Unique Custom M&V Process used for the Business Energy Assessments product.

Systemic O&M	New system or process automation measures that consist of equipment and processes whose automation capabilities don't currently exist or are underutilized.	EIS tracking mechanisms or Process path re-measurements will be established to check the ongoing performance of the measures. Annually, the third-party implementer, with review by the Company's engineers, will analyze the data in accordance with IPMVP criteria and the Company's custom M&V process, to ensure persistence of the measure's savings. These savings will be reported annually for the duration of the customer's involvement in the SEM product.
Behavioral	Measures that require manual intervention with repeated decision-making to achieve energy savings. Behavioral measures rely on the choice of individuals to change the way they use equipment. Savings is the reduction in energy use by customer personnel that is statistically attributable to measures conducted as part of the product.	EIS tracking mechanisms or Process path re-measurements will be established to check the ongoing performance of the measures. Annually, the third-party implementer, with review by Xcel Energy engineers, will analyze the data in accordance with IPMVP criteria and the Company's custom M&V process, to ensure persistence of the measure's savings. These savings will be reported annually for the duration of the customer's involvement in SEM.

3. M&V Process for Products Delivering Upstream/Midstream Incentives

The Home Lighting & Recycling product was launched from the outset as an upstream product. Beginning in 2015, the Company started offering midstream incentives to distributors for Business Cooling and Lighting Efficiency measures. The rebate treatment (administration vs. participant incentive) and NTG are based on actual, verified participant costs and market penetration rates observed through the products. The rebate will only be recorded as a participant incentive if the verified Net Participant Costs (based on invoices) are equal to the sum of the incremental capital costs and baseline capital costs, less the rebate; otherwise the rebate will be recorded as an administration cost. M&V for these approaches will be conducted as follows:

Business HVAC+R Systems (cooling measures)

Distributors will be offered incentives in return for increasing their stock and promotion of high efficiency HVAC equipment. The NTG for this approach will be deemed within the DSM Plan and verified through periodic product evaluations. The M&V process for the midstream component of the cooling measures is as follows:

1. Participating distributors provide biweekly reports of products sold, including the manufacturer, model, number of units installed, unit serial numbers, address where equipment was installed, contact information (for the customer, contractor, or installer), and distributor invoice number and date.
2. The third-party implementer enters the information into a tracking system and submits weekly reports containing the data to be uploaded into Sales Force.
 The VC will include the midstream projects within the sample of cooling measures that receive M&V throughout the year, in order to calculate realization rates for net energy and demand savings.

Lighting Efficiency and Small Business Solutions

Within the Lighting Efficiency and Small Business Solutions products, LED lamp incentives will be offered to distributors as the Business LED Instant Rebate. The NTG for this approach will be deemed within the DSM Plan and verified through periodic third-party product evaluations. A fraction of the rebate may be treated as a Vendor Incentive (administration cost) and the remainder as a participant incentive if the fraction of Net Participant costs is greater than the sum of the incremental capital and baseline capital costs, and there is evidence that a portion of the rebate is passed on to product participants. If there is no evidence that a portion of the rebate is passed on to product participants, then the full rebate cost will be captured as an administrative cost. The M&V process for the midstream component of the Lighting Efficiency/Small Business Solutions products is as follows:

1. Participating distributors provide sales reports listing the model, wattage, type, and number of bulbs sold.
2. The distributor enters the information into a tracking system and submits monthly reports to the third-party implementer containing the data and the third-party implementer calculates the demand and energy savings using technical assumptions provided by the Company.
3. The third-party implementer audits the database output by examining and comparing against retailer sales reports. The VC conducts a field verification of 10% of completed projects; and subsequently the third-party implementer adjusts the wattage and number of bulbs if errors are found and provides the final verified savings for all bulbs for year-end.

Public Service compares the net costs paid by product participants to the deemed incremental capital and baseline capital costs to determine the amount of instant rebate passed on to participants as a reduction in product cost. This amount is used in calculating the portion of the presumed participant incentive that is treated as a rebate in the cost-benefit analysis completed for the status report following the product year.

Home Lighting & Recycling

To deliver the Home Lighting & Recycling product, the Company partners with manufacturers and retailers to reduce the retail price of qualifying bulbs and promote them to the retailers' customers. Public Service tracks the manufacturer, model number, quantity, wattage, cost, and type of the bulbs sold through a third-party implementer and pays incentives to the manufacturer. The M&V process for the Home Lighting component of the product is as follows:

1. Participating retailers provide weekly or monthly sales reports listing the model, wattage, cost, type, and number of bulbs sold.
2. A third-party implementer enters the information into a tracking system and submits monthly reports containing the data and calculation of the demand and energy savings using technical assumptions provided by The Company. Higher bulb costs may be forecasted in the Plan based on estimated costs at the time, observed costs will be captured throughout the year and used to calculate the actual average incremental capital cost which will be reported in the Annual DSM/BE Status Report. The baseline bulb costs will be deemed within the Plan and also used within the Annual DSM/BE Status Report.

3. The VC audits the database output by examining and comparing against retailer sales reports. The validation contractor adjusts the wattage and/or number/type of bulbs if errors are found and provides the final verified total savings for all bulbs for year-end.

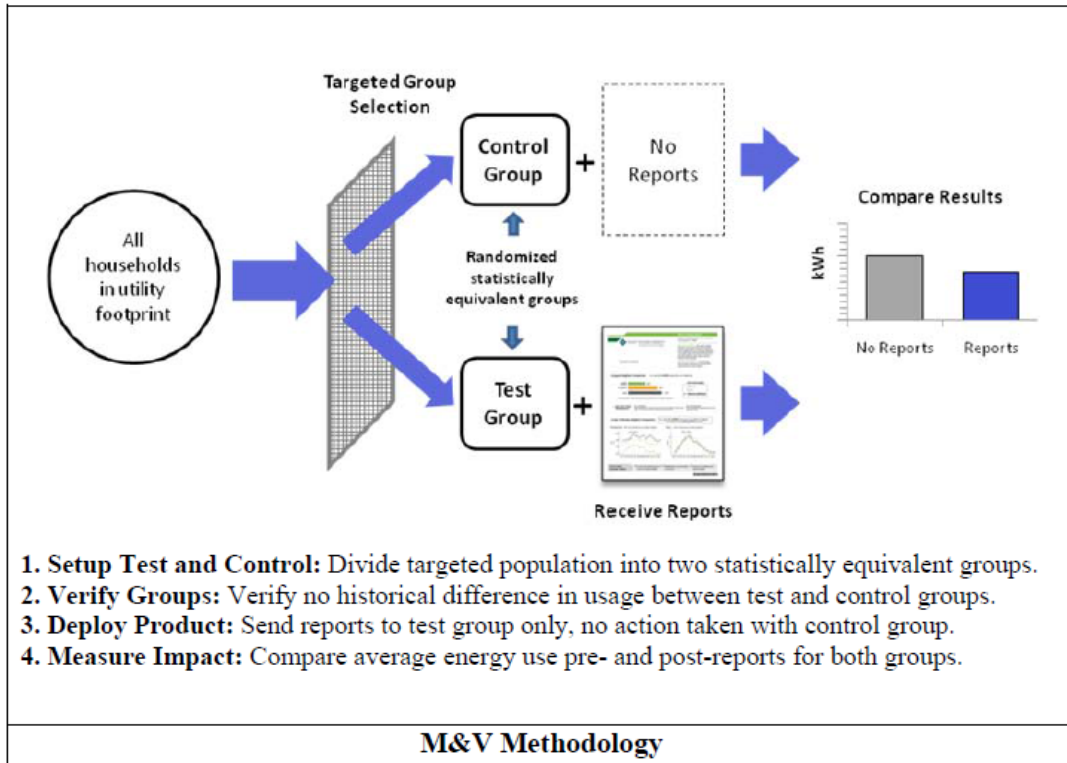
4. *M&V Process for Home Energy Insights Behavioral Products*

Behavioral products present unique challenges related to measuring resulting savings. M&V is critical for understanding the savings delivered and fine-tuning the product's effectiveness. The M&V protocol for the Home Energy Insights products is described below.

Home Energy Insights – Residential Product

The Home Energy Insights opt-out product provides targeted communication of energy-use comparisons and information to our residential customers, providing specific recommendations and feedback to motivate and teach customers how to reduce their energy consumption. Actual consumption in the form of meter data is used to M&V this product. Meter data for all participants, comparison homes, and control homes are provided to the third-party implementer for continuous analysis and performance reporting. The third-party implementer compares the consumption of participants (Treatment Group) to those of the Control Group to determine the savings resulting from the product. Savings for the print/email product will be measured compared to an appropriately sized Control Group of non-participant customers that are uninformed by any direct action of this product. In addition to determining the savings resulting from the product, the third-party implementer will track and adjust for participant's incremental participation in other energy efficiency products.

This M&V methodology is recommended by the State and Local Energy Efficiency Action Network ("SEE Action"). The following figure depicts the M&V methodology.



Moreover, the M&V methodology incorporates recommendations made by the Center for Energy and Environment (“CEE”) in their evaluation of the Minnesota Residential Energy Feedback pilot. Specifically, the following recommendations were incorporated:

- Opt-out customers are included in total savings. While opt-out customers were previously included in the calculation of savings per household (i.e. in the regression), the aggregation of savings did not include the count of opt-out customers
- Negative “savings” estimates are included in total savings. Previously, zero savings were reported in months with negative savings estimates. The updated method includes negative “savings” that occur in any month.
- Duplicate records are eliminated. Data preparation steps now remove (if present) duplicate billing records along with records from multiple meters at a customer's home that may have been added during the course of the product. The total number of records removed are noted in a logfile and stored.
- Model is robust to varying monthly imbalances between treatment and control. The regression model below controls for any remaining overall and seasonal differences between treatment and control. This update achieves the intent of the evaluation’s recommendation to take care in adjusting estimates for any residual overall or seasonal imbalance between the treatment and control group.

Online Home Energy Insights (My Energy) Opt-in Product

Residential customers in the print or email product who opt-in to participate in the My Energy tools will remain in the Home Energy Report Treatment Group and their savings will be included in the print/email product savings calculation.

Because login to the My Energy tools is a self-selected, opt-in action and therefore not easily subject to random assignment in a Randomized Controlled Trial, savings for Online Home Energy Insights are performed using the Propensity Score Matching methodology. This analysis employs a quasi-experimental matching method which seeks to match customers who log in to My Energy (“treatment customers”) to very similar customers who did not log in to My Energy (“matched control customers”). Matched controls are drawn from a larger set of candidate control customers. Not all customers who log in are successfully matched largely due to not having 12 months of pre-login usage data. These customers are not matched due to the concern that they cannot be matched well. As a result, the analysis measures the average treatment effect on the treated for those customers who visited the web and who could be matched well; it is not a measurement of the effect of web on all customers who visited My Energy.

The algorithm follows Imbens and Rubin (2015) and begins by selecting customer characteristics for estimation of a propensity score. The propensity score is the predicted probability of receiving the treatment (i.e. logging in to My Energy). Matching customers based on nearly identical propensity scores serves to balance the distribution of the included customer characteristics among the treatment and matched control populations. An important limitation of this method is that treatment customers may still differ from matched control customers along unobserved dimensions (e.g. attitudes toward energy efficiency) which could bias results. Despite this limitation, propensity score matching is an accepted method in the DOE SEE Action guidelines and widely used in other disciplines.

Energy savings will have a one-year life, with ongoing treatment and information exposure necessary to continue the full energy-savings benefits. To address this unique situation with treatment-driven behavior programs, Public Service will discount the annual savings so that 1/3 of the total savings measured are claimed each year during a three-year cycle. This is different than the standard conservation product, where a measure gets installed and credit is taken for the multi-year life of that installed measure. The third-party implementer will calculate savings throughout 2017 and 2018 using a comparison of the Treatment Group and the Control Group as savings occur and only if they occur.

Public Service will track rebates by customer and account and will subtract the energy saved through these product participations from the Home Energy Insights results to prevent double counting.

5. *Pilot Products*

EM&V for pilot products can differ from the EM&V for prescriptive and custom products since the pilots are being evaluated for market viability. Therefore, additional testing may be necessary, and, in some cases, specifically designed for a particular pilot. For these reasons, the detailed EM&V Plan for each pilot is included in the pilot’s product description, which can be found in the Indirect Products and Services section of the Plan under Product Development.

Section II – Post-Performance Year Product EM&V

The purpose of the post-performance year EM&V is to ensure that all technical assumptions, including the NTG ratios, are accurate and that the product is operating as effectively as possible. Post-performance year activities take place in the years following the performance year and include comprehensive product evaluations, a portfolio-wide technical assumptions evaluation, and calculation of outcomes for the annual status report.

a) Verified Savings Calculation and Reporting

At year-end, net verified generator savings are calculated from gross customer (meter) savings using the approved line losses, measured or assumed installation and realization rates, and NTG values and reported in the EM&V Results section of each Annual DSM/BE Status Report, according to the following formulas:

Net verified kW savings =

$$\text{Peak customer kW} * \text{Line Loss} * \text{Installation Rate} * \text{Realization Rate} * \text{NTG}$$

Net verified kWh savings =

$$\text{Customer kWh} * \text{Line Loss} * \text{Installation Rate} * \text{Realization Rate} * \text{NTG}$$

Net verified Dth savings =

$$\text{Gross Dth} * \text{Line Loss} * \text{Installation Rate} * \text{Realization Rate} * \text{NTG}$$

Where,

- peak customer kW, customer kWh, and gross Dth are reported from Salesforce and/or provided by the third-party implementers;
- line losses are 6.51% for business products and 7.69% for residential products;
- installation rates are assumed to be 100% for all of the products within the Business, Residential, and Low-Income Programs, and for pilots, with the exception of the Home Lighting & Recycling, School Education Kits, Energy Efficient Showerhead, and Energy Savings Kits products. For each of the exceptions, the third-party implementer measures the installation rate and reports it, along with gross savings, to the Company.
- realization rates are assumed to be 100% for custom products, Low-Income products, and pilots, and are measured and reported by the M&V contractor or the third-party implementer for the prescriptive products; and
- NTG values are as filed in the Technical Reference Manual of the DSM Plan, unless modifications were adopted resulting from a product evaluation, as described below.

Note that:

- Installation and realization rates, as well as NTG values, are applied at the measure and end-use levels within each product.
- Either an installation rate or a realization rate, but not both, are typically applied to calculations of net verified savings.
- Comprehensive products that claim prescriptive or custom savings from other end-uses, will apply the installation rates, realization rates, and NTG ratios specific to each end-use when calculating net verified savings.

- Products that offer studies (such as Business Energy Assessments, Compressed Air Efficiency, or Data Center Efficiency for example) may distinguish study-driven savings from non-study-driven savings and apply different installation rates, realization rates, or NTG values to the various categories of savings, as described in the Technical Reference Manual of the DSM Plan.

b) Product Evaluations

In addition to the performance-year M&V described above, Public Service will contract with an independent third-party consultant to complete evaluations for specific products each year. Product evaluations are conducted on a staggered schedule so that all products receive evaluations at least once every eight years with limited exceptions for small or indirect products. The principal objective of the product evaluation is to determine the role of the product in customer decision-making. This includes specific research that assesses customer satisfaction with the DSM product and implementation processes, conducts a thorough review of industry-wide approaches, and/or to assess changes that should be made to NTG ratios or savings baselines based on the evaluator's primary research. When considering the evaluation recommendations, Public Service will follow the guidance from Decision No. C11-0465, which gives Public Service the discretion to make changes to its DSM products that are reasonable, cost-effective, and timely; as well as to reject suggested changes that are flawed.⁶⁹

Factors that are taken into consideration in determining the priority, type, and schedule of product evaluations include, but are not limited to: product tenure in Colorado, savings achieved per participant and relative to total goals, product expenditures compared to total budgets, uncertainty and/or risk associated with savings or technical assumptions, duration since a significant product redesign, and availability of other studies regarding the particular measures. Discussions with portfolio managers, product developers, and technical consultants are used to finalize the priority and schedule of evaluations.

In 2023 the Company plans to continue the practice of separating energy efficiency and demand management evaluations.

The Company will evaluate six products in the energy efficiency portfolio in 2023.⁷⁰ In 2023 the Company proposes a full process and impact evaluation (also known as a comprehensive evaluation) of the direct install component of Small Business Solutions, Lighting Efficiency and Small Business Solutions Midstream lighting Product, Home Energy Squad, and Multifamily Buildings.⁷¹ The prescriptive and custom elements of Small Business Solutions will not be evaluated in 2023 due to lower participation in those components of this newly-

⁶⁹ Decision No. C11-0465, at 6-7 in Proceeding No. 10A-554EG.

⁷⁰ The Company agreed to conduct four comprehensive product evaluations each year, starting in 2016 under the 2015-16 DSM Plan Settlement Agreement (Proceeding No. 14A-1057EG).

⁷¹ Under the 2015-16 DSM Plan Settlement Agreement (Proceeding No. 14A-1057EG), the Company also agreed to evaluate each of its lighting products (Home Lighting & Recycling, Lighting Efficiency, and Lighting – Small Business) on a three-year rotation. As part of a previous Settlement Agreement, the Company evaluated both the Home Lighting and Lighting Efficiency products in 2015 and the Lighting – Small Business in 2016. Since the Lighting Efficiency product was evaluated in 2018 but the NTG was updated with new customer and trade partner research in 2019, the Company proposes to return to the one program per year practice in this biennial.

launched product while the DI component has grown relative to the previous evaluation of the predecessor product (Lighting Efficiency – Small Business). The Company will also complete a process-only evaluation of the Income-Qualified Weatherization and Home Energy Audits products. In addition, the Company expects to continue evaluation activities for the Codes and Standards Compliance Support components within Business New Construction and ENERGY STAR New Homes products. This evaluation will focus on verification of gross technical savings, compliance rate, and attribution factors and will not include all the same elements as a traditional Comprehensive evaluation due to the unique nature of a code support offering.

In the DR program, as a response to the rapid growth of the number of DR offerings, the Company will continue development and deploy a holistic portfolio evaluation protocol that will help provide close-to-real-time feedback regarding customer motivations, response to various marketing and control strategies, and customer satisfaction. Due to the nature of the DR program, NTG will not be included in this protocol because events would not be called in the absence of the Company's efforts to reduce demand.

This schedule will be reviewed at the beginning of the year and may be adjusted based on costs, scope, and need.

Section III – EM&V Best Practices

Public Service's ongoing M&V procedures are aligned with utility industry best practices for measuring product results. The Company requires that its contractors follow standard protocols, such as the IPMVP and the Illinois TRM. The following links to some of the common reference materials describe these protocols in more detail:

California Evaluation Framework:

http://www.calmac.org/publications/California_Evaluation_Framework_June_2004.pdf

Illinois SAG TRM:

<https://www.ilsag.info/technical-reference-manual/>

National Action Plan:

<http://www.epa.gov/cleanenergy/energy-programs/suca/resources.html>

SEE Action EM&V Resource Portal:

<https://www4.eere.energy.gov/seeaction/topic-category/evaluation-measurement-and-verification>

US Department of Energy Uniform Methods Project

<https://www.energy.gov/eere/about-us/ump-home>

The International Performance Measurement and Verification Protocol can be found in the Products & Services section of the Efficiency Valuation Organization's website at <http://www.evo-world.org>.

B. Forecasts, Participants & Budgets

Forecasts and Participants

Not applicable.

Budgets

The robustness of Public Service’s EM&V plan is balanced against its costs; we continue to be mindful of the objectives of ensuring accurate savings while keeping expenditures prudent and maintaining the cost-effectiveness of products. The budgets for the various EM&V components are included within this 2023 DSM & BE Plan in the following ways:

- *Rebate validation*: Internal labor is charged as an Administration and Product Delivery cost to individual DSM product budgets.
- *Ongoing M&V*: Most outside contractor costs, including database development, data tracking, and reporting, are charged as an M&V cost to individual DSM product budgets and are not included in the general Measurement & Verification budget under the Indirect Products and Services section of the Plan. Budgets for these activities were forecasted based upon historical experience or followed a more general budgeting plan at between 3 to 5% of the respective DSM products’ total budgets.
- *Comprehensive Product Evaluations*: Outside consultant costs are included within the “Product Evaluations” budget under the Indirect Products and Services section of the Plan. These costs were developed based on previous evaluation costs.
- Internal Xcel Energy labor that supports administration and oversight of ongoing M&V and comprehensive product evaluations is charged to “Measurement & Verification” or “Product Evaluation” budgets, respectively, under the Indirect Products and Services section of the Plan.

C. Application Process

Not applicable.

D. Marketing Objectives & Strategies

Not applicable.

E. Product-Specific Policies

EM&V does not have any specific policies.

F. Stakeholder Involvement

EM&V does not have any unique stakeholder involvement.

G. Rebates & Incentives

Not applicable.

H. Evaluation, Measurement, & Verification

As described in section (A) above and in [Table 16](#) below.

Table 16: Measurement and Verification Summary by Product

Product Name	Program Component	M&V Protocol	2021/2022 M&V Plan
Business Electric:			
Business HVAC+R Systems	Prescriptive	General Prescriptive	Verification Contractor selects random sample and performs field inspections of deemed savings factors; e.g. equipment type, size, efficiency, climate zone and building type.
	Upstream/Midstream cooling measures	Unique Prescriptive	Participating distributors will enter sales data into an online application administered by a third-party, listing the make, model, serial number, quantity, installation address and zip code. The third-party administrator will verify customer eligibility and provide periodic sales reports. Verification Contractor selects random sample and performs field inspections of deemed savings; e.g. equipment type, size, efficiency, climate zone and building type.
	Custom	General Custom	Projects <1 GWh savings: Company engineers or outside engineering firm calculate savings for pre-approval, calculations reviewed by higher levels of engineering staff depending on size. Random samples of projects sent to outside engineering firm for verification if Company engineers complete analysis. Account Manager or Business Solutions Center verifies project installation and collects equipment invoices. Projects ≥ 1 GWh savings: Pre & Post Metering verifies savings. (Projects of all sizes may be metered depending on certainty assessment of savings).
Business Energy Assessments (recommissioning component)	Custom	Unique Custom	Customer hires an in-network engineering firm to conduct study of building and to determine energy savings for each measure. The engineering firm will use a methodology that has been pre-approved by Xcel. The Xcel engineering team will randomly review vendor studies to confirm that they continue to conform to mutually accepted methodologies.
Compressed Air Efficiency	Prescriptive	General Prescriptive	Prescriptive rebates available for Variable Frequency Drive Compressors that are less than 50 hp and have no air loss drain valves. Verification Contractor selects random sample and performs field inspections of deemed savings factors -- e.g. size of compressor and number of drains.

Compressed Air Efficiency (cont.)	Custom	General Custom	Projects <1 GWh savings: Company engineers or outside engineering firm calculate savings for pre-approval, calculations reviewed by higher levels of engineering staff depending on size. Random samples of projects sent to outside engineering firm for verification if Company engineers complete analysis. Account Manager or Business Solutions Center verifies project installation and collects equipment invoices. Projects ≥ 1 GWh savings: Pre & Post Metering verifies savings. (Projects of all sizes may be metered depending on certainty assessment of savings).
Custom Efficiency	Custom - Study Driven Credit	Unique Custom	Studies may yield direct energy savings from leak fixes. The study provider will identify the location and size of leaks. The study provider and/or the customer will fix the identified leaks. The customer must verify all leak fixes, as 50% or more of the fixes must be completed in order to qualify for the study rebate. A realization rate of 100% is applied to the calculated savings from leak fixes.
	Custom	General Custom	Projects <1 GWh savings: Company engineers or outside engineering firm calculate savings for pre-approval, calculations reviewed by higher levels of engineering staff depending on size. Random samples of projects sent to outside engineering firm for verification if Company engineers complete analysis. Account Manager or Business Solutions Center verifies project installation and collects equipment invoices. Projects ≥ 1 GWh savings: Pre & Post Metering verifies savings. (Projects of all sizes may be metered depending on certainty assessment of savings).
Data Center Efficiency	Prescriptive	General Prescriptive	Verification Contractor selects random sample & performs field inspections of deemed savings factors; e.g. equipment type, number of equipment.
	Prescriptive	Unique Prescriptive	For verification of the High Efficiency CRAC units measure installation, the VC will maintain a log of any refusals for site entry for M&V, and subsequently seek out, and document, verbal confirmation of installation from the customer and/or installer.
	Custom	General Custom	Projects <1 GWh savings: Company engineers or outside engineering firm calculate savings for pre-approval, calculations reviewed by higher levels of engineering staff depending on size. Random samples of projects sent to outside engineering firm for verification if Company engineers complete analysis. Account Manager or Business Solutions Center verifies project installation and collects equipment invoices. Projects ≥ 1 GWh savings: Pre & Post Metering verifies savings. (Projects of all sizes may be metered depending on certainty assessment of savings).

Energy Management Systems	Custom	General (EMS) & Unique Custom (EIS)	Projects <1 GWh savings: Company engineers or outside engineering firm calculate savings for pre-approval, calculations reviewed by higher levels of engineering staff depending on size. Random samples of projects sent to outside engineering firm for verification if Company engineers complete analysis. Account Manager or Business Solutions Center verifies project installation and collects equipment invoices. Projects ≥ 1 GWh savings: Pre & Post Metering verifies savings. (Projects of all sizes may be metered depending on certainty assessment of savings).
	Behavioral	Behavioral Custom	The third-party implementer, with review by Xcel Energy engineers, will analyze data from energy information systems in accordance with IPMVP criteria and the Company's custom M&V process, to ensure persistence of the behavioral measure's savings. These savings will be reported annually for the duration of the customer's involvement in the EIS measure.
Lighting Efficiency ¹	Upstream / Midstream	Unique Prescriptive	Participating distributors provide sales reports listing the model, wattage, type, and number of bulbs sold. The third-party implementer enters the information into a tracking system and submits monthly reports containing the data and calculation of the demand and energy savings using technical assumptions provided by The Company. The VC audits the database output by examining and comparing against retailer sales reports. The VC adjusts the wattage and number of bulbs if errors are found and provides the final verified savings for all bulbs for year-end.
	Prescriptive	General Prescriptive	Verification Contractor selects random sample and performs field inspections of deemed savings factors -- e.g. number of fixtures, equipment type, building type, existence of air conditioning. Information gathered for a sample of lamps/fixtures and extrapolated to total population.
	Custom	General Custom	Projects <1 GWh savings: Company engineers or outside engineering firm calculate savings for pre-approval, calculations reviewed by higher levels of engineering staff depending on size. Random samples of projects sent to outside engineering firm for verification if Company engineers complete analysis. Account Manager or Business Solutions Center verifies project installation and collects equipment invoices. Projects ≥ 1 GWh savings: Pre & Post Metering verifies savings. (Projects of all sizes may be metered depending on certainty assessment of savings).

Small Business Energy Solutions ¹	Prescriptive	General Prescriptive	Verification Contractor selects random sample & performs field inspections of deemed savings factors -- e.g. number of fixtures, equipment type, building type, existence of air conditioning. Information gathered for a sample lamp/fixture.
	Direct Install	Unique Prescriptive	Xcel Energy's product implementer documents equipment installed onsite; no further verification is required.
	Custom	General Custom	Projects <1 GWh savings: Company engineers or outside engineering firm calculate savings for pre-approval, calculations reviewed by higher levels of engineering staff depending on size. Random samples of projects sent to outside engineering firm for verification if Company engineers complete analysis. Account Manager or Business Solutions Center verifies project installation and collects equipment invoices. Projects ≥1 GWh savings: Pre & Post Metering verifies savings. (Projects of all sizes may be metered depending on certainty assessment of savings).
Multifamily Buildings ¹	Custom	General Custom	Projects <1 GWh savings: Company engineers or outside engineering firm calculate savings for pre-approval, calculations reviewed by higher levels of engineering staff depending on size. Random samples of projects sent to outside engineering firm for verification if Company engineers complete analysis. Account Manager or Business Solutions Center verifies project installation and collects equipment invoices. Projects ≥ 1 GWh savings: Pre & Post Metering verifies savings. (Projects of all sizes may be metered depending on certainty assessment of savings).
New Construction ³	Custom - Energy Efficient Buildings	Unique Custom	Consultant visits site or remotely verifies that specified measures were installed. Projects with individual measure savings ≥ 1 GWh savings: Four weeks of data logging verifies savings.
	Custom - Energy Design Assistance	Unique Custom	Consultant visits site or remotely verifies that specified measures were installed. Equipment and systems are monitored for a two-week timeframe, as appropriate, to evaluate performance variables against modeling assumptions. Projects with individual measure savings ≥ 1 GWh savings: Four weeks of data logging verifies savings. All projects verified with actual results not within 15% of the energy savings identified in the original model will have an as-built model completed for rebate calculations.
Strategic Energy Management	Prescriptive	General Prescriptive	Verification Contractor selects random sample and performs field inspections of deemed savings factors specified for applicable end use product.
	Custom	General Custom	Projects <1 GWh savings: Company engineers or outside engineering firm calculate savings for pre-approval, calculations reviewed by higher levels of engineering staff depending on size. Random samples of projects sent to outside engineering firm for verification if Company engineers complete analysis. Account Manager or Business Solutions Center verifies project installation and collects equipment invoices. Projects ≥1 GWh savings: Pre & Post Metering verifies savings. (Projects of all sizes may be metered depending on certainty assessment of savings).

Self-Direct	Custom	Unique Custom	Customer will calculate savings and Company will verify calculations. Customer will develop and implement M&V plan specific to project. Company will review M&V plan and results. Pre- and post-installation metering and verification will be required for all projects with predicted energy savings greater than 0.25 GWh, unless the Company and customer agree upon another methodology. The Company reserves the right to require data measurement and verification for projects of any size.
Business Gas:			
Business HVAC+R Systems	Prescriptive	General Prescriptive	Verification Contractor selects random sample and performs field inspections of deemed savings factors. For boilers -- size and efficiency. For steam traps -- high or low pressure. For all other -- size and implemented measure.
	Custom	General Custom	Projects <20,000 Dth savings: Company engineers or outside engineering firm calculate savings for pre-approval, calculations reviewed by higher levels of engineering staff depending on size. Random samples of projects sent to outside engineering firm for verification. Account Manager or Business Solutions Center verifies project installation, collects equipment invoices. Projects ≥ 20,000 Dth savings: Pre & Post Metering verifies savings. (Projects of all sizes may be metered depending on certainty assessment of savings).
Business Energy Assessments (recommissioning component)	Custom	Unique Custom and Study-Drive Credit	Customer hires an in-network engineering firm to conduct study of building and to determine energy savings for each measure. The engineering firm will use a methodology that has been pre-approved by Xcel. The Xcel engineering team will randomly review vendor studies to confirm that they continue to conform to mutually accepted methodologies.
Custom Efficiency	Custom	General Custom	Projects <20,000 Dth savings: Company engineers or outside engineering firm calculate savings for pre-approval, calculations reviewed by higher levels of engineering staff depending on size. Random samples of projects sent to outside engineering firm for verification. Account Manager or Business Solutions Center verifies project installation, collects equipment invoices. Projects ≥ 20,000 Dth savings: Pre & Post Metering verifies savings. (Projects of all sizes may be metered depending on certainty assessment of savings).

Energy Management Systems	Custom	General Custom & Unique Custom (EIS)	Projects <20,000 Dth savings: Company engineers or outside engineering firm calculate savings for pre-approval, calculations reviewed by higher levels of engineering staff depending on size. Random samples of projects sent to outside engineering firm for verification. Account Manager or Business Solutions Center verifies project installation, collects equipment invoices. Projects ≥ 20,000 Dth savings: Pre & Post Metering verifies savings. (Projects of all sizes may be metered depending on certainty assessment of savings).
	Behavioral	Behavioral Custom	The third-party implementer, with review by Xcel Energy engineers, will analyze data from energy information systems in accordance with IPMVP criteria and the Company's custom M&V process, to ensure persistence of the behavioral measure's savings. These savings will be reported annually for the duration of the customer's involvement in the EIS measure.
Small Business Energy Solutions ¹	Direct Install	Unique Prescriptive	Xcel Energy's product implementer documents equipment installed onsite; no further verification is required.
New Construction ³	Custom - Energy Efficiency Buildings	Unique Custom	Consultant visits site or remotely verifies that specified measures were installed. Projects with individual measure savings ≥ 20,000 Dth savings: Four weeks of data logging verifies savings.
	Custom - Energy Design Assistance	Unique Custom	Consultant visits site or remotely verifies that specified measures were installed. Equipment and systems are monitored for a two-week timeframe, as appropriate, to evaluate performance variables against modeling assumptions. Projects with individual measure savings ≥ 20,000 Dth savings: Four weeks of data logging verifies savings. All projects verified with actual results not within 15% of the energy savings identified in the original model, will have an as-built model completed for rebate calculations.
Residential Electric:			
Home Energy Insights Residential	Behavioral	Behavioral Prescriptive	Actual consumption in the form of meter data is used to M&V this product. Meter data for all participants, comparison homes, and control homes are provided to the third-party implementer for continuous analysis and performance reporting. The third-party implementer compares the consumption of participants (Treatment Group) to those of the Control Group to determine the savings resulting from the product.
ENERGY STAR New Homes ³	Prescriptive	Unique Prescriptive	RESNET Certified HERS rater performs multiple site walk-throughs or remote analysis and at the end of construction determines final HERS rating. Rebate amount is determined by the modeled energy consumption (as-built home) percent better than local code requirement (reference home). Home size information, measures installed, and HERS rating are verified by third party product implementer and then submitted to Public Service.

Home Energy Squad ¹	Prescriptive	Unique Prescriptive	Third-party implementer verifies installation of measures.
Home Lighting & Recycling	Prescriptive	Unique Prescriptive	Third party administrator provides tracking data and manufacturer sales reports for bulbs sold. Verification contractor audits the data and compares to manufacturer sales reports. Verification contractor corrects any errors and calculates energy savings based on Public Service assumptions.
Whole Home Efficiency	Prescriptive	Unique Prescriptive	Third-party product implementer performs a walk-through inspection after the homeowner has performed all of their planned energy efficiency improvements. The work conducted by a participating installation contractor will be inspected through this method. Contractors will have first five completed projects inspected followed by a ten percent sample of homes. The product has this permanently built into the product as a requirement to ensure all stated improvements have been made prior to issuing the rebate. THE COMPANY will also implement a market research survey with customers to gauge satisfaction with the product, auditors, and installation contractors that were used.
Refrigerator & Freezer Recycling		Unique Prescriptive	Verification contractor conducts phone surveys of random sample of participants to verify removal of refrigerator and that refrigerator was operable at time of removal.
Residential Heating and Cooling			Verification Contractor selects random sample and performs field inspections of deemed savings factors; e.g. type of unit (tier 1, 2 or 3), and type of unit if previously installed and if registers and ducting are complete (if applicable to tier). Verification Contractor selects random sample and performs field inspections of deemed savings factors using a defined process. This includes verifying load calc was performed, unit sized properly, and that refrigerant charge, air flow, and duct leakage are within acceptable ranges.
School Education Kits	Prescriptive	Unique Prescriptive	Third-party product implementer conducts surveys to teachers/students to confirm what was installed at students' home.
Residential Gas:			
Energy Efficient Showerheads	Prescriptive	Unique Prescriptive	Verification Contractor selects random sample & performs phone survey of deemed savings factors -- e.g. did the customer receive the product and was it installed.
Home Energy Insights Residential	Behavioral	Behavioral Prescriptive	Actual consumption in the form of meter data is used to M&V this product. Meter data for all participants, comparison homes, and control homes are provided to the third-party implementer for continuous analysis and performance reporting. The third-party implementer compares the consumption of participants (Treatment Group) to those of the Control Group to determine the savings resulting from the product.

ENERGY STAR New Homes ³	Prescriptive	Unique Prescriptive	Third-party implementer manages certified energy raters who consult directly with builders during construction phase and then assign a HERS rating (with blower door testing) at end of construction prior to rebating for product. Home size information, measures installed, and HERS rating are verified by product implementer.
Residential Heating and Cooling	Prescriptive	General Prescriptive	Verification Contractor selects random sample & performs field inspections of deemed savings factors; e.g. manufacturer, model, serial number, type of unit installed
Home Energy Squad ¹	Prescriptive	Unique Prescriptive	Third-party implementer verifies installation of measures.
Whole Home Efficiency	Prescriptive	Unique Prescriptive	Third-party product implementer performs a walk-through inspection after the homeowner has performed all of their planned energy efficiency improvements. The work conducted by a participating installation contractor will be inspected through this method. Contractors will have first five completed projects inspected followed by a ten percent sample of homes. The product has this permanently built into the product as a requirement to ensure all stated improvements have been made prior to issuing the rebate. THE COMPANY will also implement a market research survey with customers to gauge satisfaction with the product, auditors, and installation contractors that were used.
Insulation & Air Sealing	Prescriptive	General Prescriptive	Verification Contractor selects random sample & conducts phone or remote verification to confirm measure(s) were installed. VC conducts post blower door test for accuracy of air leakage reduction and confirms that the contractor is certified under BPI, registered under Xcel Energy's product and licensed in Colorado.
School Education Kits	Prescriptive	Unique Prescriptive	Third-party product implementer conducts mail surveys to teachers/students to confirm what was installed at students' home.
IQ Electric:			
Energy Savings Kits	Prescriptive	Unique Prescriptive	Verification Contractor selects random sample & conducts phone surveys to confirm what was installed at recipient's home.
Multi-Family Weatherization	Prescriptive	Unique Prescriptive	Consultant visits building and completes energy audit. The Company engineer reviews audit report and approves or denies report. Consultant visits site or remotely verifies that approved measures were installed and submits final savings in verification report.
Non-Profit Energy Efficiency	Prescriptive	Unique Prescriptive	Consultant visits building and completes energy audit. The Company engineer reviews audit report and approves or denies report. Consultant visits site or remotely verifies that approved measures were installed and submits final savings in verification report.

Single Family Weatherization ²	Prescriptive	Unique Prescriptive	Contracted weatherization agency visits home, identifies savings opportunities, and then installs measures. Weatherization agency provides documentation of completed measures to third-party product implementer, who submits information to the Company.
IQ Gas:			
Energy Savings Kits	Prescriptive	Unique Prescriptive	Verification Contractor selects random sample & conducts phone surveys to confirm what was installed at recipient's home.
Multi-Family Weatherization	Prescriptive	Unique Prescriptive	Consultant visits building and completes energy audit. The Company engineer reviews audit report and approves or denies report. Consultant visits site or remotely verifies that approved measures were installed and submits final savings in verification report.
Non-Profit Energy Efficiency	Prescriptive	Unique Prescriptive	Consultant visits building and completes energy audit. The Company engineer reviews audit report and approves or denies report. Consultant visits site or remotely verifies that approved measures were installed and submits final savings in verification report.
Single Family Weatherization ²	Prescriptive	Unique Prescriptive	Contracted weatherization agency visits home, identifies savings opportunities, and then installs measures. Weatherization agency provides documentation of completed measures to third-party product implementer, who submits information to the Company.
¹ Comprehensive Evaluation will be conducted in 2023. ² Process only Evaluation will be conducted in 2023. ³ Codes and Standards Compliance Support Evaluation will be conducted in 2023.			

➤ Market Research

A. Description

The Company conducts market research and analysis to support effective design and implementation of DSM/DR/BE products and services. This enhances understanding of current and potential customers, market segmentation, and engagement drivers. Additional research is conducted through procurement of third-party consultants who review primary and secondary data. Market research subscriptions that offer energy efficiency and/or marketing resources are also purchased. Research projects are selected and completed, providing strategic information regarding customers, DSM/DR/BE products, and business direction for DSM/DR/BE efforts.

In 2023, the Company plans to continue procurement of the following market research resources:

- *E Source* membership provides unbiased, objective research and advisory services that help advance efficiency programs, improve the customer experience, and use energy more efficiently.
- *Dun & Bradstreet* list purchase provides specific demographic information helpful in effectively identifying potential business customers capable of benefiting from existing and planned DSM/DR programs.
- *Residential Segmentation* research provides specific demographic information helpful in effectively identifying potential residential customers capable of benefiting from existing and planned DSM/DR programs.
- *JD Power subscribed research services* a portion of JD power subscription costs may be allocated to Market Research depending on the questions in specific surveys and the relevance to program delivery and development
- *End Use Study* provides valuable information regarding saturation of various home appliances and technologies in residential homes. After completion of the 2022 study, the next fielding will occur in 2024.
- *Product Experience* measurement provides insight into customer interactions with participating in various programs. This may include a portion of the costs for the customer engagement management system that enables delivery of this survey.
- *Residential and Business Advertising Tracking* data ensures the effectiveness and reach of DSM/DR advertising efforts by asking customers reactions and recall of specific campaigns.

The list of research projects will be reviewed at the beginning of each year and may be adjusted to align with current information needs.

B. Forecasts, Participants & Budgets

Forecasts and Participants

This indirect impact product does not have participants or energy savings.

Budgets

The budget reflects annual internal research costs and third-party vendor costs for market research to execute surveys, collect data from research participants, and analyze and interpret data, ensuring representative samples of the study populations, to support research results and findings. Respondents may include peer utility contacts with similar programs, customer participants and non-participants, vendor partners and internal staff involved with the programs of interest. Research is often bid competitively among a list of approved vendors.

C. Application Process

This indirect impact product does not have a rebate / participation application.

D. Marketing Objectives & Strategies

Research is focused to identify opportunities that will maximize existing DSM/DR/BE product impacts and identify new marketing opportunities. Market trends are reviewed to identify market potential for DSM/DR/BE products and gauge customer understanding and satisfaction with product implementation.

E. Product-Specific Policies

This indirect impact product does not have any product-specific policies.

F. Stakeholder Involvement

Trade allies and vendors help enable successful execution of market research with integrity and cost-effectiveness.

G. Rebates & Incentives

This indirect impact product does not deliver customer rebates or incentives.

➤ **Planning & Administration**

A. Description

DSM Planning & Administration is an indirect service that manages all energy efficiency-related compliance filings, including this Plan, the annual DSM/BE Status Report, and other regulatory filings. This group performs the benefit-cost analyses of all of the energy efficiency and load management products, provides tracking of the energy and demand savings achievements, and collaborates with the Resource Planning group to develop inputs for the resource plans. The DSM Planning and Administration group also provides management and oversight of all evaluation, measurement, and verification planning and internal policy guidance, hosts the quarterly DSM & BE Roundtable meetings and correspondence with the Roundtable members, and works with outside consultants, when needed, to bring additional expertise to our product planning. These functions are needed to ensure a cohesive and high-quality DSM & BE portfolio that meets all legal requirements as well as the expectations of Public Service's customers, regulators, and staff.

This service is administrative in nature and is not open to customer participation. However, because this group operates in all of the states where Xcel Energy offers energy efficiency products, the Company is able to lend consistency and share best practices across all of the jurisdictions.

B. Forecasts, Participants & Budgets

Forecasts and Participants

As an indirect service, DSM Planning & Administration does not have savings or participation forecasts.

Budgets

The DSM Planning and Administration budget is made up primarily of internal labor required to manage DSM & BE filings, regulatory proceedings, stakeholder meetings, and cost-effectiveness analysis. Employee expenses, consulting and contracting services are a very small portion of the total budget. Actual expenditures in recent years were used as a guide for development of the 2023 budgets.

C. Application Process

DSM Planning & Administration is not customer-facing, and therefore, has no associated application.

D. Marketing Objectives & Strategies

The DSM Planning and Administration services are not customer-facing, and therefore, have no associated marketing objectives or strategy.

E. Product-Specific Policies

The DSM Planning and Administration services ensure DSM & BE compliance with internal policies and Commission directives.

F. Stakeholder Involvement

Public Service considers its stakeholders for DSM Planning and Administration to be both the internal groups who manage the DSM/BE products and require DSM/BE data, as well as the external governmental agencies, environmental, and customer groups who express interest in the design of and strategy for the Company's future DSM & BE products. The DSM Planning and Administration group meets with its external stakeholders regularly through the DSM & BE Roundtable, but also meets with parties at other times as needed.

G. Rebates & Incentives

There are no customer rebates associated with this service.

➤ Product Development

A. Description

The Product Development team identifies, assesses, and develops new conservation and load management products and services for potential addition to the DSM & BE portfolio. The product development process begins when customers, regulators, vendors, or energy professionals submit ideas through an Opportunity Identification Form or when Public Service staff or the Product Development team identifies potential opportunities for new products or measures. The Product Development team works on both energy-efficiency and load-management products.

Product Development also supports commercial, industrial, and mixed-use buildings and neighborhood developments striving to incorporate strategies across multiple distributed energy resources technologies in order to minimize net energy consumption at the site. These projects may require additional assistance beyond that offered in the current Energy Design Assistance offering, including earlier consulting and energy modeling as well as enhanced monitoring and verification once the project is completed and in operation. The focus of Product Development efforts in these projects is to identify strategies that would enable a streamlined, cost-effective approach to serving these projects through the New Construction product in the future.

Opportunity Identification

The Product Development team will screen, research, evaluate, and prioritize ideas for potential inclusion in the DSM & BE portfolio. New items may be added to the portfolio in the form of a new measure within an existing product, launched as a pilot in need of further testing, or as a stand-alone new product. This work enables Public Service to periodically update its portfolio with promising new energy-saving opportunities for customers. The Company reports on its analysis and next steps for concepts submitted via the Product Development Opportunity Identification Form⁷² at quarterly DSM & BE Roundtable Meetings.

Custom Efficiency Analyses

The team will review measures being rebated within the Custom Efficiency product on a periodic basis. As emerging technologies become more commonly rebated as custom measures, the Company will evaluate the potential for transitioning them to prescriptive rebates, if cost-effective.

Emerging Technologies Research

Product Development also conducts research on emerging technologies.⁷³ Product Development works with other utilities, program administrators and research organizations⁷⁴ to identify new technologies that have the potential for consistent and measurable energy savings and are close to

⁷²www.xcelenergy.com/productideas

⁷³First added in the 2009/10 Biennial DSM Plan (Proceeding No. 08A-366EG) as part of the Stipulation and Settlement Agreement, Appendix A, ¶f, pg. 4; which stated: “The Company agrees to increase the budget for research on emerging technologies and new program development.”

⁷⁴Examples of research organizations include Western Cooling Efficiency Center (WCEC), E Source, Emerging Technologies Coordinating Council (ETCC), Consortium for Energy Efficiency (CEE), and the American Council for an Energy-Efficient Economy (ACEEE).

commercialization. Promising new technologies are then evaluated through the Opportunity Identification process described above.

Behavioral Demand Response

Product Development continues to investigate Behavioral Demand Response. After an inconclusive pilot in 2022, the Company still believes there is potential for behavioral savings of peak electric and gas demand that can: simultaneously save customers money on their utility bills, aid in non-wire alternatives, and utilize excess wind generation. Because incumbent behavioral demand response products are only able to capture electric savings via AMI metering infrastructure, the team will continue to investigate new and alternative options in 2023.

Pilots

Pilot product will continue to contribute to the Company's efforts to innovate and explore new approaches to cost-effectively achieve its energy-efficiency goals. The Company selects measures or products to pilot based on a variety of criteria, including: potential energy savings, cost of savings, customer interest, market dynamics, feasibility to be developed and brought to market quickly and at a reasonable cost, potential longevity of the offering, level of market barriers and risk. In addition to researching new product offerings and emerging technologies, Product Development also explores and investigates new energy-efficiency concepts, market transformation opportunities and market approaches as part of our long-term DSM strategy.

The Product Development team will support implementation and evaluation of the following energy efficiency and demand response pilots during 2023:

- A pilot that manages when electric vehicles charge to reduce their impact on system peak load and provide other possible system benefits.

B. Forecasts, Participants & Budgets

Forecasts and Participants

This is an indirect product and as such, has no estimated energy or participation forecasts.

Budgets

The budget was estimated based on the historical costs and expected costs. Product Development spending can fluctuate significantly from year to year depending on the products in development and the funding needed to research and develop those products. Due to the nature of the emergence of new technologies within the market, it is not always possible to predict steady expenditures from one year to the next.

C. Application Process

This indirect product does not include a customer application process. Ideas for new products or measures can be submitted for consideration to the Company by following the detailed instructions

included on the forms listed under ‘Product Development Idea Submissions’ on the Company’s website.⁷⁵

D. Marketing Objectives & Strategies

This indirect product does not have marketing objectives.

E. Product-Specific Policies

Product Development utilizes the following criteria to consider whether a DSM/BE technology/approach warrants exploration *via* a pilot:

- Does the market assessment indicate broader deployment is possible? Or are additional learnings needed?
 - Does the preliminary assessment sufficiently answer all technical assumptions?
 - Does sufficient market attractiveness exist for a wide-scale deployment?
- Is additional testing necessary to understand/define the true capabilities of the concept?
 - Has the chosen technology solution been widely deployed elsewhere in a comparable program with comparable learnings?
- Does the enterprise infrastructure support a full deployment or do significant manual processes still exist?
- Do the market, technical and functional requirements meet the needs of all impacted groups (e.g. technical, legal, regulatory, etc.) or are additional learnings needed?

F. Stakeholder Involvement

The Company will rely heavily on the active participation of employees, customers, trade allies and vendors to successfully identify and develop new products with a high level of integrity, timeliness, and cost-effectiveness. Representatives of the energy-efficiency industry and other stakeholder groups are engaged in the development process through such channels as the quarterly DSM & BE Roundtable Meetings and the use of Opportunity Identification Forms found on the Company’s DSM Website.

G. Rebates & Incentives

This indirect product does not provide customer rebates.

⁷⁵http://www.xcelenergy.com/Company/Rates_&_Regulations/Filings/Colorado_Demand-Side_Management

➤ **Geo-targeting Pilot**

A. Description

Background

The objective of the Company's Geo-Targeting pilot is to demonstrate that the targeted deployment of DSM/BE resources can defer the need for investment in a new distribution transformer and associated feeder upgrades. To accomplish this, the Company will continue to show how its traditional DSM, DR, and BE resources can be adapted to address localized system constraints. Each of the following three areas is key to fulfilling the pilot objective.

Drive High levels of Local Adoption

The Company believes the successful execution of geo-targeting projects will require that it is able to drive adoption of energy efficiency and demand response in concentrated locations faster and at higher levels of participation than normal. The Company will continue to explore new delivery models and promotional methods to achieve this goal. This pilot presents an opportunity to identify successful approaches and learn about any additional savings or costs associated with attracting greater levels of customer participation.

Coordinate and Dispatch Demand Response

Traditionally, the Company utilizes demand response as a system resource that reduces total system load during emergency, contingency, or economic events. These events are informed by the needs of the bulk power system, and there is an established process for how and when these resources are activated. In contrast, the Company has less experience and fewer processes for using demand response for distribution purposes. This pilot will give the Company an opportunity to continue exploration of how DR can be used in a distribution context.

Validate Concept Costs and Effectiveness

In order to substitute or continue deferral of proven infrastructure upgrades for geo-targeting solutions, the Company needs to be confident that it can deliver cost-effective and reliable solutions. The pilot will provide detailed information about cost-effectiveness and whether a portfolio of DSM, DR, and BE solutions can work to reduce load sufficiently and consistently during targeted times.

Pilot Description

The Company will continue to work in the Lakewood/Rooney Valley area as the location of its geo-targeting pilot. The Company previously determined this location represented the best opportunity for a pilot for several reasons: the deferred benefit is large enough to justify incremental DSM/BE spending; there is enough lead time before the infrastructure investment to procure additional DSM, DR, and BE; and there is additional flexibility in this location to use traditional distribution operations approaches such as switching to protect reliability during the pilot. Load growth has not occurred as rapidly in this area as originally anticipated, but capital investment is still anticipated to be necessary.

The Rooney Valley is an area located to the Southwest of Denver, and it sits South of Green Mountain and adjacent to C-470. Planning efforts by Morrison and Lakewood have suggested as much as 700 acres of land could open up to new development. A number of developers with ownership interest in the Rooney Valley are at various stages of the design, permitting, and construction process.⁷⁶

Part of Lakewood and the Rooney Valley are served by the Company's Kendrick substation and a feeder that extends from Kendrick. In addition to Rooney Valley, this feeder also serves a part of Lakewood moving eastward from C-470 between West Alameda Avenue and West Yale Avenue. On very hot summer days, this feeder, which serves mostly residential dwellings, has approached its thermal limit—requiring active switching to move some demand to nearby feeders. If a significant share of the planned development in the Rooney Valley occurs, demand will begin to regularly exceed the thermal capacity of the feeder thereby requiring system upgrades.

The Company's Distribution Planning team expected demand growth to result in the need for both a new transformer and feeder in 2023. The cost of these upgrades was expected to total \$10.1 million. Combining the DSM and DR effectivity with the existing switching capabilities at the substation, and evolving timelines from developers and builders, the expected investments have not yet been necessary, and the timeline continues to extend further into the future.

In order to continue deferring the planned distribution system upgrades, the results of demand-side management and demand response will be measured and analyzed to keep the feeder load below its thermal limits as new load from development comes online.

Through its existing Residential Demand Response product and increases seen during the first years of the pilot the Company has over one MW of load reduction available. Although these resources may still operate a few times a year for system-wide demand response, the Company will continue to evaluate their use in the geo-targeted area. After accounting for these resources, the Company still has a need for load reduction during the deferral period.

Although the Company forecasts it would not need this additional load reduction until 2026, it is continuing pursuit of these reductions in 2023 for several reasons. First, the demand forecast is uncertain and the geotargeting pilot provides valuable flexibility for capital investment to match the load growth time horizon. Second, acting earlier in the window will allow the Company to further evaluate its approach to procuring and utilizing load reduction before load reduction is required. And third, if the Company waits until 2026 or beyond, it will miss its window to affect the new construction during and after 2023.

The Company evaluated a number of different customer segments and measure types to meet the projected load reduction need. Based on its current evaluation, the Company remains focused on achieving the load reduction through air-conditioning-related measures and by targeting new construction in the area. This project focus has the advantage of targeting the primary end-use, air conditioning, that is aligned with and driving the late afternoon/early evening feeder peak. In

⁷⁶For background on the Rooney Valley and on-going planning efforts, see Lakewood and Town of Morrison. (2016). *Plan Rooney Valley*. For more on development plans, see the Rooney Valley Commission website at <http://lakewood-colorado.org/RVC/>.

addition, its emphasis on new construction in the area will allow the Company to concentrate its efforts on a few builders rather than hundreds or thousands of residential customers.

Based on planning documents and conversations with developers working in the area, the Company expects the new demand in 2023 and beyond to come from single family residences, townhomes and light industrial commercial buildings. The Company plans to focus on residential new construction, since peak demand from this segment is highly coincident with the feeder's peak and this segment represents the majority of new load beyond 2023.

Several measures in the Company's existing DSM/BE portfolio already target residential new construction. The Company currently believes these existing measures offer the right load reduction opportunities, but they may need to be marketed through different channels. Relevant products and measures that could be part of the pilot effort include:

- Targeting the adoption of specific measures within ENERGY STAR New Homes for builders interested in participating and
- Specific measures targeted at builders outside ENERGY STAR New Homes, including air conditioning rebates, insulation rebates, and smart thermostats.

For these measures, the Company may rebate at levels above existing incentives. For example, the AC Rewards offering, part of the Residential Demand Response product, could increase rebates to cover the full incremental cost of a smart thermostat, so the builder makes DR-enabled smart thermostats part of their base heating, ventilation, and air conditioning package to customers. By modifying products to engage with builders, the Company believes it could secure substantial builder and therefore customer participation.

To complement its efforts with builders and to better understand how to generate lift in existing neighborhoods, the Company will also continue to target existing homes. This effort, as described in Section B and D, will utilize local and community marketing approaches to sell products with load reduction benefits.

B. Forecasts, Participants & Budgets

Forecasts and Participants

The new development in the Rooney Valley creates an opportunity to influence the efficiency and peak power consumption of a large amount of new load. In order to meet the deferral requirements, the Company will focus on engaging directly with builders and developers.

In addition, the Company will target its efforts at growing participation in the existing neighborhoods on the feeder. These neighborhoods are predominately composed of single-family homes, but also include a small number of multifamily low-rise dwellings.

Budgets

The Company has developed a budget with expenses based on two project strategies. The first strategy focuses on paying increased rebates to drive installation of efficient equipment inside new homes. For this strategy, the timing of expenses is based on the Company's current knowledge of when the builders will construct these new homes. The second strategy focuses on driving adoption

of measures into existing homes will focus on awareness and marketing through local channels. The primary expense for this strategy is the cost of the marketing and supplemental customer rebates.

The administration costs for this project reflect that it continues a first-of-a-kind project. Administration costs cover general pilot management labor to engage with builders and developers, engage with existing single-family homeowners and establish and manage the process for using DR.

- It is important to note that the budget for this pilot only reflects incremental costs associated with the project. Thus, all or a portion of rebates and marketing expenses for measures included in the 2023 DSM & BE Plan that the project leverages will accrue to each product budget outside of this pilot. For example, if the Company were to offer builders a free smart thermostat in exchange for the home buyer's enrollment in the Residential Demand Response product, then the expenses would be allocated as shown below:
 - Full incremental cost of smart thermostat: \$249⁷⁷;
 - Portion of cost that accrues to Residential Demand Response product: \$100 (based on current rebate structure); and
 - Portion of bonus rebate that accrues to Geo-targeting Pilot: \$149.

C. Application Process

The application process will be contingent upon the measures that are implemented and the application process specific to the associated product will be applied. For example, the application process for ENERGY STAR New Homes would apply to any new home construction project targets as part of the pilot. process for ENERGY STAR New Homes would apply to any new home construction project targets as part of the pilot.

D. Marketing Objectives & Strategies

The Company is in contact with developers in the Rooney Valley. It will continue to engage directly with these developers, while also looking to reach out to builders to discuss how they can participate in relevant energy efficiency and demand response products.

For the portion of the project that emphasizes existing neighborhoods, it will look to market its offerings using a tailored, community-based approach.

Community-based marketing efforts could use budget for a range of activities that would be customized for the community and extend beyond the Company's normal marketing efforts. Examples include:

⁷⁷Price estimate for smart thermostat based on Ecobee for list price on the Xcel Energy store – June 2022 (<https://www.xcelenergystore.com/collections/rebated-smart-thermostats>).

- Hosting awareness events through local organizations, such as Homeowners' Associations;
- Use of local citizens as program champions to spread the word about their experience with energy efficiency and demand response products;
- Door-to-door selling in communities; and,
- School, church, or neighborhood group-level prizes and awards associated with achieving adoption targets.

E. Product-Specific Policies

The Geo-targeting pilot is focused on a particular feeder in the Company's distribution system. If additional incentives are offered, a customer or builder/developer must prove that the equipment they are seeking a rebate for is being placed in a location on the targeted feeder. The Company can verify location based on the building or home location and/or the customer's account number.

F. Stakeholder Involvement

Depending on the Company's marketing and outreach tactics, it may seek to engage with a range of local non-profit, government, home developers and builders, and trade partners – including low-income advocates - to drive customer adoption. Example approaches are discussed in Section D.

G. Rebates & Incentives

Rebates and incentives may be used in two principal ways.

1. Additional offset of incremental costs for builders: In order to attract builder participation, the Company may significantly offset the incremental cost for equipment such as smart thermostats or air conditioners. The Company would pursue additional rebates if it believes this practice would result in large-scale adoption in new construction.
2. Organizational prizes for participation: As described in section D, the Company plans to work with established community organizations to drive adoption. If it takes this approach, it may establish incentives for these local organizations based on the amount of participation the Company measures from the organization's member-base. The Company will seek to make incentives relevant to the mission and purpose of the organization, and it will size the awards in a way that compel both engagement from the organization and participation and adoption from its member-base.

Exclusive of these uses, the Company plans to rely on existing rebates and incentives that are already part of on-going products.

H. Evaluation, Measurement, & Verification

The Company's M&V efforts will seek to validate that products used for distribution purposes provide the same load reduction effects as is highlighted in each product's technical assumptions. The M&V analysis will do this by verifying that the participating neighborhoods look similar to

the rest of the Company's service territory and that the load reduction is occurring in a similar timeframe to what has been used in filed demand response and energy efficiency measures.

The Company may also decide to conduct additional M&V to clearly show that the dispatchable demand response is delivering the intended effect at the substation transformer during a DR event. This analysis will provide greater internal assurance to the Company's distribution operators that the project is delivering what it forecasts.

Demand Response Programs

A. Description

Demand Response (“DR”) provides utilities with a valuable tool for managing peak demand on the electric system. The utility must maintain adequate generation reserve margins to fulfill its obligation to deliver power at all times, even when unforeseen factors impact generation supply. DR offers a lower cost alternative to meet this need as compared to building or acquiring additional generation capacity. The Company’s DR portfolio provides customers with an economic incentive, in the form of rebates or bill credits, in return for their commitment to reduce load when called upon. DR benefits all customers by helping create a more reliable electric system at a lower cost.

Demand response differs from *energy efficiency* in that demand response reduces load only during times of peak demand on the electric system and results in relatively little reduction in overall electric consumption. Energy efficiency, in comparison, provides a permanent reduction in overall electric consumption through equipment replacement, or process or behavior change, only a portion of which may be coincident with system peak demand.

Generally speaking, there are three DR program constructs that the Company intends to leverage:

- *Direct Load Control (“DLC”)* – The Company directly controls a customer’s load, remotely, during periods of high demand creating a dispatchable resource. Saver’s Switch is an example of a DLC.
- *Interruptible Tariffs* – Customers agree to reduce consumption at a pre-qualified discount. These products are also dispatchable. There is a fee associated with non-compliance with a control event. The Interruptible Service Credit Option (“ISOC”) is an interruptible tariff.
- *Other Demand Response* – Products that would fall into this category include capacity bidding, demand bidding, and other offers, as well as offerings that are non-dispatchable, or those that are directly controlled by customers, such as pricing structures. The Smart Thermostats are an example.

The Company’s DR portfolio includes all three types of demand response; however, the majority of customer load is from DLC and interruptible tariffs.

Products

The Company is deploying, as part of this DSM Plan, ten demand response choices. The originating filing and customer targets for each product / pilot are identified in the table below.

Table 17: The Company’s Demand Response Program Products

Product / Pilot	Customers	Filing Source
Critical Peak Pricing	Commercial/Industrial	DSM Plan
Electric Vehicle Critical Peak Pricing	Commercial/Industrial	Advice Letter No. 1798
ISOC	Commercial/Industrial	Proceeding No. 07S-521E
Peak Partner Rewards	Commercial/Industrial	DSM Plan
Peak Day Partners	Commercial/Industrial	DSM Plan

Small Commercial Building Controls	Small Commercial/Industrial	DSM Plan
Electric Vehicle Optimization	Residential	Proceeding No. 20A-0204E
Residential Demand Response	Residential	DSM Plan
Residential Battery Demand Response	Residential	DSM Plan
Geo-targeting	All classes	DSM Plan

DR products and pilots will contribute to both energy and demand savings. Demand savings will count towards total controllable load goals.

The intent of these products and pilots is to (1) minimize increased load adjustments until such time as there is an identified resource need and (2) pilot new approaches so that they could be in place as a need is realized. Pilot products in 2023 are aimed to define the magnitude of potential peak capacity available during specific intervals.

B. Forecasts, Participants & Budgets

Forecasts and Participants

DR forecasts are created differently than energy efficiency, as such, the tables below either represent the incremental or cumulative (incremental plus renewing) demand reduction estimates for 2023, dependent on claimed measure life for each product. Table 18 summarizes the incremental controllable load expected from ISOC in 2023. Table 19, summarizes DSM products and pilots that will contribute to demand reduction, as shown in the Plan’s Executive Summary.

Table 18: 2023 Demand Response Incremental Load for Non-DSM Products

2023	Marketing & Admin. Budget	Net Gen. MW
ISOC	\$500,000	5.00
Total	\$500,000	5.00

Table 19: 2023 Demand Response Incremental Load for DSM Products & Pilots

2023	Electric Budget	Net Generator kW	Net Generator kWh	Electric MTRC Test Ratio	Lifetime Emissions Savings (Tons CO2)	SCC Benefits	Electric MTRC Test Ratio with SCC
Demand Response Program							
Critical Peak Pricing	\$334,642	34,270	1,269,542		26	\$1,262	
Electric Vehicle Critical Peak Pricing	\$154,260	1,094	0		0	\$0	
Electric Vehicle Optimization	\$1,185,000	3,727	0	0.70	1,080	\$51,925	0.77
Peak Day Partners	\$531,460	16,253	364,431		94	\$4,497	
Peak Partner Rewards	\$1,207,209	24,560	407,032		115	\$5,539	
Residential Battery Demand Response	\$568,478	408	-15,634	1.25	-72	-\$2,957	1.24
Residential Demand Response	\$17,011,000	21,965	121,250	1.71	378	\$15,542	1.71
Small Commercial Building Controls	\$551,629	2,500	566,903	2.11	91	\$3,947	2.29
DR Program Total	\$21,543,677	104,778	2,713,524	2.09	1,712	\$79,755	2.10

The Commission-approved demand response goals⁷⁸ are cumulative (total controllable load) demonstrating the total peak capacity the Company could make available during a control event

⁷⁸DR goals were established by Decision No. C18-0417, at ¶86 in Proceeding No. 17A-0462EG.

(as shown in the Table 21). The Commission-approved demand response goals will be used to inform the Company's next Electric Resource Plan.

Table 20: Demand Response Goals – Total System Controllable Load

2023
520 MW

Budgets

Budgets for demand response efforts are anticipated to fall outside of our energy efficiency budget. The budget is a small increase from expenditures on existing DR products, however, an overall increase in budget for DR overall due to piloting opportunities. For 2023, DR budgets were developed using the same well-defined process as all other energy efficiency products. Budgets are based on cumulative product load, including costs for incremental growth and maintaining existing product participation.

C. Application Process

Application processes vary by product. See individual product summaries following this overall for more information.

D. Marketing Objectives & Strategies

For commercial and industrial offerings, outreach and marketing efforts are primarily conducted through internal teams such as the Account Management and Business Solutions Center teams.

For residential offerings, marketing and outreach is primarily conducted through direct contact such as emails or direct mail. In addition, the Company has been working with manufacturers, such as thermostat and battery manufacturers, to further encourage customers to enroll in demand response products.

E. Program-Specific Policies

There are no DR Program-specific policies. Individual DR products may have unique policies as noted in each of the product summaries that follow.

F. Stakeholder Involvement

Demand Response efforts will follow the same process for stakeholder engagement as energy efficiency products, within the DSM & BE Roundtable when filed originally within a DSM & BE plan.⁷⁹ DR efforts are also discussed with stakeholders during other proceedings such as our

⁷⁹The ISOC product was originally filed outside of the DSM Plan, and therefore will not be included in the DSM Roundtable process.

Energy Resource Plan. Beyond the DSM & BE Roundtable and various proceedings, product managers individually involve trade allies, manufacturers and other groups in the development of products.

G. Rebates & Incentives

DR products offer annual or event-oriented incentive payments to participating customers rather than traditional one-time rebate payments. Incentive structures vary by product.

H. Evaluation, Measurement, & Verification

The impacts from the Company's Demand Response products are analyzed annually. Public Service's load research organization leads an annual research project to evaluate the controllable system load available from our Saver's Switch and ISOC products. This analysis includes all product participants still active in each product. For the Saver's Switch product, the team hires a consultant—that specializes in load research—to conduct the data gathering and most of the analysis on a sample of product participants. For the ISOC product, data is recorded. The results are used to document the extent of load relief achieved during each actual control event occurring within the year. The amount of available total controllable system load is determined by this analysis twice annually in early spring and late summer.

The amount of available total controllable system load is made up from the cumulative historical achievement of incremental participation reported in past Status Reports. This available total controllable system load will differ from the sum of the incremental generator kW achievements reported in past Status Reports due to various reasons, as mentioned above, including but not limited to:

- *Load Loss:* Within DR products there are factors we define as a “load loss pool.” This pool includes customers who choose to discontinue participation, as well as those who may adjust their commitment to a lower load reduction.
- *Regulation:* EPA rules, historically, can have an impact on the participation within the commercial and industrial products. Previously, changes to backup generation rules resulted in a significant drop of load from the ISOC product.
- *Savings Estimates:* The Saver's Switch component of the Residential Demand Response product assumes a deemed controllable system load per switch estimate in Status Reports. The actual controllable system load can vary over time. The Company uses data logging on a sample of installed Saver's Switches to identify the available system controllable load per switch. These data loggers record the actual load of the air-conditioning units controlled by the installed switches. This recorded load is used to estimate the available system controllable load at typical system peaking conditions. This estimated available system controllable load can vary over time due to changes in air conditioner efficiencies and residential conservation efforts. Additionally, performance of the switches varies over time due to the disconnection or mechanical failure of switches.

The results of the annual analysis of the impacts from the Company's Demand Response program is combined with a forecast of the future participation in each DR product to produce a forecast of the total controllable system load expected in the future, referred to as the Load Management Forecast. The Company uses this annual analysis, combined with the actual participation in each DR product, to determine the achievement of total system controllable load goals in annual Status Reports.

Pilot products include their own M&V procedures and are discussed in detail within the individual pilot write-ups.

➤ Critical Peak Pricing

A. Description

Critical Peak Pricing (“CPP”) is a tariff rate that was introduced through Public Service’s Phase II rate case.⁸⁰ With the approval of the rate by the Public Utilities Commission, the Company has begun to offer the product as an additional resource for meeting its demand response goals. Price signals can be used to provide an incentive to reduce system costs, including reducing system peak, ultimately reducing costs for all customers. Tariffs focused on the reduction of system peak act much like DR products, and as such should count towards the DR goals.

Critical Peak Pricing products attempt to strongly encourage – rather than require – customers to reduce their usage during periods when forecasts indicate the electric grid will experience high system loads as a percentage of available generation capacity. The nomenclature “critical peak” is a reference to such periods. The term “pricing” indicates the Company will charge a high price for usage during these critical periods that will encourage customers to reduce their usage, rather than requiring pre-determined load reductions. During all other hours, customers are assessed lower charges. While primarily focused on summer peaks, this product can be utilized year-round.

The CPP tariff is available to commercial and industrial (“C&I”) customers who have existing interval metering. The CPP offering ; provides an additional customer choice, provides customers an opportunity to reduce their bill by managing their energy usage, and contribute to reducing system costs by reducing system peak via the response price signals. This product provides an alternative for customers who cannot or choose not to participate in the Company’s other DR products such as ISOC or PPR.

Participating customers will receive day-ahead notification of when “critical peak” periods will occur. CPP events shall be four-hour events occurring between the hours of noon and eight p.m. A maximum of 15 CPP events can be called during a calendar year.

To better manage their energy usage during CPP events, participants will be provided with access to their electric load profile data in near real time. Access to this data will allow participants to monitor their performance during events, and also provide insight into their energy use throughout the year.

The CPP tariff is designed to be “revenue neutral” for the class average customer. That means a customer with the average load profile within a given rate class would pay the same amount for electricity on an annual basis whether they were on the standard rate or the CPP rate if they do not modify their consumption. This design provides a strong incentive for reducing usage with little inherent risk of an overall increase in electric bills.

⁸⁰Proceeding No. 16AL-0048E.

B. Forecasts, Participants & Budgets

Forecasts and Participants

The CPP tariff is targeted to larger C & I customers with the sophistication and ability to manage and curtail their energy consumption. Customers will primarily be recruited by the Company's Account Management and BSC teams. Market segments which may be interested in this product include:

- Manufacturing – ability to curtail a process line or production shift during an event
- Office (commercial, institutional, etc.) – ability to pre-cool, adjust HVAC settings and shed discretionary loads
- Water/wastewater treatment – ability to shift process times

For the 2023 DSM & BE Plan, the Company anticipates incremental growth of 9 participants for demand reduction of just under three MW.

Budgets

All administrative and implementation costs are included in the annual budget. Unlike other DSM products there is no monetary incentive associated with this product. Product costs are attributed to the following areas:

Administration – This category covers costs associated with day-to day operations of the product. Included in this category are expenses for the third-party implementer assisting with the product.

Equipment & Installation – This category reflects the cost to purchase and install monitoring equipment at each participant's facility. The majority of these expenditures are allocated to new participants and realized by the product during each customer's first year of participation. Future expenditures will reflect costs of growing the product incrementally and any ongoing equipment maintenance for current participants.

Advertising & Promotion – This category is for marketing campaigns and associated collateral. The CPP product will require the need for ongoing customer support and communication to ensure the product delivers reliable results year over year.

C. Application Process

Account Management will act as the primary channel for delivering this product to market. Account Managers will discuss the CPP tariff option with customers. Those customers wishing to participate will request to be placed on the new tariff. After verifying eligibility with the Product Manager, the Account Manager will initiate the tariff change for the customer.

Once a customer has elected to be on the CPP tariff, monitoring equipment will be installed to provide the participant with near real time access to their load profile data. Though each participant's configuration may vary depending on their unique circumstance, in general this equipment will consist of a "pulse" device to transmit data pulse outputs from the customer's

revenue meter and a data logger to record and translate the pulse outputs and communicate this data back to the Company's DRMS. This process is estimated to take up to 60 days.

D. Marketing Objectives & Strategies

A critical part of the Critical Peak Pricing product's success will be the Company's ability to locate potentially eligible customers and assist them with participating in the product. A qualification of this product is the existence of interval metering. This customer base is made up primarily of "managed accounts." Potential customers will be contacted by their Public Service Account Manager to discuss the product. The objective of the meeting is to introduce the customer to the product, discuss tariff requirements, and assist the customer in identifying controllable loads which could be shed during a critical peak event.

Marketing and communication materials will communicate the features and benefits of the product. These will include a rate evaluation tool which Account Managers can use to help customers evaluate whether the CPP rate offers them potential savings opportunities.

A key asset enabling this product will be the Company's DRMS. This system provides the platform from which all its demand response products are managed. In addition to managing events and providing customer notification the system will provide product participants with near real time access to their load profile data. Having this data will allow participants to manage their energy use during events to help them maximize their savings.

The CPP product will require the need for ongoing customer support and communication to ensure the product delivers reliable results year over year. Therefore, marketing is a continuous process—not a single event—which includes initial discussion to recruit participants, then ongoing engagement with participants to ensure they are aware of and can continue to evaluate the benefits of the product in order to retain these customers.

E. Product-Specific Policies

All product-specific policies are provided in full detail within the Critical Peak Pricing Service – Schedules SG-CPP, PG-CPP, and TG-CPP – electric rate tariffs. Note that the tariffs may be updated annually and mid-cycle changes to CPP may not be reflected within this Plan.

Qualification:

CPP is available to all Colorado business customers receiving electric service under Schedule SG, PG, or TG with the following qualifiers:

- Customers must have existing interval metering
- Customer's load factor for the previous 12 months is 30% or greater. Load factor ("LF") is calculated as the customer's total annual usage in kWh divided by the product of the customer's annual peak demand in kW times 8,760. ($LF = \text{kWh}_{\text{annual}} / (\text{kW}_{\text{peak}} \times 8,760)$)

Contract Term:

There are no contracts associated with this product other than the associated tariff. A minimum period of one-year participation is stipulated within the tariff. The customer may elect to leave the tariff for after 12 months and revert to their original rate plan.

Events:

Critical Peak Pricing events are triggered whenever forecasts indicate the electric grid will experience high system loads as a percentage of available generation capacity. Based on historical system peaking conditions, events are most likely to be called during the summer months of June through September, but events may occur in any month throughout the year.

Events may be called between the hours of noon and 8:00 p.m. MST. Events shall be four hours in duration within this time period. Customers will be subject to no more than one event in any 24-hour period. No individual customer will experience more than 15 events per calendar year, for a total of 60 critical peak hours per year.

Load Reductions:

Load reduction will be determined by dividing the total energy reduced during the event period as measured in kWh by the number of hours in the event. Energy reduction will be calculated by subtracting the customer's actual usage during an event from the customer's baseline consumption for the same time period. The aggregate of participant's load reductions during critical peak events will be used to determine the amount of Demand Response provided by the product. Initially this amount has been estimated at 20% of the participant's peak demand based on the Company's investigation of similar programs from other utilities. As results from actual events become available the DR estimates can be adjusted to align with actual expected performance. The Company will create a seasonal DR forecast for the product to account for differences in participant's savings throughout the year.

Baseline Consumption:

For purposes of determining a participant's load reduction, the customer's load during an event will be compared to the customer's baseline load. The baseline methodology being proposed for this product is an adaptation of baseline calculations the Company has used in past products. Public Service updated its historical approaches by reviewing "Measurement and Verification for Demand Response" (2013)¹. This document, commissioned by the National Action Plan on Demand Response Measurement and Verification Working Group, focuses on providing "best DR M&V practices in various market and program contexts." This report provided valuable context on different baseline approaches, and a number of recommendations contained within the report have been incorporated into the baseline.

Specifically, for this product, the baseline usage for any 15-minute interval during an event will be calculated as the average of the measured demand during the same interval of the customer's five (5) highest energy consumption days within the last ten (10) non-holiday, non-weekend, non-event days.

An event day correction will be made to each 15-minute interval during the event to reflect the impact of weather or other operational changes which could cause substantive differences between

the event day and the baseline calculation. This event day correction will be the average 15-minute kW difference between the baseline calculation and the participant's actual load during the hour prior to event notification.

As customer baselines are inherently unobservable, one cannot measure usage which never took place, a poor baseline methodology can lead a systematic bias. To help mitigate this problem, Public Service will regularly evaluate baseline calculations. This can be done by selecting sample participants, calculating their baseline consumption for a simulated event day, and evaluating the difference between the calculated baseline and actual loads. Should these simulations show significant bias that is leading to inaccurate baseline assumptions, then Public Service will develop and recommend changes to the baseline methodology. It is proposed that such an evaluation be done annually prior to the summer event season. Should any changes be warranted, updates to the product would be made through 60-day notice.

Incentives:

Customers do not receive a monetary incentive for participating in the CPP product, however the "incentive" to participants is the opportunity to save money by reducing usage during high priced critical peak events. Further, participants will realize savings from the CPP tariff's reduced demand charges. Participants will also receive the benefit of having access to their electric load profile data in near real time. Access to this data will not only allow participants to monitor their performance during events, but also provide insight into their energy use throughout the year. Data will be provided in near real time with updates occurring at least every fifteen minutes through a customer portal feature of the DRMS.

Notification:

Participating customers will receive advance notice of events. Notifications will be delivered a minimum of 22 hours prior to an event and always during normal business hours between 8:00 a.m. and 5:00 p.m. MST. Notifications will be sent to the customer's designated contact(s) via e-mail, SMS text, voice message, or combination thereof as specified by the customer. Customers are responsible for insuring contact information is kept current and notifying the Product Manager if any changes are necessary.

F. Stakeholder Involvement

Colorado business customers have played a major role in the on-going dynamics of this product. Additionally, key internal stakeholders such as the Account Management team have provided consistent feedback on product performance and customer satisfaction that continuously influences product design and operations. The Company continues to meet frequently and interact with these business customers and internal stakeholders to encourage their input.

G. Rebates & Incentives

There are no monetary rebates or incentives associated with this product comparable to other DSM products in the portfolio. The CPP participant's incentive is avoiding high priced energy charges during critical peak periods. These charges are established through the CPP tariffs put forward by

the Company as part of its Phase II rate case. During critical peak periods participating customers will be charged the following based on their respective rate class:

SG-CPP	\$1.44/kWh
PG-CPP	\$1.40/kWh
TG-CPP	\$1.35/kWh

These rates were established in order to provide a strong incentive for customers to reduce their usage during these critical periods. Additionally, the Company believes customers must see the opportunity to make a substantial impact on their annual electric bill to entice their participation. As CPP events are limited to 60 hours per year the effective price per kWh was set quite high to present an opportunity for substantial bill savings. At these price points, with an estimated usage reduction of 20% during peak periods, annual bill savings of between 5%-10% could be obtained.

Furthermore, participants face limited risk of increased electric bills as compared to the standard tariff as the CPP rates are designed to be revenue neutral on an annual basis.

H. Evaluation, Measurement, & Verification Plan

The Company will collect interval data from each participant in the Critical Peak Pricing product from monitoring equipment installed as part of product enrollment and/or interval data metering installed as part of their regular electric service. This data will be stored and analyzed within the DRMS. Product performance for each event will be calculated by subtracting the actual aggregated usage of all customers from the aggregated baseline usage during the event window. This calculation, both on the portfolio level and for individual customers, will be automated through the functionality of the Company's DRMS. Performance data will be available to individual participants through the customer portal feature of the DRMS. Customers can view their usage at any time using their unique username and password to log into the system. The amount of demand reduction supplied for a given event is calculated by subtracting the actual aggregated usage of all customers from the aggregated baseline usage during the event window.

➤ **Electric Vehicle Critical Peak Pricing**

A. Description

Electric Vehicle Critical Peak Pricing (“EV-CPP”) is a tariff rate that was introduced by the Company to its No. 8 electric tariff as Secondary Voltage Time-Of-Use Electrical Vehicle Service (“S-EV”) through an Advice Letter⁸¹. Among other things, the S-EV tariff includes a CPP signal that can be used to provide a price signal to reduce system costs, including reducing system peak, ultimately reducing costs for all customers.

Critical peak pricing products attempt to strongly encourage – rather than require – customers to reduce their usage during periods when forecasts indicate the electric grid will experience high system loads as a percentage of available generation capacity. The nomenclature “critical peak” is a reference to such periods. The term “pricing” indicates that, rather than requiring load reductions, the Company will charge a high price for usage during these hours that will encourage customers to reduce their usage. During all other hours customers are assessed lower charges compared to non-participants.

EV-CPP is available to C&I customers where the electric power and energy from the electric service is used to charge EVs, or for Ancillary Usage. This offering will provide an additional customer choice, provide customers an opportunity to reduce their bill by managing their energy usage, and contribute to reducing system costs by reducing system peak via the response price signals. This product provides an alternative for customers who cannot or chose not to participate in the Company’s other DR products such as ISOC.

Participating customers will receive day-ahead notification of when “critical peak” periods will occur. Critical peak events will be four hours in duration. These events will always occur on non-holiday weekdays between the hours of 12:00 p.m. and 8:00 p.m. Mountain Time. A maximum of 15 events can be called in any calendar year.

To better manage their energy usage during peak events, some participants which agree to the terms and conditions of the EV-CPP product may be provided with access to their electric load profile data in near real time. Access to this data will not only allow participants to monitor their performance during events, but also provide insight into their energy use throughout the year.

The S-EV tariff is designed to be “revenue neutral” for the class average customer. That means a customer with the average load profile within a given rate class would pay the same amount for electricity on an annual basis whether they were on the standard rate or the S-EV rate if they do not modify their consumption. This design provides a strong incentive for reducing usage with little inherent risk of an overall increase in electric bills.

⁸¹Advice Letter No. 1798

B. Forecasts, Participants & Budgets

Forecasts and Participants

The EV-CPP product will be targeted to larger C&I customers with EV fleets and the sophistication to manage or ability to curtail their energy consumption. Customers would be recruited by the Company. Market segments which may be interested in this pilot include:

- Municipalities
- Public transit service providers
- Public charging facilities

The company will promote EV-CPP to customers participating in the EV Supply Infrastructure product, including those installing EV charging equipment at multifamily facilities that may serve Income-Qualified Customers. The company expects the majority of new customers to be participants of the EV Supply Infrastructure Program, which will add approximately 70 new customers per year.

Budgets

All administrative and implementation costs are included in the annual budget. Unlike other DSM products there is no monetary incentive associated with this pilot. Pilot costs are attributed to the following areas:

Administration – This category covers costs associated with day-to day operations of the pilot as well as monitoring equipment at the participant’s facility.

Advertising & Promotion – This category is for marketing campaigns and associated collateral.

M & V – Periodic sampling of participant’s data will be done to ensure processes are performing correctly.

C. Application Process

Public Service Account Management will act as the primary channel for delivering this pilot to market. Account Managers will discuss the EV-CPP option with customers. Those customers wishing to participate will request to be placed on the new S-EV tariff. After verifying eligibility with the product manager, the account manager will initiate the tariff change process for the customer.

Once a customer has elected to be on the S-EV tariff and agrees to the terms and conditions of the EV-CPP product, monitoring equipment may be installed to provide some participants with near real time access to their load profile data. Though each participant’s configuration may vary depending on their unique circumstance, in general this equipment will consist of a “pulse” device to transmit data pulse outputs from the customer’s revenue meter and a data logger to record and translate the pulse outputs and communicate this data back to the Company’s web-based Demand Management portal. The installation process is estimated to take 60 days.

D. Marketing Objectives & Strategies

A critical part of the product's success will be the Company's ability to locate potentially eligible customers and assist them in becoming a part of the pilot. The anticipated customer base is made up primarily of "managed accounts" and customers participating in other EV programs, such as the EV Supply Infrastructure Program. Potential customers will be contacted by the Company to introduce the customer to the product, discuss tariff requirements, and assist the customer in identifying loads which would be eligible for the product.

Marketing and communication materials, including a website and information sheet, were created to communicate the features and benefits of the product.

Overall product success will be tracked and managed by a designated product manager. This individual will work with account managers to ensure product participation and demand response capacity forecasts are being met. The product manager will work with additional internal employees including product developers, marketers, technicians, and other product managers to track the progress of the product and meet the product's forecasts and objectives. This goal measurement process consists of monitoring several indicators, including the number of customers participating, event load reduction data, forecasting demand response capacity expected during events, and calculating rate savings being achieved by participants.

The product will require the need for ongoing customer support and communication to ensure the product delivers reliable results year over year. Therefore, marketing is a continuous process—not a single event—which includes initial discussion to recruit participants, assisting customers to evaluate the benefits of the product to ensure customers remain enrolled, and ongoing communication/education about how the product works.

E. Product-Specific Policies

Qualification:

The EV-CPP product is available to all Colorado business customers receiving secondary voltage electric service, including Net Metering service, with the following qualifiers:

- Electric power and energy from the electric service is used solely to charge Electric Vehicles, or for Ancillary Usage;
 - Ancillary Usage is defined in the S-EV tariff as any customer power or energy usage necessary to support electric charging of Electric Vehicles or to support electric charging stations that is not used by the customer for any other electric consumption needs.
- Electric Service on the rate will be separately metered
- Electric service on the EV-CPP rate is not eligible for the ISOC, CPP or PPR products.

Contract Term:

All service under this schedule shall be for a minimum period of twelve consecutive months and monthly thereafter until terminated. Customers will be required to sign a contract verifying that the only loads on the service are for EVs or ancillary usage.

Events:

Events are triggered whenever forecasts indicate the electric grid will experience high system loads as a percentage of available generation capacity. Based on historical system peaking conditions, events are most likely to be called during the summer months of June through September, but events may occur in any month throughout the year.

Events may be called between the hours of 12:00 p.m. and 8:00 p.m. Mountain Time. Events will be four hours in duration within this time period. Customers will be subject to no more than one event per day. No individual customer will experience more than 15 events per calendar year, for a maximum of 60 critical peak hours per year.

Load Reductions:

Load reduction during an event will be determined by subtracting the participant's actual demand during an event from the participant's baseline demand for the same time period. The aggregate of participant's load reductions during critical peak events will be used to determine the amount of demand capacity provided.

Baseline Consumption:

For purposes of determining a participant's load reduction the customer's load during an event will be compared to the customer's baseline load. The baseline methodology being proposed for this product is an adaptation of baseline calculations the Company has used in other products. The Company updated its historical approaches by reviewing "Measurement and Verification for Demand Response" (2013). This document, commissioned by the National Action Plan on Demand Response Measurement and Verification Working Group, focuses on providing "best DR M&V practices in various market and program contexts." This report provided valuable context on different baseline approaches, and a number of recommendations contained within the report have been incorporated into the baseline.

Specifically, for this product, the baseline usage for any 15-minute interval during an event will be calculated as the average of the measured demand during the same interval of the customer's five (5) highest energy consumption days within the last ten (10) non-holiday, non-weekend, non-event days.

An event day correction will be made to each 15-minute interval during the event to reflect the impact of weather or other operational changes which could cause substantive differences between the event day and the baseline calculation. This event day correction will be the average 15-minute kW difference between the baseline calculation and the participant's actual load during the hour prior to event notification.

As customer baselines are inherently unobservable, one cannot measure usage which never took place, a poor baseline methodology can lead a systematic bias. To help mitigate this problem, the

Company will regularly evaluate baseline calculations. This can be done by selecting sample participants, calculating their baseline consumption for a simulated event day, and evaluating the difference between the calculated baseline and actual loads. Should these simulations show significant bias that is leading to inaccurate baseline assumptions, then the Company will develop and recommend changes to the baseline methodology. Updates to the product would be made through a 60-Day Notice.

Incentives:

A participant's "incentive" is the opportunity to save money by reducing usage during high priced critical peak events.

Notification:

Participating customers will receive advance notice of events. Notifications will be delivered no later than 4 p.m. Mountain Time the day prior to a Critical Peak Pricing event. Notifications will be sent to the customer's designated contact(s) via e-mail, text, voice message, or combination thereof as specified by the customer. Customers are responsible for ensuring contact information is kept current and notifying the account or product manager if any changes are necessary.

F. Stakeholder Involvement

Rate development outreach included representatives from the CEO, Colorado Energy Consumers ("CEC"), the City and County of Denver ("Denver"), the City of Boulder ("Boulder"), the Regional Transportation District ("RTD"), Tesla, Inc. ("Tesla"), ChargePoint, Inc. ("ChargePoint"), and Electrify America, LLC ("Electrify America").

G. Rebates & Incentives

As previously mentioned, there are no rebates or incentives associated with this product comparable to other DSM products. The product participant's incentive is avoiding high priced energy charges during critical peak periods. These charges were established through the S-EV tariff introduced through Advice Letter No. 1798 and which became effective June 24, 2019. During critical peak periods participating customers will be charged the following:

EV-CPP: \$1.50/kWh

These rates were established in order to provide a strong incentive for customers to reduce their usage during these critical periods. Additionally, the Company believes customers must see the opportunity to make a substantial impact on their annual electric bill to entice their participation. As product events are limited to 60 hours a year the effective price per kWh was set quite high to present an opportunity for substantial bill savings.

Furthermore, participants face limited risk of increased electric bills as compared to the standard tariff as the S-EV tariff is designed to be revenue neutral on an annual basis.

H. Evaluation, Measurement, & Verification Plan

The Company will collect interval data from each participant in the product from monitoring equipment installed as part of enrollment and/or interval data metering installed as part of their regular electric service. This data will be stored and analyzed by the Company. Product performance for each event will be calculated by subtracting the actual aggregated usage of all customers from the aggregated baseline usage during the event window. The amount of demand reduction supplied for a given event is calculated by subtracting the actual aggregated usage of all customers from the aggregated baseline usage during the event window.

➤ Electric Vehicle Optimization

A. Description

Electric vehicles⁸² are poised to become a significant source of electricity demand over the coming decades. Bloomberg New Energy Finance (“BNEF”) projects that EVs could represent 60% of all US light duty vehicle sales and 40% of the US fleet by 2040.⁸³ Moreover, BNEF forecasts that over this same time period electric vehicles will begin to proliferate in the medium and heavy-duty market segments. For example, BNEF’s analysis estimates that electric buses will constitute 80% of municipal bus fleets in the US by 2040.⁸⁴

If electric vehicles approach these levels of penetration and charge in an uncontrolled manner, they could require a substantial electric system infrastructure investment to integrate. MJ Bradley, for example, estimates that achieving a scenario where 26% of the light duty vehicle fleet is electrified could increase summer peak demand in Colorado by 1.5 gigawatts. If the state achieves its decarbonization goals—electrifying 98 percent of the fleet—EV demand would increase the summer peak by 7 gigawatts.⁸⁵

The effects of EV charging can also be felt locally on the distribution system. Either through widespread adoption or a clustering effect where a single area sees a high penetration of EVs, EV home charging may challenge the capacity of parts of the distribution system and require upgrades to transformers and conductors. An early analysis conducted using data from Sacramento Municipal Utility District found local distribution costs ranged from \$34 to \$2,000 per EV, escalated as the power of the charging solution used by homeowners increased, and could be nearly eliminated with a combination of smart charging and time-varying rates.⁸⁶

While impacts from EV charging could be substantial, there is also great potential to leverage EV charging as a grid asset. The typical residential customer’s vehicle spends half its life sitting at the customer’s home, either actively charging or waiting to be driven. The EV Project showed that the average customer’s EV sits in the garage for nearly 12 hours a night.⁸⁷ For customers that utilize Level 2 charging equipment, their EVs, on average, require less than three hours of charging each night. This means that this 2-3-hour block of charging—representing on average 10 kWh of demand—can be shifted around to the optimal time period(s) during half the day (i.e., the 12-hour period the EV is parked at home) without having any effect on the customer. As the grid evolves, incorporates more renewable energy, and adds much more distributed intelligence, the flexibility

⁸²Electric vehicles refer to battery electric vehicles and plug-in hybrid electric vehicles.

⁸³Bloomberg New Energy Finance. (2018). Electric Vehicle Outlook 2019.

⁸⁴Ibid.

⁸⁵MJ Bradley. (2017). Electric Vehicle Cost-Benefit Analysis. Retrieved from https://mjbradley.com/sites/default/files/CO_PEV_CB_Analysis_FINAL_13apr17.pdf.

⁸⁶Berkheimer, J., Tang, J., Boyce, B., and Aswani, D., "Electric Grid Integration Costs for Plug-In Electric Vehicles," SAE Int. J. Alt. Power. 3(1):2014, doi:10.4271/2014-01-0344.

⁸⁷The EV Project. (2014). EV Project Electric Vehicle Charging Infrastructure Summary Report. Retrieved from <https://avt.inl.gov/sites/default/files/pdf/EVProj/EVProject%20Infrastructure%20ReportJan13Dec13.pdf>.

of EVs could be harnessed in new ways to make the bulk system and local distribution system more efficient.

In recognition of these issues, the Company proposes the Electric Vehicle Optimization product offerings to begin to mitigate grid impacts associated with EV charging, while also starting to evaluate how to harness the potential grid flexibility that EVs can provide.

The Electric Vehicle Optimization product has two offerings:

- Static Optimization (also known as “Optimize Your Charge”); and
- Dynamic Optimization (also known as “Charging Perks”).

Static Optimization will work with EV customers to identify and set a charging schedule. The Company has tested its ability to implement this type of offering in Minnesota and is confident that it can implement this product at scale as an option for the 20,000+ EV drivers already in the Company’s service territory and those future drivers that will join their ranks during the DSM Plan period. This offering is primarily focused on addressing grid impacts of EV charging with a simple schedule-based solution.

Dynamic Optimization, which is an on-going pilot, takes a more novel approach that evaluates how the Company can leverage the flexibility that EV charging can provide. The Dynamic Optimization pilot will work with automakers to formulate a customer’s daily charging schedule based on day-ahead forecasts of power production costs, vehicle state of charge, and customer driving requirements. Since Dynamic Optimization manages charging in novel ways, it is being implemented through a small-scale pilot.

As the EV market matures and smart charging technologies and vendors evolve, the Company sees value in providing two offerings that give options to customers and entail different vendor requirements. As the Company begins to engage with customers through these two offerings, it will gather information on customer interest and preferences for smart charging that it can use to evolve its Electric Vehicle Optimization offerings.

The Company describes Static and Dynamic Optimization in greater detail below:

Static Optimization (also known as “Optimize Your Charge”)

Static Optimization or Optimize Your Charge is an offering that seeks to manage the grid impacts of EVs by working with customers to schedule their daily EV charging based on the customer’s selection of a preferred schedule that ensures charging occurs outside the Company’s system peak.

Static Optimization includes several core features:

Schedule selection—During enrollment, the customer will choose their preferred charging schedule. The Company will offer at least two schedule options to allow customers that charge during the day and night to participate. Schedule options will exclude 3-7 pm and will provide a charging window that is at least eight hours long.

Opt-out—Customers will be able to override their chosen charging schedule with no restrictions.

Rebate—In exchange for participating, the customer will receive \$50 bill credit.

Behavioral reinforcements—Since the offering allows the customer to override without penalty and the customer can also re-set their schedule at any time, the Company will utilize behavioral reinforcements to keep customers engaged and re-engage customers that are consistently overriding or that have changed their schedule. Using data it receives from selected vendors, the Company will be able to track customer participation, and it will use this information to inform its behavioral strategy.

To set the charging schedule, the Company will utilize communication and educational materials that direct the customer to set their schedule either within their vehicle (or vehicle mobile app) or through their charging station (or charging station mobile app) as relevant for the customer. For participating customers that also choose to participate in any products where the Company installs, owns, and maintains a charging station at the customer's home or premise, the Company will work with its chosen installation partners to program the charging station to the customer's selected charging schedule at the time the charging station is installed.⁸⁸

The Company will use a competitive process to select vendors to provide charging data for participating customers, and it expects that vendors may include a mix of automakers, networked charging station providers, third-parties able to access charging data through Application Programming Interfaces (APIs) with automakers, and third-parties able to access data by other means (e.g., a chip placed in the on-board diagnostics (OBD) port of the vehicle).

By establishing a charging schedule for Static Optimization participants, the Company will reduce on-peak charging, reduce operating costs by increasing charging during lower cost hours, and will reduce local distribution problems that can be caused by the coincidence of charging start times.

Dynamic Optimization (also known as “Charging Perks”)

Dynamic Optimization or Charging Perks is a pilot that manages the demand of electric vehicles (EVs) and explores the potential for EVs as a flexible load that can be leveraged to support the integration of renewable energy. In addition, the pilot tests customer interest in smart charging products, and gathers baseline and smart charging load profiles from various makes and models of light duty passenger EVs. Since Dynamic Optimization is utilizing such new smart charging concepts and technologies and working with multiple OEMs in unison, the Company will monitor gaps and areas of improvement for future product considerations that may impact the customer experience, electric bills, etc.

To carry out the pilot, the Company is working with WeaveGrid and four automobile original equipment manufacturers (“OEMs”) to manage EV demand, and it is one of the first such pilots in the United States. By working with WeaveGrid (for Tesla drivers), BMW, Ford, General Motors, and Honda, the Company communicates demand management instructions to each OEM, who then communicate directly to vehicles that are charging at home.

⁸⁸For example, the Company has filed a Residential portfolio in its Transportation Electrification Plan, Proceeding No. 20-0204E, that includes an option where the Company would install, own, and maintain a charging station on behalf of the customer. As of the time of this filing, this program option is currently under consideration by the Colorado Public Utilities Commission.

The Company's collaboration with OEMs for this pilot provides several unique benefits. Because the pilot manages demand through the vehicle, customers can participate with networked or non-networked Level 1 or Level 2 charging stations. Working with OEMs allows the OEM to market the pilot direct to their customers. And the OEMs can access a vehicle's state of charge, allowing the vital piece of data to be leveraged in making load shifting decisions.

The pilot targets customers who are on TOU and non-TOU rates in order to evaluate rate design impacts on charging behaviors. Evidence from around the country shows that rates can be very effective at shifting EV charging outside of system peak, but more active control via smart charging capabilities may improve the customer experience and provide greater precision to accomplish other objectives like integrating renewable energy. The pilot tests how rate designs combine with smart charging to accomplish three different grid applications. TOU specific optimization capabilities may vary by OEM or smart charging vendor.

First, the Company shifts EV charging demand outside of its system peak to provide capacity savings. Second, the Company shifts charging into the hours with the lowest electricity production costs. Third, the Company encourages charging events in the evening in response to a wind curtailment event when additional electricity demand can be used to reduce the amount of wind power that is curtailed. The Company tests these three applications by providing OEMs with a proxy hourly production cost that is reflective of grid conditions. Each OEM uses this information in conjunction with what they know about driver needs and vehicle conditions (e.g., EV state-of-charge) to develop a recommended charging schedule that they send to the vehicle and that is activated when the vehicle arrives at home.

To attract customers to the pilot, the Company provides incentives directly to participants. All customers receive a sign-up incentive of \$100. Customers that charge at a Level 1 charging rate, or a standard 120-volt wall outlet receive a further \$50 credit at the end of each year of the pilot. Customers that charge at a Level 2 charging rate will receive a larger incentive of \$100 at the end of each year of the pilot. Level 2 customers receive higher incentives because the higher charging rate provides greater ability for the Company to shift the customer's charging load. The Company is using these incentives to attract up to 1,000 EV customers, and the Company seeks a combination of customers on its flat volumetric rate ("Schedule R") and time-of-use rate ("Schedule RE-TOU"), but residential customers on other rates are also able to participate.

This pilot is a testing ground to evaluate and learn about smart charging technology and product design before launching a full scale offering where many more EV customers would be eligible to participate. Although this pilot focuses on collaborating with specific auto OEMs, if it proves successful, the Company will look to broaden the participating vendors like the approach it seeks to take for Static Optimization.

In addition to offering Static and Dynamic Optimization as stand-alone options for EV customers, the Company is also planning to incorporate these product options into other EV products. In the Company's Residential portfolio that has been filed in the Company's Transportation Electrification Plan ("TEP"), Proceeding No. 20-0204E, the Company is proposing to offer customers both a Full Service and Bring-Your-Own charging option where the customer receives rebates for installing a 240 volt-circuit in their home for charging and may choose to have the

Company install a level 2 charging station in their home through the Full Service option. For either of these product options, the customer must enroll and participate in either a time-varying rate or Static or Dynamic Optimization. The Company expects that the Residential portfolio in the TEP will provide a significant share of enrollments in both Static and Dynamic Optimization if it is approved by the Public Utilities Commission.

B. Forecasts, Participants & Budgets

Forecasts and Participants

The Company is targeting residential EV drivers that charge at their home location for both Optimization offerings. In addition, for Static Optimization, the Company is targeting commercial customers that have light-duty fleets that operate in a similar way to residential customers and that utilize the same vehicle and charging station equipment manufacturers.

For Dynamic Optimization, the Company is seeking up to 1,000 residential customers. The size of this pilot was originally determined to seek up to 600 residential customers in a 2019-2020 DSM Plan Modification. Due to higher than anticipated interest from EV owners in the Company's service territory, new models of EV's hitting the market, and continued interest and engagement of stakeholders, the capacity of the pilot was increased to 1,000 and extended through 2023.

Budgets

The budget includes costs for vendors, rebates, administration, and EM&V through the end of 2023. Marketing for Dynamic Optimization is being performed by the automakers and is incorporated into the cost of their service.

C. Application Process

Customers that seek to participate in Static Optimization will enroll through the Company's website where they will be able to view product details and submit an application that includes fields such as name, address, email, and information necessary for the vendor to identify and enroll their vehicle or charging station as a product participant. The customer will also agree to product terms and conditions during this process.

Customers that are interested in applying for Dynamic Optimization are directed to apply for the pilot through the WeaveGrid website (for Tesla drivers), the relevant automaker's website, mobile app, or email address. As part of the enrollment process with the automaker, the customer will provide common enrollment information (name, address, email, etc.) and agree to the Company's terms and conditions. The automakers will securely share enrollment information with the Company, and the Company will validate the Customer's eligibility for the pilot. After reviewing a customer's application, the Company will directly inform the customer of their enrollment status.

D. Marketing Objectives & Strategies

The Company will leverage strategies identified in its TEP to provide residential customers with information about EVs and EV-related offerings. These strategies include digital placements such as search engine marketing, banners, and social media posts to direct car buyers and EV drivers to Xcel Energy's EV website. The website will consist of product information as well as an EV Advisor tool to help customers decide whether and how to participate in the Company's Optimization product.

In addition, for Dynamic Optimization, the participating automakers and smart charging vendors will reach out to their EV owners in the Company's Colorado service territory directly.

E. Product-Specific Policies

A customer is eligible to participate in EV Optimization if they meet the following requirements:

- Own or lease an EV;
- Have an active Xcel Energy account that receives electric service;
- Be a residential customer and charge their vehicle at their home address in Xcel Energy Colorado service territory;
- Have a charging location that has access to Wi-Fi if customer is relying on the use of their networked charging station for participation in Optimization;
- For Dynamic Optimization, customer can perform some of their charging at night;
- For Static Optimization, commercial customers can also participate, if they meet the eligibility requirements stated above (excluding the requirement related to being a residential customer); and
- Not already enrolled in conflicting EV Optimization offering from Xcel Energy.

F. Stakeholder Involvement

For Dynamic Optimization, the Company conducted a significant amount of stakeholder engagement prior to the filing of the pilot as a 2019-2020 DSM Plan Modification, which is detailed in the Modification write-up. In addition, the Company has updated stakeholders on the pilot through on-going DSM Roundtables and in EV stakeholder meetings that were hosted in 2020 to gather stakeholder feedback as part of the TEP filing. During these EV stakeholder meetings, the Company described its general approach to EV Optimization, and the Company also held a smaller workshop where it took feedback from stakeholders specifically on their views related to managing EV demand.

G. Rebates & Incentives

Static and Dynamic Optimization offer different rebate levels to the customer. Static Optimization provides a \$50 bill credit. Dynamic Optimization provides a \$100 upfront incentive and an end of year rebate of between \$50-100 depending on the charging rate (kW) the customer utilizes. The table below summarizes these rebates:

Offering	Customer Type	Initial Incentive	On-going Reward	Annual
Static Optimization	All	N/A	\$50	
Dynamic Optimization	Level 1 Level 1 chargers use a standard 120-volt plug and provide approximately 4 miles of range per hour of charging.	\$100	\$50	
Dynamic Optimization	Level 2 Level 2 chargers require 208/240-volt electrical service and typically provide approximately 20 to 60 miles of range per hour of charging.	\$100	\$100	

For Dynamic Optimization, the rebates and incentives are designed to attract participation for the pilot, and do not necessarily reflect the compensation level or structure for any future offering.

H. Evaluation, Measurement, & Verification

The Company plans to evaluate both Static and Dynamic Optimization during the 2023 DSM & BE Plan period. For Dynamic Optimization, the Company has selected a vendor and is in the process of contracting with that vendor to perform the evaluation. The Company’s EM&V plan for this pilot focuses on conducting analysis in the following areas:

- Customer interest and satisfaction—Deeper look into customer satisfaction in participating in the pilot and future products;
- Assessment of the EV charging baseline—Use of historical information to assess how EVs are used by customers, including how charging occurs for customers on different types of rates; and
- Evaluation of smart charging performance—Use of pilot data to evaluate avoided capacity, emissions savings, operational cost savings, reduced renewable energy curtailments.

Data used in the analyses comes from home charging monitoring data that is logged and communicated from the vehicle back to the automaker and from a survey administered by the selected EM&V vendor to participating customers.

For Static Optimization, the Company envisions a similar type of analysis. However, since the demand management approach is not as complex, the evaluation of smart charging performance may encompass a smaller scope than what is shown here for Dynamic Optimization. Data for the Static Optimization analysis will come from the participating vendors, which may include charging station vendors, automakers, and other third-parties able to obtain charging data.

➤ **Interruptible Service Option Credit**

A. Description

The Interruptible Service Option Credit (“ISOC”) product offers significant savings opportunities for Public Service’s business customers who can reduce their electric demand when notified. In return for participating, customers receive a monthly credit based on the notification option and total interruption hours they select.

During periods of peak demand, such as hot summer days, the system may require more power than is normally available. By participating in this product, ISOC customers help reduce the amount of electricity needed, which helps Public Service meet electric system requirements at critical times.

The product is a tariff rate approved by the Colorado Public Utilities Commission,⁸⁹ and is available to commercial customers in Public Service’s electric service territory. To qualify, customers must have an interruptible demand of at least 300 kilowatts (kW) during the months of June, July, August, and September. In addition, the customer must have a Contract Interruptible Load (CIL) of 300 kW or more.

The customer’s contracted interruptible load is the median of their maximum daily 1-hour integrated demands, which occurred between noon and 8 p.m. on Monday through Friday (excluding holidays); from June 1 through September 30 of the previous year. In addition, their interruptible demand is the maximum daily integrated demand used during the month that occurred each day between noon and 8 p.m., less any firm demand. Customers must install a phone line that is connected to their meter - this will allow Public Service to provide near real-time usage information.

The participating customer signs a contract that includes their selected firm demand, the hours of interruption per year, and other available options. Customers can use electricity as usual until Public Service notifies them of a control period. The Company will give advanced notice before requiring the customer to curtail electricity use. Then, during the interruption period, customers cut their electricity use down to the firm demand chosen in their product agreement.

Customers choose the amount of interruption appropriate for their facility. The credit they receive is tied to the capacity offered to the Company and number of hours they contract to be interrupted each year.

Interruption periods can occur at any time of year and are triggered as a result of capacity, contingency and/or economic constraints. Economic interruptions are the only interruptions that offer the customer a buy-through option. All interruptions (events) last a minimum of 4 hours, unless the customer has chosen to waive the 4-hour minimum interruption timeframe. If customers do not meet their agreed-upon load reduction, they will be charged penalties.

⁸⁹Proceeding No. 07S-521E.

B. Forecasts, Participants & Budgets

ISOC is available to all customers that qualify for the tariff. From a total demand credit budget perspective, dollars allocated for this initiative are based on the number of hours they contract to be controlled each year and the amount of controllable load they have available.

As of June 1, 2019, there were 68 Public Service customers participating in the ISOC product receiving part B credits. One customer joined the product in 2021 and is on the new part C of the tariff. All ISOC customers are now considered Within 10 Minute Notice participants as the 1-Hour notice option was eliminated in 2019.

ISOC budget items include labor, equipment, and the development of marketing materials, such as customer ISOC User Guides (described in Section D below), as well as an annual training for customers and Account Managers to share updates on any enhancements or revisions to the product.

C. Application Process

Public Service Account Managers play a vital role in communicating the benefits of this product to potential customers. They spend a great deal of time with the customer throughout the application process to ensure that the customer meets all the requirements of the product, and that all product information is understood. When customers decide to join the product, they will work with their Account Manager to determine the following:

Qualification:

ISOC is available to all customers that qualify for the tariff rate. Prior to completing a contract, the customer must have a minimum of 300 kW of Interruptible Demand in each of the summer months of June, July, August, and September. Additionally, the customer's CIL for Planning Reserves must be greater than 300 kW. The Interruptible Demand and CIL figures must be reduced by any Contract Firm Demand the customer chooses. A minimum is required for summer months; however, events can be called at any time of the year if needed.

New Within 10 Minute Notice contract term:

The initial contract term for customers joining the product after January 1, 2019, shall be five years, with an 18-month termination notice requirement. Early termination penalties will be equal to 18 months of credits.

Trial Period Provision: There is a first-year trial period provision provided in the tariff (*for example:* If the customer signs-up for ISOC in April, the trial period will run from April through December of that year). If the customer chooses to cancel their agreement in the first year, they can do so by returning all credits paid. Subsequently, the Company will return any capacity/contingency penalties and cancel the contract. This provision is only available to participants during the year in which the contract is signed.

Grandfathered Within 10 Minute Notice contract term:

Those customers enrolled by December 31, 2018, that commit the same kW load shed commitment for a period of ten years will receive a grandfathered credit rate, but no additional application process is necessary. If grandfathered customers wish to leave the product, they will be required to provide the Company with three years' notice. If these customers wish to leave the product prior to the termination of their ten-year commitment, they will be subject to an early termination penalty that amounts to 36 months of credits.

Contract Authorization:

Once it is determined that the customer will qualify for the ISOC product, an Interruptible Service Option Agreement will be executed. The Agreement must be approved by the customer and by an authorized representative of Public Service prior to May 31 for the customer to receive credits in that year.

D. Marketing Objectives & Strategies

A critical part of the ISOC product's success is the Company's ability to locate potentially eligible customers, assist them in becoming a part of the product, and provide service according to the tariff. That process begins by running a query on the customer information system to locate business customers in the electric service territory that meet eligibility requirements for the ISOC product.

Potential customers that meet product eligibility requirements are contacted by an Account Manager, and a meeting is scheduled with interested businesses. The objective of the meeting is to introduce the customer to the various ISOC product options and discuss product requirements and responsibilities.

In addition to this customer prospecting process, marketing and communication materials are created, and these materials are used to communicate the features and benefits of the product. These marketing materials include:

- The Interruptible Service Option Credit (ISOC) User Guide – Provided to customers as a valuable reference to navigating the Demand Response Management System (DRMS).
- ISOC Info Sheet – Summarizes the product's features and benefits, helps potential customers determine their qualification status, and outlines various control options and assists customers in understanding the savings they could realize by participating.
- ISOC Website – Extensive information is also included on the Xcel Energy website for current and potential customers.⁹⁰ The website is reviewed on a consistent basis to ensure the information is current.

⁹⁰http://www.xcelenergy.com/Programs_and_Rebates/Business_Programs_and_Rebates/Rates/Interruptible_Service_Option_Credit

Account Managers conduct outreach to potential customers utilizing the marketing and communications materials referenced above. The Account Managers play a crucial role by interacting with customers on a regular basis to ensure customer satisfaction.

A group of internal employees including analysts, Account Managers, product developers, marketers, technicians, and product managers are also continually working to track the progress of the product to meet the product forecasts and objectives. This measurement process consists of monitoring several indicators, including the number of customers participating, interruption data, MW available for control, and credit dollars.

Much of the effort for future ISOC marketing initiatives will involve working to target qualified customers and increase the level of communications to current and potential customers.

For a product of this nature, it is not only important to promote the product up-front, but customers also need ongoing support and communication. It should also be noted that we view marketing as a continuous process—not a single event—which includes initial discussion to recruit participants, then ongoing communication to ensure customers know and can continue to evaluate the benefits of the product in order to retain these customers, and ongoing communication/education about how the product works.

This effort includes pre-season communication and training, as well as during and post-control event communications and support. Marketing staff work to understand the various stages of any particular customer's interpretation of the product and provide materials and support necessary to ensure consistent and positive customer experience.

Marketing encompasses both solicitation communications and education, and also on-going product communication, including training to retain participant customers in support of achieving the capacity deferral benefit potential of the product, as captured in the Company's ISOC forecast.

E. Product-Specific Policies

As of January 1, 2019, all new contracts for service under this schedule shall be for an initial five-year term. New customers enrolling after January 1, 2019, must provide the Company an eighteen-month advance notice in writing to cancel service under this schedule.

Any time during the first year of service under the contract a customer may opt to cancel by returning all monthly credits received to date. No additional payment will be assessed.

Any customer who cancels service without complying with the Service Period requirements under this schedule shall be required to pay Public Service, as a penalty, an amount equal to the product of 110% times the customer's CIL times the customer's Monthly Credit Rate for each of the remaining months of the unexpired contract term.

In addition, the customer shall reimburse Public Service for the direct cost incurred for equipment to measure the customer's interruptible demand and to interrupt the customer.

F. Stakeholder Involvement

Colorado business customers have played a major role in the on-going dynamics of this product. The Company continues to meet frequently and interact with these business customers to encourage their input.

G. Rebates & Incentives

The monthly kW credit paid to customers as part of the ISOC product is calculated by multiplying the Monthly Credit Rate by the lesser of the customer's CIL or the actual Interruptible Demand during the billing month. The credits are a monthly credit to the customer's energy bill.

The Monthly Credit Rate is revised effective January 1 each year and shall remain in effect for the calendar year. The Monthly Credit Rate will vary by season. The summer season runs from June 1 through September 30, and the winter season is October 1 through May 31.

The number of hours in the year that each customer elects as interruptible is set in the ISOC Agreement. The options include 40 hours, 80 hours, or 160 hours.

H. Evaluation, Measurement, & Verification

The Company will collect interval data from each participant in the ISOC Product from monitoring equipment installed as part of product enrollment and/or interval data metering installed as part of their regular electric service. This data will be stored and analyzed within the DRMS. Performance data will be available to individual participants through the customer portal feature of the DRMS. Customers can view their usage at any time using their unique username and password to log into the system.

➤ Peak Day Partners

A. Description

Peak Day Partners is a Demand Response offering that affords the Company's commercial and industrial customers an incentive through a bid-offer process, in exchange for reducing their peak load during periods when demand is high. The purpose is to provide the Company with an additional power purchase resource to more efficiently manage system requirements during exceptional periods, as well as provide customers the option of receiving pricing associated with energy supply markets during such periods.

The Company will send offers to participating customers for a specific load reduction amount at a given price and a specific date and time. Customers will have the option to accept or decline the offer or provide a counteroffer. If accepted, the customer will be responsible for manually meeting this accepted demand reduction during the specified hours. Participation is voluntary and there is no penalty for event non-participation or withdrawal from the product. Peak Day Partners is expected to be primarily utilized on hot summer days when the Company's load is expected to reach near-peak capacity. Control events could also be issued during winter peaking events. Customers will sign an Enabling Agreement in order to participate in the bidding process for Peak Day Partners.

Peak Day Partners is designed to price capacity at or below forecasted market costs, start-up costs, and spinning reserve costs. This means that purely on a capacity basis, it should yield positive net benefits.

B. Forecasts, Participants & Budgets

Forecasts and Participants

Peak Day Partners is available to all the Company's commercial and industrial customers who can commit to reducing their peak electric load during peaking events. Historically, we have seen that most participants are at 3MW of load or above.

Budgets

The primary costs in operating Peak Day Partners are attributed to two primary categories; Marketing & Administration and Participant Incentives:

Marketing & Administration – Administration costs cover several different activities as detailed below.

- Administration - This category covers costs associated with day-to day operations. Included in this category are expenses for the third-party implementer assisting offering.
- Equipment & Installation - This category reflects the cost to purchase and install monitoring equipment at each participant's facility. Expenditure is expected to be greatest

in the early years as the participant base is built. Future expenditures will reflect costs of growing the product incrementally and any ongoing equipment maintenance for current participants.

- Advertising & Promotion - This category is for marketing campaigns and associated collateral.

Participant Incentives – Participant incentives account for a significant portion of the budget and will be based on the actual load reduction customers supply within each event bid-offer that was accepted and performance met.

C. Application Process

Peak Day Partners will leverage the Company’s Account Management team as the primary channel for delivering this offering to market. These account managers have established relationships through ongoing communication over time. This direct marketing channel will enable the Company to lay out the product in a personalized manner to interested customers in efforts to capitalize on conversion. After verifying available capacity from interested customers with the product manager, the account manager will guide the customer through the following application details:

Qualification:

Peak Day Partners is available to all commercial and industrial customers who can agree to reduce usage during weekdays in the summer months, June through September, typically in the afternoon hours, although the company anticipates more need for controls during other peak throughout the year.

The Company prefers that participants be capable of providing at least 500 kW of peak demand reduction at each site for which load reduction is offered. However, the Company may accept applications including sites providing less than 500 kW of peak demand reduction in the interest of meeting its peak load reduction forecasts. Metering considerations will impact the application process, with priority given to participants with existing Interval Data Recorders (IDRs). All included project sites must be non-residential customers of Xcel Energy taking service at Primary, Secondary or Transmission Voltage, and/or be a non-profit customer or government entity, including educational institutions.

Contract Authorization:

Once it is determined that the customer will qualify for Peak Day Partners, the Enabling Agreement will be executed.

Enabling Agreement Term:

The Enabling Agreement will be effective until cancelled by written notice from the customer or the Company. If the customer chooses to cancel their Enabling Agreement they may do so without penalty.

D. Marketing Objectives & Strategies

Peak Day Partners will be promoted to existing commercial and industrial customers primarily through Public Service Account Management team. Since eligible customers are typically large operational facilities, leveraging the continued communication, existing relationships and operational knowledge of the customers' various facilities will enable the focused marketing on interested customers.

Potential customers will be contacted by an account manager to meet and discuss the product. The objective of the meeting is to introduce the customer Peak Day Partners, discuss requirements and responsibilities, and assist the customer in identifying controllable loads which could be shed during an interruption.

Peak Day Partners requires the need for ongoing customer support and communication to ensure it delivers reliable results year over year. Therefore, marketing is a continuous process—not a single event—which includes initial discussion to recruit participants, then ongoing communication to ensure customers know and can continue to evaluate the benefits of participation in order to retain these customers, and ongoing communication/education about how the product works.

Additional marketing materials may include but are not limited to a guide summarizing key features and benefits and a Peak Day Partners website accessible on the Company's website to provide more extensive information.

E. Product-Specific Policies

Qualification:

Peak Day Partners is available to the Company's commercial and industrial customers who are not currently under an existing interruptible contract (ISOC) or Peak Partner Rewards (PPR) contract. However, if the customer has multiple premises, the premises that are not currently under ISOC or PPR contracts are eligible to participate in Peak Day Partners. Participants agree to be contacted with opportunities to reduce their load when market conditions signal a need, typically during the summer months, June through September, during high peak afternoons, but is an available resource year round if needed.

Events:

Demand response event periods are triggered as a result of capacity, contingency and/or economic constraints upon the electrical system. Based on historical system peaking conditions, events are most likely to be called on weekdays during the summer months of June through September, but events may occur in any month throughout the year.

Events will be no less than one hour in duration and no more than six hours in duration. There is no limit as to how many events can be called during a given year.

Enabling Agreement:

Term - All Enabling Agreements for service under this schedule shall not have a minimum participation commitment since it is purely voluntary. Customers can withdraw from Peak Day Partners at any time by providing the Company with a written request to un-enroll.

Load Reduction Obligation – Each participating customer will be responsible for reducing their facilities load during an event by an amount equal to or greater than that designated within each given bid-offer.

Load reduction during an event will be determined by subtracting the participant's actual demand during an event from the participant's baseline demand for the same time period. The customer's minimum hourly load reduction must be no less than the load stipulated within the participant's bid-offer.

Baseline –A participant's load reduction will be determined by comparing the customer's load during an event to the customer's baseline load. A description of the baseline methodology is provided later in this document.

Penalties - If a participant declines to participate in an event through the bid-offer, there will be no penalty. However, if a participant does not meet their hourly contractual obligation in the agreed upon bid-offer, they will not receive their specific, hourly performance incentive.

Incentives:

The customer will receive a financial incentive for the capacity they supply within each event bid-offer that was accepted and performance met. This incentive is designed to give customers the flexibility to participate in an event or not.

Notification:

Participating customers will receive advance notice of events. Notifications will be delivered likely a minimum of 24 hours prior to an event. However, in some cases notifications may come with less than 24 hours' notice and will include:

- Purchase price for energy load reduction
- Amount of energy load reduction each hour
- Event start time
- Duration of event
- Event end time

Notifications with bid-offers will be sent to the participants which will be responsible for responding to offers. Customers are responsible for ensuring contact information is kept current and notifying their account manager or the product manager if any changes are necessary.

Baselines:

A participant's load reduction will be determined by comparing the customer's load during an event to the customer's baseline load. The baseline methodology proposed for this product is an adaptation of baseline calculations the Company has used in past products. The Company updated

its historical approaches by reviewing “Measurement and Verification for Demand Response” (2013). This document, commissioned by the National Action Plan on Demand Response Measurement and Verification Working Group, focuses on providing “best DR M&V practices in various market and product contexts.” This report provided valuable context on different baseline approaches, and several recommendations contained within the report have been incorporated into the baseline.

As customer baselines are inherently unobservable, one cannot measure usage which never took place. A poor baseline methodology can lead to systematic bias. To help mitigate this problem, the Company will regularly evaluate baseline calculations. This can be done by selecting sample participants, calculating their baseline consumption for a simulated event day, and evaluating the difference between the calculated baseline and actual loads. Should these simulations show significant bias that is leading to inaccurate baseline assumptions, then the Company will develop and recommend changes to the baseline methodology. Such an evaluation shall be done annually prior to the summer event season.

F. Stakeholder Involvement

Colorado business customers have played a major role in the on-going dynamics of this product. Additionally, key internal stakeholders such as the Account Management team have provided consistent feedback on product performance and customer satisfaction that continuously influences product design and operations. The Company continues to meet frequently and interact with these business customers and internal stakeholders to encourage their input.

G. Rebates & Incentives

The Company will establish an offer for participant energy at or below forecasted market costs, start-up costs, and spinning reserve costs. Offer incentives will vary by event. Customer incentives will vary for each event and each participant and will be determined for each hour of the event. If the agreed-upon load reduction is not met during the specified hour, customers will not receive an incentive payment for that particular hour.

H. Evaluation, Measurement, & Verification

The Company will collect baseline interval data from each participant in Peak Day Partners from monitoring equipment installed as part of enrollment and/or interval data metering installed as part of their regular electric service.

➤ Peak Partner Rewards

A. Description

The Peak Partner Rewards (“PPR”) product is a Demand Response product designed to provide Public Service’s business customers an incentive for agreeing to reduce their electrical loads when the electric grid experiences peak demand periods. While primarily focused on summer peaks, this product can be utilized year-round. The product is similar in concept to the ISOC product, but is designed to be more flexible and target customers who are not currently eligible for ISOC. Customer incentives are outlined within a tariff which may be updated annually, allowing the Company to balance product cost effectiveness and customer participation.

Participating customers will sign a contract agreeing to reduce load at their facility during peak demand periods. This load reduction will be determined by the customer based on their ability to manage operations within their facility but must be at least 25 kW during summer months. Customers will receive a monthly credit (reservation incentive) based on this committed load reduction. When peak period events are dispatched, customers will receive an additional incentive based on their total load reduction, measured in kWh, during the event (performance incentive). Customers who participate in the product will receive an additional benefit of having access to their electric load profile data in near real time. Access to this data will not only allow participants to ensure they are complying with their contractual obligations, but also provide insight into their energy use throughout the year.

Peak period events are triggered as a result of capacity, contingency and/or economic constraints upon the electrical system. All interruptions will last a minimum of 1 hour, up to a maximum of 4 hours. Participating customers will receive at least one-hour notice prior to an event. If customers do not meet the agreed upon load reduction during an event, they will not receive their performance incentive for that event and may be removed from the product.

Peak Partner Rewards is designed to price capacity at or below the cost of avoided capacity as defined within the 2023 DSM & BE Plan Cost Benefit assumptions. This means that purely on a capacity basis, the product should yield positive net benefits.

B. Forecasts, Participants & Budgets

Forecasts and Participants

Peak Partner Rewards is available to all commercial customers who can commit to reducing their electric load by a minimum of 25 kW during summer months and receive electric service under the Company’s General Service Rate Schedules SG, PG or TG. Marketing of the product covers a diverse spectrum of commercial and industrial customers, ranging in size from greater than one MW to less than 100 kW.

For the 2023 DSM & BE Plan, the Company anticipates an incremental demand reduction of just over two MW.

Budgets

Product costs are attributed to two primary categories: Marketing & Administration, and Participant Incentives.

Marketing & Administration – Administration costs cover several different activities as detailed below.

- Administration – This category covers costs associated with day-to day operations of the product. Included in this category are expenses for the third-party implementer assisting with the product.
- Equipment & Installation – This category reflects the cost to purchase and install monitoring equipment at each participant’s facility. The majority of these expenditures are allocated to new participants and realized by PPR during each customer’s first year of participation. Future expenditures will reflect costs of growing the product incrementally and any ongoing equipment maintenance for current participants.
- Advertising & Promotion – This category is for marketing campaigns and associated collateral.

Participant Incentives – Participant incentives account for the majority of the product budget and include both a reservation incentive for contracted load reduction and a performance incentive for actual load reduction during event days.

C. Application Process

Peak Partner Rewards is offered to business customers of all sizes. Therefore, product marketing will be delivered through several channels: Account Managers for larger C&I customers (Managed Accounts) and the Business Solutions Center (BSC) for non-managed customers. Through these channels, customers interested in the product will be guided through the following application details:

Qualification:

Peak Partner Rewards is available to all business customers who receive electric service under the Company’s General Service Rate Schedules SG, PG or TG and can agree to reduce usage during the summer months, June through September, between the hours of 12:00 p.m. and 8:00 p.m. (events are 4 hours or less in duration) by a minimum of 25 kW. The product can also be used at peak times throughout the year as needed.

Contract Term:

The initial contract term shall be 24 months followed by an annual term that is automatically renewed each year. A sixty-day written notice is required from the customer in order to cancel their participation. If the customer chooses to cancel their agreement in the first year, a one (1) time fee of five hundred dollars (\$500) will be assessed to cover costs associated with decommissioning hardware supplied to the Customer for this product. This provision is only available to participants during the year in which the contract is signed.

Contract Authorization:

Once it is determined that the customer will qualify for PPR, a Peak Partner Rewards Product Agreement will be executed.

D. Marketing Objectives & Strategy

A critical part of the PPR product's success is the Company's ability to locate potentially eligible customers, assist them in becoming a part of the product, and provide service according to the tariff.

Potential customers are contacted by an Account Manager to discuss the product. The objective of the meeting is to introduce the customer to the product, discuss product requirements and responsibilities, and assist the customer in identifying controllable loads which could be shed during an interruption event.

Marketing materials include a product guide summarizing key features and benefits and a Peak Partner Rewards website accessible on the Company's website to provide more extensive product information.

A key asset enabling this product is the Company's Demand Response Management System (DRMS). This system provides the platform from which all of the Company's demand response products are managed. In addition to managing events and providing customer notification, the system provides product participants with near real time access to their load profile data. Having this data allows participants to manage their energy use during events to ensure they comply with their contractual requirements as well as maximize their potential incentive.

The PPR product requires the need for ongoing customer support and communication to ensure the product delivers reliable results year over year. Therefore, marketing is a continuous process—not a single event—which includes initial discussion to recruit participants, then ongoing communication to ensure customers know and can continue to evaluate the benefits of the product in order to retain these customers, and ongoing communication/education about how the product works.

E. Product-Specific Policies

All product-specific policies are provided in full detail within the Peak Partner Rewards Product, Schedule PPRP, electric rate tariff. Note that the tariff may be updated annually and mid-cycle changes to PPR may not be reflected within this Plan.

Qualification:

Peak Partner Rewards is available to Public Service's firm rate Commercial and Industrial customers who receive electric service under the Company's General Service Rate Schedules SG, PG or TG, are not currently under an existing interruptible contract (ISOC), Critical Peak Pricing tariff, or on a Standby Tariff. Participants must agree to reduce usage by a minimum of 25 kW

during the summer months, June through September, between the hours of 12:00 p.m. and 8:00 p.m. (note: events are 4 hours or less in duration). Although no minimum or maximum customer size is required, the product is focused on providing an option to customers with smaller loads who do not qualify for the ISOC tariff.

Events:

Demand response event periods are triggered as a result of capacity, contingency and/or economic constraints upon the electrical system. Based on historical system peaking conditions, events are most likely to be called during the summer months of June through September, but events may occur in any month throughout the year.

Events will be no less than one hour in duration and no more than four hours in duration. Customers will be subject to no more than one event in any 24-hour period. No more than 15 events would be called for any one customer during a given year (60 total event hours annually).

In addition to events called for a specific need, each customer may be subject to up to two test events each calendar year. The purpose of test events is to ensure participants are able to deliver the load reductions committed. Participants will receive the same incentive for test events as for actual events.

Should a capacity or contingency situation arise outside of the prescribed hours of 12:00 p.m. to 8:00 p.m., product participants may be notified and asked to curtail load on a “best effort” basis. The customer will be under no obligation to reduce load, but those able to participate will be compensated for energy reductions at the tariffed incentive level.

Contracts:

Term – All contracts for service under this schedule shall be for an initial two-year term, with automatic one-year renewal terms. A customer must provide Public Service a sixty-day advance notice in writing to cancel.

Load Reduction Obligation – Each participating customer will be responsible for reducing their facility’s load during an event by an amount equal to or greater than that designated within their contract. Participants will designate their load reduction obligations, in terms of kW, by calendar month. The kW commitment can vary each month, however during the summer months of June through September the participant’s commitment cannot be less than 25 kW. The monthly kW commitment may be zero kW outside of the summer months.

Load reduction during an event will be determined by taking the total energy reduction during the event period as measured in kWh and dividing by the number of hours in the event. Energy reduction will be calculated by subtracting the participant’s actual usage during an event from the participant’s baseline consumption for the same time period. The customer’s minimum hourly load reduction must be no less than the kW stipulated within the participant’s contract.

Baseline – For purposes of determining a participant’s load reduction, the customer’s load during an event will be compared to the customer’s baseline load. A description of the baseline methodology is provided later in this document.

Penalties – If a participant does not meet or exceed their contractual obligation during a PPR event, they will not receive payment of their performance incentive. If a participant fails to meet their contractual obligation during two PPR events within the same calendar year they will be dropped from the product. Should a participant elect to leave the product during their initial two-year contract term, a one-time fee of \$500 will be assessed to cover costs associated with decommissioning hardware supplied to the participant for this product.

Incentives:

Customers will receive three distinct incentives for their participation:

Reservation Incentive – The customer will receive a credit on their monthly bill for the capacity they have agreed to supply within their contract. This incentive is designed to keep customers committed to the product over the long term. The Reservation Incentive credit rate is \$2.00 per kW of load reduction committed. This rate shall be subject to change annually.

Performance Incentive – Participants will receive an additional incentive based on actual performance during events if they meet or exceed their committed load reduction. This is designed to help ensure customers meet their obligation during actual events. The incentive is based on a participant's total energy reduction during the event period. The Performance Incentive credit rate is \$0.70 per kWh reduced during a PPR event. This rate shall be subject to change annually.

Load Profile Data Access – Customers who participate in the product will receive an additional benefit of having access to their electric load profile data in near real time. Access to this data will not only allow participants to ensure they are complying with their contractual obligations, but also provide insight into their energy use throughout the year. Data will be provided in near real time with updates occurring at least every fifteen minutes through a customer portal feature of the DRMS. Performance data will be available to individual participants through the customer portal feature of the DRMS. Customers can view their usage at any time using their unique username and password to log into the system.

Notification:

Participating customers will receive advance notice of PPR events. Notifications will be delivered a minimum of one hour prior to an event and will include the event start time, duration of event, and event end time. Notifications will be sent to the participating customer's designated contact(s) via e-mail, SMS text, voice message, or combination thereof as specified by the customer. Customers are responsible for ensuring contact information is kept current and notifying the Product Manager if any changes are necessary.

Baselines:

For purposes of determining a participant's load reduction, the customer's load during an event will be compared to the customer's baseline load. The baseline methodology being proposed for this product is an adaptation of baseline calculations the Company has used in past products. Public Service updated its historical approaches by reviewing "Measurement and Verification for Demand Response" (2013).⁹¹ This document, commissioned by the National Action Plan on

⁹¹<https://www.ferc.gov/industries/electric/indus-act/demand-response/dr-potential/napdr-mv.pdf>

Demand Response Measurement and Verification Working Group, focuses on providing “best DR M&V practices in various market and product contexts.” This report provided valuable context on different baseline approaches, and a number of recommendations contained within the report have been incorporated into the baseline.

Specifically, for this product, the baseline usage for any 15-minute interval during an event will be calculated as the average of the measured demand during the same interval of the customer’s five highest energy consumption days within the last 10 non-holiday, non-weekend, non-event days.

An event day correction will be made to each 15-minute interval during the event to reflect the impact of weather or other operational changes which could cause substantive differences between the event day and the baseline calculation. This event day correction will be the average 15-minute kW difference between the baseline calculation and the participant’s actual load during the hour prior to event notification.

As customer baselines are inherently unobservable, one cannot measure usage which never took place, a poor baseline methodology can lead a systematic bias. To help mitigate this problem, Public Service will regularly evaluate baseline calculations. This can be done by selecting sample participants, calculating their baseline consumption for a simulated event day, and evaluating the difference between the calculated baseline and actual loads. Should these simulations show significant bias that is leading to inaccurate baseline assumptions, then Public Service will develop and recommend changes to the baseline methodology. Such an evaluation be done annually prior to the summer event season and should any changes be warranted updates to the product would be made through 60-Day Notice.

F. Stakeholder Involvement

Colorado business customers have played a major role in the on-going dynamics of this product. Additionally, key internal stakeholders such as the Account Management team have provided consistent feedback on product performance and customer satisfaction that continuously influences product design and operations. The Company continues to meet frequently and interact with these business customers and internal stakeholders to encourage their input.

G. Rebates & Incentives

The Peak Partner Rewards product was designed to price capacity at or below the avoided costs used within this 2023 DSM & BE Plan. This results in a product that, on a capacity basis, always yields positive net benefits. Incentive values are to be identified within the Peak Partner Rewards tariff which will be filed separately.

Reservation Incentive – The Reservation Incentive is a monthly kW credit calculated by multiplying a capacity payment by the participant’s contractual summer load reduction obligation.

Performance Incentive – The performance incentive is calculated by multiplying an energy payment by the participants total energy reduction during the event period. The energy payment does not necessarily reflect the anticipated marginal cost of energy during event periods. Its value is established to provide participants a compelling incentive to perform during demand response events.

H. Evaluation, Measurement, & Verification Plan

The Company will collect interval data from each participant in the Peak Partner Rewards Product from monitoring equipment installed as part of product enrollment and/or interval data metering installed as part of their regular electric service. This data will be stored and presented within the DRMS. Product performance for each event will be calculated by subtracting the actual aggregated usage of all customers from the aggregated baseline usage during the event window. The amount of demand reduction supplied for a given event is calculated by subtracting the actual aggregated usage of all customers from the aggregated baseline usage during the event window.

➤ Residential Battery Demand Response Pilot

A. Description

The Residential Battery Demand Response pilot seeks to address three primary research areas: (1) capabilities of vendor Virtual Power Plant (“VPP”) software, (2) battery performance, and (3) customer preferences.

VPP software: The Company is using the VPP software of its selected vendors⁹². The pilot will allow the Company to gain familiarity with the use of VPP software and the capabilities the software offers in terms of management of batteries and data collection and analysis.

Battery performance: The Company will assess the availability of batteries for demand response. In addition, the pilot will evaluate the quantity of demand response offered from a battery and the response speed during a series of year-round demand response events. The Company’s assessment of availability and performance is critical in determining expected performance of the technology and ultimately assessing the level of compensation to be offered to future customers.

Customer preferences: Customers can choose to use their battery in ways that provide benefits solely to the battery customer (e.g., back-up power), to the grid, or both. The pilot will explore customer interest in allocating a portion of their battery to support the grid.

To achieve these objectives, the pilot focuses on a simple incentive structure. Customers who agree to participate in the pilot receive an upfront incentive. In exchange for the incentive payment, a customer agrees to allow the utility to use 80 percent of the battery’s available capacity for up to 100 events per year. To manage pilot costs, the Company has selected two technology vendors for participation through a Request for Proposal (RFP) process conducted in 2019.

The Company uses participant batteries to test how a battery performs as a DR resource. The Company calls events that will result in the discharge of the battery over the duration of the event. The amount of DR from each battery is governed by the customer’s interconnection agreement—with some customers able to discharge all available capacity and other customers limited to discharging an amount not to exceed their onsite electricity demands.

This pilot expands on common residential DR practices. Existing products, such as AC Rewards and Saver’s Switch®, only operate during the summer months when there is air conditioning load. As a result, the Company’s period to call events is limited. Unlike air conditioning-based control strategies, batteries can provide demand response year-round, and the regular use of a battery does not have the potential to affect the customer’s comfort in any way. As a result of these differences, a battery can be used more frequently and for more purposes.

⁹²Through an RFP process, the Company selected two vendors for this pilot. The Company is currently in contract negotiations with the second vendor.

Approximately half of the DR events the Company calls will provide regular peak-load reduction during the summer months. The remainder of events are spread across non-summer months to test non-summer performance and solar time shifting. The estimated savings are the same, regardless of time of year.

To execute these events, the Company inserts instructions in each vendors VPP. The vendor will then communicate these instructions to each battery through the vendor's preferred communications path to the battery.

B. Forecasts, Participants & Budgets

Forecasts and Participants

The Company is seeking up to 500 customers for the pilot. This amount of pilot participation was determined in the 2019/2020 DSM Plan, and the Company believes there is no reason to adjust this number up or down at this time.

Budgets

The original pilot budget filed as part of the 2019/2020 DSM Plan made estimates for vendor fees and EM&V costs. The Company now has firm vendor costs, and it also has a firm proposal from an EM&V vendor. As a result, the budget has been refined with more accurate figures.

C. Application Process

Customers who are interested in applying are directed to the Company's enrollment portal to complete the pilot application and agree to pilot terms and conditions. The Company screens these customers to ensure that they are electric or combination electric and gas residential customers in Colorado. Following this initial screen, the Company notifies the customer that they are pre-qualified for participation in the pilot. A customer may apply to pre-qualify for the pilot while they are purchasing or installing a battery. Once the Company verifies that the customer's battery has a valid interconnection agreement with the Company and the customer's battery is accessible within the vendor's VPP, the Company officially enrolls the customer in the pilot.

D. Marketing Objectives & Strategies

The Company performs direct marketing to eligible customers that already have a battery with a valid interconnection agreement. The Company conducts this outreach using email.

In addition, Tesla and SolarEdge, either directly and/or through their channel partners discuss the pilot with customers that show interest in purchasing a battery. As part of this outreach, Tesla and SolarEdge perform trainings and provide training materials to relevant sales personnel, so there is an awareness of the pilot and the benefits it offers customers.

Last, the Company uses its website to share information to interested customers about the pilot and answer common questions.

E. Product-Specific Policies

Batteries: Participation is open to customers that have onsite solar and battery storage or standalone battery storage, where the battery can be managed by one of the selected vendors.

Interconnection Agreement: Each customer participating in the pilot must have an interconnection agreement with Public Service that allows their system to operate in parallel with the grid. These interconnection agreements will dictate how the Company utilizes each customer's battery in the pilot. For example, some agreements only permit a customer to use their battery to offset onsite electricity demand. For these customers, the Company works with participating technology vendors to ensure a customer's participation in the pilot does not violate the interconnection standard they have chosen to operate within.

System Size: There is a wide range of battery sizes in the residential market today that range from one kWh up to tens of kWh. For this initial pilot, the Company is limiting participation to those customers who have batteries sizes greater than or equal to five kWh.

Early Termination: The Company will include an early termination fee to discourage customers from accepting an upfront rebate and unenrolling. The early termination fee will be prorated based on the amount of time the customer has participated in the pilot. If a customer chooses to leave after one year of participation, there will be no early termination fee.

F. Stakeholder Involvement

The Company conducted a significant amount of stakeholder engagement prior to the filing of the pilot in the 2019/2020 DSM Plan, which is detailed in that plan write-up. In addition, the Company, as part of the settlement agreement for that plan, agreed to re-engage with DSM stakeholders several months after pilot launch to discuss the status of the pilot. Since pilot launch has not occurred, this meeting with stakeholders has been delayed, but the Company still intends to host this meeting. In addition, as part of complying with Commission Decision No. C20-0289 in Proceeding No. 19A-0369E (2020-21 Renewable Energy Standard Plan), the Company has hosted several stakeholder meetings in June and July of 2020 to discuss issues surrounding the development of a retail solar plus storage and behind the meter storage program. These stakeholder sessions have included participants from Colorado Solar and Storage Association, Solar Energy Industries Association, Colorado Energy Office, PUC Staff, as well as the following: Office of Consumer Counsel, Western Resources Advocates, GRID Alternatives, Energy Outreach Colorado, City and County of Denver, and the City of Boulder. Public Service has also held informal, one-on-one discussions with a number of these and other stakeholders with the objective of advancing the stakeholder process.

G. Rebates & Incentives

The Company offers a rebate to participating customers. Upon signing up for the pilot, each customer receives a rebate of \$1,250.

The rebate is designed to attract participation for this particular pilot and does not necessarily reflect the compensation level or structure for any future product.

H. Evaluation, Measurement, & Verification

The Company's EM&V plan focuses on conducting analysis in the following areas:

- Customer interest and satisfaction—Deeper look into customer motivations for purchasing and using their battery and their interest and satisfaction in participating in the pilot and future products;
- Assessment of the battery baseline—Use of historical and non-event day information to assess how batteries are used by customers; and
- Evaluation of battery performance—Use of pilot data to evaluate ability of battery to perform tested use cases and determination of avoided capacity the battery is able to provide to the energy system.

Data used in the analyses comes from on-site monitoring of solar, battery, and energy use that the participating vendors collect and from surveys administered by the Company's EM&V provider to participating customers.

➤ Residential Demand Response

A. Description

The Company's Residential Demand Response product contains three offerings:

- Saver's Switch
- AC Rewards
- Smart Water Heaters (water heater demand management)

The products seek to reduce system load by curtailing central air conditioners and electric heat pump water heaters and are generally utilized on hot summer days when Public Service's load is expected to reach near-peak capacity.

Saver's Switch®

Saver's Switch offers residential participants a \$40 annual bill credit as an incentive for allowing the Company to control operation of their central air conditioners. Since the launch of Saver's Switch in 2000, Public Service has declared an average of seven control events per year. When a customer enrolls, a switch device is installed near the AC unit that can interrupt the operations of the compressor.

When activated, a control signal is sent to interrupt the customer's central air conditioning load during peak periods, typically between the hours of 2:00 p.m. and 7:00 p.m. on weekdays. The product has deployed switches with varying load control strategies:

- Switches installed prior to 2004 are cycled 15 minutes out of every 30 minutes (a 50% cycling strategy) during the control period.
- Switches installed after 2004 utilize an "adaptive algorithm" cycling strategy. This strategy allows the switches to "learn" how a customer's air conditioning is being operated and directed to achieve a default 50% reduction in load. In certain circumstances the load reduction can be increased to meet temporary needs. The newer switches generally provide greater load reduction per unit. Approximately 99% of the approximately 201,000 switches in the field use the adaptive algorithm strategy.

Control events, normally last for about four hours on a control day and take place in the late afternoon or early evening. With the expanding participant population, Public Service has created subgroups of participants to enable the activation of less than the entire population at a time. This gives the Company flexibility to better manage peak demands on the system.

Saver's Switch was launched in Colorado in 2000. The switches utilized are deemed to have a 15-year life. As there is very little attrition from Saver's Switch, the switch population is beginning to include a sizeable portion of devices that are beyond their 15-year life. In the 2021/2022 biennial, the company began to initiate maintenance replacements of switches older than 15 years and plans to continue this replacement cycle. These maintenance replacements will be tracked

separately but counted in the same manner as new installations for the achievements in the DSM plan.

AC Rewards

Following a pilot in 2015 and 2016, Public Service launched the AC Rewards offering in July 2017. Like Saver's Switch, AC Rewards seeks to reduce AC load at peak times, but the methodology is different.

Customers can join AC Rewards by installing and enrolling a Wi-Fi enabled thermostat. Currently, certain devices from ecobee, Honeywell, and Emerson are eligible for enrollment. There are two channels for customers to join:

- Bring Your Own Thermostat (BYOT) – customers that already have a qualifying thermostat installed at their residence can enroll it at a company provided portal. BYOT participants receive a one-time bill credit of \$100 upon joining AC Rewards.
- Direct Install – for customers not comfortable installing their own device, the Company can provide and install one free of charge.

In addition to discounts, bill credits and devices, customers receive an annual bill credit of \$25 for their participation.

In a control event, the Company communicates with the thermostat over the customer's Wi-Fi system and adjusts the set point by a few degrees. Customers have the ability to override control events by returning the device to a different set point. Currently, customers are not penalized for opting out of control events. However, the Company will monitor product performance over time and may make adjustments to incentives depending on how often events are overridden. The Company expects to experiment with different control approaches including event pre-cooling in the coming years to determine optimal operations.

Smart Water Heaters (water heater demand management)

This was a new offering for 2020. Customers owning qualifying electric heat pump water heaters that are capable of receiving control signals from the utility are eligible for enrollment. Qualifying enrolled water heaters will be controlled in two ways:

- Peak demand load reduction – in a peak load event, normally on hot summer afternoons but also an option during winter peaks, the enrolled water heaters would be turned off for the duration of the control event. Previously heated water would be available for customer use. But water heaters would not heat new water until the end of the event. Unlike the AC Rewards offering, water heaters can be turned off at any time of system need, not just during the traditional summer afternoon peaks.
- Daily load shifting – the temperature setpoint of enrolled water heaters would be adjusted to shift heating load away from the daily system peaks. I.e. the water temperature would be increased at night and reduced during the day. This strategy is also designed to save the customer energy. The daily load shifting is designed to be largely invisible to the customer.

In order to participate, customers need to have a water heater equipped with a receiver for over the air operating instructions and a mixing valve as a safety measure for when water in the tank is heated beyond the original set point. Participants in the product will receive an annual \$25 bill credit for their participation.

B. Forecasts, Participants & Budgets

Forecasts and Participants

Saver's Switch is aimed at single family homeowners with central air conditioning. Between Saver Switch and AC Rewards, the Company aims to install/enroll 17,000 devices per year. This will be quite challenging as Saver's Switch has been an offering for almost two decades. As a result, it has an installed base of participants that accounts for an estimated half of the eligible customers in the state. AC Rewards currently targets single family homes, attached family homes such as townhomes and duplexes, and multifamily facilities to reach more customer segments while adding resource options for system load relief. To the extent possible, the Company aims to promote AC Rewards in ways that minimize cannibalization of existing Saver's Switch participants.

Budgets

The primary costs in operating Saver's Switch are: the cost of switches, switch installation, rebates for participating customers, and promotional expenses for recruiting participants. For AC Rewards, the primary costs are incentives (bill credits and device discounts) and promotional expenses. Over time, as Residential Demand Response has been a focus of the Company, advertising and promotional expenses have been escalating with increasing product penetration.

C. Application Process

Customers may sign up for Saver's Switch via mail-in forms, over the phone, or at the Company website <http://www.xcelenergy.com/saversswitch>. Applications are generally processed, and switches installed within six to eight weeks. Due to variations in air conditioner age, code compliance, and where the AC unit is located (next to the house), the installer will make the final on site determination as to whether the customer qualifies for the product. The installation work normally takes place entirely outside, allowing customers not to be home for the installation.

Customers wanting to join AC Rewards can do so at the Company's website <https://co.my.xcelenergy.com/s/residential/heating-cooling/ac-rewards>.

D. Marketing Objectives & Strategies

Saver's Switch and AC Rewards are promoted to residential customers using a variety of channels including bill inserts, company newsletters, print and radio advertising, direct mail and email.

Based on an analysis of customer energy usage during the summer months and market research, Public Service estimates that approximately 325,000-375,000 residential electric customers in Colorado have central air conditioning. Where possible (i.e. in direct mail and telemarketing), the Company directs its promotional efforts to customers not currently participating who also were identified as likely to have central air conditioning. Through ongoing research, the company is still determining the participation impact adding multifamily facilities will have to the product.

In 2023, Public Service expects to continue an intense promotional effort with activities including:

- Direct mail, including up-front incentives to new participants;
- E-mail marketing;
- Bill inserts;
- Digital media advertising; and
- Print advertising.

E. Product-Specific Policies

Saver's Switch has the following additional requirements:

- The product does not offer customers the choice of opting out of individual control days. The one exception is in the case of medical emergencies where customers can be removed from the product on short notice.
- When a customer moves into a premise with a pre-existing switch, they are automatically enrolled in the product, but notified that they may opt-out.
- Upon request for a Saver's Switch from a customer, a third-party implementer installs the switch. The third-party makes the determination in the field as to whether or not a switch can be successfully deployed, depending on the age of the A/C unit, electrical code compliance, etc.

AC Rewards has the following additional requirements:

- Participants must have central AC to join AC Rewards. As there, in most cases, is no contractor at the premise to validate this, we assume participants have central AC. The Company reserves the right to remove customers from the product who are deemed to not have central AC.
- The Company also reserves the right to remove participants from AC Rewards if the device goes 'offline' for too long or if the customer opts out of most or all control events.

F. Stakeholder Involvement

Public Service recognizes that the HVAC community and homebuilders are in a position to influence customer attitudes towards the product. The HVAC community may also have lingering misconceptions about Saver's Switch being harmful to customers' air conditioners. Public Service

is planning to increase its efforts to educate the HVAC / builder community about the benefits of Saver's Switch to customers.

G. Rebates & Incentives

Saver's Switch participants will receive a \$40 discount on their October energy bills following participation in the preceding summer control season. AC Rewards participants receive a \$25 discount on their October bills. AC Rewards participants that enroll through the BYOT channel qualify for a one-time \$100 bill credit. Customers without a qualifying thermostat can get a discount when purchasing one at <https://www.xcelenergystore.com>. Participants in water heater demand response receive an initial \$75 bill credit for enrolling an annual \$25 bill credit for their participation.

H. Evaluation, Measurement, & Verification

Public Service's load research organization leads an annual research project to evaluate the load relief achieved from installed Saver's Switch and AC Rewards units. The team hires a consultant—that specializes in load research—to conduct the data gathering and most of the analysis. A sample of participants is included in the research, undertaken annually. This is done with data loggers deployed onsite to monitor A/C run time and device operations during the cooling season. The results are used to document the extent of load relief achieved during a control day.

➤ **Small Commercial Building Controls**

A. Description

The Small Commercial Building Controls product seeks to reduce system load through various curtailment strategies. The Company will offer prescriptive measures and incentives to customers for the installation of building control measures and continued participation in the product. Prescriptive controls measures will be marketed to small and medium sized commercial customers (peak load of approximately 200kW and under) to provide simple demand management solutions that are more accessible to these customers than the Company's larger performance-based products. At this time, only smart thermostat demand response will be offered through this product with more measures to be added as they become more commercially available.

Commercial Smart Thermostat Demand Response

Following a study conducted by the Company in 2019, Public Service added the product through a modification in 2020 to expand its residential thermostat demand response product to commercial customers. This product seeks to reduce air conditioning load in commercial building at peak times by offsetting the customer's temperature set point during peak hours. The study measured the impacts of this control strategy at commercial sites and the results have been used to file the demand response measure in this product.

This product will initially be made available to customers exclusively through direct installations with potential to open to other enrollment channels in the near future. Upon signing up for the product, customers will receive a thermostat and installation at no cost along with a \$25 annual bill credit per thermostat. There is no limit on the number of thermostats that a customer can request however each thermostat must directly control an AC unit and have access to a Wi-Fi signal.

Customers can also be enrolled in the product through other commercial direct install offerings offered by Public Service. The following products that offer direct installation measures will now include Wi-Fi enable thermostats as a part of their offering.

- Small Business Solutions
- Multifamily Building Efficiency (Common Areas)

The installing partners for these products will install the product qualifying thermostat and assist the customers in setting up their connection. They will then provide Public Service the customer and device information necessary to enroll them in this product and enable control events.

In a control event, the Company communicates with the thermostat over the customer's Wi-Fi system and adjusts the set point by a few degrees. Customers have the ability to override control events by returning the device to a different set point. Currently, customers are not penalized for opting out of control events. However, the Company will

monitor product performance over time and may adjust incentives depending on how often events are overridden. The Company expects to analyze different control approaches including event pre-cooling, group staggering and more in the coming years to determine optimal operations.

B. Forecasts, Participants & Budgets

Forecasts and Participants

The target population for this product, for both thermostat demand response and future prescriptive measures, is small to medium commercial customers that either do not meet the size requirements for other commercial demand response products or do not have the resources to participate. This product fills a gap in the Company's demand management portfolio and will make demand response products more accessible to customers within this segment. The Company expects to continue to enroll customers and look for product growth opportunities.

Budgets

The primary costs for this product are the material and labor costs associated with the thermostat installations. These costs will be spread out across products in situations where other products complete the installation. Once the devices are installed, the recurring API costs to the device manufacturers and Demand Response Management System (DRMS) providers and bill credits to customers will continue for devices that remain enrolled in the product. As product penetration increases, both administrative budgets and advertising and promotional budgets will increase accordingly.

C. Application Process

Customers can sign up for an installation through the product website or through participation in one of the direct installation products that include Wi-Fi thermostats. The installing contractors will record the information necessary to enroll the customers in the Company's DRMS and provide it to the product manager to complete the enrollment.

D. Marketing Objectives & Strategies

Smart thermostat demand response is currently promoted to customers through a variety of channels including bill inserts, company newsletters, print and radio advertising, social media and direct mail or email campaigns. The commercial product will take advantage of these marketing efforts where applicable and will expand the distribution of promotional materials to commercial customers that meet the customer characteristics spelled out above. Marketing for the commercial product will include email and direct mail marketing.

E. Product-Specific Policies

The smart thermostat demand response product requires customers to have a working Wi-Fi connection available for the thermostat to connect to and an air-conditioning unit directly

controlled by the thermostat being installed. The thermostat must directly control a central or rooftop air conditioning unit and must be replacing a device that is not eligible for the Company's product. The Company also reserves the right to remove customers from the product if their devices go offline for an extended period and are no longer able to communicate with the Company's DRMS.

F. Stakeholder Involvement

Public Service has worked with its existing installation partners to provide customers with information regarding its demand response and Wi-Fi enable thermostats. Most, if not all, of these partnerships have included smart thermostat installation in the past so only minor adjustments to processes are necessary to expand these efforts to the commercial space.

G. Rebates & Incentives

Customers will receive a free thermostat and installation of a smart thermostat in exchange for their participation in the Company's demand response product. They will also receive a recurring \$25 bill credit per thermostat for each year that they remain involved in the product. The Company reserves the right to change these recurring payments based on ongoing evaluation of its product and customer behavior.

H. Evaluation, Measurement, & Verification

Public Service's load research organization leads an annual research project to evaluate the load relief achieved from installed Saver's Switch and AC Rewards units. A similar evaluation process will be conducted for the commercial smart thermostats. The team hires a consultant—that specializes in load research—to conduct the data gathering and most of the analysis. A sample of participants is included in the research, undertaken annually. This is done with data loggers deployed onsite to monitor A/C run time and device operations during the cooling season. The results are used to document the extent of load relief achieved during a control day. The Company is looking to modernize this approach using data available via device manufacturers; however, increased testing and data verification is required before using this approach exclusively.

Cost-Benefit Analyses

The cost-benefit analyses (“CBAs”) for the portfolio and each program included in this 2023 DSM & BE Plan are displayed on the following pages, with the 2023 electric CBAs followed by the 2023 gas CBAs. The Company has incorporated the Social Cost of Carbon and Social Cost of Methane into these cost-benefit analyses pursuant to the language in Senate Bill 19-236, codified at §40-3.2-106(c)(4), C.R.S., HB 21-1238, codified at § 40-3.2-107, C.R.S, respectively, and SB 21-246 and § 40-3.2-109(3), C.R.S.

PORTFOLIO TOTAL				
2023 Net Present Cost Benefit Summary Analysis For All Participants				
	Participant Test (\$Total)	Utility Test (\$Total)	Rate Impact Test (\$Total)	Modified Total Resource Test (\$Total)
Benefits				
Avoided Revenue Requirements				
Generation Capacity	N/A	\$139,658,372	\$139,658,372	\$139,658,372
Trans. & Dist. Capacity	N/A	\$15,210,509	\$15,210,509	\$15,210,509
Marginal Energy	N/A	\$100,167,533	\$100,167,533	\$100,167,533
Avoided Emissions (CO2)	N/A	N/A	N/A	\$163,060,674
Subtotal				\$418,097,088
Non-Energy Benefits Adder (21.5%)				\$54,745,850
Subtotal	N/A	\$255,036,414	\$255,036,414	\$472,842,938
Participant Benefits				
Bill Reduction - Electric	\$421,181,846	N/A	N/A	N/A
Participant Rebates and Incentives	\$65,951,804	N/A	N/A	\$65,951,804
Incremental Capital Savings	\$5,920,252	N/A	N/A	\$4,253,219
Incremental O&M Savings	\$15,958,541	N/A	N/A	\$14,239,101
Subtotal	\$509,012,444	N/A	N/A	\$84,444,124
Total Benefits	\$509,012,444	\$255,036,414	\$255,036,414	\$557,287,063
Costs				
Utility Project Costs				
Program Planning & Design	N/A	\$0	\$0	\$0
Administration & Program Delivery	N/A	\$39,823,844	\$39,823,844	\$39,823,844
Advertising/Promotion/Customer Ed	N/A	\$7,010,119	\$7,010,119	\$7,010,119
Participant Rebates and Incentives	N/A	\$65,951,804	\$65,951,804	\$65,951,804
Equipment & Installation	N/A	\$743,623	\$743,623	\$743,623
Measurement and Verification	N/A	\$3,428,766	\$3,428,766	\$3,428,766
Subtotal	N/A	\$116,958,156	\$116,958,156	\$116,958,156
Utility Revenue Reduction				
Revenue Reduction - Electric	N/A	N/A	\$415,809,050	N/A
Subtotal	N/A	N/A	\$415,809,050	N/A
Participant Costs				
Incremental Capital Costs	\$155,866,224	N/A	N/A	\$131,907,358
Incremental O&M Costs	\$2,132,013	N/A	N/A	\$1,817,000
Subtotal	\$157,998,237	N/A	N/A	\$133,724,358
Total Costs	\$157,998,237	\$116,958,156	\$532,767,206	\$250,682,514
Net Benefit (Cost)	\$351,014,207	\$138,078,258	(\$277,730,792)	\$306,604,548
Benefit/Cost Ratio	3.22	2.18	0.48	2.22

Note: Dollar values represent present value of impacts accumulated over the lifetime of the measures.

2023	ELECTRIC	GOAL
Input Summary and Totals		
Program "Inputs" per Customer kW and per Participant		
Lifetime (Weighted on Generator kWh)	A	15.1 years
T & D Loss Factor (Energy)	B	5.58%
T & D Loss Factor (Demand)	C	8.06%
Net-to-Gross (Energy)	D	85.17%
Net-to-Gross (Demand)	E	91.21%
Installation Rate (Energy)	F	98.68%
Installation Rate (Demand)	G	98.76%
Net coincident kW Saved at Generator	H	0.04 kW
Gross Annual kWh Saved at Customer	I	119.17 kWh
Net Annual kWh Saved at Generator	J	105.89 kWh
Program Summary All Participants		
Total Budget	K	\$116,958,156
Net coincident kW Saved at Generator	L	204,739 kW
Gross Annual kWh Saved at Customer	M	552,592,089 kWh
Net Annual kWh Saved at Generator	N	491,029,407 kWh
Total MTRC Net Benefits with Adder	O	\$306,604,548
Total MTRC Net Benefits without Adder	P	\$251,858,698
Utility Program Cost per kWh Lifetime		
	K/(A x N)	\$0.0158
Utility Program Cost per kW at Gen		
	K/ L	\$571
Avoided Lifetime CO2 Emissions, Total Program (tons CO2)		
		2,773,482

EE PORTFOLIO TOTAL				
2023 Net Present Cost Benefit Summary Analysis For All Participants				
	Participant Test (\$Total)	Utility Test (\$Total)	Rate Impact Test (\$Total)	Modified Total Resource Test (\$Total)
Benefits				
Avoided Revenue Requirements				
Generation Capacity	N/A	\$110,894,790	\$110,894,790	\$110,894,790
Trans. & Dist. Capacity	N/A	\$13,576,464	\$13,576,464	\$13,576,464
Marginal Energy	N/A	\$99,872,732	\$99,872,732	\$99,872,732
Avoided Emissions (CO2)	N/A	N/A	N/A	\$162,681,119
Subtotal				\$387,025,105
Non-Energy Benefits Adder (21.7%)				\$48,607,364
Subtotal	N/A	\$224,343,986	\$224,343,986	\$435,632,469
Participant Benefits				
Bill Reduction - Electric	\$420,344,371	N/A	N/A	N/A
Participant Rebates and Incentives	\$53,686,626	N/A	N/A	\$53,686,626
Incremental Capital Savings	\$5,920,252	N/A	N/A	\$4,253,219
Incremental O&M Savings	\$15,958,541	N/A	N/A	\$14,239,101
Subtotal	\$495,909,791	N/A	N/A	\$72,178,947
Total Benefits	\$495,909,791	\$224,343,986	\$224,343,986	\$507,811,416
Costs				
Utility Project Costs				
Program Planning & Design	N/A	\$0	\$0	\$0
Administration & Program Delivery	N/A	\$29,419,681	\$29,419,681	\$29,419,681
Advertising/Promotion/Customer Ed	N/A	\$5,740,354	\$5,740,354	\$5,740,354
Participant Rebates and Incentives	N/A	\$53,686,626	\$53,686,626	\$53,686,626
Equipment & Installation	N/A	\$647,273	\$647,273	\$647,273
Measurement and Verification	N/A	\$2,834,369	\$2,834,369	\$2,834,369
Subtotal	N/A	\$92,328,303	\$92,328,303	\$92,328,303
Utility Revenue Reduction				
Revenue Reduction - Electric	N/A	N/A	\$414,971,575	N/A
Subtotal	N/A	N/A	\$414,971,575	N/A
Participant Costs				
Incremental Capital Costs	\$155,153,866	N/A	N/A	\$131,195,000
Incremental O&M Costs	\$2,132,013	N/A	N/A	\$1,817,000
Subtotal	\$157,285,880	N/A	N/A	\$133,012,001
Total Costs	\$157,285,880	\$92,328,303	\$507,299,878	\$225,340,304
Net Benefit (Cost)	\$338,623,912	\$132,015,683	(\$282,955,892)	\$282,471,112
Benefit/Cost Ratio	3.15	2.43	0.44	2.25

Note: Dollar values represent present value of impacts accumulated over the lifetime of the measures.

2023	ELECTRIC	GOAL
Input Summary and Totals		
Program "Inputs" per Customer kW and per Participant		
Lifetime (Weighted on Generator kWh)	A	15.1 years
T & D Loss Factor (Energy)	B	5.58%
T & D Loss Factor (Demand)	C	8.06%
Net-to-Gross (Energy)	D	85.10%
Net-to-Gross (Demand)	E	83.70%
Installation Rate (Energy)	F	98.67%
Installation Rate (Demand)	G	97.49%
Net coincident kW Saved at Generator	H	0.02 kW
Gross Annual kWh Saved at Customer	I	119.28 kWh
Net Annual kWh Saved at Generator	J	105.90 kWh
Program Summary All Participants		
Total Budget	K	\$92,328,303
Net coincident kW Saved at Generator	L	99,961 kW
Gross Annual kWh Saved at Customer	M	550,024,357 kWh
Net Annual kWh Saved at Generator	N	488,315,883 kWh
Total MTRC Net Benefits with Adder	O	\$282,471,112
Total MTRC Net Benefits without Adder	P	\$233,863,748
Utility Program Cost per kWh Lifetime		
	K/(A x N)	\$0.0125
Utility Program Cost per kW at Gen		
	K/ L	\$924
Avoided Lifetime CO2 Emissions, Total Program (tons CO2)		
		2,768,036

BUSINESS PROGRAM EE TOTAL				
2023 Net Present Cost Benefit Summary Analysis For All Participants				
	Participant Test (\$Total)	Utility Test (\$Total)	Rate Impact Test (\$Total)	Modified Total Resource Test (\$Total)
Benefits				
Avoided Revenue Requirements				
Generation Capacity	N/A	\$82,827,046	\$82,827,046	\$82,827,046
Trans. & Dist. Capacity	N/A	\$10,108,085	\$10,108,085	\$10,108,085
Marginal Energy	N/A	\$73,824,638	\$73,824,638	\$73,824,638
Avoided Emissions (CO2)	N/A	N/A	N/A	\$121,797,554
Subtotal				\$288,557,323
Non-Energy Benefits Adder (20.0%)				\$33,351,954
Subtotal	N/A	\$166,759,768	\$166,759,768	\$321,909,276
Participant Benefits				
Bill Reduction - Electric	\$278,341,239	N/A	N/A	N/A
Participant Rebates and Incentives	\$34,145,472	N/A	N/A	\$34,145,472
Incremental Capital Savings	\$0	N/A	N/A	\$0
Incremental O&M Savings	\$14,292,197	N/A	N/A	\$12,619,364
Subtotal	\$326,778,909	N/A	N/A	\$46,764,836
Total Benefits	\$326,778,909	\$166,759,768	\$166,759,768	\$368,674,113
Costs				
Utility Project Costs				
Program Planning & Design	N/A	\$0	\$0	\$0
Administration & Program Delivery	N/A	\$14,969,649	\$14,969,649	\$14,969,649
Advertising/Promotion/Customer Ed	N/A	\$2,157,900	\$2,157,900	\$2,157,900
Participant Rebates and Incentives	N/A	\$34,145,472	\$34,145,472	\$34,145,472
Equipment & Installation	N/A	\$0	\$0	\$0
Measurement and Verification	N/A	\$1,397,932	\$1,397,932	\$1,397,932
Subtotal	N/A	\$52,670,954	\$52,670,954	\$52,670,954
Utility Revenue Reduction				
Revenue Reduction - Electric	N/A	N/A	\$278,293,661	N/A
Subtotal	N/A	N/A	\$278,293,661	N/A
Participant Costs				
Incremental Capital Costs	\$127,103,993	N/A	N/A	\$108,246,842
Incremental O&M Costs	\$1,592,496	N/A	N/A	\$1,381,522
Subtotal	\$128,696,489	N/A	N/A	\$109,628,364
Total Costs	\$128,696,489	\$52,670,954	\$330,964,615	\$162,299,318
Net Benefit (Cost)	\$198,082,419	\$114,088,815	(\$164,204,846)	\$206,374,795
Benefit/Cost Ratio	2.54	3.17	0.50	2.27

Note: Dollar values represent present value of impacts accumulated over the lifetime of the measures.

2023	ELECTRIC	GOAL
Input Summary and Totals		
Program "Inputs" per Customer kW and per Participant		
Lifetime (Weighted on Generator kWh)	A	16.3 years
T & D Loss Factor (Energy)	B	5.33%
T & D Loss Factor (Demand)	C	7.71%
Net-to-Gross (Energy)	D	86.27%
Net-to-Gross (Demand)	E	86.08%
Installation Rate (Energy)	F	99.87%
Installation Rate (Demand)	G	99.76%
Net coincident kW Saved at Generator	H	0.11 kW
Gross Annual kWh Saved at Customer	I	568.99 kWh
Net Annual kWh Saved at Generator	J	517.89 kWh
Program Summary All Participants		
Total Budget	K	\$52,670,954
Net coincident kW Saved at Generator	L	71,225 kW
Gross Annual kWh Saved at Customer	M	385,773,957 kWh
Net Annual kWh Saved at Generator	N	351,131,109 kWh
Total MTRC Net Benefits with Adder	O	\$206,374,795
Total MTRC Net Benefits without Adder	P	\$173,022,842
Utility Program Cost per kWh Lifetime		
	K/(A x N)	\$0.0092
Utility Program Cost per kW at Gen		
	K/ L	\$740
Avoided Lifetime CO2 Emissions, Total Program (tons CO2)		
		2,081,711

RESIDENTIAL PROGRAM EE TOTAL				
2023 Net Present Cost Benefit Summary Analysis For All Participants				
	Participant Test (\$Total)	Utility Test (\$Total)	Rate Impact Test (\$Total)	Modified Total Resource Test (\$Total)
Benefits				
Avoided Revenue Requirements				
Generation Capacity	N/A	\$23,212,635	\$23,212,635	\$23,212,635
Trans. & Dist. Capacity	N/A	\$2,828,279	\$2,828,279	\$2,828,279
Marginal Energy	N/A	\$19,033,858	\$19,033,858	\$19,033,858
Avoided Emissions (CO2)	N/A	N/A	N/A	\$29,336,132
Subtotal				\$74,410,904
Non-Energy Benefits Adder (20.0%)				
Subtotal	N/A	\$45,074,772	\$45,074,772	\$83,425,858
Participant Benefits				
Bill Reduction - Electric	\$101,620,809	N/A	N/A	N/A
Participant Rebates and Incentives	\$15,123,391	N/A	N/A	\$15,123,391
Incremental Capital Savings	\$5,556,784	N/A	N/A	\$3,889,750
Incremental O&M Savings	\$1,393,765	N/A	N/A	\$1,347,158
Subtotal	\$123,694,747	N/A	N/A	\$20,360,299
Total Benefits	\$123,694,747	\$45,074,772	\$45,074,772	\$103,786,158
Costs				
Utility Project Costs				
Program Planning & Design	N/A	\$0	\$0	\$0
Administration & Program Delivery	N/A	\$8,508,984	\$8,508,984	\$8,508,984
Advertising/Promotion/Customer Ed	N/A	\$2,190,000	\$2,190,000	\$2,190,000
Participant Rebates and Incentives	N/A	\$15,123,391	\$15,123,391	\$15,123,391
Equipment & Installation	N/A	\$647,273	\$647,273	\$647,273
Measurement and Verification	N/A	\$152,500	\$152,500	\$152,500
Subtotal	N/A	\$26,622,147	\$26,622,147	\$26,622,147
Utility Revenue Reduction				
Revenue Reduction - Electric	N/A	N/A	\$96,295,590	N/A
Subtotal	N/A	N/A	\$96,295,590	N/A
Participant Costs				
Incremental Capital Costs	\$24,154,162	N/A	N/A	\$19,052,447
Incremental O&M Costs	\$509,124	N/A	N/A	\$405,085
Subtotal	\$24,663,286	N/A	N/A	\$19,457,532
Total Costs	\$24,663,286	\$26,622,147	\$122,917,737	\$46,079,680
Net Benefit (Cost)	\$99,031,462	\$18,452,625	(\$77,842,965)	\$57,706,478
Benefit/Cost Ratio	5.02	1.69	0.37	2.25

Note: Dollar values represent present value of impacts accumulated over the lifetime of the measures.

2023	ELECTRIC	GOAL
Input Summary and Totals		
Program "Inputs" per Customer kW and per Participant		
Lifetime (Weighted on Generator kWh)	A	11.4 years
T & D Loss Factor (Energy)	B	6.14%
T & D Loss Factor (Demand)	C	8.92%
Net-to-Gross (Energy)	D	78.66%
Net-to-Gross (Demand)	E	76.14%
Installation Rate (Energy)	F	95.66%
Installation Rate (Demand)	G	91.45%
Net coincident kW Saved at Generator	H	0.01 kW
Gross Annual kWh Saved at Customer	I	41.43 kWh
Net Annual kWh Saved at Generator	J	32.90 kWh
Program Summary All Participants		
Total Budget	K	\$26,622,147
Net coincident kW Saved at Generator	L	24,696 kW
Gross Annual kWh Saved at Customer	M	135,945,363 kWh
Net Annual kWh Saved at Generator	N	107,930,789 kWh
Total MTRC Net Benefits with Adder	O	\$57,706,478
Total MTRC Net Benefits without Adder	P	\$48,691,524
Utility Program Cost per kWh Lifetime		
	K/(A x N)	\$0.0217
Utility Program Cost per kW at Gen		
	K/ L	\$1,078
Avoided Lifetime CO2 Emissions, Total Program (tons CO2)		
		487,909

INCOME QUALIFIED PROGRAM TOTAL				
2023 Net Present Cost Benefit Summary Analysis For All Participants				
	Participant Test (\$Total)	Utility Test (\$Total)	Rate Impact Test (\$Total)	Modified Total Resource Test (\$Total)
Benefits				
Avoided Revenue Requirements				
Generation Capacity	N/A	\$4,855,109	\$4,855,109	\$4,855,109
Trans. & Dist. Capacity	N/A	\$592,545	\$592,545	\$592,545
Marginal Energy	N/A	\$7,014,237	\$7,014,237	\$7,014,237
Avoided Emissions (CO2)	N/A	N/A	N/A	\$11,547,433
Subtotal				\$24,009,323
Non-Energy Benefits Adder (50.0%)				\$6,230,945
Subtotal	N/A	\$12,461,890	\$12,461,890	\$30,240,268
Participant Benefits				
Bill Reduction - Electric	\$40,382,324	N/A	N/A	N/A
Participant Rebates and Incentives	\$3,462,934	N/A	N/A	\$3,462,934
Incremental Capital Savings	\$363,469	N/A	N/A	\$363,469
Incremental O&M Savings	\$272,579	N/A	N/A	\$272,579
Subtotal	\$44,481,306	N/A	N/A	\$4,098,982
Total Benefits	\$44,481,306	\$12,461,890	\$12,461,890	\$34,339,250
Costs				
Utility Project Costs				
Program Planning & Design	N/A	\$0	\$0	\$0
Administration & Program Delivery	N/A	\$781,408	\$781,408	\$781,408
Advertising/Promotion/Customer Ed	N/A	\$361,000	\$361,000	\$361,000
Participant Rebates and Incentives	N/A	\$3,462,934	\$3,462,934	\$3,462,934
Equipment & Installation	N/A	\$0	\$0	\$0
Measurement and Verification	N/A	\$246,000	\$246,000	\$246,000
Subtotal	N/A	\$4,851,342	\$4,851,342	\$4,851,342
Utility Revenue Reduction				
Revenue Reduction - Electric	N/A	N/A	\$40,382,324	N/A
Subtotal	N/A	N/A	\$40,382,324	N/A
Participant Costs				
Incremental Capital Costs	\$3,895,711	N/A	N/A	\$3,895,711
Incremental O&M Costs	\$30,393	N/A	N/A	\$30,393
Subtotal	\$3,926,104	N/A	N/A	\$3,926,104
Total Costs	\$3,926,104	\$4,851,342	\$45,233,666	\$8,777,446
Net Benefit (Cost)	\$40,555,202	\$7,610,548	(\$32,771,776)	\$25,561,804
Benefit/Cost Ratio	11.33	2.57	0.28	3.91

Note: Dollar values represent present value of impacts accumulated over the lifetime of the measures.

2023	ELECTRIC	GOAL
Input Summary and Totals		
Program "Inputs" per Customer kW and per Participant		
Lifetime (Weighted on Generator kWh)	A	16.8 years
T & D Loss Factor (Energy)	B	6.32%
T & D Loss Factor (Demand)	C	9.00%
Net-to-Gross (Energy)	D	100.00%
Net-to-Gross (Demand)	E	100.00%
Installation Rate (Energy)	F	96.82%
Installation Rate (Demand)	G	97.23%
Net coincident kW Saved at Generator	H	0.01 kW
Gross Annual kWh Saved at Customer	I	43.41 kWh
Net Annual kWh Saved at Generator	J	44.87 kWh
Program Summary All Participants		
Total Budget	K	\$4,851,342
Net coincident kW Saved at Generator	L	4,040 kW
Gross Annual kWh Saved at Customer	M	28,305,037 kWh
Net Annual kWh Saved at Generator	N	29,253,986 kWh
Total MTRC Net Benefits with Adder	O	\$25,561,804
Total MTRC Net Benefits without Adder	P	\$19,330,859
Utility Program Cost per kWh Lifetime		
	K/(A x N)	\$0.0099
Utility Program Cost per kW at Gen		
	K/ L	\$1,201
Avoided Lifetime CO2 Emissions, Total Program (tons CO2)		
		198,416

DR PORTFOLIO TOTAL				
2023 Net Present Cost Benefit Summary Analysis For All Participants				
	Participant Test (\$Total)	Utility Test (\$Total)	Rate Impact Test (\$Total)	Modified Total Resource Test (\$Total)
Benefits				
Avoided Revenue Requirements				
Generation Capacity	N/A	\$28,763,583	\$28,763,583	\$28,763,583
Trans. & Dist. Capacity	N/A	\$1,634,045	\$1,634,045	\$1,634,045
Marginal Energy	N/A	\$294,801	\$294,801	\$294,801
Avoided Emissions (CO2)	N/A	N/A	N/A	\$379,555
Subtotal				\$31,071,983
Non-Energy Benefits Adder (20.0%)				
Subtotal	N/A	\$30,692,428	\$30,692,428	\$37,210,469
Participant Benefits				
Bill Reduction - Electric	\$837,475	N/A	N/A	N/A
Participant Rebates and Incentives	\$12,265,178	N/A	N/A	\$12,265,178
Incremental Capital Savings	\$0	N/A	N/A	\$0
Incremental O&M Savings	\$0	N/A	N/A	\$0
Subtotal	\$13,102,653	N/A	N/A	\$12,265,178
Total Benefits	\$13,102,653	\$30,692,428	\$30,692,428	\$49,475,646
Costs				
Utility Project Costs				
Program Planning & Design	N/A	\$0	\$0	\$0
Administration & Program Delivery	N/A	\$10,404,163	\$10,404,163	\$10,404,163
Advertising/Promotion/Customer Ed	N/A	\$1,269,765	\$1,269,765	\$1,269,765
Participant Rebates and Incentives	N/A	\$12,265,178	\$12,265,178	\$12,265,178
Equipment & Installation	N/A	\$96,350	\$96,350	\$96,350
Measurement and Verification	N/A	\$594,397	\$594,397	\$594,397
Subtotal	N/A	\$24,629,853	\$24,629,853	\$24,629,853
Utility Revenue Reduction				
Revenue Reduction - Electric	N/A	N/A	\$837,475	N/A
Subtotal	N/A	N/A	\$837,475	N/A
Participant Costs				
Incremental Capital Costs	\$712,358	N/A	N/A	\$712,358
Incremental O&M Costs	\$0	N/A	N/A	\$0
Subtotal	\$712,358	N/A	N/A	\$712,358
Total Costs	\$712,358	\$24,629,853	\$25,467,328	\$25,342,210
Net Benefit (Cost)	\$12,390,295	\$6,062,575	\$5,225,100	\$24,133,436
Benefit/Cost Ratio	18.39	1.25	1.21	1.95

Note: Dollar values represent present value of impacts accumulated over the lifetime of the measures.

2023 ELECTRIC			GOAL
Input Summary and Totals			
Program "Inputs" per Customer kW and per Participant			
Lifetime (Weighted on Generator kWh)	A		3.4 years
T & D Loss Factor (Energy)	B		5.37%
T & D Loss Factor (Demand)	C		8.06%
Net-to-Gross (Energy)	D		100.00%
Net-to-Gross (Demand)	E		100.00%
Installation Rate (Energy)	F		100.00%
Installation Rate (Demand)	G		100.00%
Net coincident kW Saved at Generator	H		4.03 kW
Gross Annual kWh Saved at Customer	I		98.72 kWh
Net Annual kWh Saved at Generator	J		104.33 kWh
Program Summary All Participants			
Total Budget	K		\$24,629,853
Net coincident kW Saved at Generator	L		104,778 kW
Gross Annual kWh Saved at Customer	M		2,567,732 kWh
Net Annual kWh Saved at Generator	N		2,713,524 kWh
Total MTRC Net Benefits with Adder	O		\$24,133,436
Total MTRC Net Benefits without Adder	P		\$17,994,950
Utility Program Cost per kWh Lifetime			
	K/(A x N)		\$2.7029
Utility Program Cost per kW at Gen			
	K/ L		\$235
Avoided Lifetime CO2 Emissions, Total Program (tons CO2)			
			5,446

DR PROGRAM TOTAL				
2023 Net Present Cost Benefit Summary Analysis For All Participants				
	Participant Test (\$Total)	Utility Test (\$Total)	Rate Impact Test (\$Total)	Modified Total Resource Test (\$Total)
Benefits				
Avoided Revenue Requirements				
Generation Capacity	N/A	\$28,763,583	\$28,763,583	\$28,763,583
Trans. & Dist. Capacity	N/A	\$0	\$0	\$0
Marginal Energy	N/A	\$294,801	\$294,801	\$294,801
Avoided Emissions (CO2)	N/A	N/A	N/A	\$379,555
Subtotal				\$29,437,939
Non-Energy Benefits Adder (20.0%)				
Subtotal	N/A	\$29,058,383	\$29,058,383	\$35,249,615
Participant Benefits				
Bill Reduction - Electric	\$837,475	N/A	N/A	N/A
Participant Rebates and Incentives	\$11,584,553	N/A	N/A	\$11,584,553
Incremental Capital Savings	\$0	N/A	N/A	\$0
Incremental O&M Savings	\$0	N/A	N/A	\$0
Subtotal	\$12,422,028	N/A	N/A	\$11,584,553
Total Benefits	\$12,422,028	\$29,058,383	\$29,058,383	\$46,834,168
Costs				
Utility Project Costs				
Program Planning & Design	N/A	\$0	\$0	\$0
Administration & Program Delivery	N/A	\$8,439,275	\$8,439,275	\$8,439,275
Advertising/Promotion/Customer Ed	N/A	\$1,223,500	\$1,223,500	\$1,223,500
Participant Rebates and Incentives	N/A	\$11,584,553	\$11,584,553	\$11,584,553
Equipment & Installation	N/A	\$96,350	\$96,350	\$96,350
Measurement and Verification	N/A	\$200,000	\$200,000	\$200,000
Subtotal	N/A	\$21,543,677	\$21,543,677	\$21,543,677
Utility Revenue Reduction				
Revenue Reduction - Electric	N/A	N/A	\$837,475	N/A
Subtotal	N/A	N/A	\$837,475	N/A
Participant Costs				
Incremental Capital Costs	\$712,358	N/A	N/A	\$712,358
Incremental O&M Costs	\$0	N/A	N/A	\$0
Subtotal	\$712,358	N/A	N/A	\$712,358
Total Costs	\$712,358	\$21,543,677	\$22,381,152	\$22,256,035
Net Benefit (Cost)	\$11,709,670	\$7,514,706	\$6,677,231	\$24,578,133
Benefit/Cost Ratio	17.44	1.35	1.30	2.10

Note: Dollar values represent present value of impacts accumulated over the lifetime of the measures.

2023	ELECTRIC	GOAL
Input Summary and Totals		
Program "Inputs" per Customer kW and per Participant		
Lifetime (Weighted on Generator kWh)	A	3.4 years
T & D Loss Factor (Energy)	B	5.37%
T & D Loss Factor (Demand)	C	8.06%
Net-to-Gross (Energy)	D	100.00%
Net-to-Gross (Demand)	E	100.00%
Installation Rate (Energy)	F	100.00%
Installation Rate (Demand)	G	100.00%
Net coincident kW Saved at Generator	H	4.32 kW
Gross Annual kWh Saved at Customer	I	105.79 kWh
Net Annual kWh Saved at Generator	J	111.79 kWh
Program Summary All Participants		
Total Budget	K	\$21,543,677
Net coincident kW Saved at Generator	L	104,778 kW
Gross Annual kWh Saved at Customer	M	2,567,732 kWh
Net Annual kWh Saved at Generator	N	2,713,524 kWh
Total MTRC Net Benefits with Adder	O	\$24,578,133
Total MTRC Net Benefits without Adder	P	\$18,766,456
Utility Program Cost per kWh Lifetime		
	K/(A x N)	\$2.3642
Utility Program Cost per kW at Gen		
	K/ L	\$206
Avoided Lifetime CO2 Emissions, Total Program (tons CO2)		
		5,446

PORTFOLIO TOTAL				
2023 Net Present Cost Benefit Summary Analysis For All Participants				
	Participant Test (\$Total)	Utility Test (\$Total)	Rate Impact Test (\$Total)	Modified Total Resource Test (\$Total)
Benefits				
Avoided Revenue Requirements				
Commodity Cost Reduction	N/A	\$30,124,797	\$30,124,797	\$30,124,797
Variable O&M Savings	N/A	\$385,684	\$385,684	\$385,684
Demand Savings	N/A	\$5,829,413	\$5,829,413	\$5,829,413
Avoided Emissions (CO2)	N/A	N/A	N/A	\$42,360,288
Avoided Emissions (CH4)	N/A	N/A	N/A	\$618,348
Subtotal				\$79,318,529
Non-Energy Benefits Adder (8.6%)				\$6,800,276
Subtotal	N/A	\$36,339,894	\$36,339,894	\$86,118,806
Participant Benefits				
Bill Reduction - Gas	\$44,845,273	N/A	N/A	N/A
Participant Rebates and Incentives	\$16,278,443	N/A	N/A	\$16,278,443
Incremental Capital Savings	\$0	N/A	N/A	\$0
Incremental O&M Savings	\$33,785,915	N/A	N/A	\$31,814,664
Subtotal	\$94,909,631	N/A	N/A	\$48,093,107
Total Benefits	\$94,909,631	\$36,339,894	\$36,339,894	\$134,211,913
Costs				
Utility Project Costs				
Program Planning & Design	N/A	\$0	\$0	\$0
Administration & Program Delivery	N/A	\$5,518,083	\$5,518,083	\$5,518,083
Advertising/Promotion/ Customer Ed	N/A	\$881,575	\$881,575	\$881,575
Participant Rebates and Incentives	N/A	\$16,278,443	\$16,278,443	\$16,278,443
Equipment & Installation	N/A	\$189,964	\$189,964	\$189,964
Measurement and Verification	N/A	\$612,564	\$612,564	\$612,564
Subtotal	N/A	\$23,480,629	\$23,480,629	\$23,480,629
Utility Revenue Reduction				
Revenue Reduction - Gas	N/A	N/A	\$44,472,643	N/A
Subtotal	N/A	N/A	\$44,472,643	N/A
Participant Costs				
Incremental Capital Costs	\$46,463,464	N/A	N/A	\$34,912,013
Incremental O&M Costs	\$269,426	N/A	N/A	\$231,726
Subtotal	\$46,732,890	N/A	N/A	\$35,143,739
Total Costs	\$46,732,890	\$23,480,629	\$67,953,273	\$58,624,368
Net Benefit (Cost)	\$48,176,741	\$12,859,264	(\$31,613,379)	\$75,587,545
Benefit/Cost Ratio	2.03	1.55	0.53	2.29

Note: Dollar values represent present value of impacts accumulated over the lifetime of the measures.

2023	GAS	GOAL
Input Summary and Totals		
Program "Inputs" per Dth		
Lifetime (Weighted on Dth)	A	13.5 years
Net-to-Gross (Weighted on Dth)	B	68.39%
Install Rate (Weighted on Dth)	C	78.86%
Program Summary per Participant		
Gross Annual Dth Saved	D	0.7
Net Annual Dth Saved	E	0.5
Program Summary All Participants		
Total Budget	F	\$23,480,629
Gross Annual Dth Saved	G	1,278,720 Dth
Net Annual Dth Saved	H	874,462 Dth
Total MTRC Net Benefits with Adder	I	\$75,587,545
Total MTRC Net Benefits without Adder	J	\$68,787,269
Utility Program Cost per Dth Lifetime	F / (A x H)	\$1.9863
Avoided Lifetime CO2 Emissions, Total Program (tons CO2)		691,561
Avoided Lifetime CH4 Emissions, Total Program (tons CH4)		360.2

BUSINESS PROGRAM EE TOTAL				
2023 Net Present Cost Benefit Summary Analysis For All Participants				
	Participant Test (\$Total)	Utility Test (\$Total)	Rate Impact Test (\$Total)	Modified Total Resource Test (\$Total)
Benefits				
Avoided Revenue Requirements				
Commodity Cost Reduction	N/A	\$6,295,100	\$6,295,100	\$6,295,100
Variable O&M Savings	N/A	\$79,613	\$79,613	\$79,613
Demand Savings	N/A	\$1,203,314	\$1,203,314	\$1,203,314
Avoided Emissions (CO2)	N/A	N/A	N/A	\$8,950,886
Avoided Emissions (CH4)	N/A	N/A	N/A	\$131,786
Subtotal				\$16,660,699
Non-Energy Benefits Adder (9.1%)				\$1,515,605
Subtotal	N/A	\$7,578,027	\$7,578,027	\$18,176,304
Participant Benefits				
Bill Reduction - Gas	\$8,919,181	N/A	N/A	N/A
Participant Rebates and Incentives	\$1,017,578	N/A	N/A	\$1,017,578
Incremental Capital Savings	\$0	N/A	N/A	\$0
Incremental O&M Savings	\$12,187,146	N/A	N/A	\$10,614,009
Subtotal	\$22,123,905	N/A	N/A	\$11,631,587
Total Benefits	\$22,123,905	\$7,578,027	\$7,578,027	\$29,807,892
Costs				
Utility Project Costs				
Program Planning & Design	N/A	\$0	\$0	\$0
Administration & Program Delivery	N/A	\$615,056	\$615,056	\$615,056
Advertising/Promotion/ Customer Ed	N/A	\$82,194	\$82,194	\$82,194
Participant Rebates and Incentives	N/A	\$1,017,578	\$1,017,578	\$1,017,578
Equipment & Installation	N/A	\$0	\$0	\$0
Measurement and Verification	N/A	\$108,323	\$108,323	\$108,323
Subtotal	N/A	\$1,823,152	\$1,823,152	\$1,823,152
Utility Revenue Reduction				
Revenue Reduction - Gas	N/A	N/A	\$8,875,295	N/A
Subtotal	N/A	N/A	\$8,875,295	N/A
Participant Costs				
Incremental Capital Costs	\$5,404,409	N/A	N/A	\$4,667,152
Incremental O&M Costs	\$269,284	N/A	N/A	\$231,584
Subtotal	\$5,673,692	N/A	N/A	\$4,898,735
Total Costs	\$5,673,692	\$1,823,152	\$10,698,447	\$6,721,887
Net Benefit (Cost)	\$16,450,213	\$5,754,876	(\$3,120,420)	\$23,086,005
Benefit/Cost Ratio	3.90	4.16	0.71	4.43

Note: Dollar values represent present value of impacts accumulated over the lifetime of the measures.

2023	GAS	GOAL
Input Summary and Totals		
Program "Inputs" per Dth		
Lifetime (Weighted on Dth)	A	17.7 years
Net-to-Gross (Weighted on Dth)	B	87.95%
Install Rate (Weighted on Dth)	C	100.00%
Program Summary per Participant		
Gross Annual Dth Saved	D	42.4
Net Annual Dth Saved	E	37.3
Program Summary All Participants		
Total Budget	F	\$1,823,152
Gross Annual Dth Saved	G	166,076 Dth
Net Annual Dth Saved	H	146,062 Dth
Total MTRC Net Benefits with Adder	I	\$23,086,005
Total MTRC Net Benefits without Adder	J	\$21,570,399
Utility Program Cost per Dth Lifetime	F / (A x H)	\$0.7045
Avoided Lifetime CO2 Emissions, Total Program (tons CO2)		151,393
Avoided Lifetime CH4 Emissions, Total Program (tons CH4)		78.9

RESIDENTIAL PROGRAM EE TOTAL				
2023 Net Present Cost Benefit Summary Analysis For All Participants				
	Participant Test (\$Total)	Utility Test (\$Total)	Rate Impact Test (\$Total)	Modified Total Resource Test (\$Total)
Benefits				
Avoided Revenue Requirements				
Commodity Cost Reduction	N/A	\$20,453,717	\$20,453,717	\$20,453,717
Variable O&M Savings	N/A	\$261,621	\$261,621	\$261,621
Demand Savings	N/A	\$3,954,263	\$3,954,263	\$3,954,263
Avoided Emissions (CO2)	N/A	N/A	N/A	\$28,588,079
Avoided Emissions (CH4)	N/A	N/A	N/A	\$416,722
Subtotal				\$53,674,401
Non-Energy Benefits Adder (6.0%)				\$3,238,538
Subtotal	N/A	\$24,669,601	\$24,669,601	\$56,912,939
Participant Benefits				
Bill Reduction - Gas	\$30,903,913	N/A	N/A	N/A
Participant Rebates and Incentives	\$8,941,500	N/A	N/A	\$8,941,500
Incremental Capital Savings	\$0	N/A	N/A	\$0
Incremental O&M Savings	\$16,798,682	N/A	N/A	\$16,400,568
Subtotal	\$56,644,094	N/A	N/A	\$25,342,068
Total Benefits	\$56,644,094	\$24,669,601	\$24,669,601	\$82,255,007
Costs				
Utility Project Costs				
Program Planning & Design	N/A	\$0	\$0	\$0
Administration & Program Delivery	N/A	\$3,386,260	\$3,386,260	\$3,386,260
Advertising/Promotion/ Customer Ed	N/A	\$518,000	\$518,000	\$518,000
Participant Rebates and Incentives	N/A	\$8,941,500	\$8,941,500	\$8,941,500
Equipment & Installation	N/A	\$189,964	\$189,964	\$189,964
Measurement and Verification	N/A	\$54,000	\$54,000	\$54,000
Subtotal	N/A	\$13,089,724	\$13,089,724	\$13,089,724
Utility Revenue Reduction				
Revenue Reduction - Gas	N/A	N/A	\$30,575,168	N/A
Subtotal	N/A	N/A	\$30,575,168	N/A
Participant Costs				
Incremental Capital Costs	\$35,409,864	N/A	N/A	\$24,595,670
Incremental O&M Costs	\$142	N/A	N/A	\$142
Subtotal	\$35,410,006	N/A	N/A	\$24,595,812
Total Costs	\$35,410,006	\$13,089,724	\$43,664,893	\$37,685,536
Net Benefit (Cost)	\$21,234,089	\$11,579,876	(\$18,995,292)	\$44,569,471
Benefit/Cost Ratio	1.60	1.88	0.56	2.18

Note: Dollar values represent present value of impacts accumulated over the lifetime of the measures.

2023	GAS	GOAL
Input Summary and Totals		
Program "Inputs" per Dth		
Lifetime (Weighted on Dth)	A	12.6 years
Net-to-Gross (Weighted on Dth)	B	63.04%
Install Rate (Weighted on Dth)	C	74.43%
Program Summary per Participant		
Gross Annual Dth Saved	D	0.6
Net Annual Dth Saved	E	0.4
Program Summary All Participants		
Total Budget	F	\$13,089,724
Gross Annual Dth Saved	G	1,001,099 Dth
Net Annual Dth Saved	H	631,108 Dth
Total MTRC Net Benefits with Adder	I	\$44,569,471
Total MTRC Net Benefits without Adder	J	\$41,330,933
Utility Program Cost per Dth Lifetime	F / (A x H)	\$1.6499
Avoided Lifetime CO2 Emissions, Total Program (tons CO2)		464,127
Avoided Lifetime CH4 Emissions, Total Program (tons CH4)		241.8

INCOME QUALIFIED PROGRAM TOTAL

2023 Net Present Cost Benefit Summary Analysis For All Participants

	Participant Test (\$Total)	Utility Test (\$Total)	Rate Impact Test (\$Total)	Modified Total Resource Test (\$Total)
Benefits				
Avoided Revenue Requirements				
Commodity Cost Reduction	N/A	\$3,375,980	\$3,375,980	\$3,375,980
Variable O&M Savings	N/A	\$44,450	\$44,450	\$44,450
Demand Savings	N/A	\$671,836	\$671,836	\$671,836
Avoided Emissions (CO2)	N/A	N/A	N/A	\$4,821,323
Avoided Emissions (CH4)	N/A	N/A	N/A	\$69,841
Subtotal				\$8,983,429
Non-Energy Benefits Adder (22.8%)				\$2,046,133
Subtotal	N/A	\$4,092,266	\$4,092,266	\$11,029,562
Participant Benefits				
Bill Reduction - Gas	\$5,022,180	N/A	N/A	N/A
Participant Rebates and Incentives	\$5,806,447	N/A	N/A	\$5,806,447
Incremental Capital Savings	\$0	N/A	N/A	\$0
Incremental O&M Savings	\$4,800,087	N/A	N/A	\$4,800,087
Subtotal	\$15,628,714	N/A	N/A	\$10,606,534
Total Benefits	\$15,628,714	\$4,092,266	\$4,092,266	\$21,636,096
Costs				
Utility Project Costs				
Program Planning & Design	N/A	\$0	\$0	\$0
Administration & Program Delivery	N/A	\$450,397	\$450,397	\$450,397
Advertising/Promotion/ Customer Ed	N/A	\$153,000	\$153,000	\$153,000
Participant Rebates and Incentives	N/A	\$5,806,447	\$5,806,447	\$5,806,447
Equipment & Installation	N/A	\$0	\$0	\$0
Measurement and Verification	N/A	\$150,600	\$150,600	\$150,600
Subtotal	N/A	\$6,560,443	\$6,560,443	\$6,560,443
Utility Revenue Reduction				
Revenue Reduction - Gas	N/A	N/A	\$5,022,180	N/A
Subtotal	N/A	N/A	\$5,022,180	N/A
Participant Costs				
Incremental Capital Costs	\$5,649,191	N/A	N/A	\$5,649,191
Incremental O&M Costs	\$0	N/A	N/A	\$0
Subtotal	\$5,649,191	N/A	N/A	\$5,649,191
Total Costs	\$5,649,191	\$6,560,443	\$11,582,623	\$12,209,635
Net Benefit (Cost)	\$9,979,522	(\$2,468,178)	(\$7,490,357)	\$9,426,462
Benefit/Cost Ratio	2.77	0.62	0.35	1.77

Note: Dollar values represent present value of impacts accumulated over the lifetime of the measures.

2023 GAS GOAL

Input Summary and Totals

Program "Inputs" per Dth		
Lifetime (Weighted on Dth)	A	13.4 years
Net-to-Gross (Weighted on Dth)	B	87.22%
Install Rate (Weighted on Dth)	C	87.22%

Program Summary per Participant

Gross Annual Dth Saved	D	1.7
Net Annual Dth Saved	E	1.5

Program Summary All Participants

Total Budget	F	\$6,560,443
Gross Annual Dth Saved	G	111,546 Dth
Net Annual Dth Saved	H	97,292 Dth
Total MTRC Net Benefits with Adder	I	\$9,426,462
Total MTRC Net Benefits without Adder	J	\$7,380,329

Utility Program Cost per Dth Lifetime F / (A x H) **\$5.0471**

Avoided Lifetime CO2 Emissions, Total Program (tons CO2) **76,040**
Avoided Lifetime CH4 Emissions, Total Program (tons CH4) **39.6**

Appendix A – List of Acronyms

Acronym	Meaning
ACCA	Air Conditioning Contractors of America
AFCOM	Association for Computer Operations Management
AFUE	Annual Fuel Utilization Efficiency
AHRI	Air-Conditioning, Heating, and Refrigeration Institute
AMI	Advanced Metering Infrastructure
ASHP	Air Source Heat Pump
ASHRAR	American Society of Heating, Refrigeration and Air-conditioning Engineers
BE	Beneficial Electrification
BSC	Business Solutions Center
BTC	Beyond the Code
C-PACE	Colorado Property Assessed Clean Energy
CAZ	Combustion Appliance Zone
CDs	Construction Documents
CEE	Consortium for Energy Efficiency
CEO	Colorado Energy Office
CFL	Compact-fluorescent lights
CFM	Cubic Feet Per Minute
Commission	Colorado Public Utilities Commission
COP	Coefficient of Performance
CPP	Critical Peak Pricing
CRAC	Computer Room Air Conditioner
DDC	Direct Digital Controls
DI	Direct Install
DOE	U.S. Department of Energy
DR	Demand Response
DSM	Demand-Side Management
DSMCA	Demand-Side Management Cost Adjustment
EDA	Energy Design Assistance
EEB	Energy Efficient Buildings
EEBC	Energy Efficiency Business Coalition
EER	Energy Efficiency Ratio
EF	Energy Factor
EIA	Energy Information Administration
EMA	Energy Management Assessment
EMIS	Energy Management Information System
EMS	Energy Management System
EM&V	Evaluation, Measurement and Verification
EOC	Energy Outreach Colorado
EPA	U.S. Environmental Protection Agency
ESCO	Energy Service Company
ESNH	ENERGY STAR New Homes

Acronym	Meaning
EV	Electric Vehicle
GSHP	Ground Source Heat Pump
FEMP	Federal Energy Management Program
HEI	Home Energy Insights
HER	Home Energy Report
HERS	Home Energy Rating System
HP	Horsepower
HSPF	Heating Seasonal Performance Factor
HVAC+R	Heating, Ventilation, Air Conditioning, and Refrigeration
IECC	International Energy Conservation Code
IPMVP	International Performance Measurement and Verification Protocol
ISOC	Interruptible Service Option Credit
LEAP	Low-Income Energy Assistance Program
LED	Light-emitting Diode
LEED	Leadership in Energy and Environmental Design
LIHEAP	Low Income Home Energy Assistance Program
MOU	Memorandum of Understanding
MSHP	Mini-Split Heat Pump
MTRC	Modified Total Resource Cost Test
M&V	Measurement and Verification
NACH	Natural Air Changes per Hour
NAIOP	National Association of Industrial and Office Properties
NEIF	National Energy Improvement Fund
NEMA	National Electrical Manufacturers Association
NTG	Net-to-Gross
OFB	On-Bill Financing
PPR	Peak Partner Rewards
QA/QC	Quality Assurance/Quality Control
RAD	Responsible Appliance Disposal
RESNET	Residential Energy Services Network
RFP	Request for Proposal
RR	Realization Rate
SBES	Small Business Energy Solutions
SEER	Seasonal Energy Efficiency Ratio
SEM	Strategic Energy Management
SEMC	Strategic Energy Management Consultant
SL	Street Lighting
SWEEP	Southwest Energy Efficiency Project
TOU	Time of Use
WCC	Western Cooling Control
UEF	Uniform Energy Factor
VC	Verification Contractor
VDI	Virtual Desktop Infrastructures
VFD	Variable Frequency Drive

Appendix B – Key Terms

Plan – Gas Rule 4751(i) states that “DSM plan” means the DSM programs, goals, and budgets over a specified DSM period, generally considered in one-year increments, as may be proposed by the utility.” C.R.S. 40-3.2-103 (3)(a) dictates that “...each gas utility shall: (a) Develop and begin implementing a set of cost-effective DSM programs for its full-service customers. Such programs shall be of the gas utility's choosing, taking into account the characteristics of the gas utility and its customers...” The Company submits DSM plans on an annual or biennial basis to obtain Commission approval of specific DSM programs, pilots, annual energy savings and peak demand reduction goals, and annual budgets, in accordance with Paragraph 170 of Decision No. C08-0560 which states that the Commission “concur with Public Service’s plan to file DSM plans biennially and to combine electric and gas DSM into one filing.”

Portfolio – Gas Rule 4757(e) states that, “A utility has the discretion and the responsibility of managing the portfolio of DSM programs to meet the benefit to cost ratio and the energy and savings forecasts. In implementing DSM programs, a utility shall use reasonable efforts to maximize energy savings consistent with the approved DSM plan.” Consistent with the use of the term portfolio in Gas Rule 4757(e), the Company uses the term DSM “portfolio” when referring to the entire group of electric or gas programs, products, and measures that the Company implements in a given plan-year.

Program – C.R.S. 40-1-102(6) states that ““Demand-side management programs” or “DSM programs” means energy efficiency, conservation, load management, and demand response programs or any combination of these programs.” Gas Rule 4751(j) states that ““DSM program” means any combination of DSM measures, information and services offered to customers to reduce natural gas usage.” Consistent with these definitions, depending on the context, the Company may use the term “program” to refer to the entire group of energy efficiency, conservation, load management, and demand response programs it offers, to only one of the described initiatives, as in the case of the Interruptible Service Option Credit program, or Third-Party Demand Response Program, or to a subset of the energy efficiency products it provides as in the case of the Residential, Business and Low-Income and Indirect gas and electric energy efficiency programs.

Product – The term “product” is used by the Company to refer to one of the approximately three dozen DSM offerings that are included as the principal components of the business, residential, and low-income programs included in the DSM plan and offered to customers.

For example, Small Business Solutions and Lighting Efficiency are individual products within the Business Program under the electric energy efficiency portfolio.

Measure – Gas Rule 4751(g) states that “DSM measure” means an individual component or technology, such as attic insulation or replacement of equipment.” The Company uses the term “measure” when referring to individual components or technologies offered as part of a specific product. For example, each of the energy efficient lighting technologies offered as part of the Lighting Efficiency product are considered to be individual “measures.”

Third-Party Implementer – The Company considers third-party implementers to be contracted agents that support DSM product delivery. This does not include trade partners or other consultants.

Goal – The Company refers to “goal” as the Commission-approved annual GWh savings goal for the Company’s electric portfolio, such as those ordered in Proceeding No. 17A-0462EG for years 2019 through 2023.

Forecasts – The Company refers to “forecasts” as the Company’s estimated achievements for a given year for our portfolio, programs, and products.

Appendix C – Product Rankings

DSM & BE Product rankings are established by determining market segments that could participate in the product, customer classes available, total projected savings, cost-effectiveness, and participation rates (as a number and a percent of the market). This ranking is a requirement from Gas Rules 723-4, Proceeding No. 07R-371G.

2023	Rank
Home Lighting & Recycling	1
Lighting Efficiency	2
School Education Kits	3
Small Business Solutions	4
Single-Family Weatherization	5
Home Energy Insights	6
Business HVAC+R Systems	7
Strategic Energy Management	8
Energy Efficient Showerhead	9
New Construction	10
Home Energy Squad	11
Multifamily Buildings	12
Energy Savings Kit	13
Data Center Efficiency	14
Residential Heating & Cooling	15
LED Street Lighting	16
Business Energy Assessments	17
Energy Star New Homes	18
Refrigerator & Freezer Recycling	19
Compressed Air Efficiency	20
Self Direct	21
Custom Efficiency	22
Insulation & Air Sealing	23
Energy Management Systems	24
Whole Home Efficiency	25
Multifamily Weatherization	26
Non-Profit	27

Appendix D – Budget Categories

The Company uses the following six budget categories to track and report its annual expenditures for DSM & BE programs and products within its portfolio:

1. Program Planning and Design

Expenditures for:

- Labor for product development and product managers.
- Expenditures related to product development, planning, and design.

2. Administration and Program Delivery

Expenditures for:

- Labor for product managers, sales representatives, call center, rebate processing, technical consulting, and other fulfillment activities associated with delivering a product directly to the customer.
- Labor for installation contractors, vendors, technical consultants, fulfillment contractors, and alternative providers that Xcel Energy contracts with to provide DSM & BE services.
- Project fulfillment, implementation and program support activities associate with delivering a program directly to the customer.

3. Advertising / Promotion / Customer Education

Expenditures for:

- Labor for communication staff and others.
- TV, radio, newspaper, and print media; direct promotion and sales support materials; postage, promotional events; contracted outbound telephone sales.
- Customer education through seminars, pamphlets, videos, and computer games.

4. Participant Rebates and Incentives

Expenditures for:

- Customer rebates, finance interest subsidies, subsidies for engineering studies, trade incentives, and incentives given in the form of subsidized products or equipment.

5. Equipment and Installation

Expenditures for:

- The costs to purchase energy efficient equipment and to install efficiency equipment at the customer site.

6. Measurement and Verification

Expenditures for:

- Labor for market research and load research.
- Labor product development staff, product development, external consultants, and product development research activities.
- Customer surveys, program evaluation expenses.

Appendix E – Avoided Cost Assumptions

The following sections summarize the avoided cost assumptions Public Service has made in order to perform the cost-effectiveness tests for electric and gas programs, and for which the Company is asking for approval of for use in the status reports and incentives calculations for its 2023 achievements.

Electric Programs

In order to determine the cost-effectiveness of its electric energy efficiency and load management programs, Public Service must first calculate the avoided generation, transmission, distribution, and marginal energy costs these programs avoid. Below are the avoided cost assumptions used in this plan.

1. Estimated Annual Avoided Generation Capacity Costs (Source: Public Service Resource Planning) Estimated Annual Avoided Generation Capacity Costs

Capacity costs reflect the generic capacity cost estimates used in Phase I of Public Service’s 2021 Electric Resource Plan and Clean Energy Plan (Proceeding No. 21A-0141E) for a gas-fired combustion turbine (CT) referred to as a “Large or Generic CT” in compliance with paragraphs 33 and 34 of the filed Non-Unanimous Settlement Agreement (Proceeding No. 17A-0462EG) and as affirmed in paragraph 104 of Decision C18-0417.

	CT		CT
Year	Gen Capacity \$/kW-mo	Year	Gen Capacity \$/kW-mo
2023	\$8.35	2033	\$9.90
2024	\$8.50	2034	\$10.07
2025	\$8.64	2035	\$10.24
2026	\$8.79	2036	\$10.42
2027	\$8.93	2037	\$10.61
2028	\$9.09	2038	\$10.79
2029	\$9.24	2039	\$10.97
2030	\$9.40	2040	\$11.17
2031	\$9.56	2041	\$11.36
2032	\$9.72	2042	\$11.56

2. Estimated Annual Avoided Transmission and Distribution (T&D) Capacity Costs (Source: Public Service Resource Planning) Estimated Annual Avoided Transmission and Distribution (T&D) Capacity Costs

Paragraph 97 in Decision C14-0731 (Proceeding No. 13A-0686EG) required the Company to “...study the avoided transmission and distribution capacity costs and propose values in its DSM Biennial Plan for 2015 through 2016.” Consistent with the Commission’s decision in C15-0735, the Company undertook a study, specific to its own territory, utilizing the system planning approach to estimate T&D costs. The study is included as attachment SMW-6 to the Direct Testimony of Shawn M. White in Proceeding No. 16A-0512EG and affirmed in ⁹³[redacted]

⁹³ Decision No. C18-0417, at Ordering ¶104.

The results of this study represent the best estimates available and will be used for analysis of the 2023 achievements.

Avoided Capacity \$/kW-yr				Avoided Capacity \$/kW-yr			
Year	Transmission	Distribution	T&D	Year	Transmission	Distribution	T&D
2023	\$9.43	\$2.57	\$11.99	2033	\$11.49	\$3.13	\$14.62
2024	\$9.62	\$2.62	\$12.23	2034	\$11.72	\$3.19	\$14.91
2025	\$9.81	\$2.67	\$12.48	2035	\$11.96	\$3.25	\$15.21
2026	\$10.01	\$2.72	\$12.73	2036	\$12.20	\$3.32	\$15.51
2027	\$10.21	\$2.78	\$12.98	2037	\$12.44	\$3.38	\$15.82
2028	\$10.41	\$2.83	\$13.24	2038	\$12.69	\$3.45	\$16.14
2029	\$10.62	\$2.89	\$13.51	2039	\$12.94	\$3.52	\$16.46
2030	\$10.83	\$2.95	\$13.78	2040	\$13.20	\$3.59	\$16.79
2031	\$11.05	\$3.01	\$14.06	2041	\$13.47	\$3.66	\$17.13
2032	\$11.27	\$3.07	\$14.33	2042	\$13.74	\$3.73	\$17.47

3. Estimated DSM Geo-Targeting Avoided Transmission and Distribution (T&D) Capacity Costs (Source: Public Service Distribution Planning) Estimated

As part of the settlement agreement in Proceeding No. 17A-0462EG a process to determine the incremental value of avoided transmission and distribution capacity costs was approved. The table below includes the value each year for this avoided cost applicable to the Geo-Targeting Pilot included in this Plan.

Geo-Targeting Incremental T&D			
Year	T&D Capacity \$/kW-yr	Year	T&D Capacity \$/kW-yr
2023	\$408.56	2033	\$0.00
2024	\$304.56	2034	\$0.00
2025	\$233.65	2035	\$0.00
2026	\$0.00	2036	\$0.00
2027	\$0.00	2037	\$0.00
2028	\$0.00	2038	\$0.00
2029	\$0.00	2039	\$0.00
2030	\$0.00	2040	\$0.00
2031	\$0.00	2041	\$0.00
2032	\$0.00	2042	\$0.00

4. Estimated Annual Avoided Energy Costs (Source: Public Service Resource Planning)

In order to determine avoided energy costs, the Company’s Resource Planning group produced an EnCompass run to produce hourly marginal energy estimates. These runs follow the provisions stated in the settlement agreement in Proceeding No. 17A-0462EG. For each individual measure in the Plan, an hourly load shape is assigned, as documented in Appendix G. The estimated annual avoided energy resulting from the product of hourly marginal energy estimates and the hourly load shape is used to determine the estimate annual avoided energy costs for each measure.

5. Estimated Annual Avoided Emissions Costs (includes CO₂ and CH₄)

(Source: Interagency Working Group on Social Cost of Greenhouse Gases)

The Company has used the Social Cost of Carbon and Methane pursuant to the language in Senate Bill 19-236, codified at §40-3.2-106(c)(4), C.R.S., and HB 21-1238, codified at § 40-3.2-107, C.R.S, respectively, to value avoided emissions in the cost-benefit analysis at the product and portfolio level, as documented in the direct testimony of Jeremy Petersen.

Gas Programs

In order to determine the cost-effectiveness of its gas programs, Public Service must calculate the avoided commodity cost of gas, avoided capacity costs and any avoided variable O&M costs associated with the gas energy efficiency savings. Below are the avoided cost assumptions used in this Plan.

1. Estimated Commodity Cost of Gas (Source: Public Service Gas Resource Planning)

Estimated Commodity Cost of Gas (

The gas price forecast reflects a market snapshot for short-term prices and a quantitative average of projections from well-known forecasting services for the long-term forecast prices as of March 2022. Distinct costs are identified for Business and Residential customers with these values being applied to Business and Residential gas programs respectively.

Year	\$/Dth		Year	\$/Dth	
	Residential	Business		Residential	Business
2023	\$4.27	\$4.23	2033	\$4.21	\$4.19
2024	\$3.48	\$3.46	2034	\$4.34	\$4.33
2025	\$3.20	\$3.19	2035	\$4.52	\$4.51
2026	\$3.34	\$3.33	2036	\$4.65	\$4.63
2027	\$3.40	\$3.39	2037	\$4.77	\$4.76
2028	\$3.48	\$3.47	2038	\$4.92	\$4.91
2029	\$3.60	\$3.59	2039	\$5.06	\$5.05
2030	\$3.72	\$3.71	2040	\$5.22	\$5.20
2031	\$3.86	\$3.85	2041	\$5.46	\$5.45
2032	\$4.05	\$4.04	2042	\$5.63	\$5.61

2. Estimated Avoided Variable O&M Costs (Source: Public Service Pricing and Planning)

The company used the following value provided by the Company's Pricing and Planning department to determine variable O&M costs avoided with a reduction in gas usage.

Year	\$/Dth
2023-2042	\$0.05

3. Estimated Annual Avoided Reservation Costs (used to estimate capacity savings – Peak Day Dth savings estimated as 1% of annual Dth savings) (Source: Public Service Gas Resource Planning) Estimated Annual Avoided Reservation Costs (used to estimate capacity savings – Peak Day

The following annual avoided reservation costs was used to determine the cost of service to transport incremental gas supplies to the metropolitan Denver area. The Company uses the CIG firm transportation rate to estimate this cost.

Year	\$/Dth
2023-2042	\$75.572

Appendix F – Natural Gas DSM \$/Therm and ALR Methodology

The Company proposes the following dollar per therm values applicable to natural gas DSM programs provided to its residential and non-residential customers, respectively:

Proposed Dollar per Therm Values for the DSMCA factors to be effective July 1, 2022:

DTVR =	\$0.16076	
DTVNR =	\$0.17863	\$0.17863

The dollar per therm values proposed have been used to calculate the lost revenues sought to be recovered through the Gas-Demand Side Management Cost Adjustment (G-DSMCA) filed on April 1, 2022 to be effective July 1, 2022.

The methodology for calculating the dollar per therm values set forth above is as follows:

The following methodology is proposed for calculation of the Dollar per Therm Values (DTV) that is required to calculate the Acknowledgement of Lost Revenue (ALR) value in accordance with Public Service gas Demand-Side Management Cost Adjustment (DSMCA). Two dollars per therm values are required, one for residence service, which is herein labeled “DTVR”, and one for non-residence service, which is herein labeled “DTVNR”.

Calculation of the Residence Service Dollar per Therm Value (DTVR):

Calculation Components:

1. Residential Base Rate per Therm (RBR)
2. Variable Cost per Therm (VCT)

Formula: $DTVR = RBR \text{ minus } VCT$

Calculation of the Non-Residence Service Dollar per Therm Value (DTVNR):

Calculation Components:

1. Commercial Small Gas Service Base Rate per Therm (CSGBR)
2. Commercial Large Gas Service Base Rate per Therm (CLGBR)
3. Interruptible Industrial Gas Service Base Rate per Therm (IGBR)
4. CSG Sales (CSGS)
5. CLG Sales (CLGS)
6. IG Sales (IGS)
7. Total of CSG + CLG + IG Sales (TS)
8. VCT

Formula: $DTVNR = \{ [CSGBR \text{ times } (CSGS/TS)] + [CLGBR \text{ times } (CLGS/TS)] + [IGBR \text{ times } (IGS/TS)] \} \text{ minus } VCT$

Calculation of the VCT

[Note: the VCT is the same for both the DTVR and DTVNR formula]:

Calculation Components:

1. Total Variable Costs (VC)
2. Weather Normalized throughput in Therms (WNT)

Formula: $VCT = VC/WNT$

Proposed VCT to be effective January 1, 2022:

VCT = \$0.000205

As stipulated in Service Company’s gas tariff, these Dollar per Therm Values are applied to the gas DSMCA factor calculations as follows:

“The RDSM ALR Value is the sum of multiplying the dollar per therm value, as approved by the Commission for residential service, (DTVR) times the annual number of therms lost from all residential programs executed during the program year under consideration.

“The NDSMCA ALR Value is the sum of multiplying the dollar per therm value, as approved by the Commission for non-residential services (DTVNR), times the annualized number of therms lost from all non-residential programs executed during the program year under consideration.”

Appendix G – Electric Load Shape Documentation

The following section documents the load shapes applied to electric DSM & BE measures in this plan. These load shapes are scaled to the annual energy savings for each measure, and then applied to the hourly marginal energy price estimates to determine the avoided marginal energy benefit for each measure. See the Direct Testimony of Jeremy A. Petersen for more details.

Load Shape	Description	Measures Applied To
CO-BUS-COMPAIR	Operation of compressed air in business sites	Various compressed air measures
CO-Bus-Cool with Economizer	Operation of cooling equipment with economizers in business sites	Various cooling measures in the Cooling Efficiency product with economizers
CO-BUS-COOL_OUT	Operation of cooling equipment in business sites	Various cooling measures in the Cooling Efficiency product without economizers
CO-Bus-Cooling Thermal Storage	Operation of thermal storage for cooling in business sites	Thermal Energy Storage* in Cooling Efficiency program and Recommissioning Load Shifting* measure.
CO-BUS-CUSTOM_	Operation of measures in past custom projects	Various miscellaneous measures across a few products (aerators/sprayers in business products, TV timer turning off peripherals) and custom measures* within the Custom product.
CO-Bus-Data Center Blend	Blend of the load shapes of the technologies included in past data center projects	Data center prescriptive measures
CO-Bus-ECM	Hourly savings of electrically-commutated motor (ECM) fans in business installations	Various EMS measures in Heating Efficiency product
CO-BUS-EDA_CHNG	Change in load from Energy Design Assistance projects	Projects in Energy Design Assistance and Energy Efficiency Buildings products
CO-Bus-EIS Load Shift	Hourly savings and load increases from load shifting measures from Energy Information Systems	Energy Management System load shifting measures.*
CO-BUS-EMS_OFFP	Energy Management System loads shifted to off-peak	Various measures in the Energy Management System product
CO-BUS-FLAT	Flat load shape	Various measures in the Business program that run flat throughout the year
CO-BUS-GROW_LIGHTING	Operation of grow lighting technologies for indoor agriculture	Indoor Agriculture Lighting Measures
CO-BUS-Light	Operation of general lighting technologies in business sites	Computer Efficiency Virtualization
CO-BUS-Light All	Blend of lighting loadshape across all building types	Custom Lighting* and bulbs purchased through Residential Home Lighting program installed at businesses
CO-BUS-Light Flat	Flat load shape	Exit signs, stairwell fixtures and parking garage lighting
CO-BUS-Light High Bay	Blend of lighting loadshape across all building types weighted on installation of high bay lamps and fixtures	High Bay lamps and fixtures
CO-BUS-Light Refrigerated	Blend of lighting loadshape across all building types weighted on installation of lighting in refrigeration applications	LED Refrigerator and Freezer Cases
CO-BUS-Light Screw In	Blend of lighting loadshape across all building types weighted on installation of screw-in bulbs	LED Midstream Interior Lamps
CO-BUS-Light Troffer	Blend of lighting loadshape across all building types weighted on installation of lighting troffers	LED troffer fixtures and lamps
CO-BUS-Light Tube	Blend of lighting loadshape across all building types weighted on installation of lighting tubes	LED tube lamps
CO-BUS-LIGHTING	Operation of general lighting technologies in business sites	Misc. lighting measures in a couple products and measures that operate in lighted area and will be operated at the same time as the lighting (aerators, dishwashers)
CO-BUS-Light-Network-Controls	Hourly savings of lighting under network control at a business site	Networked lighting controls
CO-BUS-Light-Sensor	Hourly savings of lighting under sensor control at a business site	Standalone Controls

*Projects including measures using this shape will be run through a custom analysis during which hourly load shapes will be determined.

†Load shapes in Plan based on historical achievement among different building types. Actual load shape used in status reports will be based on actual achievement among building types in the report year.

Load Shape	Description	Measures Applied To
CO-BUS-MTRS_OUT	Operation of motors in business sites	Variable frequency drives (VFDs) and upgraded motors in the Motors product
CO-BUS-PEAK_CNT	Hourly savings and load increases from a peak control product	Measures in demand response programs including Saver's Switch, Smart Thermostats and Battery Demand Response
CO-BUS-RECM_OUT	Hourly savings of recommissioning projects at a business site	Impact of recommissioning studies and area lighting measures that have the same usage pattern as recommissioning hourly savings
CO-BUS-SBL High Bay	Blend of lighting loadshape across all building types weighted on installation of high bay lamps and fixtures through Small Business Lighting program	High Bay lamps and fixtures
CO-BUS-SBL Refrigerated	Blend of lighting loadshape across all building types weighted on installation of lighting in refrigeration applications through Small Business Lighting program	LED Refrigerator and Freezer Cases
CO-BUS-SBL Screw In	Blend of lighting loadshape across all building types weighted on installation of screw-in bulbs through Small Business Lighting program	LED Midstream Interior Lamps
CO-BUS-SBL Troffer	Blend of lighting loadshape across all building types weighted on installation of lighting troffers through Small Business Lighting program	LED troffer fixtures and lamps
CO-BUS-SBL Tube	Blend of lighting loadshape across all building types weighted on installation of lighting tubes through Small Business Lighting program	LED tube lamps
CO-BUS-FLHP_Controls	Floating head pressure controls for a commercial refrigeration system	Floating Head Pressure Controls
CO-Res_Cooling_DX	Operation of cooling at residential sites	Envelope measures for residential customers with electric cooling and electric cooling equipment and installation measures
CO-Res_Cooling_DX_Heating_DX	Operation of cooling and electric heating at residential sites	Envelope measures for residential customers with electric cooling and heating using heat pump equipment
CO-Res_Cooling_DX_Heating_Elec	Operation of cooling and electric heating at residential sites	Envelope measures for residential customers with electric cooling and heating using electric baseboard heat
CO-Res_Heating_Elec	Operation of electric heating at residential sites	Envelope measures for residential customers with electric heating and without electric cooling
CO-Res_Lighting	Operation of lighting at residential sites	LED bulbs at residential sites
CO-RES-EVAPBASE	Hourly savings of evaporative cooling replacing air conditioning at a residential site	Evaporative cooling measures replacing air-conditioning
CO-RES-FLAT	Flat load shape	Various measures that operate throughout the year
CO-RES-MFLIT	Operation of lighting at multi-family residential sites	Multi-family buildings direct install LED bulbs
CO-RES-RECM_OUT	Operation of nightlights at residential sites	LED nightlights
CO-RES-SFLIT	Operation of lighting at single-family residential sites	Various LED bulb measures and clothes washer measures
CO-RES-SFMFLOW	Operation of aerators and showerheads at residential sites	Showerheads and aerators in the Multi-family buildings
CO-RES-SFRF1	Operation of refrigerators at residential sites	Refrigerators and electrically-commutated motor (ECM) fan measures in various products
CO-RES-SFWHT	Operation of electric water heaters at residential sites	Showerhead and aerator measures as well as electric water heating equipment in various products
CO-RES-PEAK_CNT	Hourly savings and load increases from a peak control product	Measures in demand response programs including Residential Demand Response
CO-RES-HMEFF	Operation of cooling and heating at residential site	Envelope measures for Energy Star New Home customers
CO-SMART_CHARGE_1	Electric Vehicle load shifting from Level 1 charger	Electric Vehicle Optimization load shifting measures
CO-SMART_CHARGE_2	Electric Vehicle load shifting from Level 2 charger	Electric Vehicle Optimization load shifting measures
CO-SMART_CHARGE_TOU	Load Shifting from electric vehicle charging and time of use rate	Electric Vehicle Optimization load shifting measures
CO-RES-HPWH-DR-LOAD-SHIFT	Operation of grid-enabled residential heat pump water heaters	Heat Pump Water Heaters in Residential Demand Response Load Shifting measure

*Projects including measures using this shape will be run through a custom analysis during which hourly load shapes will be determined.

†Load shapes in Plan based on historical achievement among different building types. Actual load shape used in status reports will be based on actual achievement among building types in the report year.

Appendix H – Technical Reference Manual

The Technical Reference Manual (TRM) section contains the deemed savings technical assumptions and forecasts for the direct savings products in the DSM & BE portfolio. The deemed savings technical assumptions describe the calculation methodology and assumptions that will be used to determine actual savings, costs, and other values for each product rebate. These calculation methodologies and assumptions are then applied to the population and the number of participants anticipated for each product, to produce an electric and gas forecast of impacts. The forecast is utilized to conduct the cost-benefit analysis of this Plan.

The following algorithms are consistent in their applicability across all deemed savings technical assumptions and therefore are shown here and not repeated within each product's individual deemed savings sheet:

$$\begin{aligned}\text{Electrical Energy Savings (Gross Generator kWh)} &= \text{Customer kWh} / (1-\text{TDLF}) \\ \text{Electrical Demand Savings (Gross Generator kW)} &= \text{Customer kW} \times \text{CF} / (1-\text{TDLF}) \\ \text{Electrical Energy Savings (Net Generator kWh)} &= \text{Gross Generator kWh} \times \text{NTG} \\ \text{Electrical Demand Savings (Net Generator kW)} &= \text{Gross Generator kW} \times \text{NTG} \\ \text{Net Dth} &= \text{Gross Dth} \times \text{NTG}\end{aligned}$$

Where, Net-to-Gross (NTG) is the ratio equal to the net impact divided by the gross impact. This factor is applied to gross savings to determine each product's net impact.

The following constants are consistent in their applicability across all deemed savings technical assumptions and therefore are shown here and not repeated within each product's individual deemed savings sheet:

$$\begin{aligned}\text{Business TDLF} &= 5.33\% \\ \text{Residential TDLF} &= 6.38\%\end{aligned}$$

Where,

- Transmission/Distribution Loss Factor (TDLF) is the percentage loss of electricity as it flows from the power plant to the customer.
- Business TDLF is applicable to measures installed at premises on a business rate schedule.
- Residential TDLF is applicable to measures installed at premises on a residential rate schedule.

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

1.1 Dishwasher

Algorithms

$Customer\ kW = Savings\ kW$

$Customer\ kWh = Savings\ kW \times Hours$

$PCKW = Savings\ kW \times CF$

$Customer\ Dth = Savings\ Dth$

Variables

Savings kW	See Table 1.1.1	Kilowatt savings per unit installed
Savings Dth	See Table 1.1.1	Decatherm savings per unit installed
CF	See Table 1.1.2	Coincidence Factor
Hours	6570	Annual Hours of Operation
Incremental costs	See Table 1.1.2	Difference in cost between the standard equipment and the more efficient equipment
Measure Life	See Table 1.1.2	
O&M savings	See Table 1.1.2	

Customer Inputs

M&V Verified

Tier 2 Baseline Energy 7 Plug Unit, Infrared & Occupancy Sensors	Yes
Secondary water heating (booster water heating) fuel	Yes
Model Name	Yes
Model Number	Yes
Quantity	Yes
Size	Yes

Table 1.1.1 Pre and Post Retrofit Dishwasher (Gas Ref 8)

Post-retrofit Technology	Type	Dishwasher Dth/yr Savings	Savings kW
Dishwashers - Primary Fuel: Elec; Secondary Fuel: Elec	Door Type		1.806
	Under Counter		0.483
Dishwashers - Primary Fuel: Elec; Secondary Fuel: None	Door Type		2.459
	Under Counter		0.387
Dishwashers - Primary Fuel: Elec; Secondary Fuel: Gas	Door Type	16.78	1.195
	Under Counter	2.58	0.389
Dishwashers - Primary Fuel: Gas; Secondary Fuel: Elec	Door Type	29.36	0.737
	Under Counter	4.52	0.318
Dishwashers - Primary Fuel: Gas; Secondary Fuel: Gas	Door Type	46.14	
	Under Counter	7.11	
Dishwashers - Primary Fuel: Gas; Secondary Fuel: None	Door Type	67.53	
	Under Counter	10.62	

Table 1.1.2 Deemed Equipment Information (Gas Ref 3)

	Incremental Cost	Measure Life (yrs)	Non-Energy O&M Savings	Coincidence Factor (Ref 6 & 7)
Dishwashers - Primary Fuel: Elec; Secondary Fuel: Elec				
Commercial Dishwashers (Door - Electric w/ Electric Booster)	\$770	15	\$340.53	85.58%
Commercial Dishwashers (Under Counter - Electric w/ Electric Booster)	\$120	10	\$52.45	85.58%
Dishwashers - Primary Fuel: Elec; Secondary Fuel: None				
Commercial Dishwashers (Door - Electric No Booster)	\$0	15	\$783.22	85.58%
Commercial Dishwashers (Under Counter - Electric - No Booster)	\$50	10	\$123.14	85.58%
Dishwashers - Primary Fuel: Elec; Secondary Fuel: Gas				
Commercial Dishwashers (Door - Electric w/ Gas Booster)	\$770	15	\$340.53	85.58%
Commercial Dishwashers (Under Counter - Electric w/ Gas Booster)	\$120	10	\$52.45	85.58%
Dishwashers - Primary Fuel: Gas; Secondary Fuel: Elec				
Commercial Dishwashers (Door - Gas w/ Electric Booster)	\$770	15	\$340.53	85.58%
Commercial Dishwashers (Under Counter - Gas w/ Electric Booster)	\$120	10	\$52.45	85.58%
Dishwashers - Primary Fuel: Gas; Secondary Fuel: Gas				
Commercial Dishwashers (Door - Gas w/ Gas Booster)	\$770	15	\$340.53	
Commercial Dishwashers (Under Counter - Gas w/ Gas Booster)	\$120	10	\$52.45	
Dishwashers - Primary Fuel: Gas; Secondary Fuel: None				
Commercial Dishwashers (Door - Gas No Booster)	\$0	15	\$783.22	
Commercial Dishwashers (Under Counter - Gas No Booster)	\$50	10	\$123.14	

References:

3. ENERGY STAR https://www.energystar.gov/sites/default/files/asset/document/commercial_kitchen_equipment_calculator.xlsx
6. Custom DCV Projects, 2010-2011
7. MN Lighting Efficiency Tech Assumption , Tab "Forecast Market Segment"

Changes from Recent Filing:

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DEEMED SAVINGS TECHNICAL ASSUMPTIONS

1.2 Food Service

Algorithms

$Customer\ kW = Savings\ kW$

$Customer\ kWh = Savings\ kW \times Hours$

$PcKW = Savings\ kW \times CF$

$Customer\ Dth = (BTU\ Savings\ Factor \times Input\ Capacity)/1000000$

Variables

BTU Savings Factor	See Table 1.2.1	Annual BTU savings per Btuh input of cooking appliance
Incremental costs	See Table 1.2.2	Difference in cost between the standard equipment and the more efficient equipment
Measure Life	See Table 1.2.2	

Customer Inputs

M&V Verified

Model Name	Yes
Model Number	Yes
Quantity	Yes
Size	Yes
Tier 2 Baseline Energy <small>7 Plug Unit, Infrared & Occupancy Sensors</small>	Yes

Table 1.2.1 Pre and Post Restrofit Equipment (Ref 2)

Post-retrofit technology	Pre-retrofit technology	BTU ^{Cooking_Appliance} Savings Factor (Btu per Btuh In per year)
Convection Oven	Deck Oven	1,892
Combi-Oven	Steamer	1,183
Pasta Cooker	Range	1,689
Charbroiler	Standard Charbroiler	1,078
Rotating Rack Oven	Deck Oven	948

Table 1.2.2 Deemed Equipment Information (Ref 1)

Technology	Measure Life (years) (Ref 10)	Incremental Cost Per Name Plate Input Btuh (\$/Btuh In) (Ref 4)
Convection Oven	12	\$0.0375
Combi-Oven	12	\$0.0356
Pasta Cooker	12	\$0.0295
Charbroiler	12	\$0.0310
Rotating Rack Oven	12	\$0.0165

References:

1. MN DER, 2012 Deemed Savings
2. Arkansas TRM Version 3.0 Volume 2: Deemed Savings http://www.apscservices.info/pdf/10/10-100-R_110_3.pdf

Changes from Recent Filing:

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DEEMED SAVINGS TECHNICAL ASSUMPTIONS

1.3 Ozone Laundry

Algorithms

$$Customer\ Dth = \left(\frac{HW_e}{WH_{eff}} \right) \times W_{utiliz} \times W_{hotusage} \times \%HotWaterSavings/10$$

$$Customer\ Water\ Savings = W_{usage} \times W_{utiliz} \times \%Water\ Savings$$

$$O\&M\ Savings = (Water\ Savings \times (Water\ Rate + Sewer\ Rate) \div 1000) - (O\&M\ Cost \times Lb\ Capacity)$$

Variables

% Hot_Water_Savings	0.81	How much more efficient is an ozone injection machine as a rate of hot water reduction (Ref 2)
W _{usage} (gal/lb of laundry)	2.03	How efficiently a typical conventional washing machine uses hot and cold water per unit of clothes washed (Ref 2)
% Water_Savings	25%	How much more efficient an ozone injection washing machine is compared to a typical conventional washing machine as a rate of hot and cold water reduction (Ref 2)
W _{hotusage} (gallons/lbs laundry)	1.19	Hot water used by a typical conventional washing machine (Ref 2)
HW _e (Therms/gal)	0.007193	Energy required to make 140F hot water from 51.9F ground water
Water Rate (\$/1000 gal)	3.64	Ref 3
Sewer Rate (\$/1000 gal)	4.69	Ref 4
Water Heater Thermal Efficiency (WH _{eff})	See Table 1.3.1	
O&M Cost (\$ per lb capacity of washing machine)	\$0.79	Ref 3
Therm _{baseline} / Lb capacity of washing machine	37.9	Ref 3
Incremental costs	See Table 1.3.2	Difference in cost between the standard equipment and the more efficient equipment.
Tier 2 Baseline Energy ⁷ Plug Unit, Infrared & Occupancy Sensors	See Table 1.3.2	

Customer Inputs

	M&V Verified	
W _{utiliz} (lbs laundry/yr)	Yes	Annual pounds of clothes washed per year.
Water Heater Type	Yes	Standard Gas Storage WH, Condensing Gas WH, Tankless Gas WH or Plant Gas Boiler with Storage Tank
Lb capacity of washing machine	Yes	Lb capacity of washing machine served by ozone generator

Table 1.3.1 Water Heater Efficiencies for Ozone Laundry

Water Heater Type	Thermal Eff (%)
Gas Non-Condensing Storage	80%
Gas Condensing Storage	90%
Gas Tankless	96%
Gas Storage with Side-Arm Boiler	80%

Table 1.3.2 Measure Life and Incremental Costs (Ref 1, 2)

	Measure Life (Years)	Incremental Cost
Ozone Washing Machine <=100lbs	10	\$8,750.00
Ozone Washing Machine >100lbs<500lbs	10	\$15,500.00
Ozone Washing Machine =>500lbs	10	\$27,500.00

References:

1. Custom rebates and conversations with Distributors (Tim Stoklosa, Clean Energy Designs in Lakewood CO)
2. Illinois 2017 TRM ; http://ilsagfiles.org/SAG_files/Technical_Reference_Manual/Version_6/Final/IL-TRM_Effective_010118_v6.0_Vol_2_C_and_I_020817_Final.pdf
3. Denver Water rate: https://www.denverwater.org/business/billing-and-rates/2019-rates
4. Denver Sewer rate: https://www.denvergov.org/content/denvergov/en/wastewater-management/billing-and-rates/wastewater-rates.html

Changes from Recent Filing:

Changed water heater efficiencies to align with Boiler measures

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

1.4 Steam Cookers

Algorithms

$$\text{Customer Dth} = \text{Quantity} \times (\text{Therm Savings})/10$$

$$\text{O\&M Savings} = \text{Quantity} \times \text{Water Savings} \times \text{Water Rate}$$

Variables

Therm Savings	See Table 1.4.1	Therms saved by ENERGY STAR Steam Cooker (Ref 2)
Water Savings	See Table 1.4.1	Gallons of water saved by ENERGY STAR Steam Cooker (Ref 2)
Water Rate	\$8.33	Water and Sewer rate per 1000 Gallons (Ref 5 and 6)
Incremental costs	See Table 1.4.2	Difference in cost between the standard equipment and the more efficient equipment (Ref 2)
Measure Life	See Table 1.4.2	Ref 3

Customer Inputs

M&V Verified

Facility Description	Yes
Number of Pans	Yes
Quantity	Yes

Table 1.4.1 Steam Cooker Savings Ref 2

Tier 2 Baseline Energy 7 Plug Unit, Infrared & Occupancy Sensors	Number of Pans	Therm Savings	Gallons of Water Saved
Fast Food 6am-Midnight	3	1,043	72,000
	4	1,201	96,000
	5	1,362	120,000
	6+	1,520	144,000
Fast Food 24 Hr	3	1,299	90,000
	4	1,498	120,000
	5	1,699	150,000
	6+	1,898	180,000
Casual Dining 3pm-11pm	3	348	23,500
	4	398	31,200
	5	449	39,000
	6+	499	46,800
Casual Dining 11am-11pm	3	570	39,000
	4	655	52,000
	5	724	65,000
	6+	827	78,000
Casual Dining 24 Hr	3	1,299	90,000
	4	1,498	120,000
	5	1,699	150,000
	6+	1,898	180,000
Institutional	3	537	36,500
	4	616	48,667
	5	696	60,833
	6+	776	73,000
School	3	137	9,000
	4	156	12,000
	5	175	15,000
	6+	194	18,000

Table 1.4.2 Deemed Equipment Information (Ref 4 Gas)

	Measure Life (Years)	Incremental Cost
Steam Cooker	12	\$2,270.00

References:

1. Department of Energy. ENERGY STAR Commercial Steam Cooker Key Product Criteria, August 2003
2. Department of Energy. Savings Calculator for ENERGY STAR Certified Commercial Kitchen Equipment, October 2016
3. California Public Utilities Commission, Database for Energy Efficiency Resources (DEER). Spreadsheet: "DEER2014 EUL table update" February 2014
4. CleaResult Work Paper - Energy Star Steam Cooker
5. Denver Water rate: <https://www.denverwater.org/business/billing-and-rates/2019-rates>

Changes from Recent Filing:

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DEEMED SAVINGS TECHNICAL ASSUMPTIONS

1.5 Advanced Power Strips

Algorithms

Tier 1 Advanced Power Strip

$$\text{Customer kW} = \frac{\text{Tier 1 Customer kWh}_{7 \text{ Plug Unit}}}{\text{Hours of Use}}$$

$$\text{Customer Coincident kW} = \text{Customer kW} \times \text{Coincidence Factor}$$

Tier 2 Advanced Power Strip

$$\text{Customer kWh} = \text{Tier 2 Baseline Energy}_{7 \text{ Plug Unit, Infrared and Occupancy Sensors}} \times \text{ERP}$$

$$\text{Customer kW} = \frac{\text{Customer kWh}}{\text{Hours of Use}}$$

$$\text{Customer Coincident kW} = \text{Customer kW} \times \text{Coincidence Factor}$$

Variables

Tier 1 Customer kWh _{7 Plug Unit}	103 kWh	Annual average consumption of baseline power strip serving residential audio-visual home entertainment systems (References 1, 2)
Tier 2 Baseline Energy _{7 Plug Unit, Infrared & Occupancy Sensors}	466 kWh	Average of baseline energy (References 1, 3)
ERP	25%	Energy Reduction Percentage (ERP) with Product Type Infrared and Occupancy Sensor (References 1, 4, 5)
Hours of Use	Table 1.5.1	Annual Hours of Use (References 1, 6, 7)
Coincidence Factor	80%	Peak Coincidence Factor (References 1, 8)
Lifetime	7	Measure Lifetime (Reference 1)
Incremental Costs	Table 1.5.1	Difference in cost between the efficient and the baseline technologies (Reference 9)

Provided by Product Vendor

M&V Verified

Quantity and Type of Advanced Power Strips Installed	Yes
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Table 1.5.1 Incremental Costs and Lifetime

Program	Advanced Power Strip Tier and Type	Hours of Use	Incremental Costs
School Education Kits - CO	Tier 1 - 7 Plug Unit	7129	\$20.50
	Tier 2 - 7 Plug Unit, Infrared and Occupancy Sensor	4380	\$70.00
Home Energy Squad - CO	Tier 1 - 7 Plug Unit	7129	\$10.00
	Tier 2 - 7 Plug Unit, Infrared and Occupancy Sensor	4380	\$70.00

Costs are provided by the vendor and are re-evaluated throughout the year to account for the rapidly evolving market.

References

1. Illinois Statewide Technical Reference Manual for Energy Efficiency, Version 10.0, Volume 3. September 24, 2021
2. NYSEDA Measure Characterization for Advanced Power Strips. Study based on review of: Smart Strip Electrical Savings and Usability, Power Smart Engineering, October 27 2008. Final field Research Report, Ecos Consulting, October 31,2006.
3. Average of baseline energy in Regional Technical Form survey of Tier 2 APS pre-post methodology studies
4. AESC-Valmiki, MM., Corradini, Antonio, PE., Feb 2016. Energy Savings of Tier 2 Advanced Power Strips in Residential AV systems. (Simulated 27% pre/post)
5. NMR Group Inc., RLPNC 17-3: Advanced Power Strip Metering Study, Revised March 18, 2019, submitted to Massachusetts Program Administratoes and EEAC. (Pre/post with regression 37%, Pre/post only 11%)
6. NYSEDA Measure Characterization for Tier 1 Advanced Power Strips
7. This is an estimate based on assumption that approximately half of savings for Tier 2 Advanced Power Strips are during active hours (supported by AESC study) (assumed to be 5.3 hours/day, 1936 per year (NYSEDA 2011 "Advanced Power Strip Reserarch Report")) and half during standby hours (8760 - 1936 = 6824 hours). The Weighted average is 4380.
8. Efficiency Vermont 2016 TRM coincident factor for advanced power strip measure - in the absense of empirical data, this was based on assumptions of the typical runpattern for televisions and computers in homes.
9. Program Vendors

Notes:

1. All Advanced Power Strips in the School Education Kits and Home Energy Squad Programs are 7 Plug Advanced Power Strips unless otherwise noted.
2. All Tier 2 Advanced Power Strips in the School Education Kits and Home Energy Squad Programs have both Infrared and Occupancy Sensors unless otherwise

Changes from Recent Filing:

Reflective of the methodology outlined in the Illinois Statewide Technical Reference Manual for Energy Efficiency, Version 10.0

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

1.6 ENERGY STAR Clothes Dryer

Algorithms

$$Customer\ kWh = Load \times \left(\frac{1}{CEF_{Base}} - \frac{1}{CEF_{Eff}} \right) \times N_{Cycles} \times \%Electric$$

$$Customer\ Coincident\ kW = \frac{Customer\ kWh}{Hours} \times Coincidence\ Factor$$

$$Customer\ Dth = Load \times \left(\frac{1}{CEF_{Base}} - \frac{1}{CEF_{Eff}} \right) \times N_{Cycles} \times \%Gas \times 0.003412$$

Variables

Load	Customer Input	Average of total weight (lbs) of clothes per drying cycle (References 1, 2)
CEFB _{Base}	Table 1.6.1	Combined energy factor (lbs/kwh) of baseline unit (References 1,3)
CEFE _{Eff}	Table 1.6.1	Combined energy factor (lbs/kwh) of efficient unit (References 1,4)
NCycles	283	Number of dryer cycles per year (References 1,5)
%Electric	Table 1.6.1	Percent of energy savings from electricity (References 1, 6)
%Gas	Table 1.6.1	Percent of energy savings from gas (References 1, 7)
Coincidence Factor	3.8%	Coincidence Factor (References 1, 8)
Hours	234	Annual Hours of Use (References 1, 9)
Tier 2 Baseline Energy ⁷ Plug Unit, Infrared & Occupancy Sensors	16	Measure Lifetime (References 1, 10)
Incremental Cost	\$75.00	Difference in cost between the standard equipment and the more efficient equipment (Reference 11).

Provided by Product Vendor

M&V Verified

Load	Yes	8.45 lbs if unknown
Quantity of ENERGY STAR Clothes Dryers Installed	Yes	
ENERGY STAR Dryer Product Class Installed	Yes	"Electric, Vented or Ventless" if unknown

Table 1.6.1 Loads and CEF Values Across Dryer Types

Dryer Product Class	CEFB _{Base}	CEFE _{Eff}	%Electric	%Gas
Electric, Vented or Ventless	3.11	3.93	100%	0%
Gas (Dual fuel), Vented	2.84	3.48	16%	84%

References:

1. Illinois Statewide Technical Reference Manual for Energy Efficiency, Version 10.0, Volume 3. September 24, 2021
2. Based on ENERGY STAR Test Procedures
3. Combined energy factor (CEF) (lbs/kWh) is based on existing federal standards energy factor and adjusted to CEF as performed in the ENERGY STAR analysis ENERGY STAR Draft 2 Version 1.0 Clothes Dryers Data and Analysis
4. ENERGY STAR Clothes Dryers Key Product Criteria
5. Appendix D to Subpart B of Part 430 - Uniform Test Method for measuring the Energy Consumption of Dryers
6. %Electric accounts for the fact that some of the savings on gas dryers comes from electricity (motors, controls, etc.). 16% was determined using a ratio of the electric to total savings from gas dryers given by ENERGY STAR Draft 2 Version 1.0 Clothes Dryers Data and Analysis.
7. %Gas accounts for the fact that some of the savings on gas dryers comes from electricity (motors, controls, etc.). 84% was determined using a ratio of the gas to total savings from gas dryers given by ENERGY STAR Draft 2 Version 1.0 Clothes Dryers Data and Analysis.
8. Based on coincidence factor of 3.8% for Clothes Washers
9. ENERGY STAR qualified dryers have a maximum test cycle time of 80 minutes. Assume one hour per dryer cycle.
10. Based on DOE Rulemaking Technical Support Document, LCC Chapter, 2011, "ComEd Effective Useful Life Research Report", May 2018
11. Program Vendors

Notes:

1. Clothes Dryers in the Multifamily Buildings, Energy Star New Homes and Whole Home Efficiency Programs are Standard Sized (≥4.4ft³) unless otherwise noted.

Changes from Recent Filing:

Reflective of the methodology outlined in the Illinois Statewide Technical Reference Manual for Energy Efficiency, Version 10.0

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

1.7 ENERGY STAR Clothes Washer

Algorithms

Customer kWh

$$= \left(\left(\frac{Cap \times N}{IMEF_{Base}} \right) \times \left(CW_{Base} + \frac{DHW_{Base} \times \% ElectricDHW}{R_{Eff}} + (DryBase \times \%ElecDry) \right) \right) - \left(\left(\frac{Cap \times N}{IMEF_{EE}} \right) \times \left(CW_{EE} + \frac{DHW_{EE} \times \% ElectricDHW}{R_{Eff}} + (DryEE \times \%ElecDry) \right) \right)$$

$$Customer\ Coincident\ kW = \frac{Customer\ kWh}{Hours} \times Coincidence\ Factor$$

Customer Dth

$$= \left(\left(\frac{Cap \times N}{IMEF_{Base}} \right) \times \left(\frac{DHW_{Base} \times (1 - \% ElectricDHW)}{R_{Eff}} + DryBase \times (1 - \%ElecDry) \right) \right) - \left(\left(\frac{Cap \times N}{IMEF_{EE}} \right) \times \left(\frac{DHW_{EE} \times (1 - \% ElectricDHW)}{R_{Eff}} + DryEE \times (1 - \%ElecDry) \right) \right) \times 0.003412$$

$$Non-Energy\ O\&M = Cap \times N \times (IWF_{Base} - IWF_{EE}) \times Water-Sewer-Rate$$

Variables

Cap	3.45	Clothes washer drum capacity (ft ³). If unknown, assume 3.45ft ³ (Reference 1)
IMEF _{Base}	Table 1.7.1	Integrated Modified Energy Factor for Federal Minimum equipment (ft ³ /kWh/cycle) (Reference 1)
IMEF _{EE}	Table 1.7.1	Difference in cost between the standard equipment and the more efficient equipment
N	258	Annual number of loads (Reference 1)
CW _{Base}	7%	Percentage of total energy consumption for clothes washer operation for baseline equipment (Reference 1)
CW _{EE}	6%	Percentage of total energy consumption for clothes washer operation for EnergyStar equipment (Reference 1)
DHW _{Base}	33%	Percentage of total energy consumption for water heating for baseline equipment (Reference 1)
DHW _{EE}	31%	Percentage of total energy consumption for water heating for EnergyStar equipment (Reference 1)
%ElectricDHW	Table 1.7.2	Percent of domestic hot water savings assumed to be electric (Reference 1)
DryBase	59%	Percent of total energy consumption for dryer operation in baseline case.
DryEE	62%	Percent of total energy consumption for dryer operation in efficient case.
%ElecDry	Table 1.7.2	Percent of dryer operation assumed to be electric.
IWF _{Base}	Table 1.7.1	Baseline Integrated Water Factor (Gal / cycle / cu.ft.) for a standard clothes washer with a capacity of 1.6 cu.ft. or greater
IWF _{EE}	Table 1.7.1	EnergyStar Integrated Water Factor (Gal / cycle / cu.ft.) for a clothes washer with a capacity of 1.6 cu.ft. or greater
Water-Sewer-Rate	\$0.008797	Water rate + Sewer rate per saved gallon of water.
Conversion Factor	0.0034120	Convert kWh to Dtherms (factor is Dth/kWh)
R _{Eff}	Table 1.7.2	Recovery efficiency (Reference 1)
Coincidence Factor	3.8%	Coincidence Factor (Reference 1)
Hours	258	Annual Hours of Use (Reference1)
Lifetime	11	Measure Lifetime (Reference 1)
Incremental Cost	Table 1.7.1	Difference in cost between the standard equipment and the more efficient equipment (References 1, 18)

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Provided by Product Vendor or Customer

M&V Verified

Quantity of ENERGY STAR Clothes Washers Installed	Yes	
ENERGY STAR Clothes Washer Water Heater Fuel Type	Yes	Provide the Water Heater fuel type for the clothes washer's hot water: electric or gas
Clothes Dryer Fuel Type	Yes	Provide the Clothes Dryer's fuel type: electric or dual fuel

Table 1.7.1 Clothes Washer Efficiency, Operational Information and Incremental Costs

Unit Type	IMEF _{Base}	IMEF _{EE}	IWF _{Base}	IWF _{EE}	Incremental Cost
Top Loading	1.84	2.76	6.5	4.3	\$50.00
Front Loading	1.57	2.06	4.7	3.7	\$190.00

Costs are provided by the vendor and are re-evaluated throughout the year to account for the rapidly evolving market.

Table 1.7.2 Washer Fuel Type by Factor

Fuel Type	%Electric _{DHW}	R _{eff}	%ElecDry
Electric	100%	98%	100%
Dual Fuel	0%	78%	0%

References:

1. State of Minnesota Technical Reference Manual for Energy Conservation Improvement Programs Version 3.1 January 20, 2020
2. 2008 Database for Energy Efficient Resources, Version 2008.2.05, EUL/RUL Values, October 10, 2008.
3. Weighted average of 258 clothes washer cycles per year (based on 2015 Residential Energy Consumption Survey (RECS) national sample survey of housing appliances section, West North
4. 10 CFR Parts 429 and 430 [Docket Number EERE-2008—BT—STD— 0019] RIN 1904—AB90 Energy Conservation Program: Energy Conservation Standards for Residential Clothes Washers. <http://www.regulations.gov/MdocumentDetail;D=EERE-2008-BT-STD-0019-0041>.
5. The percentage of total energy consumption that is used for the machine, heating the hot water or by the dryer is different depending on the efficiency of the unit. Values are based on a sales
6. The percentage of total (gas and electric fuel types) water heating units that are electric calculated from 2015 Residential Energy Consumption Survey (RECS) data.
7. The percentage of total (gas and electric fuel types) dryer units that are electric calculated from 2015 Residential Energy Consumption Survey (RECS) data. <https://www.eia.gov/consumption/residential/data/2015/hc/php/hc3.7.php>
8. To account for the different efficiency of electric and Natural Gas hot water heaters (gas water heater): recovery efficiencies ranging from 0.74 to 0.85 (0.78 used), and electric water heater
9. Calculated from Itron eShapes, 8,760 hourly data by end-use for Missouri, as provided by Ameren. Reference is from Illinois Technical Reference Manual June 1, 2012. Page 303.
10. Clothes Washer Program Requirements Version 7.0. <https://www.energystar.gov/certified-products/sites/products/uploads/files/ENERGY%20STAR%20Final%20Version%207.0%20Clothes>
11. Clothes Washer Program Requirements Version 8.0.
12. ENERGY STAR Calculator. https://www.energystar.gov/sites/default/files/asset/document/appliance_calculator.xlsx
13. Based on the average clothes washer volume of all units that pass the new Federal Standard on the California Energy Commission (CEC) database of Clothes Washer products accessed on
14. Department of Energy. Energy Efficiency Program for certain commercial and industrial equipment
15. Department of Energy: Energy Savings Potential and RD&D Opportunities for Commercial Building Appliances Report. 2009.
16. 2015 Residential Energy Consumption Survey (RECS) Data
17. California Public Utilities District. Res Retro HIM Evaluation Report. Weighted by quantity of each efficiency level from MESP SPECTRUM. Reference it from WIFOE Technical Reference
18. Program Vendors

Changes from Recent Filing:

No changes

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

1.8 ENERGY STAR Radon Fans

Algorithms

$$Customer\ kWh = (1 - \%EE\ Fans\ Installed) \times (kW_{Baseline} - kW_{ENERGYSTAR}) \times Hours\ of\ Use$$

$$Customer\ kW = \frac{Customer\ kWh}{Hours\ of\ Use}$$

$$Customer\ Coincident\ kW = Customer\ kW \times Coincidence\ Factor$$

Variables

kW _{Baseline}	0.054	Annual energy consumption of the baseline efficiency unit (Reference 2)
kW _{EnergyStar}	0.017	Annual energy consumption of the ENERGY STAR unit (Reference 2)
Coincidence Factor	100%	Peak Coincidence Factor (Reference 2)
Hours of Use	8760	Annual Hours of Use
% EE Fans Installed	15%	Assumed percentage of Energy Star Radon Fans being sized correctly and installed currently based on contractor feedback (Reference 2)
Lifetime	10	Measure Lifetime (Reference 2)
Incremental Cost	-\$4.00	Incremental cost of RP140 as compared to RP145 (Reference 3)

Provided by Product Vendor

M&V Verified

Equipment Quantity	Yes
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Tier 2 Baseline Energy 7 Plug Unit, Infrared & Occupancy Sensors

References:

1. http://wpb-radon.com/radon_fan_performance.html33:5032:50A33:50
2. Information from manufacturer and contractors (Radonaway)
3. <https://www.radonaway.com/products/radon-fans/rp140-pro.php>

Changes from Recent Filing:

No changes

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

1.9 Refrigerator Replacement

Algorithms

$$Customer\ kWh = (kWh_{Baseline} - kWh_{ENERGYSTAR})$$

$$Customer\ kW = \frac{Customer\ kWh}{Hours\ of\ Use}$$

$$Customer\ Coincident\ kW = Customer\ kW \times Coincidence\ Factor$$

Variables

kWh _{Baseline}	1.9.1	Deemed energy consumption based on the age of the equipment (Reference 14)
kWh _{ENERGYSTAR}	1.9.1	Deemed annual energy consumption of the ENERGYSTAR unit; Top-Mounted freezer or refrigerator only (automatic defrost) (Reference 13)
Coincidence Factor	64%	Probability of equipment operating during peak time (Reference 4, Table 4)
Hours of Use	8,760	Annual hours of use in a year (Reference 13)
Lifetime	14	Measured Lifetime (Reference 13)
Incremental Cost	\$630.00	Difference in cost between the standard equipment and the more efficient equipment (Reference 12). Costs are provided by the vendor and are re-evaluated throughout the year to account for the rapidly evolving market.

Provided by Product Vendor

M&V Verified

Existing Equipment Quantity	Yes
Product Type and Class of ENERGYSTAR Refrigerators Installed	Yes

Tier 2 Baseline Energy 7 Plug Unit, Infrared & Occupancy Sensors

Table 1.9.1

Equipment	kWh _{Baseline}	kWh _{ENERGYSTAR}
Refrigerator	742	320

References:

1. Baseline kWh and Average to peak kW ratio from 1995 and 2012 versions of Residential Energy Data Sourcebook for the U.S. Residential Sector.
2. Data on expected life for savings on secondary refrigerators, 9th year Persistence Study for Southern California Edison, KEMA-XENERGY, 2004
3. Estimate for annual energy use for freezers as percent of refrigerator use. See Table Final Estimates on page 6-15 of report by KEMA-XENERGY
4. Data to support CF from "Domestic Refrigerators: Field Studies and Energy Efficiency Improvement", M. Siddhartha Bhatt, CPRI, July 2001.
5. Degradation factor cited in "2006 Refrigerator/Freezer Recycling Program Evaluation", Snohomish County PUD, Kevin L. Smit, February 2007.
6. Shipment Weighted Efficiencies from Residential Energy Databook, Years 1950 - 1995, <http://enduse.lbl.gov/Projects/RED.html>
7. Refrigerator-Freezer Sizes and Energy Factors (Shipment-Weighted Averages), Residential Energy Databook, Years 1972 - 2010,
8. Appliance Standards Awareness Project: Ref. Association of Home Appliance Manufacturers (AHAM)
9. Actual recent program data on age of recycled units were used to create weighted average energy consumption & remaining useful life of units recycled.
10. Data on Efficiency Standards, "Technical Support Document Refrigerators and Freezers", DOE, 2014.
11. Energy Star Program Requirements for Refrigerators. https://www.energystar.gov/ia/partners/product_specs/program_reqs/refrig_prog_req.pdf
12. Income Qualified Single Family Weatherization Colorado Program Data
13. State of Minnesota Technical Reference Manual for Energy Conservation Improvement Programs Version 3.1 January 20, 2020
14. Refrigerator Recycling Colorado Program Data

Changes from Recent Filing:

No changes

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

1.10 Refrigerator Recycling

Algorithms

$$\text{Customer kWh} = \text{Base kWh} \times \text{Refrigerator Factor}$$

$$\text{Customer kW} = \frac{\text{Customer kWh}}{\text{Hours of Use}}$$

$$\text{Customer Coincident kW} = \text{Customer kW} \times \text{Coincidence Factor}$$

Variables

Refrigerator Factor	Table 1.10.1	Deemed adjustment between refrigerators and freezers (Reference 3)
Base kWh	1.10.2	Deemed energy usage based on the age of the equipment (References 1,5,6,7,8,9,10,11)
Coincidence Factor	64%	Probability of equipment operating during peak time (Reference 4)
Hours of Use	8,760	Annual Hours of Use
Lifetime	Table 1.10.1	Deemed remaining service lifetime of removed equipment (Reference 2, 9)
Incremental Cost	\$0.00	Difference in cost between the standard equipment and the more efficient equipment. Customer does not pay for recycling cost.

Provided by Product Vendor

M&V Verified

Existing Equipment Quantity	Yes	
Year of Equipment Manufacture	Yes	
Tier 2 Baseline Energy 7 Plug Unit, Infrared & Occupancy Sensors	Yes	Primary units, secondary units and standalone freezers

Table 1.10.1

Equipment	Refrigerator Factor	Lifetime
Freezer	0.85	7
Primary Refrigerator	1.00	8
Secondary Refrigerator	1.00	8

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Table 1.10.2

Year of equipment manufacture	Base kWh
1970 and Earlier	2,358
1971	2,344
1972	2,330
1973	2,255
1974	2,218
1975	2,132
1976	2,008
1977	1,939
1978	1,890
1979	1,759
1980	1,646
1981	1,522
1982	1,514
1983	1,466
1984	1,431
1985	1,320
1986	1,332
1987	1,202
1988	1,183
1989	1,139
1990	1,136
1991	1,130
1992	1,123
1993	801
1994	797
1995	792
1996	795
1997	797
1998	800
1999	802
2000	805
2001	556
2002	553
2003	550
2004	547
2005	544
2006	540
2007	537
2008	534
2009	531
2010	528
2011	525
2012	522
2013	519
2014	431

References:

1. Baseline kWh and Average to peak kW ratio from 1995 and 2012 versions of Residential Energy Data Sourcebook for the U.S. Residential Sector. Berkeley, CA: Lawrence Berkeley National Laboratory. LBNL-40297
2. Data on expected life for savings on secondary refrigerators, 9th year Persistence Study for Southern California Edison, KEMA-XENERGY, 2004
3. Estimate for annual energy use for freezers as percent of refrigerator use. See Table Final Estimates on page 6-15 of report by KEMA-XENERGY (2004). "Final Report, Measurement and Evaluation Study of 2002 Statewide Residential Appliance Recycling Program." February 13, 2004
4. Data to support CF from "Domestic Refrigerators: Field Studies and Energy Efficiency Improvement", M. Siddhartha Bhatt, CPRI, July 2001.
5. Degradation factor cited in "2006 Refrigerator/Freezer Recycling Program Evaluation", Snohomish County PUD, Kevin L. Smit, February 2007.
6. Shipment Weighted Efficiencies from Residential Energy Databook, Years 1950 - 1995, <http://enduse.lbl.gov/Projects/RED.html>
7. Refrigerator-Freezer Sizes and Energy Factors (Shipment-Weighted Averages), Residential Energy Databook, Years 1972 - 2010, <http://buildingsdatabook.eren.doe.gov/TableView.aspx?table=5.7.5>
8. Appliance Standards Awareness Project: Ref. Association of Home Appliance Manufacturers (AHAM)
9. Actual recent program data on age of recycled units were used to create weighted average energy consumption & remaining useful life of units recycled.
10. Data on Efficiency Standards, "Technical Support Document Refrigerators and Freezers", DOE, 2014.
11. Energy Star Program Requirements for Refrigerators. https://www.energystar.gov/ia/partners/product_specs/program_reqs/refrig_prog_req.pdf

Changes from Recent Filing:

No changes

1.11 Window/Room Air Conditioner Recycling

Algorithms

$$Customer\ kWh = FLH \times Size \times \left(\frac{1}{EER_{Recycled}} \right) \times \left(\frac{1}{1000} \right)$$

$$Customer\ kW = \frac{Customer\ kWh}{FLH}$$

$$Customer\ Coincident\ kW = Customer\ kW \times Coincidence\ Factor$$

Variables

FLH	546	Full Load Hours of Unit (Reference 1)
Size	Customer Input	Size of Retired Unit in BTU/hr
EER _{Recycled}	9.80	Efficiency of Recycled Unit (References 2, 3)
Coincidence Factor	30%	Peak Coincidence Factor (References 1,4)
Lifetime	4	Measure Lifetime (References 1,5)
Incremental Costs	\$0.00	Difference in cost between the standard equipment and the more efficient equipment. Customer does not pay for recycling cost.

Provided by Product Vendor

M&V Verified

Tier 2 Baseline Energy 7 Plus Unit, Infrared & Occupancy Sensors	Yes	10,000 BTU/hr if unknown
Confirmation of Equipment Use and Operation	Yes	

References

1. Deemed Table 18.0.1
2. Illinois Statewide Technical Reference Manual for Energy Efficiency, Version 10.0, Volume 3, September 24, 2021
3. Minimum Federal Standard for most common room AC type (8000-14,999 capacity range with louvered sides) per federal standards from 10/1/2000 to 5/31/2014. Note that this value is the EER value, as CEER was introduced later.
4. Consistant with coincident factors found in: RLw Report: Final Report Coincident Factor Study Residential Room Air Conditioners, June 23, 2008
5. 1/3 of the assumed measure life for Window/Room Air Conditioners.

Changes from Recent Filing:

No changes

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

2.1 Electric Vehicle (EV) Optimization

Algorithms

$$Customer\ Coincident\ kW = EV\ Quantity \times Customer\ kW \times Coincidence\ Factor$$

Variables

Customer kW	See Table 2.1.1	The load reduction the customer experiences, reflecting the maximum charging rate from an average customer less the charging rate in that same hour after the load shift.
Coincidence Factor	See Table 2.1.1	Percentage of Customer kW savings that will coincide with peak summer kW savings.
EV Quantity	Customer Input	# of participating EV or charging stations the customer has at their home
Customer kWh	0	
Lifetime	1	Lifetime of EV load shifting
Net-to-Gross	100.0%	Net-to-Gross factor for EV Load Shifting
Incremental Cost	\$0.00	

Customer Inputs

M&V Verified

EV/charging station Quantity	Yes
------------------------------	-----

Table 2.1.1: EV load shifting for customers charging their electric vehicle (calculations rely on References 1-20)

Month	Customer kW	Coincidence	
		Factor	PCkW
Level 1 charging rate	0.578	92.0%	0.532
Level 2 charging rate	1.333	63.1%	0.841
Level 1 charging rate and are on a TOU rate	0.574	19.4%	0.112
Level 2 charging rate and are on a TOU rate	1.324	9.9%	0.131

References:

(1) National Oceanic and Atmospheric Administration. (2018). "Statewide Time Series." Retrieved from https://www.ncdc.noaa.gov/cag/statewide/time-series/21/tavg/1/10/1895-2018?base_prd=true&firstbaseyear=1901&lastbaseyear=2018.

(2) Office of Highway Policy Information. (2018). "Travel per Vehicle" for Colorado. Retrieved from Google Public Data site.

(3) Yuksel and Michalek. (2015). Environmental Science and Technology (49), "Effects of Regional Temperature on Electric Vehicle Efficiency, Range, and Emissions in the United States."

(4) The EV Project. (2013). "EV Charging Infrastructure Summary Reports 2013." Retrieved from <https://avt.inl.gov/sites/default/files/pdf/EVProj/EVProject%20Infrastructure%20ReportJan13Dec13.pdf>.

(5) Idaho National Laboratory. "2013 Nissan Leaf Battery Charge Profiles at Different Temperatures." Retrieved from <https://avt.inl.gov/sites/default/files/pdf/fsev/2013NissanLeafElectricChargingReport.pdf>.

(6) Mies and Helmus. (2016). "Estimating the charging profile of individual charge sessions of Electric Vehicles in the Netherlands." Retrieved from https://www.researchgate.net/publication/325942518_Estimating_the_Charging_Profile_of_Individual_Charge_Sessions_of_Electric_Vehicles_in_The_Netherlands.

(7) Vermont Energy Investment Corporation. (2013). "An Assessment of Level 1 and Level 2 Electric Vehicle Charging Efficiency." Retrieved from <https://www.veic.org/documents/default-source/resources/reports/an-assessment-of-level-1-and-level-2-electric-vehicle-charging-efficiency.pdf>.

(8) National Renewable Energy Laboratory. (2017). "National Plug-in Electric Vehicle Infrastructure Analysis." Retrieved from <https://www.nrel.gov/docs/fy17osti/69031.pdf>.

(9) Clipper Creek. (2019). "How Long Does it Take to Charge an Electric Car." Retrieved from <https://www.clippercreek.com/charging-times-chart/>.

(10) Xcel Energy Load Forecasting.

(11) Muratori, M. (2018). "Impact of uncoordinated plug-in electric vehicle charging on residential power demand." Nature Energy 3. Data set associated with this article retrieved from <https://data.nrel.gov/submissions/69>.

(12) Analysis using data from Xcel Energy Minnesota EV Services Pilot.

(13) Coignard, J., MacDougall, P., Stadtmueller, F., and Vrettos, E. (2019). "Will Electric Vehicles Drive Distribution Grid Upgrades." IEEE Electrification Magazine. Retrieved from <https://ieeexplore.ieee.org/document/8732007>.

(14) Portland General Electric. (2019). PGE's Electric Vehicle Charging Pilot Program Proposals.

(15) Avista Utilities. (2019). "Semi-Annual Report on Electric Vehicle Supply Equipment Pilot Program." Docket UE-160082.

(17) The EV Project. (2013). "EV Charging Summary Infrastructure Reports October-December 2013." Retrieved from <https://avt.inl.gov/project-type/data>.

(18) The EV Project. (2013). "EV Charging Summary Infrastructure Reports July-September 2013." Retrieved from <https://avt.inl.gov/project-type/data>.

(19) The EV Project. (2013). "EV Charging Summary Infrastructure Reports April-June 2013." Retrieved from <https://avt.inl.gov/project-type/data>.

(20) The EV Project. (2013). "EV Charging Summary Infrastructure Reports January-March 2013." Retrieved from <https://avt.inl.gov/project-type/data>.

Changes from Recent Filing:

Static Load shifting is added in addition to dynamic load shifting

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

2.2 Residential Battery Demand Response

Algorithms

$$\text{Customer Coincident kW} = \text{Customer kW} \times \text{Coincidence Factor}$$

$$\text{Customer kW} = (\text{Baseline kW} - \text{Proposed kW})$$

Variables

Cycles_Year	100	Demand response events the pilot will call in a year as described in the program write-up.
Baseline_kW	See Table 2.2.1	Average kW measures for Non-Export and Export battery participants in the previous year's pilot.
Proposed_kW	0	
Event_Duration	4	The duration, in hours, that each event will last. This amount of time follows the duration used in the Company's time-of-use pilot (Schedule RE-TOU), which has a four hour on-peak period that lasts from 2-6 pm. (Reference 1)
Customer_kWh		
Round Trip Efficiency	Customer Input	Customer input describing the round trip efficiency expected from their battery.
Battery_Capacity	6.75	Amount of energy (kWh) in the battery reserved for demand response. We assume the full battery is 13.5 kWh and 50% of battery is reserved for the pilot. (Reference 2)
Inverter_Size	5.00	The continuous power (kW) rating of the battery. (Reference 2)
Lifetime	10	Based on the warrantied lifetime of the battery. (Reference 2)
Net-to-Gross	100.0%	
Coincidence Factor	100.0%	Percentage of Customer_kW savings that will coincide with peak summer kW savings. The Company is responsible for dispatching the battery and will do so during system peak.
Incremental Cost	\$0.00	

Customer Inputs

M&V Verified

Round Trip Efficiency	No	

Assumptions:

Load reduction calculations found in Table 2.2.1 assume randomized demand response in summer and non-summer months. The total number of calls is 100 per year.
Non-export means a customer that interconnects a storage system under an interconnection standard that does not allow the battery system to export because it can charge from the grid. The relevant interconnection standards are "1b," "2a," and "2c" and more can be found about these standards in References 2 and 3. A non-export customers demand response potential would be affected by the availability of energy stored in the battery and the customer's load during an event.
Export means a customer that interconnects a solar plus storage system under an interconnection standard that does allow the battery system to export because it charges exclusively with solar. The relevant interconnection standards are "2b" and "3a" and "3b". More can be learned about these systems in References 3 and 4. An export customers demand response potential would be affected by the availability of energy stored in the battery. Since this customer is able to export the battery capacity, the demand response potential is not affected by the customer's actual load.
Table 2.2.1 averages assume that the typical demand response event in the summer will fluctuate between 2-6 pm and 3-7 pm. In the winter the typical DR event will occur from 5-9 pm. These hours/days are used to calculate the average demand response potential for a battery.
The pilot assumes participants are battery early adopters and are already bearing the full cost of the battery for purposes that aren't related to program participation.

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Table 2.2.1: Average monthly peak load reduction from residential batteries (Reference 5)

Month	Non-export Battery Participant Baseline kW	Export Battery Participant Baseline kW	Non-export Battery Participant kWh Savings*	Export Battery Participant kWh Savings*
January	1.310	1.470	-3.48	-3.93
February	1.240	1.520	0.68	0.68
March	1.120	1.520	-8.60	-10.80
April	1.050	1.520	-2.79	-4.05
May	1.190	1.520	3.70	4.73
June	1.520	1.520	-9.57	-11.03
July	1.460	1.460	-14.98	-14.98
August	1.460	1.520	-7.78	-8.10
September	1.490	1.520	0.75	1.31
October	1.060	1.520	-8.88	-10.76
November	1.120	1.480	-4.48	-5.93
December	1.170	1.520	-3.12	-4.05
Average	1.320	1.510	-58.55	-66.92

*Some months have positive kWh balances because the analysis dispatches the battery on the last day of the month and the associated charging of the battery occurs the following day, during the next month.

References:

- (1) Xcel Energy. Rate book. https://www.xcelenergy.com/staticfiles/xcel-responsive/Company/Rates%20&%20Regulations/Regulatory%20Filings/CO%20Recent%20Filings/PSCo_Electric_Entire_Tariff.pdf.
- (2) Tesla Powerwall 2.0 Product Specifications;
- (2) Xcel Energy, Storage Guidance 1: <https://www.xcelenergy.com/staticfiles/xcel-responsive/Programs%20and%20Rebates/Residential/CO-solar-residence-Storage-Guidance-1.pdf>.
- (3) Xcel Energy, Storage Guidance 2: <https://www.xcelenergy.com/staticfiles/xcel-responsive/Programs%20and%20Rebates/Residential/CO-solar-residents-Storage-Guidance-2.pdf>.
- (4) Xcel Energy, Storage Guidance 3: <https://www.xcelenergy.com/staticfiles/xcel-responsive/Programs%20and%20Rebates/Residential/CO-solar-residence-Storage-Guidance-3.pdf>.
- (5) Table 2.2.1 calculations use data from five representative PSCo residential solar customers. The calculations use this data to simulate hourly solar, battery, and load conditions and derive kilowatt and kilowatt hour values for demand response events.

Changes from Recent Filing:

No Changes from modification

3.1 Behavioral Commercial

Algorithms

$$\text{Customer kWh} = (\text{kWh}_{\text{Baseline}} - \text{kWh}_{\text{Proposed}})$$

$$\text{Customer Coincident kW} = \text{PC kW}_{\text{Baseline}} - \text{PC kW}_{\text{Proposed}}$$

$$\text{Customer therms} = (\text{therms}_{\text{Baseline}} - \text{therms}_{\text{Proposed}})$$

3.2 Energy Feedback

Algorithms

$$kWh\ Saved_{Gross\ Monthly\ Treatment} = (Control\ kWh\ Usage_{Post\ Treatment} - Group\ Rebate\ Product\ Participation) - (Treatment\ kWh\ Usage_{Post\ Treatment} - Group\ Rebate\ Product\ Participation)$$

$$kWh_{Gross\ Annual} = \Sigma kWh\ Saved_{Gross\ Monthly\ Treatment}$$

$$Gross\ Coincident\ kW = Customer\ Daily\ kW \times Treatment\ Percent\ Savings \times Peak\ Factor \times Daily\ Usage\ at\ Peak \times Coincidence\ Factor$$

$$Dth\ Saved_{Gross\ Monthly\ Treatment} = (Control\ Dth\ Usage_{Post\ Treatment} - Group\ Rebate\ Product\ Participation) - (Treatment\ Dth\ Usage_{Post\ Treatment} - Group\ Rebate\ Product\ Participation)$$

$$Dth_{Gross\ Annual} = \Sigma Dth\ Saved_{Gross\ Monthly\ Treatment}$$

$$Behavior\ Adjustment = -\frac{2}{3} \times Gross\ Coincident\ kW / Coincidence\ Factor$$

Variables

Treatment _{Print}		Group of electric and gas customers receiving periodic paper reports providing feedback on their energy use.
Treatment _{Email}		Group of electric and gas customers receiving internet delivered reports that provide feedback on their energy use.
Treatment _{Online}		Group electric and gas customers (unknown size) who choose to opt-in to a web feedback portal that provides feedback on their energy use.
Control _{Print}		Group of electric and gas customers who are similar in structure (demographics, life stage, house size, geography) to the participant Group, but receive no contact from Xcel or its contractors.
Control _{Email}		Group of electric and gas customers who are similar in structure (demographics, life stage, house size, geography) to the participant Group, but receive no contact from Xcel or its contractors.
Control _{Online}		Group of electric and gas customers who are similar in structure (demographics, life stage, house size, geography) to the participant Group, but receive no contact from Xcel or its contractors.
Treatment kWh Usage _{Post Treatment}		Electrical energy use of the Treatment Group after the treatment as determined through multi-variate regression analysis.
Control kWh Usage _{Post Treatment}		Electrical energy use of the Control Group after the treatment as determined through multi-variate regression analysis.
Treatment Dth Usage _{Post Treatment}		Natural gas energy use of the Treatment Group after the treatment as determined through multi-variate regression analysis.
Control Dth Usage _{Post Treatment}		Natural gas energy use of the Control Group after the treatment as determined through multi-variate regression analysis.
Group Rebate Product Participation		Energy savings generated by participation in Xcel's rebate products for both Treatment and Control groups, kWh and Dth. Rebated product participation from other products, (e.g. new furnace), are savings.
Behavioral Adjustment		This adjustment is applied to reduce the first year savings to 1/3rd of the actual savings in compliance with ordered treatment.
kWh Saved _{Gross Monthly Treatment}	Provided by Vendor	Monthly electric consumption savings for all homes in the treatment group.
Peak Monthly Customer kW	Provided by Vendor	Average electric demand savings per household achieved in the hour that contained the peak demand on Xcel Energy's system. Actual value is calculated each year.
Max Customer kW	Provided by Vendor	Maximum of the peak electric demand savings per household achieved in the months of June, July August or September of each year. Actual value is calculated each year.
Dth Saved _{Gross Monthly Treatment}	Provided by Vendor	Monthly natural gas consumption savings for all homes in the treatment group.
Peak Factor	Provided by Vendor	The ratio of energy usage in the peak hour to average hourly energy use. Actual value is calculated each year.
Daily Usage at Peak	Provided by Vendor	Percentage of energy usage in peak hour to daily total energy use. Actual value is calculated each year.
Coincident Factor	83%	
Hours	See Table 3.2.1	
Lifetime	1	Assumed to be 1 year as the program induces behavior change and there is no equipment purchased.
Incremental Cost	\$0.00	Assumed to be \$0.00 as the program induces behavior change with no incurred capital costs.
Operation & Maintenance (O&M) Savings	\$0.00	Assumed to be 0.
NTG	100%	

Table 3.2.1¹

Measure Description	Hours (Annual)
Print Feedback Report - Existing Participant - Original Print Group	3,861
Email Feedback Report - Existing Participant - Original Email Group	3,869
Print Feedback Report - Existing Participant - 2013 Expansion Group	5,018
Print Feedback Report - Existing Participant - 2014 Refill Print Group	3,991
Print Feedback Report - New Participant - 2015 Expansion - High Users	4,838
Print Feedback Report - New Participant - 2015 Expansion - Medium Users	4,519
Print Feedback Report - New Participant - 2015 Expansion - Medium Electric	3,864
Print Feedback Report - New Participant - 2015 Expansion - Low Users	4,493
Print Feedback Report - New Participant - 2015 Expansion - Low Email Only	3,047
Print Feedback Report - New Participant - 2016 Refill - DF	4,092
Print Feedback Report - New Participant - 2019 - DF	3,397
Print Feedback Report - New Participant - 2019 - Electric Only Users	3,772
Print Feedback Report - New Participant - 2020 - DF	3,811
Print Feedback Report - New Participant - 2020 - Electric Only Users	3,772
Print Feedback Report - New Participant - 2021 - DF	3,397
Print Feedback Report - New Participant - 2021 - Electric Only Users	3,772
Print Feedback Report - New Participant - 2022 - DF	3,811
Print Feedback Report - New Participant - 2022 - Electric Only Users	3,772

References:

1. Energy Feedback Program Data 2011-2021

Changes from Recent Filing:

3.3 High Bill Alerts

Algorithms

$Customer\ kWh = kWh\ per\ Day \times Days\ per\ year$

$Customer\ Coincident\ kW = 0$

$Customer\ Dth = Dth\ per\ Day \times Days\ per\ year$

Variables

kWh per Day	0.077	Average over all customers (Reference 1)
Dth per Day	0.00097	Average over all customers (Reference 1)
Days per Year	365	Qty of days per year
Lifetime	1	Behavioral measures have a lifetime of 1 year (Reference 1)
kW Saved	0	Behavioral programs assumed to not save peak demand (Reference 1)
Incremental Cost	\$0.00	

Assumptions

1. Savings values are the average for all customers in the program regardless of if they ever actually receive a report.
2. Behavioral measures do not have any demand savings.
3. The Cadmus analysis showed more savings after the customers stopped receiving High Bill Alerts. We did not collect the necessary information to explain why that happens so it has not been included in this product at the moment. We will continue to monitor this during measure implementation.

References:

1. Cadmus report on High Bill Alert Pilot Program

Changes from Recent Filing:

Created measure

3.4 Systemic O&M

Algorithms

$$\text{Customer kWh} = (\text{kWh}_{\text{Baseline}} - \text{kWh}_{\text{Proposed}})$$

$$\text{Customer Coincident kW} = \text{PC kW}_{\text{Baseline}} - \text{PC kW}_{\text{Proposed}}$$

$$\text{Customer therms} = (\text{therms}_{\text{Baseline}} - \text{therms}_{\text{Proposed}})$$

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

4.1 All EDA Measures

Algorithms

$$Customer\ KW = kW_{Baseline} - kW_{Proposed}$$

$$Customer\ kWh = kWh_{Baseline} - kWh_{Proposed}$$

$$Customer\ Coincident\ (PC)kW = Customer\ kW \times Coincidence\ Factor$$

$$Customer\ Dth = Dth_{Baseline} - Dth_{Proposed}$$

Variables

Baseline_kW	Calculated	Energy simulation output corresponding with the peak baseline building electrical load coincident with summer cooling design conditions.
Proposed_kW	Calculated	Energy simulation output corresponding with the peak proposed building electrical load coincident with summer cooling design conditions.
CF	Calculated	Energy simulation output corresponding with the peak proposed building electrical load coincident with summer cooling design conditions.
Baseline_kWh	Calculated	Energy simulation output corresponding with the annual baseline building electrical consumption.
Proposed_kWh	Calculated	Energy simulation output corresponding with the annual proposed building electrical consumption.
Baseline_Dth	Calculated	Energy simulation output corresponding with the annual baseline building natural gas consumption.
Proposed_Dth	Calculated	Energy simulation output corresponding with the annual proposed building natural gas consumption.

Customer Inputs

M&V Verified

	Yes	Building Characteristics for the proposed building are defined by building design team, which includes mechanical engineers, electrical engineers, and architects.
	Yes	Characteristics for the baseline building are defined by the energy consultant, utilizing methodology described by ASHRAE 90.1 Standard Appendix G and supplemented by Xcel Energy where required to accommodate regulatory requirements.

References:

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Changes from Recent Filing:

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DEEMED SAVINGS TECHNICAL ASSUMPTIONS

4.2 All EEB Measures

Description

Energy Efficient Buildings (EEB) is a holistic program including electric and gas measures. Third-party consultants work with customer design teams to identify prescriptive measures from all utility programs for new commercial buildings or retrofits of existing commercial buildings. Custom measures are used for energy savings opportunities not currently available in the prescriptive programs.

Algorithms

N/A

Variables

N/A	N/A	N/A
-----	-----	-----

Customer Inputs

M&V Verified

	Building Characteristics for the proposed building are defined by building design team, which includes engineers, contractors, and architects.
--	--

References:

Changes from Recent Filing:

None

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

4.3 Lighting NC LPD

Description

A lighting efficiency measure based upon the 2018 IECC energy code lighting allowances. Installed lighting power density must be lower than the Baseline LPD to claim credit.

Algorithms

$$Customer\ kW = \frac{(LPD_{Baseline} - LPD_{Proposed}) * Square\ Footage}{1000}$$

$$PC\ kW = Customer\ kW * CF * kW\ Factor$$

$$Customer\ kWh = Customer\ kW * Hours * kWh\ Factor$$

$$Heating\ Penalty = Customer\ kW * Hours * Heating\ Factor * O\&M\ Factor$$

$$Incremental\ Cost = Customer\ kWh * Cost\ Factor$$

Variables

LPD _{Baseline}	Table 4.3.1	Code maximum allowable LPD based on space type
Hours	Table 4.3.1	Average Operating hours based on space type
CF	Table 4.3.1	Coincidence factor based on the space type
kW Factor	Table 4.3.2	kW secondary impacts of HVAC system
kWh Factor	Table 4.3.2	kWh secondary impacts of the HVAC system
Heating Factor	Table 4.3.2	Decatherm impacts of the HVAC system
O&M Factor	\$ 5.24	Cost per Dth of gas ¹
Cost Factor	\$ 0.30	Incremental cost per kWh saved ²

Customer Inputs

M&V Verified

LPD _{Proposed}	Yes	Lighting power density of the space
Space Type	Yes	Space type based on IECC 2018
HVAC System	No	What kind of HVAC system is installed
Square Footage	Yes	Square footage of the evaluated space

Table 4.3.1 Baseline LPD, Hours, and Coincidence factor of each space type

Space Type	Baseline LPD ³	Operation Hours ⁴	CF ⁴
Automotive facility	0.71	3068	94%
Convention center	0.76	4156	94%
Court House	0.9	2278	96%
Dining: bar lounge/leisure	0.9	5571	68%
Dining: cafeteria/fast food	0.79	5571	68%
Dining: family	0.78	5571	68%
Dormitory	0.61	1924	25%
Exercise center	0.65	8234	94%
Fire Station	0.53	2697	51%
Gymnasium	0.68	2080	73%
Health care-clinic	0.82	3890	65%
Hospital	1.05	7616	76%
Hotel	0.75	3140	37%
Library	0.78	5010	71%
Manufacturing facility	0.9	4618	81%
Motel	0.75	3140	37%
Motion picture theater	0.83	3506	53%
Multi-Family	0.68	1924	25%
Museum	1.06	3068	94%
Office	0.79	2884	54%
Parking garage	0.15	6084	96%
Penitentiary	0.75	2697	51%
Performing Arts Theatre	1.18	2278	96%
Police Station	0.8	2697	51%
Post office	0.67	3435	78%
Religious building	0.94	2085	48%
Retail	1.06	4786	83%
School/University	0.81	3395	63%
Sports arena	0.87	2278	96%
Town hall	0.8	3435	78%
Transportation	0.61	5913	96%
Warehouse	0.48	5242	68%
Workshop	0.9	4618	81%

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

HVAC Type	kWh Factor	kW Factor	heating Factor
No Heating or cooling	1	1	0
Heating only	1	1	-0.000508
Heating and cooling	1.13	1.33	-0.000508

References:

- | |
|---|
| 1. Xcel energy cost of gas |
| 2. Based on past Xcel Energy lighting efficiency projects |
| 3. 2018 IECC |
| 4. Adapted from the Illinois TRM |

Changes from Recent Filing:

None

4.4 Code Compliance

Algorithms

$$Program\ Net\ Annual\ Therms = (Program\ Gross\ Potential\ Annual\ Therms * Construction\ Adjustment\ Factor) * Compliance\ Rate * Annual\ Utility\ Attribution$$

$$Program\ Net\ Annual\ kWh = (Program\ Gross\ Potential\ Annual\ kWh * Construction\ Adjustment\ Factor) * Compliance\ Rate * Annual\ Utility\ Attribution$$

$$kW\ (Gross\ kW) = \sum_0^{8760} \sum_{Building\ Type} (previous\ code\ kW_{Building\ Type,hr} - new\ code\ kW_{Building\ Type,hr}) * Square\ Feet_{Building\ Type} / Total\ Square\ Feet$$

$$Customer\ Peak\ kW = average\ (kW\ (Gross\ kW)\ savings\ at\ 16:00\ OR\ 17:00)$$

Variables

Program Gross Potential Annual (Therms)	Table 4.4.1 (See Description 4.4.1)	Calculated value for annual gas savings for each program year.
Program Gross Potential Annual (kWh)	Table 4.4.2 (See Description 4.4.1)	Calculated value for annual electric savings for each program year.
Construction Adjustment Factor	See Description 4.4.1	An adjustment factor applied to the program gross potential annual therms and program gross potential annual kWh to account for differences in assumed construction volume and actual construction volume. For 2021-2022 the commercial Construction Adjustment Factor will be the ratio of actual to expected square feet constructed as of October 1 of each year. Future program years may evaluate different metrics as identified during product evaluations.
Compliance Rate _{yr,x}	Table 4.4.3 (See Description 4.4.2)	Assumed compliance rate for each year after a new code is adopted.
Annual Utility Attribution	Table 4.4.5 (See Description 4.4.3)	Assumed 19% for construction affected by pre-2021 code trainings, 46% for construction affected by proposed program.
Previous code kW	Calculated Value	Previous code kW for each hour of each day for a year. See Description 4.4.5 for more detail
New code kW ¹	Calculated Value	New code kW for each hour of each day for a year. See Description 4.4.5 for more detail
Customer Peak kW		Average kW savings per customer at either 4:00 or 5:00.

Customer Inputs

M&V Verified

None	NA	
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Table 4.4.1 Gross Annual Commercial Gas Savings (See CHAPTER 4.3 AND PAGE 47 OF Attachment MRS-1, Direct Testimony of Company witness Mark Schoenheider, Proceeding No. 20A-XXXEG, henceforth "REPORT")

DTherm	2021	2022	2023	2024	2025
Gross Potential Savings	46,208	42,988	38,854	37,814	37,587

Table 4.4.2 Gross Annual Commercial Electric Savings (See CHAPTER 4.3 AND PAGE 47 OF REPORT)

GWh	2021	2022	2023	2024	2025
Gross Potential Savings	18.65	18.41	18.27	18.29	18.18

Table 4.4.3 Compliance Rates By Number of Years Since Code Adoption (See CHAPTER 4.3 AND PAGE 42 OF REPORT)

Program Year	Compliance Rate	Range from Other Utilities
Year 1	55%	50% (AZ)-80%(MA)
Year 2	65%	
Year 3	75%	
Year 4 and Beyond	85%	83%(MA)-100%(AZ)

Table 4.4.4 Assumed Code Adoption Schedule By County Group (See Appendix E PAGE E-7 OF REPORT APPENDICES)

Group	Current IECC Code	Program Yr. 1 (2021)	Program Yr. 2 (2022)	Program Yr. 3 (2023)	Program Yr. 4 (2024)	Program Yr. 5 (2025)
1	2009	2009	2015	2015	2015	2015
2	2006	2006	2006	2015*	2015	2015
3	2009	2015*	2015	2015	2015	2015
4	2006	2006	2015*	2015	2015	2015
5	None	None/2006	2015*	2015	2015	2015
6	None	None/2006	None/2006	2015*	2015	2015
7	2009	2009	2009	2015*	2015	2015
8	2012	2012	2012	2018*	2018	2018
9	2015	2018*	2018	2018	2018	2021*
10	2015	2015	2018*	2018	2018	2021*
11	2015	2015	2015	2018*	2018	2018
12	2018	2018	2021*	2021	2021	2021
13	2018	2018	2018	2021*	2021	2021
14	2018	2018	2018	2018	2021*	2021
15	2018	2018	2018	2018	2018	2018

Table 4.4.5 Code Compliance Activities in Colorado & Xcel Energy Proportion (See CHAPTER 4.3 PAGE 44 OF REPORT)

Activity/Budget Item	Colorado Energy Office	SWEEP	Xcel	Portion Attributable to Xcel Energy
Total Budget (\$)	\$80,000	\$30,000	\$47,000	30%
In-person trainings, university training, lunch and learns (#)	20	1	29	58%
Webinars (#)	10	4	12	46%
Code tools, videos, and other training materials (#)	30	20	5	9%
Committed jurisdiction assistance (hours)	146	Engaged	0	0%
Collaborative work (hours)	0	20	0	0%
Total				24%

*** EMI Consulting assumed SWEEP does the same level of assistance as the Colorado Energy Office.

Descriptions**4.4.1 Program Gross Potential Annual Therms/Program Gross Potential Annual kWh**

Gross potential savings was calculated by comparing the difference between a building's energy use intensity (EUI) that just meets a jurisdiction's current energy code and a building's EUI that just meets the previous code. The gross potential savings calculation assumes that all buildings are 100% compliant with code and that there is no over- or under-performance of buildings relative to code, which prevents double counting of savings relative to new construction programs. EUI data was obtained from the Pacific Northwest National Laboratory (PNNL) Commercial Prototype Building Models (https://www.energycodes.gov/development/commercial/prototype_models) for office and bank buildings, government service buildings, stores, schools/educational, hospitals and health, hotels and motels, warehouses, restaurants, and high-rise multifamily buildings in ASHRAE climate zones 5B and 6B for for 2006 IECC, 2009 IECC, 2012 IEC, and 2015 IECC. For the purposes of this analysis, Xcel Energy assumed a 10% improvement for commercial 2018 IECC (2018 commercial prototype models were not yet released) and a conservative assumption of 8% improvement for commercial 2021 IECC. Appendix E page E-4 discusses the data sources for these assumptions in detail.

As Colorado is a home rule state where each jurisdiction can adopt its own code, Xcel Energy utilized Arizona's approach of calculating gross potential savings at the jurisdiction level (Navigant Consulting, "APS MER Verification Report: Program Year 2013." February 28, 2014). For the purposes of this analysis, Xcel Energy performed the analysis for all counties within Xcel Energy's Colorado territory, aggregated into 15 groups. The savings calculated for each group was adjusted to account for the energy supply mix (e.g., gas only, electricity only, or gas and electricity) in each group, as defined in Xcel Energy's 2019 list of communities served (<https://www.xcelenergy.com/staticfiles/xeresponsive/Energy%20Portfolio/Colorado-Communities-Served-Information-Sheet.pdf>). The methodology for how the groups were determined, as well as additional details on the energy supply mix in each, is explained in detail in Appendix E pages E-1 through E-3 and the end result is shown in Table 2. Definition of County Groups (Appendix E page E-2) and Table 3. Energy Supply Mix by County Group (Appendix E page E-3).

Xcel Energy created a code adoption schedule for each jurisdiction for each year of the program, as show in Table 1.4 Assumed Code Adoption Schedule By County Group (See Appendix E PAGE E-7 OF REPORT APPENDICES) of this workbook. This was created through investigating the code adoption schedule of the jurisdictions within Xcel Energy's service territory and with stakeholder feedback received in the interviews and discussed in Chapter 4.2 of the report page 39. The details supporting the assumptions are discussed in Appendix E pages E-5 and E-6.

Savings were calculated for each year of the program using the EUI for each building type within each county group and the code adoption schedule. For example, in Program Year 1, for Group 1, the previous code EUI was derived from 2006 IECC, and the current code EUI used 2009 IECC. For Program Year 2, the previous code EUI was derived from 2009 IECC, and the current code EUI used 2015 IECC. For these calculations, Xcel Energy assumed that codes are effective at the start of the calendar year. To calculate savings the EUI is multiplied by the total square footage of commercial new construction in a jurisdiction. Xcel Energy obtained historical construction square footage from the Dodge database for the commercial sector. Detailed information, data sources, and assumptions for construction data is discussed in the gross potential savings section of the report (Chapter 4.2 pages 40-41) and Appendix E pages E-7 through E-11.

4.4.2 Compliance Rate

The gross potential savings assumes buildings are 100% compliant with code. However, in practice, not all buildings are 100% compliant with code. Xcel Energy attempted to find compliance rates specific to Colorado. While compliance snapshots have been conducted in Colorado in the past, these did not provide an estimate of broad compliance rates. The city of Ft. Collins conducted a compliance study through City Energy Project, Institute for Market Transformation, and Natural Resources Defense Council for projects permitted to the 2015 IECC code. While the report was not publicly available, a presentation by the city indicated compliance ranged from 64%–75% (https://www.energycodes.gov/sites/default/files/documents/NECC2018_07_Smith.pdf). Since compliance data specific to Colorado was not found, estimates of compliance from other regions at various points throughout a code cycle were used to estimate compliance for Xcel Energy's Colorado territory. Given the range of compliance values found in other states (Table 10. Compliance Rate Estimates and Sources in Appendix E page E-14), the fact that other utilities' programs are well established, the Ft. Collins study found compliance rates of 64%–75%, and the other home rule state (AZ) assumes a low initial compliance rate of 50%, Xcel Energy assumed the compliance rates outlined in Table 1.3 Compliance Rates By Number of Years Since Code Adoption (See CHAPTER 4.3 AND PAGE 42 OF REPORT) of this workbook. The program design includes a compliance study in year 1 to determine actual compliance rates specific to Xcel Energy's service territory.

4.4.3 Annual Utility Attribution

Attribution refers to the portion of code savings that can be credited to the utility's program efforts for increasing code compliance or assisting with the adoption of codes and standards (Cadmus, "California Statewide Codes and Standards Program Impact Evaluation Phase Two Volume Two: 2013 T24." June 23, 2017). Xcel Energy already supports the code compliance market in Colorado through trainings, lunch and learns, webinars, videos, and training materials. To capture the influence of these activities, Xcel Energy gathered detailed information on activities performed by Xcel Energy and other key market actors within the state, namely the Colorado Energy Office and SWEEP, as shown in Table 1.5 Code Compliance Activities in Colorado & Xcel Energy Proportion (See CHAPTER 4.3 PAGE 44 OF REPORT) in this workbook. Additional details regarding the information collected is available in the section "Attribution & Claimable Savings" of the report page 42-44. Xcel Energy then determined the proportion of each activity Xcel Energy was responsible for relative to other actors, and took an unweighted average of these activities to determine the total proportion of code activities for which Xcel Energy is currently responsible, which is shown in Table 1.5 Code Compliance Activities in Colorado & Xcel Energy Proportion (See CHAPTER 4.3 PAGE 44 OF REPORT) in this workbook. Due to the construction lag discussed in Chapter 4.2 page 40, the activities conducted now will result in savings in 2021 and 2022 for the commercial program. Thus, the attribution of 19% was used in the analysis for the 2021 and 2022 program years.

The program activities were designed specifically to meet current market gaps and complement and build upon existing support activities. When the program is launched in 2021, savings from the new program activities would be realized starting in 2023. States with published attribution rates include Arizona, Massachusetts, Rhode Island, and Illinois. Their attribution rates range from 33%–46%.

4.4.4 Construction Adjustment Factor

To estimate future construction growth or contraction, Xcel Energy used several sources that regularly evaluated construction data, all which suggested construction starts will experience a downturn in 2020 and beyond due to existing construction trends and the COVID-19 pandemic (<https://www.ecmweb.com/construction/article/21119974/2020-construction-outlook>, <https://www.aia.org/articles/6096562-though-signs-point-to-a-slowdown-growth-in>, <https://www.construction.com/news/Construction-Starts-Slip-back-2020-Dodge-Data-Analytics>). Therefore, the calculation assumed a contraction of -1%.

Given actual construction starts may differ from the forecast, the Construction Adjustment Factor can be applied to account for differences between anticipated and observed construction activity.

4.4.5 Previous and new code kW

The hourly meter outputs from PNNL's 2012 IECC and the 2015 IECC Prototype models (since 2018 IECC models are not yet available) for each building type were used for the Commercial analysis (https://www.energycodes.gov/development/commercial/prototype_models). The PNNL models use TMY3 data as an input in their modeling (<https://www.nrel.gov/docs/fy08osti/43156.pdf>). As TMY3 uses 30-year historical averages to create hourly weather data, it is not possible to create weekday and weekend profiles because the data is not specific to a calendar year or day of week.

References:

1. Modeled hourly outputs obtained from 1. Detailed reporting of methodology and assumptions available from PNNL:

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

5.1 Peak Day Partners

Algorithms

Customer kWh = kW Commitment x Control Hours

Customer Coincident kW = kW Commitment x Coincidence Factor

Customer kW = kW Commitment

Variables:

kW Commitment	Customer Input	Customer's average electrical load reduction during summer months
Coincidence Factor	100%	Percentage of Customer_kW savings that will coincide with peak summer kW savings
Control Hours	23	Estimated number of control hours called per year
Lifetime	1	Average contract duration

Customer Inputs:

M&V Verified:

kW Commitment	Yes	
Control Hours	Yes	

References:

Based on the average number of ISOC control events over the past 3 years.

Changes from Recent Filing:

No Changes

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

5.2 Peak Partner Rewards

Algorithms

$$\text{Customer kWh} = \text{kW Commitment} \times \text{Control Hours}$$

$$\text{Customer Coincident kW} = \text{kW Commitment} \times \text{Coincidence Factor}$$

$$\text{Customer kW} = \text{kW Commitment}$$

Variables:

kW Commitment	Customer Input	Customer's average electrical load reduction during summer months
Coincidence Factor	100%	Percentage of Customer_kW savings that will coincide with peak summer kW savings
Control Hours	17	Estimated number of control hours called per year
Lifetime	2	Average contract duration

Customer Inputs:

M&V Verified:

kW Commitment	Yes	
Control Hours	Yes	

References:

Control hours based on CO event history 2017-2021
 Participation & kW commitment based on present enrollment through 2021

Changes from Recent Filing:

Control hours are based on actual events and durations in CO, rather than estimating based on MN DR events.

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

5.3 Critical Peak Pricing

Algorithms

$$\text{Customer kWh} = \text{kW Reduction} \times \text{Control Hours}$$

$$\text{Customer Coincident kW} = \text{kW Reduction} \times \text{Coincidence Factor}$$

$$\text{Customer kW} = \text{kW Reduction}$$

Variables:

kW Reduction	Customer Input	Customer's average electrical load reduction during critical peak periods
Coincidence Factor	100%	Percentage of Customer_kW savings that will coincide with peak summer kW savings
Control Hours	38	Average number of control hours called per year
Lifetime	1	Average contract duration

Customer Inputs:

M&V Verified:

kW Reduction	Yes	
Control Hours	Yes	

References:

Control hours based on 2017-2021 CO CPP event history Participation & kW commitment still based on participation in CO CPP pilot values from Summer 2018, due to data available
--

Changes from Recent Filing:

Control Hours

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

5.4 Smart Thermostat

Algorithms

$$STDR\ Customer\ kWh = ST_Tons \times kWh_Savings_STDR$$

$$STDR\ Customer\ Coincident\ kW = ST_Tons \times kW_Savings_STDR \times STDR_CF$$

$$STDR\ Customer\ kW = ST_Tons \times kW_Savings_STDR$$

$$STEE\ Customer\ kWh = Cooling\ kW\ Annual \times (ES_Reduction_Cooling) \times Cooling\ Hours$$

$$STEE\ Customer\ Gas\ Dth = Baseline\ Dth \times (ES_Reduction_Heating)$$

$$STEE\ Electric\ Heat\ kWh = Cooling\ kW\ Annual \times (ES_Reduction_Cooling) \times Cooling\ Hours + Heating\ kW \times (ES_Reduction_Heating) \times Heating\ Hours$$

$$STEE\ Customer\ Coincident\ kW = Cooling\ kW \times (ES_Reduction_Cooling) \times EnergyStar_CF$$

Variables

ST_Tons	Customer Input	Quantity of Controlled Tons
kW_Savings_STDR	0.364	Peak coincident kW savings per average commercial AC unit ton with a smart thermostat (Reference 3)
kWh_Savings_STDR	1.185	kWh savings per year per average commercial AC Unit ton with a smart thermostat (Reference 3).
ES_Reduction_Heating	6%	Energy Star Connected Thermostat criteria for annual heating equipment runtime reduction (Reference 3)
ES_Reduction_Cooling	9%	Energy Star Connected Thermostat criteria for annual cooling equipment runtime reduction (Reference 3)
STDR_CF	100%	Coincidence factor of demand response events
Cooling_kW	6.531	Average kW for cooling at full load
Cooling_kW_Annual	5.779	Average kW for cooling using seasonal efficiency
Cooling_Hours	765	Annual cooling hours
Heating_kW	5.339	Average kW for electric heating
Heating_Hours	950	Annual heating hours
Baseline_Dth	74.1	Baseline heating load per thermostat in Dth
EnergyStar_CF	0%	coincidence factor for ES Thermostats (Reference 4)
STDR_Measure_Life	5	Measure life for demand response DR
ES_Measure_Life	10	Measure life for Energy Star thermostat (Reference 4)
Incremental Cost	Table 5.4.1	Material and Install Labor Costs (varies by program & split between demand response and energy efficiency measures)

Table 5.4.1 Current Costs*

Commercial Programs	\$175.00
DR Programs	\$300.00

* Costs are provided by the vendor and re-evaluated throughout the year to account for the evolving market.

Customer Inputs M&V Verified

AC unit tons	Yes	
Air conditioner single-stage or multi-stage	Yes	
Stage 1 and stage 2 tons (Multi-stage units only)	Yes	

References:

1. Xcel Energy, January 2016. Typical MN Business Single Stage Smart Switch Load Relief 2011-2015.
2. Xcel Energy, January 2016. Typical MN Business Dual Stage Smart Switch Load Relief 2011-2015.
3. Xcel Energy, October 2019. Commercial Smart Thermostat Demand Response Study
4. Minnesota Technical Resource Manual ver 3.0

Changes from Recent Filing:

No Changes

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

5.5 Electric Vehicle Critical Peak Pricing

Algorithms

$$\text{Customer kW} = \text{EV Load} \times \text{CPP Factor}$$

$$\text{Customer Coincident kW} = \text{Customer kW} \times \text{Coincidence Factor}$$

Variables	Value	Description
EV Load	Customer Input	Total EV charging load in kW
CPP Factor	See Table 5.5.1	The amount of discretionary load that the customer will shed during peak events.
Control Hours	60	Maximum Annual Event hours
Customer kWh	0	Assumed that EV loads reduced during CPP periods will be shifted to alternate time periods, hence 0 kWh savings.
Coincidence Factor	100%	Percentage of Customer kW savings that will coincide with peak summer kW savings
Lifetime	1	Average contract duration

Customer Inputs:

M&V Verified:

EV Load	Yes		
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Assumptions:

EV charging loads will be separately metered as required by Tariff.
 Fleet EV charging facilities will be more sensitive to pricing signals than Public EV customers, therefore assumed a higher
 After initial enrollment, customers will automatically enroll in subsequent years as long as they remain on the S-EV Rate.

Table 5.5.1

CPP Factor

Public EV Charging (Reference 1)	6.63%
Fleet EV Charging	13.26%

References:

1. Nexant, 2016. 2015 Load Impact Evaluation of California's Statewide Nonresidential Critical Peak Pricing Program. Table 1-1.

Changes from Recent Filing:

No Changes

Table 5.6.0 Common Compressed Air Variables for Reference

Motor Efficiency	94.0%	Assumed average air compressor motor efficiency based on average motor size in a typical compressed air system.
System Pressure	100	Typical compressed air system discharge pressure that the rule of thumb system efficiency assumption is based on. (Reference 10)
SCFM / HP	4.25	Standard rule of thumb assumption for flow reduction on a typical 100 psig system with variable speed control. (Reference 10)
SCFM / ACFM	0.818	Conversion from Actual to Standard Flow in CO territory
Custom CF	69.6%	Coincidence Factor from CO Custom Compressed Air projects
kW / HP	0.746	Standard conversion from HP to kW.

References:

- (1) Service factor from Compressed Air & Gas Institute (CAGI) standards comparing Nameplate HP to actual BHP @ 100% Full rated pressure and flow
- (2) National Energy Efficiency Best Practices Report (<http://www.eebestpractices.com>)
- (3) Historic compressed air product experience
- (4) Analysis of Compressed Air Study participants
- (5) National Electric Manufacturers Association. Motor efficiency standards from Pre-EPA 2005 and after.
- (6) United States Industrial Electric Motor Systems Market Opportunities Assessment. US DOE, Dec 2002, Appendix B2
- (7) Various anonymous retailer and vendor quotes
- (8) per page iv of "Tetra Tech, Process and Impact Evaluation of the Compressed Air Efficiency Program — Colorado, January 21 2014"
- (9) Massachusetts Technical Reference Manual 2013-2015 Program Years
- (10) Compressed Air Challenge (Best Practices Guide): source for baseline compressor curves, % efficiency/psi reduction, SCFM per orifice
- (11) Massachusetts Joint Utilities "Measure Life Study". Energy & Resource Solutions. Table 1-1. 2005. Source for NALD Lifetime
- (12) ZEKS Mist Eliminator (<http://www.zeks.com/PDF/ZEKS%20Mist%20Eliminator.pdf>)
- (13) Quincy Mist Eliminator (<https://www.quincycompressor.com/products/mist-eliminators>)
- (14) Compressed Air Best Practices (<https://www.airbestpractices.com/system-assessments/air-treatmentn2/desiccant-dryers-ten-lessons-learned>)

6.1 Energy Conservation Opportunity

$$\text{Customer kW} = \text{kW Savings}$$

$$\text{Customer kWh} = \text{kW Savings} \times \text{Hours}$$

$$\text{Customer Coincident kW} = \text{Customer kW} \times \text{Coincidence Factor}$$

Variables

kWh Savings	24,978	Based on an average kWh savings from historical participation in the measure. This is a custom calculation each time.
kW Savings	3.116	Based on an average kW savings from historical participation in the measure. This is a custom calculation each time.
Hours	8,017	Based on average operating hours from historical participation in the measure. This is a custom calculation each time.
Coincidence Factor	100.0%	Coincidence of energy demand savings to grid peak demand based on participation history in ECOs.
Lifetime	5	Standard assumption for compressed air study life.
Incremental Cost	\$459	Based on average incremental from historical participation in the measure. This is a custom calculation each time.

References:

Historical participation in the measure for kW & kWh savings, costs & hours

Changes from Recent Filing:

No Changes

6.2 Supply Side Study

$$\frac{kW}{SCFM} = \left(\frac{SCFM}{HP}\right)^{-1} \times \left(\frac{kW}{HP}\right) \div \text{Motor Efficiency}$$

$$\text{Customer kW} = \text{Leak SCFM} \times \left(\frac{kW}{SCFM}\right)$$

$$\text{Customer kWh} = \text{Hours} \times \text{Customer kW}$$

$$\text{Customer Coincident kW} = \text{Customer kW} \times \text{Coincidence Factor}$$

$$\text{Incremental Cost} = \text{Cost per Leak Fix} \times \# \text{ of Leaks Fixed} + \text{Study Rebate}$$

Variables

Leak SCFM	Study Input	Input from Compressed Air Supply Side Study
Motor Efficiency	94.0%	Assumed average air compressor motor efficiency based on average motor size in a typical compressed air system.
SCFM / HP	4.25	Standard rule of thumb assumption for flow reduction on a typical 100 psig system with variable speed control. (Reference 10)
kW / HP	0.746	Standard conversion from HP to kW.
kW / SCFM	0.187	
Hours	Study Input	Input from Compressed Air Supply Side Study
Lifetime	5	Standard assumption for compressed air study life.
Coincidence Factor	100%	Savings is from flow reduction during all operating hours of the compressed air system, so is assumed to be coincident with the grid peak.
Cost per Leak Fix	\$75	Engineering assumption from industry experience used for all leak studies
# of Leaks Fixed	Study Input	Input from Compressed Air Supply Side Study

References:

(4) Analysis of Compressed Air Study participants 2016 - 2019
(9) Massachusetts Technical Reference Manual 2013-2015 Program Years
(10) Compressed Air Challenge (Best Practices Guide): source for baseline compressor curves, % efficiency/psi reduction, SCFM per orifice

Changes from Recent Filing:

No Changes

6.3 Cycling Dryers

Algorithms

$Customer\ kWh = Quantity \times kWh\ Savings$

$Customer\ kW = Quantity \times kW\ Savings$

$Customer\ Coincident\ kW = Customer\ kW \times Coincidence\ Factor$

$Incremental\ Cost = Quantity \times Unit\ Incremental\ Cost$

Variables

kWh Savings	See Table 6.1.3	kWh savings based on Cycling Dryer rated CFM
kW Savings	See Table 6.1.3	kW savings based on Cycling Dryer rated CFM
Lifetime	20	Typical assumption for new industrial equipment
Coincidence Factor	69.6%	Coincidence of energy demand savings to grid peak demand based on Custom Compressed Air project history.
Incremental Cost	See Table 6.1.3	Incremental Cost of energy efficient equipment compared to less-efficient equipment option

Customer Inputs

M&V Verified

Quantity of Cycling Dryers	Yes	
CFM of Cycling Dryer	Yes	

Table 6.1.3 Energy Savings and Costs For Cycling Dryers (Reference 4 & 7)

Dryer CFM	kW Savings	kWh Savings	Incremental Cost
75 CFM to 99 CFM Cycling Dryer	0.395	2,814	\$450
100 CFM to 124 CFM Cycling Dryer	0.622	4,444	\$508
125 CFM to 149 CFM Cycling Dryer	0.746	5,349	\$441
150 CFM to 199 CFM Cycling Dryer	0.865	6,223	\$704
200 CFM to 249 CFM Cycling Dryer	0.918	6,640	\$1,208
250 CFM to 299 CFM Cycling Dryer	1.282	9,338	\$1,060
300 CFM to 399 CFM Cycling Dryer	1.494	10,936	\$1,222
400 CFM to 499 CFM Cycling Dryer	1.931	14,307	\$1,378
500 CFM to 599 CFM Cycling Dryer	2.166	16,218	\$1,486
600 CFM to 699 CFM Cycling Dryer	2.476	18,735	\$892
700 CFM to 799 CFM Cycling Dryer	3.173	24,243	\$1,228
800 CFM to 999 CFM Cycling Dryer	3.322	25,628	\$2,105
1000 CFM to 1199 CFM Cycling Dryer	4.160	32,662	\$2,046
1200 CFM to 1599 CFM Cycling Dryer	5.103	40,730	\$2,753
1600 CFM to 1999 CFM Cycling Dryer	5.969	48,984	\$4,084
2000 CFM to 2399 CFM Cycling Dryer	6.557	55,015	\$5,972
2400 CFM to 2799 CFM Cycling Dryer	8.490	72,467	\$4,515

References:

- (4) Analysis of Compressed Air Study participants 2016 - 2019
- (7) Various anonymous retailer and vendor quotes

Changes from Recent Filing:

No Changes

6.4 Dryer Purge Demand Controls**Algorithms**

$$\text{Customer kWh} = \text{Quantity} \times \text{kWh Savings}$$

$$\text{Customer kW} = \text{Quantity} \times \text{kW Savings}$$

$$\text{Customer Coincident kW} = \text{Customer kW} \times \text{Coincidence Factor}$$

$$\text{Incremental Cost} = \text{Quantity} \times \text{Unit Incremental Cost}$$

Variables

kWh Savings	See Table 6.2.4	kWh savings based on Cycling Dryer rated CFM
kW Savings	See Table 6.2.4	kW savings based on Cycling Dryer rated CFM
Lifetime	20	Typical assumption for new industrial equipment
Coincidence Factor	69.6%	Coincidence of energy demand savings to grid peak demand based on Custom Compressed Air project history.
Incremental Cost	See Table 6.2.4	Incremental Cost of energy efficient equipment compared to less-efficient equipment option

Customer Inputs**M&V Verified**

Quantity of Dryer Purge Demand Controls	Yes	
SCFM of Dryer Purge Demand Controls	Yes	

Table 6.2.4 Energy Savings and Costs for Dryer Purge Demand Control (References 4, 7, & 14)

Dryer CFM	kW Savings	kWh Savings	Incremental Cost
90 CFM to 119 CFM Dewpoint Demand Control	3.901	27,866	\$3,148
120 CFM to 159 CFM Dewpoint Demand Control	4.956	35,536	\$3,176
160 CFM to 199 CFM Dewpoint Demand Control	6.276	45,222	\$3,210
200 CFM to 249 CFM Dewpoint Demand Control	7.415	53,689	\$3,515
250 CFM to 299 CFM Dewpoint Demand Control	8.576	62,491	\$3,286
300 CFM to 399 CFM Dewpoint Demand Control	9.649	70,737	\$3,335
400 CFM to 499 CFM Dewpoint Demand Control	11.349	84,185	\$3,375
500 CFM to 599 CFM Dewpoint Demand Control	12.811	96,175	\$3,438
600 CFM to 799 CFM Dewpoint Demand Control	14.243	108,144	\$3,438
800 CFM to 999 CFM Dewpoint Demand Control	18.270	141,687	\$3,473
1000 CFM to 1249 CFM Dewpoint Demand Control	21.946	173,722	\$3,858
1250 CFM to 1499 CFM Dewpoint Demand Control	26.010	210,652	\$3,678
1500 CFM to 1999 CFM Dewpoint Demand Control	29.544	244,178	\$3,725
2000 CFM to 2499 CFM Dewpoint Demand Control	36.258	309,317	\$3,861

References:

(4) Analysis of Compressed Air Study participants 2016 - 2019
 (7) Various anonymous retailer and vendor quotes
 (14) Compressed Air Best Practices (<https://www.airbestpractices.com/system-assessments/air-treatmentn2/desiccant-dryers-ten-lessons-learned>)

Changes from Recent Filing:

No Changes

6.5 Mist Eliminators

Algorithms

$Customer\ kWh = Quantity \times kWh\ Savings$

$Customer\ kW = Quantity \times kW\ Savings$

$Customer\ Coincident\ kW = Customer\ kW \times Coincidence\ Factor$

$Incremental\ Cost = Quantity \times Unit\ Incremental\ Cost$

$O\&M\ Savings = Quantity \times Unit\ O\&M\ Savings$

Variables

kWh Savings	See Table 6.3.5	kWh savings based on Mist Eliminator rated CFM
kW Savings	See Table 6.3.5	kW savings based on Mist Eliminator rated CFM
Lifetime	11	Assumption based on various manufacturer's rated life, also the filter element life for mist eliminators (Ref 12 & 13)
Coincidence Factor	100.0%	Coincidence of energy demand savings to grid peak demand based on Custom Compressed Air project history.
Incremental Cost	See Table 6.3.5	Incremental Cost of energy efficient equipment compared to less-efficient equipment option
O&M Savings	See Table 6.3.5	O&M cost difference of filter replacements over the lifetime.

Customer Inputs

M&V Verified

Quantity of Mist Eliminators	Yes	
CFM of Dryer Mist Eliminators	Yes	

Table 6.3.5: Energy Savings and Costs for Mist Eliminator Filters (References 4 & 7)

Filter CFM	kW Savings	kWh Savings	Incremental Cost	O&M Savings
125 CFM to 249 CFM Mist Eliminator Filter	0.228	1,640	\$2,416	\$103
250 CFM to 499 CFM Mist Eliminator Filter	0.452	3,300	\$2,468	\$194
500 CFM to 799 CFM Mist Eliminator Filter	0.894	6,740	\$2,642	\$259
800 CFM to 1099 CFM Mist Eliminator Filter	1.421	11,086	\$3,400	\$308
1100 CFM to 1499 CFM Mist Eliminator Filter	1.941	15,627	\$3,619	\$369
1500 CFM to 1899 CFM Mist Eliminator Filter	2.624	21,866	\$3,908	\$452
1900 CFM to 2299 CFM Mist Eliminator Filter	3.328	28,450	\$4,775	\$566

References:

(4) Analysis of Compressed Air Study participants 2016 - 2019
(7) Various anonymous retailer and vendor quotes
(12) ZEKS Mist Eliminator (http://www.zeks.com/PDF/ZEKS%20Mist%20Eliminator.pdf)
(13) Quincy Mist Eliminator (https://www.quincycompressor.com/products/mist-eliminators)

Changes from Recent Filing:

No Changes

6.6 No Air Loss Drain

Algorithms

$$\frac{kW}{SCFM} = \left(\frac{SCFM}{HP}\right)^{-1} \times \left(\frac{kW}{HP}\right) \div \text{Motor Efficiency}$$

$$\text{Customer kW} = \text{Quantity} \times \text{Average SCFM} \times \left(\frac{kW}{SCFM}\right)$$

$$\text{Customer kWh} = \text{Hours} \times \text{Customer kW}$$

$$\text{Customer Coincident kW} = \text{Customer kW} \times \text{Coincidence Factor}$$

$$\text{Incremental Cost} = \text{Quantity} \times \text{Unit Incremental Cost}$$

Variables

Average SCFM	2.739	Based on assumed time open and cycle interval of timed drain being replaced. (Reference 3)
Motor Efficiency	94.0%	Assumed average air compressor motor efficiency based on average motor size in a typical compressed air system.
SCFM / HP	4.25	Standard rule of thumb assumption for flow reduction on a typical 100 psig system with variable speed control. (Reference 10)
kW / HP	0.746	Standard conversion from HP to kW.
kW / SCFM	0.187	
kW Savings	0.511	Estimated energy savings per No Air Loss Drain from compressed air flow reduction.
Hours	7,523	Average compressed air system operating hours from participation history in program.
kWh Savings	3,848	Based on an average annual operating hours of custom compressed air projects and estimated energy savings from flow reduction.
Coincidence Factor	100.0%	Savings is from flow reduction during all operating hours of the compressed air system, so is assumed to be coincident with the grid peak.
Lifetime	13	No Air Loss Drain Lifetime (Reference 11)
Unit Incremental Cost	\$323.00	Incremental Cost of energy efficient equipment compared to less-efficient equipment option

Customer Inputs

M&V Verified

Quantity of No Air Loss Drains	Yes	
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References:

(3) Historic compressed air product experience
(10) Compressed Air Challenge (Best Practices Guide): source for baseline compressor curves, % efficiency/psi reduction, SCFM per orifice
(11) Massachusetts Joint Utilities "Measure Life Study". Energy & Resource Solutions. Table 1-1. 2005. Source for NALD Lifetime

Changes from Recent Filing:

No Changes

6.7 VFD Compressor

Algorithms

$$Customer\ kW = Horsepower \times Service\ Factor \times 0.746 \times \left[\left(\frac{Baseline\ Load}{Motor\ Efficiency} \right) - \left(\frac{Proposed\ Load}{Motor\ Efficiency} \right) \right] \times Quantity$$

$$Customer\ kWh = Customer\ kW \times Hours$$

$$Customer\ Coincident\ kW = Customer\ kW \times Coincidence\ Factor$$

$$Incremental\ Cost = Quantity \times Unit\ Incremental\ Cost$$

Variables

Coincidence Factor	69.6%	Coincidence of energy demand savings to grid peak demand based on Custom Compressed Air project history.
Motor Efficiency	See Table 6.5.7.A	Efficiency of new compressor motor as determined by customer provided Compressor HP (Reference 5)
Baseline Load	87.43%	Average percent loading for new fixed speed compressors
Horsepower	Customer Input	Nominal horsepower of new compressor
Proposed Load	61.05%	Average percent loading for new VFD compressors
Hours	See Table 6.5.7.A	Operating hours of new compressors (Reference 6)
Service Factor	1.15	Service factor of an air compressor motor (Reference 1)
Lifetime	20	Typical assumption for new industrial equipment
Unit Incremental Cost	See Table 6.5.7.B	Incremental cost of efficient measures compared less-efficient option

Customer Inputs

M&V Verified

Compressor HP	Yes	
Compressor Quantity	Yes	

Table 6.4.7.A: Motor Efficiencies & Operating Hours (Reference 5 & 6)

Compressor HP	Motor Description	Motor Efficiency	Operating Hours
10	10 HP 1800 RPM ODP	91.7%	2,131
15	15 HP 1800 RPM ODP	93.0%	2,131
20	20 HP 1800 RPM ODP	93.0%	2,131
25	25 HP 1800 RPM ODP	93.6%	3,528
30	30 HP 1800 RPM ODP	94.1%	3,528
40	40 HP 1800 RPM ODP	94.1%	3,528

Table 6.5.7.B: Incremental Costs for Efficient Measures (Reference 7)

Measure	Incremental Cost
10 HP VFD Compressor	\$2,774.00
15 HP VFD Compressor	\$2,792.00
20 HP VFD Compressor	\$3,842.00
25 HP VFD Compressor	\$5,165.00
30 HP VFD Compressor	\$7,111.00
40 HP VFD Compressor	\$7,556.00

References:

- (1) Service factor from Compressed Air & Gas Institute (CAGI) standards comparing Nameplate HP to actual BHP @ 100% Full rated pressure and flow
- (5) National Electric Manufacturers Association. Motor efficiency standards from Pre-EPAAct 2005 and after.
- (6) United States Industrial Electric Motor Systems Market Opportunities Assessment, EERE, US DOE, Dec 2002 - Source for operating hours for industrial motors and source for load factor
- (7) Various anonymous retailer and vendor quotes
- (10) Compressed Air Challenge (Best Practices Guide): source for baseline compressor curves, % efficiency/psi reduction, SCFM per orifice

Changes from Recent Filing:

No Changes

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

7.1 VDI

Algorithms

$$Customer\ kWh = \left(Baseline\ Computer\ kW - \left(\frac{VDI\ Wattage}{1000} + VDI\ Server\ kW \right) \right) * Quantity * Cooling\ kWh\ Factor * Hours$$

Customer Coincident kW

$$= \left(Baseline\ Computer\ kW - \left(\frac{VDI\ Wattage}{1000} + VDI\ Server\ kW \right) \right) * Quantity * Cooling\ kW\ Factor * Coincidence\ Factor$$

O&M Savings

$$= \left(Baseline\ Computer\ kW - \left(\frac{VDI\ Wattage}{1000} + VDI\ Server\ kW \right) \right) * Quantity * Hours * Heating\ Penalty\ Factor * Gas\ Cost + (O\&M\ Labor\ Savings - O\&M\ License\ Cost) * Quantity$$

Variables

Baseline Computer kW	0.0213	Aggregated power demand of a baseline desktop computer (References 1-4, 11, 26)
VDI Server kW	0.0040	Average server power used to support a virtualized server (Reference 8)
Cooling kW Factor	1.33	Average annual demand of the cooling system that has to remove the heat gain caused by a desktop computer
Cooling kWh Factor	1.13	Average annual energy consumption of the cooling system that has to remove the heat gain caused by a desktop computer
Hours	8760	Number of hours that a desktop computer is connected to a virtualized server and available to operate
Coincidence Factor	100%	Probability that the calculated Customer kW will coincide with the period of peak generator operation
Heating Penalty Factor	-0.000508	Average annual energy consumption of the heating system that has to compensate for the negative heat gain associated with the more efficient desktop computer (Dth/kWh).
Gas Cost	\$5.99	Forecasted natural gas rate for businesses (\$/Dth)
O&M Labor Savings	\$42.50	Annual labor savings per desktop (Reference 12)
O&M License Cost	\$12.00	Annual software license fee per desktop (Reference 12)
NTG	80%	Net to Gross (Reference 30)
Lifetime	10	Life of a VDI, "thin client", in years (Reference 9)
Incremental Cost	\$117.00	Cost of high efficiency model over baseline model (Reference 6)

Customer Inputs

M&V Verified

Quantity	Yes	Number of VDI, "thin client", devices installed instead of a desktop PC computer
VDI Wattage	Yes	Rated wattage of the VDI, "thin client", device installed

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

References:

1. Koomey, J., M. Cramer, M.A. Piette and J. Eto. 1995. "Efficiency Improvements in U.S. Office Equipment: Expected Policy Impacts and Uncertainties." Lawrence Berkeley Laboratory. LBL-37383. December. Table 3.
2. Energy Star Calculator Tool; LBNL 2007 or Energy Star Specification
3. Hours of operation for desktop computers from office desktops/laptops and office monitors from Piette, M. A., M. Cramer, J. Eto and J. Koomey. 1995. "Office Technology Energy Use and Savings Potential in New York." Prepared for the NY State Energy R&D Authority and Con-Ed by LBNL. Lawrence Berkeley Laboratory. LBL-36752. January 1995. p. 4-2
4. LBNL Estimate based on Reference 3
5. Ecova Consulting information from manufacturers
6. Vendor data
7. Baseline desktop PC cost assumed at \$600; info from the internet indicates a PC with keyboard averages between \$300-\$1,000 or \$650; assumed the keyboard is \$50 of that (Ref 6)
8. Server Wattages from Custom Efficiency program participant; average wattage of 42 models (273W per Server / 68 Virtual Machines per Server). Wattages last confirmed in 2014.
9. 10-year life for thin-client and zero-client based on conversation with MN vendor Nowmicro
10. Not used
11. Ecos Consulting (now Ecova), 2009
12. Various Equipment Vendors
13. Measured Energy Savings and Performance of Power-Managed Personal Computers and Monitors, 1996, Lawrence Berkeley National Laboratory
14. PC and Monitor Night Status: Power Management Enabling and Manual Turn-off, 1998, Lawrence Berkeley National Laboratory
15. ENERGY STAR, 2012
16. Xcel Energy Custom Efficiency projects
17. 2014 Michaels Energy (independent 3rd party) NTG review.
18. Koomey, J., M. Cramer, M.A. Piette and J. Eto. 1995. "Efficiency Improvements in U.S. Office Equipment: Expected Policy Impacts and Uncertainties." Lawrence Berkeley Laboratory. LBL-37383. December. Table 3.
19. Cooling Plant Optimization (<http://academic.udayton.edu/kissock/http/EEB/LecturesAndHomework/23-CoolingPlantOptimization/CoolingPlantOptimization.docx>)
20. Georgia Tech Student Thesis (<http://www-old.me.gatech.edu/energy/students/liuthesis.pdf>)
21. Condenser Water Energy Savings (http://web.stanford.edu/group/narratives/classes/08-09/CEE215/ReferenceLibrary/Chillers/York%20Engineering%20Updates/Reduced%20condenser-water%20flow%20rate_energy-saving%20miracle%20or%20mirage.pdf)
22. Server Power Supplies Data Points_PMO.XLS supplied by Ecova on 9/1/14
23. 80 Plus Servers Calculator_Xcel14Aug2014.xlsx file provided by Ecova on 9/1/14
24. Internal adjustment by Xcel energy to distribute power supply cost in a commensurate with wattage served. Values will be reviewed over time as additional information becomes available.
25. Not used
26. Energy Star Office Equipment Calculator, accessed 12/21/15 from: <http://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/save-energy/purchase-energy-saving-products>
27. Energy Star 5.0 Product Database, downloaded on 12/21/15 from historical archive
28. ECOVA - Sales market share analysis, Feb. 2016.
29. 2013 EPA Study for Energy Usage of Average Computer Sold
30. 2016 Computer Efficiency Program Evaluation

Changes from Recent Filing:

1. None

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

7.2 High Efficiency Server

Algorithms

Customer kWh

$$= \left(\frac{\text{Rated Power Supply Wattage}}{1000} * \text{Power Supplies per Server} * \text{Power Supply Load Factor} * \left(\frac{1}{\text{Baseline Server Power Supply Efficiency}} - \frac{1}{\text{Proposed Server Power Supply Efficiency}} \right) * \left(\text{Hours} + \left(\frac{3412}{12000} * \text{Secondary Cooling Energy Factor} \right) \right) * \text{Quantity} \right)$$

Customer Coincident kW

$$= \left(\frac{\text{Rated Power Supply Wattage}}{1000} * \text{Power Supplies per Server} * \text{Power Supply Load Factor} * \left(\frac{1}{\text{Baseline Server Power Supply Efficiency}} - \frac{1}{\text{Proposed Server Power Supply Efficiency}} \right) * \left(1 + \left(\frac{3412}{12000} * \text{Secondary Cooling Demand Factor} \right) \right) * \text{Quantity} * \text{Coincidence Factor} \right)$$

Variables

Baseline Server Power Supply Efficiency	89.10%	Power supply efficiency of an 80 PLUS Platinum rated server (Reference 23)
Proposed Server Power Supply Efficiency	92.82%	Power supply efficiency of an 80 PLUS Titanium rated server (Reference 23)
Power Supplies per Server	2	Each server contains two power supplies for 100% redundancy (Reference 23)
Power Supply Load Factor	11.58%	Power supply load factor (Reference 22)
Secondary Cooling Demand Factor	1.025	Aggregate kW/ton of the cooling system types that have to remove the heat gain caused by a server
Secondary Cooling Energy Factor	6,611.78	Aggregate kWh/ton of the cooling system types that have to remove the heat gain caused by a server
Hours	8760	Number of hours that a server is connected and available to operate
Coincidence Factor	100%	Probability that the calculated Customer kW will coincide with the period of peak generator operation
NTG	80%	Net to Gross (Reference 30)
Lifetime	5	Lifetime of a server in years (Reference 18)
Incremental Cost	See Table 7.2.1	Additional cost required to purchase a server with a high efficiency power supply over the baseline server (Reference 24)

Customer Inputs

M&V Verified

Quantity	Yes	Number of servers installed with a high efficiency power supply
Rated Power Supply Wattage	Yes	Rated wattage of the server's power supply

Table 7.2.1

80 PLUS Titanium Rated Server	Incremental Cost
401 - 600 Rated Watts	\$32.38
601 - 1000 Rated Watts	\$37.63
>1000 Rated Watts	\$42.88

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

References:

1. Koomey, J., M. Cramer, M.A. Piette and J. Eto. 1995. "Efficiency Improvements in U.S. Office Equipment: Expected Policy Impacts and Uncertainties." Lawrence Berkeley Laboratory. LBL-37383. December. Table 3.
2. Energy Star Calculator Tool; LBNL 2007 or Energy Star Specification
3. Hours of operation for desktop computers from office desktops/laptops and office monitors from Piette, M. A., M. Cramer, J. Eto and J. Koomey. 1995. "Office Technology Energy Use and Savings Potential in New York." Prepared for the NY State Energy R&D Authority and Con-Ed by LBNL. Lawrence Berkeley Laboratory. LBL-36752. January 1995. p. 4-2
4. LBNL Estimate based on Reference 3
5. Ecova Consulting information from manufacturers
6. Vendor data
7. Baseline desktop PC cost assumed at \$600; info from the internet indicates a PC with keyboard averages between \$300-\$1,000 or \$650; assumed the keyboard is \$50 of that (Ref 6)
8. Server Wattages from Custom Efficiency program participant; average wattage of 42 models (273W per Server / 68 Virtual Machines per Server). Wattages last confirmed in 2014.
9. 10-year life for thin-client and zero-client based on conversation with MN vendor Nowmicro
10. Not used
11. Ecos Consulting (now Ecova), 2009
12. Various Equipment Vendors
13. Measured Energy Savings and Performance of Power-Managed Personal Computers and Monitors, 1996, Lawrence Berkeley National Laboratory
14. PC and Monitor Night Status: Power Management Enabling and Manual Turn-off, 1998, Lawrence Berkeley National Laboratory
15. ENERGY STAR, 2012
16. Xcel Energy Custom Efficiency projects
17. 2014 Michaels Energy (independent 3rd party) NTG review.
18. Koomey, J., M. Cramer, M.A. Piette and J. Eto. 1995. "Efficiency Improvements in U.S. Office Equipment: Expected Policy Impacts and Uncertainties." Lawrence Berkeley Laboratory. LBL-37383. December. Table 3.
19. Cooling Plant Optimization (<http://academic.udayton.edu/kissock/http/EEB/LecturesAndHomework/23-CoolingPlantOptimization/CoolingPlantOptimization.docx>)
20. Georgia Tech Student Thesis (<http://www-old.me.gatech.edu/energy/students/liuthesis.pdf>)
21. Condenser Water Energy Savings (http://web.stanford.edu/group/narratives/classes/08-09/CEE215/ReferenceLibrary/Chillers/York%20Engineering%20Updates/Reduced%20condenser-water%20flow%20rate_energy-saving%20miracle%20or%20mirage.pdf)
22. Server Power Supplies Data Points_PMO.XLS supplied by Ecova on 9/1/14
23. 80 Plus Servers Calculator_Xcel14Aug2014.xlsx file provided by Ecova on 9/1/14
24. Internal adjustment by Xcel energy to distribute power supply cost in a commensurate with wattage served. Values will be reviewed over time as additional information becomes available.
25. Not used
26. Energy Star Office Equipment Calculator, accessed 12/21/15 from: <http://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/save-energy/purchase-energy-saving-products>
27. Energy Star 5.0 Product Database, downloaded on 12/21/15 from historical archive
28. ECOVA - Sales market share analysis, Feb. 2016.
29. 2013 EPA Study for Energy Usage of Average Computer Sold
30. 2016 Computer Efficiency Program Evaluation

Changes from Recent Filing:

1. None

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

8.1 Custom

Algorithms

Customer may apply for rebate under the Custom Efficiency Program for electric or gas projects not listed under prescriptive rebate programs. Each Custom Efficiency project will be analyzed individually by Xcel Energy. Technical variables required for the analysis will be obtained from the customer or vendor. Analysis will be based on standard engineering methodologies.

Electrical energy savings and electrical demand savings will be calculated based on the project specific details. Each project will undergo an engineering review in accordance with standard engineering practices. The review will be in accordance with the calculation methodologies detailed in the prescriptive programs where applicable.

Variables

Lifetime	Product Life will be evaluated for each project, lifetimes for end use technologies will be in accordance with prescriptive programs where applicable
Coincidence Factor	Coincidence factor will be evaluated for each project.
O&M Savings	Operation and Maintenance Savings will be evaluated for each project.
Energy and Demand Savings	Energy and demand savings will be evaluated for each project.

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

9.1 Attic Insulation

Algorithms

$$Customer\ Dth = \left(\frac{1}{R_{struc} + R_{attic,base}} - \frac{1}{R_{struc} + R_{attic,eff}} \right) \left(\frac{A_{attic} * HDD * 24}{Gas\ Heating\ Eff * 1,000,000} \right)$$

$$Cooling\ kWh = \left(\frac{1}{R_{struc} + R_{attic,base}} - \frac{1}{R_{struc} + R_{attic,eff}} \right) \left(\frac{A_{attic} * CDD * 24}{Cooling\ Eff * 3412} \right)$$

$$Heating\ kWh = \left(\frac{1}{R_{struc} + R_{attic,base}} - \frac{1}{R_{struc} + R_{attic,eff}} \right) \left(\frac{A_{attic} * HDD * 24}{Elec\ Heating\ Eff * 3412} \right)$$

Gross Annual kWh Saved at Customer = Cooling kWh + Heating kWh

$$Customer\ kW\ (Gross\ kW) = \frac{Gross\ Annual\ kWh\ Saved\ at\ Customer}{Cooling\ Hours + Heating\ Hours}$$

$$Customer\ PkW = \frac{Cooling\ kWh}{Cooling\ Hours}$$

Variables

R _{struc}	4.39	R-Value of the existing attic structure with no insulation (Reference 2,4,5)
Dth to BTU Conversion	1,000,000	1 Dth = 1,000,000 BTU
kWh to BTU Conversion	3412	1 kWh = 3412 BTU
Measure Lifetime	20	Deemed lifetime of measure in years (Reference 1)
HDD	See Table 9.1.0	Heating degree days, 65°F base (based on TMY3 data)
CDD	See Table 9.1.0	Cooling degree days, 65°F base (based on TMY3 data)
Heating Hours	See Table 9.1.0	Full load heating hours (from Residential HVAC program)
Cooling Hours	See Table 9.1.0	Full load cooling hours (from Residential HVAC program)
Gas Heating Eff	See Table 9.4.0	Heating efficiency determined based on customer's heating system type
Elec Heating Eff	See Table 9.4.0	Heating efficiency determined based on customer's heating system type
Cooling Eff	See Table 9.5.0	Cooling efficiency determined based on customer's cooling system type

Customer Inputs

M&V Verified

Heating Type	Yes	Heating system type for the residence
Cooling Type	Yes	Cooling system type for the residence
R _{attic,base}	No	R-Value for baseline attic insulation
R _{attic,eff}	Yes	R-Value for upgraded attic insulation
A _{attic}	Yes	ft ² of attic insulation added
Climate Zone	No	Climate zone where the customer is located (Front Range, Western Slope, Mountain, High Mountain)
Incremental Cost	No	Incremental cost for attic insulation provided by customer

References:

See Deemed Tables

Changes from Recent Filing:

None

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

9.2 Wall Insulation

Algorithms

$$Customer\ Dth = \left(\frac{1}{R_{wall,base}} - \frac{1}{R_{wall,eff}} \right) \left(\frac{A_{wall} * HDD * 24}{Gas\ Heating\ Eff * 1,000,000} \right)$$

$$Cooling\ kWh = \left(\frac{1}{R_{wall,base}} - \frac{1}{R_{wall,eff}} \right) \left(\frac{A_{wall} * CDD * 24}{Cooling\ Eff * 3412} \right)$$

$$Heating\ kWh = \left(\frac{1}{R_{wall,base}} - \frac{1}{R_{wall,eff}} \right) \left(\frac{A_{wall} * HDD * 24}{Elec\ Heating\ Eff * 3412} \right)$$

$$Gross\ Annual\ kWh\ Saved\ at\ Customer = Cooling\ kWh + Heating\ kWh$$

$$Customer\ kW\ (Gross\ kW) = \frac{Gross\ Annual\ kWh\ Saved\ at\ Customer}{Cooling\ Hours + Heating\ Hours}$$

$$Customer\ PkW = \frac{Cooling\ kWh}{Cooling\ Hours}$$

Variables

R _{wall,base}	4.41	R-Value for baseline wall insulation, calculated assuming no cavity insulation (Reference 2,3,4,5)
R _{wall,eff}	15.81	R-Value for upgraded wall insulation, calculated assuming R-14 cavity insulation (Reference 2,3,4,5)
Dth to BTU Conversion	1,000,000	1 Dth = 1,000,000 BTU
kWh to BTU Conversion	3412	1 kWh = 3412 BTU
Measure Lifetime	20	Deemed lifetime of measure in years (Reference 1)
HDD	See Table 9.1.0	Heating degree days, 65°F base (based on TMY3 data)
CDD	See Table 9.1.0	Cooling degree days, 65°F base (based on TMY3 data)
Heating Hours	See Table 9.1.0	Full load heating hours (from Residential HVAC program)
Cooling Hours	See Table 9.1.0	Full load cooling hours (from Residential HVAC program)
Gas Heating Eff	See Table 9.4.0	Heating efficiency determined based on customer's heating system type
Elec Heating Eff	See Table 9.4.0	Heating efficiency determined based on customer's heating system type
Cooling Eff	See Table 9.5.0	Cooling efficiency determined based on customer's cooling system type

Customer Inputs

M&V Verified

Heating Type	Yes	Heating system type for the residence
Cooling Type	Yes	Cooling system type for the residence
A _{wall}	Yes	ft ² of wall insulation added
Climate Zone	No	Climate zone where the customer is located (Front Range, Western Slope, Mountain, High Mountain)
Incremental Cost	No	Incremental cost for wall insulation provided by customer

References:

See Deemed Tables

Changes from Recent Filing:

1. Updating insulation added to empty wall cavity from R11 to R14 based on dense pack blown in fiberglass.

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

9.3 Crawl Space Wall Insulation

Algorithms

$$Customer\ Dth = \left(\frac{1}{R_{crawl,base}} - \frac{1}{R_{crawl,eff}} \right) \left(\frac{A_{crawl} * HDD * 24}{Gas\ Heating\ Eff * 1,000,000} \right)$$

$$Cooling\ kWh = \left(\frac{1}{R_{crawl,base}} - \frac{1}{R_{crawl,eff}} \right) \left(\frac{A_{crawl} * CDD * 24}{Cooling\ Eff * 3412} \right)$$

$$Heating\ kWh = \left(\frac{1}{R_{crawl,base}} - \frac{1}{R_{crawl,eff}} \right) \left(\frac{A_{crawl} * HDD * 24}{Elec\ Heating\ Eff * 3412} \right)$$

$$Gross\ Annual\ kWh\ Saved\ at\ Customer = Cooling\ kWh + Heating\ kWh$$

$$Customer\ kW\ (Gross\ kW) = \frac{Gross\ Annual\ kWh\ Saved\ at\ Customer}{Cooling\ Hours + Heating\ Hours}$$

$$Customer\ PkW = \frac{Cooling\ kWh}{Cooling\ Hours}$$

Variables

R _{crawl,base}	4.41	R-Value for baseline crawl space wall insulation, calculated assuming no cavity insulation (Reference 2,3,4,5)
R _{crawl,eff}	20.34	R-Value for upgraded crawl space wall insulation, calculated assuming R-11 cavity insulation (Reference 2,3,4,5)
Dth to BTU Conversion	1,000,000	1 Dth = 1,000,000 BTU
kWh to BTU Conversion	3412	1 kWh = 3412 BTU
Measure Lifetime	20	Deemed lifetime of measure in years (Reference 1)
HDD	See Table 9.1.0	Heating degree days, 65°F base (based on TMY3 data)
Heating Hours	See Table 9.1.0	Full load heating hours (from Residential HVAC program)
Gas Heating Eff	See Table 9.4.0	Heating efficiency determined based on customer's heating system type
Elec Heating Eff	See Table 9.4.0	Heating efficiency determined based on customer's heating system type

Customer Inputs

M&V Verified

Heating Type	Yes	Heating system type for the residence
A _{crawl}	Yes	ft ² of wall insulation added
Climate Zone	No	Climate zone where the customer is located (Front Range, Western Slope, Mountain, High Mountain)
Incremental Cost	No	Incremental cost for crawl space wall insulation provided by customer

References:

See Deemed Tables

Changes from Recent Filing:

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DEEMED SAVINGS TECHNICAL ASSUMPTIONS

9.4 Air Sealing

Algorithms

$$Customer\ Dth = \frac{(CFM50_{base} - CFM50_{eff}) \cdot ATF \cdot HDD \cdot 24}{N_{winter} + Gas\ Heating\ Eff + 1,000,000}$$

$$Cooling\ kWh = \frac{(CFM50_{base} - CFM50_{eff}) \cdot ATF \cdot CDD \cdot 24}{N_{summer} + Cooling\ Eff + 3412}$$

$$Heating\ kWh = \frac{(CFM50_{base} - CFM50_{eff}) \cdot ATF \cdot HDD \cdot 24}{N_{winter} + Elec\ Heating\ Eff + 3412}$$

$$Gross\ Annual\ kWh\ Saved\ at\ Customer = Cooling\ kWh + Heating\ kWh$$

$$Customer\ kW\ (Gross\ kW) = \frac{Gross\ Annual\ kWh\ Saved\ at\ Customer}{Cooling\ Hours + Heating\ Hours}$$

$$Customer\ PCKW = \frac{Cooling\ kWh}{Cooling\ Hours}$$

Variables

Dth to BTU Conversion	1,000,000	1 Dth = 1,000,000 BTU
kWh to BTU Conversion	3412	1 kWh = 3412 BTU
Measure Lifetime	10	Deemed lifetime of measure in years (Reference 1)
HDD	See Table 9.1.0	Heating degree days, 65°F base (based on TMY3 data)
CDD	See Table 9.1.0	Cooling degree days, 65°F base (based on TMY3 data)
Heating Hours	See Table 9.1.0	Full load heating hours (from Residential HVAC program)
Cooling Hours	See Table 9.1.0	Full load cooling hours (from Residential HVAC program)
ATF	See Table 9.2.0	Air transfer factor for converting airflow in ft ³ /min to BTU/hr
N _{winter}	See Table 9.3.0	Conversion factor for relating measured air leakage rate in ft ³ /min at reference pressure of 50 Pa to a natural infiltration in ft ³ /min (Reference 6,7)
N _{summer}	See Table 9.3.0	Conversion factor for relating measured air leakage rate in ft ³ /min at reference pressure of 50 Pa to a natural infiltration in ft ³ /min (Reference 6,7)
Gas Heating Eff	See Table 9.4.0	Heating efficiency determined based on customer's heating system type
Elec Heating Eff	See Table 9.4.0	Heating efficiency determined based on customer's heating system type
Cooling Eff	See Table 9.5.0	Heating efficiency determined based on customer's cooling system type

Customer Inputs

M&V Verified

Heating Type	Yes	Heating system type for the residence
Cooling Type	Yes	Cooling system type for the residence
CFM50 _{base}	No	Air leakage rate in ft ³ /min determined by blower door test at 50 Pa maintained pressure
CFM50 _{off}	Yes	Air leakage rate in ft ³ /min determined by blower door test at 50 Pa maintained pressure
House Stories	Yes	Number of stories above grade for the home
Conditioned Area	Yes	Home's conditioned floor area
Climate Zone	No	Climate zone where the customer is located (Front Range, Western Slope, Mountain, High Mountain)
Incremental Cost	No	Incremental cost for air sealing provided by customer

References:

See Deemed Tables

Changes from Recent Filing:

Updated to add new climate zone CO4 - High Mountain Areas

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

9.5 Weatherstripping

Algorithms

$$CFM50_{base} = \frac{Gap_{base} * Gap \ Length}{LAF}$$

$$CFM50_{eff} = \frac{Gap_{eff} * Gap \ Length}{LAF}$$

$$Customer \ Dth = \frac{(CFM50_{base} - CFM50_{eff}) * ATF * HDD * 24}{N_{winter} * Gas \ Heating \ Eff + 1,000,000}$$

$$Cooling \ kWh = \frac{(CFM50_{base} - CFM50_{eff}) * ATF * CDD * 24}{N_{summer} * Cooling \ Eff + 3412}$$

$$Heating \ kWh = \frac{(CFM50_{base} - CFM50_{eff}) * ATF * HDD * 24}{N_{winter} * Elec \ Heating \ Eff + 3412}$$

Gross Annual kWh Saved at Customer = Cooling kWh + Heating kWh

$$Customer \ kW \ (Gross \ kW) = \frac{Gross \ Annual \ kWh \ Saved \ at \ Customer}{Cooling \ Hours + Heating \ Hours}$$

$$Customer \ PCkW = \frac{Cooling \ kWh}{Cooling \ Hours}$$

Variables

Gap _{base}	0.56	Effective air leakage area in in ² per foot of door gap for door without weatherstripping (Reference 6,7,10)
Gap _{eff}	0.15	Effective air leakage area in in ² per foot of door gap for door with weatherstripping (Reference 6,7,10)
Dth to BTU Conversion	1,000,000	1 Dth = 1,000,000 BTU
kWh to BTU Conversion	3412	1 kWh = 3412 BTU
Incremental Cost	\$9.03	Home Energy Squad - Incremental cost to weatherstrip one door
Measure Lifetime	10	Deemed lifetime of measure in years (Reference 1)
HDD	See Table 9.1.0	Heating degree days, 65°F base (based on TMY3 data)
CDD	See Table 9.1.0	Cooling degree days, 65°F base (based on TMY3 data)
Heating Hours	See Table 9.1.0	Full load heating hours (from Residential HVAC program)
Cooling Hours	See Table 9.1.0	Full load cooling hours (from Residential HVAC program)
LAF	See Table 9.2.0	Leakage area factor for calculating CFM50 from a gap area (Reference 6)
ATF	See Table 9.2.0	Air transfer factor for converting airflow in ft ³ /min to BTU/hr
N _{winter}	See Table 9.3.0	Conversion factor for relating measured air leakage rate in ft ³ /min at reference pressure of 50 Pa to a natural infiltration in ft ³ /min (Reference 6,7)
N _{summer}	See Table 9.3.0	Conversion factor for relating measured air leakage rate in ft ³ /min at reference pressure of 50 Pa to a natural infiltration in ft ³ /min (Reference 6,7)
Gas Heating Eff	See Table 9.4.0	Heating efficiency determined based on customer's heating system type
Elec Heating Eff	See Table 9.4.0	Heating efficiency determined based on customer's heating system type
Cooling Eff	See Table 9.5.0	Heating efficiency determined based on customer's cooling system type

Customer Inputs

M&V Verified

Heating Type	Yes	Heating system type for the residence
Cooling Type	Yes	Cooling system type for the residence
Gap Length	Yes	Length of weatherstripping installed in ft
House Stories	Yes	Number of stories above grade for the home
Climate Zone	No	Climate zone where the customer is located (Front Range, Western Slope, Mountain, High Mountain)
Quantity of Doors Treated	Yes	Number of doors to be treated with weatherstripping

References:

See Deemed Tables

Changes from Recent Filing:

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DEEMED SAVINGS TECHNICAL ASSUMPTIONS

9.6 Cellular Shades

Algorithms

$$\text{Customer Dth} = A_{\text{window}} * [(\text{Therms per ft}^2)_{\text{base}} - (\text{Therms per ft}^2)_{\text{eff}}] * \frac{1}{10}$$

$$\text{Gross Annual kWh Saved at Customer} = A_{\text{window}} * [(\text{kWh per ft}^2)_{\text{base}} - (\text{kWh per ft}^2)_{\text{eff}}]$$

$$\text{Customer kW (Gross kW)} = A_{\text{window}} * [(\text{kW per ft}^2)_{\text{base}} - (\text{kW per ft}^2)_{\text{eff}}]$$

$$\text{Customer PckW} = \text{Customer kW} * CF$$

$$\text{Incremental Cost} = \text{Incremental Cost per ft}^2 * A_{\text{window}}$$

Variables

Dth to Therms Conversion	10	1 Dth = 10 Therms
Incremental Cost per ft ²	\$1.88	Insulation Rebates - Incremental cost per ft ² of cellular shades (Reference 15,16)
CF	100%	Percent of customer kW savings that will coincide with peak summer kW savings
Measure Lifetime	13.7	Average measure lifetime based on manufacturing testing protocols
(Therms per ft ²) _{base}	See Table 9.7.6	Therms per ft ² of roller shades
(Therms per ft ²) _{eff}	See Table 9.7.6	Therms per ft ² of cellular shades
(kWh per ft ²) _{base}	See Table 9.7.6	kWh per ft ² of roller shades
(kWh per ft ²) _{eff}	See Table 9.7.6	kWh per ft ² of cellular shades
(kW per ft ²) _{base}	See Table 9.7.6	kW per ft ² of roller shades
(kW per ft ²) _{eff}	See Table 9.7.6	kW per ft ² of cellular shades

Customer Inputs

M&V Verified

Heating Type	Yes	Heating system type for the residence
Cooling Type	Yes	Cooling system type for the residence
A _{window}	Yes	ft ² of window covered by cellular shades

Table 9.7.6

	(Therms per ft ²) _{base}	(Therms per ft ²) _{eff}	(kWh per ft ²) _{base}	(kWh per ft ²) _{eff}	(kW per ft ²) _{base}	(kW per ft ²) _{eff}
Central AC & Gas Heat	1.346	1.319	5.895	5.553	0.0053	0.0050
Central AC & Electric Resistance Heat	N/A	N/A	37.443	36.471	0.0053	0.0050

References:

See Deemed Tables

Changes from Recent Filing:

None

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

9.7 Storm Windows

Algorithms

$Customer\ Dth = Quantity * Storm\ Window\ Gas\ Savings$

$Gross\ Annual\ kWh\ Saved\ at\ Customer = Quantity * Storm\ Window\ Electric\ Savings$

Variables

Measure Lifetime	20	Deemed lifetime of measure in years (Reference 1)
CF	0%	Storm window coincidence factor in electrically heated homes
Customer Dth	See Table 9.8.7	Storm window savings in gas heated homes (Reference 17)
Customer kWh	See Table 9.8.7	Storm window savings in electrically heated homes (Reference 17)

Table 9.8.7	Storm Window Gas Savings / Window (Dth)	Storm Window Electric Savings / Window (kWh)
Storm Windows (Front Range - Denver)	1.7	395
Storm Windows (Western Slope - Grand Junction)	1.5	359
Storm Windows (Mountain - Eagle / Alamosa)	2.4	560
Storm Windows (High Mountain - Dillon / Leadville)	3.3	762

Customer Inputs

M&V Verified

Heating Type	Yes	Heating system type for the residence
Quantity	Yes	Quantity of storm windows installed
Climate Zone	No	Climate zone where the customer is located (Front Range, Western Slope, Mountain, High Mountain)
Incremental Cost	No	Incremental cost for storm windows provided by customer

References:

See Deemed Tables

Changes from Recent Filing:

Adjusted savings to be per window treated and requested number of treated windows as input.
 Added new Climate Zone for High Mountains

9.0 Envelope Deemed Tables

Table 9.1.0	Front Range	Western Slope	Mountain	High Mountain
HDD	6,016	5,580	9,015	10,333
CDD	1,116	1,452	434	90
Heating Hours	1,825	1,971	2,104	2,739
Cooling Hours	590	837	210	2

Table 9.2.0	Front Range	Western Slope	Mountain	High Mountain
LAF	0.0730	0.0736	0.0696	0.0671
ATF	0.891	0.906	0.813	0.753

Table 9.3.0.a N-Winter

Stories	Front Range	Western Slope	Mountain	High Mountain
1	14.328	16.021	15.138	15.049
2	11.282	12.405	11.520	11.458
3	9.713	10.577	9.730	9.680

Table 9.3.0.b N-Summer

Stories	Front Range	Western Slope	Mountain	High Mountain
1	19.313	18.405	18.321	18.619
2	16.449	15.969	14.762	14.485
3	14.932	14.712	12.890	12.383

Table 9.4.0	Gas Heating Eff	Elec Heating Eff
ASHP	N/A	2.26
GSHP	N/A	3.30
Electric Resistance	N/A	1.00
Natural Gas	0.78	N/A

Table 9.5.0	Cooling Eff
AC/ASHP	3.93
GSHP	4.13
Evap/None	0

References:

1. California Measurement Advisory Committee (CALMAC) Protocols, Appendix F (www.calmac.org/events/APX_F.pdf).
2. 2017 ASHRAE Fundamentals, Chapter 26, Table 1 - Thermal resistance values for building and insulating materials
3. 2017 ASHRAE Fundamentals, Chapter 26, Table 3 - Thermal resistance values of plane air spaces
4. 2017 ASHRAE Fundamentals, Chapter 26, Table 10 - Thermal resistance values for surface films
5. 2017 ASHRAE Fundamentals, Chapter 27, Example 3 - Thermal resistance values for 2x4 framing studs
6. 2017 ASHRAE Fundamentals, Chapter 16, Equation (41) - Defining equivalent air leakage area
7. 2017 ASHRAE Fundamentals, Chapter 16, Equation (48) - Defining airflow rate from infiltration.
8. 2017 ASHRAE Fundamentals; Chapter 16, Table 4 - Defining stack coefficient, C_s
9. 2017 ASHRAE Fundamentals; Chapter 16, Table 6 - Defining basic model wind coefficient, C_w
10. Door leakage estimate taken from Colorado Energy Office website - http://www.coloradoenergy.org/procorner/stuff/window_air_leakage.htm
11. Estimates for air density in Colorado based on altitude at airport - http://www.engineeringtoolbox.com/air-altitude-density-volume-d_195.html
12. Metzger CE, J Zhang, VV Mendon, and KA Cort. 2017. Modeling Cellular Shades in Energy Plus. PNNL-27187. For City of Santa Clara and Silicon Valley Power
13. Cort, KA, JA McIntosh, GP Sullivan, TA Ashley, CE Metzger, and N Fernandez. Testing the Performance and Dynamic Control of Energy-Efficient Cellular Shades in the PNNL Lab Homes. August 2018. PNNL-27663, <https://www.osti.gov/servlets/purl/1477792>
14. D&R International (2013). "Residential Windows and Window Coverings: A Detailed View of the Installed Base and User Behavior." https://www.energy.gov/sites/prod/files/2013/11/f5/residential_windows_coverings.pdf
15. AERC. 2018. Window Attachments: Efficiency Program Brief. https://aercnet.org/wp-content/uploads/2018/03/AERC_Utility_Briefing_Doc_27FEB18.pdf
16. Blinds.Com. 2019. Pricing information of Roller Shades. <https://www.blinds.com/c/roller-shades/45/?filters={}&width=36&height=60&pagesize=24&q=&sorts=Price%20Asc>
17. 2011 Program Evaluation by Cadmus Group. <https://www.xcelenergy.com/staticfiles/xcel/Regulatory/Regulatory%20PDFs/CO-DSM/2011-CO-Low-Income-Single-Family-Weatherization-Program-Evaluation.pdf>

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

10.1 Holistic

Customer may apply for any prescriptive electric or gas rebate while participating as an enrollee in a holistic program. The values shown on Forecast Summary represent the average project characteristics, as defined by past program participation for a given technology. The technical details for a given technology are defined in the technology's Technical Assumptions.

Variables

Lifetime	Based on individual prescriptive product
Coincidence Factor	Based on individual prescriptive product
O&M Savings	Based on individual prescriptive product
Energy and Demand Savings	Based on individual prescriptive product

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

11.1 Home Lighting

Algorithms

$kW \text{ Savings per Bulb} = (\text{Baseline Wattage} - \text{LED Wattage})/1000$

$\text{Customer kWh} = \text{Number of Bulbs} \times kW \text{ Savings per Bulb} \times \text{Hours}$

$\text{Customer kW} = \text{Number of Bulbs} \times kW \text{ Savings per Bulb}$

$\text{Customer kWhNightlight} = \text{Customer kWh} \times \text{WHFe}$

$\text{Peak Coincident kW} = \text{Customer kW} \times \text{Coincident Factor}$

Variables

Number of Bulbs	Vendor Input	Quantity of bulbs sold.
Baseline Wattage	Tables 11.1.1- 11.1.5	Baseline wattages are determined using an adjusted ENERGY STAR lumen equivalency rating, adjusted for EISA requirements based on lumen output. Direct install measures use removed wattage. Linear lamps based on past participation ^{1,2}
LED Wattage	Table 11.1.6	Wattage of the LED bulb.
Lifetime Hours	Table 11.1.7	Lifetime Hours for LEDs. ³
Hours	Table 11.1.8	Annual hours of operation for the bulbs for both residential and non-residential segments. ^{3,4,8,9}
Coincident Factor	Table 11.1.8	Probability that peak demand of the bulb will coincide with peak utility system demand. ^{3,4,8}
Measure Life	Table 11.1.8	Measure life of the average bulb sold, determined by lifetime hours divided by hours of use by segment.
Incremental Cost of Bulbs	Table 11.1.9	Cost difference between baseline and efficient bulb options. ^{6,7}
Labor Costs	Table 11.1.10	Cost of labor to install fixtures, Type B, and Type C lamps. ¹⁵
NTG	Table 11.1.11	Net-to-gross factor. ^{9,10,17}
Installation Rate	99%	Future savings for bulbs purchased and put in storage and installed in later years. The net present value of the saving for all bulbs purchased is 100% if all bulbs are installed when purchased. ⁸
Non-Energy O&M savings	\$0.00	Non-Energy operation and maintenance savings are assumed to be zero.
WHFe	1.06	Waste heat factor for energy to account for cooling savings from efficient lighting (listed here for a Single Family Home) ¹⁸

Provided by product Vendor:	Program	M&V Verified
Quantity and type of bulbs purchased	Home Lighting	Yes
Quantity and type of bulbs installed	All other programs	Yes

Assumptions:

The baseline bulb cost and LED bulb cost will be tracked and updated at the end of the year in the status report to account for the rapid evolving market and cost for LED bulbs. The baseline will be reviewed and updated at least semi-annually and the LED bulb cost will be reviewed and updated monthly.

Specialty bulbs on the forecast include Specialty, R, BR, and ER Bulbs, 3-way Bulbs as well as PAR, MR, and MRX Bulbs

Assume all sales made through the pro-desk will be to small business customers

If the formula below for the PAR, MR and MRX Lamp baseline equivalent results in a negative or undefined value, the manufacturer recommendation is used.

Table 11.1.1: GSL Bulbs¹

Minimum Lumens	Maximum Lumens	Incandescent Equivalent Wattage	
		Baseline (Exempt Bulbs)	Baseline (Post-EISA)
2,000	2,600	150	72
1,600	1,999	100	72
1,100	1,599	75	53
800	1,099	60	43
450	799	40	29
310	449	25	25

¹GSL bulbs are medium screw-base bulbs that are not globe, bullet, candle, flood, reflector, or decorative shaped

Table 11.1.2: Specialty Bulbs¹

Lumen Bins		Globe Shape		Incandescent Equivalent Wattage	
Decorative Shape				Baseline	Baseline
		1100	1300	150	72
		650	1099	100	72
		575	649	75	53
500	699	500	574	60	43
300	499	350	499	40	29
150	299	250	349	25	25
90	149			15	15
70	89			10	10

¹Specialty bulbs are medium screw-base bulbs that are globe, bullet, candle or decorative shaped

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

R, BR, and ER Bulbs ^{1,2}

Table 11.1.3: EISA Impacted ^{1,2,14}

Bulb Type	Lower Lumen Range	Upper Lumen Range	Watts _{Base}
R, ER, BR with medium screw bases w/diameter >2.25" (*see exceptions below)	420	472	40
	473	524	45
	525	714	50
	715	937	65
	938	1,259	75
	1,260	1,399	90
	1,400	1,739	100
	1,740	2,174	120
	2,175	2,624	150
	2,625	2,999	175
	3,000	4,500	200
	400	449	40
*R, BR, and ER with medium screw bases w/diameter <=2.25"	450	499	45
	500	649	50
	650	1,199	65
*ER30, BR30, BR40, or ER40	400	449	40
	450	499	45
	500	649	50
*BR30, BR40, or ER40	650	1,419	65
*R20	400	449	40
*LED Fixtures	450	719	45
	420	560	45
	561	837	60
	838	1,203	75
	1,204	1,681	100
	1,682	2,339	120
*All reflector lamps below lumen ranges specified above	2,340	3,075	150
	200	299	20
	300	399	30

PAR, MR, MRX Bulbs

The following equation is used to determine the baseline wattage for these bulbs, result should be rounded down to the nearest wattage in Table 4.

$$Watts_{base} = 375.1 - 4.355(D) - \sqrt{227,800 - 937.9(D) - 0.9903(D^2)} - 1479(BA) - 12.02(D * BA) + 14.69(BA^2) - 16,720 * \ln(CBCP)$$

D = Bulb Diameter
 BA = Beam Angle
 CBCP = Center Beam Candle Power

Table 11.1.4: PAR, MR, MRX Bulbs - Energy Star Permitted Wattages ^{1,2}

Diameter	Permitted Wattages
16	20, 35, 40, 45, 50, 60, 75
20	50
30S	40, 45, 50, 60, 75
30L	50, 75
38	40, 45, 50, 55, 60, 65, 75, 85, 90, 100, 120, 150, 250

Table 11.1.5: Linear Lamps ¹¹

	Watts
Baseline	29.62

Table 11.1.6: Proposed Wattage ¹⁸

Program	Wattage
Income Qualified Single Family Weatherization	9
All other programs	Manufacturer Defined

Table 11.1.7: Lifetime Hours ⁵

Bulb Category
A-Line
Reflectors
Globe/Decorative
3-Way
Fixtures (Retrofit kits)
Linear Lamps

Table 11.1.8: Hours, CF, Measure Lifetime ^{3,4,8,13,19}

Bulb Category	Installation Type	Hours	CF	% Breakdown	Measure Lifetime	Lifetime (Hours)
A-Line	Residential	986	12.6%	94%	18.2	17,922
Reflectors					1.5	20,316
Globe/Decorative					1.5	15,171
3-Way					17.2	16,998
Fixtures (Retrofit kits)					20.0	43,080
Linear Lamps					24%	20.0
Nightlights	4,380	0.0%	100%	1.1	35,040	
A-Line	Non-Residential	4,897	75.3%	6%	3.7	17,922
Reflectors					1.1	20,316
Globe/Decorative					1.1	15,171
3-Way					3.5	16,998
Fixtures (Retrofit kits)					8.8	43,080
Linear Lamps					76%	8.9

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Table 11.1.9: Average Costs* ^{6, 7, 12, 15, 20}

Bulb Type	Incremental Cost
A-Line Residential and Business	\$1.48
Fixtures (Retrofit kits) Residential and Business	\$6.50
Reflectors Residential and Business	\$1.72
Globe/Decorative Residential and Business	\$2.50
3-Way Residential and Business	\$5.00
Linear Lamps Residential	\$7.50
Linear Lamps Business	\$7.50
Home Lighting Nightlight	\$1.89
Multifamily Buildings LED Globe	\$5.00
Multifamily Buildings LED A19 EnergyStar Rated Lamp	\$5.00
Multifamily Buildings LED Candelabra	\$5.00
Multifamily Buildings LED BR30 Flood	\$5.00
Multifamily Buildings LED MR16 Reflector	\$5.00
Multifamily Buildings LED PAR30	\$5.50
School Education Kits 9W LED	\$3.19
School Education Kits 11W LED	\$4.81
School Education Kits 8W Reflector	\$2.65
School Education Kits 5W Candelabra	\$2.65
School Education Kits 0.3W Nightlight	\$1.40
Home Energy Squad LEDs	\$2.65
Energy Savings Kits 9W A-Line - qty (8)	\$7.12
Energy Savings Kits 11W A-Line - qty (8)	\$10.36
Energy Savings Kits 5W Candelabra - qty (4)	\$5.99
Energy Savings Kits 8W Reflector - qty (4)	\$7.96
Energy Savings Kits 0.5W Nightlight - qty (1)	\$1.89
Income Qualified Single Family Weatherization A-Line - Give Away Bulb	\$0.87
Income Qualified Single Family Weatherization A-Line	\$5.00
Income Qualified Single Family Weatherization Specialty	\$8.00
Income Qualified Single Family Weatherization 0.5W Nightlight	\$1.89

Costs are provided by the vendor and are re-evaluated throughout the year to account for the rapidly evolving market.

Table 11.1.10: Labor Costs* ¹⁵

Bulb Category	Labor Cost
LED Linear Lamps - Type B	\$8.00
LED Linear Lamps - Type C	\$12.00
LED PL Lamp - Type B	\$12.00
LED Mogul Based HID Replacement	\$55.00

Costs are provided by program vendors and are re-evaluated throughout the year to account for the rapidly evolving market.

Table 11.1.11: NTG Values* ^{9,10,17}

Bulb Category	Program Year 2023
LED Bulb - A-Line	44.7%
LED Bulb - Fixtures (Retrofit Kits)	78.0%
LED Bulb - Reflectors	41.5%
LED Bulb - Globe/Decorative	89.6%
LED Bulb - 3-Way	100.0%
LED Tubes (Linear Lamps)	78.0%

References:

1. The Uniform Methods Project: Residential Lighting Evaluation Protocol, published April 2013. Page 11.
2. State of Illinois Energy Efficiency Technical Reference Manual Final Technical Version as of February 8th, 2017, effective January 1st, 2018. Vol 3, Pages 244-245.
3. Northeast Residential Lighting Hours-of-Use Study, Pages XVI and 37
4. "Lighting - Small Business" participation data from 3/1/2017 through 2018.
5. Lifetime hours from program administrator for bulbs sold in 2019 used to calculate weighted lifetimes.
6. 2018 CO Home Lighting Product Results compiled by WECC (program administrator).
7. Market survey 2018 (homedepot.com, lowes.com, samsclub.com, target.com, walmart.com, etc)
8. 2016 CO Home Lighting and Recycling Evaluation by Cadmus, 2016. Pages 35, 72-73.
9. 2018 CO Home Lighting and Recycling Evaluation by EMI Consulting, Dec 12 2018. Page 5.
10. 2019 Unopposed Comprehensive Settlement Agreement
11. Estimated values based on ranges provided by Slipstream and historical participation in "CO Lighting Efficiency" product
12. 2019 CO Home Lighting Product Results compiled by program administrator.
13. DOE 2015 US Lighting Market Characterization.
14. MN Technical Reference Manual Version 3.0 Page 26.
15. "Lighting Efficiency - CO" and "Lighting - Small Business" participation data from 2017 through 2019.
16. Colorado House Bill 2019-1231
17. 2021 CO home Lighting and Recycling Evaluation by TRC and Apex Analytics, Jan 25 2022. Page 5
18. Income Qualified Single Family Weatherization (IQ SFW-CO) Program Implimentor - Data on Installed bulbs during the 2021 Program Year
19. State of Illinois Energy Efficiency Technical Reference Manual Final Technical Version 10.0 as of September 24th, 2021, effective January 1st, 2022. Vol 3, Pages 310-313.
20. Submittal Data Provided from the the School Education Kits Program (SEK-CO) Implimentor and the Energy Savings Kits Program Implimentor (ESK-CO)

Changes from Recent Filing:

1. Added in Deemed Proposed Wattage For Aline Bulbs in the Income Qualified Single Family Weatherization - CO (IQ SFW-CO) Program

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

12.1 DX Units

Algorithms

$$\text{Customer kWh} = \text{Size} \times \text{EFLH} \times \left(\frac{12}{\text{SEER}_{\text{Baseline}}} - \frac{12}{\text{SEER}_{\text{Eff}}} \right) \times \text{Qty}$$

$$\text{Customer kW} = \text{Size} \times \left(\frac{12}{\text{EER}_{\text{Baseline}}} - \frac{12}{\text{EER}_{\text{Eff}}} \right) \times \text{Qty}$$

$$\text{Customer PC kW} = \text{CF} \times \text{Size} \times \left(\frac{12}{\text{EER}_{\text{Baseline}}} - \frac{12}{\text{EER}_{\text{Eff}}} \right) \times \text{Qty}$$

$$\text{EER} = \text{SEER} \times 0.85$$

$$\text{Incremental Cost} = \text{Size} \times \text{Incremental Cost per Ton}$$

Variables

EFLH	See Table 12.0.2	Equivalent Full Load Hours. The equivalent number of hours that the equipment would be running at full load over the course of the year.
SEER _{Baseline} / IEER _{Baseline}	See Table 12.0.1	Deemed Baseline Efficiencies based on IECC 2018
EER _{Baseline}	See Table 12.0.1	Deemed Baseline Efficiencies based on IECC 2018
CF	90%	Coincidence Factor (Reference 1)
Incremental Costs Per Ton	See Table 12.0.3	Incremental Costs Per Ton.
NTG Midstream	92%	Net-to-gross = We will use 92% for all midstream cooling equipment (Reference 4).
SEER to EER conversion factor	0.85	SEER to EER conversion factor
Lifetime, years	20	Reference 11

Customer Inputs

M&V Verified

SEER _{Eff} / IEER _{Eff}	Yes	Seasonal (or Integrated) Energy Efficiency Ratio in Btu/W-hr of high efficiency equipment that the customer will install.
EER _{Eff}	Yes	EER of high efficiency equipment that the customer will install.
Size	Yes	The equipment capacity in tons.
Building Type / Market Segment	Yes	
County/Zone	Yes	
System Type	Yes	
Quantity Proposed Equipment (Qty)	Yes	

References:

1. NYSERDA (New York State Energy Research and Development Authority); NY Energy \$mart Programs Deemed Savings Database - Source for coincidence factor
2. ASHRAE, 2011, Applications Handbook, Ch. 37, table 4, Comparison of Service Life Estimates
3. CBECs (Commercial Buildings Energy Consumption Survey), 2012 - Total Floor space of Cooled Buildings by Principal Building Activity - source of market segment distributions
4. NTG for cooling is updated through a 2017 program evaluation.
5. Cypress, Ltd. Analysis of office building load profile and RTU efficiency improvement from application of wet bulb depression to reduce air cooled condensing temperatures.
6. International Energy Conservation Code 2018
7. Building America, Research Benchmark Definitions, 2010 (see p. 10). <http://www.nrel.gov/docs/fy10osti/47246.pdf>
8. Midstream Product Data Analysis by Product Management Vendor
9. California DEER Database 2008
10. Incremental costs for MSHPs were determined from the NEEP Incremental Cost Study Phase 2 Report
11. Equipment life is from Minnesota Technical Reference Manual (TRM) version 3.1 Jan 20, 2020.
12. 2017-2019 CO Cooling Program Participation Data, used for forecasts, minimum qualifying efficiencies

Changes from Recent Filing:

EFLH and Building Type/Market Segment updated

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

12.2 WSHP

Algorithms

$$WSHP_{Cooling} kWh = Size \times EFLH \times \left(\frac{12}{SEER_{Baseline}} - \frac{12}{SEER_{Eff}} \right)$$

$$WSHP_{Heating} kWh = Size_{Heat} \times EFLH_{Heat} \times \left(\frac{1}{COP_{Baseline} \times 3412} - \frac{1}{COP_{Eff} \times 3412} \right)$$

$$Customer kWh = (WSHP_{Cooling} kWh + WSHP_{Heating} kWh) \times Qty$$

$$Customer kW = Size \times \left(\frac{12}{EER_{Baseline}} - \frac{12}{EER_{Eff}} \right) \times Qty$$

$$Customer PC kW = CF \times Size \times \left(\frac{12}{EER_{Baseline}} - \frac{12}{EER_{Eff}} \right) \times Qty$$

$$EER = SEER$$

$$Incremental Cost = Size \times Incremental Cost per Ton$$

Variables

EFLH	See Table 12.0.2	Equivalent Full Load Hours. The equivalent number of hours that the equipment would be running at full load over the course of the year.
EFLH _{Heat}	See Table 12.0.2	The equivalent number of hours that WSHP equipment would be running at Full Load over the course of the year for heating.
SEER _{Baseline} / IEER _{Baseline}	See Table 12.0.1	Deemed Baseline Efficiencies based on IECC 2018
EER _{Baseline}	See Table 12.0.1	Deemed Baseline Efficiencies based on IECC 2018
CF	90%	Coincidence Factor (Reference 1)
Lifetime, years	15	Reference 11
3412	3,412	kWh to BTU conversion factor
NTG Midstream	92%	Net-to-gross = We will use 92% for all midstream cooling equipment (Reference 4).
Incremental Costs Per Ton	See Table 12.0.3	Incremental Costs Per Ton.
COP _{Baseline}	4.30	COP of standard Water Source Heat Pump equipment in Heating Mode for Water:Air Water Loop from the International Energy Conservation Code, 2018, Table 403.3.2(2).

Customer Inputs

M&V Verified

SEER _{Eff}	Yes	SEER of high efficiency equipment that the customer will install.
EER _{Eff}	Yes	EER of high efficiency equipment that the customer will install.
COP _{Eff}	Yes	COP of High Efficiency unit that the customer will install.
Size	Yes	The equipment capacity in tons.
Size _{Heat}	Yes	Heating Capacity of Water Source Heat Pumps in BTU/h, provided by customer
Building Type / Market Segment	Yes	
County/Zone	Yes	
System Type	Yes	
Quantity Proposed Equipment (Qty)	Yes	

References:

1. NYSERDA (New York State Energy Research and Development Authority); NY Energy Smart Programs Deemed Savings Database - Source for coincidence factor
2. ASHRAE, 2011, Applications Handbook, Ch. 37, table 4, Comparison of Service Life Estimates
3. CBECs (Commercial Buildings Energy Consumption Survey), 2012 - Total Floor space of Cooled Buildings by Principal Building Activity - source of market segment
4. NTG for cooling is updated through a 2017 program evaluation.
5. Cypress, Ltd. Analysis of office building load profile and RTU efficiency improvement from application of wet bulb depression to reduce air cooled condensing
6. International Energy Conservation Code 2018
7. Building America, Research Benchmark Definitions, 2010 (see p. 10). <http://www.nrel.gov/docs/fy10osti/47246.pdf>
8. Midstream Product Data Analysis by Product Management Vendor
9. California DEER Database 2008
10. Incremental costs for MSHPs were determined from the NEEP Incremental Cost Study Phase 2 Report
11. Equipment life is from Minnesota Technical Reference Manual (TRM) version 3.1 Jan 20, 2020.

Changes from Recent Filing:

EFLH and Building Type/Market Segment updated

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

12.3 PTAC

Algorithms

$$\text{Customer kWh} = \text{Size} \times \text{EFLH} \times \left(\frac{12}{\text{SEER}_{\text{Baseline}}} - \frac{12}{\text{SEER}_{\text{Eff}}} \right) \times \text{Qty}$$

$$\text{Customer kW} = \text{Size} \times \left(\frac{12}{\text{EER}_{\text{Baseline}}} - \frac{12}{\text{EER}_{\text{Eff}}} \right) \times \text{Qty}$$

$$\text{Customer PC kW} = \text{CF} \times \text{Size} \times \left(\frac{12}{\text{EER}_{\text{Baseline}}} - \frac{12}{\text{EER}_{\text{Eff}}} \right) \times \text{Qty}$$

$$\text{EER} = \text{SEER} \times 0.85$$

$$\text{Incremental Cost} = \text{Size} \times \text{Incremental Cost per Ton}$$

Variables

EFLH	See Table 12.0.2	Equivalent Full Load Hours. The equivalent number of hours that the equipment would be running at full load over the course of the year.
SEER _{Baseline} / IEER _{Baseline}	See Table 12.0.1	Deemed Baseline Efficiencies based on IECC 2018
EER _{Baseline}	See Table 12.0.1	Deemed Baseline Efficiencies based on IECC 2018
CF	90%	Coincidence Factor (Reference 1)
Incremental Costs Per Ton	See Table 12.0.3	Incremental Costs Per Ton.
NTG Midstream	92%	Net-to-gross = We will use 92% for all midstream cooling equipment (Reference 4).
SEER to EER conversion factor	0.85	SEER to EER conversion factor
Lifetime, years	20	Reference 11

Customer Inputs

M&V Verified

SEER _{Eff} / IEER _{Eff}	Yes	Seasonal (or Integrated) Energy Efficiency Ratio in Btu/W-hr of high efficiency equipment that the customer will install.
EER _{Eff}	Yes	EER of high efficiency equipment that the customer will install.
Size	Yes	The equipment capacity in tons.
Building Type / Market Segment	Yes	
County/Zone	Yes	
System Type	Yes	
Quantity Proposed Equipment (Qty)	Yes	

References:

1. NYSERDA (New York State Energy Research and Development Authority); NY Energy \$mart Programs Deemed Savings Database - Source for coincidence factor
2. ASHRAE, 2011, Applications Handbook, Ch. 37, table 4, Comparison of Service Life Estimates
3. CBECs (Commercial Buildings Energy Consumption Survey), 2012 - Total Floor space of Cooled Buildings by Principal Building Activity - source of market segment
4. NTG for cooling is updated through a 2017 program evaluation.
5. Cypress, Ltd. Analysis of office building load profile and RTU efficiency improvement from application of wet bulb depression to reduce air cooled condensing
6. International Energy Conservation Code 2018
7. Building America, Research Benchmark Definitions, 2010 (see p. 10). <http://www.nrel.gov/docs/fy10osti/47246.pdf>
8. Midstream Product Data Analysis by Product Management Vendor
9. California DEER Database 2008
10. Incremental costs for MSHPs were determined from the NEEP Incremental Cost Study Phase 2 Report
11. Equipment life is from Minnesota Technical Reference Manual (TRM) version 3.1 Jan 20, 2020.

Changes from Recent Filing:

EFLH and Building Type/Market Segment updated

12.4 Scroll-Screw Chiller

Algorithms

$$Customer\ kWh = Size \times EFLH \times (IPLV_{Baseline} - IPLV_{Eff}) \times Qty$$

$$Customer\ kW = Size \times (FLV_{Baseline} - FLV_{Eff}) \times Qty$$

$$Customer\ PckW = CF \times Size \times (FLV_{Baseline} - FLV_{Eff}) \times Qty$$

$$Incremental\ Cost = Size \times Incremental\ Cost\ per\ Ton$$

Variables

EFLH	See Table 12.0.2	Equivalent Full Load Hours. The equivalent number of hours that the equipment would be running at full load over the course of the year.
FLV _{Baseline}	See Table 12.0.1	Deemed Baseline Efficiencies based on IECC 2018
IPLV _{Baseline}	See Table 12.0.1	Deemed Baseline Efficiencies based on IECC 2018
CF	90%	Coincidence Factor (Reference 1)
Incremental Costs Per Ton	See Table 12.0.3	Incremental Costs Per Ton.
NTG_General_Cooling	92%	Net-to-gross = We will use 92% for all cooling equipment except MSHP units (Reference 4).
Lifetime, years	20	Reference 11

Customer Inputs

M&V Verified

FLV _{Eff}	Yes	Full Load Value cooling efficiency in kW/ton, representing the efficiency at design conditions for the customer's operating conditions.
IPLV _{Eff}	Yes	Integrated Part Load Value (representing the average efficiency over a range of loaded states) cooling efficiency in kW/ton of high efficiency equipment at the customer's operating conditions.
Size	Yes	The equipment capacity in tons.
Building Type / Market Segment	Yes	
County/Zone	Yes	
System Type	Yes	
Quantity Proposed Equipment (Qty)	Yes	
Air or Waterside Economizer	Yes	Check if the chiller is equipped with or without an Airside/Waterside Economizer

References:

1. NYSERDA (New York State Energy Research and Development Authority); NY Energy Smart Programs Deemed Savings Database - Source for coincidence factor
2. ASHRAE, 2011, Applications Handbook, Ch. 37, table 4, Comparison of Service Life Estimates
3. CBECS (Commercial Buildings Energy Consumption Survey), 2012 - Total Floor space of Cooled Buildings by Principal Building Activity - source of market segment distributions
4. NTG for cooling is updated through a 2017 program evaluation.
5. Cypress, Ltd. Analysis of office building load profile and RTU efficiency improvement from application of wet bulb depression to reduce air cooled condensing temperatures.
6. International Energy Conservation Code 2018
7. Building America, Research Benchmark Definitions, 2010 (see p. 10). <http://www.nrel.gov/docs/fy10osti/47246.pdf>
8. Midstream Product Data Analysis by Product Management Vendor
9. California DEER Database 2008
10. Incremental costs for MSHPs were determined from the NEEP Incremental Cost Study Phase 2 Report
11. Equipment life is from Minnesota Technical Reference Manual (TRM) version 3.1 Jan 20, 2020.

Changes from Recent Filing:

EFLH and Building Type/Market Segment updated

12.5 Centrifugal Chillers

Algorithms

$$\text{Customer kWh} = \text{Size} \times \text{EFLH} \times (\text{IPLV}_{\text{AHRI,Adj}} - \text{IPLV}_{\text{Eff}}) \times \text{Qty}$$

$$\text{Customer kW} = \text{Size} \times (\text{FLV}_{\text{AHRI,Adj}} - \text{FLV}_{\text{Eff}}) \times \text{Qty}$$

$$\text{Customer PckW} = \text{CF} \times \text{Size} \times (\text{FLV}_{\text{AHRI,Adj}} - \text{FLV}_{\text{Eff}}) \times \text{Qty}$$

$$\text{IPLV}_{\text{AHRI,Adj}} = \text{IPLV}_{\text{AHRI}} \div K_{\text{adj}}$$

$$\text{FLV}_{\text{AHRI,Adj}} = \text{FLV}_{\text{AHRI}} \div K_{\text{adj}}$$

$$K_{\text{adj}} = A \times B$$

$$A = 0.0000014592 \times (\text{Lift})^4 - 0.0000346496 \times (\text{Lift})^3 + 0.00314196 \times (\text{Lift})^2 - 0.147199 \times (\text{Lift}) + 3.9302$$

$$B = 0.0015 \times \text{Lv}_{\text{Evap}} + 0.934$$

$$\text{Lift} = \text{Lv}_{\text{Cond}} - \text{Lv}_{\text{Evap}}$$

$$\text{Minimum Qualifying FLV} = \text{FLV}_{\text{AHRI,Adj}} - \text{Qualifying FLV}_{\text{Offset}}$$

$$\text{Minimum Qualifying IPLV} = \text{IPLV}_{\text{AHRI,Adj}} - \text{Qualifying IPLV}_{\text{Offset}}$$

$$\text{Incremental Cost} = \text{Size} \times \text{Incremental Cost per Ton}$$

Variables

EFLH	See Table 12.0.2	Equivalent Full Load Hours. The equivalent number of hours that the equipment would be running at full load over the course of the year.
FLV _{AHRI}	See Table 12.0.1	Full load cooling efficiency in kW/ton of standard equipment, based upon the minimum acceptable efficiency defined by International Energy Conservation Code, 2018, Table 403.2.3(7) for selected centrifugal chiller type, size, condensing and chilled water temperature (provided by customer).
IPLV _{AHRI}	See Table 12.0.1	Integrated Part Load Value (representing the average efficiency over a range of loaded states) cooling efficiency in kW/ton of standard equipment, based upon the minimum acceptable efficiency defined by International Energy Conservation Code, 2018 for chiller type and size (type and size provided by customer).
FLV _{AHRI,Adj}		IECC based FLV for water cooled centrifugal chillers adjusted to actual site rated conditions (provided by customer) per IECC 2018 code adjustment formulas.
IPLV _{AHRI,Adj}		IECC based IPLV or NPLV for water cooled centrifugal chillers adjusted to actual site rated conditions (provided by customer) per IECC 2018 code adjustment formulas.
Lifetime, years	20	Reference 11
0.0000014592, 0.0000346496, 0.00314196, 0.147199, 3.9302, 0.0015, 0.934		Coefficients to calculate K _{adj} (adjustment factor) per IECC 2018 code adjustment formulas
NTG_General_Cooling	92%	Net-to-gross = We will use 92% for all cooling equipment except MSHP units (Reference 4).
Incremental Costs Per Ton	See Table 12.0.3	Incremental Costs Per Ton.
CF	90%	Coincidence Factor (Reference 1)

Customer Inputs

M&V Verified

FLV _{Eff}	Yes	Full Load Value cooling efficiency in kW/ton, representing the efficiency at design conditions for the customer's operating conditions.
IPLV _{Eff}	Yes	Integrated Part Load Value (representing the average efficiency over a range of loaded states) cooling efficiency in kW/ton of high efficiency equipment at the customer's operating conditions.
Lv _{Evap} (Chilled water supply temperature [°F] at full load)	Yes	The full load water temperature leaving the evaporator, in °F.
Lv _{Cond} (Condenser water leaving temperature [°F] at full load)	Yes	The full load water temperature leaving the condenser, in °F.
Size	Yes	The equipment capacity in tons.
Building Type / Market Segment	Yes	
County/Zone	Yes	
System Type	Yes	
Quantity Proposed Equipment (Qty)	Yes	
Chill water flow [gpm/ton] at full load	Yes	
Condenser water flow [gpm/ton] at full load	Yes	

References:

1. NYSERDA (New York State Energy Research and Development Authority); NY Energy Smart Programs Deemed Savings Database - Source for coincidence factor
2. ASHRAE, 2011, Applications Handbook, Ch. 37, table 4, Comparison of Service Life Estimates
3. CBECs (Commercial Buildings Energy Consumption Survey), 2012 - Total Floor space of Cooled Buildings by Principal Building Activity - source of market segment distributions
4. NTG for cooling is updated through a 2017 program evaluation.
5. Cypress, Ltd. Analysis of office building load profile and RTU efficiency improvement from application of wet bulb depression to reduce air cooled condensing temperatures.
6. International Energy Conservation Code 2018
7. Building America, Research Benchmark Definitions, 2010 (see p. 10). <http://www.nrel.gov/docs/fy10osti/47246.pdf>
8. Midstream Product Data Analysis by Product Management Vendor
9. California DEER Database 2008
10. Incremental costs for MSHPs were determined from the NEEP Incremental Cost Study Phase 2 Report
11. Equipment life is from Minnesota Technical Reference Manual (TRM) version 3.1 Jan 20, 2020.

Changes from Recent Filing:

EFLH and Building Type/Market Segment updated

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

12.6 Air-Cooled Chillers

Algorithms

$$\text{Customer kWh} = \text{Size} \times \text{EFLH} \times \left(\frac{12}{\text{SEER}_{\text{Baseline}}} - \frac{12}{\text{SEER}_{\text{Eff}}} \right) \times \text{Qty}$$

$$\text{Customer kW} = \text{Size} \times \left(\frac{12}{\text{EER}_{\text{Baseline}}} - \frac{12}{\text{EER}_{\text{Eff}}} \right) \times \text{Qty}$$

$$\text{Customer PC kW} = \text{CF} \times \text{Size} \times \left(\frac{12}{\text{EER}_{\text{Baseline}}} - \frac{12}{\text{EER}_{\text{Eff}}} \right) \times \text{Qty}$$

$$\text{EER} = \text{SEER} \times 0.85$$

$$\text{Incremental Cost} = \text{Size} \times \text{Incremental Cost per Ton}$$

Variables

EFLH	See Table 12.0.2	Equivalent Full Load Hours. The equivalent number of hours that the equipment would be running at full load over the course of the year.
SEER _{Baseline} / IEER _{Baseline}	See Table 12.0.1	Deemed Baseline Efficiencies based on IECC 2018
EER _{Baseline}	See Table 12.0.1	Deemed Baseline Efficiencies based on IECC 2018
CF	90%	Coincidence Factor (Reference 1)
Incremental Costs Per Ton	See Table 12.0.3	Incremental Costs Per Ton.
NTG_General_Cooling	92%	Net-to-gross = We will use 92% for all cooling equipment except MSHP units (Reference 4).
SEER to EER conversion factor	0.85	SEER to EER conversion factor
Lifetime, years	20	Reference 11

Customer Inputs

M&V Verified

SEER _{Eff} / IEER _{Eff}	Yes	Seasonal (or Integrated) Energy Efficiency Ratio in Btu/W-hr of high efficiency equipment that the customer will install.
EER _{Eff}	Yes	EER of high efficiency equipment that the customer will install.
Size	Yes	The equipment capacity in tons.
Building Type / Market Segment	Yes	
County/Zone	Yes	
System Type	Yes	
Quantity Proposed Equipment (Qty)	Yes	

References:

1. NYSERDA (New York State Energy Research and Development Authority); NY Energy Smart Programs Deemed Savings Database - Source for coincidence factor
2. ASHRAE, 2011, Applications Handbook, Ch. 37, table 4, Comparison of Service Life Estimates
3. CBECs (Commercial Buildings Energy Consumption Survey), 2012 - Total Floor space of Cooled Buildings by Principal Building Activity - source of market segment
4. NTG for cooling is updated through a 2017 program evaluation.
5. Cypress, Ltd. Analysis of office building load profile and RTU efficiency improvement from application of wet bulb depression to reduce air cooled condensing
6. International Energy Conservation Code 2018
7. Building America, Research Benchmark Definitions, 2010 (see p. 10). <http://www.nrel.gov/docs/fy10osti/47246.pdf>
8. Midstream Product Data Analysis by Product Management Vendor
9. California DEER Database 2008
10. Incremental costs for MSHPs were determined from the NEEP Incremental Cost Study Phase 2 Report
11. Equipment life is from Minnesota Technical Reference Manual (TRM) version 3.1 Jan 20, 2020.

Changes from Recent Filing:

EFLH and Building Type/Market Segment updated

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

12.7 VFD Chill Retrofit

Algorithms

$$Customer\ kWh = Size \times EFLH \times (IPLV_{VFD\ Baseline} - IPLV_{VFD\ Eff}) \times Qty$$

$$Customer\ kW = Size \times (FLV_{VFD\ Baseline} - FLV_{VFD\ Eff}) \times Qty$$

$$Customer\ PCKW = CF \times Size \times (FLV_{VFD\ Baseline} - FLV_{VFD\ Eff}) \times Qty$$

$$Incremental\ Cost = Size \times Incremental\ Cost\ per\ Ton$$

Variables

EFLH	See Table 12.0.2	Equivalent Full Load Hours. The equivalent number of hours that the equipment would be running at full load over the course of the year.
Incremental Costs Per Ton	See Table 12.0.3	Incremental Costs Per Ton.
NTG_General_Cooling	92%	Net-to-gross = We will use 92% for all cooling equipment except MSHP units (Reference 4).
Lifetime, years	15	Equal to the value used in the Motors and Drives program for VFDs.

Customer Inputs

M&V Verified

FLV _{VFD^{Baseline}} [Chiller Full Load efficiency without VFD]	Yes	Full Load Value cooling efficiency in kW/ton, representing the efficiency of existing chiller without a VFD at 95% load.
FLV _{VFD^{Eff}} [Chiller Full Load efficiency with VFD]	Yes	Full Load Value cooling efficiency in kW/ton, representing the efficiency of existing chiller with a VFD at 95% load.
IPLV _{VFD^{Baseline}} [Chiller Part Load efficiency without VFD]	Yes	Integrated Part Load Value (representing the average efficiency over a range of loaded states) cooling efficiency in kW/ton of existing chiller without a VFD.
IPLV _{VFD^{Eff}} [Chiller Part Load Efficiency with VFD]	Yes	Integrated Part Load Value (representing the average efficiency over a range of loaded states) cooling efficiency in kW/ton of existing chiller with a VFD.
Size	Yes	The equipment capacity in tons.
Building Type / Market Segment	Yes	
County/Zone	Yes	
System Type	Yes	
Quantity of same size Chillers with VFD Retrofit (Qty)	Yes	

References:

1. NYSERDA (New York State Energy Research and Development Authority); NY Energy Smart Programs Deemed Savings Database - Source for coincidence factor
2. ASHRAE, 2011, Applications Handbook, Ch. 37, table 4, Comparison of Service Life Estimates
3. CBECs (Commercial Buildings Energy Consumption Survey), 2012 - Total Floor space of Cooled Buildings by Principal Building Activity - source of market segment distributions
4. NTG for cooling is updated through a 2017 program evaluation.
5. Cypress, Ltd. Analysis of office building load profile and RTU efficiency improvement from application of wet bulb depression to reduce air cooled condensing temperatures.
6. International Energy Conservation Code 2018
7. Building America, Research Benchmark Definitions, 2010 (see p. 10). <http://www.nrel.gov/docs/fy10osti/47246.pdf>
8. Midstream Product Data Analysis by Product Management Vendor
9. California DEER Database 2008
10. Incremental costs for MSHPs were determined from the NEEP Incremental Cost Study Phase 2 Report
11. Equipment life is from Minnesota Technical Reference Manual (TRM) version 3.1 Jan 20, 2020.

Changes from Recent Filing:

EFLH and Building Type/Market Segment updated

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

12.8 CRAC Units

Algorithms

$$Customer\ kWh_{No\ Economizer} = Size * EFLH * \left(\frac{12}{3.412 * SCOP_{Baseline}} - \frac{12}{3.412 * SCOP_{Eff}} \right) * Quantity$$

$$Customer\ Coincident\ kWh_{No\ Economizer} = CF * Size * \left(\frac{12}{3.412 * SCOP_{Baseline}} - \frac{12}{3.412 * SCOP_{Eff}} \right) * Quantity$$

$$Customer\ kWh_{With\ Economizer} = \left(\begin{aligned} &Size * Hours_{Not\ Economizing} * \left(\frac{12}{3.412 * SCOP_{Baseline}} - \frac{12}{3.412 * SCOP_{Eff}} \right) + \\ &Economizer\ Size * Hours_{Economizing} * \left(\frac{12}{3.412 * SCOP_{Adj\ Baseline}} - \frac{12}{3.412 * SCOP_{Economizer\ Eff}} \right) \end{aligned} \right) * Quantity$$

$$Customer\ Coincident\ kWh_{With\ Economizer} = CF * Size * \left(\frac{12}{3.412 * SCOP_{Baseline}} - \frac{12}{3.412 * SCOP_{Eff}} \right) * Quantity$$

Variables

EFLH	8760	Equivalent Full Load Hours. The equivalent number of hours that the equipment would be running at full load over the course of the year.
Hours _{Not Economizing}	See Table 12.8.0	Number of hours that cooling is provided by compressors
Hours _{Economizing}	See Table 12.8.0	Number of hours that cooling is provided by economization
SCOP _{Baseline}	See Table 12.8.1	The minimum acceptable SCOP, as defined by the DOE, for a specific size and type of equipment (Reference 2)
SCOP _{Adj Baseline}	See Table 12.8.1	The minimum acceptable SCOP during economizer operation, which is defined by adjusting the DOE minimum acceptable SCOP to align with Test D of the rating standard (Reference 1).
Coincidence Factor	100%	Probability that the calculated Customer kW will coincide with the period of peak generator operation
Lifetime	20	Life of a new CRAC unit, in years
NTG_General_Cooling	92%	Net-to-gross = We will use 92% for all cooling equipment except MSHP units (Reference 4).
Incremental Cost	See Table 12.8.1	Incremental cost incurred for purchasing a CRAC unit that is more efficient than the DOE minimum requirement (Reference 3)

Customer Inputs

M&V Verified

Size	Yes	The rated equipment sensible capacity in tons, based on the actual indoor operating conditions of the data center (RAT and RH) and the outdoor conditions specified in the rating standard (Reference 1). The maximum eligible unit size is 759,999 Btu/h (63.3 tons).
SCOP _{Eff}	Yes	The rated SCOP of the equipment that the customer will install, based on the actual indoor operating conditions of the data center (RAT and RH) and the outdoor conditions specified in the rating standard (Reference 1).
Economizer Size	Yes	The rated equipment sensible capacity during economization in tons, based on the actual indoor operating conditions of the data center (RAT and RH) and the outdoor conditions specified in Optional Test D of the rating standard (Reference 1). The maximum eligible unit size is 759,999 Btu/h (63.3 tons).
SCOP _{Economizer Eff}	Yes	The SCOP of the equipment that the customer will install, based on the actual indoor operating conditions of the data center (RAT and RH) and the outdoor conditions specified in Test D of the rating standard (Reference 1).
Quantity	Yes	Number of more efficient CRAC units that the customer installed

Table 12.8.0

Equipment Type	Hours _{Economizing}	Hours _{Not Economizing}
CRAC, Air-Cooled with Economizer	1,989	6,771
CRAC, Water-Cooled with Economizer	1,289	7,471
CRAC, Glycol-Cooled with Economizer	1,257	7,503

Table 12.8.1

Equipment Type	Net Sensible Cooling Capacity (Btu/h)		SCOP_Standard		SCOP_Standard_Adj		Incremental Cost \$/SCOP
	Lower Limit ≥	Upper Limit <	Downflow Units	Upflow Units	Downflow Units	Upflow Units	
	CRAC, Air-Cooled	1	65,000	2.20	2.09	N/A	
	65,000	240,000	2.10	1.99	N/A	N/A	\$7,715.73
	240,000	760,000	1.90	1.79	N/A	N/A	\$11,110.13
CRAC, Air-Cooled with Economizer	1	65,000	2.20	2.09	6.58	6.25	\$12,152.77
	65,000	240,000	2.10	1.99	6.28	5.95	\$13,057.12
	240,000	760,000	1.90	1.79	5.67	5.36	\$18,801.37
CRAC, Water-Cooled	1	65,000	2.60	2.49	N/A	N/A	\$18,628.16
	65,000	240,000	2.50	2.39	N/A	N/A	\$32,837.67
	240,000	760,000	2.40	2.29	N/A	N/A	\$62,303.50
CRAC, Water-Cooled with Economizer	1	65,000	2.55	2.44	4.86	4.65	\$19,714.89
	65,000	240,000	2.45	2.34	4.67	4.46	\$34,751.50
	240,000	760,000	2.35	2.24	4.48	4.27	\$65,931.00
CRAC, Glycol-Cooled	1	65,000	2.50	2.39	N/A	N/A	\$18,575.38
	65,000	240,000	2.15	2.04	N/A	N/A	\$32,791.17
	240,000	760,000	2.10	1.99	N/A	N/A	\$62,303.50
CRAC, Glycol-Cooled with Economizer	1	65,000	2.45	2.34	4.65	4.44	\$19,656.86
	65,000	240,000	2.10	1.99	3.99	3.78	\$34,700.33
	240,000	760,000	2.05	1.94	3.89	3.68	\$65,931.00

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

References:

1. ASHRAE 127-2007
2. CFR Title 10, Volume 3, Chapter II, Subchapter D, Part 431, Subpart F
3. Chapter 3 of the Technical Support Document for the DOE CRAC efficiency final rule making, <https://www.regulations.gov/document?D=EERE-2011-BT-STD-0029-0039>

Changes from Recent Filing:

1. New prescriptive measure

Assumptions:

1. The DOE standard does not apply to CRAH units, horizontal flow units, or ceiling-mounted units; therefore, these units are excluded from this prescriptive rebate.
2. The equipment type of CRAC, Air-Cooled with Economizer is not in the DOE standard, but are included in the prescriptive rebate since these are in the market and have a large market share.
3. Minimum SCOP requirements for CRAC, Air-Cooled with Economizer are assumed to be the same as CRAC, Air-Cooled, because market research showed that these types of unit's don't have additional coils for economization. Therefore, no reduction in minimum SCOP is needed to account for the additional flow resistance through the unit.
4. Proposed SCOP ratings must be based on the same outdoor operating conditions used in the rating standard (Reference 1), i.e. air-cooled units are rated at the same OAT, water-cooled units are rated at the same entering and leaving water temperatures, and glycol-cooled units are rated at the same entering and leaving glycol temperatures.
5. Proposed SCOP ratings must be based on actual indoor operating conditions in the data center, i.e. RAT and RH. Credits or penalties for operating the data center above or below the RAT rating condition of 75F and RH rating condition of 45% are part of the savings for this prescriptive rebate. For Glycol Cooled CRAC units, credits or penalties for operating with a propylene glycol solution above or below the rating condition of 40% are also part of the savings for this prescriptive rebate.
6. Credit for being able to run CRAC fans at reduced speeds is not given in the prescriptive savings, because speed controls are standard on all units with EC fans, i.e. new CRAC units. Since units with EC fans have the necessary controls to reduce speed below 100%, the fan speed in the baseline for a new CRAC unit would be the same as the fan speed in the new, proposed CRAC unit.
7. The rated size for units in economization is required since most Water-Cooled and Glycol-Cooled CRAC units have a separate coil for economization, and this coil typically has a different cooling capacity than the evaporator coil. For Air-Cooled units with Economizer, the rated size in economization is likely the same as non-economization, since these units only have one coil for economization and refrigerant evaporation.
8. Economization hours are based on the OA conditions outlined in rating Test D of the rating standard (Reference 1), and an assumed approach temperature of 15 °F for cooling towers and dry coolers.
9. The efficiency curves used for adjusting the minimum SCOP values for economization are from past M&V projects or previous TAs. The efficiency curves are used to find the difference in efficiency at the outdoor operating conditions in Test A and Test D of the rating standard (Reference 1). This difference is then applied to the DOE minimum SCOP values to obtain the minimum SCOP values for economizer operation.
10. CRAC cost from taken from the DOE's data is only for downflow units (Reference 3), but it is assumed that the incremental cost calculated from this data would be the same for upflow units.
11. The DOE's cost data shows negative incremental cost as efficiency improves for smaller Water-Cooled and Glycol-Cooled CRAC units (Reference 3). The DOE mentioned that the negative values were likely due to an insufficient amount of data and the result did not make sense. Therefore, this was corrected here by using ratios of the known, positive incremental cost to correct the DOE's negative incremental cost.
12. The incremental cost for CRAC, Air-Cooled with Economizer is based on a cost multiplier calculated from past Xcel Energy projects. The DOE's cost multiplier was not used, since it did not account for the additional labor and components associated with a CRAC, Air-Cooled with Economizer. The DOE value only accounted for an additional coil, but air-cooled units with economizers don't have additional coils. These units usually have additional mechanical components (e.g. pumps), and these components require more labor beyond connecting a second coil that is housed within the same CRAC enclosure.

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

12.9 DEPACC

Algorithms

$$Customer\ kWh_{With\ Economizer} = Size \times DEPACC\ EFLH\ Factor \times EFLH_{With\ Economizer} \times KW\ per\ Ton_{Average}$$

$$Customer\ kWh_{No\ Economizer} = Size \times DEPACC\ EFLH\ Factor \times EFLH_{No\ Economizer} \times KW\ per\ Ton_{Average}$$

$$Customer\ KW = Size \times KW\ per\ Ton_{peak}$$

$$Customer\ PC\ KW = Size \times KW\ per\ Ton_{peak} \times Coincidence\ Factor$$

$$Incremental\ Cost\ of\ Equipment = Size \times Incremental\ Cost\ per\ Ton$$

Variables

DEPACC EFLH Factor	1.1631	= DEPACC_Operating_Hours_Office / EFLH for Front Range Office (w/economizer). Equivalent Full Load Hours. The equivalent number of hours that the equipment would be running at full load over the course of the year.
DEPACC_Operating_Hours_Office	1134	DEPACC Operating hrs/yr = Estimated annual hours of operation of the DEPACC system for an office in the Front Range. Used to scale DEPACC operating hours to A/C EFLH by segment
EFLH _{With Economizer}	See Table 12.0.2	Equivalent Full Load Hours. The equivalent number of hours that cooling equipment with an economizer would be running at full load over the course of the year.
EFLH _{No Economizer}	See Table 12.0.2	Equivalent Full Load Hours. The equivalent number of hours that cooling equipment without an economizer would be running at full load over the course of the year
KW per Ton _{Average}	0.1488	Average kW/ton = kWh/ ton / DEPACC Operating hrs/yr = Efficiency improvement of incumbent air-cooled condensers in kW per ton resulting from installation of condenser evaporative pre-cooler averaged for annual cooling hours.
KW per Ton _{Peak}	0.4544	Peak Coincident kW/ton = Efficiency improvement of incumbent air-cooled condensers in kW per ton resulting from installation of condenser evaporative pre-cooler at summer cooling design conditions: 0.4% design temperatures @ DIA = 93.9°F DB and 64.7°F WB
Coincidence Factor	90%	Probability that the calculated Customer kW will coincide with the period of peak generator operation
Incremental_O&M_Cost_Factor	0.000886667	\$ / ton-hour = (Water Cost / Ton) / DEPACC Operating Hours. Factor used to calculate Incremental annual non-energy Operations and Maintenance cost per ton-hr for water usage.
Incremental Cost of Equipment	See Table 12.9.0 DEPACC Incremental Costs	\$ / ton-hour = (Water Cost / Ton) / DEPACC Operating Hours. Factor used to calculate Incremental annual non-energy Operations and Maintenance cost per ton-hr for water usage.
Baseline Cost of Equipment	\$0.00	= \$0 because the baseline option is to do nothing.
NTG_General_Cooling	92%	Net-to-gross = We will use 92% for all cooling equipment.
Lifetime	20	Life of a new Direct Evaporative Cooling unit, in years

Customer Inputs

M&V Verified

Size	Yes	The rated cooling equipment capacity in tons.
Building Type / Market Segment	Yes	
County/Zone	Yes	
System Type	Yes	
Quantity Proposed Equipment (Qty)	Yes	

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Economizer	Yes	Indicates if the equipment does or does not have a functional cooling economizer (ie., Air or Waterside Economizer).
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Table 12.9.0 DEPACC Incremental Costs

System Tons	Incremental Capital Cost (\$/ton)	Incremental Electrical O&M Cost (\$/ton-hr)
10 to 59	\$ 248.27	\$ 0.0008867
60 to 99	\$ 219.91	\$ 0.0008867
100 to 139	\$ 209.23	\$ 0.0008867
140 to 239	\$ 202.80	\$ 0.0008867
240 and above	\$ 190.49	\$ 0.0008867

References:

1. Cypress, Ltd. Analysis of office building load profile and RTU efficiency improvement from application of wet bulb depression to reduce air cooled condensing temperatures.

Changes from Recent Filing:

EFLH and Building Type/Market Segment updated

Assumptions:

1. Minimum equipment size that DEPACC can be installed on is 10 ton.
2. Qualifying evaporative cooling units must have a minimum Media Saturation Effectiveness of 75% and above. The units must be installed with an evaporative media, a remote thermostat, outside air temp sensor and a periodic purge water control if sump is used.
3. Units should have outdoor air, humidity and controls to determine operation of spray nozzles to wet media. If sump is used, periodic purge control would need to be installed.
4. Condenser fan energy costs due to DEPACC media are not expected to increase measurably. Media decreases condenser fan cfm while increasing fan static.
5. Denver Water 2018 average rate at \$3.167/1000 gal (Source <https://www.denverwater.org/business/billing-and-rates/2018-rates>)
6. DEPACC estimate of water consumed by the evaporative pre-cooling system is 0.28 gallons per ton-hour of cooling based on manufacturer's data.

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

12.10 Mini-Split Heat Pump

Algorithms

$$\text{Cooling Electrical Energy Savings (kWh)} = \text{Size} \times \text{EFLH} \times \left(\frac{12}{\text{SEER}_{\text{Baseline}}} - \frac{12}{\text{SEER}_{\text{Eff}}} \right)$$

$$\text{Heating Electrical Energy Savings (kWh)} = \frac{\text{MSHP}_{\text{Size Heating}}}{1000} \times \text{MSHP_EFLHH} \times \left(\frac{1}{\text{HSPF}_{\text{Standard}}} - \frac{1}{\text{HSPF}_{\text{Eff}}} \right)$$

$$\text{Customer kWh} = \text{Cooling Electrical Energy Savings} + \text{Heating Electrical Energy Savings}$$

$$\text{Customer kW} = \text{Size} \times \left(\frac{12}{\text{EER}_{\text{Baseline}}} - \frac{12}{\text{EER}_{\text{Eff}}} \right)$$

$$\text{Customer PC kW} = \text{CF} \times \text{Size} \times \left(\frac{12}{\text{EER}_{\text{Baseline}}} - \frac{12}{\text{EER}_{\text{Eff}}} \right)$$

Variables

EFLH	See Table 12.0.2	Equivalent Full Load Hours. The equivalent number of hours that the equipment would be running at full load over the course of the year.
MSHP_EFLHH	950	Mini-Split Heat Pump Equivalent Full Load Hours Heating: The equivalent number of hours that MSHP equipment would be running at full load over the course of the year for heating. From Heating Efficiency Program.
SEER _{Baseline}	See Table 12.0.1	Seasonal (or Integrated) Energy Efficiency Ratio in BTU/W-hr of standard equipment, based upon the minimum acceptable efficiency defined by the current building code.
EER _{Baseline}	See Table 12.0.1	EER of standard equipment, based upon the minimum acceptable efficiency defined by the current building code. If unavailable, EER_Baseline is calculated from SEER_Eff using a polynomial conversion.
HSPF_Standard	8.20	Heating Seasonal Performance Factor (HSPF) of standard equipment, based upon the minimum Federal standard for efficiency as manufactured.
SEER to EER conversion factor	0.85	SEER to EER conversion factor
CF	90%	Coincidence Factor
NTG_General_Cooling	92%	Net-to-gross = 92% for all cooling equipment.
Measure Life ²	18	Life of a new unit, in years

Customer Inputs

M&V Verified

Cooling capacity (BTU/h)	Yes	(Btu/h) Size - Cooling capacity of equipment at standard ARI test conditions
Cooling efficiency (SEER)	Yes	SEER_Eff - Seasonal (or Integrated) Energy Efficiency Ratio in Btu/W-hr of high efficiency equipment that the customer will install.
Cooling efficiency (EER)	No	EER_Eff - Full-load efficiency of efficient equipment. If unavailable, value is calculated from SEER_Eff using a polynomial conversion.
Heating capacity (BTU/h)	Yes	(Btu/h) MSHP_Size_Heating - Heating capacity of Mini Split Heat Pump at 17 F outdoor air temperature, in BTU/h
Heating efficiency (HSPF)	Yes	HSPF_Eff - Heating Seasonal Performance Factor (HSPF) of High Efficiency equipment that the customer will install.
Building Type / Market Segment	Yes	
County/Zone	Yes	
System Type	Yes	
Quantity Proposed Equipment (Qty)	Yes	
Primary use, cooling or heating (MSHP)	No	

References:

- Incremental costs for MSHPs were determined from the NEEP Incremental Cost Study Phase 2 Report
- MSHP equipment life is from Measure Life Report Residential and Commercial/Industrial Lighting and HVAC Measures; <http://library.cee1.org/content/measure-life-report-residential-and-commercial-industrial-lighting-and-hvac-measures>
- IECC 2018 for Equipment Baseline Efficiencies
- No heating demand (kW) saving are claimed for MSHP during winter, only summer cooling demand (kW) savings are claimed.
- It is assumed that NO supplemental heating source is used.
- For new Mini-Split Heat Pumps (MSHP) it is assumed that the MSHP is being installed in either new construction or to supplement an existing heating and cooling system. The MSHP rebate is intended to incent customers to install a high efficiency MSHP rather than the code level baseline unit.

Changes from Recent Filing:

EFLH and Building Type/Market Segment updated

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

12.11 Mini-Split AC

Algorithms

$$Customer\ kWh = Size \times EFLH \times \left(\frac{12}{SEER_{Baseline}} - \frac{12}{SEER_{Eff}} \right)$$

$$Customer\ kW = Size \times \left(\frac{12}{EER_{Baseline}} - \frac{12}{EER_{Eff}} \right)$$

$$Customer\ PC\ kW = CF \times Size \times \left(\frac{12}{EER_{Baseline}} - \frac{12}{EER_{Eff}} \right)$$

Variables

EFLH	See Table 12.0.2	Equivalent Full Load Hours. The equivalent number of hours that the equipment would be running at full load over the course of the year.
SEER _{Baseline}	See Table 12.0.1	Seasonal (or Integrated) Energy Efficiency Ratio in BTU/W-hr of standard equipment, based upon the minimum acceptable efficiency defined by the current building code.
EER _{Baseline}	See Table 12.0.1	EER of standard equipment, based upon the minimum acceptable efficiency defined by the current building code. If unavailable, EER_Baseline is calculated from SEER_Eff using a polynomial conversion.
SEER to EER conversion factor	0.85	SEER to EER conversion factor
CF	90%	Coincidence Factor
NTG_General_Cooling	92%	Net-to-gross = We will use 92% for all cooling equipment.
Measure Life ²	18	Life of a new unit, in years

Customer Inputs

M&V Verified

Cooling capacity (BTU/h)	Yes	(Btu/h) Size - Cooling capacity of equipment at standard ARI test conditions
Cooling efficiency (SEER)	Yes	SEER_Eff - Seasonal (or Integrated) Energy Efficiency Ratio in Btu/W-hr of high efficiency equipment that the customer will install.
Cooling efficiency (EER)	No	EER_Eff - Full-load efficiency of efficient equipment. If unavailable, value is calculated from SEER_Eff using a polynomial conversion.
County/Zone	No	
Building type	Yes	
System Type	Yes	
Equipment quantity	Yes	
Primary use, cooling or heating (MSHP)	No	

References:

- Incremental costs were determined from the NEEP Incremental Cost Study Phase 2 Report
- Equipment life is from Measure Life Report Residential and Commercial/Industrial Lighting and HVAC Measures; <http://library.cee1.org/content/measure-life-report-residential-and-commercialindustrial-lighting-and-hvac-measures>
- IECC 2018 for Equipment Baseline Efficiencies
- For new Mini-Split Air Conditioners (MSAC) it is assumed that the MSAC is being installed in either new construction or to supplement an existing cooling system. The MSAC rebate is intended to incent customers to install a high efficiency MSAC rather than the code level baseline unit.

Changes from Recent Filing:

EFLH and Building Type/Market Segment updated

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

12.12 Plate & Frame Heat Exchangers

Algorithms

$$Customer\ kWh = (A \times T_{WB\ Onset}^2 + B \times T_{Balance}^2 + C \times T_{WB\ Onset} \times T_{Balance} + D \times T_{WB\ Onset} + E \times T_{Balance} + F) \times \left(\frac{Cooling\ Hrs\ No\ Econ}{G_EFLH} \right) \times \left(\frac{IPLV_{Eff}}{IPLV_{Baseline}} \right) \times \left(\frac{PF\ Tons\ Offset}{100} \right)$$

$$Customer\ kW = \frac{PF\ Tons\ Offset}{IPLV_{Baseline}}$$

$$Customer\ PC\ kW = CF \times Customer\ kW$$

$$PF\ Tons\ Offset = \left(\frac{Load_{onset}}{(T_{DB\ Design} - T_{Balance})} \right) \times T_{WB\ to\ MCDB} + \left(Load_{onset} - \left(\frac{Load_{onset}}{(T_{DB\ Design} - T_{Balance})} \right) \times T_{DB\ Design} \right)$$

Variables

IPLV _{Baseline}	0.570	Baseline Chiller IPLV (kW/ton)
T _{DB Design}	92	Design dry-bulb temperature for cooling (°F)
T _{WB to MCDB}	30.505	Mean Coincident Dry Bulb Temperature (as determined from binned TMY3 data for the location) corresponding to the Onset Wet Bulb Temperature provided by the customer
A	3.254	Coefficient from regression
B	0	Coefficient from regression
C	0	Coefficient from regression
D	5958.821	Coefficient from regression
E	0	Coefficient from regression
F	-47208.137	Coefficient from regression
G _{EFLH}	8760	Coefficient from regression
Coincidence Factor (CF)	0%	Coincidence Factor, the probability that peak demand of the equipment will coincide
Cooling Hrs No Econ	8760	Equivalent Full Load Hours. The equivalent number of hours that the equipment would be running at full load over the course of the year.
NTG_General_Cooling	92%	Net-to-gross = We will use 92% for all cooling equipment.
Lifetime	20	Measure life is taken at 20 years for all cooling equipment. (Reference 1) (years)

Customer Inputs

M&V Verified

IPLV _{Eff}	Yes	Efficient Chiller IPLV (kW/ton)
T _{WB Onset}	No	Wet Bulb Temperature at which waterside economizer is activated (°F)
Capacity _{HX}	Yes	Cooling capacity of plate and frame heat exchanger (tons)
T _{balance}	No	Building Balance Point Temperature, the outside air dry bulb temperature at which there is no cooling load. Customer input for all segments except Industrial and Data Center (20°F default); Not used for Industrial and Data Centers since Load (OADB) = Load (°F)
Load _{onset}	No	Cooling load at onset wet-bulb temperature (T _{WB Onset}) (tons)
County/Zone	No	
Building type	Yes	
System Type	Yes	
Equipment quantity	Yes	

References:

1. ASHRAE, 2007, Applications Handbook, Ch. 36, table 4, Comparison of Service Life Estimates
2. Data from historic Xcel Energy Custom Efficiency cooling tower projects

Assumptions:

No airside economizers are in operation
Heat exchanger is installed in parallel with the chiller and additional cooling towers are not required

Description

Prescriptive rebates will be offered for installation of plate & frame heat exchangers on existing chiller systems to allow cooling towers to provide "free cooling" in lieu of chiller operation. Eligible systems will NOT have air-side economizers install
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DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Table 12.0.1 Deemed Baseline Efficiencies (IECC 2018)

EQUIPMENT BASELINE EFFICIENCIES REQUIRED BY CODE, NOTE: For Rooftop Units Larger Than 5.4 Tons, Add 0.2 to Both IEER and EER for Units That Have No Heat or Electric Heat

Equipment	Equipment Classification	EER	SEER/ IEER/ IPLV	Path A FLV (kW/ton)	Path A IPLV (kW/ton)	COP or HSPF
Rooftop Units less than 5.4 tons	Baseline Efficiency	11.90	14.00			
Split Systems less than 5.4 tons	Baseline Efficiency	11.05	13.00			
Rooftop Units Condensing Units & Split Systems 5.5-11.3 tons	Baseline Efficiency	11.00	12.60			
Rooftop Units & Split Systems 11.4-19.9 tons & Condensing Units > 11.4 tons	Baseline Efficiency	10.80	12.20			
Rooftop Units & Split Systems 20-63.3 tons	Baseline Efficiency	9.80	11.40			
Rooftop Units greater than 63.3 tons	Baseline Efficiency	9.50	11.00			
Water Source Heat Pumps (Water-Air - Water Loop)	Baseline Efficiency	13.00	13.00			4.30
PTAC Replacement <= 7000 BTUH	Baseline Efficiency	9.41	11.07			
PTAC Replacement >7000 BTUH to <15000 BTUH	Baseline Efficiency	8.34	9.82			
PTAC Replacement >=15000 BTUH	Baseline Efficiency	7.71	9.06			
scroll/screw chiller < 75 tons	Baseline Efficiency			0.750	0.600	
scroll/screw chiller >=75 to < 150 tons	Baseline Efficiency			0.720	0.560	
scroll/screw chiller >=150 to <300 tons	Baseline Efficiency			0.660	0.540	
scroll/screw chiller >= 300 to <600 tons	Baseline Efficiency			0.610	0.520	
scroll/screw chiller >= 600 tons	Baseline Efficiency			0.560	0.500	
Centrifugal Chillers < 150 tons	AHRI Rated Efficiency			0.610	0.550	
Centrifugal Chillers >= 150 to < 300 tons	AHRI Rated Efficiency			0.610	0.550	
Centrifugal Chillers >=300 tons to < 400 tons	AHRI Rated Efficiency			0.560	0.520	
Centrifugal Chillers >=400 tons to < 600 tons	AHRI Rated Efficiency			0.560	0.500	
Centrifugal Chillers >= 600 tons	AHRI Rated Efficiency			0.560	0.500	
Air-Cooled Chillers - < 150 tons	Baseline Efficiency	10.100	13.700			
Air-Cooled Chillers - >= 150 tons	Baseline Efficiency	10.100	14.000			
Mini-Split Heat Pump (16-21 SEER, 9-12 HSPF)	Baseline Efficiency	8.75	14.00			8.20
Mini-Split Heat Pump (21-24 SEER, 9-12 HSPF)	Baseline Efficiency	8.75	14.00			8.20
Mini-Split Heat Pump (24-26 SEER, 9-12 HSPF)	Baseline Efficiency	8.75	14.00			8.20

NOTES

- * Bold values indicates direct sourcing to IECC 2018, tables 403.2.3(x), otherwise estimated by using the code SEER in the algorithm above to get EER, or using EER in the following algorithm to get SEER = 28 - SQRT(784 - (50 x EER)). For water-sourced heat pumps only, the EER is set equal to the SEER because the condenser water loop temperature is assumed to be maintained by cooling towers.
- * High Efficiency IEER, SEER and EER values are supplied by Customer.
- * AHRI rated efficiency is converted to Standard efficiency as per Table 403.3.2(7)
- * Values for Centrifugal Chillers assumed to be at AHRI rating conditions of 85 degrees condensing temperature, 44 degrees chilled water temperature, 2.4 gpm/ton chill water flow, and 3 gpm/ton condenser water flow. Reference International Energy Conservation Code (IECC), 2015, Sec. 403.2.3.1. Reference International Energy Conservation Code (IECC), 2018, Sec. 403.3.2.1
- * Values for PTAC from IECC 2018 formula, Table 403.3.2(3) for Cooling Mode, Replacements.
- * Chiller categories are now aligned with the IECC 2018.

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Table 12.0.2 Equivalent Full Load Hours by Building Type				
County/Zone	System Type	CO1	CO1	CO1
		Front Range EFLH	Front Range EFLH w/ Economizer	Front Range EFLH Hydronic System
Building Type / Market Segment				
Data Center	Data CenterCO1	8760	8760	8760
Full Service Restaurant	Full Service RestaurantCO1	1284	1037	1820
High-rise Apartment	High-rise ApartmentCO1	1797	1387	1768
Hospital	HospitalCO1	2579	1446	3178
Large Office	Large OfficeCO1	2124	1387	2341
LargeHotel	LargeHotelCO1	2404	1005	2453
Medium Office	Medium OfficeCO1	1209	688	1068
Mid-rise Apartment	Mid-rise ApartmentCO1	1647	688	1610
Outpatient Healthcare	Outpatient HealthcareCO1	2469	1358	2662
Primary School	Primary SchoolCO1	948	711	1142
Process Load	Process LoadCO1	5840	5840	5840
Quick Service Restaurant	Quick Service RestaurantCO1	1099	920	2036
Secondary School	Secondary SchoolCO1	1685	1390	1423
Small Hotel	Small HotelCO1	2010	586	1882
Small Office	Small OfficeCO1	826	586	755
Stand-alone Retail	Stand-alone RetailCO1	1154	873	1088
Strip Mall	Strip MallCO1	901	763	885
Warehouse (non-refrigerated)	Warehouse (non-refrigerated)CO1	129	112	765
CO2				
County/Zone	System Type	Western Slope EFLH	Western Slope EFLH w/ Economizer	Western Slope EFLH Hydronic System
Building Type / Market Segment				
Full Service Restaurant	Full Service RestaurantCO2	1440	1224	2028
High-rise Apartment	High-rise ApartmentCO2	2010	1224	1986
Hospital	HospitalCO2	2706	1663	3261
Large Office	Large OfficeCO2	2257	1623	2432
LargeHotel	LargeHotelCO2	2468	1132	2539
Medium Office	Medium OfficeCO2	1309	799	1174
Mid-rise Apartment	Mid-rise ApartmentCO2	1803	799	1767
Outpatient Healthcare	Outpatient HealthcareCO2	2536	1507	2711
Primary School	Primary SchoolCO2	1048	837	1226
Quick Service Restaurant	Quick Service RestaurantCO2	1258	1093	2217
Stand-alone Retail	Stand-alone RetailCO2	1249	1000	1173
Strip Mall	Strip MallCO2	988	865	947
Secondary School	Secondary SchoolCO2	1840	1570	1535
Small Hotel	Small HotelCO2	2061	656	1923
Small Office	Small OfficeCO2	872	656	808
Warehouse (non-refrigerated)	Warehouse (non-refrigerated)CO2	170	156	847
Process Load	Process LoadCO2	5840	5840	5840
Data Center	Data CenterCO2	8760	8760	8760
CO3				
County/Zone	System Type	Mountain EFLH	Mountain EFLH w/ Economizer	Mountain EFLH Hydronic System
Building Type / Market Segment				
Full Service Restaurant	Full Service RestaurantCO3	797	502	1395
High-rise Apartment	High-rise ApartmentCO3	1332	614	1496
Hospital	HospitalCO3	2098	813	3009
Large Office	Large OfficeCO3	1631	726	2093
LargeHotel	LargeHotelCO3	2377	614	2510
Medium Office	Medium OfficeCO3	1058	388	980
Mid-rise Apartment	Mid-rise ApartmentCO3	1277	388	1422
Outpatient Healthcare	Outpatient HealthcareCO3	2109	886	2621
Primary School	Primary SchoolCO3	691	395	941
Quick Service Restaurant	Quick Service RestaurantCO3	591	402	1322
Stand-alone Retail	Stand-alone RetailCO3	915	537	960
Strip Mall	Strip MallCO3	694	457	735
Secondary School	Secondary SchoolCO3	1294	856	1166
Small Hotel	Small HotelCO3	1804	364	1785
Small Office	Small OfficeCO3	688	364	622
Warehouse (non-refrigerated)	Warehouse (non-refrigerated)CO3	83	58	577
Process Load	Process LoadCO3	5840	5840	5840
Data Center	Data CenterCO3	8760	8760	8760

Recommended System Type by Equipment Type	
Equipment Type	Table 12.0.2. System Type
Rooftop Units (RTUs) <5.4 tons	EFLH
Rooftop Units (RTUs) >5.4 tons	EFLH w/Economizer
Mini Split System	EFLH
PTAC	EFLH
Water Cooled Chiller	Hydronic System
Water Source Heat Pump	Hydronic System
Air Cooled Chiller	Hydronic System

Heating Equivalent Full Load Hours	Zone	EFLH _{heat}
CO1: Denver / Front Range	CO1	950
CO2: Alamosa / Mountain is climate zone	CO2	950
CO3: Grand Junction / Western Slope	CO3	950

NOTES:

- * EFLH: Zone 1 (Front Range/Denver); Zone 2 (Western State as represented by Grand Junction) and Zone 3 (Mountain Areas as represented by Alamosa)
- * Market segment hours scaled from Minnesota OES data (Reference 10) with Office value calculated for Denver and Grand Junction Typical Meteorological Year data. Distributions developed from CBECS data (Reference 3)
- * WSHP's will use Non-Economizer hours for all projects.
- * RTU's that are less than 5.4 tons will use Non-Economizer hours for all projects.
- * Air Cooled Chillers and RTU's will use Hydronic System hours for all projects.
- * PTAC's will use Non-Economizer Small Hotel hours for all projects.

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Table 12.0.3 Incremental Costs For Equipment in the Midstream Product		
Equipment	Equipment Tier	Incremental Cost per Ton, \$/ton (Reference 8)
Rooftop Units less than 5.4 tons	Tier 1	\$97.30
Rooftop Units less than 5.4 tons	Tier 2	\$146.42
Rooftop Units less than 5.4 tons	Tier 3	\$335.07
Rooftop Units less than 5.4 tons	Tier 4	\$790.61
Split Systems less than 5.4 tons	Tier 1	\$97.30
Split Systems less than 5.4 tons	Tier 2	\$146.42
Split Systems less than 5.4 tons	Tier 3	\$335.07
Split Systems less than 5.4 tons	Tier 4	\$790.61
Rooftop Units & Split Systems 5.5-11.3 tons	Tier 1	\$79.97
Rooftop Units & Split Systems 5.5-11.3 tons	Tier 2	\$129.41
Rooftop Units & Split Systems 5.5-11.3 tons	Tier 3	\$115.75
Rooftop Units & Split Systems 5.5-11.3 tons	Tier 4	\$283.27
Rooftop Units & Split Systems 11.4-19.9 tons	Tier 1	\$106.76
Rooftop Units & Split Systems 11.4-19.9 tons	Tier 2	\$169.99
Rooftop Units & Split Systems 11.4-19.9 tons	Tier 3	\$195.07
Rooftop Units & Split Systems 11.4-19.9 tons	Tier 4	\$316.18
Rooftop Units & Split Systems 20-63.3 tons	Tier 1	\$12.84
Rooftop Units & Split Systems 20-63.3 tons	Tier 2	\$67.72
Rooftop Units & Split Systems 20-63.3 tons	Tier 3	\$144.31
Rooftop Units & Split Systems 20-63.3 tons	Tier 4	\$163.71
Rooftop Units greater than 63.3 tons	Tier 1	\$108.99
Rooftop Units greater than 63.3 tons	Tier 2	\$139.21
Rooftop Units greater than 63.3 tons	Tier 3	\$264.06
Rooftop Units greater than 63.3 tons	Tier 4	\$333.66
Air-Cooled Chillers - < 150 tons	Tier 1	\$42.75
Air-Cooled Chillers - < 150 tons	Tier 2	\$66.22
Air-Cooled Chillers - < 150 tons	Tier 3	\$91.92
Air-Cooled Chillers - < 150 tons	Tier 4	\$167.90
Air-Cooled Chillers - >= 150 tons	Tier 1	\$42.75
Air-Cooled Chillers - >= 150 tons	Tier 2	\$66.22
Air-Cooled Chillers - >= 150 tons	Tier 3	\$91.92
Air-Cooled Chillers - >= 150 tons	Tier 4	\$167.90
PTAC (Replacements) - 11 EER	Tier 1	\$106.62
PTAC (Replacements) - 11.5 EER	Tier 2	\$178.85
PTAC (Replacements) - 12 EER	Tier 3	\$300.03
Water-source Heat Pumps	Tier 1	\$80.53
Water-source Heat Pumps	Tier 2	\$167.63
Water-source Heat Pumps	Tier 3	\$261.83
Water-source Heat Pumps	Tier 4	\$363.72
MSAC 16-21 SEER - MS	Tier 1	\$90.52
MSAC 21-24 SEER - MS	Tier 2	\$189.28
MSAC 24+ SEER - MS	Tier 3	\$366.33
Mini-Split Heat Pump (16-21 SEER, 9-12 HSPF)	Tier 1	\$90.52
Mini-Split Heat Pump (21-24 SEER, 9-12 HSPF)	Tier 2	\$189.28
Mini-Split Heat Pump (24-26 SEER, 9-12 HSPF)	Tier 3	\$366.33

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Table 12.0.4. Incremental Costs For Equipment in the Downstream Product

Equipment	Incremental Cost per Ton, \$/ton (References 9, 11)
scroll/screw chiller < 75 tons	\$178.14
scroll/screw chiller >=75 to < 150 tons	\$124.41
scroll/screw chiller >=150 to <300 tons	\$54.25
scroll/screw chiller >= 300 to <600 tons	\$23.61
scroll/screw chiller >= 600 tons	\$23.61
Centrifugal Chillers < 150 tons	\$84.11
Centrifugal Chillers >= 150 to < 300 tons	\$96.40
Centrifugal Chillers >=300 tons to < 400 tons	\$80.23
Centrifugal Chillers >=400 tons to < 600 tons	\$49.25
Centrifugal Chillers >= 600 tons	\$26.67
VFD's for Chillers	\$71.88

Assumptions:

- Customer selection of cooling equipment is in lieu of equipment of the same size and configuration that met minimum 2018 International Energy Conservation Code requirements.
- Prescriptive rebates are not given for backup cooling equipment.
- Small RTU assumed to have gas heat for code baseline selection
- No Heating kW saving are claimed for MSHP during winter, only summer cooling kW savings are claimed.

EC Motors:

- Each motor is replaced with the same size on a 1 for 1 basis.
- Rebates do not apply to rewound or repaired motors.

References:

1. NYSERDA (New York State Energy Research and Development Authority); NY Energy Smart Programs Deemed Savings Database - Source for coincidence factor
2. ASHRAE, 2011, Applications Handbook, Ch. 37, table 4, Comparison of Service Life Estimates
3. CBECS (Commercial Buildings Energy Consumption Survey), 2012 - Total Floor space of Cooled Buildings by Principal Building Activity - source of market segment distributions
4. NTG for cooling is updated through a 2017 program evaluation.
5. Cypress, Ltd. Analysis of office building load profile and RTU efficiency improvement from application of wet bulb depression to reduce air cooled condensing temperatures.
6. International Energy Conservation Code 2018
7. Building America, Research Benchmark Definitions, 2010 (see p. 10). <http://www.nrel.gov/docs/fy10osti/47246.pdf>
 Approximation: EER = 1.12 x SEER - 0.02 x SEER^2
8. Midstream Product Data Analysis by Product Management Vendor
9. California DEER Database 2008
10. Minnesota Office of Energy Security (MOES) 2008 Cooling Equivalent Full Load Hours
11. Incremental costs for MSHPs were determined from the NEEP Incremental Cost Study Phase 2 Report
12. MSHP equipment life is from Measure Life Report Residential and Commercial/Industrial Lighting and HVAC Measures; <http://library.cee1.org/content/measure-life-report-residential-and-commercial/industrial-lighting-and-hvac-measures>
13. Energy model analysis of EFLH values completed by Energy Solutions in 2019 following the DOE Uniform Methods process using PNNL prototype buildings. EFLH values were peer reviewed by Michael's Energy; "XCEL ENERGY EFLH – EFLH ANALYSIS".

Changes from 2019 / 2020 Plan

Incremental cost are adjusted according to updated information from registered distributors.
 Equivalent Full Load Hours updated to correct discrepancies between climate zones.
 EFLH System Type options increased from two to three types.
 Water Source Heat Pump measures altered to capture heating energy savings compared to baseline equipment.
 Minimum qualifying EERs have been evaluated and updated to improve measure level performance.

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

13.1. Water Heater

Algorithms

$$Customer\ Dth = Quantity \times (BTUH\ Input \times Alt \times \left(\frac{EFFh}{EFFb}\right) - 1) \times EFLH + (Gallons\ Storage \times \left(\frac{SL_{Base}}{EFFb} - \frac{SL_{New}}{EFFh}\right)) \times SLHrs / 1000000$$

Variables

Alt	See Table 13.0.4	Altitude Adjustment factor to adjust the sea level manufacturer's rated input for altitude effects. No adjustment for near sea-level altitude.
Effb	See Table 13.0.2	Efficiency Rating of standard replacement water heater, Thermal Efficiency
SL_base	13.21	Standby Losses for baseline storage water heater, BTUH per gallon of storage (Ref 26)
SL_new	8.9	Standby Losses for efficient water heater, BTUH per gallon of storage (Ref 26)
SLHrs	8,760	Standby loss annual hours for commercial water heaters.
EFLH	See Table 13.0.3	
NTG	86%	Net-to-gross = 86% Per 2011 Cadmus Program Evaluation and Michaels Energy Review.
Incremental Cost	See Table 13.1.1	Incremental cost of efficient water heater over standard water heater.
Measure Life	See Table 13.0.1	

Customer Inputs

M&V Verified

BTUH input	Yes	BTUH of proposed water heater
Quantity	Yes	Quantity of water heaters
Effh	Yes	Efficiency Rating of high efficiency replacement water heater, Thermal Efficiency
Gallons Storage	Yes	Only needed for tank type water heaters

Table 13.1.1 Commercial Water Heater Incremental Cost (Ref 30)

Water Heater Type/Capacity	Incremental Cost
75,000 to 199,99 BTUh	\$1,018.46
200,000 to 299,000 BTUh	\$1,000.36
>=300,000 BTUh	\$1,728.11
Tankless 75,000 to 199,99 BTUh	\$1,242.36
Tankless >= 200,000 BTUh	\$1,000.36

References:

26. AHRI Directory of Certified Product Performance; average of Standby Loss in BTUH per gallon of storage calculated for units with 80% or less thermal efficiency for baseline unit and <96% thermal efficiency for efficient unit
 30. Baseline and Energy Efficient equipment costs provided by vendors

Changes from Recent Filing:

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DEEMED SAVINGS TECHNICAL ASSUMPTIONS

13.2 Boiler

Algorithms

$$Customer\ Dth = Input\ Capacity \times Alt \times \left(\frac{Effh - Adj}{Effb} - 1 \right) \times EFLH$$

Variables

Alt	See Table 13.0.4	Altitude Adjustment factor to adjust the sea level manufacturer's rated input for altitude effects. No adjustment for near sea-level altitude.
EFFb	See Table 13.0.2	Efficiency of Baseline equipment
Adj		Adjustment for operation at less than nominal efficiency
	0%	Efficiency adjustment for non-condensing boilers.
EFLH	See Table 13.0.3	Based on Bin Analysis assuming 30% oversizing for boiler plant. See "Forecast Boiler Op Hours " tab.
Conversion Factor	1000000	Conversion from BTU to Dth
Incremental Cost	See Table 13.2.1	Incremental cost of efficient boiler or furnace over standard equipment.
Measure Life	See Table 13.0.1	

Customer Inputs

M&V Verified

Input Capacity	Yes	Rated input BTUH nameplate data for the new boiler, furnace, unit heater, or water heater.
EFFh	Yes	Efficiency of purchased boiler, provided by customer.
Use	Yes	Use of boiler: space heating, domestic water, or both.
Cost		

Table 13.2.1a Hot water boiler costs (Ref 23)

Input Capacity Range	Baseline	High Efficient - Non Condensing	Baseline to High Efficient Non Condensing Incremental Cost
0 - 0.499 MMBTUH	\$3,000	\$3,500	\$500
0.5 - 0.999 MMBTUH	\$5,000	\$9,000	\$4,000
1 - 1.999 MMBTUH	\$7,300	\$11,700	\$4,400
2 - 3.999 MMBTUH	\$12,000	\$17,000	\$5,000
4 - 5.999 MMBTUH	\$24,000	\$34,000	\$10,000
6 - 7.999 MMBTUH	\$36,000	\$51,000	\$15,000
8 - 9.999 MMBTUH	\$48,000	\$68,000	\$20,000

Table 13.2.1b Steam boiler costs, Vendor supplied, Engineered Products

Boiler Input Capacity Range	Incremental
Low Pressure Steam Boiler; 0 - 0.499 MMBTUH	\$1,320
Low Pressure Steam Boiler; 0.5 - 4.999 MMBTUH	\$3,168
Low Pressure Steam Boiler; 5 - 9.999 MMBTUH	\$16,500
High Pressure Steam Boiler; 0 - 0.499 MMBTUH	\$1,320
High Pressure Steam Boiler; 0.5 - 4.99 MMBTUH	\$3,168
High Pressure Steam Boiler; 5 - 9.999 MMBTUH	\$16,500

References:

23. Cost information supplied by Engineered Products

Changes from Recent Filing:

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

13.3 Destratification Fans

Algorithms

$$Customer (Dth) = \left(U_{roof} \times (Area_{Destrat} \times \Delta T C) + U_{wall} \times \sqrt{(Area_{Total})} \times 4 \times \frac{Area_{Destrat}}{Area_{Total}} \times Ceilingheight \times Destrat Height \times \Delta T C \right) \times HeatingHours \times \frac{HrsPerDay}{24} \times \frac{HeatEff}{1000000} + Destrat Fan kWh \times \left(\frac{3412}{HeatEff} - Source BTU Factor \right) / 1000000$$

$$Destrat Fan kWh = Destrat Fan kW \times QTY \times Heating Hours \times HrsPerDay/24$$

Variables

HeatingHours	6499	Heating hours in season with outdoor air temperatures below 65F. (Ref 10)
deltaT_C	10	Difference between ceiling air temperature (deg F) and floor temperature in stratified space. Ref (48)
Destrat_Height	0.25	Assumption that the top 25% of the wall height will experience the same stratified deltaT as the ceiling.
U_roof	0.08	Average heat transfer coefficient for the roof (BTU/h*ft^2*F). (Ref 48)
U_walls	0.115	Average heat transfer coefficient for the walls (BTU/h*ft^2*F) assuming equal distribution between newer and older buildings. (Ref 43)
Heat_Eff	80%	Assumed efficiency of heating equipment.
Conversion Factor	1,000,000	Conversion factor from BTU to Dth.
Destrat_Fan_kW	0.588	kW per fan, based on typical 1 HP motor with 65% load factor.
Source_BTU_Factor	7500	Source BTU per kWh, used to account for cross-fuel penalty of this measure. (Ref 45)
Measure Life	See Table 13.0.1	Refer to table 15 for measure life.

Customer Inputs

M&V Verified

HrsPerDay	Yes	Hours per day of destratification fan operation.
Qty	Yes	Quantity of destratification fans installed.
Ceiling Height	Yes	Height of ceiling in space being destratified, in feet.
Area_Destrat	Yes	Total area being destratified, in square feet.
Cost	No	Total cost for equipment and installation of destratification fans.
Area_Total	Yes	Total facility floor area, in square feet

References:

- 10. TMY3 Weather data from Department of Energy
- 43. Illinois 2017 TRM ; http://ilsagfiles.org/SAG_files/Technical_Reference_Manual/Version_6/Final/IL-TRM_Effective_010118_v6.0_Vol_2_C_and_I_020817_Final.pdf
- 45. Source BTU for electricity based on MN DOC No. G008/CIP-00-864.07 Reply Comments of May 23, 2003 which states a Source BTU comparison must be made using an assumed heat rate of 7500 BTU/Generator kWh , based on typical Heat Rate for Combined-Cycle Natural Gas-fired Plant.
- 48. State of Minnesota Technical Reference Manual for Energy Conservation Improvement Programs version 3.0 Jan 10 2019

Changes from Recent Filing:

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DEEMED SAVINGS TECHNICAL ASSUMPTIONS

13.4 Unit Heater

Algorithms

$$\text{Unit Heater Savings (Dth)} = \text{Input Capacity} \times \text{Alt} \times \left(\frac{\text{EFFh}}{\text{EFFb}} - 1 \right) \times \text{EFLH}_{UH} \times (\text{Oversize Factor}_{\text{heat}}) \div 1000000$$

$$\text{Infrared Heater Savings (Dth)} = \text{Dth Base Infrared} - \text{Dth Eff Radiant}$$

$$\text{Dth Base Infrared} = \left(\frac{\text{Infrared Input Capacity} \times \text{Alt}}{\text{Infrared Size Factor}} \right) \times \text{Oversize Factor}_{\text{heat}} \times \text{EFLH}_{UH} \times \left(\frac{1 \text{ Dth}}{1000000 \text{ BTU}} \right) - \text{Dth}_{fan}$$

$$\text{Dth Eff Infrared} = \text{Infrared Input Capacity} \times \text{Alt} \times \text{Oversize Factor}_{\text{heat}} \times \text{EFLH}_{UH} \times \left(\frac{1 \text{ Dth}}{1000000 \text{ BTU}} \right)$$

$$\text{EFLH}_{UH} = \frac{\text{HDD}_a \times T_{\text{indoor}}^2 + \text{HDD}_b \times T_{\text{indoor}} + \text{HDD}_c}{T_{\text{indoor}} - T_{\text{design}}} \times 24 \times \% \text{conditioned}$$

$$\text{FLH} = \frac{\text{HDD}_a \times T_{\text{indoor}}^2 + \text{HDD}_b \times T_{\text{indoor}} + \text{HDD}_c}{T_{\text{indoor}} - T_{\text{offset}}} \times 24 \times \% \text{conditioned}$$

$$\text{Fan}_{kW} = \text{Input Capacity} \times \text{Heat}_{\text{eff infrared}} \times (\text{Alt} \div \text{Infrared Size Factor}) \times \text{Oversize Factor}_{\text{heat}} \times (\text{HP/BTUh}) \times 0.746 \times \text{LF} \div \text{Mtr}_{\text{eff}}$$

$$\text{Fan}_{kWh} = \text{Fan}_{kW} \times \text{FLH}$$

$$\text{Dth}_{fan} = \text{Fan}_{kW} \times 3412 \times \text{FLH} \div 1000000$$

Variables

Alt	See Table 13.0.4	Altitude Adjustment factor to adjust the sea level manufacturer's rated input for altitude effects.
HP/BTUh	2.96834E-06	Average axial/propeller/centrifugal fan power (rated) per BTU/h of heating output. Taken from manufacturer data for 38 unit heaters from Trane and Sterling; Applies to Infrared Heaters only
Oversize Factor _{heat}	0.9	Factor to account for design oversize commonly found on unit heater installations. Reference 1
T _{design}	See Table 13.4.1	Winter Design temperature for the given location. Reference 52.
LF	0.8	Design load factor of fan motor, deemed based on typical engineering assumption
EFFb	80%	Thermal efficiency of the baseline, non-power-vented, code-compliant unit heater. Reference 3.
EFFh	See Table 13.0.2	Thermal efficiency of the new, efficient unit heater
EFLH	See Table 13.0.3	The equivalent full load heating hours for unit heaters.
Heat _{eff infrared}	80%	Thermal efficiency of the new, radiant heater. = 0.80, same as baseline because the radiant heaters do not have specific combustion efficiency improvements over the baseline unit heater, their savings are all from radiation heat transfer versus convection. Also, Ref 5 uses this value.
Radiation Size Factor	0.85	Factor to account for the fact that radiant heaters should be designed smaller than an equivalent standard unit heater due to radiation heat transfer being more effective at producing thermal comfort. This also accounts for the lower room temperature afforded by radiant heaters. = 0.85 (Ref 4)
HDD _a	See Table 13.4.1	Polynomial Constants used in calculating HDD based on TMY3 weather data and design indoor temperature. HDD is proportional to the indoor temperature based on the formula HDD = a * Tin ² + b * Tin + c
HDD _b	See Table 13.4.1	Polynomial Constants used in calculating HDD based on TMY3 weather data and design indoor temperature. HDD is proportional to the indoor temperature based on the formula HDD = a * Tin ² + b * Tin + c
HDD _c	See Table 13.4.1	Polynomial Constants used in calculating HDD based on TMY3 weather data and design indoor temperature. HDD is proportional to the indoor temperature based on the formula HDD = a * Tin ² + b * Tin + c
T-Offset	See Table 13.4.1	Difference between the maximum heating degree day and the indoor design temperature.
Mtr _{eff}	29.58%	Average efficiency of 6 unit heater fans, calculated by taking the manufacturer-provided (Reznor, Sterling, and Trane) current draw to calculate power consumption and working backwards with the rated motor power and an assumed load factor of 0.8 to compute the efficiency for each fan and then taking the average of all of the fans. = 0.296 and includes both axial and centrifugal fans.
Conversion Factor	0.746	Conversion factor from HP to kW
Conversion Factor	1000	Conversion factor from kBTU/h to BTU/h
Conversion Factor	3412	Conversion factor from kW to BTU/h
Measure Life	See Table 13.0.1	Refer to table for measure life.
Incremental Cost	Table 10	Incremental cost of efficient unit heater over standard power vented unit heater.

Customer Inputs

M&V Verified

Input capacity	Yes	Rated Input Capacity of the new non-infrared heater in BTU/h
Infrared Input Capacity	Yes	Rated Input Capacity of the new infrared heater in BTU/h
%conditioned	Yes	Percentage of the time during heating season the space is heated
T _{indoor}	Yes	Space temperature set point of space being heated

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Table 13.4.1 HDD Estimation Constants and Site Weather Data (Ref 10 and 52)

Climate Zone	HDD_a	HDD_b	HDD_c	T_design	T-Offset
CO1: Denver / Front Range	2.87	-111.29	901.25	-4.00	-12.40
CO2: Alamosa / Mountain is climate zone	2.65	-103.77	906.11	3.40	-14.62
CO3 Grand Junction / Western Slope	3.33	-109.56	1,677.73	-16.80	4.96
Minnesota	2.51	(54.61)	679.14	(16.00)	(12.40)

Table 13.4.2 Unit Heater and Radiant Heater Costs (Ref 7)

	\$/kBTUh (output)	Incremental Cost
Baseline Unit Heater	\$8.42	N/A
Power-vented Unit Heater (83%)	\$10.04	\$1.62
Radiant Heater (uses input kBTU/h)	\$9.45	\$1.03

References:

1. 1999 Minnesota Energy Code - Chapter 7676.1100 Subpart 3D, 4A
3. International Energy Conservation Code (IECC) 2015 Table C403.2.3 (4)
4. ASHRAE HVAC Systems and Equipment 2008 pg 15.1
7. Cost data from online review on 8/5/15 of available products from various distributors
10. TMY3 Weather data from Department of Energy
52. 99.6% design temperature for Denver (Stapleton), taken from the 2005 ASHRAE Handbook - Fundamentals. Grand Junction - Station 724760; Alamosa - Station 724620.

Changes from Recent Filing:

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DEEMED SAVINGS TECHNICAL ASSUMPTIONS

13.5 Boiler Controls

Algorithms

$$Customer\ Dth = Input\ Capacity \times Alt \times (1 - \frac{EFFb}{Effh}) \times EFLH$$

Variables

Alt	See Table 13.0.4	Altitude Adjustment factor to adjust the sea level manufacturer's rated input for altitude effects. No adjustment for near sea-level altitude.
Effb	See Table 13.0.2	Efficiency of Baseline equipment.
Effh	See Table 13.0.2	Efficiency of equipment after controls implemented
EFLH	See Table 13.0.3	Based on Bin Analysis assuming 30% oversizing for boiler plant. (Ref 28)
Measure Life	See Table 13.0.1	

Customer Inputs

M&V Verified

Input Capacity	Yes	Rated input BTUH nameplate data for the boiler
Use	Yes	Use of boiler: space heating, domestic water, or both.
Cost	Yes	Cost of boiler tuneup

References:

28. MN Bin Temp Bin Hrs are taken from the "Thermal Environmental Engineering, Third Edition, Thomas H. Kuehn, James W. Ramsey and James L. Threlkeld, Pages 717-718, Table B.5" to determine full load equivalent hours (FLEH) in Minnesota area. See Forecast furnace operating hours for calculation. Adjusted for CO

Changes from Recent Filing:

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DEEMED SAVINGS TECHNICAL ASSUMPTIONS

13.6 Steam Traps

Algorithms

$$Customer (Dth) = LeakRate \times Leak\ Hours \times \frac{BTU\ Per\ Pound}{EFFb} / 1000000$$

Variables

Leak_Rate	5	Leakage rate for low pressure steam traps in pounds of steam per hour.(Reference 20)
Leak_Hours	11	Leakage rate for high pressure steam traps in pounds of steam per hour.(Reference 20)
Leak_Hours	See Table 13.6.1	Annual hours boiler lines are pressurized, based on customer-provided system type.
Effb	See Table 13.0.2	Efficiency of steam boiler
BTU_Per_Pound	1064	Loss in btu/lb for Steam traps in Low Pressure Applications: 1164 BTU per pound for lost to atmosphere, 964 BTU per pound lost to condensate. Assume 50/50 mix = 1064 BTU per pound. (Reference 20)
	1081	Loss in btu/lb for Steam traps in High Pressure Applications: 1181 BTU per pound for lost to atmosphere, 981 BTU per pound lost to condensate. Assume 50/50 mix = 1081 BTU per pound. (Reference 20)
Measure Life	See Table 13.0.1	

Customer Inputs

M&V Verified

Incremental Cost	No	Cost of replacing or repairing steam traps, per trap, provided by the customer.
Steam Pressure	Yes	Steam pressure, low or high.
Use	Yes	Use of steam system: space heating, domestic water, or both.

Table 13.6.1 Annual Leak Hours - Steam Traps (Ref 28)

Use	Hours
Space Heating	6,000
Domestic Water Heating	8,760
Space and Domestic Water Heating	8,760

References:

20. Leakage data from Energy Management Handbook, by Wayne Turner
 28. MN Bin Temp Bin Hrs are taken from the "Thermal Environmental Engineering, Third Edition, Thomas H. Kuehn, James W. Ramsey and James L. Threlkeld, Pages 717-718, Table B.5" to determine full load equivalent hours (FLEH) in Minnesota area. See Forecast furnace operating hours for calculation. Adjusted for CO

Changes from Recent Filing:

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DEEMED SAVINGS TECHNICAL ASSUMPTIONS

13.7 Pipe Insulation

Algorithms

$$Customer (Dth) = LFT \times Hrs \times (BTU \text{ Per Foot } U - BTU \text{ Per Foot } I) \times Existing/EFFb$$

$$BTU \text{ Per Foot} = Coef0 + (Coef1 \times \Delta T) + (Coef2 \times \Delta T^2) + (Coef3 \times \Delta T^3)$$

$$\Delta T = T_{fluid} - T_{ambient}$$

Variables

Hrs	See Table 13.7.1	The operating hours for the boiler system.
	70	Average temperature of the space surrounding the pipe for conditioned spaces.
	51	= Average temperature of the space surrounding the pipe for outside domestic hot water, full year average based on average TMY3 temperatures for Colorado. (Ref 10)
T ambient	44	= Average temperature of the space surrounding the pipe for outside space heating (average excluding June-September) based on average TMY3 temperatures for Colorado. (Ref 10)
		= Pipe insulation savings multiplier to determine credit if existing deteriorated insulation is being replaced.
	1	= Multiplier of 1 if no existing insulation is present.
Existing	0.25	= Pipe insulation savings multiplier of 0.25 if existing insulation is being replaced.
Effb	See Table 13.0.2	= Efficiency of boiler or water heater serving the pipes being insulated.
Coef0, Coef1, Coef2, Coef3	See Table 13.7.2	= Polynomial coefficients
Measure Life	See Table 13.0.1	Refer to table 15 for measure life.

Customer Inputs

M&V Verified

LFT	Yes	Linear feet of insulation installed, provided by the customer.
T fluid	Yes	Average temperature of the fluid in the pipe receiving insulation in degrees F

Table 13.7.1 Hours for Pipe Insulation (Ref 28)

Use of Pipe	Location	Pipe Insulation Hours	Explanation
Domestic Hot Water	Inside	5,558	Hours when outside temp is above building balance point. Heat loss from pipe is wasted.
Domestic Hot Water	Outside	8,760	Domestic hot water available year round, outside temp is always less than 120 F.
Space Heating	Inside	1,648	Hours when boiler is running but outdoor temp is above building balance point
Space Heating	Outside	4,791	Hours that boiler is running

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Table 13.7.2 Deemed Insulation Polynomial Equation Coefficients and Incremental Costs

Pipe Nominal Diameter (inches)	Insulation Thickness (Inches)	Heat Loss (BTU/Hr) at Specified					Polynomial Coefficients				Cost Per Foot	Cost Per 3' Materials (Ref 28)
		5	70	135	200	265	Coef0	Coef1	Coef2	Coef3		
0.50	-	1.73000	35.90	81.40	136.00	201.00	-0.51699304	0.43276708	0.001310573	-2.82203E-07	\$ -	\$ -
0.50	0.5	0.64500	10.10	21.20	34.4	50.0	-0.02055491	0.13279564	0.000150494	2.291E-07	\$ 6.18	\$ 6.18
0.50	1	0.46300	7.07	14.80	23.9	34.6	-0.00506792	0.09314387	0.000102935	1.44743E-07	\$ 7.47	\$ 7.47
0.50	1.5	0.37900	5.75	12.00	19.4	28.0	0.003984993	0.07518613	8.91729E-05	9.74056E-08	\$ 14.18	\$ 14.18
0.50	2	0.33700	5.10	10.60	17.1	24.7	0.000608336	0.06740019	6.8221E-05	1.1015E-07	\$ 22.02	\$ 22.02
0.50	2.5	0.29500	4.45	9.28	14.9	21.6	-0.00747838	0.05974442	4.96359E-05	1.22895E-07	\$ 26.02	\$ 26.02
0.50	3	0.27800	4.18	8.72	14.0	20.3	-0.00630559	0.05611641	4.66467E-05	1.15916E-07	\$ 31.44	\$ 31.44
0.50	3.5	0.26400	3.97	8.28	13.3	19.2	-0.00185037	0.05272378	5.22687E-05	8.37506E-08	\$ 36.87	\$ 36.87
0.50	4	0.25300	3.80	7.92	12.7	18.4	-0.0060451	0.05110554	4.13115E-05	1.05295E-07	\$ 42.29	\$ 42.29
0.50	4.5	0.24200	3.64	7.59	12.2	17.6	-0.00056352	0.04820003	4.96014E-05	7.22E-08	\$ 47.71	\$ 47.71
0.50	5	0.23500	3.53	7.34	11.8	17.1	-0.00336602	0.04731939	3.88419E-05	9.86193E-08	\$ 53.14	\$ 53.14
0.50	5.5	0.23400	3.51	7.31	11.8	17.0	0.005221094	0.0459022	5.38618E-05	5.64406E-08	\$ 58.56	\$ 58.56
0.50	6	0.22700	3.41	7.10	11.4	16.5	-0.00354018	0.04566163	3.91228E-05	8.89091E-08	\$ 63.98	\$ 63.98
0.75	-	2.09000	43.40	98.50	165.00	245.00	-0.64101619	0.52569402	0.001536569	-8.79988E-08	\$ -	\$ -
0.75	0.5	0.75300	11.80	24.90	40.4	58.7	-0.02396278	0.15426539	0.000194013	2.26673E-07	\$ 7.00	\$ 7.00
0.75	1	0.55600	8.51	17.80	28.8	41.8	-0.00762203	0.11236975	0.000117924	2.01487E-07	\$ 8.17	\$ 8.17
0.75	1.5	0.43900	6.66	13.90	22.4	32.5	-0.00849852	0.08880715	8.10579E-05	1.76301E-07	\$ 14.24	\$ 14.24
0.75	2	0.38300	5.80	12.10	19.5	28.2	-0.00261003	0.07677564	7.83555E-05	1.26536E-07	\$ 22.77	\$ 22.77
0.75	2.5	0.32900	4.97	10.40	16.7	24.1	-0.0040483	0.0658327	6.97763E-05	9.43711E-08	\$ 26.39	\$ 26.39
0.75	3	0.30800	4.64	9.66	15.5	22.5	-0.00946158	0.06266411	4.6068E-05	1.43226E-07	\$ 31.73	\$ 31.73
0.75	3.5	0.29100	4.38	9.12	14.7	21.2	0.002629685	0.05765753	6.2664E-05	8.16265E-08	\$ 37.07	\$ 37.07
0.75	4	0.27700	4.17	8.69	14.0	20.2	0.001543377	0.05497413	5.90396E-05	7.98058E-08	\$ 42.40	\$ 42.40
0.75	4.5	0.26600	3.99	8.32	13.4	19.3	0.003691319	0.05237176	5.99558E-05	6.4937E-08	\$ 47.74	\$ 47.74
0.75	5	0.25600	3.85	8.02	12.9	18.6	0.000585786	0.05088343	5.32258E-05	7.40404E-08	\$ 53.08	\$ 53.08
0.75	5.5	0.25300	3.80	7.92	12.7	18.4	-0.0060451	0.05110554	4.13115E-05	1.05295E-07	\$ 58.42	\$ 58.42
0.75	6	0.24500	3.68	7.67	12.3	17.8	-0.0049141	0.04935649	4.19306E-05	9.55849E-08	\$ 63.76	\$ 63.76
1.00	-	2.52000	52.60	120.00	201.00	297.00	-0.72836621	0.62472376	0.002067703	-7.0399E-07	\$ -	\$ -
1.00	0.5	0.88700	13.90	29.40	47.8	69.5	-0.02227222	0.18067121	0.000242842	2.467E-07	\$ 7.22	\$ 7.22
1.00	1	0.57800	8.83	18.50	29.8	43.2	-0.01520707	0.11731005	0.000117809	2.06949E-07	\$ 8.77	\$ 8.77
1.00	1.5	0.47600	7.22	15.10	24.3	35.2	-0.00941903	0.09605189	9.35275E-05	1.71142E-07	\$ 15.25	\$ 15.25
1.00	2	0.41300	6.24	13.00	21.0	30.3	0.005230275	0.08179042	9.32915E-05	1.11364E-07	\$ 24.21	\$ 24.21
1.00	2.5	0.37300	5.63	11.70	18.9	27.3	0.00381926	0.07414985	7.78159E-05	1.17433E-07	\$ 28.23	\$ 28.23
1.00	3	0.34500	5.21	10.90	17.5	25.2	-0.00201092	0.06871287	7.74465E-05	8.34471E-08	\$ 33.97	\$ 33.97
1.00	3.5	0.32400	4.88	10.20	16.4	23.6	0.001685103	0.06407339	7.52741E-05	7.16128E-08	\$ 39.72	\$ 39.72
1.00	4	0.30700	4.63	9.64	15.5	22.4	-0.00291777	0.06161312	5.81228E-05	1.07116E-07	\$ 45.46	\$ 45.46
1.00	4.5	0.29200	4.40	9.16	14.7	21.3	-0.00719958	0.05916601	4.73061E-05	1.23805E-07	\$ 51.21	\$ 51.21
1.00	5	0.26800	4.02	8.37	13.5	19.4	0.0071897	0.05238594	4.66778E-05	5.21924E-08	\$ 56.95	\$ 56.95
1.00	5.5	0.27500	4.13	8.61	13.8	20.0	-0.00733195	0.05562929	4.39788E-05	1.16826E-07	\$ 62.70	\$ 62.70
1.00	6	0.26600	4.00	8.33	13.4	19.3	0.001648014	0.05273795	5.69907E-05	7.10059E-08	\$ 68.44	\$ 68.44
1.00	6.5	0.25800	3.88	8.08	13.0	18.8	-0.00152036	0.05160684	4.87015E-05	9.16401E-08	\$ 74.19	\$ 74.19
1.00	7	0.25100	3.78	7.87	12.7	18.3	0.0040483	0.04953021	5.68509E-05	6.34198E-08	\$ 79.93	\$ 79.93
1.00	7.5	0.24500	3.69	7.67	12.3	17.8	-0.00565225	0.04963139	3.93036E-05	1.01654E-07	\$ 85.68	\$ 85.68
1.00	8	0.24000	3.60	7.50	12.1	17.4	0.006196242	0.04692785	5.77671E-05	4.85511E-08	\$ 91.42	\$ 91.42
1.00	8.5	0.23500	3.53	7.35	11.8	17.1	-0.00467117	0.04741068	3.85038E-05	9.86193E-08	\$ 97.17	\$ 97.17
1.00	9	0.23000	3.46	7.20	11.6	16.7	0.003090708	0.04543952	5.10371E-05	5.76544E-08	\$ 102.91	\$ 102.91
1.00	9.5	0.22600	3.40	7.07	11.4	16.4	0.004308785	0.04451934	5.15157E-05	5.27993E-08	\$ 108.66	\$ 108.66
1.00	10	0.22200	3.34	6.95	11.2	16.1	0.004221705	0.04369047	5.16562E-05	4.79442E-08	\$ 114.40	\$ 114.40
1.25	-	3.11000	64.80	147.00	248.00	368.00	-0.81894089	0.76796747	0.002475005	-4.58201E-07	\$ -	\$ -
1.25	0.5	1.01000	15.80	33.40	54.2	78.8	-0.03151388	0.2063746	0.000264133	3.0041E-07	\$ 7.71	\$ 7.71
1.25	1	0.73700	11.30	23.70	38.4	55.6	-0.0014191	0.14752113	0.000181817	2.01183E-07	\$ 9.48	\$ 9.48
1.25	1.5	0.53100	8.05	16.80	27.1	39.2	-0.00257736	0.10635244	0.000111172	1.7266E-07	\$ 16.60	\$ 16.60
1.25	2	0.48900	7.41	15.50	24.9	36.0	-0.00971317	0.09853622	9.81917E-05	1.61129E-07	\$ 25.56	\$ 25.56
1.25	2.5	0.43300	6.55	13.70	22.0	31.8	-0.00812404	0.08712265	8.65811E-05	1.41708E-07	\$ 30.01	\$ 30.01
1.25	3	0.39700	5.98	12.50	20.1	29.0	-0.00106199	0.07896063	8.58034E-05	1.1015E-07	\$ 36.07	\$ 36.07
1.25	3.5	0.36900	5.56	11.60	18.7	26.9	0.006159386	0.07261071	8.88153E-05	7.61645E-08	\$ 42.14	\$ 42.14
1.25	4	0.34700	5.23	10.90	17.5	25.3	-0.00557854	0.06983173	6.35978E-05	1.25322E-07	\$ 48.21	\$ 48.21
1.25	4.5	0.32800	4.94	10.30	16.5	23.9	-0.00994743	0.06655574	5.29215E-05	1.37157E-07	\$ 54.27	\$ 54.27
1.25	5	0.31400	4.72	9.83	15.8	22.8	-0.0008386	0.06261432	6.21848E-05	9.89228E-08	\$ 60.34	\$ 60.34
1.25	5.5	0.30300	4.55	9.47	15.2	22.0	-0.00503333	0.06099609	5.12276E-05	1.20467E-07	\$ 66.41	\$ 66.41
1.25	6	0.29200	4.39	9.14	14.7	21.2	0.000448248	0.05809058	5.95175E-05	8.73919E-08	\$ 72.47	\$ 72.47
1.50	-	3.50000	73.10	167.00	280.00	416.00	-1.08946746	0.8782643	0.002272811	-3.94477E-07	\$ -	\$ -
1.50	0.5	1.18000	18.70	39.40	64.1	93.2	-0.04143286	0.24393112	0.00030924	3.70202E-07	\$ 8.88	\$ 8.88
1.50	1	0.74800	11.50	24.00	38.8	56.2	-0.011669	0.15185253	0.000158962	2.58534E-07	\$ 10.23	\$ 10.23
1.50	1.5	0.59900	9.11	19.00	30.7	44.4	-0.00057161	0.11994951	0.000129735	1.88439E-07	\$ 17.36	\$ 17.36
1.50	2	0.47800	7.23	15.10	24.3	35.1	-0.00364976	0.09565997	0.000100122	1.4626E-07	\$ 26.68	\$ 26.68
1.50	2.5	0.43400	6.54	13.60	22.0	31.7	0.011069068	0.08529243	0.000101654	1.04992E-07	\$ 30.92	\$ 30.92
1.50	3	0.40100	6.04	12.60	20.3	29.3	0.001635399	0.07960692	8.63392E-05	1.15005E-07	\$ 36.97	\$ 36.97
1.50	3.5	0.37500	5.65	11.80	19.0	27.4	0.001530008	0.07434559	8.34742E-05	9.86193E-08	\$ 43.03	\$ 43.03
1.50	4	0.35300	5.31	11.10	17.8	25.7	-0.0051704	0.07067377	6.97919E-05	1.11364E-07	\$ 49.08	\$ 49.08
1.50	4.5	0.33700	5.06	10.50	17.0	24.5	0.010881306	0.06598783	7.70382E-05	8.58747E-08	\$ 55.13	\$ 55.13
1.50	5	0.32300	4.85	10.10	16.3	23.5	0.005816529	0.06357831	7.23994E-05	8.4054E-08	\$ 61.19	\$ 61.19
1.50	5.5	0.32100	4.82	10.00	16.1	23.3	-0.00118663	0.06432578	5.53879E-05	1.27143E-07	\$ 67.24	\$ 67.24
1.50	6	0.30900	4.64	9.68	15.6	22.5	0.003362065	0.0609862	6.84368E-05	8.22333E-08	\$ 73.29	\$ 73.29
2.00	-	4.30000	90.00	205.00	346.00	514.00	-1.16894206	1.06399527	0.003504974	-6.97921E-07	\$ -	\$ -
2.00	0.5	1.43000	22.70	48.00	78.1	114.0	-0.07119943	0.29777781	0.0003583	5.37096E-07	\$ 9.48	\$ 9.48
2.00	1	0.87700	13.40	28.20	45.5	66.0	-0.0188967	0.17681671	0.000198555	2.80079E-07	\$ 11.07	\$ 11.07
2.00	1.5	0.68300	10.40	21.70	35.0	50.6	-0.0058209	0.13736995	0.000144615	2.17569E-07	\$ 19.13	\$ 19.13
2.00	2	0.58000	8.79	18.30	29.6	42.7	0.008893686	0.11491811	0.000134157	1.51722E-07	\$ 28.12	\$ 28.12
2.00	2.5	0.51600	7.80	16.30								

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

3.00	2	0.75600	11.50	23.90	38.6	55.8	-0.00124762	0.15194443	0.000153453	2.56107E-07	\$	32.08	\$	32.08
3.00	2.5	0.66100	10.00	20.90	33.6	48.6	-0.0108026	0.13295408	0.000131023	2.24245E-07	\$	37.28	\$	37.28
3.00	3	0.59500	8.98	18.70	30.1	43.6	-0.0078217	0.11980756	0.000107338	2.32135E-07	\$	44.37	\$	44.37
3.00	3.5	0.53900	8.13	16.90	27.3	39.4	0.007359204	0.10683283	0.000115989	1.58094E-07	\$	51.46	\$	51.46
3.00	4	0.50200	7.56	15.80	25.4	36.6	0.000265661	0.09960819	0.000111673	1.2684E-07	\$	58.56	\$	58.56
3.00	4.5	0.47300	7.12	14.80	23.9	34.5	0.006580948	0.09365604	0.000100275	1.41708E-07	\$	65.65	\$	65.65
3.00	5	0.44200	6.65	13.90	22.3	32.2	-0.00588012	0.08844116	8.79914E-05	1.3897E-07	\$	72.75	\$	72.75
3.00	5.5	0.42300	6.36	13.30	21.3	30.8	-0.01024901	0.08516517	7.73152E-05	1.50812E-07	\$	79.84	\$	79.84
3.00	6	0.40600	6.10	12.70	20.4	29.5	-0.00459374	0.08144689	7.30516E-05	1.49901E-07	\$	86.93	\$	86.93
3.50	0	6.92000	145.00	331.00	559.0	832.0	-1.93043137	1.71646834	0.005630873	-8.86057E-07	\$	-	\$	-
3.50	0.5	2.18000	34.60	73.30	119.0	174.0	-0.14230418	0.45737022	0.000510683	9.16401E-07	\$	13.37	\$	13.37
3.50	1	1.11000	17.00	35.70	57.6	83.4	-0.02042864	0.22391562	0.000255225	3.30754E-07	\$	14.60	\$	14.60
3.50	1.5	0.89900	13.70	28.50	46.0	66.6	-0.01005389	0.18179222	0.000174042	3.34092E-07	\$	23.58	\$	23.58
3.50	2	0.76700	11.60	24.30	39.1	56.5	-0.00713703	0.15322166	0.000167467	2.22425E-07	\$	34.83	\$	34.83
3.50	2.5	0.67900	10.30	21.40	34.5	49.9	-0.00525488	0.13683459	0.000128317	2.49128E-07	\$	39.94	\$	39.94
3.50	3	0.60900	9.19	19.20	30.9	44.6	-0.00147856	0.12129396	0.000131484	1.73267E-07	\$	47.27	\$	47.27
3.50	3.5	0.56200	8.47	17.70	28.4	41.0	-0.00791849	0.11261127	0.000112466	1.75391E-07	\$	54.61	\$	54.61
3.50	4	0.52400	7.90	16.50	26.5	38.3	-0.00736386	0.10511607	0.000102467	1.74784E-07	\$	61.94	\$	61.94
3.50	4.5	0.52600	7.92	16.50	26.6	38.4	0.003398452	0.10439888	0.000111507	1.5597E-07	\$	69.28	\$	69.28
3.50	5	0.48800	7.34	15.30	24.6	35.6	-0.00533933	0.09784689	9.01541E-05	1.79639E-07	\$	76.62	\$	76.62
3.50	5.5	0.46500	6.99	14.60	23.4	33.9	-0.01240562	0.0939246	7.89421E-05	1.86618E-07	\$	83.95	\$	83.95
3.50	6	0.44400	6.68	13.90	22.4	32.3	0.004144041	0.08799887	9.44041E-05	1.26233E-07	\$	91.29	\$	91.29
4.00	0	7.72000	162.00	369.00	624.0	929.0	-2.11759308	1.91712942	0.006241966	-8.25368E-07	\$	-	\$	-
4.00	0.5	2.32000	36.70	77.80	126.0	184.0	-0.15691423	0.48603008	0.000540165	9.34608E-07	\$	14.12	\$	14.12
4.00	1	1.42000	21.90	45.80	74.1	107.0	-0.00829469	0.28613195	0.000349321	3.58064E-07	\$	17.83	\$	17.83
4.00	1.5	1.09000	16.60	34.70	55.9	80.9	-0.01859211	0.22004346	0.000224585	3.67167E-07	\$	24.48	\$	24.48
4.00	2	0.91000	13.70	28.50	46.0	66.6	-0.00784584	0.18174334	0.000174355	3.33485E-07	\$	37.48	\$	37.48
4.00	2.5	0.78100	11.80	24.70	39.7	57.5	-0.01566404	0.15719233	0.000151844	2.78865E-07	\$	42.66	\$	42.66
4.00	3	0.68800	10.40	21.70	34.9	50.4	-0.00603197	0.13784793	0.000140326	2.6052E-07	\$	50.33	\$	50.33
4.00	3.5	0.62800	9.48	19.80	31.8	46.0	-0.0114396	0.12640601	0.000119272	2.1221E-07	\$	58.01	\$	58.01
4.00	4	0.58200	8.77	18.30	29.4	42.5	-0.00748309	0.11675566	0.000111764	1.99666E-07	\$	65.68	\$	65.68
4.00	4.5	0.53700	8.09	16.90	27.1	39.2	-0.01195737	0.10821834	9.82229E-05	1.95116E-07	\$	73.35	\$	73.35
4.00	5	0.50800	7.64	15.90	25.6	37.0	-0.0060456	0.10137334	9.83601E-05	1.7357E-07	\$	81.03	\$	81.03
4.00	5.5	0.48400	7.29	15.20	24.4	35.3	-0.00877487	0.0974755	8.69914E-05	1.80853E-07	\$	88.70	\$	88.70
4.00	6	0.46300	6.96	14.50	23.3	33.7	-0.00507885	0.09283602	8.48189E-05	1.69018E-07	\$	96.37	\$	96.37
4.50	0	8.52000	178.00	408.00	689.0	1027.0	-2.40444918	2.10560938	0.00699286	-1.06812E-06	\$	-	\$	-
4.50	0.5	2.55000	40.30	85.30	139.0	202.0	-0.05858508	0.52038548	0.000748911	6.2206E-07	\$	15.84	\$	15.84
4.50	1	1.33000	20.30	42.50	64.7	99.3	-0.07481345	0.33922828	-0.00059846	2.78258E-06	\$	18.42	\$	18.42
4.50	1.5	1.06000	16.10	33.60	54.3	78.5	0.002667794	0.21153564	0.00023601	3.15582E-07	\$	25.56	\$	25.56
4.50	2	0.89700	13.60	28.40	45.8	66.2	-0.00329127	0.17937951	0.000193236	2.7401E-07	\$	40.36	\$	40.36
4.50	2.5	0.77800	11.80	24.60	39.5	57.1	-0.01738693	0.15755305	0.000144611	2.79775E-07	\$	45.22	\$	45.22
4.50	3	0.70300	10.60	22.10	35.6	51.5	-0.00342438	0.14057606	0.000138841	2.41845E-07	\$	53.29	\$	53.29
4.50	3.5	0.64500	9.73	20.30	32.6	47.2	-0.01333572	0.13015457	0.000115563	2.47307E-07	\$	61.36	\$	61.36
4.50	4	0.59000	8.89	18.50	29.8	43.1	-0.0020883	0.11804825	0.000112836	2.09376E-07	\$	69.43	\$	69.43
4.50	4.5	0.59100	8.90	18.60	29.9	43.1	-0.00044406	0.11737559	0.000129873	1.54453E-07	\$	77.50	\$	77.50
4.50	5	0.55500	8.36	17.40	28.0	40.5	-0.0041952	0.11127415	0.000103397	2.0179E-07	\$	85.57	\$	85.57
4.50	5.5	0.52800	7.95	16.60	26.6	38.5	-0.01398888	0.10670557	9.16497E-05	2.03914E-07	\$	93.64	\$	93.64
4.50	6	0.50300	7.56	15.80	25.3	36.6	-0.01296024	0.1014198	8.89414E-05	1.87225E-07	\$	101.71	\$	101.71
5.00	0	9.49000	199.00	454.00	768.0	1145.0	-2.63998882	2.35783048	0.007642948	-7.55576E-07	\$	-	\$	-
5.00	0.5	2.90000	46.00	97.40	158.0	231.0	-0.19629105	0.60934239	0.000662657	1.24412E-06	\$	17.71	\$	17.71
5.00	1	1.76000	27.20	57.00	92.2	134.0	-0.05303284	0.36028654	0.000369179	6.79715E-07	\$	20.14	\$	20.14
5.00	1.5	1.32000	20.10	42.10	68.0	98.5	-0.01160179	0.26478965	0.00029262	4.18753E-07	\$	27.40	\$	27.40
5.00	2	1.08000	16.40	34.20	55.1	79.7	-0.01265856	0.21749832	0.000216256	3.70202E-07	\$	42.88	\$	42.88
5.00	2.5	0.90700	13.70	28.70	46.2	66.8	-0.0072637	0.18098636	0.000196493	2.70976E-07	\$	47.73	\$	47.73
5.00	3	0.80600	12.20	25.40	40.9	59.2	-0.01008045	0.16244023	0.000150235	3.01623E-07	\$	56.00	\$	56.00
5.00	3.5	0.73100	11.00	23.00	37.1	53.5	0.009459835	0.14392218	0.000172879	1.7266E-07	\$	64.28	\$	64.28
5.00	4	0.66100	9.97	20.80	33.5	48.3	0.003031589	0.13119868	0.000146122	1.75694E-07	\$	72.56	\$	72.56
5.00	4.5	0.61700	9.29	19.40	31.2	45.0	-0.00033867	0.12263692	0.000132737	1.70839E-07	\$	80.83	\$	80.83
5.00	5	0.58100	8.74	18.20	29.3	42.3	0.000947708	0.11564264	0.000117798	1.81763E-07	\$	89.11	\$	89.11
5.00	5.5	0.55200	8.31	17.30	27.9	40.2	0.007803212	0.10904227	0.00012328	1.42012E-07	\$	97.39	\$	97.39
5.00	6	0.52700	7.92	16.50	26.6	38.4	0.004502477	0.10437444	0.000111663	1.55667E-07	\$	105.66	\$	105.66
6.00	0	11.20000	234.00	535.00	905.0	1350.0	-3.08990812	2.76905087	0.009072892	-9.76710E-07	\$	-	\$	-
6.00	0.5	3.53000	56.30	119.00	194.0	283.0	-0.15708408	0.7346363	0.000932785	1.23502E-06	\$	19.84	\$	19.84
6.00	1	2.09000	32.20	67.70	109.0	159.0	-0.12171064	0.43338373	0.000363801	1.0044E-06	\$	21.37	\$	21.37
6.00	1.5	1.54000	23.50	49.20	79.4	115.0	-0.022132	0.31034744	0.000333273	5.03717E-07	\$	28.93	\$	28.93
6.00	2	1.22000	18.50	38.70	62.3	90.2	-0.0201056	0.24557579	0.000246973	4.18753E-07	\$	44.19	\$	44.19
6.00	2.5	1.04000	15.80	32.90	53.1	76.7	-0.00047779	0.20829659	0.000221042	3.21651E-07	\$	48.74	\$	48.74
6.00	3	0.92000	13.90	29.00	46.7	67.5	-0.00527499	0.18405076	0.000187932	2.97375E-07	\$	56.80	\$	56.80
6.00	3.5	0.81000	12.20	25.50	41.0	59.3	-0.00868535	0.1620373	0.00016146	2.70065E-07	\$	64.86	\$	64.86
6.00	4	0.74500	11.20	23.40	37.7	54.4	0.0052322	0.14727491	0.000166165	1.98756E-07	\$	72.92	\$	72.92
6.00	4.5	0.69200	10.40	21.70	35.0	50.5	0.008414695	0.13653207	0.000154933	1.84494E-07	\$	80.98	\$	80.98
6.00	5	0.64500	9.70	20.20	32.5	47.0	-0.0038009	0.12901711	0.000121754	2.291E-07	\$	89.04	\$	89.04
6.00	5.5	0.61600	9.27	19.30	31.1	44.9	0.003054607	0.12241674	0.000127236	1.89349E-07	\$	97.10	\$	97.10
6.00	6	0.58600	8.82	18.40	29.6	42.7	0.000251824	0.11650911	0.000123835	1.68108E-07	\$	105.16	\$	105.16
7.00	0	12.70000	267.00	611.00	1034.0	1542.0	-3.55732102	3.15132865	0.010491384	-1.42619E-06	\$	-	\$	-
7.00	0.5	4.01000	64.00	136.00	221.0	322.0	-0.							

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

9.00	3.5	1.06000	16.00	33.40	53.8	77.7	-0.00110228	0.21119752	0.000225866	3.15582E-07	\$	81.13	\$	81.13
9.00	4	0.96800	14.60	30.50	49.0	70.8	-0.01201649	0.1939775	0.000193308	3.13154E-07	\$	86.27	\$	86.27
9.00	4.5	0.89300	13.50	28.10	45.2	65.2	-0.00415707	0.17882638	0.000180774	2.75224E-07	\$	91.40	\$	91.40
9.00	5	0.83300	12.50	26.20	42.1	60.8	-0.00365951	0.16518526	0.000180735	2.32742E-07	\$	96.53	\$	96.53
9.00	5.5	0.78800	11.90	24.70	39.8	57.4	0.003311945	0.15731625	0.000158468	2.46397E-07	\$	101.67	\$	101.67
9.00	6	0.75100	11.30	23.60	37.9	54.7	-0.00586652	0.14988485	0.000153125	2.2728E-07	\$	106.80	\$	106.80
10.00	-	17.70000	370.00	847.00	1435.0	2142.0	-4.77502048	4.36019572	0.014570323	-1.72963E-06	\$	-	\$	-
10.00	0.5	5.68000	91.00	193.00	315.0	459.0	-0.23064022	1.17751696	0.001668431	1.61432E-06	\$	55.91	\$	55.91
10.00	1	3.35000	51.90	109.00	177.0	257.0	-0.0441186	0.67825054	0.000823688	1.04688E-06	\$	61.62	\$	61.62
10.00	1.5	2.18000	33.30	69.60	112.0	163.0	-0.0936014	0.44840497	0.000355017	1.03778E-06	\$	67.32	\$	67.32
10.00	2	1.76000	26.80	56.00	90.2	131.0	-0.05060875	0.35834406	0.00031755	7.40404E-07	\$	73.03	\$	73.03
10.00	2.5	1.49000	22.60	47.30	76.2	110.0	-0.0065094	0.29733934	0.000339092	3.97512E-07	\$	78.73	\$	78.73
10.00	3	1.31000	19.80	41.30	66.5	96.1	-0.00784914	0.26219379	0.000267384	4.21787E-07	\$	84.44	\$	84.44
10.00	3.5	1.17000	17.70	36.90	59.4	85.8	-0.00772248	0.23442909	0.000238358	3.73236E-07	\$	90.14	\$	90.14
10.00	4	1.06000	16.10	33.50	53.9	77.9	-0.01580415	0.21425927	0.000201287	3.76271E-07	\$	95.85	\$	95.85
10.00	4.5	0.97800	14.70	30.70	49.5	71.5	0.007093205	0.1934533	0.000213927	2.79775E-07	\$	101.56	\$	101.56
10.00	5	0.91000	13.70	28.60	46.0	66.4	-0.00236244	0.18120045	0.000190201	2.70065E-07	\$	107.26	\$	107.26
10.00	5.5	0.85900	12.90	27.00	43.4	62.7	-0.00429227	0.17072149	0.000180973	2.55196E-07	\$	112.97	\$	112.97
10.00	6	0.81000	12.20	25.40	40.9	59.0	0.002934391	0.1611066	0.000168678	2.39721E-07	\$	118.67	\$	118.67
12.00	-	20.80000	435.00	997.00	1691.0	2524.0	-5.46682879	5.10092117	0.017473698	-2.67031E-06	\$	-	\$	-
12.00	0.5	6.02000	95.60	203.00	330.0	480.0	-0.25335483	1.24131456	0.001737707	1.57184E-06	\$	67.10	\$	67.10
12.00	1	3.51000	54.10	114.00	184.0	267.0	-0.10928747	0.71373529	0.000813128	1.11971E-06	\$	73.94	\$	73.94
12.00	1.5	2.53000	38.60	80.80	130.0	189.0	-0.09863554	0.5179718	0.000442636	1.11364E-06	\$	80.79	\$	80.79
12.00	2	2.04000	30.90	64.70	104.0	151.0	-0.06195253	0.4138481	0.00036715	8.37506E-07	\$	87.63	\$	87.63
12.00	2.5	1.72000	26.10	54.40	87.7	127.0	-0.02054776	0.3466554	0.00033339	6.31164E-07	\$	94.48	\$	94.48
12.00	3	1.50000	22.70	47.30	76.3	110.0	0.01147929	0.29800789	0.000337278	3.94477E-07	\$	101.33	\$	101.33
12.00	3.5	1.34000	20.20	42.10	67.9	98.1	0.005964757	0.26641416	0.000282229	4.12684E-07	\$	108.17	\$	108.17
12.00	4	1.21000	18.30	38.20	61.4	88.7	-0.01560388	0.24301287	0.00024248	3.91443E-07	\$	115.02	\$	115.02
12.00	4.5	1.11000	16.80	34.90	56.2	81.2	-0.00728604	0.2232242	0.000210358	3.91443E-07	\$	121.87	\$	121.87
12.00	5	1.03000	15.50	32.40	52.1	75.3	-0.00722388	0.20543869	0.000211022	3.24685E-07	\$	128.71	\$	128.71
12.00	5.5	0.97200	14.60	30.50	49.1	70.9	0.002430171	0.19266164	0.000207915	2.81596E-07	\$	135.56	\$	135.56
12.00	6	0.91400	13.80	28.70	46.1	66.6	-0.01264821	0.18416445	0.000166249	3.2954E-07	\$	142.41	\$	142.41

References:

10. TMY3 Weather data from Department of Energy
 28. MN Bin Temp Bin Hrs are taken from the "Thermal Environmental Engineering, Third Edition, Thomas H. Kuehn, James W. Ramsey and James L. Threlkeld, Pages 717-718, Table B.5" to determine full load equivalent hours (FLEH) in Minnesota area. See Forecast furnace operating hours for calculation. Adjusted for CO

Changes from Recent Filing:

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DEEMED SAVINGS TECHNICAL ASSUMPTIONS

13.8 Demand Control Ventilation

Algorithms

$Customer\ kW = Total\ Exhaust\ Fan\ HP \times ESF$

$Customer\ kWh = Customer\ kW \times Hours$

$Customer\ Dth = Total\ Exhaust\ Fan\ HP \times GSF$

Variables

ESF	0.9054	Demand Controlled Ventilation Electric Savings Factor, kW per name plate HP. (Ref 49)
GSF	42.3224	Demand Controlled Ventilation Gas Savings Factor =42.3224 Dth per name plate hp. (Ref 49)

Customer Inputs

M&V Verified

Model Name	Yes	
Model Number	Yes	
Quantity	Yes	
Size	Yes	
Total Exhaust Fan hp	Yes	Total nameplate HP of exhaust fans with DCV installed.

Table 13.8.1 Ref (49, 50)	Incremental Cost Per Name Plate HP	Measure Life (yrs)	Coincidence Factor (CF)	O&M Savings - energy Per Name Plate HP	Hours
Demand Controlled Ventilation	\$ 2,451.55	20	49.46%	\$0	3307

References:

- 49. Custom DCV Projects, 2010-2011
- 50. MN Lighting Efficiency Tech Assumption , Tab "Forcast Market Segment".

Changes from Recent Filing:

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DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Table 13.0.1 Measure Lives

Hot Water Boilers (Non Condensing)	Product Life (yrs)	Source of Information
Hot Water Boiler - Non-condensing 175 MBTUH	20	Reference 3
Hot Water Boiler - Non-condensing 500 MBTUH	20	Reference 3
Hot Water Boiler - Non-condensing 1MMBTUH	20	Reference 3
Hot Water Boiler - Non-condensing 2 MMBTUH	20	Reference 3
Hot Water Boiler - Non-condensing 4 MMBTUH	20	Reference 3
Hot Water Boiler - Non-condensing 6 MMBTUH	20	Reference 3
Hot Water Boiler - Non-condensing 8, MMBTUH	20	Reference 3
Low Pressure Steam Boilers		
Low Pressure Steam Boiler - 300 MBTUH	20	Reference 3
Low Pressure Steam Boiler - 1 MMBTUH	20	Reference 3
Low Pressure Steam Boiler - 10 MMBTUH	20	Reference 3
High Pressure Steam Boilers		
High Pressure Steam Boiler - 300 MBTUH	20	Reference 3
High Pressure Steam Boiler - 1 MMBTUH	20	Reference 3
High Pressure Steam Boiler - 10 MMBTUH	20	Reference 3
Outdoor Air Reset		
Gas Boiler condensing or non-condensing	20	Reference 51
Stack Dampers		
Gas Boiler condensing or non-condensing	12	Reference 51
Linkageless Controls		
Gas Boiler condensing or non-condensing	16	Reference 43
Modulating Burners		
Gas Boiler condensing or non-condensing	20	Reference 3
Turbulators		
Gas Boiler condensing or non-condensing	20	Reference 3
O2 Trim Control		
Gas Boiler condensing or non-condensing	20	Reference 51
Water Heaters		
Storage Water Heater	15	Reference 35
Tankless Water Heater	20	Reference 35
Steam Traps		
Gas Boiler - Steam Traps - Low and High Pressure	5	Reference 4
Pipe Insulation		
Insulation - Hot Water System	13	Reference 51
Insulation - Steam System	13	Reference 51
High Efficiency Furnace	20	Reference 48
Unit Heaters		
Unit Heaters - Non-Condensing	20	
Unit Heaters - Infrared	15	
Destratification Fans	15	Reference 48

Table 13.0.2 Heating Equipment Efficiencies

	Baseline Efficiency (EFFb)	Efficient Efficiency (EFFh)	Unit	Reference
New Boilers (Non-Condensing) <300,000 BTU/h	80.0%	85.0%*	AFUE	Ref. 11
New Boilers (Non-Condensing) >= 300,000 BTU/h and <=2,500,000 BTU/h	80.0%	85.0%*	Et (Thermal Eff)	Ref. 11
New Boilers (Non-Condensing) >2,500,000 BTU/h	82.0%	85.0%*	Ec (Combustion Eff)	Ref. 11
Retrofit Boilers <300,000 BTU/h	78.0%	92.0%*	AFUE	Ref. 11
Retrofit Boilers >=300,000 BTU/h and <=2,500,000 BTU/h	78.0%	92.0%*	Et (Thermal Eff)	Ref. 11
Retrofit Boilers >2,500,000 BTU/h	78.0%	92.0%*	Ec (Combustion Eff)	Ref. 11
Low Pressure Steam Boilers	79.0%	81.0%*	Et (Thermal Eff)	Ref. 6
High Pressure Steam Boilers	79.0%	81.0%*	Et (Thermal Eff)	Ref. 6
Outdoor Air Reset	80.0%	83.0%		Ref. 13
Stack Dampers	80.0%	81.0%		Ref. 14
Modulating Burner Controls	80.0%	83.0%		Ref. 15
O2 Trim Control	80.0%	82.0%		Ref. 16
Steam Traps	80.0%	N/A		Ref. 17
Turbulators	80.0%	83.0%		
Linkageless Controls	80.0%	83.0%		Ref. 46
Water Heaters	80.0%	92.0%*		Ref. 18
Unit Heater (Non-condensing)	80.0%	83.0%*		Ref. 3
Pipe Insulation	80.0%	N/A		Ref 17

*High efficiency boiler and furnace efficiencies are per customer. Listed efficiencies are minimum qualifying efficiencies.

Table 13.0.3 Effective Full Load Heating Hours (Ref 28, 47, 48)

Equipment	Use	Hours	Explanation
Boiler	Space Heating Only	1,204	Based on MN TRM Table of EFLH weighted average calculated from historical participation
	Domestic Hot Water Only	2,191	Based on Bin Analysis assuming Constant 25% load and 30% oversizing
	Space Heating and Domestic Hot Water	2,057	Based on Bin Analysis assuming constant 15% load and 30% oversizing for the DHW and TRM values for space heating
Commercial Water Heater	All	1,092	Based on historical custom rebate projects

Table 13.0.4 Altitude Adjustment

Climate Zone	Alt
CO1: Denver / Front Range	0.823
CO2: Alamosa / Mountain is climate zone	0.756
CO3 Grand Junction / Western Slope	0.837

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

References:

1. 1999 Minnesota Energy Code - Chapter 7676.1100 Subpart 3D, 4A
2. Centerpoint TRM
3. International Energy Conservation Code (IECC) 2015 Table C403.2.3 (4)
4. ASHRAE HVAC Systems and Equipment 2008 pg 15.1
5. Whole Building Design Guide for US Army. Tech Note 14: Overhead Radiant Heating <<https://www.wbdg.org/ffc/army-coe/technotes/technote-14>>
6. 2015 Minnesota Energy Code Table C403.2.3(5) pg C-44
7. Cost data from online review on 8/5/15 of available products from various distributors
8. Nicor Gas Energy Efficiency Plan 2011-2014. Revised Plan Filed Pursuant to Order Docket 10-0562, May 27, 2011
9. Sachs, Harvey M., Unit Heaters Deserve Attention for Commercial Programs, ACEEE, April 2003
10. TMY3 Weather data from Department of Energy
11. International Energy Conservation Code (IECC) 2012
12. 2% efficiency improvement for boiler tune up based on Michaels Energy literature review. Sources included (but not limited to):
 - 12A. Illinois Technical Reference Manual (2015-2016)
 - 12B. Michigan Energy Measures Database (MEMD) accessed at <https://www.michigan.gov/mpsc/0,9535,7-395-93309_94801_94808_94811---,00.html>
 - 12C. Arkansas Technical Reference Manual <<http://www.apscservices.info/EEInfo/TRM4.pdf>>
13. 3% efficiency improvement for boiler outdoor air reset based on Michaels Energy literature review. Sources included (but not limited to):
 - 13A. Arkansas Technical Reference Manual <<http://www.apscservices.info/EEInfo/TRM4.pdf>>
 - 13B. NEEP Mid-Atlantic TRM. V5. >http://www.neep.org/sites/default/files/resources/Mid-Atlantic_TRM_V5_FINAL_5-26-2015.pdf
14. 1% efficiency improvement for stack dampers based on Michaels Energy literature review. Sources included (but not limited to):
 - 14A. Arkansas Technical Reference Manual <<http://www.apscservices.info/EEInfo/TRM4.pdf>>
 - 14B. Illinois Technical Reference Manual (2015-2016)
 - 14C. Minnesota TRM. Version 1.3. <<http://mn.gov/commerce-stat/pdfs/trm-version-1.3.pdf>>
15. 3% efficiency improvement for modulating boiler controls based on Michaels Energy literature review. Sources included (but not limited to):
 - 15A. Illinois Technical Reference Manual (2015-2016)
 - 15B. Minnesota TRM. Version 1.3. <<http://mn.gov/commerce-stat/pdfs/trm-version-1.3.pdf>>
16. 2% efficiency improvement for O2 trim control based on Michaels Energy literature review. Sources included (but not limited to):
 - 16A. Illinois Technical Reference Manual (2015-2016)
 - 16B. Minnesota TRM. Version 1.3. <<http://mn.gov/commerce-stat/pdfs/trm-version-1.3.pdf>>
17. 80% boiler efficiency assumed based on minimum boiler efficiency from IECC 2015.
18. California DEER Database, 2014 (value used is for remaining useful life of commercial high efficiency furnaces)
19. AHRI Directory of Certified Product Performance; average of Standby Loss in BTUH per gallon of storage calculated for units with 80% or less thermal efficiency for baseline unit and <96% thermal efficiency for efficient unit
20. Leakage data from Energy Management Handbook, by Wayne Turner
21. Measure life from the Federal Energy Management Program (FEMP).
22. The average baseline and high efficiency costs are based on the California DEER database.
23. Cost information supplied by Engineered Products
24. Material costs taken from zoro.com for fiberglass pipe insulation (February 2016)
25. Commercial Condensing Boiler Optimization. Center for Energy and Environment. Prepared for Minnesota Department of Commerce, Division of Energy Resources. 2015.
26. AHRI Directory of Certified Product Performance; average of Standby Loss in BTUH per gallon of storage calculated for units with 80% or less thermal efficiency for baseline unit and <96% thermal efficiency for efficient unit
27. Arkansas Deemed Savings Quick Start Program Draft Report Commercial Measures Final Report, Nexant.
28. MN Bin Temp Bin Hrs are taken from the "Thermal Environmental Engineering, Third Edition, Thomas H. Kuehn, James W. Ramsey and James L. Threlkeld, Pages 717-718, Table B.5" to
29. Arkansas Deemed Savings Quick Start Program Draft Report Commercial Measures Final Report, Nexant.
30. Baseline and Energy Efficient equipment costs provided by vendors
31. Minnesota DER Deemed Values
32. Bradford White RightSpec® commercial water heater sizing software
33. Bosch tankless water heater sizing software
34. Commercial Buildings Energy Consumption Study (CBECS), 2006
35. 2008 DEER Effective Useful Life Summary October 1st 2008
36. 2007 ASHRAE HVAC Applications Handbook Chapter 36, page 36.3, Table 4
37. 2006 IECC
38. "Electricity Savings from Variable-Speed Furnaces in Cold Climates" Pigg, Scott and Talerico, Tom. ACEEE Summer Study Proceedings 2004
39. U.S. Department of Energy, Preliminary Analysis Report, 2012 (http://www1.eere.energy.gov/buildings/appliance_standards/pdfs/ff_prelim_ch_00_execsummary_2012_06_26.pdf)
40. <http://www.grainger.com>
41. Wisconsin Focus on Energy, ECM Furnace Fan Impact Evaluation Report, https://focusenergy.com/sites/default/files/emcfurnaceimpactassessment_evaluationreport.pdf)
42. MN custom rebates and conversations with Distributors (Tim Stoklosa, Clean Energy Designs in Lakewood CO)
43. Illinois 2017 TRM ; http://ilsagfiles.org/SAG_files/Technical_Reference_Manual/Version_6/Final/IL-TRM_Effective_010118_v6.0_Vol_2_C_and_I_020817_Final.pdf
45. Source BTU for electricity based on MN DOC No. G008/CIP-00-864.07 Reply Comments of May 23, 2003 which states a Source BTU comparison must be made using an assumed heat rate of 7500 BTU/Generator kWh , based on typical Heat Rate for Combined-Cycle Natural Gas-fired Plant.
46. Wisconsin Focus on Energy 2019 TRM
47. Historical program participation
48. State of Minnesota Technical Reference Manual for Energy Conservation Improvement Programs version 3.0 Jan 10 2019
49. Custom DCV Projects, 2010-2011
50. MN Lighting Efficiency Tech Assumption , Tab "Forcast Market Segment".
51. 2011 Tetrattech Program Evaluation
52. 99.6% design temperature for Denver (Stapleton), taken from the 2005 ASHRAE Handbook - Fundamentals. Grand Junction - Station 724760; Alamosa - Station 724620.

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

14.1 Lighting Controls

Algorithms

$$\text{Customer kW} = \text{kW Connected} \times \% \text{ Savings} \times \text{Cooling kW Savings Factor}$$

$$\text{Customer kWh} = \text{kW Connected} \times \% \text{ Savings} \times \text{Hours} \times \text{Cooling kWh Savings Factor}$$

$$\text{Customer PckW} = \text{kW Connected} \times \% \text{ Savings} \times \text{Cooling kW Savings Factor} \times \text{CF}$$

$$\text{Natural Gas Savings (Dth)} = \text{kW Connected} \times \% \text{ Savings} \times \text{Hours} \times \text{Heating Penalty Factor}$$

Variables

Cooling_kW_Savings_Factor	See Table 14.0.1	Cooling system secondary demand savings factor resulting from efficient lighting. Reduction in lighting demand results in a reduction in cooling demand, if the customer has air conditioning. Existence of air conditioning determined by HVAC_Type.
Cooling_kWh_Savings_Factor	See Table 14.0.1	Cooling system secondary energy savings factor resulting from efficient lighting. Reduction in lighting energy results in a reduction in cooling energy, if the customer has air conditioning. Existence of air conditioning determined by HVAC_Type.
Heating_Penalty_Factor	See Table 14.0.1	Heating system secondary energy penalty factor resulting from efficient lighting. Reduction in lighting demand results in an increase in heating usage, if the customer has gas heating. Existence of gas heating to be determined by HVAC_Type.
CF	See Table 14.0.3	Coincidence Factor is the probability that the peak demand of the lights will coincide with the peak utility system demand, determined by Facility_Type.
Hours	See Table 14.0.3	Annual operating hours, determined by Facility_Type.
% Savings	See Table 14.1.1	Stipulated savings percentage based on control type.
Measure Life	See Table 14.0.2	Length of time the lighting equipment will be operational.
NTG	See Table 14.1.2	Net-to-gross.

Customer Inputs

M&V Verified

HVAC_Type	Yes	Type of heating or cooling, verified during M&V.
Facility_Type	No	Type of facility.
kW_Connected	Yes	Total connected fixture load connected to lighting controls, provided by customer and verified during M&V.

Table 14.1.1 Lighting Controls ^{3, 4, 5, 12, 29 & 30}

Control Type	% Savings	Full Cost Per Watt
Standalone or Integrated LLLC - Occupancy Sensor	24%	\$0.49
Standalone or Integrated LLLC - Daylighting (Photocell) Sensor	28%	\$0.49
Standalone or Integrated LLLC - Occupancy and Daylighting	38%	\$0.49
Networked Lighting Controls (w & w/o LLLC)	49%	\$0.97
Integrated LLLC - High End Trim	29%	\$0.48

Table 14.1.2 Net To Gross ^{11, 28}

Program	NTG %
Lighting Efficiency	100%
Small Business Solutions	94%

References:

3. State of Illinois Technical Reference Manual, Version 9.0 Final Technical Version as of October 17th, 2019. Effective January 1st, 2021.

4. Design Lights Consortium. (2017). Energy Savings from Networked Lighting Control (NLC) Systems. Medford: Design Lights Consortium. Retrieved 1 23, 2020, from <https://www.designlights.org/lighting-controls/reports-tools-resources/nlc-energy-savings-report/>

5. Lawrence Berkeley National Laboratory. (2011). A Meta-Analysis of Energy Savings from Lighting Controls in Commercial Buildings. Berkeley, CA: Lawrence Berkeley National Laboratory. Retrieved 10 01, 2017, from https://eta.lbl.gov/sites/default/files/publications/a_meta-analysis_of_energy_savings_from_lighting_controls_in_commercial_buildings_lbnl-5095e.pdf

6. Measure Life for automatically controlled measures from the Deemed Savings for CO Energy Management Systems, 2019-2020. (NLC Measure Life)

11. The Unopposed Settlement Agreement in Proceeding No. 18A-0606EG.

12. "Lighting Efficiency - CO" and "Lighting - Small Business" participation data

28. Net-to-Gross factor from the Evaluation of Xcel Energy's Small Business Solutions Program. 2020. EMI Consulting.

29. Design Lights Consortium. Energy Savings from Networked Lighting Control (NLC) Systems with and without LLLC. Sept 24, 2020. <https://www.designlights.org/resources/reports/report-energy-savings-from-networked-lighting-control-nlc-systems-with-and-without-lllc/>

30. NEEA. 2020 Luminaire Level Lighting Controls Incremental Cost Study. <https://neea.org/img/documents/2020-LLLC-Incremental-Cost-Study.pdf>

Changes from Recent Filing:

Updated NLC measure to include LLLC type networked controls
 Added Luminaire Level Lighting controls version of current standalone occupancy & photocell controls offering
 Added High End Trim measure for LLLC
 Updated controls costs based on reported values

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

14.2 Lighting Retrofit

Algorithms

$$\text{Customer kW} = (\text{kW Exist} - \text{kW Prop}) \times \text{Cooling kW Savings Factor}$$

$$\text{Customer kWh} = (\text{kW Exist} - \text{kW Prop}) \times \text{Hours} \times \text{Cooling kWh Savings Factor}$$

$$\text{Customer PckW} = (\text{kW Exist} - \text{kW Prop}) \times \text{Cooling kW Savings Factor} \times \text{CF}$$

$$\text{kW Exist} = \text{Qty Existing Equip} \times \text{Existing Model kW}$$

$$\text{kW Prop} = \text{Qty Prop Equip} \times \text{Equipment Model kW}$$

$$\text{Natural Gas Savings (Dth)} = (\text{kW Exist} - \text{kW Prop}) \times \text{Hours} \times \text{Heating Penalty Factor}$$

Variables

Cooling_kW_Savings_Factor	See Table 14.0.1	Cooling system secondary demand savings factor resulting from efficient lighting. Reduction in lighting demand results in a reduction in cooling demand, if the customer has air conditioning. Existence of air conditioning determined by HVAC_Type.
Cooling_kWh_Savings_Factor	See Table 14.0.1	Cooling system secondary energy savings factor resulting from efficient lighting. Reduction in lighting energy results in a reduction in cooling energy, if the customer has air conditioning. Existence of air conditioning determined by HVAC_Type.
Heating_Penalty_Factor	See Table 14.0.1	Heating system secondary energy penalty factor resulting from efficient lighting. Reduction in lighting demand results in an increase in heating usage, if the customer has gas heating. Existence of gas heating to be determined by HVAC_Type.
CF	See Table 14.0.1	Coincidence Factor is the probability that the peak demand of the lights will coincide with the peak utility system demand, determined by Facility_Type.
Hours	See Table 14.0.1	Annual operating hours, determined by Facility_Type.
Measure Life	See Table 14.0.2	Length of time the lighting equipment will be operational.
NTG	See Table 14.2.1	Net-to-gross

Customer Inputs

M&V Verified

Qty_Existing_Equip	Yes	Quantity of existing equipment, verified during M&V.
Qty_Prop_Equip	Yes	Quantity of proposed equipment, verified during M&V.
HVAC_Type	Yes	Type of heating or cooling, verified during M&V.
Facility_Type	No	Type of facility.
Existing_Model_kW	Yes	Existing equipment wattage determined from stipulated fixture or lamp wattage. Specific lighting product provided by customer and verified during M&V.
Equipment_Model_kW	Yes	Proposed equipment wattage of fixture or lamp. Specific lighting product provided by customer and verified during M&V.
Baseline Cost	No	Cost of the baseline technology. For Retrofit, the cost is \$0.00 since the baseline is to continue to operate the existing system. For New Construction, the cost is that of the lower efficiency option. Costs are determined through market research and provided by vendors.
High Efficiency Cost	No	Cost of the High Efficiency technology. 9 Equipment and Labor costs are also collected on a per measure basis, data is used to evaluate and identify the need to update costs as needed throughout the year to account for the rapidly evolving market.

Table 14.2.1 Net To Gross^{9, 28}

Program	NTG %
Lighting Efficiency	73%
Small Business Solutions	94%

References:

9. Net-to-Gross factor from Evaluation of Xcel Energy's Lighting Efficiency Program. 2019. EMI Consulting.
 28. Net-to-Gross factor from the Evaluation of Xcel Energy's Small Business Solutions Program. 2020. EMI Consulting.

Changes from Recent Filing:

Updated the NTG Value used in the Small Business Solutions Program based on the 2020 Xcel Small Business Solutions Evaluation

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

14.3 Lighting Midstream

Algorithms

$$\text{Customer kW} = \text{Quantity} \times \frac{\text{Watts Base} - \text{Watts EE}}{1000} \times \text{Cooling kW Savings Factor}$$

$$\text{Customer kWh} = \text{Quantity} \times \frac{\text{Watts Base} - \text{Watts EE}}{1000} \times \text{Hours} \times \text{Cooling kWh Savings Factor}$$

$$\text{Customer PckW} = \text{Quantity} \times \frac{\text{Watts Base} - \text{Watts EE}}{1000} \times \text{Cooling kW Savings Factor} \times \text{CF}$$

$$\text{LPW EE} = (\text{Lumens EE}) / (\text{Watts EE})$$

$$\text{Watts Base} = \text{Watts EE} \times \frac{\text{LPW EE}}{\text{LPW Base}}$$

$$\text{Natural Gas Savings (Dth)} = \text{Quantity} \times \frac{\text{Watts Base} - \text{Watts EE}}{1000} \times \text{Hours} \times \text{Heating Penalty Factor}$$

Applies to: LED Linear Lamps - Type B & C, LED PL/G based CFL Replacement lamp - Type B, LED Screw-in Lamps - HID Replacement

$$\text{Watts Base} = \text{Watts EE} \times \frac{\text{LPW EE}}{\text{LPW Base} \times \text{Baseline Equivalency Factor} \times \text{Ballast Factor}}$$

*Rest of the equations are the same as the first table

Applies to: LED Linear Lamps - Type A, LED PL/G based CFL Replacement lamp - Type A

$$\text{Customer kW} = \text{Quantity} \times \frac{\text{Watts Base} - \text{Sys Watts EE}}{1000} \times \text{Cooling kW Savings Factor}$$

$$\text{Customer kWh} = \text{Quantity} \times \frac{\text{Watts Base} - \text{Sys Watts EE}}{1000} \times \text{Hours} \times \text{Cooling kWh Savings Factor}$$

$$\text{Customer PckW} = \text{Quantity} \times \frac{\text{Watts Base} - \text{Sys Watts EE}}{1000} \times \text{Cooling kW Savings Factor} \times \text{CF}$$

$$\text{Watts Base} = \text{Watts EE} \times \frac{\text{LPW EE}}{\text{LPW Base} \times \text{Baseline Equivalency Factor} \times \text{Ballast Factor}}$$

$$\text{Sys Watts EE} = (\text{Watts EE}) / (\text{Ballast Efficiency})$$

Variables

Variable	Value	Description
LPW_Base	See Table 14.3.1	Efficacy of the baseline technology (lumens per watt).
Cooling_kW_Savings_Factor	1.24	Reduction in lighting demand results in a reduction in cooling demand, if the customer has air conditioning. The program will not have direct access to market segment information, so a deemed weighted average was created based on a three year history of downstream participation. ^{1,2}
Cooling_kWh_Savings_Factor	1.09	Reduction in lighting energy results in a reduction in cooling energy, if the customer has air conditioning. The program will not have direct access to market segment information, so a deemed weighted average was created based on a three year history of downstream participation. ^{1,2}
Heating_Penalty_Factor	-0.000508	Reduction in lighting energy results in an increase in heating usage, if the customer has gas heating (Dth/kWh). ²
CF	75%	Coincidence Factor is the probability that the peak demand of the lights will coincide with peak utility system demand. The program will not have direct access to market segment information, so a deemed weighted average was created based on a three year history of downstream participation. ^{1,2}
Hours	4,897	Annual operating hours. The program will not have direct access to market segment information, so a deemed weighted average based on a three year history of downstream participation was created. ^{1,2}
Ballast_Factor	88%	Ballast factor is the measured ability of a fluorescent ballast to produce light from the lamp(s) it powers. In addition to the effect on light output, there is also an indirect impact on energy consumption. A normal ballast factor is assumed here. ¹⁶
Ballast_Efficiency	85%	There is an inefficiency when an LED lamp is running off of a ballast, which adds additional wattage to the nominal lamp wattage. Ballast efficiency may also be referred to as power factor in general terms. Power factor is the fraction of power actually used by the ballast compared to the total power supplied. The ballast efficiency accounts for this inefficiency. ²⁰
Baseline_Equivalency_Factor	See Table 14.3.2	Accounts for differences in luminaire efficiency (ratio of light emitted by the fixture to the lumen output of the lamp-ballast system alone), lumen depreciation over time, and oversized spaces.
Measure Life	See Table 14.3.3	Length of time the lighting equipment will be operational, equals the lifetime hours of the lamp divided by the deemed hours of use.
Baseline Cost	See Table 14.3.4	Cost of the baseline technology.
Labor Cost	See Table 14.3.5	Cost of labor to install fixtures, Type B, and Type C lamps. ¹
NTG	78%	Net-to-gross factor. ¹⁴

Customer Inputs

M&V Verified

Customer Input	M&V Verified	Description
Quantity	No	Quantity of lamps or retrofit kits.
Measure Category	No	Type of lamp or retrofit kit.
Watts_EE	No	High efficiency lamp wattage. This is defined by the manufacturer and maintained and reported by the distributor.
Lumens_EE	No	High efficiency lamp rated brightness (lumens). This is defined by the manufacturer and maintained and reported by the distributor.
High Efficiency Cost	No	Cost of the high efficiency technology. Costs will be collected from the equipment distributor on the product invoice.

Table 14.3.1 Baseline Lamp Efficacy based on Lamp Category ¹⁵⁻²⁰

Measure Category	Avg. Efficacy
A Lamp rated for 310 - 749 Lumens	27.12
A Lamp rated for 750 - 1049 Lumens	36.88
A Lamp rated for 1050 - 1489 Lumens	39.45
A Lamp rated for 1490 - 2600 Lumens	37.93
General Directional (PAR, BR, R)	18.69
Multifaceted Reflector (MR16)	13.00
Decorative (B, BA, Candle, Globe)	10.45
Downlight Retrofit Kit	24.39
Fluorescent Linear Lamps	88.70
PL/G based CFL lamp	69.30
HID Screw-in Lamp	83.20
LED Interior Fixture <= 25W	48.42
LED Interior Fixture 26W - 50W	49.09
LED Exit Sign	7.50

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Table 14.3.2 Baseline Equivalency Factor (BEF) ²⁴

Measure Category	BEF
LED Linear Lamps - Type A	0.70
LED Linear Lamps - Type B, C	0.87
LED PL/G based CFL Replacement Lamp	0.52
LED Screw-in Lamps, HID Replacement	0.62

Table 14.3.3 Measure Lifetimes in Years ^{8, 21, 23}

Measure Category	2021 Lifetime	2022 Lifetime	2023 Lifetime
LED Interior Lamp - A Lamp	5.2	5.2	5.2
General Directional (PAR, BR, R)	3.3	2.3	1.3
Multifaceted Reflector (MR16)	3.1	2.1	1.1
Decorative (B, BA, Candle, Globe)	3.4	2.4	1.4
Downlight Retrofit Kit	9.4	9.4	9.4
LED Linear & U-Bend Tubes - Type A & B	10.2	10.2	10.2
LED Linear & U-Bend Tubes - Type C & LED Interior Fixtures	20.0	20.0	20.0
LED PL/G based CFL Replacement lamp	10.2	10.2	10.2
LED Screw-in Lamps, HID Replacement	10.2	10.2	10.2

Table 14.3.4 Baseline Costs ²²

Measure Category	Baseline Cost
A19 60W, 750-1049 lm	\$2.36
A19 100W, 1490-2600 lm	\$3.28
Decorative (Candle/Globe)	\$1.54
BR30	\$3.39
BR40	\$7.06
MR16	\$2.64
PAR16	\$5.99
PAR20	\$5.45
R20	\$4.30
PAR30	\$6.85
PAR38	\$8.89
Downlight Retrofit Kit	\$8.41
LED Linear Lamps - Type A	\$2.19
LED Linear Lamps - Type B	\$2.07
LED Linear Lamps - Type C	\$2.18
LED PL/G based CFL Replacement lamp	\$4.59
LED Screw-in Lamps, HID Replacement	\$37.68

Table 14.3.5 Labor Costs ¹²

Measure Category	Labor Cost
LED Linear Lamps - Type B	\$8.00
LED Linear Lamps - Type C	\$12.00
LED PL/G based CFL Replacement Lamp - Type B	\$12.00
LED Screw-in Lamps, HID Replacement	\$55.00
LED Interior Fixtures	\$40.00
LED/LEC Exit Sign	\$60.00

References:

12. "Lighting Efficiency - CO" and "Lighting - Small Business" participation data from 2017 through 2019.
 13. Deemed Savings for 2019-2020 "Product: Lighting Efficiency - CO" to reference deemed values used to create weighted averages for HVAC Interactive Factors, Hours and CF.
 14. Net-to-Gross factor from 2020 Xcel Energy Small Business Lighting Efficiency Program Evaluation
 15. Energy Independence and Security Act. United States Congress. Jan 4, 2007. <https://www.govinfo.gov/content/pkg/BILLS-110hr6enr/pdf/BILLS-110hr6enr.pdf>
 16. Adoption of Light-Emitting Diodes in Common Lighting Applications. Prepared for the U.S. Department Of Energy by Navigant Consulting. April 2013. http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/led-adoption-report_2013.pdf
 17. Caliper Benchmark Report - Performance of Incandescent A-Type and Decorative Lamps and LED Replacements. U.S. Department of Energy. November, 2008. https://www1.eere.energy.gov/buildings/publications/pdfs/ssl/a-type_benchmark_11-08.pdf
 18. ENERGY STAR @ Integral LED Product Qualifications Requirements. 2010.
 19. Caliper Benchmark Report - Performance of Halogen Incandescent MR 16 Lamps and LED Replacements. U.S. Department of Energy. November, 2008. https://www1.eere.energy.gov/buildings/publications/pdfs/ssl/a-type_benchmark_11-08.pdf
 20. Incandescent Reflector Lamps minimum efficacy standards. http://www1.eere.energy.gov/buildings/appliance_standards/product.aspx/productid/58
 21. ENERGY STAR @ Certified Light Bulbs and Light Fixtures Qualified Products Lists. Accessed July 2018.
 22. Actual sales data from distributors from 2017-2018. (Baseline Distributor Costs)
 23. Design Lights Consortium (2018). Qualified Products List as of February 27, 2018. (Lamp Lifetime Hours)
 24. Compared lumen equivalency data in the CO Lighting Efficiency downstream program from 2018 and 2019 to identify the baseline equivalency factors for the lamps.
 25. "What is a ballast factor, and how does it affect my fluorescent tubes?". July 7, 2016. <https://insights.regencylighting.com/what-is-a-ballast-factor-and-how-does-it-affect-my-fluorescent-tubes>
 26. Ballast Efficiency (Aka: Power Factor). <https://www.yumpu.com/en/document/read/48349742/what-is-the-difference-between-power-factor-and-csram-sylvania>

Changes from Recent Filing:

- Addition of Ballast Factor, Ballast Efficiency & Baseline Equivalency Factor for determining lamp efficacy
 Added Labor Cost of install or Type B & C Lamps
 Cost updated based on ClearResult market research
 Updated the NTG Value used in the Lighting Efficiency and Small Business Solutions Programs based on the 2020 Xcel Lighting Efficiency Midstream and Small Business Solutions Evaluations

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

14.4 Lighting DI

Algorithms

$$\text{Customer kW} = (\text{kW Exist} - \text{kW Prop}) \times \text{Cooling kW Savings Factor}$$

$$\text{Customer kWh} = (\text{kW Exist} - \text{kW Prop}) \times \text{Hours} \times \text{Cooling kWh Savings Factor}$$

$$\text{Customer PckW} = (\text{kW Exist} - \text{kW Prop}) \times \text{Cooling kW Savings Factor} \times \text{CF}$$

$$\text{kW Exist} = \text{Qty Existing Equip} \times \text{Existing Model kW}$$

$$\text{kW Prop} = \text{Qty Prop Equip} \times \text{Equipment Model kW}$$

$$\text{Natural Gas Savings (Dth)} = (\text{kW Exist} - \text{kW Prop}) \times \text{Hours} \times \text{Heating Penalty Factor}$$

Variables

Cooling_kW_Savings_Factor	See Table 14.0.1	Cooling system secondary demand savings factor resulting from efficient lighting. Reduction in lighting demand results in a reduction in cooling demand, if the customer has air conditioning. Existence of air conditioning determined by HVAC_Type.
Cooling_kWh_Savings_Factor	See Table 14.0.1	Cooling system secondary energy savings factor resulting from efficient lighting. Reduction in lighting energy results in a reduction in cooling energy, if the customer has air conditioning. Existence of air conditioning determined by HVAC_Type.
Heating_Penalty_Factor	See Table 14.0.1	Heating system secondary energy penalty factor resulting from efficient lighting. Reduction in lighting demand results in an increase in heating usage, if the customer has gas heating. Existence of gas heating to be determined by HVAC_Type.
CF	See Table 14.0.3	Coincidence Factor is the probability that the peak demand of the lights will coincide with the peak utility system demand, determined by Facility_Type.
Hours	See Table 14.0.3	Annual operating hours, determined by Facility_Type.
Measure Life Hours	25,000	Lifetime of lamps installed through the program in hours. Spec sheets provided by third-party implementer.
High Efficiency Cost	See Table 14.4.1 & Table 14.4.2	Costs are provided by the vendor and are re-evaluated throughout the year to account for the rapidly evolving market.
NTG	See Table 14.4.3	Net-to-gross ¹⁴

Customer Inputs

Qty_Existing_Equip	Quantity of existing equipment.
Qty_Prop_Equip	Quantity of proposed equipment
HVAC_Type	Type of heating or cooling
Facility_Type	Type of facility.
Existing_Model_kW	Existing equipment wattage determined from stipulated fixture or lamp wattage. Specific lighting product provided by third-party implementer.
Equipment_Model_kW	Proposed equipment wattage of fixture or lamp. Specific lighting product provided by third-party implementer. Type-A tubes assume a ballast efficiency built into the lamp kW.

Table 14.4.1 DI Lamp Costs²⁷

Lamps	Wattage*	Equipment Cost*	Labor W/ Incandescent Baseline*	Labor W/ CFL Baseline*
A-Lamps	9W	\$0.84	\$5.00	\$3.00
	6W	\$0.84		
BR30	8W	\$1.47		
MR16	7W	\$2.72		
	7W	\$2.72		
Par20	11W	\$2.33		
Par30	15W	\$3.26		
Par38	13W	\$4.52		
BR20	7W	\$1.10		
LED Exit Sign	0.7W-1.8W**	\$16.00		

* See note in the variables section on updating costs and lamp wattages throughout the program year.

** Exit sign wattage varies depending on color

Table 14.4.2 DI Tubes Cost

	Equipment Cost*	Labor Cost*
LED Tubes	\$4.75	\$9.84

* See note in the variables section on updating costs and lamp wattages throughout the program year.

Table 14.4.3 Net To Gross²⁸

Program	NTG %
Small Business Solutions	94%
Multifamily Buildings	100%

References:

14. Net-to-Gross factor from 2019 Xcel Energy Small Business Lighting Efficiency Program Evaluation
27. Cost information supplied by direct install implementer
28. Net-to-Gross factor from the Evaluation of Xcel Energy's Small Business Solutions Program. 2020. EMI Consulting.

Changes from Recent Filing:

New Exit sign DI to SBS
Added DI Tubes
Updated the NTG Value used in the Small Business Solutions Program based on the 2020 Xcel Small Business Solutions Evaluation

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

14.5 Refrigerated Case LED DI

Algorithms

$$\text{Customer kW} = \frac{(\text{Existing Watts} - \text{Proposed Watts})}{1000} \times \text{Cooling kW Savings Factor} \times \text{Qty Prop Equip}$$

$$\text{Customer kWh} = \frac{(\text{Existing Watts} - \text{Proposed Watts})}{1000} \times \text{Hours} \times \text{Cooling kWh Savings Factor} \times \text{Qty Prop Equip}$$

$$\text{Customer PCKW} = \frac{(\text{Existing Watts} - \text{Proposed Watts})}{1000} \times \text{Cooling kW Savings Factor} \times \text{CF} \times \text{Qty Prop Equip}$$

Variables

Cooling_kW_Savings_Factor	See Table 14.0.1	Cooling system secondary demand savings factor resulting from efficient lighting. Reduction in lighting demand results in a reduction in cooling demand, if the customer has air conditioning. Existence of air conditioning determined by HVAC_Type.
Cooling_kWh_Savings_Factor	See Table 14.0.1	Cooling system secondary energy savings factor resulting from efficient lighting. Reduction in lighting energy results in a reduction in cooling energy, if the customer has air conditioning. Existence of air conditioning determined by HVAC_Type.
CF	100%	Coincidence Factor is the probability that the peak demand of the lights will coincide with the peak utility system demand. For refrigerated case lighting this is deemed to be 100%
Hours	4,897	Annual operating hours. The program will not have direct access to market segment information, so a deemed weighted average based on a three year history of downstream participation was created. ^{1,2}
Measure Life Hours	25,000	Lifetime of lamps installed through the program in hours. Spec sheets provided by vendor
High Efficiency Cost	See Table 14.5.1	Costs are provided by the vendor and are re-evaluated throughout the year to account for the rapidly evolving market.
NTG	94%	Net-to-gross ²⁸

Customer Inputs

Qty_Prop_Equip	Quantity of proposed equipment.
Existing Watts	Existing equipment wattage determined from stipulated fixture or lamp wattage.
Proposed Watts	See Table 14.5.1. Wattage of proposed LED lamp. Specific lighting product provided by vendor.

Table 14.5.1 DI Lamp Costs²⁷

Lamps	Proposed Watts*	Equipment Cost*	Labor W/ Incandescent Baseline*	Labor W/ CFL Baseline*
A Lamps	9	\$0.84	\$5.00	\$3.00

* See note in the variables section on updating costs and lamp wattages throughout the program year.

References:

12. "Lighting Efficiency - CO" and "Lighting - Small Business" participation data from 2017 through 2019.
27. Cost information supplied by direct install implementer
28. Net-to-Gross factor from the Evaluation of Xcel Energy's Small Business Solutions Program. 2020. EMI Consulting.

Changes from Recent Filing:

Updated operating hours to align Midstream
Updated the NTG Value used in the Small Business Solutions Program based on the 2020 Xcel Small Business Solutions Evaluation

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

14.6 Grow Lighting

Algorithms

$$\text{Customer kW} = \left(\left(\frac{\text{Proposed Fixture kW} * \text{Proposed Quantity} * \% \text{Reflector Eff}_{\text{prop}} * \text{Proposed PPE}}{\% \text{Reflector Eff}_{\text{base}} * \text{Baseline PPE}} \right) - \text{Proposed Quantity} * \text{Proposed Fixture kW} \right) * \text{Cooling kW Savings Factor}$$

$$\text{Customer kWh} = \left(\left(\frac{\text{Proposed Fixture kW} * \text{Proposed Quantity} * \% \text{Reflector Eff}_{\text{prop}} * \text{Proposed PPE}}{\% \text{Reflector Eff}_{\text{base}} * \text{Baseline PPE}} \right) - \text{Proposed Quantity} * \text{Proposed Fixture kW} \right) * \text{Hours} * \text{Cooling kWh Savings Factor}$$

$$PCKW = \text{Customer kW} * CF$$

Variables

%Reflector Eff_base	78.3%	Accounts for reflector losses and amount of useful light delivered using baseline fixtures ²
%Reflector Eff_prop	97.2%	Accounts for reflector losses and amount of useful light delivered from LED grow lights ²
Cooling kW Savings Factor*	1.33	Assuming year round A/C cooling for indoor grow facilities
Cooling kWh Savings Factor*	See Table 14.6.1	Assuming year round A/C cooling for indoor grow facilities
Hours	See Table 14.6.1	Annual Hours of Operation
CF	See Table 14.6.1	Coincidence Factor
Incremental Cost	See Table 14.6.2	Average fixture costs per watt based weighted against total watts from historical custom projects
Baseline PPE	See Table 14.6.3	Average value weighted against historical custom project baseline wattage

* These values assume year round mechanical cooling in all facilities. This is the current standard assumption for custom analysis.

Customer Inputs

	M&V Verified	
Grow Room Type*	Yes	Flower or Veg
Proposed Fixture Quantity	Yes	Number of proposed LED grow fixtures being installed
Proposed Fixture PPE (PPF/W)	Yes	Umols/J from spec sheet or DLC listing
Proposed Fixture kW	Yes	kW per proposed LED fixture
Total Equipment Cost	No	Field only used for data collection to update cost assumptions to match changing market conditions
Total Labor Cost	No	Field only used for data collection to update cost assumptions to match changing market conditions

Table 14.6.1: Operating Schedule ^{1,4}

Grow Room Type	Annual Hours*	CF*	Cooling kWh Savings Factor
Cannabis Flower Room	4,255	0.68	1.16
Cannabis Veg Room	6,498	0.89	1.24
Flowering Crops (Tomatoes/Peppers/Flowers)	4,200	0.76	1.21
Vegetative/Propagation Growth	6,300	0.95	1.21
Microgreens	6,300	0.95	1.21

* Cannabis values are calculated averages of custom indoor grow project operating schedules

Table 14.6.2: Incremental Cost per Watt ¹

Baseline Cost/W*	Proposed Cost/W**
\$ 0.27	\$ 1.40

* Calculated as average baseline cost per watt from historical custom projects weighted against baseline wattage

** Calculated as average proposed cost per watt from historical custom projects weighted against proposed wattage

Table 14.6.3: Baseline PPF ²

	PPE	Wtd Avg PPE** ¹
Mogul Based HPS	1.02	1.08
DE HPS	1.7	
CMH	1.46	
Fluorescent*	0.84	

* The reference for this was specific to T8. Due to lack of sources T5 is assumed to be equivalent

** Baseline average PPE calculated from historical custom projects and weighted against total baseline watts. We investigated using separate values based on room type but found only a 3% difference between flower and veg and determined a single value was sufficient.

References:

1. Historical custom grow lighting projects from 2020. 54 spaces and over 5500 proposed fixtures.
2. LED and HID Horticultural Luminaire Testing Report, Lighting Energy Analysis, Natural Resources Canada, 2018: <https://www.lrc.rpi.edu/programs/energy/pdf/HorticulturalLightingReport-Final.pdf>
3. Energy Savings Potential of SSL in Horticultural Applications, US Department of Energy Office of Energy Efficiency and Renewable Energy, December 2017: https://www.energy.gov/sites/prod/files/2017/12/146/ssl_horticulture_dec2017.pdf
4. State of Illinois Technical Reference Manual, Version 9.0 Final Technical Version as of October 17th, 2019. Effective January 1st, 2021.

Table 14.0.1: HVAC Interactive Factors ^{1,2}

HVAC_Type	Cooling_kWh_Savings_Factor	Cooling_kW_Savings_Factor	Heating_Penalty_Factor (Dth/kWh)
Heating Only	1.00	1.00	-0.000508
Heating and Cooling	1.13	1.33	-0.000508
Cooler Door Retrofit to LED	1.44	1.44	N/A
Freezer Door Retrofit to LED	1.70	1.70	N/A

Table 14.0.2: Measure Lifetimes in Years ^{3, 6, 7 & 8}

Measure	Lifetime
LED Fixtures & Retrofit Kits	20.0
Lighting Sensors	8.0
Networked Lighting Controls	15.0
Luminaire Level Lighting Controls	15.0
LED Interior Lamp	7.0
LED Ref and Frz Screw In Fixture Retrofit	5.0
LED Tubes	11.0

Table 14.0.3: Coincident Peak Demand Factors and Annual Operating Hours by Facility Type ³

Facility_Type	CF	Annual Operating Hours
24-Hour Facility	100%	8,760
Assisted Living	66%	7,862
College	63%	3,395
Elementary School	65%	3,038
Exterior - Dusk to Dawn	0%	4,380
Grocery/Convenience Store	79%	4,661
Healthcare Office / Outpatient	67%	3,890
Hospital	56%	7,616
Hotel/Motel Common Areas	85%	6,138
Hotel/Motel Guest Rooms	46%	2,390
Manufacturing	81%	4,618
Office - Low Rise	52%	2,698
Office - Mid Rise	60%	3,266
Office - High Rise	59%	2,886
Other/Misc.	67%	3,379
Religious Building	48%	2,085
Restaurant	100%	5,571
Retail - Department Store	94%	4,099
Retail - Strip Mall	71%	4,093
Safety or Code Required (Including Exit Signs)	100%	8,760
Secondary School	65%	3,038
Warehouse	85%	3,135

References:

1. HVAC Interactive Factors developed based on the Rundquist Simplified HVAC Interaction Factor method, ASHRAE Journal - "Calculating lighting and HVAC interactions".
2. COP values from the Deemed Savings for CO Commercial Refrigeration, 2019-2020. (Cooler and Freezer Door Interactive Factors).
3. State of Illinois Technical Reference Manual, Version 9.0 Final Technical Version as of October 17th, 2019. Effective January 1st, 2021. (Hours and CF)
4. Design Lights Consortium. (2017). Energy Savings from Networked Lighting Control (NLC) Systems. Medford: Design Lights Consortium. Retrieved 1 23, 2020, from <https://www.designlights.org/lighting-controls/reports-tools-resources/nlc-energy-savings-report/>
5. Lawrence Berkeley National Laboratory. (2011). A Meta-Analysis of Energy Savings from Lighting Controls in Commercial Buildings. Berkeley, CA: Lawrence Berkeley National Laboratory. Retrieved 10 01, 2017, from https://eta.lbl.gov/sites/default/files/publications/a_meta-analysis_of_energy_savings_from_lighting_controls_in_commercial_buildings_lbnl-5095e.pdf
6. Measure Life for automatically controlled measures from the Deemed Savings for CO Energy Management Systems, 2019-2020. (NLC Measure Life)
7. Design Lights Consortium (2018). Qualified Products List as of February 27, 2018. (Lamp Lifetime Hours)
8. Hours of Use to calculate measure life for lamps was determined using a weighted hours of operation from Xcel Energy 2018/2019 participation.
9. Net-to-Gross factor from Evaluation of Xcel Energy's Lighting Efficiency Program. 2019. EMI Consulting.
10. LED baseline and proposed costs come from previous Xcel Energy Custom Lighting Efficiency projects, as well as market research through ShineRetrofits.com, LightingAtlanta.org, 1000bulbs.com, grainger.com, Pro Lighting.com, and more.
11. The Unopposed Settlement Agreement in Proceeding No. 18A-0606EG.
29. Design Lights Consortium. Energy Savings from Networked Lighting Control (NLC) Systems with and without LLLC. Sept 24, 2020. <https://www.designlights.org/resources/reports/report-energy-savings-from-networked-lighting-control-nlc-systems-with-and-without-lllc/>
30. NEEA. 2020 Luminaire Level Lighting Controls Incremental Cost Study. <https://neea.org/img/documents/2020-LLLC-Incremental-Cost-Study.pdf>

Midstream:

12. "Lighting Efficiency - CO" and "Lighting - Small Business" participation data from 2017 through 2019.
13. Deemed Savings for 2019-2020 "Product: Lighting Efficiency - CO" to reference deemed values used to create weighted averages for HVAC Interactive Factors, Hours and CF.
14. Net-to-Gross factor from 2020 Xcel Energy Small Business Lighting Efficiency Program Evaluation
15. Energy Independence and Security Act. United States Congress. Jan 4, 2007. <https://www.govinfo.gov/content/pkg/BILLS-110hr6enr/pdf/BILLS-110hr6enr.pdf>
16. Adoption of Light-Emitting Diodes in Common Lighting Applications. Prepared for the U.S. Department Of Energy by Navigant Consulting. April 2013. http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/led-adoption-report_2013.pdf
18. ENERGY STAR @ Integral LED Product Qualifications Requirements. 2010.
17. Caliper Benchmark Report - Performance of Incandescent A-Type and Decorative Lamps and LED Replacements. U.S. Department of Energy. November, 2008. https://www1.eere.energy.gov/buildings/publications/pdfs/ssl/a-type_benchmark_11-08.pdf
20. Incandescent Reflector Lamps minimum efficacy standards. http://www1.eere.energy.gov/buildings/appliance_standards/product.aspx/productid/58
21. ENERGY STAR @ Certified Light Bulbs and Light Fixtures Qualified Products Lists. Accessed July 2018.
22. Actual sales data from distributors from 2017-2018. (Baseline Distributor Costs)
23. Design Lights Consortium (2018). Qualified Products List as of February 27, 2018. (Lamp Lifetime Hours)
24. Compared lumen equivalency data in the CO Lighting Efficiency downstream program from 2018 and 2019 to identify the baseline equivalency factors for the lamps.
25. "What is a ballast factor, and how does it affect my fluorescent tubes?". July 7, 2016. <https://insights.regencylighting.com/what-is-a-ballast-factor-and-how-does-it-affect-my-fluorescent-tubes>
26. Ballast Efficiency (Aka: Power Factor). <https://www.yumpu.com/en/document/read/48349742/what-is-the-difference-between-power-factor-and-osram-sylvania>

DI:

27. Cost information supplied by direct install implementer

Small Business Solutions:

28. Net-to-Gross factor from the Evaluation of Xcel Energy's Small Business Solutions Program. 2020. EMI Consulting.

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

15.1 Motors

Algorithms

$$Customer\ kWh = (HP \times LF_Motors \times Conversion \times \left(\frac{1}{Standard_Eff} - \frac{1}{High_Eff} \right)) \times Hrs \times Refrigeration_Factor$$

$$Customer\ Coincident\ kW = (HP \times LF_Motors \times Conversion \times \left(\frac{1}{Standard_Eff} - \frac{1}{High_Eff} \right)) \times CF \times Refrigeration_Factor$$

Variables

Hrs	Table 15.1 and Table 15.3	Annual operational hours per year of the motor. Deemed values are used for hours based on the type and use of the motor. The customer provides the following information on the rebate form: HP, industrial/non-industrial, building type, and compressor/pump/fan/other.
LF_Motors	Table 15.2	Motor load factor as a percentage. ¹
COP	Table 15.4	Coefficient of Performance = Refrigeration/Cooling Capacity (BTU/hr) / Energy Input (BTU/hr)
Cost Factor b	Table 15.5	Coincidence factor
High_Eff	Table 15.6	Efficiency of high efficiency replacement motor as a percentage. New Enhanced and Upgrade Enhanced are NEMA Premium plus 1%. Upgrade is NEMA Premium. The customer will provide the model and serial number of the motor along with actual nameplate efficiency from the new motor. If the actual efficiency is not provided by the customer, it will be determined from specification sheet.
Standard_Eff	Table 15.6	Efficiency of standard replacement motor as a percentage. New Enhanced is NEMA Premium. Upgrade and Upgrade Enhanced are EPACT. Based on customer provided motor size, speed, and enclosure type.
Conversion	0.746	Conversion from HP to kW
Refrigeration_Factor	1+1/COP	Multiplier to include interactive effects of refrigeration or cooling energy to remove heat from the motor.
Lifetime Upgrade	15	This is the incremental lifetime of retiring an EPACT motor early. ¹
Lifetime Enhanced	20	This is the full lifetime of a motor since this is a new to new comparison ¹

Customer Inputs

M&V Verified

New motor model and serial number	Yes	HP, efficiency, type, and speed can then be looked up in a database
Application of motor	Yes	
Building type	Yes	Where motor is installed for non-industrial motors
Use of motor	Yes	Pump, fan, other
Equipment is installed	Yes	

References:

1. Efficiency Vermont's Technical Reference User Manual, 2004 - Source for operating hours for non-industrial motors (p.15) and source for measure life, source for load factor
2. Office of Industrial Electric Motor Systems Market Opportunities Assessment : Department of Energy (assessment of 265 Industrial facilities in 1997) - Source for VSD opportunity in the US market along with load factors for fans and pumps along with average savings

Assumptions:

- Each motor is replaced with the same size on a 1 for 1 basis. Motors replaced with different sizes can participate in the Custom Efficiency product.
- Prescriptive rebates are only given for motors put into service, rebates are not given for backup motors.
- Prescriptive rebates are only given to VFD's installed on centrifugal pump or fan applications.
- Rebates do not apply to rewind or repaired motors.

Changes from Recent Filing:

Opening the Enhance efficiency program to all motors that meet that efficiency level. This includes induction, Permanent Magnet, Electronically Commutated, Switched Reluctance Combined enhanced upgrade and enhanced motors products into one enhanced motors program.
 All rebates for both the upgrade motors and the enhanced motors are cut by 50% from their previous level

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

15.2 VFDs

Algorithms

$$Customer\ kWh = \frac{HP \times LF_{Motors} \times Conversion \times Hours \times \%_{Savings_Drives} \times Refrigeration_Factor}{Avg_Motor_Efficiency}$$

$$Customer\ Coincident\ kW = \frac{HP \times LF_{Motors} \times Conversion \times CF \times \%_{Savings_Drives} \times Refrigeration_Factor}{Avg_Motor_Efficiency}$$

Variables

Hours	Table 15.1 and Table 15.3	Annual operational hours per year of the motor. Deemed values are used for hours based on the type and use of the motor. The customer provides the following information on the rebate form: HP, industrial/non-industrial, building type, and compressor/pump/fan/other. ¹
LF_Motors	Table 15.2	Motor load factor as a percentage. ²
Refrigeration_Factor	Table 15.3	Coefficient of Performance = Refrigeration/Cooling Capacity (BTU/hr) / Energy Input (BTU/hr)
CF	Table 15.5	Coincidence factor
Incremental Cost	Table 15.7	Incremental cost for VFD ³
Avg_Motor Efficiency	Table 15.8	Efficiency of NEMA premium efficient motor as a percentage. Value is a weighted average by HP based on customer past selections.
% Savings Drives	33%	Average savings achieved by installing a VFD on a fan or pumping motor. ²
Measure life	15	Years
Conversion	0.746	Conversion from horsepower to kW.

Customer Inputs

M&V Verified

HP	Yes	Rated motor horsepower.
Facility Type	Yes	
Application	Yes	

Assumptions:

- Each VFD is replaced with the same size on a 1 for 1 basis.
- Prescriptive rebates are only given for VFDs put into service, rebates are not given for backup VFDs.
- Prescriptive rebates are only given to VFD's installed on centrifugal pump and fan applications.

References:

1. Efficiency Vermont's Technical Reference User Manual, 2004 - Source for operating hours for non-industrial motors (p.15) and source for measure life, source for load factor
2. Office of Industrial Electric Motor Systems Market Opportunities Assessment : Department of Energy (assessment of 265 Industrial facilities in 1997) - Source for VSD opportunity in the US market along with load factors for fans and pumps along with average savings
3. Costs are derived from customer invoices received through Xcel Energy's prescriptive program.

Changes from Recent Filing:

VFD incremental costs were changed to represent past participation costs.
 Updating the motor efficiency to be the average motor efficiency based on the motors Xcel Energy has seen through its motors efficiency programs.

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

15.3 Refrigeration Fans

Algorithms

$$Customer\ kWh = \frac{(ECM_{Baseline\ Fan\ W} - ECM_{Efficient\ Fan\ W})}{1000} \times Refrigeration_{Factor} \times ECM_{Hours}$$

$$Customer\ Coincident\ kW = \frac{(ECM_{Baseline\ Fan\ W} - ECM_{Efficient\ Fan\ W})}{1000} \times Refrigeration_{Factor} \times CF$$

Variables

ECM Baseline Fan Watts	Table 15.3.1	Average input watts for shaded pole or permanent split capacitor motor
ECM Efficient Fan Watts	Table 15.3.1	Average input watts for efficient motor ¹
ECM Hours	Table 15.3.1	Hours per year (freezer subtracts defrost time) ¹
Cost Factor b	Table 15.3.2	Deemed Incremental Costs
COP	Table 15.4	Coefficient of Performance = Refrigeration/Cooling Capacity (BTU/hr) / Energy Input (BTU/hr)
CF	Table 15.5	Coincidence factor
Refrigeration_Factor	1+1/COP	Multiplier to include interactive effects of refrigeration or cooling energy to remove heat from the motor. Reduction in motor energy results in a reduction in refrigeration/cooling energy.
Lifetime	15	Years ⁴

Customer Inputs

M&V Verified

Size of motor	Yes	Watts
Application of motor	Yes	Display Case or Walk-in
Case or Walk-in temperature (Medium Temp or Low Temp)	Yes	Medium Temp or Low Temp
For Walk-in's: Fan diameter (<= 15 inches or >15 inches)	Yes	<= 15 inches or >15 inches

Table 15.3.1

Motor Application	ECM Baseline Fan Watts ¹	ECM Efficient Fan Watts ^{1,2}	ECM Hours ¹
MediumTemp Shaded Pole to PMSM in display case	49.69	15.25	8,672
Low Temp Shaded Pole to PMSM in display case	49.69	15.25	8,672
MediumTemp Shaded Pole to ECM in display case	49.69	16.50	8,672
Low Temp Shaded Pole to ECM in display case	49.69	16.50	8,672
Med Temp Shaded Pole to ECM in Walk-in	95.08	30.88	8,585
Low Temp Shaded Pole to ECM in Walk-in	95.08	30.88	8,585
Med Temp permanent split capacitor (PSC) to ECM in Walk-in	96.00	47.00	8,585
Low Temp permanent split capacitor (PSC) to ECM in Walk-in	96.00	47.00	8,585

Table 15.3.2

Motor Application	Equipment ^{1,2}	Labor ¹	Total
Reach-in PMSM	\$75.00	\$18.30	\$93.30
Walk-in ECM	\$226.20	\$42.81	\$269.01
Reach-in ECM	\$122.41	\$18.30	\$140.71

References:

1. ECM baseline and efficient watts and hours are from monitored data from Custom Efficiency projects
2. ENERGY SAVINGS OF PERMANENT MAGNET SYNCHRONOUS FAN MOTOR ASSEMBLY REFRIGERATED CASE EVAPORATORS, Alternative Energy Systems Consulting, Inc., 2016
3. Q-Sync Motors in Commercial Refrigeration: Preliminary Test Results and Projected Benefits, ORNL/TM-2015/466
4. http://www.deeresources.com/files/DEER2016/download/2010-2012_WO017_Ex_Ante_Measure_Cost_Study_-_Final_Report.pdf

Changes from Recent Filing:

None

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

15.4 Fan Efficiency (FEI)

Algorithms

$$Customer\ kW = \frac{HP \times LF \times Conversion}{Avg_Motor\ Efficiency} \times \left(Control_Factor \times \left(\frac{1}{FEI_{Baseline}} - \frac{1}{FEI} \right) + Int_VFD_Factor \right)$$

$$Baseline_Cost = \left(A \times \left(\frac{Fan_Diameter}{Size_Factor} \right) + \left(\frac{Fan_Diameter}{Size_Factor} \right)^B \right) \times (MSP_Min * Markup_Base + (MSP_Base - MSP_Min) \times Markup_Increm)$$

$$Proposed_Cost = (A \times Fan_Diameter + Fan_Diameter^B) \times (MSP_Min * Markup_Base + (MSP_Prop - MSP_Base) \times Markup_Increm)$$

$$Incremental\ Cost = Proposed_Cost - Baseline_Cost + VFD_Cost$$

$$Customer\ kWh = Customer\ kW \times Hours$$

$$Customer\ Coincident\ kW = Customer\ kW \times CF$$

Variables

Control_Factor	Table 15.4.1	Factor to adjust fan energy use for the inclusion of a VFD. This factor uses the prescriptive variable frequency drive factor to avoid double-counting for VFD savings.
Int_VFD_Factor	Table 15.4.2	Factor to add in VFD savings for an integrated VFD. This value matches the prescriptive VFD savings.
Minimum Qualifying FEI	Table 15.4.3	Minimum Qualifying FEI ^{1,2,3,5}
Measure life	Table 15.4.4	Years. Integrated controls reduce the lifetime by 5 years.
MSP_Min, MSP_Base, MSP_Prop	Table 15.4.5	The factors to determine manufacturers selling price based on type of fan and efficiency level. These values can change based on the FEI of the fan, and must be calculated. These factors relate to the minimum markup (FEI=1), baseline FEI, and actual proposed FEI, respectively. ¹
Markup_Base	Table 15.4.5	Base cost markup occurring during distribution based on fan type from the DOE. ¹
Markup_Increm	Table 15.4.5	Incremental cost markup due to efficiency increase from distributors based on fan type from the DOE. Rounded to three decimal places. ¹
A	18.919	Constant in Manufacturers Production Cost equation from DOE. Rounded to three decimal places. ¹
B	2.105	Constant in Manufacturers Production Cost equation from DOE. Rounded to three decimal places. ¹
Hours	Table 15.1, 15.3	Based on Segment
LF	Table 15.2	Fan Motor Loading Factor
CF	Table 15.5	Coincidence factor
VFD_Cost	Table 15.7	Incremental cost due to integrated VFD, matches VFD prescriptive rebate.
Avg_Motor Efficiency	Table 15.8	Efficiency of NEMA premium efficient motor as a percentage. Value is a weighted average by HP based on customer past selections.
Conversion	0.746	Conversion from horsepower to kW
Size_Factor	110%	The average fan size increase to reach a qualifying FEI value. This was developed through conversations with MN Trade Partners. ²

Customer Inputs

M&V Verified

HP	Yes	Nominal Fan HP
Fan Diameter	Yes	Fan diameter, in inches
Fan Type	Yes	Fan type, available options are in Table 15.4.5
Fan Control	Yes	Fan control, available options are (constant speed or variable speed)
Integrated VFD	Yes	Yes/No option of if a VFD is integrated into fan.
FEI	Yes	Customer Fan Efficiency Index
Industry Segment	Yes	Available options are in tables 15.1 and 15.3
Selection Screenshot Provided	Yes	Selection nameplate showing provided values ⁴

Table 15.4.1 Control type factors for energy savings.

Control Type	Value
Constant Speed	100%
Variable Speed	67%

Table 15.4.2 VFD Savings factor

VFD Type	Value
Has Integrated VFD	33%
Does Not have Integrated VFD	0%

Table 15.4.3 FEI values^{1,2,3}

HP Bins	Baseline FEI	Minimum Qualifying FEI
10 HP or Less	1.10	1.12

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

20 HP to 60 HP	1.20	1.22
75 HP or More	1.25	1.27

Table 15.4.4 Measure Life based on control strategy

Measure Life	Value
Integrated VFD Measure Life	15
Fan-only Measure Life	20

Table 15.4.5 Incremental Cost Factors¹

Fan Type	Baseline Markup	Incremental Markup	MSP Factor
Axial Cylindrical Housed	1.780	1.460	$0.0101*FEI+1.5084$
Panel	1.724	1.442	0.283
Centrifugal Housed	1.665	1.394	$21.4022*FEI^3+-78.3942*FEI^2+96.0738*FEI+-38.1369$
Centrifugal Unhoused	1.699	1.405	0.941
Inline and mixed flow	1.568	1.368	$16.5886*FEI^3+-60.7626*FEI^2+74.3786*FEI+-29.0017$
Radial	1.433	1.255	1.309
Power Roof Ventilator	1.551	1.361	0.844

References:

1. DOE NODA V3 LCC, Engineering, and NIA Supplemental Documents From FEI Working Group
2. 13,000 MN Fan Selections From Trade Partner
3. CEC Draft Staff Report - Analysis of efficiency Standards and Test Procedures for Commercial and Industrial Fans and Blowers
4. AMCA Standard 208-18
5. 2019 ASHRAE 90.1

Changes from Recent Filing:

New Product

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

15.5 Well Pump VFDs

Algorithms

$$Customer\ kWh = (Base_{kW} - VFD_{kW}) \times Well\ Hours$$

$$Customer\ Coincident\ kW = (Base_{kW} - VFD_{kW}) \times CF$$

$$VFD_{kW} = (VFD_{BHP} / Avg_Motor_Efficiency / VFD_{Eff}) \times Conversion$$

$$Base_{kW} = (Base_{BHP} / Avg_Motor_Efficiency) \times Conversion$$

$$VFD_{BHP} = \frac{Cost_Factor \times b \times (Flow \times VFD_{Head})}{(Constant \times Design_{Pump\ Eff})}$$

$$Base_{BHP} = \frac{(Flow \times Base_{Head})}{(Constant \times Base_{Pump\ Eff})}$$

$$Base_{Pump\ Eff} = -0.40205 \times (\%_{Flow})^2 + 1.00876 \times \%_{Flow} + 0.20113$$

$$VFD_{Head} = Static_{Head} + Flow_{Coeff} \times (Flow)^2$$

$$Base_{Head} = \%_{Design\ Head} \times Design_{Head}$$

$$Static_{Head} = \%_{Flow} \times (Max_{Well\ Depth} - Average_{Well\ Depth}) + Average_{Well\ Depth}$$

$$Flow_{Coeff} = Peak\ Dynamic\ head * / (Design_{Flow})^2$$

$$\%_{Design\ Head} = -0.11656 \times (\%_{Flow})^2 - 0.34465 \times \%_{Flow} + 1.46170$$

$$\%_{Flow} = \frac{Flow}{Design_{Flow}}$$

$$Peak\ Dynamic\ head = Design_{Head} - Max\ Well\ Depth$$

Variables

Well Hours	See 15.5.1	Number of hours per year the well pump will operate. Deemed values are used for hours based on the well pump application that will be provided by the customer.
CF	Table 15.5	Coincidence factor ²
Avg_Motor Efficiency	Table 15.8	Efficiency of NEMA premium efficient motor as a percentage. Value is a weighted average by HP based on customer past selections.
VFD_Eff	97%	Drive efficiency of a VFD, deemed to be 97% using a table of drive efficiency versus percent of rated power using the motor rated power. ¹
Constant	3960	Pump power equation constant used to convert units of feet of water and gallons per minute to HP. ⁶
Base_Pump_Eff	Calculated	Percent efficiency of the water well pump at a given percent of design flow rate. The algorithm is defined above and comes from a linear regression of a second-order polynomial on pump curve data (normalized to design head and flow) from Xcel well pump custom rebate projects. ²
Design_Pump_Eff	80.8%	Pumping efficiency at given conditions (%_Flow). This algorithm comes from a second-order polynomial curve fit of achievable pump efficiency versus flow rate from custom rebates and their associated pump curves. The design pump efficiency is a constant value used at all flow rates for VFD driven pumps. ²
Conversion	0.746	HP to kW conversion
%_Design_Head	Calculated	Percent of design total pump head occurring at a given percent of design flow rate. The algorithm is defined above and comes from a linear regression of a second-order polynomial on pump curve data (normalized to design head and flow) from seven Xcel well pump custom rebate projects. ²
Measure Life	15	Years ⁷

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Customer Inputs	M&V Verified
Pump Rated HP	Yes
Design Flow (GPM)	Yes
Design Head (ft)	Yes
Well Depth (ft)	No
Max Well Depth at design flow (ft)	No
Average Flow Rate (GPM)	No
Application of well pump (agriculture, golf course)	Yes

Table 15.5.1: Operating Hours by Application for Well Pumps^{2, 3, 4, 5}

Application	Operating Hours
Agricultural Irrigation	1,954
Golf & Landscape Irrigation	1,941
Municipal Water Supply	3,177
Other Water Well Pump	3,630

References:

1. US DOE Advanced Manufacturing Office Energy Tips, Motor Systems Tip Sheet #11, Adjustable Speed Drive Part-Load Efficiency,
2. Xcel Energy well pump and high static head custom motor rebates
3. Bonneville Power Association, Variable Frequency Drives, <http://www.bpa.gov/EE/Sectors/agriculture/Pages/Variable-Frequency-Drives.aspx>
4. Department of Energy (DOE) Guidelines for Estimating Unmetered Landscaping Water Use,
5. How Many Acres Are Needed for an 18 Hole Golf Course?, <https://golftips.golfweek.com/many-acres-needed-18-hole-golf-course-1812.html>
6. Water Distribution Formula Sheet <https://www.heritagesystemsinc.com/Downloads/WhitePapers/CommonWaterConversion%20Formulas.pdf>
7. Efficiency Vermont's Technical Reference User Manual, 2004 - Source for operating hours for non-industrial motors (p.15) and source for measure life,

Changes from Recent Filing:

VFD Costs are changing
 Updating the motor efficiency to be the average motor efficiency based on the motors Xcel Energy has seen through its motors efficiency programs.
 Changed the qualifying equipment to be 10HP - 200HP

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

15.6 Pump Efficiency (PEI)

Algorithms

$$Customer\ kW = \frac{HP \times Conversion \times Adj_Factor}{Avg_Motor_Efficiency} \times ((Baseline\ PEI - Proposed\ PEI) \times CTRL_Factor + VFD_Factor)$$

$$Customer\ kWh\ Savings = Customer\ kW \times Hours$$

$$Customer\ Coincident\ kW = Customer\ kW \times CF$$

$$Pump\ Incremental\ Cost = (Cost\ Factor\ m \times (Baseline\ PEI - Proposed\ PEI) + Cost\ Factor\ b) + VFD\ Cost$$

Cost Factor b

Baseline_PEI	Table 15.6.1	Pumps manufactured after 2020 must meet the minimum performance standard for the style and size pump This varies for variable pumps, but is a deemed value of 1 for constant speed pumps. ¹
Adj_Factor	Table 15.6.2	Adjustment Factors are derived from a sample of simulated pump installations, and varies with
VFD _{Eff}	Table 15.6.8	Efficiency of the integrated VFD
VFD _{Factor}	Table 15.6.7	VFD Savings factor to account for the savings of integrated VFDs
CTRL _{Factor}	Table 15.6.6	Adjustment factor to prevent double counting of savings from from our VFD product
Hours	Table 15.6.3	Hours of Operation per year or (hr/yr.) Hours are associated with customer provided market segments
Cost Factor m	Table 15.6.5	For constant speed to variable speed applications, use average incremental cost found by NEEA per pump based on hp and PEI.
Cost Factor b	Table 15.6.5	For variable speed to variable speed applications, use average incremental cost found by NEEA per pump based on hp and PEI.. This is the same as the CS_to_CS_Incremental_Cost as the only change is the pump body.
CF	Table 15.5	Coincidence factor
VFD_Cost	Table 15.7	Incremental cost due to integrated VFD, matches VFD prescriptive rebate.
Avg_Motor Efficiency	Table 15.8	Efficiency of NEMA premium efficient motor as a percentage. Value is a weighted average by HP based on customer past selections.
Conversion	0.746	Conversion from HP to kW
Constant Speed Lifetime	20	Years ⁹
Variable Speed Lifetime	15	Years ⁹

Customer Inputs

M&V Verified

Proposed_PEI	Yes	Pump efficiency level (PEI), which must be meet the minimum requirements in table below **must be at least .02 PEI below baseline**.
Integrated VFD	Yes	Does the p[roposed pump have an integrated VFD
Proposed Pump Speed Control	Yes	Identify if the proposed pump speed is constant speed or variable speed.
Horsepower	Yes	Nominal Pump Horsepower as identified on pump motor
Pumping Application	Yes	Check Pumping Application for Commercial HVAC and DHW, Agricultural or Industrial or Municipal
Percent Glycol	No	What percentage Glycol is the system
Pump Class	Yes	Identify type of pump and class

Table 15.6.1 Minimum PEI values

DOE Product Category	1-5 HP	7.5+ HP
All Constant Speed Pumps	1.00	1.00
Non-VT Variable Speed Pumps	0.54	0.50
VT Variable Speed Pumps	0.63	0.60

Table 15.6.2: Adjustment Factors for Pumps⁴

Pump Type	Variable Speed Pumps			Constant Flow Pumps (All Segments)
	Agricultural Irrigation	Industrial and Municipal	Commercial HVAC and DHW	
Non-Vertical Turbine Pump	1.13	1.13	1.22	0.85
Vertical Turbine Pump	1.50	1.50	1.60	1.15

Note: Commercial HVAC is assumed to have pumps with 40% BEP minimum. Agricultural and Industrial/Municipal are assumed to have 20% BEP minimum.

Source CIP_FR_LCC_2015-09-21_VL_VL_LoadFactor_v2.xlsm, taken and simplified from "lookups" tab and is calculated in excel file "ComIndAgPumps_1_1" on tab "Adj Factors"

Table 15.6.3: Pumping Application Data³

Application	Agricultural Irrigation	Industrial and Municipal	Commercial HVAC and DHW
Operating Hours (hrs/yr)	2,400	4,000	5,000

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Table 15.6.4: Pump Cost factors⁵

Incremental Costs Equation Factors		
HP	Cost Factor m	Cost Factor b
1	2,164.68	-7.4759
1.5	2,475.70	-8.3028
2	2,723.12	-8.9389
3	3,114.36	-9.9095
5	3,688.25	-11.2651
7.5	4,218.13	-12.4541
10	4,639.64	-13.3620
15	5,306.17	-14.7368
20	5,836.38	-15.7824
25	6,283.85	-16.6348
30	6,674.80	-17.3586
40	7,341.73	-18.5514
50	7,904.60	-19.5199
60	8,396.37	-20.3395
75	9,040.06	-21.3773
100	9,943.27	-22.7713
125	10,705.54	-23.8955
150	11,371.53	-24.8413
200	11,966.83	-25.6596

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Table 15.6.5: Pump Types Considered

Type	HP Range
End Suction Frame Mount (ESFM)	1-200 HP
End Suction Close Coupled (ESCC)	1-200 HP
In-Line (IL)	1-200 HP
Radially Split multi-stage vertical in-line diffuser casing (RSV)	1-200 HP
Vertical Turbine Submersible (ST)	1-200 HP

Table 15.6.6: Control Type Factors⁸

Control factors	Value
Constant Speed	100%
Variable speed	67%

Table 15.6.7: VFD Savings Factors⁸

Integrated VFD Factor	Value
Non integrated	0%
Integrated	33%

Table 15.6.8: Integrated VFD Efficiencies⁸

VFD Efficiency	Value
No VFD	100%
Yes VFD	97%

References:

- 1: DOE pump equipment classes and nominal speed, defined in the Rulemaking http://www.pumps.org/DOE_Pumps.aspx
- 2: These values were derived in CIP_FR_LCC_2015-09-21_CL_baselinePEI.xlsm as an estimate of the current market average efficiency level. This is based on the Table 8.3.4
- 3: Irrigation hours are taken from metering shown in the Green Motors Rewind UES workbook
 Industrial hours are the average hours for pump applications in the NW Motor Database
 Commercial water circulation hours are from the Circulator Pump Working Group
 Municipal hours are based on assumed hours close to 8760 with redundant pumps
 Other hours are from the DOE LCC calculator, combined with RTF pump subcommittee judgment
- 4: Work product is included a Utility titled "ComIndAgPumps_1_1" based upon CIP_FR_LCC_2015-09-21_CL_CL_LoadFactor.xlsm
- 5: Work product from utility work paper based upon CIP_FR_LCC_2015-09-21_Costs.xlsm
- 6: Supplyhouse.com shows variable speed 1 HP circulator pumps from \$1400-\$3100; non variable speed are under \$1000, some data available at the following website <http://www.supplyhouse.com/Grundfos-Pumps-1838000>
- 7: Pump Energy Index (PEI) based upon the Regional Technical Forum (RTF) approved Northwest Energy Efficiency Alliance (NEEA) pump ECS savings analysis from the Efficient Commercial and Industrial Pumps (ECIP) project, the Federal Standard is under Title 10 Section 431.462 for the Department of Energy (DOE) Energy Conservation Standard (ECS) for commercial, industrial and agricultural clean water pumps.
8. Office of Industrial Electric Motor Systems Market Opportunities Assessment : Department of Energy (assessment of 265 Industrial facilities in 1997) - Source for VSD opportunity in the US market along with load factors for fans and pumps along with average savings
9. Efficiency Vermont's Technical Reference User Manual, 2004 - Source for operating hours for non-industrial motors (p.15) and source for measure life, source for load factor

Changes from Recent Filing:

- Updated the calculation methodology to be more streamlined.
- Updated the offering to be based on the integration of the VFD rather than on the previous control type and the new control type.
- Updating the motor efficiency to be the average motor efficiency based on the motors Xcel Energy has seen through its motors efficiency programs.

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

15.7 Fractional HP Circ. Pumps

Algorithms

$$Customer\ kWh = (kW_{BASE} - kW_{ECM}) \times Hours$$

$$Customer\ Coincident\ kW = (kW_{BASE} - kW_{ECM}) \times CF$$

$$kW_{ECM} = \frac{ECM_{wattage}}{1000}$$

$$kW_{BASE} = \frac{kW_{ECM}}{Baseline_Conversion}$$

$$Incremental\ cost = ECM_{wattage} * Cost\ Factor_M + Cost\ Factor_b$$

Variables

Hours	Table 15.7.1	Annual operational hours per year of the motor. Deemed values are used for hours based on the type and use of the motor.
CF	Table 15.7.1	Deemed Coincident Factor
Incremental Cost	15.7.2	\$/Nameplate Watt ¹
Cost Factor b	0.746	HP to kW conversion
Baseline_Conversion	0.18	Multiplier to convert the nameplate power of a proposed motor to the to the assumed baseline.
Lifetime	15	The lifetime of an ECM circulator pump

Customer Inputs

M&V Verified

ECM Wattage	Yes	If wattage isnt listed on the nameplate then convert the HP to Watts (ECM HP*746)
Application	Yes	DHW Circulator, Heating Water Circulator, or Cooling Water Circulator

Table 15.7.1 Operating hours and CF by application¹

Type	Hours	CF
DHW Circulator	2190	100.0%
Heating Water Circulator	2582	0.0%
Cooling Water Circulator	1191	29.9%

Table 15.7.2 Incremental Cost Factor²

Cost Factor M	Cost Factor b
\$ 0.1851	\$ 135.34

Assumptions:

Domestic Hot water pumps are installed with on demand controls

References:

1. MN TRM Version 3.0, "C/I HVAC - ECM Circulators" p. 274
2. Xcel energy research into the cost difference between an ECM and PSC (September 2019)

Changes from Recent Filing:

New Measure

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

15.8 Fractional HP Fan Motors

Algorithms

$$Customer\ kWh = (CFM \times Box_{Factor} \times LF \times Hours) / Conversion$$

$$Customer\ Coincident\ kW = (CFM \times Box_{Factor} \times LF \times CF) / Conversion$$

$$Incremental\ cost = HP * Cost\ Factor_M + Cost\ Factor_b$$

Variables

LF	90%	Load Factor for Fractional ECM Fans per MN TRM ¹
Box Factor	Table 15.8.1	The savings factor in w/CFM based ¹
Cost Factor M	Table 15.8.2	Dollars Per HP
Cost Factor b	Table 15.8.2	Dollars
Hours	Table 15.8.3	Operating Hours for Fractional HP ECM Fans based on EFLH per MN TRM ¹
CF	90%	Coincident Factor for Fractional ECM Fans per MN TRM ¹
Conversion	1000	Watts to kW conversion
Lifetime	15	Lifetime of an ECM ¹

Customer Inputs

M&V Verified

ECM HP	Yes	HP or Converted Wattage of ECM
Building Type	Yes	Building area the fan is Serving
CFM	Yes	The rated CFM of the ECM Fan

Table 15.8.1 Box Factor based on CFM¹

CFM	Watts / CFM
<1000	0.31
>=1000	0.21

Table 15.8.2 Incremental Cost Factor²

Cost Factor M	Cost Factor b
\$ 138.07	\$ 135.34

Table 15.8.3 Fractional ECM Operating Hours¹

Building Type	Average Hours
Office	1,940
Retail	1,595
Hospitals	3,073
Elementary/Secondary Schools	1,863
Restaurant	1,690
Warehouse	739
Hotels/Motels	2,799
Grocery	2,207
Health	2,983
College/University	2,474
Manufacturing	5,840
Other/Miscellaneous	2,136

Adapted from the CO HVAC Cooling and Heating TAs, Represents the average EFLH for heating and cooling in each segment.

Assumptions:

- Prescriptive rebates are only given for motors put into service, rebates are not given for backup motors.
- Rebates do not apply to rewind or repaired motors.
- Terminal ECM Fan Operating Hours are lower due to direct correlation to heating and cooling energy use.

References:

1. MN TRM Version 3.0, "C/I HVAC - ECM Fans" p. 274
2. Xcel energy research into the cost difference between an ECM and PSC (September 2019)

Changes from Recent Filing:

New Measure

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

15.9 Integrated Drives

Algorithms

$$Customer\ kWh = HP \times LF_{Motors} \times Conversion \times Hours \times Refrigeration_Factor \times \left(\frac{1 + \% Savings\ Drives}{Baseline_{Eff}} - \frac{1}{Proposed_{Eff}} \right)$$

$$Customer\ Coincident\ kW = HP \times LF_{Motors} \times Conversion \times CF \times Refrigeration_Factor \times \left(\frac{1 + \% Savings\ Drives}{Baseline_{Eff}} - \frac{1}{Proposed_{Eff}} \right)$$

Variables

Hours	Table 15.1 and Table 15.3	Annual operational hours per year of the motor. Deemed values are used for hours based on the type and use of the motor. The customer provides the following information on the rebate form: HP, industrial/non-industrial, building type, and compressor/pump/fan/other. ¹
LF_Motors	Table 15.2	Motor load factor as a percentage. ²
Refrigeration Factor	Table 15.3	Coefficient of Performance = Refrigeration/Cooling Capacity (BTU/hr) / Energy Input (BTU/hr)
CF	Table 15.5	Coincidence factor
Incremental Cost	Table 15.7	Incremental cost for integrated drives based on type ³
Baseline_Eff	Table 15.8	Efficiency of NEMA premium efficient motor as a percentage. Value is a weighted average by HP based on customer past selections.
Proposed_Eff	Table 15.8	Peak Efficiency of the Motor and Drive combo. This is deemed for Switched Reluctance Motors, and provided by the customers for EC motors
% Savings Drives	33%	Average savings achieved by installing a VFD on a fan or pumping motor. ²
Measure life	15	Years ¹
Conversion	0.746	Conversion from horsepower to kW.

Customer Inputs

M&V Verified

HP	Yes	Rated motor horsepower.
Proposed Eff	Yes	Peak efficiency of Motor and Drive Combo
Facility Type	Yes	
Application	Yes	
Motor Type	No	Switched reluctance motor with controller or EC motor with integrated drive

Assumptions:

- Each integrated motors and drives is replaced with the same size on a 1 for 1 basis.
- Prescriptive rebates are only given for integrated motors and drives put into service, rebates are not given for backup integrated motors and drives.
- Prescriptive rebates are only given to integrated motors and drive's installed on centrifugal pump and fan applications.

References:

1. Efficiency Vermont's Technical Reference User Manual, 2004 - Source for operating hours for non-industrial motors (p.15) and source for measure life, source for load factor
2. Office of Industrial Electric Motor Systems Market Opportunities Assessment : Department of Energy (assessment of 265 Industrial facilities in 1997) - Source for VSD opportunity in the US market along with load factors for fans and pumps along with average savings
3. Costs are derived from customer invoices received through Xcel Energy's prescriptive program.

Changes from Recent Filing:

Filed as par of a 60 day notice in 2022. No changes

Table 15.1: Operating Hours by Motor Size, Industrial Applications³

HP	Fans	Pumps	Data Center	Case Fans	Air Compressor	Other
1	4550	3380	8760	8629	1257	2435
1.5	4550	3380	8760	8629	1257	2435
2	4550	3380	8760	8629	1257	2435
3	4550	3380	8760	8629	1257	2435
5	4550	3380	8760	8629	1257	2435
7.5	4316	4121	8760	8629	2131	2939
10	4316	4121	8760	8629	2131	2939
15	4316	4121	8760	8629	2131	2939
20	4316	4121	8760	8629	2131	2939
25	5101	4889	8760	8629	3528	3488
30	5101	4889	8760	8629	3528	3488
40	5101	4889	8760	8629	3528	3488
50	5101	4889	8760	8629	3528	3488
60	6151	5667	8760	8629	4520	5079
75	6151	5667	8760	8629	4520	5079
100	6151	5667	8760	8629	4520	5079
125	5964	5126	8760	8629	4685	5137
150	5964	5126	8760	8629	4685	5137
200	5964	5126	8760	8629	4685	5137
250	7044	5968	8760	8629	6148	6102
300	7044	5968	8760	8629	6148	6102
350	7044	5968	8760	8629	6148	6102
400	7044	5968	8760	8629	6148	6102
450	7044	5968	8760	8629	6148	6102
500	7044	5968	8760	8629	6148	6102

#N/A

Table 15.2 Load Factors^{3,4,5}

Application	Load Factor
Other	75%
Pump	75%
ECM Fan	90%
Fan	65%

Table 15.3: Operating Hours by Application for all products other than motor controllers, Non-Industrial⁴

Building Type	Pumps	Fans	Data Center	Case Fans	Air Compressor	Other
Office	2000	6192	8760	8629	4500	4500
Retail	2000	3261	8760	8629	4500	4500
Hospitals	2754	8374	8760	8629	4500	4500
Elementary/Secondary Schools	2190	3699	8760	8629	4500	4500
Restaurant	2000	4155	8760	8629	4500	4500
Warehouse	2241	6389	8760	8629	4500	4500
Hotels/Motels	4231	3719	8760	8629	4500	4500
Grocery	2080	6389	8760	8629	4500	4500
Health	2559	2000	8760	8629	4500	4500
College/University	3641	3631	8760	8629	4500	4500
Data Center	2241	6389	8760	8629	4500	4500

Table 15.4 COPs for different systems

Application	COP
Low Temperature	1.43
Medium Temperature	2.28
HVAC	3.00
Data Center	4.00

Table 15.5 Coincidence Factors^{1,2,4}

Application	CF
Motors	78%
Well Pumps	38%
Pumps	78%
Fans	78%
Display Case Refrigeration Fans	99%
Walk-in Refrigeration Fans	98%

Table 15.6 Efficiencies by Motor Types

Motor Tag	HP	Speed	Type	EPACT Motor Efficiency	NEMA Premium Motor Efficiency	NEMA Premium +1% Motor Efficiency	NEMA Premium Cost	NEMA +1% Cost
1 HP 900 RPM ODP	1	900	ODP	74.0%	75.5%	76.5%	\$ 683.54	\$ 817.66
1.5 HP 900 RPM ODP	1.5	900	ODP	75.5%	77.0%	78.0%	\$ 718.34	\$ 866.89
2 HP 900 RPM ODP	2	900	ODP	85.5%	86.5%	87.5%	\$ 726.88	\$ 878.97
3 HP 900 RPM ODP	3	900	ODP	86.5%	87.5%	88.5%	\$ 759.91	\$ 925.69
5 HP 900 RPM ODP	5	900	ODP	87.5%	88.5%	89.5%	\$ 802.06	\$ 985.31
7.5 HP 900 RPM ODP	7.5	900	ODP	88.5%	89.5%	90.5%	\$ 996.00	\$ 1,259.65

10 HP 900 RPM ODP	10	900	ODP	89.5%	90.2%	91.2%	\$ 1,117.02	\$ 1,430.85
15 HP 900 RPM ODP	15	900	ODP	89.5%	90.2%	91.2%	\$ 2,144.34	\$ 2,585.56
20 HP 900 RPM ODP	20	900	ODP	90.2%	91.0%	92.0%	\$ 2,369.70	\$ 2,904.34
25 HP 900 RPM ODP	25	900	ODP	90.2%	91.0%	92.0%	\$ 2,675.38	\$ 3,336.74
30 HP 900 RPM ODP	30	900	ODP	91.0%	91.7%	92.7%	\$ 2,921.91	\$ 3,685.47
40 HP 900 RPM ODP	40	900	ODP	91.0%	91.7%	92.7%	\$ 3,403.22	\$ 4,366.31
50 HP 900 RPM ODP	50	900	ODP	91.7%	92.4%	93.4%	\$ 3,728.24	\$ 4,826.07
60 HP 900 RPM ODP	60	900	ODP	92.4%	93.0%	94.0%	\$ 4,731.77	\$ 6,245.61
75 HP 900 RPM ODP	75	900	ODP	93.6%	94.1%	95.1%	\$ 5,507.32	\$ 7,342.66
100 HP 900 RPM ODP	100	900	ODP	93.6%	94.1%	95.1%	\$ 7,154.13	\$ 9,373.68
125 HP 900 RPM ODP	125	900	ODP	93.6%	94.1%	95.1%	\$ 8,514.50	\$ 11,297.99
150 HP 900 RPM ODP	150	900	ODP	93.6%	94.1%	95.1%	\$ 9,729.63	\$ 13,016.85
200 HP 900 RPM ODP	200	900	ODP	93.6%	94.1%	95.1%	\$ 11,653.55	\$ 15,738.32
250 HP 900 RPM ODP	250	900	ODP	94.5%	95.0%	96.0%	\$ 13,935.15	\$ 18,965.76
300 HP 900 RPM ODP	300	900	ODP	94.5%	95.0%	96.0%	\$ 16,722.72	\$ 22,908.92
350 HP 900 RPM ODP	350	900	ODP	94.5%	95.0%	96.0%	\$ 26,199.40	\$ 36,314.14
400 HP 900 RPM ODP	400	900	ODP	94.9%	95.1%	96.1%	\$ 29,656.70	\$ 41,204.66
450 HP 900 RPM ODP	450	900	ODP	95.3%	95.5%	96.5%	\$ 33,407.70	\$ 46,510.64
500 HP 900 RPM ODP	500	900	ODP	95.3%	95.5%	96.5%	\$ 34,526.40	\$ 48,093.09
1 HP 1200 RPM ODP	1	1200	ODP	80.0%	82.5%	83.5%	\$ 683.54	\$ 817.66
1.5 HP 1200 RPM ODP	1.5	1200	ODP	84.0%	86.5%	87.5%	\$ 718.34	\$ 866.89
2 HP 1200 RPM ODP	2	1200	ODP	85.5%	87.5%	88.5%	\$ 726.88	\$ 878.97
3 HP 1200 RPM ODP	3	1200	ODP	86.5%	88.5%	89.5%	\$ 759.91	\$ 925.69
5 HP 1200 RPM ODP	5	1200	ODP	87.5%	89.5%	90.5%	\$ 802.06	\$ 985.31
7.5 HP 1200 RPM ODP	7.5	1200	ODP	88.5%	90.2%	91.2%	\$ 996.00	\$ 1,259.65
10 HP 1200 RPM ODP	10	1200	ODP	90.2%	91.7%	92.7%	\$ 1,117.02	\$ 1,430.85
15 HP 1200 RPM ODP	15	1200	ODP	90.2%	91.7%	92.7%	\$ 2,144.34	\$ 2,585.56
20 HP 1200 RPM ODP	20	1200	ODP	91.0%	92.4%	93.4%	\$ 2,369.70	\$ 2,904.34
25 HP 1200 RPM ODP	25	1200	ODP	91.7%	93.0%	94.0%	\$ 2,675.38	\$ 3,336.74
30 HP 1200 RPM ODP	30	1200	ODP	92.4%	93.6%	94.6%	\$ 2,921.91	\$ 3,685.47
40 HP 1200 RPM ODP	40	1200	ODP	93.0%	94.1%	95.1%	\$ 3,403.22	\$ 4,366.31
50 HP 1200 RPM ODP	50	1200	ODP	93.0%	94.1%	95.1%	\$ 3,728.24	\$ 4,826.07
60 HP 1200 RPM ODP	60	1200	ODP	93.6%	94.5%	95.5%	\$ 4,731.77	\$ 6,245.61
75 HP 1200 RPM ODP	75	1200	ODP	93.6%	94.5%	95.5%	\$ 5,507.32	\$ 7,342.66
100 HP 1200 RPM ODP	100	1200	ODP	94.1%	95.0%	96.0%	\$ 7,154.13	\$ 9,373.68
125 HP 1200 RPM ODP	125	1200	ODP	94.1%	95.0%	96.0%	\$ 8,514.50	\$ 11,297.99
150 HP 1200 RPM ODP	150	1200	ODP	94.5%	95.4%	96.4%	\$ 9,729.63	\$ 13,016.85
200 HP 1200 RPM ODP	200	1200	ODP	94.5%	95.4%	96.4%	\$ 11,653.55	\$ 15,738.32
250 HP 1200 RPM ODP	250	1200	ODP	95.4%	95.8%	96.8%	\$ 13,935.15	\$ 18,965.76
300 HP 1200 RPM ODP	300	1200	ODP	95.4%	95.8%	96.8%	\$ 16,722.72	\$ 22,908.92
350 HP 1200 RPM ODP	350	1200	ODP	95.4%	95.8%	96.8%	\$ 26,199.40	\$ 36,314.14
400 HP 1200 RPM ODP	400	1200	ODP	95.8%	95.9%	96.9%	\$ 29,656.70	\$ 41,204.66
450 HP 1200 RPM ODP	450	1200	ODP	96.2%	96.3%	97.3%	\$ 33,407.70	\$ 46,510.64
500 HP 1200 RPM ODP	500	1200	ODP	96.2%	96.3%	97.3%	\$ 34,526.40	\$ 48,093.09
1 HP 1800 RPM ODP	1	1800	ODP	82.5%	85.5%	86.5%	\$ 683.54	\$ 817.66
1.5 HP 1800 RPM ODP	1.5	1800	ODP	84.0%	86.5%	87.5%	\$ 718.34	\$ 866.89
2 HP 1800 RPM ODP	2	1800	ODP	84.0%	86.5%	87.5%	\$ 726.88	\$ 878.97
3 HP 1800 RPM ODP	3	1800	ODP	86.5%	89.5%	90.5%	\$ 759.91	\$ 925.69
5 HP 1800 RPM ODP	5	1800	ODP	87.5%	89.5%	90.5%	\$ 802.06	\$ 985.31
7.5 HP 1800 RPM ODP	7.5	1800	ODP	88.5%	91.0%	92.0%	\$ 996.00	\$ 1,259.65
10 HP 1800 RPM ODP	10	1800	ODP	89.5%	91.7%	92.7%	\$ 1,117.02	\$ 1,430.85
15 HP 1800 RPM ODP	15	1800	ODP	91.0%	93.0%	94.0%	\$ 2,144.34	\$ 2,585.56
20 HP 1800 RPM ODP	20	1800	ODP	91.0%	93.0%	94.0%	\$ 2,369.70	\$ 2,904.34
25 HP 1800 RPM ODP	25	1800	ODP	91.7%	93.6%	94.6%	\$ 2,675.38	\$ 3,336.74
30 HP 1800 RPM ODP	30	1800	ODP	92.4%	94.1%	95.1%	\$ 2,921.91	\$ 3,685.47
40 HP 1800 RPM ODP	40	1800	ODP	93.0%	94.1%	95.1%	\$ 3,403.22	\$ 4,366.31
50 HP 1800 RPM ODP	50	1800	ODP	93.0%	94.5%	95.5%	\$ 3,728.24	\$ 4,826.07
60 HP 1800 RPM ODP	60	1800	ODP	93.6%	95.0%	96.0%	\$ 4,731.77	\$ 6,245.61
75 HP 1800 RPM ODP	75	1800	ODP	94.1%	95.0%	96.0%	\$ 5,507.32	\$ 7,342.66
100 HP 1800 RPM ODP	100	1800	ODP	94.1%	95.4%	96.4%	\$ 7,154.13	\$ 9,373.68
125 HP 1800 RPM ODP	125	1800	ODP	94.5%	95.4%	96.4%	\$ 8,514.50	\$ 11,297.99
150 HP 1800 RPM ODP	150	1800	ODP	95.0%	95.8%	96.8%	\$ 9,729.63	\$ 13,016.85
200 HP 1800 RPM ODP	200	1800	ODP	95.0%	95.8%	96.8%	\$ 11,653.55	\$ 15,738.32
250 HP 1800 RPM ODP	250	1800	ODP	95.4%	95.8%	96.8%	\$ 13,935.15	\$ 18,965.76
300 HP 1800 RPM ODP	300	1800	ODP	95.4%	95.8%	96.8%	\$ 16,722.72	\$ 22,908.92
350 HP 1800 RPM ODP	350	1800	ODP	95.4%	95.8%	96.8%	\$ 26,199.40	\$ 36,314.14
400 HP 1800 RPM ODP	400	1800	ODP	95.4%	95.8%	96.8%	\$ 29,656.70	\$ 41,204.66
450 HP 1800 RPM ODP	450	1800	ODP	95.8%	96.2%	97.2%	\$ 33,407.70	\$ 46,510.64
500 HP 1800 RPM ODP	500	1800	ODP	95.8%	96.2%	97.2%	\$ 34,526.40	\$ 48,093.09
1 HP 3600 RPM ODP	1	3600	ODP	76.3%	77.0%	78.0%	\$ 683.54	\$ 817.66
1.5 HP 3600 RPM ODP	1.5	3600	ODP	82.5%	84.0%	85.0%	\$ 718.34	\$ 866.89
2 HP 3600 RPM ODP	2	3600	ODP	84.0%	85.5%	86.5%	\$ 726.88	\$ 878.97
3 HP 3600 RPM ODP	3	3600	ODP	84.0%	85.5%	86.5%	\$ 759.91	\$ 925.69
5 HP 3600 RPM ODP	5	3600	ODP	85.5%	86.5%	87.5%	\$ 802.06	\$ 985.31
7.5 HP 3600 RPM ODP	7.5	3600	ODP	87.5%	88.5%	89.5%	\$ 996.00	\$ 1,259.65
10 HP 3600 RPM ODP	10	3600	ODP	88.5%	89.5%	90.5%	\$ 1,117.02	\$ 1,430.85
15 HP 3600 RPM ODP	15	3600	ODP	89.5%	90.2%	91.2%	\$ 2,144.34	\$ 2,585.56

20 HP 3600 RPM ODP	20	3600	ODP	90.2%	91.0%	92.0%	\$ 2,369.70	\$ 2,904.34
25 HP 3600 RPM ODP	25	3600	ODP	91.0%	91.7%	92.7%	\$ 2,675.38	\$ 3,336.74
30 HP 3600 RPM ODP	30	3600	ODP	91.0%	91.7%	92.7%	\$ 2,921.91	\$ 3,685.47
40 HP 3600 RPM ODP	40	3600	ODP	91.7%	92.4%	93.4%	\$ 3,403.22	\$ 4,366.31
50 HP 3600 RPM ODP	50	3600	ODP	92.4%	93.0%	94.0%	\$ 3,728.24	\$ 4,826.07
60 HP 3600 RPM ODP	60	3600	ODP	93.0%	93.6%	94.6%	\$ 4,731.77	\$ 6,245.61
75 HP 3600 RPM ODP	75	3600	ODP	93.0%	93.6%	94.6%	\$ 5,507.32	\$ 7,342.66
100 HP 3600 RPM ODP	100	3600	ODP	93.0%	93.6%	94.6%	\$ 7,154.13	\$ 9,373.68
125 HP 3600 RPM ODP	125	3600	ODP	93.6%	94.1%	95.1%	\$ 8,514.50	\$ 11,297.99
150 HP 3600 RPM ODP	150	3600	ODP	93.6%	94.1%	95.1%	\$ 9,729.63	\$ 13,016.85
200 HP 3600 RPM ODP	200	3600	ODP	94.5%	95.0%	96.0%	\$ 11,653.55	\$ 15,738.32
250 HP 3600 RPM ODP	250	3600	ODP	94.5%	95.0%	96.0%	\$ 13,935.15	\$ 18,965.76
300 HP 3600 RPM ODP	300	3600	ODP	95.0%	95.4%	96.4%	\$ 16,722.72	\$ 22,908.92
350 HP 3600 RPM ODP	350	3600	ODP	95.0%	95.4%	96.4%	\$ 26,199.40	\$ 36,314.14
400 HP 3600 RPM ODP	400	3600	ODP	95.4%	95.8%	96.8%	\$ 29,656.70	\$ 41,204.66
450 HP 3600 RPM ODP	450	3600	ODP	95.8%	96.2%	97.2%	\$ 33,407.70	\$ 46,510.64
500 HP 3600 RPM ODP	500	3600	ODP	95.8%	96.2%	97.2%	\$ 34,526.40	\$ 48,093.09
1 HP 900 RPM TEFC	1	900	TEFC	74.0%	75.5%	76.5%	\$ 683.54	\$ 817.66
1.5 HP 900 RPM TEFC	1.5	900	TEFC	77.0%	78.5%	79.5%	\$ 718.34	\$ 866.89
2 HP 900 RPM TEFC	2	900	TEFC	82.5%	84.0%	85.0%	\$ 726.88	\$ 878.97
3 HP 900 RPM TEFC	3	900	TEFC	84.0%	85.5%	86.5%	\$ 759.91	\$ 925.69
5 HP 900 RPM TEFC	5	900	TEFC	85.5%	86.5%	87.5%	\$ 802.06	\$ 985.31
7.5 HP 900 RPM TEFC	7.5	900	TEFC	85.5%	86.5%	87.5%	\$ 996.00	\$ 1,259.65
10 HP 900 RPM TEFC	10	900	TEFC	88.5%	89.5%	90.5%	\$ 1,117.02	\$ 1,430.85
15 HP 900 RPM TEFC	15	900	TEFC	88.5%	89.5%	90.5%	\$ 2,144.34	\$ 2,585.56
20 HP 900 RPM TEFC	20	900	TEFC	89.5%	90.2%	91.2%	\$ 2,369.70	\$ 2,904.34
25 HP 900 RPM TEFC	25	900	TEFC	89.5%	90.2%	91.2%	\$ 2,675.38	\$ 3,336.74
30 HP 900 RPM TEFC	30	900	TEFC	91.0%	91.7%	92.7%	\$ 2,921.91	\$ 3,685.47
40 HP 900 RPM TEFC	40	900	TEFC	91.0%	91.7%	92.7%	\$ 3,403.22	\$ 4,366.31
50 HP 900 RPM TEFC	50	900	TEFC	91.7%	92.4%	93.4%	\$ 3,728.24	\$ 4,826.07
60 HP 900 RPM TEFC	60	900	TEFC	91.7%	92.4%	93.4%	\$ 4,731.77	\$ 6,245.61
75 HP 900 RPM TEFC	75	900	TEFC	93.0%	93.6%	94.6%	\$ 5,507.32	\$ 7,342.66
100 HP 900 RPM TEFC	100	900	TEFC	93.0%	93.6%	94.6%	\$ 7,154.13	\$ 9,373.68
125 HP 900 RPM TEFC	125	900	TEFC	93.6%	94.1%	95.1%	\$ 8,514.50	\$ 11,297.99
150 HP 900 RPM TEFC	150	900	TEFC	93.6%	94.1%	95.1%	\$ 9,729.63	\$ 13,016.85
200 HP 900 RPM TEFC	200	900	TEFC	94.1%	94.5%	95.5%	\$ 11,653.55	\$ 15,738.32
250 HP 900 RPM TEFC	250	900	TEFC	94.5%	95.0%	96.0%	\$ 13,935.15	\$ 18,965.76
300 HP 900 RPM TEFC	300	900	TEFC	95.0%	95.8%	96.8%	\$ 16,722.72	\$ 22,908.92
350 HP 900 RPM TEFC	350	900	TEFC	95.0%	95.8%	96.8%	\$ 26,199.40	\$ 36,314.14
400 HP 900 RPM TEFC	400	900	TEFC	95.0%	95.8%	96.8%	\$ 29,656.70	\$ 41,204.66
450 HP 900 RPM TEFC	450	900	TEFC	95.0%	95.8%	96.8%	\$ 33,407.70	\$ 46,510.64
500 HP 900 RPM TEFC	500	900	TEFC	95.0%	95.8%	96.8%	\$ 34,526.40	\$ 48,093.09
1 HP 1200 RPM TEFC	1	1200	TEFC	80.0%	82.5%	83.5%	\$ 683.54	\$ 817.66
1.5 HP 1200 RPM TEFC	1.5	1200	TEFC	85.5%	87.5%	88.5%	\$ 718.34	\$ 866.89
2 HP 1200 RPM TEFC	2	1200	TEFC	86.5%	88.5%	89.5%	\$ 726.88	\$ 878.97
3 HP 1200 RPM TEFC	3	1200	TEFC	87.5%	89.5%	90.5%	\$ 759.91	\$ 925.69
5 HP 1200 RPM TEFC	5	1200	TEFC	87.5%	89.5%	90.5%	\$ 802.06	\$ 985.31
7.5 HP 1200 RPM TEFC	7.5	1200	TEFC	89.5%	91.0%	92.0%	\$ 996.00	\$ 1,259.65
10 HP 1200 RPM TEFC	10	1200	TEFC	89.5%	91.0%	92.0%	\$ 1,117.02	\$ 1,430.85
15 HP 1200 RPM TEFC	15	1200	TEFC	90.2%	91.7%	92.7%	\$ 2,144.34	\$ 2,585.56
20 HP 1200 RPM TEFC	20	1200	TEFC	90.2%	91.7%	92.7%	\$ 2,369.70	\$ 2,904.34
25 HP 1200 RPM TEFC	25	1200	TEFC	91.7%	93.0%	94.0%	\$ 2,675.38	\$ 3,336.74
30 HP 1200 RPM TEFC	30	1200	TEFC	91.7%	93.0%	94.0%	\$ 2,921.91	\$ 3,685.47
40 HP 1200 RPM TEFC	40	1200	TEFC	93.0%	94.1%	95.1%	\$ 3,403.22	\$ 4,366.31
50 HP 1200 RPM TEFC	50	1200	TEFC	93.0%	94.1%	95.1%	\$ 3,728.24	\$ 4,826.07
60 HP 1200 RPM TEFC	60	1200	TEFC	93.6%	94.5%	95.5%	\$ 4,731.77	\$ 6,245.61
75 HP 1200 RPM TEFC	75	1200	TEFC	93.6%	94.5%	95.5%	\$ 5,507.32	\$ 7,342.66
100 HP 1200 RPM TEFC	100	1200	TEFC	94.1%	95.0%	96.0%	\$ 7,154.13	\$ 9,373.68
125 HP 1200 RPM TEFC	125	1200	TEFC	94.1%	95.0%	96.0%	\$ 8,514.50	\$ 11,297.99
150 HP 1200 RPM TEFC	150	1200	TEFC	95.0%	95.8%	96.8%	\$ 9,729.63	\$ 13,016.85
200 HP 1200 RPM TEFC	200	1200	TEFC	95.0%	95.8%	96.8%	\$ 11,653.55	\$ 15,738.32
250 HP 1200 RPM TEFC	250	1200	TEFC	95.0%	95.8%	96.8%	\$ 13,935.15	\$ 18,965.76
300 HP 1200 RPM TEFC	300	1200	TEFC	95.0%	95.8%	96.8%	\$ 16,722.72	\$ 22,908.92
350 HP 1200 RPM TEFC	350	1200	TEFC	95.0%	95.8%	96.8%	\$ 26,199.40	\$ 36,314.14
400 HP 1200 RPM TEFC	400	1200	TEFC	95.0%	95.8%	96.8%	\$ 29,656.70	\$ 41,204.66
450 HP 1200 RPM TEFC	450	1200	TEFC	95.0%	95.8%	96.8%	\$ 33,407.70	\$ 46,510.64
500 HP 1200 RPM TEFC	500	1200	TEFC	95.0%	95.8%	96.8%	\$ 34,526.40	\$ 48,093.09
1 HP 1800 RPM TEFC	1	1800	TEFC	82.5%	85.5%	86.5%	\$ 683.54	\$ 817.66
1.5 HP 1800 RPM TEFC	1.5	1800	TEFC	84.0%	86.5%	87.5%	\$ 718.34	\$ 866.89
2 HP 1800 RPM TEFC	2	1800	TEFC	84.0%	86.5%	87.5%	\$ 726.88	\$ 878.97
3 HP 1800 RPM TEFC	3	1800	TEFC	87.5%	89.5%	90.5%	\$ 759.91	\$ 925.69
5 HP 1800 RPM TEFC	5	1800	TEFC	87.5%	89.5%	90.5%	\$ 802.06	\$ 985.31
7.5 HP 1800 RPM TEFC	7.5	1800	TEFC	89.5%	91.7%	92.7%	\$ 996.00	\$ 1,259.65
10 HP 1800 RPM TEFC	10	1800	TEFC	89.5%	91.7%	92.7%	\$ 1,117.02	\$ 1,430.85
15 HP 1800 RPM TEFC	15	1800	TEFC	91.0%	92.4%	93.4%	\$ 2,144.34	\$ 2,585.56

20 HP 1800 RPM TEFC	20	1800	TEFC	91.0%	93.0%	94.0%	\$ 2,369.70	\$ 2,904.34
25 HP 1800 RPM TEFC	25	1800	TEFC	92.4%	93.6%	94.6%	\$ 2,675.38	\$ 3,336.74
30 HP 1800 RPM TEFC	30	1800	TEFC	92.4%	93.6%	94.6%	\$ 2,921.91	\$ 3,685.47
40 HP 1800 RPM TEFC	40	1800	TEFC	93.0%	94.1%	95.1%	\$ 3,403.22	\$ 4,366.31
50 HP 1800 RPM TEFC	50	1800	TEFC	93.0%	94.5%	95.5%	\$ 3,728.24	\$ 4,826.07
60 HP 1800 RPM TEFC	60	1800	TEFC	93.6%	95.0%	96.0%	\$ 4,731.77	\$ 6,245.61
75 HP 1800 RPM TEFC	75	1800	TEFC	94.1%	95.4%	96.4%	\$ 5,507.32	\$ 7,342.66
100 HP 1800 RPM TEFC	100	1800	TEFC	94.5%	95.4%	96.4%	\$ 7,154.13	\$ 9,373.68
125 HP 1800 RPM TEFC	125	1800	TEFC	94.5%	95.4%	96.4%	\$ 8,514.50	\$ 11,297.99
150 HP 1800 RPM TEFC	150	1800	TEFC	95.0%	95.8%	96.8%	\$ 9,729.63	\$ 13,016.85
200 HP 1800 RPM TEFC	200	1800	TEFC	95.0%	96.2%	97.2%	\$ 11,653.55	\$ 15,738.32
250 HP 1800 RPM TEFC	250	1800	TEFC	95.0%	96.2%	97.2%	\$ 13,935.15	\$ 18,965.76
300 HP 1800 RPM TEFC	300	1800	TEFC	95.4%	96.2%	97.2%	\$ 16,722.72	\$ 22,908.92
350 HP 1800 RPM TEFC	350	1800	TEFC	95.4%	96.2%	97.2%	\$ 26,199.40	\$ 36,314.14
400 HP 1800 RPM TEFC	400	1800	TEFC	95.4%	96.2%	97.2%	\$ 29,656.70	\$ 41,204.66
450 HP 1800 RPM TEFC	450	1800	TEFC	95.4%	96.2%	97.2%	\$ 33,407.70	\$ 46,510.64
500 HP 1800 RPM TEFC	500	1800	TEFC	95.8%	96.2%	97.2%	\$ 34,526.40	\$ 48,093.09
1 HP 3600 RPM TEFC	1	3600	TEFC	75.5%	77.0%	78.0%	\$ 683.54	\$ 817.66
1.5 HP 3600 RPM TEFC	1.5	3600	TEFC	82.5%	84.0%	85.0%	\$ 718.34	\$ 866.89
2 HP 3600 RPM TEFC	2	3600	TEFC	84.0%	85.5%	86.5%	\$ 726.88	\$ 878.97
3 HP 3600 RPM TEFC	3	3600	TEFC	85.5%	86.5%	87.5%	\$ 759.91	\$ 925.69
5 HP 3600 RPM TEFC	5	3600	TEFC	87.5%	88.5%	89.5%	\$ 802.06	\$ 985.31
7.5 HP 3600 RPM TEFC	7.5	3600	TEFC	88.5%	89.5%	90.5%	\$ 996.00	\$ 1,259.65
10 HP 3600 RPM TEFC	10	3600	TEFC	89.5%	90.2%	91.2%	\$ 1,117.02	\$ 1,430.85
15 HP 3600 RPM TEFC	15	3600	TEFC	90.2%	91.0%	92.0%	\$ 2,144.34	\$ 2,585.56
20 HP 3600 RPM TEFC	20	3600	TEFC	90.2%	91.0%	92.0%	\$ 2,369.70	\$ 2,904.34
25 HP 3600 RPM TEFC	25	3600	TEFC	91.0%	91.7%	92.7%	\$ 2,675.38	\$ 3,336.74
30 HP 3600 RPM TEFC	30	3600	TEFC	91.0%	91.7%	92.7%	\$ 2,921.91	\$ 3,685.47
40 HP 3600 RPM TEFC	40	3600	TEFC	91.7%	92.4%	93.4%	\$ 3,403.22	\$ 4,366.31
50 HP 3600 RPM TEFC	50	3600	TEFC	92.4%	93.0%	94.0%	\$ 3,728.24	\$ 4,826.07
60 HP 3600 RPM TEFC	60	3600	TEFC	93.0%	93.6%	94.6%	\$ 4,731.77	\$ 6,245.61
75 HP 3600 RPM TEFC	75	3600	TEFC	93.0%	93.6%	94.6%	\$ 5,507.32	\$ 7,342.66
100 HP 3600 RPM TEFC	100	3600	TEFC	93.6%	94.1%	95.1%	\$ 7,154.13	\$ 9,373.68
125 HP 3600 RPM TEFC	125	3600	TEFC	94.5%	95.0%	96.0%	\$ 8,514.50	\$ 11,297.99
150 HP 3600 RPM TEFC	150	3600	TEFC	94.5%	95.0%	96.0%	\$ 9,729.63	\$ 13,016.85
200 HP 3600 RPM TEFC	200	3600	TEFC	95.0%	95.4%	96.4%	\$ 11,653.55	\$ 15,738.32
250 HP 3600 RPM TEFC	250	3600	TEFC	95.4%	95.8%	96.8%	\$ 13,935.15	\$ 18,965.76
300 HP 3600 RPM TEFC	300	3600	TEFC	95.4%	95.8%	96.8%	\$ 16,722.72	\$ 22,908.92
350 HP 3600 RPM TEFC	350	3600	TEFC	95.4%	95.8%	96.8%	\$ 26,199.40	\$ 36,314.14
400 HP 3600 RPM TEFC	400	3600	TEFC	95.4%	95.8%	96.8%	\$ 29,656.70	\$ 41,204.66
450 HP 3600 RPM TEFC	450	3600	TEFC	95.4%	95.8%	96.8%	\$ 33,407.70	\$ 46,510.64
500 HP 3600 RPM TEFC	500	3600	TEFC	95.4%	95.8%	96.8%	\$ 34,526.40	\$ 48,093.09

Table 15.7 Incremental Costs for VFDs (Derived from customer invoices)

HP	VFDs	Switched Reluctance Motor	EC Motor
1	\$2,182.10	\$1,034.00	\$2,588.78
2	\$2,493.50	\$1,073.00	\$2,752.19
2	\$2,741.03	\$1,132.00	\$2,915.60
3	\$3,132.19	\$1,282.00	\$3,388.43
5	\$3,705.41	\$2,271.00	\$3,594.60
8	\$4,234.18	\$3,030.00	\$4,592.88
10	\$4,654.52	\$3,500.00	\$5,648.33
15	\$5,318.74	\$4,619.00	NA
20	\$5,846.74	\$5,409.00	NA
25	\$6,292.12	NA	NA
30	\$6,681.09	NA	NA
40	\$7,344.33	NA	NA
50	\$7,903.80	NA	NA
60	\$8,392.40	NA	NA
75	\$9,031.71	NA	NA
100	\$9,928.29	NA	NA
125	\$10,684.59	NA	NA
150	\$11,345.11	NA	NA
200	\$12,471.35	NA	NA

Table 15.8 Average Motor Efficiency (Derived From Past Participation)

HP	EPACT	NEMA	NEMA +1%	Switched Reluctance
1	81.4%	84.1%	85.1%	86.7%
1.5	83.7%	86.1%	87.1%	87.7%
2	84.1%	86.4%	87.4%	89.6%
3	86.5%	88.9%	89.9%	91.5%
5	87.4%	89.2%	90.2%	92.6%
7.5	88.7%	90.9%	91.9%	93.8%
10	89.4%	91.4%	92.4%	93.6%
15	90.8%	92.4%	93.4%	93.6%
20	90.9%	92.8%	93.8%	94.0%
25	91.8%	93.3%	94.3%	NA
30	92.2%	93.5%	94.5%	NA
40	92.8%	93.8%	94.8%	NA
50	92.9%	94.3%	95.3%	NA
60	93.5%	94.6%	95.6%	NA
75	93.9%	95.0%	96.0%	NA
100	94.2%	95.2%	96.2%	NA
125	94.4%	95.3%	96.3%	NA
150	94.9%	95.6%	96.6%	NA
200	94.9%	95.8%	96.8%	NA
250	95.0%	95.8%	96.8%	NA
300	95.4%	95.8%	96.8%	NA
350	95.4%	96.0%	97.0%	NA
400	95.4%	96.2%	97.2%	NA
450	95.6%	96.2%	97.2%	NA
500	95.8%	96.2%	97.2%	NA

Table 14.9 VFD Energy Savings Factors⁶

Application	ESF
Pumps	
Hot Water Pump	0.333
Chiller Water or Condensor Water Pump	0.333
Industrial	0.333
Other	0.333

15.1 Modeled Residential New Construction

Algorithms

$$Customer\ kWh = kWh_{Reference\ Home} - kWh_{As\ Built\ Home}$$

$$Summer\ Peak\ kW = Summer\ Peak\ kW_{Reference\ Home} - Summer\ Peak\ kW_{As\ Built\ Home}$$

$$Winter\ Peak\ kW = Winter\ Peak\ kW_{Reference\ Home} - Winter\ Peak\ kW_{As\ Built\ Home}$$

$$Customer\ Dth = Dth_{Reference\ Home} - Dth_{As\ Built\ Home}$$

$$\% \text{ Better Than Code} = \frac{(MMBTU_{Reference\ Home} - MMBTU_{As\ Built\ Home})}{MMBTU_{Reference\ Home}}$$

$$MMBTU_{Reference\ Home} = \{ (Heating\ kWh_{Reference\ Home} + Cooling\ kWh_{Reference\ Home} + Water\ Heating\ kWh_{Reference\ Home} + Lighting\ and\ Appliance\ kWh_{Reference\ Home}) \times \frac{3,412}{1,000,000} \} + \{ (Heating\ th_{Reference\ Home} + Water\ Heating\ th_{Reference\ Home} + Lighting\ and\ Appliance\ th_{Reference\ Home}) \times \frac{1}{10} \}$$

$$MMBTU_{As\ Built\ Home} = \{ (Heating\ kWh_{As\ Built\ Home} + Cooling\ kWh_{As\ Built\ Home} + Water\ Heating\ kWh_{As\ Built\ Home} + Lighting\ and\ Appliance\ kWh_{As\ Built\ Home}) \times \frac{3,412}{1,000,000} \} + \{ (Heating\ th_{As\ Built\ Home} + Water\ Heating\ th_{As\ Built\ Home} + Lighting\ and\ Appliance\ th_{As\ Built\ Home}) \times \frac{1}{10} \}$$

$$ICC\ As\ Built\ Home = \left(\frac{ICC}{SF_a} \times \% \text{ Better Than Code}^3 + \frac{ICC}{SF_b} \times \% \text{ Better Than Code}^2 + \frac{ICC}{SF_c} \times \% \text{ Better Than Code} + \frac{ICC}{SF_d} \right) \times ICC\ Adj\ Factor$$

$$ICC\ Adj\ Factor = 1 + (ICCA_{adj\ a} \times \ln(Home\ Size) + ICCA_{adj\ b})$$

Variables

ICC _{ADJ a}	Table 15.1.1	Constants for use in calculating an Incremental Cost / Square Foot of home. The cost curve is derived from information provided by Residential Science Resources estimates and home modeling of the most common measures implemented to improve the envelope performance over local codes (Reference 2).
ICC _{ADJ b}	Table 15.1.1	
ICC/SF _a	Table 15.1.2	Constants for use in calculating an adjustment factor to correct the incremental cost for home size. An increase in homes size reduces the cost per square foot for the same set of measures due to economies of scale. This factor is used in conjunction with the As Built ICC SF cost formula (Reference 2).
ICC/SF _b	Table 15.1.2	
ICC/SF _c	Table 15.1.2	
ICC/SF _d	Table 15.1.2	
Lifetime	20	Deemed lifetime
Incremental Cost	Tables 15.1.1 and 15.1.3	Difference in cost between home built to a greater performance or certification and the jurisdictional baseline energy code (References 2 and 4+)

Modeler Inputs

M&V Verified

Percent Better Than Code	Yes	Calculated percent better than baseline code
Baseline Energy Code	Yes	IECC 2006 thru IECC 2021
Home Size	Yes	Total modeled conditioned space of home (sqft)
Final HERS Index NoPV	Yes	As-Built Home's HERS Index Score calculated by the Home Rater using a software modeling tool and provided under HERS Index
ENERGYSTAR Certified	Yes	ENERGYSTAR v3.1 Certified
Ref Home Heat Therms	Yes	Reference home gas heating energy
Ref Home Heat kWh	Yes	Reference home electric heating energy
Ref Home Cool kWh	Yes	Reference home electric cooling energy
Ref Home Water Heat Therms	Yes	Reference home gas water heating energy
Ref Home Water Heat kWh	Yes	Reference home electric water heating energy
Ref Home LightApp Therms	Yes	Reference home gas lights & appliance energy
Ref Home LightApp kWh	Yes	Reference home electric lights & appliance energy
As Built Home Heat Therms	Yes	As-built home gas heating energy
As Built Home Heat kWh	Yes	As-built home electric heating energy
As Built Home Cool kWh	Yes	As-built home electric cooling energy
As Built Home Water Heat Therms	Yes	As-built home gas water heating energy
As Built Home Water Heat kWh	Yes	As-built home electric water heating energy
As Built Home LightApp Therms	Yes	As-built home gas lights & appliance energy
As Built Home LightApp kWh	Yes	As-built home electric lights & appliance energy
Ref Home Peak kW Winter	Yes	Reference home winter demand
Ref Home Peak kW Summer	Yes	Reference home summer demand
As Built Home Peak kW Winter	Yes	As-built home winter demand
As Built Home Peak kW Summer	Yes	As-built home summer demand
Des OAT	No	Defined Outdoor Ambient Temp to be 5 degrees Fahrenheit when heating equipment is a Cold Climate Air Source Heat Pump and/or MiniSplit Heat Pump. Heating equipment type will be verified. OAT and it's relation to the heating performance of this equipment will continue to be studied and the variables for this program will be updated to reflect best practices and best available research.

Table 15.1.1 Incremental Cost per Square Foot Adjustment Factor Constants

Customer Type	Cost / SF Adjustment Factor Constants	ICC _{ADJ a}	ICC _{ADJ b}
Combo & Gas Only	IECC 2009	-0.7237094011964	5.8253260979282
	IECC 2012	-0.2389969816525	1.9388419806113
	IECC 2015	-0.2389969816525	1.9388419806113
	IECC 2018	-0.2389969816525	1.9388419806113
	IECC 2021	-0.1239486286142	1.7564234894150
Electric Only	IECC 2009	-0.0331223345001	0.2235513199389
	IECC 2012	-0.0331223345001	0.2235513199389
	IECC 2015	-0.0331223345001	0.2235513199389
	IECC 2018	-0.0331223345001	0.2235513199389
	IECC 2021	-0.0294627894100	0.2183458931159

Table 15.1.2 Incremental Cost per Square Foot Formula Constants

Customer Type	Cost / SF Adjustment Factor Constants	ICC/SF _a	ICC/SF _b	ICC/SF _c	ICC/SF _d
Combo & Gas Only	IECC 2009	0.0000000000000	-1.5873776258178	3.7927326153691	-0.0238069137844
	IECC 2012	0.0000000000000	27.2773059522290	-1.5760510381200	0.1307241656023
	IECC 2015	0.0000000000000	27.2773059522290	-1.5760510381200	0.1307241656023
	IECC 2018	135.4064974001910	-32.1556080746469	3.6616218361661	-0.0002624153096
	IECC 2021	10.8580000000000	-2.8741000000000	2.8922000000000	0.0442000000000
Electric Only	IECC 2009	0.0000000000000	56.7265518419520	-0.7931310460476	0.0501196304125
	IECC 2012	0.0000000000000	56.7265518419520	-0.7931310460476	0.0501196304125
	IECC 2015	0.0000000000000	56.7265518419520	-0.7931310460476	0.0501196304125
	IECC 2018	0.0000000000000	13.3182292174891	3.9975225576078	-0.0978142722627
	IECC 2021	0.0000000000000	10.4625000000000	2.8553000000000	0.0254000000000

Table 15.1.3 Incremental Cost

High Performance Certification	Baseline Code	Incremental Cost
ENERGYSTAR v3.1	IECC 2021	\$100

References:

- California Measurement Advisory Committee (CALMAC) Protocols, Appendix F (www.calmac.org/events/APX_F.pdf).
- RSR (Residential Science Resources) Energy Saving and Incremental Cost modeling, 2022
- NEEP QPL Data Sheets

Changes from Recent Filing:

- Updated New Home Performance using Ekotrope 4.0
- Added in a IECC 2021 Baseline Energy Code
- Defined Outdoor Ambient Temp for Cold Climate Air Source Heat Pumps and MiniSplit Heat Pumps to be 5 degrees Fahrenheit
- Added in Direct-to-Rebuilding Homeowner Incentives related to the Marshall Fire Recovery Effort

Table 17.0.8

COP _{Cooler}	2.28	Medium Temperature COP for Coolers
COP _{Freezer}	1.43	Low Temperature COP for Freezers
Door HF	0.35	Door Residual Heat Fraction
Ref Hours	8,760	Annual hours for commercial refrigeration systems
MT Load Factor	62%	Compressor Duty Cycle - Medium Temp. (Reference 2)
LT Load Factor	80%	Compressor Duty Cycle - Low Temp. (Reference 2)

References

1. Energy Savings Potential and R&D Opportunities for Commercial Refrigeration, Final Report; Submitted to: U.S. Department of Energy, Energy Efficiency and Renewable Energy Building Technologies Program; Navigant Consulting, Inc.; September 23, 2009
2. PSC of Wisconsin, Focus on Energy Evaluation, Business Programs: Deemed Savings Manual V1.0
3. NREL/TP-550-46101 "Grocery Store 50% Energy Savings Technical Support Document" September 2009
4. State of Illinois Energy Efficiency Technical Reference Manual, Page 131. July 18, 2012.
5. Average of multiple vendor products
8. State of Illinois Energy Efficiency Technical Reference Manual, June 1st, 2012. Pages 109-113.
11. 2008 Database for Energy-Efficient Resources, EUL/RUL (Effective/Remaining Useful Life) Values.
<http://www.deeresources.com/deer2008exante/downloads/DEER%200607%20Measure%20Update%20Report.pdf>
14. Efficiency Vermont Technical Reference User Manual, 2/19/2010.
15. Monitored data from Custom Efficiency projects
16. Northwest Regional Technical Forum
17. Comprehensive Process and Impact Evaluation of the (Xcel Energy) Colorado Motor and Drive Efficiency Program, FINAL, March 28, 2011, TetraTech
19. New York Standard Approach for Estimating Energy Savings from Energy Efficiency Measures in Commercial and Industrial Programs, Sept 1, 2009.
21. http://www.deeresources.com/files/DEER2016/download/2010-2012_WO017_Ex_Ante_Measure_Cost_Study_-_Final_Report.pdf
22. A Study of Energy Efficient Solutions for Anti-Sweat Heaters. Southern California Edison RTTC. December 1999
23. Pennsylvania PUC Technical Reference Manual, June 2011
24. SCE Workpaper WPSCNRRN0009, Revision 0, Anti-Sweat Heat (ASH) Controls, October 15, 2007
25. Wisconsin Focus on Energy Anti-Sweat Heater Controls Technical Data Sheet, 2004.
26. Energy Use of Doored and Open Vertical Refrigerated Display Cases, Fricke and Becker; Presented at 2010 International Refrigeration and Air Conditioning Conference
27. Infiltration Modeling Guidelines for Commercial Building Energy Analysis, US Department of Energy Sept 2009
28. Arkansas Deemed Savings Quick Start Program Draft Report Commercial Measures Final Report, Nexant. CF and hours
29. HVAC Interactive Factors developed based on the Rundquist Simplified HVAC Interaction Factor method for Minnesota, presented on page 28 of the 11/93 issue of the ASHRAE Journal - "Calculating lighting and HVAC interactions".
30. Technical Reference User Manual No. 2004-31, Efficiency Vermont, 12/31/04. CF and Hours
31. Deemed Savings Database, Minnesota Office of Energy Security, 2008. CF, Hours, kW, Costs, Measure life
32. Net-to-Gross factor from 2008 Xcel Energy Lighting Efficiency Program Evaluation
33. Wisconsin Focus on Energy Technical Reference Manual 2015, pg. 238-241
34. Costs calculated and derived from four open-to-closed refrigerated case custom rebate projects.
35. Work Paper PECIREF_PGE604 Vertical Refrigerated Case, Medium Temperature: Open to Closed (Retrofit)
36. ENERGY STAR
38. 2015 International Energy Conservation Code (IECC)
39. State of Illinois Energy Efficiency Technical Reference Manual, Pages 60-63 & Pages 90-97. February 8th, 2017.
40. State of Wisconsin, Public Service Commission of Wisconsin, Focus on Energy Evaluation, Business Programs Deemed Savings Manual, March 22, 2010.
41. The minimum value calculated on Forecast Weather Data Analysis or Forecast Door Openings
42. Illinois Statewide TRM 2015
43. Efficiency Maine Commercial TRM 2015
44. California Energy Commission and California Public Utilities Commission. Database for Efficient Resources (DEER) 2008, Effective/Remaining Useful Life Values.
45. Custom Project History of Medium Temperature Cases
46. Energy Analysis of KE2 Controllers for Walk-in Freezers; Michaels Energy; January 20, 2015
47. Custom project history of Defrost Controls
48. Custom M&V project energy consumption, operation, and savings on Floating Head Pressure Controls
49. History of Completed Custom project costs for Floating Head Pressure Controls
50. Data from Illinois TRM 2019

17.1 Anti-Sweat Heater Controls

Algorithms

$$Customer\ kW = kW_{Door} \times \left(1 + \left(\frac{Door\ HF}{COP} \right) \right) \times PAF \times Doors\ Controlled$$

$$Customer\ kWh = Customer\ kW \times Ref\ Hours$$

$$Customer\ Coincident\ kW = Customer\ kW \times Coincidence\ Factor$$

Variables

Doors Controlled	Customer Input	Number of doors being controlled
kW_Door	See Table 17.1.1	Average anti-sweat heater kW per door without controls
Door HF	0.35	Residual Heat fraction; estimated percentage of the heat produced by the heaters that remains in the freezer or cooler case and must be removed by the refrigeration unit. (Reference 24)
PAF	See Table 17.1.1	Percent of time the anti-sweat heaters are turned off by the controller (References 25, 26, & 41)
Ref Hours	8,760	Annual hours for commercial refrigeration systems
Lifetime	12	Measure Lifetime (Reference 11)
Incremental Cost per Door	See Table 17.1.1	Incremental cost of efficient measures; See Table 1.1.1
Coincidence Factor	See Table 17.1.1	Coincidence Factor (Reference 15)

Customer Inputs

M&V Verified

Application temperature (medium or low temperature case)	Yes	
Number of doors controlled	Yes	

Table 17.1.1	Eq. kW Door (Reference 24)	Eq. PAF	ASH Incremental Cost	Eq. Coincidence Factor
Anti-Sweat Heater - Med Temp	0.105	90%	\$180.00	90%
Anti-Sweat Heater - Low Temp	0.191	90%	\$180.00	90%

References:

11. 2008 Database for Energy-Efficient Resources, EUL/RUL (Effective/Remaining Useful Life) Values.
 15. Monitored data from Custom Efficiency projects
 24. SCE Workpaper WPSCNRRN0009, Revision 0, Anti-Sweat Heat (ASH) Controls, October 15, 2007
 25. Wisconsin Focus on Energy Anti-Sweat Heater Controls Technical Data Sheet, 2004.
 26. Energy Use of Doored and Open Vertical Refrigerated Display Cases, Fricke and Becker; Presented at 2010 International Refrigeration and Air Conditioning Conference
 40. State of Wisconsin, Public Service Commission of Wisconsin, Focus on Energy Evaluation, Business Programs Deemed Savings Manual, March 22, 2010.
 41. The minimum value calculated on Forecast Weather Data Analysis or Forecast Door Openings
 42. Illinois Statewide TRM 2015
 43. Efficiency Maine Commercial TRM 2015

Changes from Recent Filing:

No Changes

17.2 No Heat Doors

Algorithms

$$Customer\ kW = (kW_{Baseline} - kW_{Proposed}) \times \left(1 + \left(\frac{Door\ HF}{COP} \right) \right) \times Quantity$$

$$Customer\ kWh = Customer\ kW \times Ref\ Hours$$

$$Customer\ Coincident\ kW = Customer\ kW \times Coincidence\ Factor$$

Variables

Quantity	Customer Input	Quantity of proposed equipment installed
kW Baseline	See Table 17.2.2	Average kW for a standard case door (Reference 23 and 24)
KW Proposed	See Table 17.2.2	Average kW for a no heat case door (Reference 2)
Door HF	0.35	Estimated percentage of the heat produced by the heaters that remains in the freezer or cooler case and must be removed by the refrigeration unit. (Reference 24)
Ref Hours	8,760	Annual hours for commercial refrigeration systems
Lifetime	12.00	Measure Lifetime (Reference 44)
NHD Incremental Cost	See Table 17.2.2	Incremental cost per door
Coincidence Factor	100%	Peak Coincidence, based on 8,760 annual hours and average kW

Customer Inputs

M&V Verified

Application temperature (medium or low temperature case)	Yes	
Quantity (# of doors)	Yes	

Table 17.2.2	kW Baseline	kW Proposed	NHD Incremental Cost
No Heat Case Door - Medium Temp.	0.105	0.000	\$275.00
No Heat Case Door - Low Temp.	0.191	0.000	\$800.00

References:

2. PSC of Wisconsin, Focus on Energy Evaluation, Business Programs: Deemed Savings Manual V1.0
 20. Energy Savings Potential and R&D Opportunities for Commercial Refrigeration, Final Report; Submitted to: U.S. Department of Energy, Energy Efficiency and Renewable Energy Building Technologies Program; Navigant Consulting, Inc.; September 23, 2009
 23. Pennsylvania PUC Technical Reference Manual, June 2012
 24. SCE Workpaper WPSCNRRN0009, Revision 0, Anti-Sweat Heat (ASH) Controls, October 15, 2007
 44. California Energy Commission and California Public Utilities Commission. Database for Efficient Resources (DEER) 2008, Effective/Remaining Useful Life Values.

Changes from Recent Filing:

No Changes

17.3 Medium Temperature Reach-in Case

Algorithms

Customer kW

$$= Savings\ Factor \times (Load_{Baseline} - Load_{Proposed}) \times MT\ Load\ Factor \times \left(\left(\frac{1}{COP_{Cooler}} \right) / 3412 \right) \times Linear\ Feet$$

$$Customer\ kWh = Customer\ kW \times Ref\ Hours$$

$$Customer\ Coincident\ kW = Customer\ kW \times Coincidence\ Factor$$

Variables

Linear Feet	Customer Input	Proposed linear feet of equipment installed
Savings Factor	1.00	Amount of time doors are active
TDA	5.5	Total Display area per linear foot. Assumed to be 5.5 square feet based on a 5.5 foot tall glass door.
Baseline Load	1,652	Btuh/ft load of the standard efficiency refrigerated case (Reference 38)
Proposed Load	262	Btuh/ft load of the high efficiency refrigerated case. (Reference 5)
MT Load Factor	62.0%	Duty cycle of compressor for Medium Temperature (Reference 2)
Ref Hours	8,760	Annual hours for commercial refrigeration systems
Lifetime	15.00	Measure Lifetime
Incremental Cost	\$337.58	Incremental cost per linear feet of efficient measure (References 21 & 45).
Coincidence Factor	100%	Peak Coincidence, based on 8,760 annual hours and average kW used

Customer Inputs

M&V Verified

Application temperature (medium temperature)	Yes	
Linear feet installed	Yes	

References:

2. PSC of Wisconsin, Focus on Energy Evaluation, Business Programs: Deemed Savings Manual V1.0, p. 4-103 to 4-106.
 3. NREL/TP-550-46101 "Grocery Store 50% Energy Savings Technical Support Document" September 2010
 5. Average of multiple vendor products
 21. http://www.deeresources.com/files/DEER2016/download/2010-2012_WO017_Ex_Ante_Measure_Cost_Study_-_Final_Report.pdf
 38. 2015 International Energy Conservation Code (IECC)
 45. Custom Project History of Medium Temperature Cases

Changes from Recent Filing:

No Changes

17.4 Close The Case

Algorithms

$$kWh\ Open = (Load \times FI\ Open) \times Load\ Factor \times \left(\frac{1}{3412} \right) \times RefHours - HVAC\ kWh\ Open$$

$$kWh\ Closed = (Load \times FI\ Closed) \times Load\ Factor \times \left(\frac{1}{3412} \right) \times RefHours - HVAC\ kWh\ Closed$$

$$HVAC\ kWh\ Open = (Load \times FI\ Open) \times \left(\frac{1}{3412} \right) \times Cooling\ Hours \times Cooling\ Duty\ Cycle$$

$$HVAC\ kWh\ Closed = (Load \times FI\ Closed) \times \left(\frac{1}{3412} \right) \times Cooling\ Hours \times Cooling\ Duty\ Cycle$$

$$Customer\ Dth = (Load \times (FI\ Closed - FI\ Open)) \times Heating\ Hours \times 1/1000000 \times \frac{1}{Heating\ Eff}$$

$$Customer\ kWh = (kWh\ Open - kWh\ Closed) \times LinearFeet$$

$$Customer\ kW = \frac{Customer\ kWh}{Ref\ Hours}$$

$$Customer\ Coincident\ kW = Customer\ kW \times Coincidence\ Factor$$

Variables

Linear Feet	Customer Input	Proposed linear feet of equipment installed.
Load	See Table 17.4.3	Total refrigeration load per linear foot for Medium and Low Temp. Cases based on typical cases from past Custom projects.
FI Open	See Table 17.4.3	Calculated Fraction of Refrigerated Case Load that is infiltration for open cases.
FI Closed	See Table 17.4.3	Calculated Fraction of Refrigerated Case Load that is infiltration for closed cases.
FCR	13%	Fraction of Refrigerated Case Load that is conduction and radiation (Reference 33).
Cooling Hours	2908	Number of hours per year that facility is in cooling mode, assuming facility balance point of 60 F (Base on Denver Weather Bin Data).
Cooling Duty Cycle	70%	Cooling compressor duty cycle, typical assumption confirmed with metered data from a grocery store on two summer days.
COP hvac	3.2	Coefficient of Performance for facility HVAC system (Reference 33). This assumes a DX rooftop unit or similar.
Heating Hours	5155	Number of hours per year that facility is in heating mode, assuming facility balance point of 60 F, with a 5 degree economizing dead band before heating starts at 55 F (Base on Denver Weather Bin Data).
Heating Eff	78%	Efficiency of heating system from (Reference 33).
Lifetime	12.00	Measure Lifetime (Reference 11).
Incremental Cost	\$497.82	Incremental cost of efficient measures per linear foot (Reference 34) The incremental cost is split by avoided revenue requirements between gas and electric cost.
Coincidence Factor	100%	Peak Coincidence, based on 8,760 annual hours and average kW used

Customer Inputs

M&V Verified

Application temperature (medium or low)	Yes	
Linear feet installed	Yes	

Table 17.4.3

Load (Btu/hr/ft)

FI Open

FI Closed

Medium Temp. Cases	1500	81.77%	13.77%
Low Temp. Cases	1850	82.76%	14.76%

References:

11. 2008 Database for Energy-Efficient Resources, EUL/RUL (Effective/Remaining Useful Life) Values.
 21. http://www.deeresources.com/files/DEER2016/download/2010-2012_WO017_Ex_Ante_Measure_Cost_Study_-_Final_Report.pdf
 26. Energy Use of Doored and Open Vertical Refrigerated Display Cases, Fricke and Becker; Presented at 2010 International Refrigeration and Air Conditioning Conference
 27. Infiltration Modeling Guidelines for Commercial Building Energy Analysis, US Department of Energy Sept 2009
 29. HVAC Interactive Factors developed based on the Rundquist Simplified HVAC Interaction Factor method for Minnesota, presented on page 28 of the 11/93 issue of the ASHRAE Journal - "Calculating lighting and HVAC interactions".
 33. Wisconsin Focus on Energy Technical Reference Manual 2015, pg. 238-241
 34. Costs calculated and derived from four open-to-closed refrigerated case custom rebate projects.
 35. Work Paper PECIREF_PGE604 Vertical Refrigerated Case, Medium Temperature: Open to Closed (Retrofit)

Changes from Recent Filing:

No Changes

17.5 Walk-in Freezer Defrost Controls

Algorithms

$$Customer\ kWh = (((Baseline\ Duration / (60 \times Baseline\ Interval)) - (Proposed\ Duration / (60 \times Proposed\ Interval))) \times Defrost\ Wattage / 1000 \times Hours \times (1 + 1 / COP_{Freezer}))$$

$$Customer\ Coincident\ kW = \frac{Customer\ kWh \times Coincidence\ Factor}{Ref\ Hours}$$

Variables

Ref Hours	8,760	Annual hours for commercial refrigeration systems
Baseline Interval	6.0	Baseline hours between defrost cycles (Reference 46).
Proposed Interval	24.0	Proposed hours between defrost cycles (Reference 46).
Baseline Duration	40.0	Baseline defrost duration with timer control (Reference 46).
Proposed Duration	27.0	Proposed defrost duration with demand controls (Reference 46).
Lifetime	15	Assumed lifetime for commercial controls
Incremental Cost	\$1,351.31	Average cost from Custom projects (Reference 47).
Coincidence Factor	100%	Savings coincidence with summer hours 2pm-6pm.

Customer Inputs

M&V Verified

Defrost Wattage	Yes	Defrost coil wattage being controlled
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References:

46. Energy Analysis of KE2 Controllers for Walk-in Freezers; Michaels Energy; January 20, 2015
47. Custom project history of Defrost Controls

Changes from Recent Filing:

No Changes

17.6 Floating Head Pressure Controls

Algorithms

$$Avg\ LT\ kW = LT\ Tons \times LT\ \%Load \times (LT\ Eff\ Baseline - LT\ Eff\ Proposed)$$

$$Avg\ MT\ kW = MT\ Tons \times MT\ \%Load \times (MT\ Eff\ Baseline - MT\ Eff\ Proposed)$$

$$Customer\ kW = Avg\ LT\ kW + Avg\ MT\ kW$$

$$Customer\ kWh = (Avg\ LT\ kW + Avg\ MT\ kW) \times Ref\ Hours$$

$$Customer\ Coincident\ kW = Customer\ kW \times Coincidence\ Factor$$

Variables

Ref Hours	8,760	Annual hours for commercial refrigeration systems
LT %Load	75%	Low Temperature Load Factor (Reference 48).
MT %Load	50%	Medium Temperature Load Factor (Reference 48).
LT Eff Baseline	2.21	Low Temperature Baseline Average kW/Ton (Reference 48).
LT Eff Proposed	2.00	Low Temperature Proposed Average kW/Ton (Reference 48).
MT Eff Baseline	1.14	Medium Temperature Baseline Average kW/Ton (Reference 48).
MT Eff Proposed	0.98	Medium Temperature Proposed Average kW/Ton (Reference 48).
Lifetime	15	Assumed lifetime for commercial controls.
Incremental Cost	\$4,185.00	Average cost from completed Custom projects (Reference 49).
Coincidence Factor	0%	Savings coincidence with summer hours 2pm-6pm.

Customer Inputs

M&V Verified

LT Tons	Yes	Design evaporator load on low temperature racks
MT Tons	Yes	Design evaporator load on medium temperature racks

References:

48. Custom M&V project energy consumption, operation, and savings on Floating Head Pressure Controls
49. History of Completed Custom project costs for Floating Head Pressure Controls

Changes from Recent Filing:

Corrections to average efficiencies with DIA weather bin data.
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17.7 DI Strip Curtains

Algorithms

$$Customer\ kW = Quantity \times \frac{Customer\ kWh}{Ref\ Hours}$$

$$Customer\ kWh = Quantity \times kWh\ Per\ SF \times Area\ SF$$

$$Customer\ Coincident\ kW = Customer\ kW \times Coincidence\ Factor$$

Variables

Area SF	See Table 17.7.4	Door area in square feet (Reference 50)
kWh Per SF	See Table 17.7.5	kWh saved per square foot of curtain installed (Reference 50)
Ref Hours	8,760	Annual hours for commercial refrigeration systems
Lifetime	4	Measure Lifetime in years (Reference 50)
Total Cost*	\$270.83	Incremental cost of efficient measures (Reference 50) *Costs are re-evaluated throughout the year and updated to account for the evolving market.
Coincidence Factor	100%	Coincidence factor for medium and low temperature applications. (Reference 50)

Customer Inputs

M&V Verified

Facility Type	Yes	Facility and its temperature application
Quantity	Yes	
Pre Existing Curtains	No	

Table 17.7.4

Facility Type	Doorway Area Sq Ft
Supermarket - Cooler	35
Supermarket - Freezer	35
Convenience Store - Cooler	21
Convenience Store - Freezer	21
Restaurant - Cooler	21
Restaurant - Freezer	21
Refrigerated Warehouse	80

Table 17.7.5

Facility Type	Pre-Existing	
	Curtains	kWh Savings/Sq Ft
Supermarket - Cooler	Yes	37
	No	108
Supermarket - Freezer	Yes	119
	No	349
Convenience Store - Cooler	Yes	5
	No	20
Convenience Store - Freezer	Yes	8
	No	27
Restaurant - Cooler	Yes	8
	No	30
Restaurant - Freezer	Yes	34
	No	119
Refrigerated Warehouse	Yes	254
	No	729

References:

50. Data from Illinois TRM 2019. Efficient equipment is a strip curtain at least 0.06 inches thick and covers entire doorway. A doorway area of 26.5 sq ft was assumed based on the weighted average of estimated customer participants by customer type.

Changes from Recent Filing:

No Changes

17.8 DI Auto Close Doors

Algorithms

$Customer\ kW = Quantity \times PCkW$

$Customer\ kWh = Quantity \times kWh$

$Customer\ Coincident\ kW = Quantity \times PCkW$

Variables

kWh	See Table 17.8.6	kWh saved per door. (Reference 50)
PCkW	See Table 17.8.6	PCkW saved per door. (Reference 50)
Lifetime	8	Measure Lifetime in years (Reference 50)
Total Cost*	\$156.82	Incremental cost of efficient measures (Reference 50) *Costs are re-evaluated throughout the year and updated to account for the evolving market.

Customer Inputs

M&V Verified

Application	Yes	Walk-in Cooler or Freezer
Quantity	Yes	
Pre Existing Curtains	No	

Table 17.8.6

Application	Annual kWh	PCkW
Walk-in Cooler	943	0.137
Walk-in Freezer	2,307	0.309

References:

50. Data from Illinois TRM 2019. Baseline assumes no auto closers.

Changes from Recent Filing:

No Changes

18.0 Residential HVAC Deemed Tables

Table 18.0.1: Effective Full Load Hours, Altitude	EFLH Cooling		EFLH Heat		EFLH Heating_HP (Heat Pump Impacted heating hours) ****		Altitude Adjustment Factor	HSPF Climate Zone Adjustment
	Single Family	Multi-Family	Single Family	Multi-Family	Single Family	Multi-Family		
Zone 1 - CO Front Range *	590	699	1,825	1,409	750	579	0.177	100%
Zone 2 - CO Western Slope **	837	992	1,971	1,522	779	601	0.163	100%
Zone 3 - CO Mountain Areas ***	210	249	2,104	1,625	536	414	0.244	85%
Zone 4 - CO Very High Altitude Areas *****	2	2	2,739	2,115	673	520	0.303	85%

* Zone 1 (Front Range as represented by Denver International Airport TMY3 data);
 ** Zone 2 (Western Slope as represented by Grand Junction TMY3 Data)
 *** Zone 3 (Mountain Areas as represented by Alamosa TMY3 Data)
 **** the heat pump impacted hours are determined at a cutoff temperature of 35 F.
 ***** Zone 4 (Very High Altitude Areas as represented by Lake CO Airport TMY3 Data)

Table 18.0.1a: Effective Full Load Hours Cold Climate Heat Pumps	Cold Climate Heat Pump Full Load Hours w/ 5 F Cutover *****		Cold Climate Heat Pump Full Load Hours w/ 10 F Cutover *****		Cold Climate Heat Pump Full Load Hours w/ 15 F Cutover *****		Cold Climate Heat Pump Full Load Hours w/ 20 F Cutover *****		Cold Climate Heat Pump Full Load Hours w/ 25 F Cutover *****	
	Single Family	Multi-Family	Single Family	Multi-Family	Single Family	Multi-Family	Single Family	Multi-Family	Single Family	Multi-Family
Zone 1 - CO Front Range	1,809	1,397	1,776	1,371	1,714	1,323	1,566	1,209	1,409	1,088
Zone 2 - CO Western Slope	1,971	1,522	1,963	1,515	1,925	1,486	1,835	1,417	1,495	1,154
Zone 3 - CO Mountain Areas	1,748	1,349	1,589	1,227	1,381	1,066	1,216	939	920	710
Zone 4 - CO Very High Altitude Areas	2,521	1,946	2,384	1,840	2,145	1,656	1,908	1,473	1,360	1,050

***** All Cutover Temperatures are defined as the Outdoor Ambient Temperature where Backup Heat takes over the load.

Table 18.0.2: Minimum Qualifying Efficiency	for units manufactured before 1/1/2023				for units manufactured after 1/1/2023			
	Minimum Qualifying SEER	Minimum Qualifying EER	Minimum qualifying HSPF	Minimum qualifying Heating COP	Minimum Qualifying SEER2	Minimum Qualifying EER2	Minimum qualifying HSPF2	Minimum qualifying Heating COP
High Efficiency Air Conditioner - Split System	15.00	12.50	N/A	N/A	15.20	12.50	N/A	N/A
High Efficiency Air Conditioner - Packaged System	15.00	12.50	N/A	N/A	15.20	12.50	N/A	N/A
Air Source Heat Pump - Split System	15.00	11.50	9.00	N/A	15.20	11.70	7.80	N/A
Air Source Heat Pump - Packaged System	15.00	11.50	9.00	N/A	15.20	10.60	7.20	N/A
Mini-Split & Multi-Split Heat Pumps	15.00	11.50	9.00	N/A	15.20	11.50	7.80	N/A
Cold Climate Air Source Heat Pumps (Ducted & Mixed Ducted / Non-Ducted) ++	18.00	11.50	9.50	N/A	18.00	11.70	8.10	N/A
Cold Climate Mini-Split & Multi-Split Heat Pumps (Non-Ducted) ++	18.00	11.50	9.50	N/A	18.00	11.50	8.50	N/A
Ground Source Heat Pump **	N/A	16.00	N/A	3.30	N/A	16.00	N/A	3.30

** Ground Loop Brine to Air with entering temperatures of 77 F cooling mode and 32 F heating mode. This GSHP equipment not subject to the new SEER2 / EER2 requirements.
 ++ Cold climate air source heat pumps and mini-split heat pumps must have a low temp heating efficiency (COP at 5 F) that is >= 1.75.

Table 18.0.3: Baseline Efficiencies	BASELINE Efficiency units manufactured before 1/1/2023				BASELINE Efficiency units manufactured after 1/1/2023			
	SEER	EER	HSPF	Heating COP	SEER2	EER2	HSPF2	Heating COP2
High Efficiency Air Conditioner - Split System	13.00	11.18	N/A	N/A	13.40	11.42	N/A	N/A
High Efficiency Air Conditioner - Packaged System	14.00	11.76	N/A	N/A	13.40	11.42	N/A	N/A
Air Source Heat Pump - Split System - Gas Backup *	13.00	11.18	0.00	0.95	13.40	11.42	0.00	0.95
Air Source Heat Pump - Split System - Elec Resist. Backup *	13.00	11.18	3.412	1.00	13.40	11.42	3.412	1.00
Mini-Split & Multi-Split Heat Pumps - Gas Backup *	13.00	11.18	0.00	0.95	13.40	11.42	0.00	0.95
Mini-Split & Multi-Split Heat Pumps - Elec Resist. Backup *	13.00	11.18	3.412	1.00	13.40	11.42	3.412	1.00
Cold Climate Air Source Heat Pumps - Gas Backup *	13.00	11.18	0.00	0.95	13.40	11.42	0.00	0.95
Cold Climate Air Source Heat Pumps - Elec Resist. Backup *	13.00	11.18	3.412	1.00	13.40	11.42	3.412	1.00
Cold Climate Mini-Split & Multi-Split Heat Pumps - Gas Backup *	13.00	11.18	0.00	0.95	13.40	11.42	0.00	0.95
Cold Climate Mini-Split & Multi-Split Heat Pumps - Elec Resist. Backup *	13.00	11.18	3.412	1.00	13.40	11.42	3.412	1.00
Ground Source Heat Pump w/ Furnace & AC Baseline**	13.00	11.18	N/A	0.80	N/A	N/A	N/A	N/A
Ground Source Heat Pump w/ ER in Air Handler & AC Baseline**	13.00	11.18	N/A	1.00	N/A	N/A	N/A	N/A
Ground Source Heat Pump w/ Boiler + Air Handler & AC Baseline**	13.00	11.18	N/A	0.84	N/A	N/A	N/A	N/A

* ASHP & MSHP baseline case is a Standard AC with Condensing Furnace, Boiler, or Electric Resistance Heat
 ** Ground Loop Brine to Air with entering temperatures of 77 F cooling mode and 32 F heating mode. This GSHP equipment not subject to the new SEER2 / EER2 requirements.

Table 18.0.4: Coincidence Factors, Baseline Efficiencies and Lifetimes	Deemed Equipment Coincidence Factor	Deemed QI Coincidence Factor	Lifetime	Notes
High Efficiency Air Conditioner - Split System *	90%	100%	18	(Reference 17)
Air Source Heat Pump - Split System - with Gas Backup	90%	100%	18	(Reference 17)
Air Source Heat Pump - Split System - with Elec Resist. Backup	90%	100%	18	(Reference 17)
Mini-Split & Multi-Split Heat Pumps	90%	N/A	15	
Cold Climate Air Source Heat Pump - Split System	90%	100%	18	(Reference 17)
Cold Climate Mini-Split & Multi-Split Heat Pumps	90%	N/A	15	
Ground Source Heat Pump **	90%	100%	20	

** Baseline for GSHP is Code minimum AC and Gas Fired Furnace.

Table 18.0.5: QI Factors (Reference 4, Reference 6, Reference 7, Reference 14)

Home Type - equipment type	Sizing Loss	Refrigeratio n Charge	Improper Airflow	Duct Leakage	Loss NO Field QI	Loss_Uncor r
New Home - AC/ASHP	0%	7.0%	2.0%	0.0%	9.00%	0.0%
Existing Home - AC/ASHP	2.0%	7.0%	2.0%	8.3%	17.30%	3.7%
New Home - GSHP	0%	0.0%	2.0%	0.0%	2.00%	0.0%
Existing Home - GSHP	2.0%	0.0%	2.0%	8.3%	10.30%	3.7%
New Home MSHP	0.0%	0.0%	0.0%	0.0%	0.00%	0.0%
Existing Home MSHP	0.0%	0.0%	0.0%	0.0%	0.00%	0.0%

Table 18.0.6: Conversion Factors and Constants

Conversion Factor from BTUH to kW	3,412	BTU/kW-hr
Btu to Dth	1,000,000	BTU/Dth
Therm to Dth	10	Therm/Dth
Btu to Therm	100,000	Btu/Therm
Convert from Btu/wh to kW/ton	12	Btu/wh per kW/ton
Conversion between Watts and kiloWatts	1,000	watts/kilowatt
Conversion between BTU/h and tons	12,000	BTU/h / ton
Water Lb/gallon	8.34	lb/gal
Water_h_fg	1,059	BTU/lb (Evaporative energy / lb water)

Table 18.0.7: Cooling & Heating Weather Data for Load Estimates	Maximum Outside Air Temperature (F)	Mimimum Outside Air Temperature (F)	Balance Point OSA Temperature (F)	Balance Point Load (BTUH)
Zone 1 - CO Front Range	104	-3	60	0
Zone 2 - CO Western Slope	99	7	60	0
Zone 3 - CO Mountain Areas	87	-26	60	0
Zone 4 - CO Mountain Areas	81	-17	60	0

Changes from Recent Filing:

Modified Hours for non-cold climate heat pumps. Cutover temperature was raised from 25F to 35F.
 Clarified baseline efficiencies to reflect actual baseline equipment, which may be different than Proposed Efficient equipment.
 Added a flexible cutover temperature for cold climate ASHP and cold climate MSHP equipment.

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

18.1 Residential Air Conditioning

Algorithms

$$\text{Customer kW Savings} = \text{Customer kW}_{EqCooling} + \text{Customer kW}_{QICooling}$$

$$\text{Customer kWh Savings} = \text{Customer kWh}_{EqCooling} + \text{Customer kWh}_{QICooling}$$

$$\text{Customer Coincident kW Savings} = \text{Customer Coincident kW}_{Equipment} + \text{Customer Coincident kW}_{QI}$$

$$\text{Customer Dth}_{QI} \text{ Existing Home} = \text{Dth Heat}_{NoQI} \text{ Existing Home}_{Eff} - \text{Dth Heat}_{QI} \text{ Existing Home}_{Eff}$$

$$EER_{baseline} = iCoef0 * (SEER_{baseline}^2) + iCoef1 * SEER_{baseline}$$

$$\text{Customer kW}_{EqCooling} = \frac{\text{Size}_{Cool}}{12,000} * \left(\left(\frac{12}{EER_{baseline}} \right) - \left(\frac{12}{EER_{proposed}} \right) \right)$$

$$\text{Customer kW}_{QICooling} = \frac{\text{Size}_{Cool}}{12,000} * \left(\frac{12}{EER_{baseline}} * \left(\frac{1}{1 - \text{Sizing Loss}} - 1 \right) + \frac{12}{EER_{proposed}} * \left(\left(\frac{1}{1 - \text{Loss}_{NoQI}} \right) - \left(\frac{1}{1 - \text{Loss}_{Uncorr}} \right) \right) \right)$$

$$\text{Customer kWh}_{EqCooling} = \frac{\text{Size}_{Cool}}{12,000} * EFLH_{cooling} * \left(\left(\frac{12}{SEER_{baseline}} \right) - \left(\frac{12}{SEER_{proposed}} \right) \right)$$

$$\text{Customer kWh}_{QICooling} = \frac{\text{Size}_{Cool}}{12,000} * EFLH_{cooling} * \left(\frac{12}{SEER_{baseline}} * \left(\frac{1}{1 - \text{Sizing Loss}} - 1 \right) + \frac{12}{SEER_{proposed}} * \left(\left(\frac{1}{1 - \text{Loss}_{NoQI}} \right) - \left(\frac{1}{1 - \text{Loss}_{Uncorr}} \right) \right) \right)$$

$$\text{Customer Coincident kW}_{Equipment} = \text{Coincidence Factor} * \frac{\text{Size}_{Cool}}{12,000} * \left(\left(\frac{12}{EER_{baseline}} \right) - \left(\frac{12}{EER_{proposed}} \right) \right)$$

$$\text{Customer Coincident kW}_{QI} = \text{Coincidence Factor} * \frac{\text{Size}_{Cool}}{12,000} * \left(\frac{12}{EER_{baseline}} * \left(\frac{1}{1 - \text{Sizing Loss}} - 1 \right) + \frac{12}{EER_{proposed}} * \left(\left(\frac{1}{1 - \text{Loss}_{NoQI}} \right) - \left(\frac{1}{1 - \text{Loss}_{Uncorr}} \right) \right) \right)$$

$$\text{Incremental Capital Cost}_{Equipment} = \text{Inc Cost per Ton}_{EQ} * \frac{\text{Size}_{Cool}}{12,000}$$

$$\text{Incremental Capital Cost}_{QI} \text{ New Home} = \text{Inc Cost}_{QI}$$

$$\text{Incremental Capital Cost}_{QI} \text{ E Home} = \text{MAX}(75, \text{Inc Cost}_{QI} - \frac{\text{Size}_{Cool}}{12,000} * \left(\left(\frac{1}{1 - \text{Sizing Loss}} \right) - 1 \right) * \text{Cost per Ton}_{baseline})$$

AC with Furnace Heating Savings

$$\text{Customer Dth}_{QI} \text{ Existing Home} = \text{Dth Heat}_{NoQI} \text{ Existing Home}_{Eff} - \text{Dth Heat}_{QI} \text{ Existing Home}_{Eff}$$

$$\text{Dth Heat}_{NoQI} \text{ Existing Home}_{Eff} = \text{Size}_{Heat} * (1 - \text{Oversize Factor}) * (1 - \text{Altitude}_{Adj_Factor}) * EFLH_{Heat} * 1 / (\text{Furnace}_{Eff} * (1 - \text{Loss}_{DuctLeakage})) / 1,000,000$$

$$\text{Dth Heat}_{QI} \text{ Existing Home}_{Eff} = \text{Size}_{Heat} * (1 - \text{Oversize Factor}) * (1 - \text{Altitude}_{Adj_Factor}) * EFLH_{Heat} * 1 / (\text{Furnace}_{Eff} * (1 - \text{Uncorr}_{Loss})) / 1,000,000$$

$$\text{Estimated Furnace Size}_{Heat} = \text{Const}_a * \text{Size}_{Cool} + \text{Const}_b \quad \text{NOTE: only if actual furnace capacity is not available}$$

Note: All formulas using SEER, EER, and HSPF are valid with SEER2, EER2, HSPF2 substitutions.

Variables

<i>Inc Cost per Ton_{EQ}</i>	See Table 18.1.1	Deemed Plan A Incremental Capital Cost per Ton, Based On Unit Efficiency (New Construction)
<i>Cost per Ton_{baseline}</i>	See Table 18.1.2	Baseline capital cost per ton for equipment
<i>Inc Cost_{QI}</i>	See Table 18.1.2	Deemed incremental cost for 'quality install' installation effort.
<i>EER_{baseline}</i>	See Table 18.0.3	Baseline EER as calculated for residential equipment from the code required SEER.
<i>SEER_{baseline}</i>	See Table 18.0.3	IECC 2012 identified code minimum SEER
<i>Sizing Loss</i>	See Table 18.0.5	
<i>Loss_{NoQI}</i>	See Table 18.0.5	
<i>Loss_{Uncorr}</i>	See Table 18.0.5	
<i>Coincidence Factor_{EQ}</i>	See Table 18.0.4	
<i>Coincidence Factor_{QI}</i>	See Table 18.0.4	
<i>iCoef0</i>	-0.02	coefficient used in polynomial conversion to derive AC's EER (or EER2) from a known SEER (or SEER2).
<i>iCoef1</i>	1.12	coefficient used in polynomial conversion to derive AC's EER (or EER2) from a known SEER (or SEER2).
<i>Oversize Factor_c</i>	20%	Deemed Oversize Safety Factor for heating equipment.
<i>Conversion Factors</i>	See Table 18.0.6	for all conversion factors
<i>EFLH_{cooling}</i>	See Table 18.0.1	Effective Full Load Hours for cooling load energy savings
<i>EFLH_{Heat}</i>	See Table 18.0.1	Effective Full Load Hours for heating load QI energy savings
<i>EFLH_{Heating_HP}</i>	See Table 18.0.1	Effective Full Load Hours for Heat Pump impacted energy savings
<i>uCoef0</i>	1.70223	formula constant (slope) for use in estimating furnace size from nameplate cooling capacity for
<i>uCoef1</i>	24779	constant for use in estimating furnace size from nameplate cooling capacity for a furnace
<i>Furnace_Eff</i>	Derived from Inputs	Contractor to provide the associated furnace efficiency if known. If the furnace efficiency is unknown, the Furnace Type (Condensing or Non-Condensing) will determine the deemed furnace efficiency to be used in the calculations. Condensing furnaces = 95% efficiency and for Non-Condensing = 80% efficiency. If Furnace Type is unknown we will assume Condensing.
<i>Minimum QI EER</i>	8	Minimum allowable EER for QI Only Measures
<i>Minimum QI EER2</i>	8	Minimum allowable EER2 for QI Only Measures
<i>Measure Life - Matched Split-System Air Conditioner (Plan A)</i>	See Table 18.0.4	Reference 16
<i>Measure Life - Quality Installation</i>	18	Reference 16

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Customer Inputs	M&V Verified	
Size Cool	Yes	AHRI rating of total cooling equipment BTUH (sensible plus latent)
Qty Prop	Yes	Quantity of proposed equipment
EER proposed	Yes	AHRI rated full load energy efficiency ratio
SEER proposed	Yes	AHRI rated seasonal energy efficiency ratio
Home Type	No	customer home type; new or existing
County	No	Location of the installed new equipment
Size Heat	No	Make/Model of existing furnace
Furnace Type	No	Contractor to determine if the new AC equipment is associated with a furnace that has a Condensing or Non-Condensing burner / heat exchanger.

Table 18.1.1 Incremental Capital Costs - New Construction (Plan A) - Reference 6

SEER	AC Cost per Ton	AC Incremental Cost per Ton
13 SEER	\$ 2,507.42	N/A
15 SEER	\$ 2,691.67	\$ 184.25
16 SEER	\$ 2,783.80	\$ 276.38
17/18+ SEER	\$ 2,875.93	\$ 368.51

Table 18.1.2 Incremental Capital Costs - Quality Install (Reference 6)

Measures	New Home	Existing Home*
Quality Installation	\$ 103.56	\$ 259.80

References:

1. Building America, Research Benchmark Definitions, 2010. (see p. 10) <http://www.nrel.gov/docs/fy10osti/47246.pdf>
2. ASHRAE, 2019, Applications Handbook, Ch. 38, table 4, Comparison of Service Life Estimates
3. DOE Appliance Standards Website, Residential Central Air Conditioners and Heat Pumps. https://www1.eere.energy.gov/buildings/appliance_standards/product.aspx/productid/75
4. Neme, Proctor, Nadel, ACEEE, 1999. Energy Savings Potential From Addressing Residential Air Conditioner and Heat Pump Installation Problems, <http://aceee.org/research-report/a992>
5. State of Minnesota Technical reference Manual For Energy Conservation Improvement Programs, Version 3.1 <https://mn.gov/commerce/industries/energy/utilities/cip/technical-6>
6. ENERGY STAR Quality Installation standards (ESVI). https://www.energystar.gov/index.cfm?c=hvac_install.hvac_install_index
7. NREL 2011 Measure Guideline Sealing and Insulating Ducts in Existing Homes. <http://www.nrel.gov/docs/fy12osti/53494.pdf>
8. State of Illinois Technical Reference Manual Version 8, dated 2020
9. For explanation of duct sealing requirements for new homes see "Significant Changes to the 2015 Minnesota Residential Codes (MR 1303, 1309 and 1322)". <http://www.ci.minneapolis.mn.us/www/groups/public/@regservices/documents/webcontent/wcms1p-142763.pdf>
10. Incremental costs for MSHPs were determined from the NEEP Incremental Cost Study Phase 2 Report
11. MSHP equipment life is from Measure Life Report Residential and Commercial/Industrial Lighting and HVAC Measures; <http://library.eee1.org/content/measure-life-report-residential-and-commercial/industrial-lighting-and-hvac-measures>
12. For estimated life of GSHP see http://www.energysavers.gov/your_home/space_heating_cooling/index.cfm?mytopic=12640 (indoor components up to 25 years; ground loop =50 years)
13. Costs obtained from "2010-2012 WO017 Ex Ante Measure Cost Study Final Report", by Itron, May 2014. These are used in the DEER 2016 database.
14. For assumptions on losses related to overcharge or undercharge on refrigerant see "Sensitivity Analysis of Installation Faults on Heat Pump Performance", by P. Domanski, et. al., Sept 2014, <http://www.acca.org/HigherLogic/System/DownloadDocumentFile.ashx?DocumentFileKey=f02c1f61-4d1d-4a24-971d-cc9ea3e626b2&forceDialog=0>
15. ENERGY STAR Connected Thermostat Key Product Criteria, Version 1.0, Rev. Jan 2017 -
16. Code of Federal Regulations Title 10: Energy PART 430—ENERGY CONSERVATION PROGRAM FOR CONSUMER PRODUCTS Subpart C—Energy and Water
17. "Measure Life Report - Residential and Commercial/Industrial Lighting and HVAC Measures", dated June 2007 for The New England State Program Working Group prepared
18. Assumptions on EC fan operating modes. Center for Energy and Environment Comments to Docket Number EERE-2010-BT-STD-0011-0022, July 27, 2010
19. ECM Furnace Impact Assessment Report https://focusonenergy.com/sites/default/files/emcfurnaceimpactassessment_evaluationreport.pdf
20. Xcel Energy, January 2019. Typical MN Residential Smart Switch Load Relief 2011-2015.
21. Xcel Energy, January 2019. Saver's Switch Control History.
22. Xcel Energy, January 2006. Residential Saver's Switch 2005 Impact Evaluation.
23. http://wpb-radon.com/radon_fan_performance.html#3:5032:50A33:50
24. Information from manufacturer and contractors (Radonaway)
25. <https://www.radonaway.com/products/radon-fans/rp140-pro.php>
26. Energy Information Administration's (EIA) 2009 Residential Energy Consumption Survey (RECS)
27. Bin analysis using RECS data for thermostat operation and typical CO home cooling and heating conditions.

Changes from Recent Filing:

Included Minimum Qualifying levels for SEER2, EER2, and HSPF2 for all AC and Heat Pump equipment based on IECC2021 where applicable. See Deemed Tables tab. modified the application of QI Sizing Loss factors.

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

18.2 Residential Ground Source Heat Pump

Algorithms

$$Customer\ kW\ Savings = Customer\ kWh_{EqCooling} + Customer\ kWh_{QICooling}$$

$$Customer\ Coincident\ kW\ Savings = Customer\ Coincident\ kWh_{Equipment} + Customer\ Coincident\ kWh_{QI}$$

AC Cooling with Gas Heat Baseline:

$$Customer\ kWh\ Savings = Customer\ kWh_{EqCooling} + Customer\ kWh_{QICooling} + Customer\ kWh_{EQ\&QIHeating\ Penalty} + Customer\ Furnace\ Fan\ kWh$$

$$Customer\ DTherms\ Savings = Customer\ GSHP\ DTh_{EQ\&QIHeating}$$

AC Cooling with Electric Resistance Heat Baseline:

$$Customer\ kWh\ Savings = Customer\ kWh_{EqCooling} + Customer\ kWh_{QICooling} + Customer\ kWh_{EQHeating} + Customer\ kWh_{QIHeating}$$

$$Customer\ kWh_{EqCooling} = \frac{Full_Load_Cool}{12,000} \times \left(\left(\frac{12}{EER_{baseline}} \right) - \left(\frac{12}{EER_{proposed}} \right) \right)$$

$$Customer\ kWh_{QICooling} = \frac{Full_Load_Cool}{12,000} * 12 / (EER_{proposed}) * \left(\left(\frac{1}{1 - Loss_{NoQI}} \right) - \left(\frac{1}{1 - Loss_{Uncorr}} \right) \right)$$

$$Customer\ Coincident\ kWh_{Equipment} = Coincidence\ Factor * \frac{Full_Load_Cool}{12,000} * \left(\left(\frac{12}{EER_{baseline}} \right) - \left(\frac{12}{EER_{cooling}} \right) \right)$$

$$Customer\ Coincident\ kWh_{QI} = Coincidence\ Factor * \frac{12}{EER_{cooling}} * \frac{Full_Load_Cool}{12,000} * \left(\left(\frac{1}{1 - Loss_{NoQI}} \right) - \left(\frac{1}{1 - Loss_{Uncorr}} \right) \right)$$

$$Customer\ kWh_{EqCooling} = \frac{Full_Load_Cool}{12,000} * EFLH_{cooling} * \left(\left(\frac{12}{SEER_{baseline}} \right) - \left(\frac{12}{SEER_{proposed}} \right) \right)$$

$$Customer\ kWh_{QICooling} = \frac{Full_Load_Cool}{12,000} * EFLH_{cooling} * \frac{12}{SEER_{proposed}} * \left(\left(\frac{1}{1 - Loss_{NoQI}} \right) - \left(\frac{1}{1 - Loss_{Uncorr}} \right) \right)$$

$$Incremental\ Capital\ Cost_{Equipment} = \frac{Size_{Heat}}{12,000} * (GSHP_Cost_per_Heat_Ton) - Full_{Load_Cooling} / 12000 * Base_AC_Cost_per_Ton - Base_Furnace_Cost$$

$$Incremental\ Capital\ Cost_{QI\ New\ Home} = Inc\ Cost_{QI}$$

$$Incremental\ Capital\ Cost_{QI\ E\ Home} = MAX(75, Inc\ Cost_{QI} - \frac{Size_{Heat}}{12,000} * \left(\left(\frac{1}{1 - Sizing\ Loss} \right) - 1 \right) * Cost\ per\ Ton_{baseline})$$

$$load\ profile\ slope\ (m) = \frac{-1 * Size_{Heat} - balance\ pt\ load}{(Min\ OAT - balance\ pt\ temp)}$$

$$load\ profile\ y\ intercept\ (b) = (-1 * Size_{Heat}) - (m * Min\ OAT)$$

$$Full_Load_Cooling = m * Max\ OAT + b$$

$$Customer\ kWh_{EQ\&QIHeating\ Penalty} = Size_{Heat} * EFLH_{Heat} * (1 / (COP_{Eff} * 3.412) / 1000 * ((0 - 1 / (1 - Loss_{uncorr})))$$

$$Customer\ GSHP\ DTh_{EQ\&QIHeating} = Size_{Heat} * 1 / (1 - Loss_{No_QI_Duct_Leakage}) * EFLH_{Heat} * (1 / Baseline\ Gas\ Eff) / 100000$$

$$Customer\ Furnace\ Fan\ kWh = Furnace_Fan_kW * EFLH_{Heat}$$

$$Customer\ kWh_{EQHeating} = Size_{Heat} * EFLH_{Heat} * ((1 / (COP_{baseline} * 3.412)) - (1 / (COP_{Eff} * 3.412))) / 1000$$

$$Customer\ kWh_{QIHeating}$$

$$= Size_{Heat} * EFLH_{Heat} * (1 / (COP_{baseline} * 3.412)) / 1000 * \left(\frac{1}{1 - Sizing\ Loss} - 1 \right) + \frac{1}{(COP_{Eff} * 3.412)} / 1000 * \left(\frac{1}{1 - Loss_{NoQI}} - \frac{1}{1 - Loss_{Uncorr}} \right)$$

Variables

m_load_profile	Calculated	load profile slope (m)
b_load_profile	Calculated	load profile y intercept (b)
Full Load Cooling	Calculated	calculated full load cooling BTUH required to serve the home or space at the maximum Outside Air Temperature
COP_Baseline	See Table 18.0.3	Baseline COP for Ground Source Heat Pump system with Electric Resistance
Baseline Gas Eff	See Table 18.5.2	Efficiency of the baseline gas furnace
EER_Base	See Table 18.0.3	Efficiency of the baseline Air Conditioner
GSHP_Cost_per_Heat_Ton	See Table 18.2.1	Cost per heating ton of a ground source heat pump system including wells
Base_AC_Cost_per_Ton	See Table 18.2.1	Cost per cooling ton of a baseline AC unit sized to meet cooling load
Base_Furnace_Cost	See Table 18.2.1	Cost of a furnace sized to meet GSHP heating load including oversize and altitude adjustment factors.
EFLH_cooling	See Table 18.0.1	Effective Full Load Hours for cooling load energy savings
EFLH_Heat	See Table 18.0.1	Effective Full Load Hours for heating load energy savings
Balance Pt Temp	See Table 18.0.7	Outdoor Ambient Temperature at which residential cooling and heating loads are zero BTUH
Max OAT	See Table 18.0.7	Maximum Outdoor Ambient Temperature used in building ASHP load profile
Min OAT	See Table 18.0.7	Minimum Outdoor Ambient Temperature for calculating full load heating.
Balance Pt Load	See Table 18.0.7	Heating and cooling loads are zero at the balance point outdoor ambient temperature
Furnace_Fan_kW	0.357	Furnace Fan EC Motor kW demand for baseline energy calculations
Electric Resistance Heat HSPF	3.412	Electric resistance heat assumed heating season performance factor based on a COP of 1. no climate zone correction required.
Minimum Qualifying Efficiency	See Table 18.0.2	
Lifetime	See Table 18.0.4	

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Customer Inputs	M&V Verified	
Size_Heat	Yes	AHRI rated Heating Capacity
COP_Eff	Yes	AHRI rated Heating COP
Size_Cool	Yes	AHRI rated Cooling Capacity
EER_Eff	Yes	AHRI rated Cooling Efficiency
Home Type	Yes	Existing or New home
Baseline Heat Type	No	For Existing Homes there is a choice of Electric Resistance or Gas Heat. For New Homes the baseline will be Electric Resistance.
County	No	Location of the home for determining weather zones.

Table 18.2.1 Incremental Capital Costs - New Construction (Plan A) - Reference 8

	Baseline AC Cost per Ton w/ Labor	Baseline Cost of Heat / kBTUH	Baseline Air Handler	Proposed Cost per Heat Ton Including Wells
GSHP - w/ Gas Furnace & AC Baseline	\$ 2,507.42	\$ 48.37		\$ 6,960.00
GSHP - w/ ER Heat & Air Handler & AC Baseline	\$ 2,507.42	\$ 40.00	\$ 1,200.00	\$ 6,960.00
GSHP - w/ Boiler Heat & Air Handler & AC Baseline	\$ 2,507.42	\$ 74.22	\$ 1,200.00	\$ 6,960.00

References:

See 18.1 Residential AC for references

Changes from Recent Filing:

modified application of QI Sizing Loss factors to apply to size heat in lieu of full load size cool (which is a calculated value).

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

18.3 Residential Air Source Heat Pumps

Algorithms

$$\text{Customer kW Savings} = \text{Customer kW}_{EqCooling} + \text{Customer kW}_{QICooling}$$

$$\text{Customer Coincident kW Savings} = \text{Customer Coincident kW}_{Equipment} + \text{Customer Coincident kW}_{QI}$$

ASHP Baseline Cooling Only:

$$\text{Customer kWh Savings} = \text{Customer kWh}_{EqCooling} + \text{Customer kWh}_{QICooling}$$

Electric Resistance Heat Baseline:

$$\text{Customer kWh Savings} = \text{Customer kWh}_{EqCooling} + \text{Customer kWh}_{QICooling} + \text{Customer kWh}_{EQHeating} + \text{Customer kWh}_{QIHeating}$$

Dual Fuel Gas Heat Baseline

$$\text{Customer kWh Savings} = \text{Customer kWh}_{EqCooling} + \text{Customer kWh}_{QICooling} + \text{Customer kWh}_{Heating Penalty}$$

$$\text{Customer Dtherm Savings} = \text{Customer DTherms}_{EQ Heating} + \text{Customer DTherm}_{QI Heating}$$

$$\text{Customer kW}_{EqCooling} = \frac{\text{Size}_{Cool}}{12,000} \times \left(\left(\frac{12}{EER_{baseline}} \right) - \left(\frac{12}{EER_{proposed}} \right) \right)$$

$$\text{Customer kW}_{QICooling} = \frac{\text{Size}_{Cool}}{12,000} * 12 / (EER_{proposed}) * \left(\left(\frac{1}{1 - Loss_{NoQI}} \right) - \left(\frac{1}{1 - Loss_{Uncorr}} \right) \right)$$

$$\text{Customer kWh}_{EqCooling} = \frac{\text{Size}_{Cool}}{12,000} * EFLH_{cooling} * \left(\left(\frac{12}{SEER_{baseline}} \right) - \left(\frac{12}{SEER_{proposed}} \right) \right)$$

$$\text{Customer kWh}_{QICooling} = \frac{\text{Size}_{Cool}}{12,000} * EFLH_{cooling} * \left(\frac{12}{SEER_{baseline}} * \left(\frac{1}{1 - Sizing_{Loss}} - 1 \right) + \frac{12}{SEER_{proposed}} * \left(\left(\frac{1}{1 - Loss_{NoQI}} \right) - \left(\frac{1}{1 - Loss_{Uncorr}} \right) \right) \right)$$

$$\text{Customer Coincident kW}_{Equipment} = \text{Coincidence Factor} * \frac{\text{Size}_{Cool}}{12,000} * \left(\left(\frac{12}{EER_{baseline}} \right) - \left(\frac{12}{EER_{proposed}} \right) \right)$$

$$\text{Customer Coincident kW}_{QI} = \text{Coincidence Factor} * \frac{\text{Size}_{Cool}}{12,000} * \left(\frac{12}{EER_{baseline}} * \left(\frac{1}{1 - Sizing_{Loss}} - 1 \right) + \frac{12}{EER_{cooling}} * \left(\left(\frac{1}{1 - Loss_{NoQI}} \right) - \left(\frac{1}{1 - Loss_{Uncorr}} \right) \right) \right)$$

$$\text{Incremental Capital Cost}_{Equipment} = \text{Cost per Ton}_{Proposed} * \frac{\text{Size}_{Cool}}{12,000} - \text{Cost per Ton}_{baseline} * \frac{\text{Size}_{Cool}}{12,000} - \text{Cost} / \text{kBTUh}_{Heat} * \text{Full}_{Load}_{Heat} / 1000 - \text{Baseline Air Handling}$$

$$\text{Incremental Capital Cost}_{QI New Home} = \text{Inc Cost}_{QI}$$

$$\text{Incremental Capital Cost}_{QI E Home} = \text{MAX}(75, \text{Inc Cost}_{QI} - \frac{\text{Size}_{Cool}}{12,000} * \left(\left(\frac{1}{1 - Sizing_{Loss}} \right) - 1 \right) * \text{Cost per Ton}_{baseline})$$

ASHP Heating Energy Savings

$$m_{load_profile} = (\text{balance pt load} - \text{Size}_{Cool}) / (\text{balance pt temp} - \text{Max OAT})$$

$$b_{load_profile} = \text{Size}_{Cool} - (m_{load_profile} * \text{Max OAT})$$

$$\text{Full Load Heat} = m_{load_profile} * \text{Min OAT} + b_{load_profile}$$

Electric Resistance Heat Baseline:

$$\text{Customer kWh}_{EQHeating} = -1 * \text{Full}_{Load}_{Heat} * EFLH_{Heating_HP} * \left(\frac{1}{(HSPF_{Baseline} * HSPF_{Adj_Factor})} - \frac{1}{(HSPF_{Proposed} * HSPF_{Adj_Factor})} \right) / 1000$$

$$\text{Customer kWh}_{QIHeating} = -1 * \text{Full}_{Load}_{Heat} * EFLH_{Heating_HP} * \frac{1}{(HSPF_{Proposed} * HSPF_{Adj_Factor})} * \left(\frac{1}{(1 - loss_{No_QI})} - \frac{1}{Loss_{uncorr}} \right) / 1000$$

Dual Fuel Gas Heat Baseline

$$\text{Customer DTherms}_{EQ Saved} = (-1 * \text{Full}_{Load}_{Heat} * EFLH_{Heating_HP}) / \text{COP}_{Baseline} / 1,000,000$$

$$\text{Customer kWh}_{Heating Penalty} = \text{Furnace_Fan_kW} * EFLH_{Heating_HP} - \text{Full}_{Load}_{Heat} * EFLH_{Heating_HP} * \left(0 - \left(\frac{1}{(HSPF_{Proposed} * HSPF_{Adj_Factor})} \right) \right) / 1000$$

$$\text{Customer DTherms}_{QI} = -1 * \text{Full}_{Load}_{Heat} * (EFLH_{Heat} - EFLH_{Heating_HP}) / \text{COP}_{Baseline} * \left(\frac{1}{(1 - Loss_{DuctLeakage})} - \frac{1}{(1 - Uncorr_{Loss})} \right) / 1,000,000$$

Note: All formulas using SEER, EER, and HSPF are valid with SEER2, EER2, HSPF2 substitutions.

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Variables

Cost per Ton Proposed	See Table #.X.5	Deemed Plan A Incremental Capital Cost per Ton, Based On Unit Efficiency (New Construction)
Cost per Ton Baseline	See Table #.X.5	Baseline capital cost per ton for AC equipment
EER baseline	See Table 18.0.3	Baseline EER as calculated for residential equipment from the code required SEER.
SEER baseline	See Table 18.0.3	IECC 2012 identified code minimum SEER
COP Baseline	See Table 18.0.3	Baseline heating efficiency. A COP of 1 and does not require climate zone correction.
Sizing Loss	See Table 18.0.5	
Loss_NoQI	See Table 18.0.5	
Loss_Uncorr	See Table 18.0.5	
Inc Cost_QI	See Table 18.0.5	
Coincidence Factor_EQ	See Table 18.0.4	
Coincidence Factor_QI	See Table 18.0.4	
Oversize_Factor_c	20%	Deemed Oversize Safety Factor for heating equipment.
EFLH_cooling	See Table 18.0.1	Effective Full Load Hours for cooling load energy savings
EFLH_Heat	See Table 18.0.1	Effective Full Load Hours for heating load QI energy savings
EFLH_Heating_HP	See Table 18.0.1	Effective Full Load Hours for Heat Pump impacted energy savings
Balance Pt Temp	See Table 18.0.7	Outdoor Ambient Temperature at which residential cooling and heating loads are zero BTUH
Max OAT	See Table 18.0.7	Maximum Outdoor Ambient Temperature used in building ASHP load profile
Min OAT	See Table 18.0.7	Minimum Outdoor Ambient Temperature for calculating full load heating.
Electric Resistance Heat HSPF	3.412	Electric resistance heat assumed heating season performance factor based on a COP of 1. no climate zone correction required.
Balance Pt Load	See Table 18.0.7	Heating and cooling loads are zero at the balance point outdoor ambient temperature
Furnace_Fan_kW	0.357	Furnace Fan EC Motor kW demand for baseline energy calculations
ASHP / MSHP operating temperature cutoff	35	Outdoor Ambient Temperature below which heat pump operation ceases and gas furnace or electric resistance heating begins.
Cost / kBtUh Heat - Baseline Furnace	\$ 59.72	Average High Efficiency Furnace Cost / kBtUh; installed costs
Cost / kBtUh Heat - Baseline Boiler	\$ 89.77	Average High Efficiency Boiler Cost / kBtUh; installed costs
Cost / kBtUh Heat - Baseline Electric Resistance	\$ 40.00	Average Cost for electric duct heater / kBtUh; installed costs
Baseline Air Handler	\$ 1,200.00	Average Cost for Baseline Air Handler for use with ER Heat or Boiler Heat associated with Air Conditioning; installed costs
HSPF_Adj_Factor	See Table 18.0.1	Adjustment factor for correcting HSPF from published data in AHRI's Climate Zone IV to AHRI's Climate Zone V. The HSPF_Adjustment_Factor for Electric Resistance Heat will be 1.
HSPF_Baseline	See Table 18.0.3	Heating season performance factor of baseline equipment. For electric resistance heat baseline, a COP of 1 is assumed with no climate zone correction required.
Measure Life - Matched Split-System Air -Source Heat Pump	See Table 18.0.3	Reference 16
Measure Life - Quality Installation	18	Reference 16
Conversion Factors	See Table 18.0.5	

Customer Inputs

M&V Verified

Size Cool	Yes	AHRI rated Cooling Capacity
Quantity proposed equipment	Yes	
EER proposed	Yes	AHRI rated full load Cooling Efficiency
SEER proposed	Yes	AHRI rated part load Cooling Efficiency
Home Type	Yes	Single Family, Multi-Family
County	Yes	Location of the home for determining weather zones.
Baseline Heat Type	Yes	baseline heating type; gas furnace or electric resistance backup heat
HSPF Proposed	Yes	AHRI rated Heating HSPF

Table 18.3.1. Incremental Capital Costs - New Construction (Plan A) - Reference 6

SEER	ASHP Cost per Ton	ASHP Incremental Cost per Ton
13 SEER	N/A	N/A
14/14.5 SEER	\$ 3,065.00	N/A
15 SEER	\$ 4,070.00	\$ 1,005.00
16 SEER	\$ 4,070.00	\$ 1,005.00
17/18+ SEER	\$ 4,070.00	\$ 1,005.00

Table 18.3.2. Baseline Costs

ASHP Scenario	Baseline Cost per Ton (Res AC) Installed
Dual Fuel ASHP	\$ 2,507.42
ASHP w/ ER Baseline	\$ 2,507.42

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

References:

1. Building America, Research Benchmark Definitions, 2010. (see p. 10) <http://www.nrel.gov/docs/fy10osti/47246.pdf>
2. ASHRAE, 2019, Applications Handbook, Ch. 38, table 4, Comparison of Service Life Estimates
3. DOE Appliance Standards Website, Residential Central Air Conditioners and Heat Pumps. https://www1.eere.energy.gov/buildings/appliance_standards/product.aspx/productid/75
4. Neme, Proctor, Nadel, ACEEE, 1999. Energy Savings Potential From Addressing Residential Air Conditioner and Heat Pump Installation Problems, <http://aceee.org/research-report/a992>
5. State of Minnesota Technical reference Manual For Energy Conservation Improvement Programs, Version 3.1 <https://mn.gov/commerce/industries/energy/utilities/cip/technical-6>
6. ENERGY STAR Quality Installation standards (ESVI). https://www.energystar.gov/index.cfm?c=hvac_install.hvac_install_index
7. NREL 2011 Measure Guideline Sealing and Insulating Ducts in Existing Homes. <http://www.nrel.gov/docs/fy12osti/53494.pdf>
8. State of Illinois Technical Reference Manual Version 8, dated 2020
9. For explanation of duct sealing requirements for new homes see "Significant Changes to the 2015 Minnesota Residential Codes (MR 1303, 1309 and 1322)". <http://www.ci.minneapolis.mn.us/www/groups/public/@regservices/documents/webcontent/wcms1p-142763.pdf>
10. Incremental costs for MSHPs were determined from the NEEP Incremental Cost Study Phase 2 Report
11. MSHP equipment life is from Measure Life Report Residential and Commercial/Industrial Lighting and HVAC Measures; <http://library.cee1.org/content/measure-life-report-residential-and-commercial-industrial-lighting-and-hvac-measures>
12. For estimated life of GSHP see http://www.energysavers.gov/your_home/space_heating_cooling/index.cfm/mytopic=12640 (indoor components up to 25 years; ground loop =50 years)
13. Costs obtained from "2010-2012 WO017 Ex Ante Measure Cost Study Final Report", by Itron, May 2014. These are used in the DEER 2016 database.
14. For assumptions on losses related to overcharge or undercharge on refrigerant see "Sensitivity Analysis of Installation Faults on Heat Pump Performance", by P. Domanski, et. al., Sept 2014, <http://www.acca.org/HigherLogic/System/DownloadDocumentFile.ashx?DocumentFileKey=f02c1f61-4d1d-4a24-971d-cc9ea3e626b2&forceDialog=0>
15. ENERGY STAR Connected Thermostat Key Product Criteria, Version 1.0. Rev. Jan 2017 -
16. Code of Federal Regulations Title 10: Energy PART 430—ENERGY CONSERVATION PROGRAM FOR CONSUMER PRODUCTS Subpart C—Energy and Water
17. "Measure Life Report - Residential and Commercial/Industrial Lighting and HVAC Measures", dated June 2007 for The New England State Program Working Group prepared
18. Assumptions on EC fan operating modes. Center for Energy and Environment Comments to Docket Number EERE-2010-BT-STD-0011-0022, July 27, 2010
19. ECM Furnace Impact Assessment Report https://focusonenergy.com/sites/default/files/emcfurnaceimpactassessment_evaluationreport.pdf
20. Xcel Energy, January 2019. Typical MN Residential Smart Switch Load Relief 2011-2015.
21. Xcel Energy, January 2019. Saver's Switch Control History.
22. Xcel Energy, January 2006. Residential Saver's Switch 2005 Impact Evaluation.
23. http://wpb-radon.com/radon_fan_performance.html33:5032:50A33:50
24. Information from manufacturer and contractors (Radonaway)
25. <https://www.radonaway.com/products/radon-fans/rp140-pro.php>
26. Energy Information Administration's (EIA) 2009 Residential Energy Consumption Survey (RECS)
27. Bin analysis using RECS data for thermostat operation and typical CO home cooling and heating conditions.

Changes from Recent Filing:

- Modified calculation of Incremental Cost to include the following items in the baseline costs: AC in lieu of ASHP, Baseline HE Furnace or Boiler or ER Heat, and Baseline air moving equipment when the baseline is electric resistance w/ AC or Boiler w/ AC.
- Modified Deemed Cutover temperature to Backup Heat source from 25 F to 35 F.
- Updated Proposed and Baseline Costs
- Included Minimum Qualifying levels for SEER2, EER2, and HSPF2 for all AC and Heat Pump equipment based on IECC2021 where applicable. See Deemed Tables tab.

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

18.4 Mini-Split Heat Pumps

Algorithms

Customer kW Savings = Customer kW_{EqCooling}

Customer Coincident kW Savings = Customer Coincident kW_{Equipment}

Electric Resistance Heat Baseline:

Customer kWh Savings = Customer kWh_{EqCooling} + Customer kWh_{EqHeating}

Dual Fuel Gas Heat Baseline:

Customer kWh Savings = Customer kWh_{EqCooling} + Customer kWh_{Heating Penalty}

Customer Dtherm Savings = Customer DTherm_{EQ Heating}

$$EER_{baseline} = iCoef0_c * SEER_Base^2 + iCoef1_c * SEER_Base + iCoef2_c$$

$$Customer\ kW_{EqCooling} = Qty_{prop} * \frac{Size_{cool}}{12,000} * \left(\left(\frac{12}{EER_{baseline}} \right) - \left(\frac{12}{EER_{proposed}} \right) \right)$$

$$Customer\ kWh_{EqCooling} = Qty_{prop} * \frac{Size_{Cool}}{12,000} * EFLH_{cooling} * \left(\left(\frac{12}{SEER_{baseline}} \right) - \left(\frac{12}{SEER_{proposed}} \right) \right)$$

$$Customer\ Coincident\ kW_{equipment} = Qty_{prop} * Coincidence\ Factor * \frac{Size_{Cool}}{12,000} * \left(\left(\frac{12}{EER_{baseline}} \right) - \left(\frac{12}{EER_{proposed}} \right) \right)$$

Incremental Capital Cost_{Equipment}

$$= Qty_{prop} * (Qty_{Indoor_Heads} * Cost/eff_Indoor_Head - Cost\ Per\ Ton\ Baseline * \frac{Size_{Cool}}{12,000} - Cost\ per\ kBTUH\ heat * (Full_Load_Heat/COP_Baseline)/1000 - Baseline_Air_Handler)$$

MSHP Heating Energy Savings

$$m_load_profile = (balance\ pt\ load - Size_{Cool}) / (balance\ pt\ temp - Max\ OAT)$$

$$b_load_profile = Size_{Cool} - (m_load_profile * Max\ OAT)$$

$$Full\ Load\ Heat = m_load_profile * Min\ OAT + b_load_profile$$

$$HSPF_Baseline_Adj = HSPF_Baseline * HSPF_Adjustment_Factor$$

$$HSPF_Proposed_Adj = HSPF_Proposed * HSPF_Adjustment_Factor$$

$$Customer\ kWh_{EqHeating} = Qty_{prop} * (-1 * Full_Load_Heat * EFLH_Heating_HP * (1 / HSPF_Baseline_Adj - 1 / HSPF_Proposed_Adj)) / 1000$$

$$Customer\ DTherm_{EQ\ Saved} = (-1 * Full_Load_Heat * EFLH_Heating_HP) / COP_Baseline / 1,000,000$$

$$Customer\ kWh_Heating\ Penalty = -1 * Full_Load_Heat * EFLH_Heating_HP * (0 - (1 / (HSPF_Proposed * HSPF_Adj_Factor))) / 1000$$

Note: All formulas using SEER, EER, and HSPF are valid with SEER2, EER2, HSPF2 substitutions.

Variables

Inc Cost per Ton_EQ	See Table 18.4.2	Deemed Plan A Incremental Capital Cost per Ton, Based On Unit Efficiency (New Construction)
Cost per Ton_baseline	See Table 18.4.2	Baseline capital cost per ton for equipment
EER baseline	See Table 18.0.3	Baseline EER or EER2 for the Proposed Equipment as selected in the table.
SEER baseline	See Table 18.0.3	Baseline SEER or SEER2 for the Proposed Equipment as selected in the table.
HSPF_Baseline	See Table 18.0.3	Baseline HSPF or HSPF2 for the Proposed Equipment as selected in the table. For Electric Resistance Heat Baseline the HSPF will be 3.412 based on a Heating COP of 1 and does not require climate zone correction.
COP_Baseline	See Table 18.0.3	Baseline heating efficiency. A COP of 1 and does not require climate zone correction.
Coincidence Factor	See Table 18.0.4	
iCoef0	See Table 18.4.1	MSHP SEER2 to EER2 Conversion Coefficient
iCoef1	See Table 18.4.1	MSHP SEER2 to EER2 Conversion Coefficient
iCoef2	See Table 18.4.1	MSHP SEER2 to EER2 Conversion Coefficient
EFLH_Cooling	See Table 18.0.1	Effective Full Load Hours for cooling load energy savings
EFLH_Heating_HP	See Table 18.0.1	Effective Full Load Hours for Heat Pump impacted energy savings
ASHP / MSHP operating temperature cutoff	35	Outdoor Ambient Temperature below which heat pump operation ceases and backup heating (either electric resistance or gas fired) begins.
Balance Pt Temp	See Table 18.0.7	Outdoor Ambient Temperature at which residential cooling and heating load profiles equal zero BTUH
Max OAT	See Table 18.0.7	Maximum Outdoor Ambient Temperature used in building ASHP load profile; TMY3 basis
Min OAT	See Table 18.0.7	Minimum Outdoor Ambient Temperature for calculating full load heating; TMY3 Basis.
HSPF_Adj_Factor	See Table 18.0.1	Adjustment factor for correcting HSPF from published data in climate zone IV to Minnesota Climate zone V. The HSPF Adjustment Factor for Electric Resistance Heat will be 1.
Balance Point Load	See Table 18.0.7	BTUH - Heating and cooling loads are zero at the balance point outdoor ambient temperature
m_load_profile	Calculated	load profile slope (m)
b_load_profile	Calculated	load profile y intercept (b)
Full Load Heat	Calculated	calculated full load heating BTUH required to serve the home or space at the minimum Outside Air Temperature
Cost / kBTUh Heat - Baseline Furnace	\$ 59.72	Average High Efficiency Furnace Cost / kBTUH; installed costs
Cost / kBTUh Heat - Baseline Boiler	\$ 89.77	Average High Efficiency Boiler Cost / kBTUH; installed costs
Cost / kBTUh Heat - Baseline Electric Resistance	\$ 40.00	Average Cost for air handler and electric duct heater / kBTUH; installed costs
Baseline Air Handler	\$ 1,200.00	Average Cost for Baseline Air Handler for use with ER Heat or Boiler Heat associated with Air Conditioning; installed costs
Lifetime	See Table 18.0.4	Measure Lifetime for MSHPs.
Minimum Qualifying Efficiency	See Table 18.0.2	

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Customer Inputs	M&V Verified	
Size Cool	Yes	AHRI rated Cooling Capacity
Quantity proposed equipment	Yes	The Quantity of Outdoor Units. Only applies if the Outdoor Unit's Size AND the quantity and size of the Indoor Units served by each outdoor unit are identical.
Quantity Indoor Heads	Yes	The Quantity of Indoor Heads + Coils served by a single Outdoor Unit.
EER _{Proposed}	Yes	AHRI rated full load Cooling Efficiency
SEER proposed	Yes	AHRI rated part load Cooling Efficiency
Home Type	Yes	Single Family, Multi-Family
County	Yes	Location of the home for determining weather zones.
Baseline Heat Type	Yes	Baseline heating type; gas furnace or electric resistance backup heat
HSPF Proposed	Yes	AHRI rated Heating HSPF

Table 18.4.1: SEER Conversion Coefficients

Equipment type	Coef0	Coef1	Coef2
MSHP - SEER2 to EER2	-0.0088000	0.8828200	-2.2811300

Table 18.4.2 Incremental Capital Costs - Mini-Split Heat Pump

Mini-Split Heat Pump	Baseline AC Cost per Cooling Ton	Cost/Efficient Indoor Head or Coil
Mini-Split Heat Pump (15+ SEER, 11.5+ EER, 9+ HSPF)	\$ 2,507.42	\$ 5,291.23
Multi-Split Heat Pump (15+ SEER, 11.5+ EER, 9+ HSPF)	\$ 2,507.42	\$ 4,508.69
Mini-Split Heat Pump (15.2+ SEER2, 11.5+ EER2, 7.8+ HSPF2)	\$ 2,507.42	\$ 5,291.23
Multi-Split Heat Pump (15.2+ SEER2, 11.5+ EER2, 7.8+ HSPF2)	\$ 2,507.42	\$ 4,508.69

References:

See 18.1 Residential AC references

Changes from Recent Filing:

Modified calculation of Incremental Cost to include the following items in the baseline costs: AC in lieu of MSHP, Baseline HE Furnace or Boiler or ER Heat, and Baseline air moving equipment when the baseline is electric resistance w/ AC or Boiler w/ AC.

Modified Deemed Cutover temperature to Backup Heat source from 25 F to 35 F.

Updated Proposed and Baseline Costs

Included Minimum Qualifying levels for SEER2, EER2, and HSPF2 for all AC and Heat Pump equipment based on IECC2021 where applicable. See Deemed Tables tab.

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

18.5 Residential Furnaces & Boilers

Algorithms

$$Customer\ DTh = Qty_Prop_Equip * \left(\left(Size_{Heat} \times \frac{EFF_{proposed}}{EFF_{baseline}} \right) - Size_{Heat} \right) \times 1 / (1 + Oversize\ Factor) \times (1 - Altitude\ Factor) \times \frac{EFLH_{heating}}{1,000,000}$$

Variables

EFLH Heating	See Table 18.0.1	Equivalent Full Load Heating Hours assumed for installed high efficiency furnace and boiler equipment
Incremental Cost	See Table 18.5.1	Incremental costs of efficient equipment
Baseline Efficiency	See Table 18.5.2	Efficiency of baseline code minimum boiler (Reference 10) or furnace (Reference 1) Efficiency of Existing Equipment receiving Tune-up.
Proposed Efficiency	See Table 18.5.2	Proposed Efficiency of existing equipment after Tune-up.
Altitude_Factor	See Table 18.0.1	Deemed Altitude adjustment factor for derating sea level rated equipment (4% / 1000 Feet above sea level)
Boiler Oversize Factor	25%	Deemed Oversize Safety Factor for all new boiler heating equipment and all Income Qualified Single Family Weatherization Boiler Tune-up products
Furnace Oversize Factor	20%	Deemed Oversize Safety Factor for all new furnace heating equipment and all Income Qualified Single Family Weatherization Furnace Tune-up products
Lifetime	See Table 18.5.1	
Conversion from Btu to Dth	1,000,000	1 Dth = 1,000,000 Btuh
Conversion from Btu to Therms	100,000	1 Therm = 100,000 Btuh

Customer Inputs

M&V Verified

Qty Prop Equip	Yes	Quantity of units of the same size
Size_Heat *	Yes	For new furnace or boiler AHRI rated Input BTUH. Provide data on customer rebate form. For Tune-up Measure on existing furnace or boiler Nameplate Input BTUH rating for existing equipment getting the tune-up measure. Provided data on customer rebate form.
Proposed Efficiency *	Yes	AHRI rated efficiency of the proposed new equipment.
County	Yes	County where the new equipment is installed or Tune-up is being performed.

* See table 18.5.3 for Income Qualified SF Weatherization Customer Input Assumptions

Incremental Cost
 (Reference 4 for
 Furnaces, IQ Boilers
 and Tune-ups)
 (Reference 7 for all
 other High Efficiency
 Boilers)

Table 18.5.1	Measure Life (Reference 2)	Baseline Equipment Cost	High Efficiency Equipment Cost
High Efficiency Furnace	18	\$1,293.85	\$2,806.44
IQ-SFW Boiler	20	\$1,446.00	\$4,100.30
IQ-SFW Boiler/Furnace Tune-up	2	\$250.00	N/A
High Efficiency Boiler 95%	20	\$1,330.61	\$3,025.87

Table 18.5.2	Baseline EFF	Proposed EFF	Lifetime
High Efficiency Furnace	80%	Customer Input	18
High Efficiency Boiler	84%	Customer Input	20
IQ SFW - Furnace Tune-up	75%	80%	2
IQ SFW - Boiler Tune-up	75%	80%	2

Table 18.5.3 Income Qualified SF Weatherization Customer Input Assumptions

	CO1 - Front Range	CO2 - Western Slope	CO3 - Mountain Areas	CO4 - Very High Altitude Areas
Furnace Input BTUh	62,000	53,000	88,000	87,000
Furnace Minimum Proposed Efficiency	95%	95%	95%	95%
Boiler Input BTUh	64,000	55,000	92,000	90,000
Boiler Minimum Proposed Efficiency	95%	95%	95%	95%

References:

1. US Department of Energy; Residential Furnaces and Boilers; http://www1.eere.energy.gov/buildings/appliance_standards/product.aspx/productid/72
2. 2015 ASHRAE Handbook - HVAC Applications; Comparison of Service Life Estimates; Page 37.3, Table 4
3. ECM Furnace Impact Assessment Report https://focusonenergy.com/sites/default/files/emcfurnaceimpactassessment_evaluationreport.pdf
4. Xcel program data from 2017 program year
5. Cost information from "2010 - 2012 W0017 Ex Ante Measure Cost Study Final Report.", Itron, May 2014.
6. DOE incremental cost for EC motors <https://www.regulations.gov/document?D=EERE-2010-BT-STD-0011-0117>
7. Xcel Minnesota Program Cost Data

Changes from Recent Filing:

Updated Proposed and Baseline Costs

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

18.6 Residential Programmable Thermostats

Algorithms

Primary Thermostat:

$$\text{Customer kWh} = \text{Cooling_Delta_T} * \text{kWh_Savings_per_Degree}$$

$$\text{Customer kW} = \text{Cooling_Delta_T} * \text{kW_Savings_per_Degree}$$

$$\text{Customer Coincident kW} = \text{Cooling_Delta_T} * \text{kW_Savings_per_Degree} * \text{Coincidence Factor}$$

$$\text{Customer Dth} = \text{Heating_Delta_T} * \text{Dth_Savings_per_Degree}$$

Secondary Thermostat:

$$\text{Customer kWh} = \text{Cooling_Delta_T} * \text{kWh_Savings_per_Degree_2nd}$$

$$\text{Customer kW} = \text{Cooling_Delta_T} * \text{kW_Savings_per_Degree_2nd}$$

$$\text{Customer Coincident kW} = \text{Cooling_Delta_T} * \text{kW_Savings_per_Degree_2nd} * \text{Coincidence Factor}$$

$$\text{Customer Dth} = \text{Heating_Delta_T} * \text{Dth_Savings_per_Degree_2nd}$$

Variables

kW_Savings_per_Degree	0.1272	kW per degree F of setback (Reference 1, 2)
kWh_Savings_per_Degree	123.8	kWh per degree F of setback (Reference 1, 2)
kW_Savings_per_Degree_2nd	0.0636	kW per degree F of setback for second thermostat = half of savings for first thermostat (Reference 1, 2)
kWh_Savings_per_Degree_2nd	61.9	kWh per degree F of setback for second thermostat = half of savings for first thermostat (Reference 1, 2)
Dth_Savings_per_Degree	4.4	Dth per degree F of setback (Reference 1, 2)
Dth_Savings_per_Degree_2nd	2.2	Dth per degree F of setback for second thermostat = half of savings for first thermostat (Reference 1, 2)
School Kit kW Savings per Degree	0.1138	kW per degree F of setback (Reference 2). Model results differ from calculated measure due to deemed setback schedules.
School Kit kWh Savings per Degree	112.1	kWh per degree F of setback (Reference 2). Model results differ from calculated measure due to deemed setback schedules.
School Kit Dth Savings per Degree	41.7	Dth per degree F of setback (Reference 2). Model results differ from calculated measure due to deemed setback schedules.
School Kit Cooling Delta T	0.76	F degree average weekly setup cooling temperature for School Education Kits.
School Kit Heating Delta T	1.39	F degree average weekly setback heating temperature for School Education Kits.
School Kit Deemed Savings	See Table 18.6.2	Results of the application of the deemed values in the energy savings formulas for the School Education Kits are presented in Table 18.6.2
Coincidence Factor	See Table 18.6.1	
Incremental Cost	See Table 18.6.1	
Measure Lifetime	See Table 18.6.1	

Customer Inputs

M&V Verified

Cooling_Delta_T	Yes	One-week weighted average temperature difference between normal operation and cooling setback temperature in degrees F, based on information provided by the customer during the interview.
Heating_Delta_T	Yes	One-week weighted average temperature difference between normal operation and heating setback temperature in degrees F, based on information provided by the customer during the interview.
Deemed Input Values for School Education Kits - See Variables List above and Table 18.6.2		
School Kit Cooling Delta T	No	The School education Kit setback temperatures are deemed from qualitative feedback provided by the program's vendor.
School Kit Heating Delta T	No	The School education Kit setback temperatures are deemed from qualitative feedback provided by the program's vendor.

Table 18.6.1: Measure Life, Coincidence Factor, and Hours (Reference 4)

Type of measure:	Measure life:	Incremental Cost:	Coincidence Factor:	
Programmable thermostat - Home Energy Squad	10	\$35.00	76%	Reference 3
ALC Second Programmable thermostat - Home Energy Squad	10	\$35.00	76%	
T-Stat Install & Programming LI-SFW (Heating Only)	10	\$29.00	0%	

Table 18.6.2: Deemed Savings for School Education Kits

Type of measure:	kWh	PcKW	Dtherms	Measure life:	Incremental Cost:
Existing Programmable Thermostat - School Education Kits	85	0.066	5.8	10	\$0.00

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

References:

1. Energy Information Administration's (EIA) 2009 Residential Energy Consumption Survey (RECS)
2. Bin analysis using RECS data for thermostat operation and typical CO home cooling and heating conditions.
3. Lifetime of 5 years for door weatherstripping and 10 years for programmable T-Stats from "Measure Life Report Residential and Commercial/Industrial Lighting and HVAC Measures", June 2007 by GDS Associates.
4. Consumer Electronics Characteristics <http://standby.lbl.gov/summary-table.html>

Changes from Recent Filing:

updated model to align program assumptions.

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

18.7 Residential Smart Thermostats

Algorithms

$$\text{Customer kWh} = \text{Customer Cooling kWh} + \text{Customer Heating kWh}$$

$$\text{Customer Coincident kW} = \text{Customer kW} * \text{Coincidence Factor}$$

Smart Thermostat Savings:

$$\text{Customer kW} = (\text{Cooling kW} * \text{TStat Qty Factor}) \times \text{ES Reduction}_{\text{cooling}} * \text{Cooling Scaling Factor}$$

$$\text{Customer Cooling kWh} = (\text{Cooling Tons} * \text{TStat Qty Factor}) * \frac{12}{\text{SEER}_{\text{Avg}}} * \text{EFLH}_{\text{cooling}} * \text{ES Reduction}_{\text{cooling}} * \text{Cooling Scaling Factor}$$

$$\text{Customer DTh} = (\text{Baseline DTh} * \text{TStat Qty Factor}) * \text{ES Reduction}_{\text{heating}} * \text{Heating Scaling Factor}$$

Thermostat Optimization Savings:

$$\text{Customer kW} = \text{Cooling kW} * (1 - \text{ES Reduction}_{\text{cooling}}) * \text{Tstat_Optimization_Reduction} * \text{Cooling Scaling Factor}$$

$$\text{Customer Cooling kWh} = \text{Cooling Tons} * \frac{12}{\text{SEER}_{\text{Avg}}} * \text{EFLH}_{\text{cooling}} * (1 - \text{ES Reduction}_{\text{cooling}}) * \text{Tstat_Optimization_Reduction} * \text{Cooling Scaling Factor}$$

$$\text{Customer Heating kWh} = \text{Heating kW} * \text{EFLH}_{\text{Heat}} * (1 - \text{ES Reduction}_{\text{heating}}) * \text{Tstat_Optimization_Reduction} * \text{Heating Scaling Factor}$$

$$\text{Customer Dth} = \text{Baseline Dth} * (1 - \text{ES Reduction}_{\text{heating}}) * \text{Tstat_Optimization_Reduction} * \text{Heating Scaling Factor}$$

Variables

ES Reduction Heating	8%	Energy Star Connected Thermostat criteria for annual heating equipment runtime reduction (Reference 1)
ES Reduction Cooling	10%	Energy Star Connected Thermostat criteria for annual cooling equipment runtime reduction (Reference 1)
Typical Res Gas Heating System Efficiency	80%	gas heating system efficiency in existing homes
Typical Res Electric Heating System Efficiency	100%	electric resistance heating system efficiency in existing homes
Cooling Tons	2.690	Average Home model capacity for Res Cooling (Tons)
SEER_Avg	13.400	Average Home model SEER rating
EER_Avg	11.417	Average Home model EER rating (converted from SEER)
Cooling kW	2.827	Forecasted High Efficiency Thermostat demand
EFLH_Cooling	See Table 18.0.1	Forecasted High Efficiency Thermostat hours use Cooling EFLH
Baseline Dth	101.1	Forecasted Home gas use estimated from average furnace program participation
Heating kW	12.989	Full load kW for electric resistance heating based on forecasted gas usage and annual operating hours.
EFLH_Heat	See Table 18.0.1	Forecasted High Efficiency Thermostat hours use Heating EFLH
TStat Qty Factor	See Table 18.7.3	The Primary Thermostat in a home saves the full EnergyStar heating or cooling criteria. A Secondary Thermostat in a home saves half of the energy and demand of a Primary Thermostat. The baseline cooling and heating demands will be adjusted by the factor based on the type of thermostat (Primary or Secondary) selected.
EnergyStar_CF	76%	Coincidence Factor for High Efficiency Thermostat
Cooling Scaling Factor	See Table 18.7.1	Cooling energy and demand percent adjustment for home types
Heating Scaling Factor	See Table 18.7.1	Heating energy percent adjustment for home types
Tstat_Optimization_Reduction	3%	Assumed percent savings by participating in manufacturer's optimization algorithm updates.
Lifetime	10	Measure life for ENERGY STAR Smart Thermostat (Reference 4)
Incremental Cost	See Table 18.7.2	Incremental cost for ENERGY STAR Smart Thermostat (Reference 4)

Customer Inputs

M&V Verified

Certified Energy Star Connected Thermostat	Yes	
County	No	
Home Type	No	

Table 18.7.1

Home type	Single Family	Multifamily	Townhome
Cooling Scaling Factor	100%	35%	64%
Heating Scaling Factor	100%	15%	52%

Table 18.7.2

	Incremental Cost
LI SFW EnergyStar Smart Thermostat	\$100.00
ENERGY STAR smart thermostat (Reference)	\$200.00
Home Energy Squad Smart Thermostat	\$125.00
ALC Home Energy Squad upgraded Smart Thermostat	\$225.00

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

	TStat Qty Factor
Primary EnergyStar Smart Thermostat	1.0
Sedondary EnergyStar Smart Thermostat	0.5

References:

1. ENERGY STAR Connected Thermostat Key Product Criteria - https://www.energystar.gov/products/heating_cooling/smart_thermostats/key_product_criteria
2. 2017 Seasonal Savings Evaluation, Navigant, 3/5/2018
3. Xcel Study of Winter Seasonal Savings, 2017-2018, Initial Estimates
4. Lifetime of 10 years for programmable T-Stats from "Measure Life Report Residential and Commercial/Industrial Lighting and HVAC Measures", June 2007 by GDS Associates.

Changes from Recent Filing:

1. included electric heating savings
2. added Thermostat Optimization savings measure
3. clarified secondary thermostat savings for smart thermostat measures.

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

18.8 Residential AC Rewards

Algorithms

$$\text{Customer kWh} = \text{Quantity Equipment} * \text{Equipment kWh Savings} * \text{Cooling Savings}$$

$$\text{Customer kW} = \text{Quantity Equipment} * \text{Equipment kW Savings} * \text{Cooling Savings}$$

$$\text{Customer Coincident kW} = \text{Quantity Equipment} * \text{Equipment PCKW Savings} * \text{Cooling Savings}$$

Variables

Quantity Equipment	Customer Input	Quantity of smart saver switches installed.
Equipment kW Savings	1.164	Customer kW savings per unit with a smart thermostat.
Equipment kWh Savings	4	Annual kWh savings per unit with a smart thermostat.
Equipment PCKW Savings	1.164	Peak Coincident kW savings perunit with a smart thermostat
Lifetime	5	Length of time the thermostat will be operational
NTG	1	Net-to-Gross factor for Residential Demand Response will be 100% as customers would not have the ability to install a switch or participate in events without the program.
Cooling Scaling Factor	Table 18.8.1	Cooling Scaling factor based on home type

Table 18.8.1

Smart Thermostat Home Type	Single Family	Multi-Family	Townhome/Duplex
Cooling Scaling Factor	100%	35%	64%
Heating Scaling Factor	100%	15%	52%

Customer Inputs

M&V Verified

Number of thermostats installed.	Yes	
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References:

(1) DNV GL & AEC, January 2016. Saver's Switch Program, Residential Program, 2015 Impact Evaluation Report.
(2) Xcel Energy, May 2018. Saver's Switch Control History.
(3) Nexant, 2017. Evaluation of 2016 Smart Thermostat Pilot.
(4) DNV GL & AEC, January 2018. Saver's Switch Program, Residential Wireless Modeling & Event Day Report, Version 8.

Changes from Recent Filing:

None

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

18.9 Residential Saver's Switch

Algorithms

$Customer\ kWh = Quantity\ Equipment * Equipment\ kWh\ Savings$

$Customer\ kW = Quantity\ Equipment * Equipment\ kW\ Savings$

$Customer\ Coincident\ kW = Quantity\ Equipment * Equipment\ PCKW\ Savings$

Variables

Quantity Equipment	Customer Input	Quantity of smart saver switches installed.
Equipment kW Savings	2.628	Customer kW savings per unit with a smart switch
Equipment kWh Savings	9	Annual kWh savings per unit with a smart switch
Equipment PCKW Savings	1.200	Peak Coincident kW savings perunit with a smart switch
Lifetime	15	Length of time the switch will be operational
NTG	1	Net-to-Gross factor for Residential Demand Response will be 100% as customers would not have the ability to install a switch or participate in events without the program.

Customer Inputs

M&V Verified

Number of units with switch installed.	Yes	
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References:

(1) DNV GL & AEC, January 2016. Saver's Switch Program, Residential Program, 2015 Impact Evaluation Report.
(2) Xcel Energy, May 2018. Saver's Switch Control History.
(3) Nexant, 2017. Evaluation of 2016 Smart Thermostat Pilot.
(4) DNV GL & AEC, January 2018. Saver's Switch Program, Residential Wireless Modeling & Event Day Report, Version 8.

Changes from Recent Filing:

None

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

18.11 Residential Evaporative Cooling

Algorithms

$$Customer\ kW = Qty_Prop * (Size_Cooling * 12 / EER_Baseline - Watts_Proposed / 1000)$$

$$Customer\ kWh = Qty_Prop * (Size_Cooling * 12 / SEER_Baseline - Watts_Proposed / Watts/kW) * EFLH_Cool$$

$$Customer\ Coincident\ kW = Customer\ kW * Coincidence\ Factor$$

$$Customer\ Incremental\ O\&M\ Savings\ Electric = -1 * Size_Cooling * 12000 * EFLH_Cool / Water_h_fg / Water_Lb/gallon * Water_Rate / 1000\ Gals$$

Variables

Coincidence Factor	70%	Coincidence factor for the refrigerated air system, the probability that peak demand of the AC unit will coincide with peak utility system demand. (Reference 11)
NTG	See Table 18.11.4	Net-to-Gross Factor calculated based on Xcel Energy product experience.
Incremental Costs	See Table 18.11.5	Incremental cost of efficient technology over baseline technology
Measure Life	15	Life of evap cooling equipment
MotorHP	See Table 18.11.3	Motor Horsepower represents the motor size for an evaporative cooler which corresponds to the cooling output of a 3 ton AC unit. (Reference 4)
HP to kW	0.746	Standard conversion from HP to kW
Load Factor	80.00%	Load factor for motor - We will use 80% for all Evap Systems.
Motor Eff	81.67%	Efficiency of the evaporative cooler motor (Reference 2)
Watts/kW	See Table 18.0.6	Conversion factor from Watts to KiloWatts
Water_Rate	9.23	combined cost of water and sewer rate per 1000 gallons
EFLH_Cool	See Table 18.0.1	Full Load Cooling hours based on climate zone.
Watts_Proposed	See Table 18.11.3	Evaporative Cooler operating watts, derived from motor horsepower, load factors and efficiency.
Size_Cooling	See Table 18.11.1	Deemed size of baseline cooling equipment in Tons for an evaporative cooler in each climate zone.
EER_Baseline	See Table 18.11.2	Calculated full load efficiency (EER2) of baseline air conditioning or mini-split heat pump equipment, based on the code minimum SEER2 requirements.
SEER_Baseline	See Table 18.11.2	code part load efficiency of baseline air conditioning equipment.
Water_h_fg	See Table 18.0.6	Specific Enthalpy heat of vaporization of water at standard conditions (60 F), BTU / lb
Water_Lb/gallon	See Table 18.0.6	Density of Water at standard conditions

Customer Inputs	M&V Verified
Qty Proposed	Yes
County	Yes
Evap Cooler Type	Yes

Table 18.11.1 Evap Cooling System Baseline Tons

Description	Front Range	Western Slope	Alamosa / Mountain Area	Lake / Very High Mountains
Standard evaporative cooler	1.8	1.6	1.1	0.9
Premium evaporative cooler	2.5	2.2	1.5	1.2
Multi-ducted premium evaporative cooler	2.5	2.2	1.5	1.2

Table 18.11.2 Evap Cooling System Baseline SEER2 & EER2

Description	Standard evaporative cooler *		Premium evaporative cooler **		Multi-ducted premium evaporative cooler **	
	Baseline SEER2	Baseline EER2	Baseline SEER2	Baseline EER2	Baseline SEER2	Baseline EER2
Front Range	13.4	7.97	13.4	11.42	13.4	11.42
Western Slope	13.4	7.97	13.4	11.42	13.4	11.42
Alamosa/Mountain Area	13.4	7.97	13.4	11.42	13.4	11.42
Lake/Very High Mountain Area	13.4	7.97	13.4	11.42	13.4	11.42

* Standard Evap Cooler Baseline is a code minimum MSHP; 13.4 SEER2, 7.97 EER2.

** Premium and Multi-ducted Premium Evap Cooler baselines are code minimum AC; 13.4 SEER2, 11.42 EER2

Table 18.11.3: Evap Cooler Motor HP & Watts

System Type	HP	Watts Proposed
Standard evaporative cooler	0.52	380
Premium evaporative cooler	0.52	380
Multi-ducted premium evaporative cooler	1.02	745

Table 18.11.4: Net to Gross Factor

System Type	Net To Gross
Standard evaporative cooler	70%
Premium evaporative cooler	70%
Multi-ducted premium evaporative cooler	85.1%

Table 18.11.5: Incremental Cost of Evaporative Coolers (Reference 5,6,7)

	Evap Cooler Cost	Baseline Labor Cost	Front Range		Western Slope		Alamosa / Mountain Area		Lake / Very High Mountain Area	
			Baseline Equipment Cost	Evap Cooler Inc Cost	Baseline Equipment Cost	Evap Cooler Inc Cost	Baseline Equipment Cost	Evap Cooler Inc Cost	Baseline Equipment Cost	Evap Cooler Inc Cost
Standard evaporative cooler	\$ 433.67	\$ -	\$ 5,797.93	\$ (5,364.26)	\$ 5,153.71	\$ (4,720.04)	\$ 3,543.18	\$ (3,109.51)	\$ 2,898.96	\$ (2,465.29)
Premium evaporative cooler	\$ 2,778.32	\$ (3,712)	\$ 6,268.55	\$ 221.43	\$ 5,516.32	\$ 973.66	\$ 3,761.13	\$ 2,728.85	\$ 3,008.90	\$ 3,481.08
Multi-ducted premium evaporative cooler	\$ 4,020.66	\$ (3,712)	\$ 6,268.55	\$ 1,463.77	\$ 5,516.32	\$ 2,215.99	\$ 3,761.13	\$ 3,971.19	\$ 3,008.90	\$ 4,723.41

Note: Standard Evap Cooler baseline is a code minimum MSHP.

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

References:

1. ESPRE 2.1 engineering model: Simplified energy analysis methods for residential buildings
2. Average motor efficiency for 1 hp motor from NEMA, "Premium Efficiency Motor Selection and Application Guide"
3. Kinney, Larry. New Evaporative Cooling Systems: An Emerging Solution for Homes in Hot Dry Climates with Modest Cooling Loads.
4. Web site information - Grainger Evap Cooler - Essick Model N28W; Pheonix Mfg Corp; Model PD4231
5. <http://www.google.com/products?q=home+depot+evaporative+cooler+cost&ie=UTF-8&oe=utf-8&rls=org.mozilla:en->
6. Xcel Program Data
7. SWEEP 2007 Report. O&M Savings based on manufacturers water use data and current Denver water rates (Denver Water Board).
8. ASHRAE Applications 2007 p.36.3 Used AC window unit as estimate for evaporative cooler.
9. <https://www.denverwater.org/residential/billing-and-rates/2018-rates>
10. <https://www.denvergov.org/content/denvergov/en/wastewater-management/billing-and-rates/wastewater-rates.html>
11. 2010 Cadmus Program Evaluation

Changes from Recent Filing:

Included Minimum Qualifying levels for SEER2, EER2, and HSPF2 for all AC and Heat Pump equipment based on IECC2021 where applicable. See Deemed Tables tab.
updated water rates

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

18.12 Residential Western Cooling Control Device

Algorithms

$Customer\ kW\ Savings = WCC_Device_kW_Savings$

$Customer\ kWh\ Savings = WCC_Device_kWh_Savings$

$Customer\ Coincident\ kW\ Savings = WCC_Device_kW_Savings * Coincidence\ Factor$

$Incremental\ Capital\ Cost_{Equipment} = Qty_{Prop} * Inc\ Cost\ WCCD$

Variables

WCC_Device_kW_Savings	See Table 18.12.1	Deemed demand savings (kW) for Western Cooling Control Device
WCC_Device_kWh_Savings	See Table 18.12.1	Deemed energy savings (kWh) for Western Cooling Control Device
NTG	67.6%	Net-to-gross for Western Cooling Control Device
Measure Life - WCCD	7.5	Matches associated AC System Lifetime (Plan A/B)
Inc Cost WCCD	\$100.00	Incremental Cost of Western Cooling Control Device from Market Data
Coincidence Factor	90%	Coincidence Factor of Western Cooling Control Device

Customer Inputs

M&V Verified

Qty Prop	Yes	Quantity of proposed equipment
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Table 18.12.1 Deemed Demand and Energy Savings (per unit)

Equipment type	kW_Savings	kWh_Savings	Notes
Western Cooling Control Device	0.130	73.0	Based on Internal Analysis

References:

None

Changes from Recent Filing:

None

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

18.13 Residential Cold Climate Air Source Heat Pumps

Algorithms

$$\text{Customer kW Savings} = \text{Customer kW}_{\text{EqCooling}} + \text{Customer kW}_{\text{QICooling}}$$

$$\text{Customer Coincident kW Savings} = \text{Customer Coincident kW}_{\text{Equipment}} + \text{Customer Coincident kW}_{\text{QI}}$$

ASHP Baseline Cooling Only:

$$\text{Customer kWh Savings} = \text{Customer kWh}_{\text{EqCooling}} + \text{Customer kWh}_{\text{QICooling}}$$

Electric Resistance Heat Baseline:

$$\text{Customer kWh Savings} = \text{Customer kWh}_{\text{EqCooling}} + \text{Customer kWh}_{\text{QICooling}} + \text{Customer kWh}_{\text{EQHeating}} + \text{Customer kWh}_{\text{QIHeating}}$$

Dual Fuel Gas Heat Baseline

$$\text{Customer kWh Savings} = \text{Customer kWh}_{\text{EqCooling}} + \text{Customer kWh}_{\text{QICooling}} + \text{Customer kWh}_{\text{Heating Penalty}}$$

$$\text{Customer Dtherm Savings} = \text{Customer DTherms}_{\text{EQ Heating}} + \text{Customer DTherm}_{\text{QI Heating}}$$

$$\text{Customer kW}_{\text{EqCooling}} = \frac{\text{Full Load Cool}}{12,000} \times \left(\left(\frac{12}{\text{EER}_{\text{baseline}}} \right) - \left(\frac{12}{\text{EER}_{\text{proposed}}} \right) \right)$$

$$\text{Customer kW}_{\text{QICooling}} = \frac{\text{Full Load Cool}}{12,000} * 12 / (\text{EER}_{\text{proposed}}) * \left(\left(\frac{1}{1 - \text{Loss}_{\text{NoQI}}} \right) - \left(\frac{1}{1 - \text{Loss}_{\text{Uncorr}}} \right) \right)$$

$$\text{Customer kWh}_{\text{EqCooling}} = \frac{\text{Full Load Cool}}{12,000} * \text{EFLH}_{\text{cooling}} * \left(\left(\frac{12}{\text{SEER}_{\text{baseline}}} \right) - \left(\frac{12}{\text{SEER}_{\text{proposed}}} \right) \right)$$

$$\text{Customer kWh}_{\text{QICooling}} = \frac{\text{Full Load Cool}}{12,000} * \text{EFLH}_{\text{cooling}} * \frac{12}{\text{SEER}_{\text{proposed}}} * \left(\left(\frac{1}{1 - \text{Loss}_{\text{NoQI}}} \right) - \left(\frac{1}{1 - \text{Loss}_{\text{Uncorr}}} \right) \right)$$

$$\text{Customer Coincident kW}_{\text{Equipment}} = \text{Coincidence Factor} * \frac{\text{Full Load Cool}}{12,000} * \frac{1}{1 - \text{Sizing Loss}} * \left(\left(\frac{12}{\text{EER}_{\text{baseline}}} \right) - \left(\frac{12}{\text{EER}_{\text{proposed}}} \right) \right)$$

$$\text{Customer Coincident kW}_{\text{QI}} = \text{Coincidence Factor} * \frac{12}{\text{EER}_{\text{cooling}}} * \frac{\text{Full Load Cool}}{12,000} * \left(\left(\frac{1}{1 - \text{Loss}_{\text{NoQI}}} \right) - \left(\frac{1}{1 - \text{Loss}_{\text{Uncorr}}} \right) \right)$$

$$\text{Incremental Capital Cost}_{\text{Equipment}} = \text{ASHP Cost per Ton}_{\text{EQ}} * \frac{\text{Size Cool}}{12,000} - \text{Cost Per Ton Baseline} * \frac{\text{Full Load Cool}}{12,000} - \text{Cost per kBTUH heat} * (\text{Full Load Heat} / \text{COP}_{\text{Baseline}}) / 1000 - \text{Baseline Air Handler}$$

$$\text{Incremental Capital Cost}_{\text{QI New Home}} = \text{Inc Cost}_{\text{QI}}$$

$$\text{Incremental Capital Cost}_{\text{QI E Home}} = \text{MAX}(75, \text{Inc Cost}_{\text{QI}} - \frac{\text{Size Cool}}{12,000} * \left(\left(\frac{1}{1 - \text{Sizing Loss}} \right) - 1 \right) * \text{Cost per Ton}_{\text{baseline}})$$

Note: All formulas using SEER, EER, and HSPF are valid with SEER2, EER2, HSPF2 substitutions.

ccASHP Heating Energy Savings

$$\text{Load Heat} = -1 * \text{Size Heat} * 1 / (1 + \text{Oversize Factor})$$

$$m_{\text{load_profile}} = (\text{balance pt load} - \text{Load Heat}) / (\text{balance pt temp} - \text{Des_OAT})$$

$$b_{\text{load_profile}} = \text{Load Heat} - (m_{\text{load_profile}} * \text{Des_OAT})$$

$$\text{Full Load Cool} = m_{\text{load_profile}} * \text{Max_OAT} + b_{\text{load_profile}}$$

$$\text{Full Load Heat} = m_{\text{load_profile}} * \text{Min_OAT} + b_{\text{load_profile}}$$

Electric Resistance Heat Baseline:

$$\text{Customer kWh}_{\text{EQHeating}} = -1 * \text{Full Load Heat} * \text{EFLH}_{\text{Heating HP}} * (1 / (\text{HSPF}_{\text{Baseline}} * \text{HSPF}_{\text{Adj Factor}}) - 1 / (\text{HSPF}_{\text{Proposed}} * \text{HSPF}_{\text{Adj Factor}})) / 1000$$

$$\text{Customer kWh}_{\text{QIHeating}} = -1 * \text{Full Load Heat} * \text{EFLH}_{\text{Heating HP}} * (1 / (\text{HSPF}_{\text{Baseline}} * \text{HSPF}_{\text{Adj Factor}}) * \left(\frac{1}{1 - \text{Sizing Loss}} - 1 \right) + 1 / (\text{HSPF}_{\text{Proposed}} * \text{HSPF}_{\text{Adj Factor}})) * (1 / (1 - \text{loss}_{\text{No QI}}) - 1 / \text{Loss}_{\text{uncorr}}) / 1000$$

Dual Fuel Gas Heat Baseline

$$\text{Customer DTherms}_{\text{EQ Saved}} = (-1 * \text{Full Load Heat} * \text{EFLH}_{\text{Heating HP}}) / \text{Furnace Eff} / 1,000,000$$

$$\text{Customer kWh}_{\text{Heating Penalty}} = \text{Furnace Fan kW} * \text{EFLH}_{\text{Heating HP}} - \text{Full Load Heat} * \text{EFLH}_{\text{cc HP Heat}} * (0 - (1 / (\text{HSPF}_{\text{Proposed}} * \text{HSPF}_{\text{Adj Factor}}))) / 1000$$

$$\text{Customer DTherms}_{\text{QI}} = \text{Full Load Heat} * (\text{EFLH}_{\text{Heat}} - \text{EFLH}_{\text{cc HP Heat}}) / \text{Furnace Eff} * (1 / (1 - \text{Loss}_{\text{Duct Leakage}}) - 1 / (1 - \text{Uncorr Loss})) / 1,000,000$$

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Variables

ASHP Cost per Ton EQ	See Table 18.13.1	Capital Cost per Ton of new ccASHP.
Cost per Ton baseline	See Table 18.13.1	Baseline capital cost per ton for new AC equipment.
EER baseline	See Table 18.0.3	Baseline EER as calculated for residential equipment from the code required SEER baseline AC unit.
SEER baseline	See Table 18.0.3	IECC 2021 identified code minimum AC unit SEER
COP Baseline	See Table 18.0.3	Baseline heating efficiency. A COP of 1 and does not require climate zone correction.
Sizing Loss	See Table 18.0.5	
Loss_NoQI	See Table 18.0.5	
Loss_Uncorr	See Table 18.0.5	
Inc Cost_QI	See Table 18.0.5	
Coincidence Factor EQ	See Table 18.0.4	
Coincidence Factor QI	See Table 18.0.4	
Oversize Factor_c	20%	Deemed Oversize Safety Factor for heating equipment.
EFLH cooling	See Table 18.0.1	Effective Full Load Hours for cooling load energy savings
EFLH Heat	See Table 18.0.1	Effective Full Load Hours for heating load QI energy savings
EFLH_ccHP_Heat	See Table 18.0.1a	Effective Full Load Hours for Cold Climate Heat Pump at and above customer provided Operating Cutover Temperature.
Balance Pt Temp	See Table 18.0.7	Outdoor Ambient Temperature at which residential cooling and heating loads are zero BTUH
Max_OAT	See Table 18.0.7	Maximum Outdoor Ambient Temperature used in building load profile
Min_OAT	See Table 18.0.7	Minimum Outdoor Ambient Temperature used in building load profile
Des OAT	5	Low Outdoor Ambient Temperature for calculating heating load Profile. Based on Low Temp Rating from NEEP QPL Data Sheets. Deemed to be 5 F.
Electric Resistance Heat HSPF	3,412	Electric resistance heat assumed heating season performance factor based on a COP of 1. no climate zone correction required.
Balance Pt Load	See Table 18.0.7	Heating and cooling loads are zero at the balance point outdoor ambient temperature
Furnace_Fan_kW	0.357	Furnace Fan EC Motor kW demand for baseline energy calculations for ASHP.
Furnace Eff	95%	This is the assumed furnace efficiency for the backup gas fired heat (Baseline Heat Type equals Gas Furnace) in a dual fuel ASHP system application.
Cost / kBtUHeat - Baseline Furnace	\$ 59.72	Average High Efficiency Furnace Cost / kBtUH; installed costs
Cost / kBtUHeat - Baseline Boiler	\$ 89.77	Average High Efficiency Boiler Cost / kBtUH; installed costs
Cost / kBtUHeat - Baseline Electric Resistance	\$ 40.00	Average Cost for air handler and electric duct heater / kBtUH; installed costs
Baseline Air Handler	\$ 1,200.00	Average Cost for Baseline Air Handler for use with ER Heat or Boiler Heat associated with Air Conditioning; installed costs
HSPF_Adj_Factor	See Table 18.0.1	Adjustment factor for correcting HSPF from published data in AHRI's Climate Zone IV to AHRI's Climate Zone V. The HSPF_Adjustment_Factor for Electric Resistance Heat will be 1.
HSPF_Baseline	See Table 18.0.3	Heating season performance factor of baseline equipment. For electric resistance heat baseline, a COP of 1 is assumed with no climate zone correction required.
Measure Life - Matched Split-System Air -Source Heat Pump	See Table 18.0.3	Reference 16
Measure Life - Quality Installation	18	Reference 16
Conversion Factors	See Table 18.0.6	

Customer Inputs

M&V Verified

Size_Cool	Yes	NEEP QPL Data Sheet Rated Cooling Capacity at 95 F
Size_Heat_5	Yes	NEEP QPL Data Sheet Max Heating Capacity at 5 F
Size_Heat_47	Yes	NEEP QPL Data Sheet Rated Heating Capacity at 47 F
EER proposed	Yes	NEEP QPL Data Sheet rated full load Cooling Efficiency
SEER proposed	Yes	NEEP QPL Data Sheet rated part load Cooling Efficiency
HSPF Proposed	Yes	NEEP QPL Data Sheet rated Heating HSPF
EER2 proposed	Yes	AHRI Certification for units manufactured after 1/1/2023
SEER2 proposed	Yes	AHRI Certification for units manufactured after 1/1/2023
HSPF2 Proposed	Yes	AHRI Certification for units manufactured after 1/1/2023
Home Type	Yes	Single Family or Multi-Family home
County	Yes	Location of the home for determining weather zones.
Baseline Heat Type	Yes	baseline heating type; gas furnace or electric resistance backup heat
Home Category	Yes	New Home or Existing Home
Operating Cutover Temperature	Yes	Outdoor Ambient Temperature below which heat pump operation ceases and electric resistance heating begins

Table 18.13.1. Incremental Capital Costs - New Construction (Plan A) - Reference 6

SEER	ccASHP Cost per Ton	Baseline Cost per Ton (Res AC) Installed
13 SEER	N/A	\$ 2,507.42
18+ SEER	\$ 3,500.00	N/A

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

References:

1. Building America, Research Benchmark Definitions, 2010. (see p. 10) <http://www.nrel.gov/docs/fy10osti/47246.pdf>
2. ASHRAE, 2019, Applications Handbook, Ch. 38, table 4, Comparison of Service Life Estimates
3. DOE Appliance Standards Website, Residential Central Air Conditioners and Heat Pumps. https://www1.eere.energy.gov/buildings/appliance_standards/product.aspx/productid/75
4. Neme, Proctor, Nadel, ACEEE, 1999. Energy Savings Potential From Addressing Residential Air Conditioner and Heat Pump Installation Problems, <http://aceee.org/research-report/a992>
5. State of Minnesota Technical reference Manual For Energy Conservation Improvement Programs, Version 3.1 <https://mn.gov/commerce/industries/energy/utilities/cip/technical-6>
- 6 ENERGY STAR Quality Installation standards (ESVI). https://www.energystar.gov/index.cfm?c=hvac_install.hvac_install_index
7. NREL 2011 Measure Guideline Sealing and Insulating Ducts in Existing Homes. <http://www.nrel.gov/docs/fy12osti/53494.pdf>
8. State of Illinois Technical Reference Manual Version 8, dated 2020
9. For explanation of duct sealing requirements for new homes see "Significant Changes to the 2015 Minnesota Residential Codes (MR 1303, 1309 and 1322)". <http://www.ci.minneapolis.mn.us/www/groups/public/@regservices/documents/webcontent/wcms1p-142763.pdf>
10. Incremental costs for MSHPs were determined from the NEEP Incremental Cost Study Phase 2 Report
11. MSHP equipment life is from Measure Life Report Residential and Commercial/Industrial Lighting and HVAC Measures; <http://library.cee1.org/content/measure-life-report-residential-and-commercial-industrial-lighting-and-hvac-measures>
12. For estimated life of GSHP see http://www.energysavers.gov/your_home/space_heating_cooling/index.cfm/mytopic=12640 (indoor components up to 25 years; ground loop =50 years)
13. Costs obtained from "2010-2012 WO017 Ex Ante Measure Cost Study Final Report", by Itron, May 2014. These are used in the DEER 2016 database.
14. For assumptions on losses related to overcharge or undercharge on refrigerant see "Sensitivity Analysis of Installation Faults on Heat Pump Performance", by P. Domanski, et. al., Sept 2014, <http://www.acca.org/HigherLogic/System/DownloadDocumentFile.ashx?DocumentFileKey=f02c1f61-4d1d-4a24-971d-cc9ea3e626b2&forceDialog=0>
15. ENERGY STAR Connected Thermostat Key Product Criteria, Version 1.0. Rev. Jan 2017 -
16. Code of Federal Regulations Title 10: Energy PART 430—ENERGY CONSERVATION PROGRAM FOR CONSUMER PRODUCTS Subpart C—Energy and Water
- 17: "Measure Life Report - Residential and Commercial/Industrial Lighting and HVAC Measures", dated June 2007 for The New England State Program Working Group prepared
18. Assumptions on EC fan operating modes. Center for Energy and Environment Comments to Docket Number EERE-2010-BT-STD-0011-0022, July 27, 2010
19. ECM Furnace Impact Assessment Report https://focusonenergy.com/sites/default/files/emcfurnaceimpactassessment_evaluationreport.pdf
20. Xcel Energy, January 2019. Typical MN Residential Smart Switch Load Relief 2011-2015.
21. Xcel Energy, January 2019. Saver's Switch Control History.
22. Xcel Energy, January 2006. Residential Saver's Switch 2005 Impact Evaluation.
23. http://wpb-radon.com/radon_fan_performance.html33:5032:50A33:50
24. Information from manufacturer and contractors (Radonaway)
25. <https://www.radonaway.com/products/radon-fans/rp140-pro.php>
26. Energy Information Administration's (EIA) 2009 Residential Energy Consumption Survey (RECS)
27. Bin analysis using RECS data for thermostat operation and typical CO home cooling and heating conditions.

Changes from Recent Filing:

Modified calculation of Incremental Cost to include the following items in the baseline costs: AC in lieu of ASHP, Baseline HE Furnace or Boiler or ER Heat, and Baseline air moving equipment when the baseline is electric resistance w/ AC or Boiler w/ AC.
Updated Proposed and Baseline Costs
Included Minimum Qualifying levels for SEER2, EER2, and HSPF2 for all AC and Heat Pump equipment based on IECC2021 where applicable. See Deemed Tables tab.
Removed QI Sizing Loss factors from full load cooling. Sizing should have been heating load basis.

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

18.14 Cold Climate Mini-Split Heat Pumps

Algorithms

Customer kW Savings = Customer kW_{EqCooling}

Customer Coincident kW Savings = Customer Coincident kW_{Equipment}

Electric Resistance Heat Baseline:

Customer kWh Savings = Customer kWh_{EqCooling} + Customer kWh_{EQHeating}

Dual Fuel Gas Heat Baseline:

Customer kWh Savings = Customer kWh_{EqCooling} + Customer kWh_{Heating Penalty}

Customer Dtherm Savings = Customer DTherms_{EQ Heating}

$$\text{Customer kW}_{EqCooling} = Qty_{prop} * \frac{\text{Full_Load_Cool}}{12,000} * \left(\left(\frac{12}{EER_{baseline}} \right) - \left(\frac{12}{EER_{proposed}} \right) \right)$$

$$\text{Customer kWh}_{EqCooling} = Qty_{prop} * \frac{\text{Full_Load_Cool}}{12,000} * EFLH_{cooling} * \left(\left(\frac{12}{SEER_{baseline}} \right) - \left(\frac{12}{SEER_{proposed}} \right) \right)$$

$$\text{Customer Coincident kW}_{equipment} = Qty_{prop} * \text{Coincidence Factor} * \frac{\text{Full_Load_Cool}}{12,000} * \left(\left(\frac{12}{EER_{baseline}} \right) - \left(\frac{12}{EER_{proposed}} \right) \right)$$

$$\text{Incremental Capital Cost}_{Equipment} = Qty_{Indoor_Heads} * \text{Cost/Eff_Indoor_Head} - \text{Cost Per Ton Baseline} * \frac{\text{Size_Cool}}{12,000} - \text{Cost per kBTUh heat} * (\text{Full_Load_Heat}/\text{COP_Baseline})/1000 - \text{Baseline_Air_Handler}$$

ccMSHP Heating Energy Savings

$$\text{Load_Heat} = -1 * \text{Size_Heat}_5 * 1 / (1 + \text{Oversize_Factor})$$

$$m_load_profile = (\text{balance pt load} - \text{Load_Heat}) / (\text{balance pt temp} - \text{Des_OAT})$$

$$b_load_profile = \text{Load_Heat} - (m_load_profile * \text{Des_OAT})$$

$$\text{Full Load Heat} = m_load_profile * \text{Min OAT} + b_load_profile$$

$$\text{Full Load Cool} = m_load_profile * \text{Max OAT} + b_load_profile$$

$$\text{HSPF_Baseline_Adj} = \text{HSPF_Baseline} * \text{HSPF_Adjustment_Factor}$$

$$\text{HSPF_Proposed_Adj} = \text{HSPF_Proposed} * \text{HSPF_Adjustment_Factor}$$

$$\text{Customer kWh}_{EQHeating} = Qty_{prop} * (-1 * \text{Full_Load_Heat} * \text{EFLH_ccHP_Heat} * (1 / \text{HSPF_Baseline_Adj} - 1 / \text{HSPF_Proposed_Adj})) / 1000$$

$$\text{Customer DTherms}_{EQ Saved} = (-1 * \text{Full_Load_Heat} * \text{EFLH_ccHP_Heat}) / \text{Furnace_Eff} / 1,000,000$$

$$\text{Customer kWh}_{Heating Penalty} = -1 * \text{Full_Load_Heat} * \text{EFLH_ccHP_Heat} * (0 - (1 / (\text{HSPF_Proposed} * \text{HSPF_Adj_Factor}))) / 1000$$

Note: All formulas using SEER, EER, and HSPF are valid with SEER2, EER2, HSPF2 substitutions.

Variables

Cost/Eff_Indoor_Head	See Table 18.4.1	Deemed Cost per Indoor Head or Coil, Based On Mini-Split vs. Multi-Split
Cost per Ton_baseline	See Table 18.4.1	Baseline capital cost per ton for new AC equipment
EER baseline	See Table 18.0.3	Baseline EER as calculated for residential equipment from the code required SEER.
SEER baseline	See Table 18.0.3	IECC 2012 identified code minimum SEER
HSPF_Baseline	See Table 18.0.3	Baseline heating season performance factor for code minimum MSHP. For Electric Resistance Heat Baseline the HSPF will be 3.412 based on a COP of 1 and does not require climate zone correction.
COP_Baseline	See Table 18.0.3	Baseline heating efficiency. A COP of 1 and does not require climate zone correction.
Coincidence Factor	See Table 18.0.3	
EFLH_Cooling	See Table 18.0.1	Effective Full Load Hours for cooling load energy savings
EFLH_Heating_HP	See Table 18.0.1	Effective Full Load Hours for Heat Pump impacted energy savings
EFLH_ccHP_Heat	See Table 18.0.1a	Effective Full Load Hours for Cold Climate Heat Pump at and above customer provided cutover temperature.
Balance Pt Temp	See Table 18.0.7	Outdoor Ambient Temperature at which residential cooling and heating load profiles equal zero BTUH
Max OAT	See Table 18.0.7	Maximum Outdoor Ambient Temperature used in building ASHP load profile; TMY3 basis
Min OAT	See Table 18.0.7	Minimum Outdoor Ambient Temperature for calculating full load heating; TMY3 Basis.
Des OAT	5	Low Outdoor Ambient Temperature for calculating heating load Profile. Based on Low Temp Rating from NEEP QPL Data Sheets. Deemed to be 5 F.
HSPF_Adj_Factor	See Table 18.0.1	Adjustment factor for correcting HSPF from published data in climate zone IV to Minnesota Climate zone V. The HSPF_Adjustment_Factor for Electric Resistance Heat will be 1.
Balance Point Load	See Table 18.0.7	BTUH - Heating and cooling loads are zero at the balance point outdoor ambient
m_load_profile	Calculated	load profile slope (m)
b_load_profile	Calculated	load profile y intercept (b)
Full Load Heat	Calculated	Calculated full load heating BTUH based on the calculated load profile using the minimum Outside Air Temperature for the selected ccMSHP equipment. The load served is assumed to not be the whole load for the home.

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Full Load Cool	Calculated	Calculated full load cooling BTUH based on the calculated load profile using the maximum Outside Air Temperature for the selected ccMSHP equipment. The load served is assumed to not be the whole load for the home.
Cold Climate Heat Maintenance Ratio	70%	The Max Heating Capacity at 5 °F must be at least 70% of the Rated Heating Capacity at 47 °F
Furnace Eff	95%	Furnace efficiency for backup heating deemed to be condensing type furnace with 95% efficiency
Oversize_Factor_c	20%	Deemed Oversize Safety Factor for heating equipment.
Cost / kBtUh Heat - Baseline Furnace	\$ 59.72	Average High Efficiency Furnace Cost / kBtUh; installed costs
Cost / kBtUh Heat - Baseline Boiler	\$ 89.77	Average High Efficiency Boiler Cost / kBtUh; installed costs
Cost / kBtUh Heat - Baseline Electric Resistance	\$ 40.00	Average Cost for air handler and electric duct heater / kBtUh; installed costs
Baseline Air Handler	\$ 1,200.00	Average Cost for Baseline Air Handler for use with ER Heat or Boiler Heat associated with
Lifetime	See Table 18.0.4	Measure Lifetime for ccMSHPs are the same as for MSHPs found in referenced table.
Minimum Qualifying Efficiency	See Table 18.0.2	

Customer Inputs	M&V Verified	
Size_Cool	Yes	NEEP QPL Data Sheet Rated Cooling Capacity at 95 °F
Size_Heat_5	Yes	NEEP QPL Data Sheet Max Heating Capacity at 5 °F
Size_Heat_47	Yes	NEEP QPL Data Sheet Rated Heating Capacity at 47 °F
EER proposed	Yes	NEEP QPL Data Sheet rated full load Cooling Efficiency
SEER proposed	Yes	NEEP QPL Data Sheet rated part load Cooling Efficiency
HSPF Proposed	Yes	NEEP QPL Data Sheet rated Heating HSPF
Quantity proposed equipment	Yes	The Quantity of Outdoor Units. Only applies if the Outdoor Unit's Size AND the quantity and size of the Indoor Units served by each outdoor unit are identical.
Quantity Indoor Heads	Yes	The Quantity of Indoor Heads + Coils served by a single Outdoor Unit.
Home Type	Yes	Single Family or Multi-Family home
County	Yes	Location of the home for determining weather zones.
Baseline Heat Type	Yes	Baseline heating type; gas furnace or electric resistance backup heat
Operating Cutover Temperature	Yes	Outdoor Ambient Temperature below which heat pump operation ceases and electric resistance heating begins

Table 18.14.1: Baseline and Proposed Capital Costs - Cold Climate Mini-Split Heat Pump (Reference 8)

	Baseline AC cost / ton	Cost/Efficient Indoor Head or Coil
ccMSHP Single Head System Costs	\$ 2,507.42	\$ 6,670.00
ccMSHP Multi-Head System Costs	\$ 2,507.42	\$ 6,010.00

References:

See 18.1 Residential AC references

Changes from Recent Filing:

Modified calculation of Incremental Cost to include the following items in the baseline costs: AC in lieu of MSHP, Baseline HE Furnace or Boiler or ER Heat, and Baseline air moving equipment when the baseline is electric resistance w/ AC or Boiler w/ AC.
 Updated Proposed and Baseline Costs
 Included Minimum Qualifying levels for SEER2, EER2, and HSPF2 for all AC and Heat Pump equipment based on IECC2021 where applicable. See Deemed Tables tab.

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

19.1 BOC

Algorithms

$$Customer\ kWh = ft^2 \times \left[\frac{kWh}{ft^2} \right]$$

$$Customer\ kW = CF \times \frac{Customer\ kWh}{hours}$$

$$Customer\ therms = ft^2 \times \left[\frac{therms}{ft^2} \right]$$

Variables

$\left[\frac{kWh}{ft^2} \right]$	0.121	kWh/sqft of attributable savings (Reference 1)
$\left[\frac{therms}{ft^2} \right]$	0.00806	Therms/sqft of attributable savings (Reference 1)
CF	33.00%	Average of Implemented Recommissioning program measures
hours	8760	Hours per year
Lifetime	5	years (Reference 2)

Customer Inputs

M&V Verified

ft ²		Building Area
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References:

1. Department of Energy Resource Technical Reference Manual Version 2.1
2. BOC-Expansion Initiative Market Progress Evaluation Report #1; http://theboc.info/pdf/Eval-BOC-expansion-initiative-market-progress-0414.pdf

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

19.2 BOC

Algorithms

$$Customer\ kWh = (kWh_{Baseline} - kWh_{Proposed})$$

$$Customer\ kW = kW_{Baseline} - kW_{Proposed}$$

Customer may apply for rebate based upon the recommendations provided in the Xcel Energy-funded Study or Assessment. Each measure will be provided by a study consultant and reviewed by Xcel Energy. Technical variables will be provided by the study consultant. Analysis will be based on standard engineering methodologies. Electrical energy savings and electrical demand savings will be calculated based on the project specific details.

Variables

Lifetime	7
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DEEMED SAVINGS TECHNICAL ASSUMPTIONS

19.3 BOC

Algorithms

$$Customer\ kWh = (kWh_{Baseline} - kWh_{Proposed})$$

$$Customer\ kW = kW_{Baseline} - kW_{Proposed}$$

Customer may apply for rebate based upon the recommendations provided in the Xcel Energy-funded Study or Assessment. Each measure will be provided by a study consultant and reviewed by Xcel Energy. Technical variables will be provided by the study consultant. Analysis will be based on standard engineering methodologies. Electrical energy savings and electrical demand savings will be calculated based on the project specific details.

Variables

Lifetime	7
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20.0 Water Heater Deemed Tables

Table 20.0.1 - Water Heater Incremental Cost, Lifetime, NTG - References 3, 10

Water Heater Type	Size	Draw Pattern	Baseline Cost	Incremental Cost	Lifetime	NTG
High Efficiency Tank-Type Water Heater	Volume <= 40 Gallon	MEDIUM	\$ 906.99	\$ 126.88	13	90%
High Efficiency Tank-Type Water Heater	Volume <= 40 Gallon	HIGH	\$ 833.02	\$ 260.86	13	90%
High Efficiency Tank-Type Water Heater	Volume > 40 Gallon	MEDIUM	\$ 714.09	\$ 119.30	13	90%
High Efficiency Tank-Type Water Heater	Volume > 40 Gallon	HIGH	\$ 958.42	\$ 384.34	13	90%
High Efficiency Tankless Water Heater	N/A	MEDIUM	\$ 975.06	\$ 610.06	20	90%
High Efficiency Tankless Water Heater	N/A	HIGH	\$ 1,071.37	\$ 1,100.27	20	90%
Air Source Heat Pump Water Heater ERWH Baseline	N/A	Any	\$ 1,013.92	\$ 3,110.08	12	100%
Air Source Heat Pump Water Heater Gas Storage WH Baseline	N/A	Any	\$ 1,090.99	\$ 3,033.01	12	100%

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

20.1 Gas Water Heaters

Algorithms

$$Customer_Dth = Baseline_Dth - Proposed_Dth$$

$$Baseline_Dth = Hot_Water_Energy / Baseline_Eff_Gas / 1,000,000$$

$$Proposed_Dth = Hot_Water_Energy / Proposed_Eff / 1,000,000$$

$$Hot_Water_Energy = Qty \times Hot_Water_Consumption \times C_p \times Water_Heater_Delta_T \times Days_Per_Year \times Water_Density$$

$$Water_Heater_Delta_T = Water_Heater_Temperature - City_Mains_Temperature$$

For Storage Water Heaters:

$$Baseline_Efficiency_Gas = coef1 - (coef2 \times Proposed_Tank_Size)$$

For Instantaneous and Indirect Water Heaters:

$$Baseline_Efficiency_Gas = coef1 - (coef2 \times Baseline_Tank_Size)$$

For Indirect Water Heaters:

$$Proposed_Dth = (Hot_Water_Energy / Eff_{P,Boiler} + \frac{UA_{P,DHW}}{Eff_{P,Boiler}} \times Ambient_dT \times HoursPerYear) / 1,000,000$$

$$Ambient_dT = Water_Heater_Temperature - Ambient_Temperature$$

$$UA_{P,DHW} = \frac{SL_{P,DHW}}{70} \times Proposed\ Tank\ Size \times Water_Density \times SpecificHeat_{water}$$

$$Incremental\ Cost = Proposed\ Cost - Baseline\ Cost$$

Variables

Hot_Water_Consumption	See Table 20.1.4	Gallons of Water per day based on number of Bedrooms and Home Type
Water Heater Temperature	120.0	Water Heater Tank Temperature
City Mains Temperature	51.4	Water Main temperature average over the year
Conversion from Btu to Dth	1,000,000	1 Dth = 1,000,000 Btuh
Conversion from Btu to Therm	100,000	1 Therm = 100,000 Btuh
Conversion from kW to Watts	1,000	1 kW = 1,000 Watts
Conversion from Btu to kWh	3,412	1 kW = 3,412 Btuh
C_p	1	Btu/lb°F Specific Heat of Water
Water_Density	8.34	lb/gal H2O
Days_Per_Year	365	Days per Year
HoursPerYear	8,760	Hours per Year
Coef1	See Table 20.1.1 See Table 20.1.2	Code based formula for calculation of Baseline efficiency based on water heater type and Proposed Tank Size
Coef2	See Table 20.1.1 See Table 20.1.2	Code based formula for calculation of Baseline efficiency based on water heater type and draw pattern
Baseline_Tank_Size	See Table 20.1.3	For Instantaneous Water Heaters the baseline tank size will be based on the deemed First Hour Rating and the number of bedrooms.
Water Heater Self-Installation Rate	52%	Percent of Water Heaters that self-installed after retail purchase (Reference 9). Zero percent for heat pump water heaters.
Ambient_Temperature	70	Deemed ambient air temperature of the space where the Indirect Water Heater is installed.
SL_P,DHW	See Table 20.1.7	Standby loss factor for the proposed Indirect Water Heater, in °F/h. Deemed from Averages of AHRI database.
Indirect Water Heater Baseline Cost	See Table 20.1.6	Baseline cost of Indirect Water Heater, based on number of bedrooms
Indirect Water Heater Draw Pattern	See Table 20.1.6	Draw Pattern of baseline water heater for Indirect Water Heater measure based on number of bedrooms
Indirect Water Heater Proposed Cost	See Table 20.1.7	Proposed cost of Indirect Water Heater based on the proposed nominal tank size.
Measure Life for Indirect Water Heater	13	Indirect Water Heater measure life is equivalent to a gas fired storage water heater.

Customer Inputs

M&V Verified

Number of Bedrooms	Yes	total number of bedrooms in the home where a new water heater is being installed
Proposed Eff	Yes	Proposed water heater AHRI Certified Uniform Energy Factor (UEF)
First Hour Rating	Yes	AHRI certified First Hour Rating in gallons per hour (GPH)
Quantity Proposed Equipment	Yes	
Instantaneous Water Heater Max GPM Rating	Yes	AHRI Certified GPM Rating
Proposed Tank Size	Yes	DOE Rated Storage Volume for tank type water heaters
Type of Proposed Water Heater	No	Type of proposed water heater. (i.e. Storage, Tankless, Heat Pump)
Water Heater Draw Pattern	No	Usage Bin identified on AHRI Certificate
Eff_P,Boiler	Yes	Proposed Boiler Percent AFUE for boiler equipment associated with operation of the indirect water heater.

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Deemed Calculator inputs for Income Qualified Single Family Weatherization Program In Lieu of Customer/Contractor Provided Inputs **

Number of Bedrooms	2	Assumed number of bedrooms in the home where a new water heater is being installed
Proposed Tank Size	40	Assumed Nominal tank volume of the Installed Gas Storage Water Heater
First Hour Draw Rating	60	Assumed first hour draw of the installed Gas Storage Water Heater.
Proposed UEF	0.68	Assumed Gas Storage Water Heater Efficiency.
Gas Instantaneous Water Heater Max GPM Rating	3.25	Assumed GPM rating of Gas Tankless Water Heater.
Proposed UEF for Gas Instantaneous Water Heater	0.90	Assumed Gas Tankless Water Heater Efficiency.

** Other inputs necessary to complete the calculations will be provided as required in the Customer Inputs section.

Table 20.1.1 Gas Fired Storage Water Heater and Heat Pump Water Heater Baseline Efficiency Calculation Parameters (Reference 8)

Draw Pattern	First Hour Rating to Define Draw Pattern		Electric Storage Water Heater >=20 Gallon and <=55 Gallon Baseline Efficiency Coefficients		Gas Storage WH >20 Gallon and <=55 Gallon Baseline Efficiency Coefficients		Gas Storage WH >55 Gallon and <=100 Gallon Baseline Efficiency Coefficients	
	min (>=Gallons)	max (< Gallons)	coef1	coef2	coef1	coef2	coef1	coef2
Very Small	1	18	0.8808	0.0008	0.3456	0.0020	0.6470	0.0006
Low	18	51	0.9254	0.0003	0.5982	0.0019	0.7689	0.0005
Medium	51	75	0.9307	0.0002	0.6483	0.0017	0.7897	0.0004
High	75	No Upper Limit	0.9349	0.0001	0.6920	0.0013	0.8072	0.0003

Table 20.1.2 Instantaneous Gas Fired Water Heater baseline Efficiency calculation parameters (Reference 8)

Draw Pattern	Instantaneous Gas-Fired Water Heater <2 gal and >50,000 Btu/h GPM Drawn	
	Minimum (>=GPM)	Maximum (< GPM)
Very Small	0	1.7
Low	1.7	2.8
Medium	2.8	4
High	4	No Upper Limit

Table 20.1.3 Estimated Baseline Gas Storage Water Heater Tank Size for Instantaneous and Indirect Water Heaters - 2019 ASHRAE HVAC Applications Chapter 51 Service Water Heating: Table 4 HUD-FHA Minimum Water Heater Capacities for One- and Two-Family Living Units (Reference 12)

Water Heater Type \ Number of Bedrooms	1	2	3	4	5	6
Average Gas Storage First Hour Draw (Reference 12)	43	60	67	77	90	92
Instantaneous Water Heater Baseline Tank Size	20	30	35	40	50	50
Indirect Water Heater Baseline Tank Size	20	30	35	40	50	50

Table 20.1.4 Water Usage per Day by Number of Bedrooms

Home Type \ Number of Bedrooms	1	2	3	4	5	6
Single Family total HW usage per day	34	48	60	72	84	96
Multi-Family total HW usage per day	41	53	63	73	83	92

Table 20.1.5: Inc Costs for Income Qualified Single Family Weatherization Program

Weatherization Program	Incremental Cost
High Efficiency Tank-Type Gas Fired Water Heater	\$374.00
High Efficiency Tankless Gas Fired Water Heater	\$1,100.27

Table 20.1.6: Baseline Water Heater Deemed Information for Indirect Water Heaters

No. of Bedrooms \ Cost & Draw Pattern	Baseline Cost	Deemed Draw Pattern
1	\$719.04	Low
2	\$719.04	Medium
3	\$719.04	Medium
4	\$719.04	High
5	\$773.07	High
6	\$773.07	High

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Table 20.1.7: Proposed Indirect Water Heater Standby Loss Factor (Reference 7), Equipment Cost

Indirect Nominal Tank Size (Proposed Tank Size)	Standby Loss, °F/h	Indirect WH Equip Cost	Minimum Tank Size	Maximum Tank Size
30	1.1286	\$1,130.14	25	33
35	0.9538	\$1,192.44	33	38
40	0.9957	\$1,361.20	38	45
50	0.7304	\$1,497.25	45	55

References:

1. Energy Conservation Program for Consumer Products: Test Procedure for Water Heaters; United States Department of Energy; <http://www.gpo.gov/fdsys/pkg/FR-1998-05-11/pdf/98-12296.pdf>
2. Denver Water's 2006 Treated Water Quality Summary Report; <http://www.denverwater.org/docs/assets/9A12FBC5-BCDF-1B42-D1BC5F0B1CE3B115/TreatedWQSummaryReport20061.pdf>
3. Energy Star Residential Water Heaters -Final Criterial Analysis, April 2008. http://www.energystar.gov/ia/partners/prod_development/new_specs/downloads/water_heaters/WaterHeaterAnalysis_Final.pdf
4. New York Standard Approach for Estimating Energy Savings from Energy Efficiency Programs; [https://www3.dps.ny.gov/W/PSCWeb.nsf/96f0fec0b45a3c6485257688006a701a/72c23deccff52920a85257f1100671bdd/\\$FILE/TRM%20Version%206%20-%20January%202019.pdf](https://www3.dps.ny.gov/W/PSCWeb.nsf/96f0fec0b45a3c6485257688006a701a/72c23deccff52920a85257f1100671bdd/$FILE/TRM%20Version%206%20-%20January%202019.pdf)
5. US Department of Energy; Residential Heat Pump Water Heaters; <http://energy.gov/eere/femp/covered-product-category-residential-heat-pump-water-heaters>
6. US Department of Energy; Consumer Water Heaters; https://www1.eere.energy.gov/buildings/appliance_standards/standards.aspx?productid=32
7. AHRI Directory of Certified Product Performance for Indirect Water Heaters; <https://www.ahridirectory.org/NewSearch?programId=28&searchTypeId=3>
- 8.US Department of Energy,Energy and water conservation standards and their compliance dates: 10 CFR 430.32(d); https://www.ecfr.gov/cgi-bin/text-idx?SID=80dfa785ea350ebee184bb0ae03e7f0&mc=true&node=se10.3.430_132&rgn=div8
9. EnergyStar - http://aceee.org/sites/default/files/files/pdf/conferences/hwf/2016/Ryan_Session1C_HWF16_2.22.16_0.pdf
10. Equipment Manufacturer Retail Price Information Request (Q4 - 2017)
11. NREL - National Residential Efficiency Measure Database, <https://remdb.nrel.gov/measures.php?gld=6&ctld=270>
12. 2019 ASHRAE HVAC Applications manual Chapter 51 Service Water Heating
- 13 Florida Solar Energy Center paper "Estimating Daily Domestic Hot Water Use in North American Homes. <https://fsec.ucf.edu/en/publications/pdf/FSEC-PF-464-15.pdf> Table 5 on Page 11.

Changes from Recent Filing:

None

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

20.2 Residential Low Flow

Algorithms

$$\Delta T_{WH} = T_{WH} - T_{city}$$

$$Customer\ Dth = \frac{GPY_{saved} \cdot \Delta T_{WH} \cdot H_{water} \cdot Split\ Factor}{EFF_{WH,gas} \cdot 1,000,000}$$

$$Customer\ kWh = \frac{GPY_{saved} \cdot \Delta T_{WH} \cdot H_{water} \cdot (1 - Split\ Factor)}{EFF_{WH,electric} \cdot 3,412}$$

$$Customer\ kW = \frac{Customer\ kWh}{8760}$$

$$Customer\ PckW = Customer\ kW \cdot CF$$

Variables

T_{WH}	120	Water heater setpoint temperature °F. (Reference 1)
T_{city}	51.4	Water temperature of city water entering the water heater °F. (Reference 2)
GPY _{saved}	See Table 20.2.3 and 20.2.4	Gallons per year of hot water saved with high-efficiency showerhead or aerator. See table for appropriate home type; Single Family or Multifamily.
ρ_w	8.34	Density of water in lb/gal
C_w	1	Specific heat of water in BTU/(lb·°F)
H_{water}	8.34	Heat content of 1 gallon of water in BTU/(gal·°F)
EFF _{WH,gas}	80%	Assumed gas water heater efficiency without standby losses. This only includes combustion efficiency.
EFF _{WH,electric}	100%	Assumed electric water heater efficiency without standby losses.
Split Factor	See Table 20.2.6	Gas/electric split factor is based on customer response to showerhead post card. The customer selects from three options for water heating fuel.
Conversion from Dth to BTU	1,000,000	1 Dth = 1,000,000 Btu
Conversion from kWh to BTU	3,412	1 kWh = 3,412 Btu
CF	See Table 20.2.3 and 20.2.4	Amount of Customer kW demand that will coincide with peak utility system demand.
Baseline Flowrates	See Table 20.2.1 and 20.2.2	Baseline showerhead flowrate is assumed to be 2.5GPM and kitchen/bathroom aerator baseline flowrates are assumed to be 2.2GPM per federal minimum standards.
Measure Life	10	Lifetime of showerhead and aerator measures. (Reference 3)
Incremental Costs	See Table 20.2.5	Actual costs provided by vendor; cost per showerhead is assumed for the material costs for cost/benefit calculation purposes.
Residential Water Rate	\$3.44	\$ / 1000 Gallons
Residential Sewer Rate	\$5.79	\$ / 1000 Gallons

Customer Inputs

M&V Verified

Showerhead / Aerator received by customer	Yes	
Showerhead / Aerator installed by customer	Yes	
Water Heating Fuel provided by Customer	Yes	If water heating fuel is unknown, the split factor is used to divide the measure between gas and electric fuel types.

Table 20.2.1 - Showerhead Assumptions

Single Family Multifamily

	Single Family	Multifamily	
Baseline Showerhead Flowrate	2.50	2.50	Federal minimum standards
Proposed Showerhead Flowrate	1.50	1.50	
Proposed Showerhead Flowrate	1.25	1.25	
Shower Duration	13.02	13.02	Reference 6
Showers per Day	1.39	1.07	Reference 6
Showers in Home	1.82	1.21	Reference 8
Shower Temperature	105	105	Reference 1

Table 20.2.2 - Aerator Assumptions

Single Family Multifamily

	Single Family	Multifamily	
Baseline kitchen & bathroom aerator flowrate	2.20	2.20	Federal minimum standards
Proposed kitchen aerator flowrate	1.50	1.50	
Proposed kitchen aerator flowrate	1.00	1.00	
Proposed bathroom aerator flowrate	1.00	1.00	
Proposed bathroom aerator flowrate	0.50	0.50	
Faucet Use for Homes w/o Dishwasher (gal/day)	12.30	9.48	Reference 7
Faucet Use for Homes w/ Dishwasher (gal/day)	7.50	5.78	Reference 7
Houses with Dishwashers	75%	55%	Reference 8
Kitchen Sinks in Home	1.00	1.00	Assumed
Bathroom Sinks in Home	2.21	1.31	Reference 8
Dish Washing Temperature (°F)	120	120	Reference 1
Hand Washing Temperature (°F)	105	105	Reference 1

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Table 20.2.3 - Single Family Gallons per Year Savings & Coincidence Factors

	Primary Showerhead			Secondary Showerhead			Kitchen Aerator (1.5 GPM)	Primary Bath Faucet Aerator		Secondary Bath Faucet Aerator	
	Standard (1.5 GPM)	Handheld (1.5 GPM)	Styled (1.5 GPM)	Standard (1.5 GPM)	Handheld (1.5 GPM)	Styled (1.5 GPM)		(1.0 GPM)	(0.5 GPM)	(1.0 GPM)	(0.5 GPM)
GPY_DHW_Savings	2,836	2,836	2,836	2,325	2,325	2,325	351	363	515	363	515
Total Water Savings/Year - Gallons	3,630	3,630	3,630	2,976	2,976	2,976	411	465	659	465	659
Coincidence_Factor (Reference 8)	64%	64%	64%	64%	64%	64%	124%	124%	124%	124%	124%
O&M Savings	\$33.50	\$33.50	\$33.50	\$27.47	\$27.47	\$27.47	\$3.79	\$4.29	\$6.08	\$4.29	\$6.08

Table 20.2.4 - Multifamily Gallons per Year Savings & Coincidence Factors

	Primary Showerhead				Secondary Showerhead			Kitchen Aerator		Primary Bath Faucet Aerator		Secondary Bath Faucet Aerator	
	Standard (1.5 GPM)	Standard (1.25 GPM)	Handheld (1.5 GPM)	Styled (1.5 GPM)	Standard (1.5 GPM)	Handheld (1.5 GPM)	Styled (1.5 GPM)	(1.5 GPM)	(1.0 GPM)	(1.0 GPM)	(0.5 GPM)	(1.0 GPM)	(0.5 GPM)
GPY_DHW_Savings	3,282	4,102	3,282	3,282	695	695	695	419	718	389	551	389	551
Total Water Savings/Year - Gallons	4,200	5,250	4,200	4,200	890	890	890	482	827	498	706	498	706
Coincidence_Factor (Reference 8)	64%	64%	64%	64%	64%	64%	64%	124%	124%	124%	124%	124%	124%
O&M Savings	\$38.77	\$48.46	\$38.77	\$38.77	\$8.21	\$8.21	\$8.21	\$4.45	\$7.63	\$4.60	\$6.51	\$4.60	\$6.51

Table 20.2.5 - Incremental Costs

	Primary Showerhead				Secondary Showerhead			Kitchen Aerator		Primary Bath Faucet Aerator		Secondary Bath Faucet Aerator	
	Standard (1.5 GPM)	Standard (1.25 GPM)	Handheld (1.5 GPM)	Styled (1.5 GPM)	Standard (1.5 GPM)	Handheld (1.5 GPM)	Styled (1.5 GPM)	(1.5 GPM)	(1.0 GPM)	(1.0 GPM)	(0.5 GPM)	(1.0 GPM)	(0.5 GPM)
Energy Efficient Showerhead	\$3.35	-	\$8.65	\$4.25	\$3.35	\$8.65	\$4.25	\$1.69	-	\$0.54	-	\$0.54	-
Home Energy Squad	\$3.23	-	-	-	-	-	-	\$2.05	-	\$0.47	\$0.47	-	-
Energy Savings Kits	\$3.89	-	-	-	\$3.89	-	-	\$2.39	-	\$0.89	-	-	-
Income Qualified SF Weatherization	\$3.35	-	-	-	-	-	-	\$1.69	-	\$0.54	-	-	-
Multifamily Building Incremental Costs	\$14.00	\$14.00	\$14.00	-	-	-	-	\$5.00	\$5.00	\$4.00	\$4.00	-	-
School Kits - Incremental Costs	\$3.22	-	-	-	-	-	-	\$1.22	-	-	\$0.48	-	-

*Note that these incremental costs are estimates. Actual incremental costs will be used when they are known.

Table 20.2.6 Gas Split Factor

Gas Water Heater	100%
Electric Water Heater	0%
Unknown Water Heater	93%

References:

1. Development of Standardized Domestic Hot Water Event Schedules for Residential Buildings; R. Hendron and J. Burch; NREL/CP-550-40874
2. Denver Water's 2006 Treated Water Quality Summary Report; <http://www.denverwater.org/docs/assets/9A12FBC5-BCDF-1B42-D1BC5F0B1CE3B115/TreatedWQSummaryReport20061.pdf>
3. DEER Database for Energy Efficient Resources; www.deeresources.com
4. Inside and outside city of Denver water rates - <https://www.denverwater.org/residential/billing-and-rates/2020-rates>
5. Inside and outside city of Denver sewer rates - <https://www.denvergov.org/content/denvergov/en/wastewater-management/billing-and-rates.html>
6. Xcel Energy New Mexico Residential Shower Use Study
7. The Effect of Efficiency Standards on Water Use and Water Heating Energy Use in the U.S.: A Detailed End-use Treatment; J. Koomey, C. Dunham, J. Lutz; LBL-35475
8. Residential Energy Consumption Survey 2015; <http://www.eia.gov/consumption/residential/>
9. 2010 Xcel Energy Colorado Home Use Study (PS Co Service Area)

Changes from Recent Filing:

Updated water & sewer rates, and costs.

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

20.3 Commercial Low Flow

Algorithms

$$\Delta T_{WH} = T_{WH} - T_{city}$$

$$Gas\ Savings\ (Gross\ Dth) = Quantity * \frac{\rho_w * C_w * W_{tr} * Save * \Delta T_{WH}}{EFF_{WH,gas} * 1,000,000}$$

$$Energy\ Savings\ (Customer\ kWh) = Quantity * \frac{GPY_{saved} * \Delta T_{WH} * H_{water}}{EFF_{WH,electric} * 3,412}$$

$$Demand\ Savings\ (Customer\ kW) = \frac{Customer\ kWh}{8760}$$

$$Demand\ Savings\ (Customer\ PckW) = Customer\ kW * CF$$

$$GPY_{saved} = (Baseline_{GPM} - Proposed_{GPM}) * Runtime_{Hours} * Facility_{Days} * 60$$

$$O\&M\ Savings = Quantity * GPY_{saved} * (Water_{Rate} + Sewer_{Rate}) / 1000$$

Variables

T _{WH}	Table 20.3.1	Water heater setpoint temperature °F. (Reference 1)
T _{city}	51.4	Water temperature of city water entering the water heater °F. (Reference 2)
ρ _w	8.34	Density of water in lb/gal
C _w	1	Specific heat of water in BTU/(lb.°F)
H _{water}	8.34	Heat content of 1 gallon of water in BTU/(gal.°F)
EFF _{WH,gas}	80%	Assumed gas water heater efficiency without standby losses. This only includes combustion efficiency.
EFF _{WH,electric}	98%	Assumed electric water heater efficiency
Conversion from Dth to BTU	1,000,000	1 Dth = 1,000,000 Btu
Conversion from kWh to BTU	3,412	1 kWh = 3,412 Btu
CF	See Table 20.3.2	Amount of Customer kW demand that will coincide with peak utility system demand.
Baseline GPM	See Table 20.3.2	Baseline showerhead flowrate is assumed to be 2.5GPM and kitchen/bathroom aerator baseline flowrates
Proposed GPM	See Table 20.3.2	Lifetime of showerhead and aerator measures. (Reference 3)
Runtime Hours	See Table 20.3.3	Number of hours per day equipment is used
Facility Days	See Table 20.3.3	Number of days per year the equipment is operated based on building type
Incremental Costs	See Table 20.3.4	Actual costs provided by vendor. Costs are re-evaluated throughout the year and updated to account for the evolving market.
Measure Life	See Table 20.3.4	Lifetime of commercial aerator and pre-rinse sprayer measures
Water Rate	\$3.44	\$/ 1000 Gallons
Sewer Rate	\$5.79	\$/ 1000 Gallons

Customer Inputs

M&V Verified

Quantity of Equipment	Yes
Building Type	Yes
Water Heating Fuel	Yes

Table 20.3.1

Equipment	Degrees F
Kitchen Aerator	125
Restroom Aerator	105
Pre-Rinse Sprayer	105
Showerhead	105

Table 20.3.2

Equipment	Baseline GPM	Proposed GPM	CF
Kitchen Aerator	2.2	1.5	1%
Restroom Aerator	2.2	0.6	1%
Pre-Rinse Sprayer	1.6	1.28	6%
Showerhead	2.5	1.5	6%

Table 20.3.3:

Building Type	Facility Days	Annual Gallons per Faucet	Runtime Hours (Hrs/Day)
Large Office	250	11,250	0.341
Fast Food Restaurant	365	9,581	0.199
Sit-Down Restaurant	365	15,768	0.327
Grocery Store	365	3,650	0.076
Elementary School	200	3,000	0.114
Jr/Sr High School or College	200	9,000	0.341
Healthcare	365	16,425	0.341
Hotel	365	1,278	0.027
Other Commercial	250	5,000	0.152
Average	303	8,328	0.213

* The following building types were considered not to apply to this measure: Small Office, Retail, Warehouse and Motel.

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Table 20.3.4

Equipment	Cost*	Lifetime
Kitchen Aerator	\$9.51	9
Restroom Aerator	\$9.49	9
Pre-Rinse Sprayer	\$39.50	5
Showerhead	\$14.00	10

* See note above on updating costs throughout the program year.

References:

1. Development of Standardized Deomestic Hot Water Event Schedules for Residential Buildings; R. Hendron and J. Burch; NREL/CP-550-40874
2. United States Department of Energy. DHW Event Schedule Generator. (365 day average water main temperature for Minneapolis-St Paul Intl AP, MN). http://energy.gov/eere/buildings/downloads/dhw-event-schedule-generator
3. DEER Database for Energy Efficient Resources version 2014; www.deeresources.com
4. St Paul 2015 Water Rate Schedule - http://mn-stpaul.civicplus.com/DocumentView.asp?DID=3493
5. Xcel Energy New Mexico Residential Shower Use Study
6. The Effect of Efficiency Standards on Water Use and Water Heating Energy Use in the U.S.: A Detailed End-use Treatment; J Koomey, C Dunham, J Lutz; LBL-35475
7. Residential Energy Consumption Survey 2009; http://www.eia.gov/consumption/residential/

Changes from Recent Filing:

Updated water & sewer rates

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

20.4 Heat Pump Water Heaters

Algorithms

$$Hot_Water_Energy = Qty \times Hot_Water_Consumption \times Water_Heater_Delta_T \times Days_Per_Year \times Water_Density$$

$$Water\ Heater\ Delta\ T = Water_Heater_Temperature - City_Mains_Temperature$$

Heat Pump Water Heater with Gas Water Heater Baseline:

$$Customer\ kWh = Zero$$

$$Customer\ PCKW = Zero$$

Note: Fuel Switching with HPWH will target predominant use of renewable energy. Therefore generator impact will be set to zero.

$$Customer_Dth = Baseline_Dth + Heating_Penalty_Dth$$

$$Baseline_Dth = Hot_Water_Energy / Baseline_Eff_Gas / 1,000,000$$

$$Heating_Penalty_Dth = -1 * (Hot\ Water\ Energy / Proposed_Eff) / Heating_Eff * Heating\ Hours / 8760 / 1,000,000$$

$$Baseline_Efficiency_Gas = coef1 - coef2 \times Baseline_Tank_Size$$

Heat Pump Water Heater with Electric Resistance Water Heater Baseline:

$$Customer\ kWh = Baseline_kWh - Proposed\ kWh + Cooling_Benefit\ kWh + Heating_Penalty\ kWh$$

$$Baseline_kWh = Hot_Water_Energy / Baseline_Eff_Electric / 3,412$$

$$Proposed_kWh = Hot_Water_Energy / Proposed_Eff / 3,412$$

$$Baseline_Eff_Electric = coef1 - (coef2 \times Baseline_Tank_Size)$$

$$Customer\ kW = Baseline_kW - Proposed_kW$$

$$Baseline_kW = Baseline_kWh / 8760 + Cooling_Benefit_kWh / Cooling_Hrs$$

$$Proposed_kW = Proposed_kWh / 8760$$

$$Customer_PCKW = Customer_kW \times Coincidence_Factor$$

$$Heating_Penalty_kWh = -1 * (Hot\ Water\ Energy / Proposed_Eff) / Heating_Eff * Heating\ Hours / 8760 / 3,412$$

$$Heating_Penalty_Dth = -1 * (Hot\ Water\ Energy / Proposed_Eff) / Heating_Eff * Heating\ Hours / 8760 / 1,000,000$$

$$Cooling_Benefit_kWh = (Hot\ Water\ Energy / Proposed_Eff) / (Cooling_SEER * 1000 / 3412) * Cooling_Hrs / 8760 / 3412$$

$$Heat\ Penalty\ Energy\ O\&M = Heating_Penalty_Dth * Heating\ Energy\ O\&M\ Rate$$

Variables

Hot_Water_Consumption	See Table 20.4.4	Gallons of Water per day based on number of Bedrooms and Home Type
Water_Heater_Temperature	120.0	Water Heater Tank Temperature
City_Mains_Temperature	51.4	Water Main temperature average over the year
Conversion from Btu to Dth	1,000,000	1 Dth = 1,000,000 Btuh
Conversion from Btu to Therm	100,000	1 Therm = 100,000 Btuh
Conversion from kW to Watts	1,000	1 kW = 1,000 Watts
Conversion from Btu to kWh	3,412	1 kW = 3,412 Btuh
Specific Heat of Water	1	Btu/lb/°F
Water_Density	8.34	lb/gal H2O
Days_Per_Year	365	Days per Year
Coef1	See Table 20.4.1 See Table 20.4.2	Code based formula for calculation of Baseline efficiency based on water heater type and draw pattern
Coef2	See Table 20.4.1 See Table 20.4.2	Code based formula for calculation of Baseline efficiency based on water heater type and draw pattern
Baseline_Tank_Size	See Table 20.4.2	Baseline Gas Water Heater Tank Size determined by customer provided First Hour Rating. Tank Size used in baseline efficiency equation.
Baseline_Tank_Size	See Table 20.4.3	Baseline Electric Resistance Water Heater Tank Size and Quantity determined by number of bedrooms. Tank Size used in baseline efficiency equation.
Gas Heating System Efficiency	78%	For homes with Gas heating systems the assumed efficiency for calculating HPWH O&M heating penalty
Air Source Heat Pump Heating System Efficiency	2.40	For homes with ASHP heating systems the assumed efficiency for calculating HPWH O&M kWh heating penalty in COP HSPF
Electric Resistance Heating Efficiency	100%	The assumed heating efficiency used for Heating Penalty calculations for homes with electric resistance heat.
Cooling System Efficiency	13.4	SEER of the typical home cooling system for calculating HPWH O&M Cooling benefit
Heating Energy O&M Rate	6.38	Cost per Dth for heating penalty due to heat pump water heater operating during heating season.
Coincidence_Factor	100%	We are using the average water heater savings over the summer hours. Coincidence factor becomes 100%
Hours per Year	8760	total hours in a year
Heating Hours	6154	Hours in the year at or below the heating enable temp of 62 F
Cooling Hours	957	Hours in the year at or above the cooling enable temp of 77 F
Water Heater Self-Installation Rate	52%	Percent of Water Heaters that self-installed after retail purchase (Reference 9)

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Customer Inputs	M&V Verified	
Number of Bedrooms	Yes	total number of bedrooms in the home where a new water heater is being installed
Proposed Eff	Yes	Proposed water heater AHRI Certified Uniform Energy Factor (UEF)
First Hour Rating	Yes	AHRI certified First Hour Rating in gallons per hour (GPH)
Quantity Proposed Equipment	Yes	
Proposed Tank Size	Yes	DOE Rated Storage Volume for tank type water heaters
Type of Proposed Water Heater	No	Type of proposed water heater. (i.e. Storage, Tankless, Heat Pump)
Water Heater Draw Pattern	No	Usage Bin identified on AHRI Certificate

Table 20.4.1 Gas Fired Storage Water Heater and Heat Pump Water Heater Baseline Efficiency Calculation Parameters (Reference 8)

Draw Pattern	First Hour Rating to Define Draw Pattern		Electric Storage Water Heater >=20 Gallon and <=55 Gallon Baseline Efficiency Coefficients		Gas Storage WH >=20 gallons and <=55 Gallons Baseline Efficiency Coefficients		Gas Storage WH >55 Gallons and <=100 gallons Baseline Efficiency Coefficients	
	min (>=Gallons)	max (< Gallons)	coef1	coef2	coef1	coef2	coef1	coef2
Very Small	1	18	0.8808	0.0008	0.3456	0.0020	0.6470	0.0006
Low	18	51	0.9254	0.0003	0.5982	0.0019	0.7689	0.0005
Medium	51	75	0.9307	0.0002	0.6483	0.0017	0.7897	0.0004
High	75	No Upper Limit	0.9349	0.0001	0.6920	0.0013	0.8072	0.0003

Table 20.4.2 Estimated Baseline Gas Storage Water Heater Tank Size

First Hour Draw		
Minimum (>=GPH)	Maximum (< GPH)	Baseline Tank Size
20	45	20
45	55	25
55	64	30
64	72	35
72	81	40
81	89	45
89	99	50
99	106	55
106	115	60
115	125	65
125	135	70
135	140	75
140	149	80
149	157	85
157	167	90
167	199	95

Table 20.4.3 2019 ASHRAE HVAC Applications Chapter 51 Service Water Heating: Table 4 HUD-FHA Minimum Water Heater Capacities for One- and Two-Family Living Units (Reference 12)

Water Heater Type \ Number of Bedrooms	1	2	3	4	5	6
Baseline Quantity Electric Storage Tanks	1	1	1	2	2	2
Baseline Tank Volume Electric Storage Tanks	30	40	55	30	30	40
Baseline Wattage per Electric Storage Tank	3.8	4.5	4.5	4.5	4.5	4.5

Table 20.4.4 Water Usage per Day by Number of Bedrooms

Home Type \ Number of Bedrooms	1	2	3	4	5	6
Single Family total HW usage per day	34	48	60	72	84	96
Multi-Family total HW usage per day	41	53	63	73	83	92

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

References:

1. Energy Conservation Program for Consumer Products: Test Procedure for Water Heaters; United States Department of Energy; <http://www.gpo.gov/fdsys/pkg/FR-1998-05-11/pdf/98-12296.pdf>
2. Denver Water's 2006 Treated Water Quality Summary Report; <http://www.denverwater.org/docs/assets/9A12FBC5-BCDF-1B42-D1BC5F0B1CE3B115/TreatedWQSummaryReport20061.pdf>
3. Energy Star Residential Water Heaters -Final Criterial Analysis, April 2008. http://www.energystar.gov/ia/partners/prod_development/new_specs/downloads/water_heaters/WaterHeaterAnalysis_Final.pdf
4. Not Used
5. US Department of Energy; Residential Heat Pump Water Heaters; <http://energy.gov/eere/femp/covered-product-category-residential-heat-pump-water-heaters>
6. US Department of Energy; Consumer Water Heaters; https://www1.eere.energy.gov/buildings/appliance_standards/standards.aspx?productid=32
7. Not Used
8. US Department of Energy, Energy and water conservation standards and their compliance dates: 10 CFR 430.32(d); https://www.ecfr.gov/cgi-bin/text-idx?SID=80dfa785ea350ebee184bb0ae03e7f0&mc=true&node=se10.3.430_132&rgn=div8
9. EnergyStar - http://aceee.org/sites/default/files/files/pdf/conferences/hwf/2016/Ryan_Session1C_HWF16_2.22.16_0.pdf
10. Equipment Manufacturer Retail Price Information Request (Q4 - 2017)
11. NREL - National Residential Efficiency Measure Database, <https://remdb.nrel.gov/measures.php?gld=6&ctld=270>
12. 2019 ASHRAE HVAC Applications manual Chapter 51 Service Water Heating
13. Florida Solar Energy Center paper "Estimating Daily Domestic Hot Water Use in North American Homes. <https://sec.ucf.edu/en/publications/pdf/FSEC-PF-464-15.pdf> Table 5 on Page 11.

Changes from Recent Filing:

Updated incremental costs

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

20.5 Water Heater Demand Response

Algorithms

$Customer\ kWh = HPWH\ Load\ Shifting\ \&\ DR\ kWh$

$Customer\ kW = HPWH_Load_Shift_DR_kW$

$Customer_PCKW = Customer_kW \times Coincidence_Factor$

Variables

HPWH Load Shifting & DR kWh Savings	118.400	kWh savings per year for daily load shifting in Residential Heat Pump WH Unit with a smart switch.
HPWH Load Shifting & DR PCKW @ Customer Savings	0.076	Peak Coincident kW savings per year for daily load shifting in Residential HPWH Unit with a smart switch (Reference 3).
HPWH_Load_Shift_DR_kW	0.536	kW savings of average residential HPWH Unit operating in HP only mode.
Coincidence_Factor	0.142	Coincidence Factor for DR or Load Shifting event of Heat Pump Water Heater.
Incremental Cost	\$0.00	There is no cost to the customer to enroll

Customer Inputs

M&V Verified

Quantity Proposed Equipment	Yes	quantity of controlled water heaters.

References:

1. Energy Conservation Program for Consumer Products: Test Procedure for Water Heaters; United States Department of Energy; <http://www.gpo.gov/fdsys/pkg/FR-1998-05-11/pdf/98-12296.pdf>
2. Denver Water's 2006 Treated Water Quality Summary Report; <http://www.denverwater.org/docs/assets/9A12FBC5-BCDF-1B42-D1BC5F0B1CE3B115/TreatedWQSummaryReport20061.pdf>
3. Energy Star Residential Water Heaters -Final Critical Analysis, April 2008. http://www.energystar.gov/ia/partners/prod_development/new_specs/downloads/water_heaters/WaterHeaterAnalysis_Final.pdf
4. Not Used
5. US Department of Energy; Residential Heat Pump Water Heaters; <http://energy.gov/eere/femp/covered-product-category-residential-heat-pump-water-heaters>
6. US Department of Energy; Consumer Water Heaters; https://www1.eere.energy.gov/buildings/appliance_standards/standards.aspx?productid=32
7. Not Used
8. US Department of Energy, Energy and water conservation standards and their compliance dates: 10 CFR 430.32(d); https://www.ecfr.gov/cgi-bin/text-idx?SID=80dfa785ea350eb003e7f0&mc=true&node=se10.3.430_132&rgn=div8
9. EnergyStar - http://aceee.org/sites/default/files/files/pdf/conferences/hwf/2016/Ryan_Session1C_HWF16_2.22.16_0.pdf
10. Equipment Manufacturer Retail Price Information Request (Q4 - 2017)
11. NREL - National Residential Efficiency Measure Database, <https://remdb.nrel.gov/measures.php?gld=6&ctld=270>
12. 2019 ASHRAE HVAC Applications manual Chapter 51 Service Water Heating
13. Florida Solar Energy Center paper "Estimating Daily Domestic Hot Water Use in North American Homes. <https://fsec.ucf.edu/en/publications/pdf/FSEC-PF-464-15.pdf> Table 5 on Page 11.

Changes from Recent Filing:

None

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

20.6 Water Heater Treatments

Algorithms

$$Customer_Dth_Water_Heater_Blanket = (WH_Tank_Size / 45) \times (HLF\ before - HLF\ with\ blanket) \times 8760 / HE_Gas / 1,000,000$$

$$Customer_kWh_Water_Heater_Blanket = (WH_Tank_Size / 45) \times (HLF\ before - HLF\ with\ blanket) \times 8760 / HE_Elec / 3412$$

$$Customer_kW_Water_Heater_Blanket = (WH_Tank_Size / 45) \times (HLF\ before - HLF\ with\ blanket) \times 8760 / HE_Elec / 3412 / Hr_WH_Operation$$

$$Customer_PCkWh_Water_Heater_Blanket = Customer_kW_Water_Heater_Blanket \times Coincidence\ Factor$$

$$Customer_Dth_Water_Heater_Setback = (WH_S_Baseline - WH_S_Proposed) / 10$$

Variables

WH_S_Baseline	26.2	Baseline gas water heater shell losses, Therms/year
WH_S_Proposed	22.4	Proposed gas water heater shell losses, with -10 F adjustment of setpoint, Therms/year
HE_Elec	1.0	Heat generation efficiency for electric water heater based on steady-state water heater efficiency.
HE_Gas	0.8	Heat generation efficiency for gas water heater based on steady-state water heater efficiency.
HLF_Before	236.86	Heat loss in BTU/hr based on a 45 gallon average of water heater sizes with 2" of polyurethane insulation at 135 F degrees.
HLF_with_blanket	138	Heat loss in BTU/hr based on a 45 gallon average of water heater sizes with 2" of polyurethane insulation at 135 F degrees plus an additional 2.5" fiberglass blanket.
Coincidence_Factor	100%	Coincidence Factor for water heater treatments is 100% because the kW is based on the average water heater savings over all annual hours.
Hr_WH_Operation	8760	Annual Water Heater available operating hours
Measure Life	7.5	Water Heater Blanket measure life
Measure Life	8	Water Heater Setback measure life

Customer Inputs

M&V Verified

Quantity Proposed Equipment	Yes	
Type of Water Heater	Yes	Type of water heater, i.e. Gas or Electric Resistance
WH Tank Size	Yes	Tank Size of customer's Water Heater

*For Income Qualified SF Weatherization Program, WH Tank Size is assumed to be 40 gallons.

Table 20.6.1: Inc Costs for Various Program Water Heater Treatments

Heater Treatments	Incremental Cost
IQ Single Family Weatherization Water Heater Blanket direct install	\$ 75.00
Home Energy Squad Water Heater Blanket	\$ 12.00
Home Energy Squad Water Heater Temperature Setback	\$ -

References:

None

Changes from Recent Filing:

None

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

21.1 Residential Codes & Standards

Algorithms

Customer kW =

$$\sum_0^{8760} \sum_{Foundation Type} ((Single\ Family\ Previous\ Code\ kW_{Foundation\ Type,hr} - Single\ Family\ New\ Code\ kW_{Foundation\ Type,hr}) * \% \text{ Foundation Type}) / \% \text{ Gas Furnace}$$

Customer Coincident kW = average (Customer kW at 16:00 or 17:00)

Variables

Customer kWh	477	Value for annual electric savings for each customer in the 2023 Program Year (References 1,2) Description 21.1.1
Customer DTh	3.0	Value for annual gas savings for each customer in the 2023 Program Year (References 1, 2) Description 21.1.1
Construction Adjustment Factor	Description 21.1.4	An adjustment factor applied to program unit participation. For 2023, the residential Construction Adjustment Factor will be the ratio of actual to forecasted permitted units as of October 1 based on jurisdictional census data. (References 1, 3) Description 21.1.4
Compliance Rate	Table 21.1.1	Assumed compliance rate for each year after a new code is adopted. This value is included in the NTG for this measure. (Reference 2)
Annual Utility Attribution	Table 21.1.3	24% This value is included in the NTG for this measure (Reference 1)
Single Family Previous Code kW	Description 21.5	Previous code kW for a single family home for each hour of each day for a year (Reference 1)
Single Family New Code kW	Description 21.5	New code kW for a single family home for each hour of each day for a year (Reference 1)
Lifetime	20	Measure Lifetime.
Incremental Cost	\$0.00	Difference in cost between the baseline product and the more efficient product.

Customer Inputs

M&V Verified

None	
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Table 21.1.1 Compliance Rates By Number of Years Since Code Adoption

Program Year	Compliance Rate	Range from Other Utilities
Year 1	55%	50% (AZ) - 80% (MA)
Year 2	65%	
Year 3	75%	
Year 4 and Beyond	85%	83% (MA) - 100% (AZ)

Table 21.1.2 Assumed Code Adoption Schedule By County Group

Group	Current IECC Code	Program Year 3 (2023)
1	2015	2015
2	2006	2015*
3	2015	2015
4	2015*	2015
5	2015*	2015
6	None/2006	2015*
7	2009	2015*
8	2012	2018*
9	2018	2018
10	2018*	2018
11	2015	2018*
12	2021*	2021
13	2018	2021*
14	2018	2018
15	2018	2018

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Table 21.1.3 Code Compliance Activities in Colorado & Xcel Energy Proportion

Activity/Budget Item	Colorado Energy Office	SWEEP	Xcel Energy	Portion Attributable to Xcel Energy
Total Budget(\$)	\$80,000	\$30,000	\$47,000	30%
In-person trainings, university training, lunch and learns	20	1	29	58%
Webinars	10	4	12	46%
Code tools, videos, and other training materials	30	20	5	9%
Committed jurisdiction assistance (hours)	146	Engaged	0	0%
Collaborative work (hours)	0	20	0	0%
Total				24%

Description 21.1.1 Program Gross Potential Annual Therms/Program Gross Potential Annual kWh

Gross potential savings was calculated by comparing the difference between a building's energy use intensity (EUI) that just meets a jurisdiction's current energy code and a building's EUI that just meets the previous code. The gross potential savings calculation assumes that all buildings are 100% compliant with code and that there is no over- or under-performance of buildings relative to code, which prevents double counting of savings relative to new construction programs. EUI data was obtained from the Pacific Northwest National Laboratory (PNNL) Residential Prototype Building Models (https://www.energycodes.gov/development/residential/iecc_models) for single family detached houses and multifamily low-rise detached apartment buildings in ASHRAE climate zones 5B and 6B for for 2006 IECC, 2009 IECC, 2012 IEC, 2015 IECC, and 2018 IECC. For the purposes of this analysis, Xcel Energy assumed a conservative assumption of 8% improvement for residential 2021 IECC. See Reference 2 Appendix E page E-4.

As Colorado is a home rule state where each jurisdiction can adopt its own code, Xcel Energy utilized Arizona's approach of calculating gross potential savings at the jurisdiction level (Navigant Consulting. "APS MER Verification Report: Program Year 2013." February 28, 2014). For the purposes of this analysis, Xcel Energy performed the analysis for all counties within Xcel Energy's Colorado territory, aggregated into 15 groups. (Refer to Table 21.4.) The savings calculated for each group was adjusted to account for the energy supply mix (e.g., gas only, electricity only, or gas and electricity) in each group, as defined in Xcel Energy's 2019 list of communities served (<https://www.xcelenergy.com/staticfiles/xe-responsive/Energy%20Portfolio/Colorado-Communities-Served-Information-Sheet.pdf>). The methodology for how the groups were determined, as well as additional details on the energy supply mix in each, is explained in detail in Reference 2, refer to Appendix E pages E-1 through E-3 and the end result is shown in Table 2. Definition of County Groups (Appendix E page E-2) and Table 3. Energy Supply Mix by County Group (Appendix E page E-3).

Xcel Energy created a code adoption schedule for each jurisdiction for each year of the program, as show in Reference 2, Table 1.4 Assumed Code Adoption Schedule By County Group (See Appendix E PAGE E-7 OF REPORT APPENDICES) of this workbook. This was created through investigating the code adoption schedule of the jurisdictions within Xcel Energy's service territory and with stakeholder feedback received in the interviews and discussed in Chapter 4.2 of the report (reference 2) page 39. The details supporting the assumptions are discussed in Reference 2, Appendix E pages E-5 and E-6.

Savings were calculated for each year of the program using the EUI for each building type within each county group and the code adoption schedule. For example, in Program Year 1, for Group 1, the previous code EUI was derived from 2006 IECC, and the current code EUI used 2009 IECC. For Program Year 2, the previous code EUI was derived from 2009 IECC, and the current code EUI used 2015 IECC. For these calculations, codes are assumed to be effective at the start of the calendar year. To calculate savings, the EUI is multiplied by the total square footage of residential new construction in a jurisdiction. Historical construction square footage was obtained from the Census Building Permit Survey and from the Census Survey of Construction for the residential sector. Detailed information, data sources, and assumptions for construction data is discussed in the gross potential savings section of the Reference #2 report (Chapter 4.2 pages 40-41) and Appendix E pages E-7 through E-11.

Description 21.1.2 Compliance Rate

The gross potential savings assumes buildings are 100% compliant with code. However, in practice, not all buildings are 100% compliant with code. While compliance snapshots have been conducted in Colorado in the past, these did not provide an estimate of broad compliance rates. The city of Ft. Collins conducted a compliance study through City Energy Project, Institute for Market Transformation, and Natural Resources Defense Council for projects permitted to the 2015 IECC code. While the report was not publicly available, a presentation by the city indicated compliance ranged from 64%–75% (https://www.energycodes.gov/sites/default/files/documents/NECC2018_07_Smith.pdf). Since compliance data specific to Colorado was not found, estimates of compliance from other regions at various points throughout a code cycle were used to estimate compliance for Xcel Energy's Colorado territory. Given the range of compliance values found in other states (Table 10. Compliance Rate Estimates and Sources in Reference 2 - Appendix E page E-14), the fact that other utilities' programs are well established, the Ft. Collins study found compliance rates of 64%–75%, and the other home rule state (AZ) assumes a low initial compliance rate of 50%, the compliance rates outlined in Reference 2 -Table 1.3 Compliance Rates By Number of Years Since Code Adoption (See CHAPTER 4.3 AND PAGE 42 OF REPORT) were utilized. The program design includes a compliance study in year 1 to determine actual compliance rates specific to Xcel Energy's service territory.

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Description 21.1.3 Annual Utility Attribution

Attribution refers to the portion of code savings that can be credited to the utility's program efforts for increasing code compliance or assisting with the adoption of codes and standards (Cadmus. "California Statewide Codes and Standards Program Impact Evaluation Phase Two Volume Two: 2013 T24." June 23, 2017). Xcel Energy already supports the code compliance market in Colorado through trainings, lunch and learns, webinars, videos, and training materials. To capture the influence of these activities, Xcel Energy gathered detailed information on activities performed by Xcel Energy and other key market actors within the state, namely the Colorado Energy Office and SWEEP, as shown in Table 21.1.5 Code Compliance Activities in Colorado & Xcel Energy Proportion (See CHAPTER 4.3 PAGE 44 OF REPORT) in this workbook. Additional details regarding the information collected is available in the section "Attribution & Claimable Savings" of the Reference #2 report page 42-44. Xcel Energy then determined the proportion of each activity Xcel Energy was responsible for relative to other actors, and took an unweighted average of these activities to determine the total proportion of code activities for which Xcel Energy is currently responsible, which is shown in Reference #2 - Table 1.5 Code Compliance Activities in Colorado & Xcel Energy Proportion (See CHAPTER 4.3 PAGE 44 OF REPORT). Due to the construction lag discussed in Reference #2 - Chapter 4.2 page 40, the activities conducted now will result in savings in 2021 and 2022 for the commercial program. Thus, the attribution of 19% was used in the analysis for the 2021 and 2022 program years.

The program activities were designed specifically to meet current market gaps and complement and build upon existing support activities. When the program is launched in 2021, savings from the new program activities would be realized starting in 2023. States with published attribution rates include Arizona, Massachusetts, Rhode Island, and Illinois. Their attribution rates range from 33%–46%.

Description 21.1.4 Construction Adjustment Factor

To estimate future construction growth or contraction, several sources that regularly evaluated construction data were used, all which suggested construction starts will experience a downturn in 2020 and beyond due to existing construction trends and the COVID-19 pandemic (<https://www.ecmweb.com/construction/article/21119974/2020-construction-outlook>, <https://www.aia.org/articles/6096562-though-signs-point-to-a-slowdown-growth-in>, <https://www.construction.com/news/Construction-Starts-Slip-back-2020-Dodge-Data-Analytics>). Therefore, the calculation assumed a contraction of -1%.

Given actual construction starts may differ from the forecast, the Construction Adjustment Factor will be applied to account for differences between anticipated and observed construction activity.

Description 21.1.5 Previous and new code kW

The hourly meter outputs from PNNL's 2015 IECC and the 2018 IECC Prototype models (https://www.energycodes.gov/development/residential/iecc_models). The PNNL models use TMY3 data as an input in their modeling (<https://www.nrel.gov/docs/fy08osti/43156.pdf>). As TMY3 uses 30-year historical averages to create hourly weather data, it is not possible to create weekday and weekend profiles because the data is not specific to a calendar year or day of week.

References:

1. Modeled hourly outputs obtained from 1. Detailed reporting of methodology and assumptions available from PNNL: https://www.energycodes.gov/sites/default/files/documents/2015_IECC_Commercial_Analysis.pdf
2. 2020 Codes & Standards report authored by TRC (formerly EMI).
3. 2021 Census Permit Data

Changes from Recent Filing:

Customer kWh and Customer Dth have been revised to reflect the Code Adoption schedule for Program Year 3 (2023).

Program	Measure Group	Measure Lifetime (years)	Rebate Amount (\$)	Incremental Cost (\$)	Annual Customer kWh Savings (kWh/yr)	Annual Customer Peak Coincident Demand Savings (PCKW)	Gas Savings (Dth)	Non-Energy O&M Savings (\$)	Electric NTG (%)	Gas NTG (%)	Install Rate (%)	2023 Electric Units	2023 Gas Units
Business Energy Assessments - CO	Behavioral Commercial	1	\$0	\$0	0	0.000	0.0	\$0.00	100%	100%	100%	0	0
Business Energy Assessments - CO	Custom BEA Commercial Project	17	\$7,754	\$34,851	101,300	19,617	0.0	\$0.00	100%	100%	100%	4	0
Business Energy Assessments - CO	BEA Prescriptive	15	\$4,248	\$19,988	65,803	7,871	24.8	-\$108.82	100%	100%	100%	122	4
Business Energy Assessments - CO	BEA Assessment	1	\$6,154	\$8,462	0	0.000	0.0	\$0.00	100%	100%	100%	52	4
Business Energy Assessments - CO	Building Operator Certification	5	\$500	\$1,619	48,288	2,977	30.0	\$0.00	100%	100%	100%	30	16
Business Energy Assessments - CO	Streamlined/Building Assessment RCx Implementation	7	\$69	\$5,639	66,768	13,212	26.9	\$215.83	100%	100%	100%	20	2
Business Energy Assessments - CO	Targeted Building Assessment RCx Implementation	7	\$275	\$22,558	267,073	52,847	107.5	\$863.33	100%	100%	100%	2	0
Business Energy Assessments - CO	CO - Small Building Tune-Up Study - E/G	1	\$1,099	\$2,306	0	0.000	0.0	\$0.00	100%	100%	100%	10	0
Business Energy Assessments - CO	CO - Small Building Tune-Up Measure - E/G	7	\$0	\$0	50,394	0.000	0.0	-\$51.18	100%	100%	100%	10	0
Business New Construction - CO	EDA	20	\$26,977	\$166,229	303,857	82,696	611.6	\$4,691.92	86%	86%	100%	90	68
Business New Construction - CO	EEB	19	\$8,219	\$26,617	51,633	12,279	74.5	-\$209.17	86%	86%	100%	154	111
Business New Construction - CO	Lighting NC LPD	14	\$3,947	\$10,744	35,814	7,081	0.0	-\$16.97	95%	95%	100%	110	0
Business New Construction - CO	Code Compliance - 2021	1	\$0	\$0	0	0.000	0.0	\$0.00	100%	100%	100%	0	0
Business New Construction - CO	AC Rewards - Business	10	\$35	\$35	534	0.000	1.5	\$0.00	86%	86%	100%	15	5
Commercial Building Controls - CO	AC Rewards - Business	10	\$129	\$129	242	1,039	0.9	\$0.00	100%	100%	100%	2,220	0
Compressed Air - CO	ECO	5	\$0	\$499	24,978	3,116	0.0	\$0.00	89%	89%	100%	3	0
Compressed Air - CO	Supply Side Study	5	\$4,767	\$6,909	34,543	5,210	0.0	\$0.00	89%	89%	100%	40	0
Compressed Air - CO	Cycling Dryers	20	\$768	\$1,437	16,026	1,498	0.0	\$0.00	90%	90%	100%	18	0
Compressed Air - CO	Dryer Purge Demand Controls	20	\$1,673	\$3,265	46,498	4,483	0.0	\$0.00	90%	90%	100%	3	0
Compressed Air - CO	Mist Eliminators	11	\$1,163	\$3,148	10,634	1,371	0.0	\$303.00	90%	90%	100%	6	0
Compressed Air - CO	No Air Loss Drain	13	\$200	\$323	3,848	0.511	0.0	\$0.00	90%	90%	100%	43	0
Compressed Air - CO	New VFD Compressor	20	\$3,837	\$5,238	19,866	4,299	0.0	\$0.00	90%	90%	100%	69	0
Compressed Air - CO	Custom Compressed Air Project	19	\$6,612	\$26,862	73,895	11,365	0.0	\$0.00	90%	90%	100%	32	0
Critical Peak Pricing - CO	Critical Peak Pricing	1	\$0	\$0	22,256	585,697	0.0	\$0.00	100%	100%	100%	54	0
Custom Efficiency - CO	Custom Electric Project	18	\$9,478	\$364,989	156,422	27,113	0.0	\$27,620.57	87%	87%	100%	35	0
Custom Efficiency - CO	Custom Custom Project	17	\$3,808	\$39,849	0	0.000	952.1	\$238.58	87%	87%	100%	0	8
Custom Efficiency - CO	Custom Electric Engineering Study	1	\$10,935	\$18,598	0	0.000	0.0	\$0.00	100%	100%	100%	1	0
Custom Efficiency - CO	Custom Gas Engineering Study	1	\$11,682	\$27,792	0	0.000	0.0	\$0.00	100%	100%	100%	0	1
Data Center Efficiency - CO	EDA	20	\$677,649	\$1,464,186	6,906,450	1261,900	0.0	\$0.00	100%	100%	100%	2	0
Data Center Efficiency - CO	Computer VDI	10	\$10	\$117	723	0.097	0.0	\$305.00	80%	80%	100%	2	0
Data Center Efficiency - CO	High Efficiency Servers	5	\$15	\$40	1,192	0.145	0.0	\$0.00	80%	80%	100%	2	0
Data Center Efficiency - CO	Data Center Implementation	15	\$48,531	\$377,294	971,980	89,415	0.0	\$0.00	81%	81%	100%	5	0
Data Center Efficiency - CO	Data Center Prescriptive Project- Study Identified	1	\$0	\$0	0	0.000	0.0	\$0.00	100%	100%	100%	0	0
Data Center Efficiency - CO	Data Center Prescriptive Project - Site Visit Identified	18	\$20,345	\$60,133	324,716	20,597	0.0	\$0.00	80%	80%	100%	3	0
Data Center Efficiency - CO	Data Center Prescriptive Project - Customer Identified	17	\$8,476	\$30,433	293,851	18,609	0.0	-\$258.81	45%	45%	100%	3	0
Data Center Efficiency - CO	CRAC Units	20	\$1,274	\$9,317	20,031	2,499	0.0	\$0.00	45%	45%	100%	4	0
Data Center Efficiency - CO	Plate & Frame Heat Exchangers - Study Identified	1	\$0	\$0	0	0.000	0.0	\$0.00	100%	100%	100%	0	0
Data Center Efficiency - CO	Plate & Frame Heat Exchangers - Site Visit Identified	1	\$0	\$0	0	0.000	0.0	\$0.00	100%	100%	100%	0	0
Data Center Efficiency - CO	Plate & Frame Heat Exchangers - Customer Identified	20	\$10,600	\$65,571	180,351	0.000	0.0	\$0.00	45%	45%	100%	1	0
Data Center Efficiency - CO	CO - Data Center Eff Study	1	\$7,000	\$9,333	0	0.000	0.0	\$0.00	100%	100%	100%	2	0
Electric Vehicle Optimization - CO	Dynamic Optimization	1	\$115	\$0	0	0.574	0.0	\$0.00	100%	100%	100%	1,000	0
Electric Vehicle Optimization - CO	Static Optimization	1	\$50	\$0	0	0.827	0.0	\$0.00	100%	100%	100%	3,400	0
Energy Efficient Showerhead - CO	Aerators - EWH	10	\$1	\$1	60	0.008	0.0	\$4.10	94%	94%	32%	5,333	0
Energy Efficient Showerhead - CO	Aerators - GWH	10	\$1	\$1	0	0.000	0.3	\$4.11	94%	94%	32%	0	48,692
Energy Efficient Showerhead - CO	Showerheads - EWH	10	\$3	\$4	439	0.032	0.0	\$30.96	94%	94%	72%	3,420	0
Energy Efficient Showerhead - CO	Showerheads - GWH	10	\$3	\$4	0	0.000	1.9	\$30.78	94%	94%	71%	0	31,755
Energy Management Systems - CO	Energy Management Systems Custom Project	15	\$56,395	\$171,340	403,756	57,535	497.3	\$4,228.64	87%	87%	100%	5	3
Energy Management Systems - CO	Energy Management Systems Load Shift Project	5	\$0	\$0	20,857	20,000	0.0	\$0.00	100%	100%	100%	5	0
Energy Savings Kits - CO	Home Lighting DI	15	\$7	\$7	252	0.032	0.0	\$0.00	100%	100%	78%	10,000	0
Energy Savings Kits - CO	Home Lighting - Direct Install	1	\$2	\$2	30	0.000	0.0	\$0.00	100%	100%	78%	8,000	0
Energy Savings Kits - CO	Aerators - EWH	10	\$2	\$2	60	0.008	0.0	\$4.04	100%	100%	66%	1,000	0
Energy Savings Kits - CO	Aerators - GWH	10	\$2	\$2	0	0.000	0.3	\$4.04	100%	100%	66%	0	39,000
Energy Savings Kits - CO	Showerheads - EWH	10	\$4	\$4	475	0.034	0.0	\$33.44	100%	100%	70%	505	0
Energy Savings Kits - CO	Showerheads - GWH	10	\$4	\$4	0	0.000	1.9	\$30.56	100%	100%	70%	0	19,500
Energy Star New Homes - CO	Builder Incentive	1	\$100	\$0	0	0.000	0.0	\$0.00	73%	73%	100%	1,500	1,500
Energy Star New Homes - CO	ENERGY STAR Clothes Washer	11	\$40	\$120	68	0.010	3.1	\$12.53	73%	73%	100%	733	733
Energy Star New Homes - CO	ENERGY STAR Radon Fan	10	\$20	-\$4	319	0.036	0.0	\$0.00	73%	73%	100%	15	0
Energy Star New Homes - CO	IECC 2012 - IECC 2015	20	\$460	\$3,463	1,345	0.278	21.1	\$0.00	73%	73%	100%	2,129	3,720
Energy Star New Homes - CO	IECC 2015	20	\$2,991	\$7,788	6,522	2,288	0.0	\$0.00	73%	73%	100%	22	0
Energy Star New Homes - CO	IECC 2018	20	\$481	\$2,488	1,029	0.258	19.8	\$0.00	73%	73%	100%	1,527	2,629
Energy Star New Homes - CO	IECC 2021	20	\$626	\$3,517	1,023	0.324	22.7	\$0.00	73%	73%	100%	861	1,707
Energy Star New Homes - CO	Marshall Fires Recovery	1	\$8,882	\$0	0	0.000	0.0	\$0.00	73%	73%	100%	209	186
Energy Star New Homes - CO	Rater Incentive	1	\$106	\$0	0	0.000	0.0	\$0.00	73%	73%	100%	5,202	9,216
Energy Star New Homes - CO	Codes & Standards	20	\$0	\$0	477	0.455	3.0	\$0.00	30%	30%	100%	6,242	14,565
Energy Star New Homes - CO	Energy Star Smart Thermostat	10	\$50	\$215	68	0.102	7.7	\$0.00	73%	73%	100%	557	1,114
Energy Star New Homes - CO	Heat Pump Water Heater	12	\$649	\$3,110	2,668	0.363	0.0	-\$1.51	73%	73%	100%	69	0
EV Critical Peak Pricing - CO	Electric Vehicle Critical Peak Pricing	1	\$0	\$0	0	4.296	0.0	\$0.00	100%	100%	100%	235	0
Geotargeting - DR - CO	Battery - DR	10	\$1,250	\$0	-60	1.488	0.0	\$0.00	100%	100%	100%	37	0
Geotargeting - DR - CO	Residential AC Switch	15	\$0	\$0	9	1.200	0.0	\$0.00	100%	100%	100%	75	0
Geotargeting - DR - CO	AC Rewards-DR	5	\$83	\$0	4	1.031	0.0	\$0.00	100%	100%	100%	1,625	0
Geotargeting - EE - CO	Standard Efficiency AC with QI	18	\$100	\$0	251	0.527	0.0	\$0.00	68%	68%	100%	20	0
Geotargeting - EE - CO	High Efficiency AC with QI	18	\$100	\$0	504	0.768	0.0	\$0.00	68%	68%	100%	20	0
Geotargeting - EE - CO	Standard Efficiency AC with QI and associated furnace	18	\$100	\$0	250	0.492	4.8	\$0.00	68%	68%	100%	20	0

Program	Measure Group	Measure Lifetime (years)	Rebate Amount (\$)	Incremental Cost (\$)	Annual Customer kWh Savings (kWh/yr)	Annual Customer Peak Coincident Demand Savings (PCKW)	Gas Savings (Dth)	Non-Energy O&M Savings (\$)	Electric NTG (%)	Gas NTG (%)	Install Rate (%)	2023 Electric Units	2023 Gas Units
Geotargeting - EE - CO	High Efficiency AC without Qi and associated furnace	18	\$100	\$0	169	0.208	0.0	\$0.00	68%	68%	100%	20	0
Geotargeting - EE - CO	Quality Install of High Efficiency AC with associated furnace	18	\$100	\$0	179	0.372	4.8	\$0.00	68%	68%	100%	20	0
Geotargeting - EE - CO	High Efficiency Dual Fuel ASHP with Qi and associated furnace	18	\$100	\$0	502	0.688	38.8	\$0.00	68%	68%	100%	5	0
Geotargeting - EE - CO	High Efficiency ASHP and Electric Resistance Heat Backup with Qi	18	\$100	\$0	5,462	0.450	0.0	\$0.00	68%	68%	100%	5	0
Home Energy Insights - CO	Behavioral Residential	1	\$0	\$0	88	0.017	0.4	\$0.00	100%	100%	100%	578,581	578,581
Home Energy Insights - CO	Behavioral Adjustment	1	\$0	\$0	-59	-0.012	-0.3	\$0.00	100%	100%	100%	578,581	578,581
Home Energy Insights - CO	High Bill Alerts	1	\$0	\$0	28	0.000	0.4	\$0.00	100%	100%	100%	150,000	150,000
Home Energy Squad - CO	Advanced Power Strip	7	\$10	\$10	103	0.012	0.0	\$0.00	100%	100%	100%	50	0
Home Energy Squad - CO	Weatherstripping - Electric Heating and Cooling	10	\$6	\$9	221	0.020	0.0	\$0.00	100%	100%	100%	35	0
Home Energy Squad - CO	Weatherstripping - Electric Heating Only	10	\$8	\$9	209	0.000	0.0	\$0.00	100%	100%	100%	62	0
Home Energy Squad - CO	Weatherstripping - Gas Heating / Electric Cooling	10	\$8	\$9	12	0.020	1.6	\$0.00	100%	100%	100%	2,303	2,402
Home Energy Squad - CO	Weatherstripping - Gas Heating Only	10	\$8	\$9	0	0.000	1.6	\$0.00	100%	100%	100%	0	698
Home Energy Squad - CO	Trip Charge	1	\$0	\$50	0	0.000	0.0	\$0.00	100%	100%	100%	3,480	0
Home Energy Squad - CO	Home Lighting - Direct Install	12	\$3	\$3	32	0.004	0.0	\$0.00	100%	100%	100%	141,108	0
Home Energy Squad - CO	ALC Energy Star Smart Thermostat	10	\$0	\$266	129	0.195	0.7	\$0.00	100%	100%	100%	20	22
Home Energy Squad - CO	Smart Thermostat Optimization	1	\$0	\$0	45	0.054	0.0	\$0.00	100%	100%	100%	528	0
Home Energy Squad - CO	AC Rewards-EE	10	\$192	\$192	142	0.215	8.1	\$0.00	100%	100%	100%	600	600
Home Energy Squad - CO	Energy Star Smart Thermostat	10	\$125	\$125	0	0.000	8.1	\$0.00	100%	100%	100%	0	20
Home Energy Squad - CO	Programmable Thermostat	10	\$0	\$16	144	0.112	10.2	\$0.00	100%	100%	100%	645	645
Home Energy Squad - CO	Aerators - EWH	10	\$1	\$1	60	0.009	0.0	\$4.17	100%	100%	100%	230	0
Home Energy Squad - CO	Aerators - GWH	10	\$1	\$1	0	0.000	0.3	\$4.24	100%	100%	100%	0	2,245
Home Energy Squad - CO	Showerheads - EWH	10	\$3	\$3	476	0.035	0.0	\$33.50	100%	100%	100%	235	0
Home Energy Squad - CO	Showerheads - GWH	10	\$3	\$3	0	0.000	2.0	\$33.50	100%	100%	100%	0	1,600
Home Energy Squad - CO	Water Heater Setback	8	\$0	\$0	0	0.000	0.4	\$0.00	100%	100%	100%	0	135
Home Energy Squad - CO	Water Heater Blanket Electric	8	\$12	\$12	254	0.029	0.0	\$0.00	100%	100%	100%	1	0
Home Energy Squad - CO	Water Heater Blanket Gas	8	\$12	\$12	0	0.000	1.1	\$0.00	100%	100%	100%	0	1
Home Lighting - CO	Home Lighting - Business Customers	7	\$2	\$6	114	0.018	0.0	\$0.00	70%	70%	99%	224,808	0
Home Lighting - CO	Home Lighting - Residential Customers	15	\$2	\$3	31	0.005	0.0	\$0.00	54%	54%	99%	1,100,322	0
HVAC+R Systems - CO	Food Service	12	\$550	\$3,174	0	0.000	134.2	\$0.00	100%	100%	100%	0	10
HVAC+R Systems - CO	Ozone Laundry	1	\$0	\$0	0	0.000	0.0	\$0.00	100%	100%	100%	0	0
HVAC+R Systems - CO	Steam Cooker	12	\$430	\$2,270	0	0.000	511.1	\$718.99	100%	100%	100%	0	12
HVAC+R Systems - CO	Custom Cooling Project	19	\$26,286	\$78,509	101,583	54.853	0.0	-\$1,560.43	87%	87%	100%	3	0
HVAC+R Systems - CO	Custom Heating Project	17	\$3,808	\$39,849	0	0.000	952.1	\$238.58	87%	87%	100%	0	4
HVAC+R Systems - CO	Custom Motors Project	16	\$37,881	\$161,177	487,067	71.041	0.0	\$880.50	87%	87%	100%	3	0
HVAC+R Systems - CO	DX Units < 5.4 Tons	20	\$0	\$369	383	0.276	0.0	\$0.00	89%	89%	100%	480	0
HVAC+R Systems - CO	DX Units 5.5 - 11.3 Tons	20	\$0	\$785	1,971	0.985	0.0	\$0.00	89%	89%	100%	511	0
HVAC+R Systems - CO	DX Units 11.4 - 19.9 Tons	20	\$0	\$2,175	1,952	1.608	0.0	\$0.00	89%	89%	100%	291	0
HVAC+R Systems - CO	DX Units 20 - 63.3 Tons	20	\$0	\$1,352	4,277	3.275	0.0	\$0.00	89%	89%	100%	143	0
HVAC+R Systems - CO	DX Units > 63.3 Tons	20	\$0	\$24,840	26,690	12.136	0.0	\$0.00	89%	89%	100%	2	0
HVAC+R Systems - CO	Water-source Heat Pumps	15	\$0	\$390	314	0.303	0.0	\$0.00	89%	89%	100%	1,092	0
HVAC+R Systems - CO	PTAC	20	\$0	\$238	422	0.448	0.0	\$0.00	89%	89%	100%	3,007	0
HVAC+R Systems - CO	Air-Cooled Chillers	20	\$0	\$20,033	54,186	16.423	0.0	\$0.00	89%	89%	100%	53	0
HVAC+R Systems - CO	Screw/Scroll Chillers	20	\$7,523	\$11,545	48,545	12.437	0.0	\$0.00	71%	71%	100%	9	0
HVAC+R Systems - CO	Centrifugal Chillers	20	\$21,433	\$25,635	169,102	34.493	0.0	\$0.00	71%	71%	100%	16	0
HVAC+R Systems - CO	VFD Chiller Retrofit	1	\$0	\$0	0	0.000	0.0	\$0.00	100%	100%	100%	0	0
HVAC+R Systems - CO	DEPACC	20	\$14,754	\$29,824	27,524	60.338	0.0	-\$164.01	71%	71%	100%	63	0
HVAC+R Systems - CO	Mini-Split Air Conditioning - MS	18	\$138	\$368	3,808	0.699	0.0	\$0.00	89%	89%	100%	759	0
HVAC+R Systems - CO	Mini-Split Heat Pump - MS	18	\$148	\$372	1,159	1.401	0.0	\$0.00	89%	89%	100%	570	0
HVAC+R Systems - CO	Boiler	20	\$1,197	\$5,084	0	0.000	110.5	\$0.00	86%	86%	100%	0	31
HVAC+R Systems - CO	Unit Heater	20	\$70	\$227	0	0.000	19.4	\$0.00	86%	86%	100%	0	22
HVAC+R Systems - CO	Unit Heater Infrared	15	\$350	\$144	1,541	0.000	65.6	\$0.00	100%	100%	100%	0	45
HVAC+R Systems - CO	Boiler Controls	20	\$200	\$823	0	0.000	9.0	\$0.00	100%	100%	100%	0	1
HVAC+R Systems - CO	Steam Traps	1	\$0	\$0	0	0.000	0.0	\$0.00	100%	100%	100%	0	0
HVAC+R Systems - CO	Pipe Insulation	13	\$2,751	\$2,734	0	0.000	100.4	\$0.00	86%	86%	100%	0	22
HVAC+R Systems - CO	Water Heater	16	\$783	\$1,144	0	0.000	46.8	\$0.00	86%	86%	100%	0	14
HVAC+R Systems - CO	Destratification Fans	15	\$2,000	\$7,320	0	0.000	87.8	\$0.00	86%	86%	100%	0	2
HVAC+R Systems - CO	Pipe Insulation - Direct Install	13	\$803	\$803	0	0.000	100.4	\$0.00	86%	86%	100%	0	22
HVAC+R Systems - CO	Motors	1	\$0	\$0	0	0.000	0.0	\$0.00	100%	100%	100%	0	0
HVAC+R Systems - CO	VFDs	15	\$2,764	\$5,704	27,533	4.116	0.0	\$0.00	81%	81%	100%	406	0
HVAC+R Systems - CO	Well Pump VFD	15	\$1,273	\$6,548	51,202	6.808	0.0	\$0.00	81%	81%	100%	16	0
HVAC+R Systems - CO	Fan Efficiency (FEI)	16	\$1,850	\$3,163	19,722	2.877	0.0	\$0.00	81%	81%	100%	192	0
HVAC+R Systems - CO	Refrigeration Fans	15	\$55	\$193	611	0.070	0.0	\$0.00	100%	100%	100%	100	0
HVAC+R Systems - CO	Fractional HP Circ. Pumps	15	\$75	\$187	3,081	0.550	0.0	\$0.00	81%	81%	100%	10	0
HVAC+R Systems - CO	Fractional HP Fan Motors	15	\$75	\$187	523	0.221	0.0	\$0.00	81%	81%	100%	10	0
HVAC+R Systems - CO	Pump Efficiency (PEI)	16	\$2,502	\$4,226	50,959	9.291	0.0	\$0.00	81%	81%	100%	238	0
HVAC+R Systems - CO	Integrated Drives	15	\$1,101	\$3,316	5,250	1.088	0.0	\$0.00	81%	81%	100%	175	0
HVAC+R Systems - CO	Anti-Sweat Heater Controls	12	\$60	\$180	1,415	0.146	0.0	\$0.00	100%	100%	100%	64	0
HVAC+R Systems - CO	No Heat Case Doors	12	\$125	\$538	1,572	0.180	0.0	\$0.00	100%	100%	100%	6	0
HVAC+R Systems - CO	Medium-temp Enclosed Reach-in Case	15	\$70	\$338	970	0.111	0.0	\$0.00	100%	100%	100%	3	0
HVAC+R Systems - CO	Retrofit of open multi-deck cases with solid glass doors	12	\$125	\$498	1,047	0.120	7.5	\$0.00	100%	100%	100%	6	0
HVAC+R Systems - CO	Walk-in Freezer Defrost Controls	15	\$319	\$1,351	3,368	0.385	0.0	\$0.00	100%	100%	100%	3	0
HVAC+R Systems - CO	Floating Head Pressure Controls	1	\$0	\$0	0	0.000	0.0	\$0.00	100%	100%	100%	0	0
HVAC+R Systems - CO	Cooling Engineering Study	1	\$0	\$0	0	0.000	0.0	\$0.00	100%	100%	100%	0	0
HVAC+R Systems - CO	Motors Engineering Study	1	\$0	\$0	0	0.000	0.0	\$0.00	100%	100%	100%	0	0

Program	Measure Group	Measure Lifetime (years)	Rebate Amount (\$)	Incremental Cost (\$)	Annual Customer kWh Savings (kWh/yr)	Annual Customer Peak Coincident Demand Savings (PCKW)	Gas Savings (Dth)	Non-Energy O&M Savings (\$)	Electric NTG (%)	Gas NTG (%)	Install Rate (%)	2023 Electric Units	2023 Gas Units
Income Qualified MF Weatherization - CO	IQMF Project	19	\$23,397	\$29,597	24,954	3,016	180.4	\$301.49	100%	100%	100%	40	41
Income Qualified MF Weatherization - CO	Custom Beneficial Electrification Project	15	\$14,457	\$14,457	296	0.174	18.5	\$0.00	100%	100%	100%	35	35
Income Qualified SF Weatherization - CO	Refrigerator Replacement	14	\$630	\$630	422	0.031	0.0	\$0.00	100%	100%	100%	475	0
Income Qualified SF Weatherization - CO	Attic Insulation - Electric Heating Only	20	\$2,005	\$2,005	2,413	0.000	0.0	\$0.00	100%	100%	100%	15	0
Income Qualified SF Weatherization - CO	Attic Insulation - Gas Heating Only	20	\$1,680	\$1,681	0	0.000	11.6	\$0.00	100%	100%	100%	0	650
Income Qualified SF Weatherization - CO	Wall Insulation - Electric Heating Only	20	\$1,873	\$1,873	5,346	0.000	0.0	\$0.00	100%	100%	100%	3	0
Income Qualified SF Weatherization - CO	Wall Insulation - Gas Heating Only	20	\$1,241	\$1,092	0	0.000	19.7	\$0.00	100%	100%	100%	0	190
Income Qualified SF Weatherization - CO	Crawl Space Wall Insulation - Electric Heating Only	20	\$1,875	\$1,875	7,306	0.000	0.0	\$0.00	100%	100%	100%	5	0
Income Qualified SF Weatherization - CO	Crawl Space Wall Insulation - Gas Heating Only	20	\$1,205	\$1,103	0	0.000	12.6	\$0.00	100%	100%	100%	0	250
Income Qualified SF Weatherization - CO	Air Sealing - Electric Heating Only	10	\$908	\$938	1,533	0.000	0.0	\$0.00	100%	100%	100%	20	0
Income Qualified SF Weatherization - CO	Air Sealing - Gas Heating Only	10	\$472	\$480	0	0.000	8.8	\$0.00	100%	100%	100%	0	850
Income Qualified SF Weatherization - CO	Storm Windows - Electric Heating Only	20	\$451	\$451	853	0.000	0.0	\$0.00	100%	100%	100%	5	0
Income Qualified SF Weatherization - CO	Storm Windows - Gas Heating Only	20	\$809	\$821	0	0.000	5.7	\$0.00	100%	100%	100%	0	200
Income Qualified SF Weatherization - CO	Home Lighting - Direct Install	17	\$1	\$1	34	0.004	0.0	\$0.00	100%	100%	99%	631,250	0
Income Qualified SF Weatherization - CO	High Efficiency Mini-Split Heat Pump	17	\$7,750	\$2,973	4,897	0.249	0.0	\$0.00	100%	100%	100%	2	0
Income Qualified SF Weatherization - CO	High Efficiency Dual Fuel Mini-Split Heat Pump	17	\$8,500	\$3,596	291	0.122	24.4	\$0.00	100%	100%	100%	4	4
Income Qualified SF Weatherization - CO	High Efficiency Furnace Tier 1	18	\$1,000	\$1,294	0	0.000	14.6	\$0.00	100%	100%	100%	0	375
Income Qualified SF Weatherization - CO	High Efficiency Furnace Tier 2	18	\$3,760	\$1,294	0	0.000	14.6	\$0.00	100%	100%	100%	0	90
Income Qualified SF Weatherization - CO	High Efficiency Boiler Tier 1	20	\$1,000	\$1,446	0	0.000	10.1	\$0.00	100%	100%	100%	0	15
Income Qualified SF Weatherization - CO	High Efficiency Boiler Tier 2	20	\$4,000	\$1,446	0	0.000	10.1	\$0.00	100%	100%	100%	0	5
Income Qualified SF Weatherization - CO	IQ-SFW Boiler/Furnace Tune-up	2	\$319	\$250	0	0.000	5.2	\$0.00	100%	100%	100%	0	105
Income Qualified SF Weatherization - CO	Energy Star Smart Thermostat	10	\$150	\$100	0	0.000	6.5	\$0.00	100%	100%	100%	0	250
Income Qualified SF Weatherization - CO	T-Stat Install & Programming	10	\$100	\$29	0	0.000	11.6	\$0.00	100%	100%	100%	0	600
Income Qualified SF Weatherization - CO	High Efficiency Dual Fuel ASHP with Qi and associated furnace	18	\$8,500	\$1,407	426	0.594	38.8	\$0.00	100%	100%	100%	4	4
Income Qualified SF Weatherization - CO	High Efficiency ASHP and Electric Resistance Heat Backup with Qi	18	\$7,750	\$694	4,752	0.463	0.0	\$0.00	100%	100%	100%	4	0
Income Qualified SF Weatherization - CO	Standard evaporative cooler	15	\$1,200	-\$5,119	685	1.551	0.0	-\$12.64	100%	100%	100%	71	0
Income Qualified SF Weatherization - CO	High Efficiency Cold Climate Mini-Split Heat Pump with Electric Resistance Backup	15	\$9,250	\$11,276	4,612	0.014	0.0	\$0.00	100%	100%	100%	4	0
Income Qualified SF Weatherization - CO	High Efficiency Dual Fuel Cold Climate Mini-Split Heat Pump	15	\$11,000	\$5,990	160	0.067	29.1	\$0.00	100%	100%	100%	8	8
Income Qualified SF Weatherization - CO	High Efficiency ccASHP with Qi with Electric Resistance Backup	18	\$10,500	\$4,562	9,198	0.345	0.0	\$0.00	100%	100%	100%	5	0
Income Qualified SF Weatherization - CO	High Efficiency Dual Fuel ccASHP with Qi and associated furnace	18	\$11,000	\$4,559	340	0.334	46.4	\$0.00	100%	100%	100%	8	8
Income Qualified SF Weatherization - CO	Single-Family Audit	1	\$200	\$200	0	0.000	0.0	\$0.00	100%	100%	100%	400	400
Income Qualified SF Weatherization - CO	Aerators - EWH	10	\$5	\$1	60	0.008	0.0	\$4.04	100%	100%	100%	40	0
Income Qualified SF Weatherization - CO	Aerators - GWH	10	\$4	\$1	0	0.000	0.3	\$4.12	100%	100%	100%	0	600
Income Qualified SF Weatherization - CO	Showerheads - EWH	10	\$10	\$3	476	0.035	0.0	\$33.50	100%	100%	100%	15	0
Income Qualified SF Weatherization - CO	Showerheads - GWH	10	\$10	\$3	0	0.000	2.0	\$33.50	100%	100%	100%	0	500
Income Qualified SF Weatherization - CO	Water Heater Blanket Gas	8	\$75	\$75	0	0.000	1.0	\$0.00	100%	100%	100%	0	400
Income Qualified SF Weatherization - CO	Water Heater Blanket Electric	8	\$75	\$75	226	0.026	0.0	\$0.00	100%	100%	100%	1	0
Income Qualified SF Weatherization - CO	Gas-Fired Storage Water Heater	13	\$970	\$374	0	0.000	2.5	\$0.00	100%	100%	100%	0	150
Income Qualified SF Weatherization - CO	Heat Pump Water Heater	12	\$2,450	\$3,110	2,641	0.350	0.0	-\$8.94	100%	100%	100%	14	0
Income Qualified SF Weatherization - CO	Heat Pump Water Heater - Gas WH Baseline	12	\$4,057	\$3,033	0	0.000	16.0	\$0.00	100%	100%	100%	7	7
Income Qualified SF Weatherization - CO	Tankless Water Heater	20	\$1,104	\$1,100	0	0.000	6.1	\$0.00	100%	100%	100%	0	100
Insulation Rebates - CO	Attic Insulation - Electric Heating and Cooling	20	\$398	\$1,598	1,373	0.156	0.0	\$0.00	89%	89%	100%	25	0
Insulation Rebates - CO	Attic Insulation - Electric Heating Only	20	\$353	\$3,683	1,494	0.000	0.0	\$0.00	89%	89%	100%	10	0
Insulation Rebates - CO	Attic Insulation - Gas Heating / Electric Cooling	20	\$332	\$1,985	122	0.207	11.3	\$0.00	89%	89%	100%	700	700
Insulation Rebates - CO	Attic Insulation - Gas Heating Only	20	\$390	\$2,052	0	0.000	12.6	\$0.00	89%	89%	100%	0	50
Insulation Rebates - CO	Wall Insulation - Electric Heating and Cooling	20	\$308	\$2,570	3,593	0.595	0.0	\$0.00	89%	89%	100%	10	0
Insulation Rebates - CO	Wall Insulation - Electric Heating Only	20	\$350	\$3,541	5,637	0.000	0.0	\$0.00	89%	89%	100%	5	0
Insulation Rebates - CO	Wall Insulation - Gas Heating / Electric Cooling	20	\$248	\$1,919	219	0.372	20.3	\$0.00	89%	89%	100%	155	150
Insulation Rebates - CO	Wall Insulation - Gas Heating Only	20	\$333	\$2,214	0	0.000	22.9	\$0.00	89%	89%	100%	0	20
Insulation Rebates - CO	Air Sealing - Electric Heating and Cooling	10	\$200	\$1,137	2,619	0.191	0.0	\$0.00	89%	89%	100%	35	0
Insulation Rebates - CO	Air Sealing - Electric Heating Only	10	\$190	\$1,708	3,405	0.000	0.0	\$0.00	89%	89%	100%	15	0
Insulation Rebates - CO	Air Sealing - Gas Heating / Electric Cooling	10	\$157	\$948	101	0.172	13.8	\$0.00	89%	89%	100%	855	850
Insulation Rebates - CO	Air Sealing - Gas Heating Only	10	\$184	\$964	0	0.000	13.2	\$0.00	89%	89%	100%	0	70
Insulation Rebates - CO	Cellular Shades - Electric Heating and Cooling	14	\$20	\$28	15	0.005	0.0	\$0.00	89%	89%	100%	15	0
Insulation Rebates - CO	Cellular Shades - Gas Heating / Electric Cooling	14	\$20	\$28	5	0.005	0.0	\$0.00	89%	89%	100%	15	15
LED Street Lighting - CO	Company Owned Street Lighting	20	\$0	\$116	463	0.000	0.0	\$0.00	90%	90%	100%	4,000	0
Lighting - CO	Custom Lighting Project	16	\$6,944	\$24,015	79,287	12,370	0.0	-\$50.38	73%	73%	100%	140	0
Lighting - CO	Network Lighting Controls	15	\$27	\$60	132	0.027	0.0	-\$0.13	100%	100%	100%	20,000	0
Lighting - CO	Lighting Controls	12	\$8	\$37	113	0.020	0.0	-\$0.03	73%	73%	100%	87,600	0
Lighting - CO	Retrofit Flat	20	\$66	\$215	784	0.093	0.0	-\$0.02	73%	73%	100%	5,400	0
Lighting - CO	Retrofit High Bay	20	\$94	\$366	715	0.121	0.0	-\$0.07	73%	73%	100%	21,690	0
Lighting - CO	Retrofit Exterior	20	\$52	\$541	1,740	0.000	0.0	\$0.00	73%	73%	100%	6,840	0
Lighting - CO	Retrofit Troffer	20	\$28	\$128	243	0.045	0.0	-\$0.05	73%	73%	100%	86,400	0
Lighting - CO	Retrofit Tube	1	\$0	\$0	0	0.000	0.0	\$0.00	73%	73%	100%	0	0

Program	Measure Group	Measure Lifetime (years)	Rebate Amount (\$)	Incremental Cost (\$)	Annual Customer kWh Savings (kWh/yr)	Annual Customer Peak Coincident Demand Savings (PCKW)	Gas Savings (Dth)	Non-Energy O&M Savings (\$)	Electric NTG (%)	Gas NTG (%)	Install Rate (%)	2023 Electric Units	2023 Gas Units
Lighting - CO	Retrofit Refrigerator	20	\$35	\$164	343	0.056	0.0	\$0.00	73%	73%	100%	600	0
Lighting - CO	Indoor Agricultural Lighting	20	\$132	\$482	2,285	0.455	0.0	\$0.00	92%	92%	100%	7,000	0
Lighting - CO	Midstream Screw In	5	\$6	\$23	94	0.024	0.0	-\$0.02	78%	78%	100%	18,200	0
Lighting - CO	Midstream Tube	14	\$4	\$15	130	0.023	0.0	-\$0.01	78%	78%	100%	117,800	0
Lighting - CO	Midstream High Bay	10	\$53	\$113	737	0.128	0.0	-\$0.08	78%	78%	100%	600	0
Lighting - CO	Midstream Troffer	10	\$7	\$17	78	0.014	0.0	-\$0.01	78%	78%	100%	8,000	0
Lighting - CO	Midstream Flat	1	\$0	\$0	0	0.000	0.0	\$0.00	78%	78%	100%	0	0
Multifamily Buildings - CO	ENERGY STAR Clothes Dryer	16	\$30	\$75	154	0.021	0.0	\$0.00	100%	100%	100%	618	20
Multifamily Buildings - CO	ENERGY STAR Clothes Washer	11	\$30	\$77	84	0.012	2.4	\$9.62	100%	100%	100%	605	860
Multifamily Buildings - CO	AC Rewards - Business	10	\$27	\$27	481	0.000	3.3	\$0.00	100%	100%	100%	38	30
Multifamily Buildings - CO	Multi-Family Prescriptive	15	\$3,458	\$11,756	36,653	3,943	15.6	-\$35.60	100%	100%	100%	82	11
Multifamily Buildings - CO	Home Lighting - Direct Install	14	\$5	\$5	20	0.003	0.0	\$0.00	100%	100%	100%	176,744	0
Multifamily Buildings - CO	Direct Install Flat	20	\$25	\$48	348	0.046	0.0	-\$0.04	94%	94%	100%	7,200	0
Multifamily Buildings - CO	Midstream Tube	10	\$4	\$14	125	0.022	0.0	-\$0.01	94%	94%	100%	173	0
Multifamily Buildings - CO	Energy Star Smart Thermostat	10	\$60	\$60	59	0.075	0.9	\$0.00	100%	100%	100%	140	100
Multifamily Buildings - CO	Smart Thermostat Optimization	1	\$0	\$0	0	0.000	0.0	\$0.00	100%	100%	100%	100	100
Multifamily Buildings - CO	Multifamily Audit	1	\$400	\$400	0	0.000	0.0	\$0.00	100%	100%	100%	1,421	1,500
Multifamily Buildings - CO	Aerators - EWH	10	\$4	\$4	82	0.012	0.0	\$5.54	100%	100%	100%	140	0
Multifamily Buildings - CO	Aerators - GWH	10	\$4	\$4	0	0.000	0.4	\$5.98	100%	100%	100%	0	19,871
Multifamily Buildings - CO	Showerheads - EWH	10	\$14	\$14	550	0.040	0.0	\$38.77	100%	100%	100%	50	0
Multifamily Buildings - CO	Showerheads - GWH	10	\$14	\$14	0	0.000	2.3	\$38.77	100%	100%	100%	0	3,700
Non-Profit Energy Efficiency Program - CO	NEEP Project	18	\$15,985	\$20,146	16,976	3,724	81.3	\$174.79	100%	100%	100%	37	53
Non-Profit Energy Efficiency Program - CO	Custom Beneficial Electrification Project	15	\$12,400	\$12,400	247	0.146	18.2	\$0.00	100%	100%	100%	15	15
Peak Day Partners - CO	Peak Day Partners	1	\$80,500	\$0	57,500	2500.000	0.0	\$0.00	100%	100%	100%	6	0
Peak Partner Rewards - CO	Peak Partner Rewards	2	\$14,030	\$0	6,644	390.800	0.0	\$0.00	100%	100%	100%	58	0
Refrigerator Recycling - CO	Refrigerator Recycling	8	\$50	\$0	769	0.056	0.0	\$0.00	80%	80%	100%	5,965	0
Refrigerator Recycling - CO	Window/Room AC Unit Recycling	4	\$0	\$0	557	0.306	0.0	\$0.00	80%	80%	100%	35	0
Residential Battery DR - CO	Battery - DR	10	\$1,250	\$0	-59	1.484	0.0	\$0.00	100%	100%	100%	250	0
Residential Demand Response - CO	Residential AC Switch	15	\$0	\$0	9	1.200	0.0	\$0.00	100%	100%	100%	8,000	0
Residential Demand Response - CO	AC Rewards-DR	5	\$125	\$47	4	1.151	0.0	\$0.00	100%	100%	100%	9,000	0
Residential Demand Response - CO	Water Heater HPWH Load Shift & DR	1	\$63	\$0	118	0.076	0.0	\$0.00	100%	100%	100%	50	0
Residential HVAC - CO	Standard Efficiency AC with QI	18	\$200	\$128	260	0.531	0.0	\$0.00	73%	73%	100%	600	0
Residential HVAC - CO	High Efficiency AC with QI	18	\$400	\$860	481	0.736	0.0	\$0.00	73%	73%	100%	334	0
Residential HVAC - CO	Standard Efficiency AC with QI and associated furnace	18	\$200	\$137	246	0.492	4.8	\$0.00	73%	73%	100%	1,600	1,600
Residential HVAC - CO	High Efficiency AC without QI and associated furnace	18	\$200	\$369	152	0.188	0.0	\$0.00	73%	73%	100%	4,600	0
Residential HVAC - CO	Quality Install of High Efficiency AC with associated furnace	18	\$600	\$150	179	0.371	4.8	\$0.00	73%	73%	100%	4,600	4,600
Residential HVAC - CO	High Efficiency Dual Fuel ASHP with QI and associated furnace	18	\$1,500	\$2,512	479	0.655	38.8	\$0.00	100%	100%	100%	65	65
Residential HVAC - CO	High Efficiency ASHP and Electric Resistance Heat Backup with QI	18	\$1,500	\$694	4,781	0.463	0.0	\$0.00	100%	100%	100%	40	0
Residential HVAC - CO	High Efficiency Mini-Split Heat Pump	18	\$500	\$2,973	4,897	0.249	0.0	\$0.00	57%	57%	100%	220	0
Residential HVAC - CO	High Efficiency Dual Fuel Mini-Split Heat Pump	18	\$1,484	\$3,596	291	0.122	24.4	\$0.00	57%	57%	100%	310	310
Residential HVAC - CO	High Efficiency Dual Fuel ccASHP with QI and associated furnace	18	\$2,000	\$4,783	357	0.351	48.9	\$0.00	100%	100%	100%	30	30
Residential HVAC - CO	High Efficiency ccASHP with QI with Electric Resistance Backup	18	\$2,000	\$4,668	9,409	0.349	0.0	\$0.00	100%	100%	100%	2	0
Residential HVAC - CO	High Efficiency Dual Fuel Cold Climate Mini-Split Heat Pump	15	\$2,000	\$11,399	160	0.067	29.1	\$0.00	57%	57%	100%	210	210
Residential HVAC - CO	High Efficiency Cold Climate Mini-Split Heat Pump with Electric Resistance Backup	15	\$2,000	\$517	4,683	0.014	0.0	\$0.00	57%	57%	100%	26	0
Residential HVAC - CO	High Efficiency Boiler	20	\$225	\$1,331	0	0.000	20.6	\$0.00	100%	100%	100%	0	300
Residential HVAC - CO	High Efficiency GSHP with QI	20	\$2,500	\$22,519	24,929	1.482	0.0	\$0.00	100%	100%	100%	3	0
Residential HVAC - CO	High Efficiency GSHP with QI - AC & Gas Baseline	20	\$2,500	\$23,217	633	1.482	149.3	\$0.00	100%	100%	100%	5	5
Residential HVAC - CO	Enhanced Fan Time Delay for Retrofit	1	\$0	\$0	0	0.000	0.0	\$0.00	100%	100%	100%	0	0
Residential HVAC - CO	Standard evaporative cooler	15	\$300	-\$5,107	769	1.547	0.0	-\$14.33	70%	70%	100%	1,088	0
Residential HVAC - CO	Premium evaporative cooler	15	\$675	-\$547	1,165	1.477	0.0	-\$19.89	70%	70%	100%	464	0
Residential HVAC - CO	Multi-ducted premium evaporative cooler	15	\$1,200	\$1,534	890	1.297	0.0	-\$18.81	88%	88%	100%	818	0
Residential HVAC - CO	High Efficiency Furnace	18	\$225	\$1,294	0	0.000	21.3	\$0.00	86%	86%	100%	0	5,100
Residential HVAC - CO	AC Rewards-EE	1	\$0	\$0	0	0.000	0.0	\$0.00	100%	100%	100%	0	0
Residential HVAC - CO	Energy Star Smart Thermostat	10	\$50	\$215	142	0.215	8.1	\$0.00	100%	100%	100%	3,395	3,820
Residential HVAC - CO	Smart Thermostat Optimization	1	\$0	\$0	45	0.054	0.0	\$0.00	100%	100%	100%	5,600	5,600
Residential HVAC - CO	Heat Pump Water Heater	12	\$643	\$3,110	2,725	0.354	0.0	-\$8.57	100%	100%	100%	56	0
Residential HVAC - CO	Gas-Fired Storage Water Heater	13	\$50	\$354	0	0.000	2.3	\$0.00	90%	90%	100%	0	170
Residential HVAC - CO	Tankless Water Heater	20	\$100	\$1,049	0	0.000	7.6	\$0.00	90%	90%	100%	0	670
Residential HVAC - CO	Heat Pump Water Heater - Gas WH Baseline	12	\$606	\$3,033	14	0.000	16.0	\$0.00	100%	100%	100%	31	31
Residential HVAC - CO	Indirect Water Heater	13	\$100	\$576	0	0.000	5.2	\$0.00	100%	100%	100%	0	15
School Education Kits - CO	Advanced Power Strip	7	\$21	\$21	103	0.012	0.0	\$0.00	100%	100%	83%	7,750	0
School Education Kits - CO	Home Lighting - Direct Install	15	\$7	\$7	58	0.008	0.0	\$0.00	100%	100%	89%	207,350	0
School Education Kits - CO	Aerators - EWH	10	\$1	\$1	77	0.011	0.0	\$5.27	100%	100%	45%	6,283	0
School Education Kits - CO	Aerators - GWH	10	\$1	\$1	0	0.000	0.3	\$5.27	100%	100%	45%	0	83,468
School Education Kits - CO	Showerheads - EWH	10	\$3	\$3	476	0.035	0.0	\$33.50	100%	100%	47%	3,413	0
School Education Kits - CO	Showerheads - GWH	10	\$3	\$3	0	0.000	2.0	\$33.50	100%	100%	47%	0	45,338
School Education Kits - CO	Programmable Thermostat	10	\$0	\$0	85	0.065	5.8	\$0.00	100%	100%	2%	26,645	29,578
Self Direct - CO	Self Direct	17	\$124,195	\$503,145	926,303	201,981	0.0	\$0.00	100%	100%	100%	11	0
Small Business Solutions - CO	Dishwasher	15	\$250	\$371	6,998	0.988	7.0	\$395.19	94%	94%	100%	35	0

Program	Measure Group	Measure Lifetime (years)	Rebate Amount (\$)	Incremental Cost (\$)	Annual Customer kWh Savings (kWh/yr)	Annual Customer Peak Coincident Demand Savings (PCKW)	Gas Savings (Dth)	Non-Energy O&M Savings (\$)	Electric NTG (%)	Gas NTG (%)	Install Rate (%)	2023 Electric Units	2023 Gas Units
Small Business Solutions - CO	Food Service	12	\$500	\$3,150	0	0.000	145.0	\$0.00	94%	94%	100%	0	5
Small Business Solutions - CO	Steam Cooker	1	\$0	\$0	0	0.000	0.0	\$0.00	100%	100%	100%	0	0
Small Business Solutions - CO	AC Rewards - Business	1	\$0	\$0	0	0.000	0.0	\$0.00	100%	100%	100%	0	0
Small Business Solutions - CO	Custom Small Business Solutions Lighting Project	17	\$2,623	\$9,242	29,526	4,618	0.0	-\$16.43	94%	94%	100%	15	0
Small Business Solutions - CO	Custom Small Business Solutions Refrigeration Project	15	\$84,521	\$105,409	657,978	168,954	0.0	\$0.00	94%	94%	100%	1	0
Small Business Solutions - CO	SBS Prescriptive	15	\$4,444	\$12,122	34,565	5,889	0.0	\$0.00	94%	94%	100%	2	0
Small Business Solutions - CO	Demand Control Ventilation	20	\$751	\$3,738	9,218	1,379	50.2	\$0.00	94%	94%	100%	10	0
Small Business Solutions - CO	Pipe Insulation - Direct Install	1	\$0	\$0	0	0.000	0.0	\$0.00	100%	100%	100%	0	0
Small Business Solutions - CO	Direct Install Refrigerator	5	\$3	\$3	741	0.137	0.0	\$0.00	94%	94%	100%	20	0
Small Business Solutions - CO	Direct Install Screw In	7	\$8	\$8	169	0.031	0.0	-\$0.39	94%	94%	100%	35	0
Small Business Solutions - CO	Direct Install Tubes	11	\$16	\$16	79	0.017	0.0	-\$0.10	94%	94%	100%	28,000	0
Small Business Solutions - CO	Direct Install Flat	20	\$25	\$25	348	0.046	0.0	-\$0.04	94%	94%	100%	180	0
Small Business Solutions - CO	Network Lighting Controls	15	\$13	\$29	58	0.012	0.0	-\$0.06	94%	94%	100%	3	0
Small Business Solutions - CO	Lighting Controls	13	\$17	\$58	149	0.023	0.0	-\$0.04	94%	94%	100%	36	0
Small Business Solutions - CO	Retrofit Flat	20	\$53	\$240	1,429	0.165	0.0	-\$0.01	94%	94%	100%	309	0
Small Business Solutions - CO	Retrofit High Bay	20	\$89	\$461	1,005	0.171	0.0	-\$0.10	94%	94%	100%	2,505	0
Small Business Solutions - CO	Retrofit Exterior	20	\$50	\$485	1,547	0.000	0.0	\$0.00	94%	94%	100%	309	0
Small Business Solutions - CO	Retrofit Troffer	20	\$28	\$143	229	0.044	0.0	-\$0.06	94%	94%	100%	8,050	0
Small Business Solutions - CO	Retrofit Tube	14	\$4	\$16	137	0.024	0.0	-\$0.01	94%	94%	100%	14,880	0
Small Business Solutions - CO	Retrofit Refrigerator	1	\$0	\$0	0	0.000	0.0	\$0.00	100%	100%	100%	0	0
Small Business Solutions - CO	Midstream Screw In	5	\$3	\$8	99	0.019	0.0	-\$0.01	78%	78%	99%	68,456	0
Small Business Solutions - CO	Midstream Tube	12	\$4	\$13	140	0.024	0.0	-\$0.01	78%	78%	99%	136,334	0
Small Business Solutions - CO	Midstream High Bay	10	\$52	\$101	966	0.099	0.0	-\$0.06	78%	78%	99%	980	0
Small Business Solutions - CO	Midstream Troffer	15	\$12	\$41	116	0.021	0.0	-\$0.02	78%	78%	99%	23,145	0
Small Business Solutions - CO	Midstream Flat	1	\$0	\$0	0	0.000	0.0	\$0.00	100%	100%	100%	0	0
Small Business Solutions - CO	Refrigeration Fans	15	\$55	\$205	658	0.075	0.0	\$0.00	94%	94%	100%	8	0
Small Business Solutions - CO	Anti-Sweat Heater Controls	1	\$0	\$0	0	0.000	0.0	\$0.00	100%	100%	100%	0	0
Small Business Solutions - CO	No Heat Case Doors	1	\$0	\$0	0	0.000	0.0	\$0.00	100%	100%	100%	0	0
Small Business Solutions - CO	Medium-temp Enclosed Reach-In Case	1	\$0	\$0	0	0.000	0.0	\$0.00	100%	100%	100%	0	0
Small Business Solutions - CO	Retrofit of open multi-deck cases with solid glass doors	1	\$0	\$0	0	0.000	0.0	\$0.00	100%	100%	100%	0	0
Small Business Solutions - CO	Walk-in Freezer Defrost Controls	1	\$0	\$0	0	0.000	0.0	\$0.00	100%	100%	100%	0	0
Small Business Solutions - CO	Floating Head Pressure Controls	1	\$0	\$0	0	0.000	0.0	\$0.00	100%	100%	100%	0	0
Small Business Solutions - CO	Strip Curtains - Direct Install	1	\$0	\$0	0	0.000	0.0	\$0.00	100%	100%	100%	0	0
Small Business Solutions - CO	Auto Closers - Direct Install	1	\$0	\$0	0	0.000	0.0	\$0.00	100%	100%	100%	0	0
Small Business Solutions - CO	Aerators - EWH	9	\$10	\$10	501	0.001	0.0	\$25.33	94%	94%	100%	859	0
Small Business Solutions - CO	Aerators - GWH	9	\$10	\$10	0	0.000	3.5	\$57.54	94%	94%	100%	2	3,487
Small Business Solutions - CO	Showerheads - EWH	10	\$14	\$14	1,807	0.481	0.0	\$124.71	94%	94%	100%	2	10
Small Business Solutions - CO	Showerheads - GWH	10	\$14	\$14	0	0.000	7.6	\$124.71	94%	94%	100%	0	10
Strategic Energy Management - CO	Energy Information Systems	3	\$6,051	\$151	302,548	49,384	0.0	\$0.00	100%	100%	100%	41	0
Strategic Energy Management - CO	Custom Strategic Energy Management Load Shift Project	1	\$3,750	\$0	78,214	75,000	0.0	\$0.00	100%	100%	100%	9	0
Strategic Energy Management - CO	Custom Strategic Energy Management Project	15	\$25,365	\$97,702	469,676	39,687	0.0	\$4,143.92	100%	100%	100%	26	0
Strategic Energy Management - CO	SEM Prescriptive	15	\$9,826	\$26,433	120,758	21,224	0.0	-\$67.28	100%	100%	100%	316	0
Strategic Energy Management - CO	SEM	1	\$17,253	\$0	0	0.000	0.0	\$0.00	100%	100%	100%	15	0
Whole Home Efficiency - CO	ENERGY STAR Clothes Dryer	16	\$30	\$75	160	0.022	0.0	\$0.00	116%	116%	100%	75	0
Whole Home Efficiency - CO	ENERGY STAR Clothes Washer	11	\$30	\$121	78	0.011	2.8	\$12.57	116%	116%	100%	85	100
Whole Home Efficiency - CO	Attic Insulation - Electric Heating and Cooling	20	\$346	\$2,500	706	0.157	0.0	\$0.00	100%	100%	100%	12	0
Whole Home Efficiency - CO	Attic Insulation - Electric Heating Only	20	\$322	\$1,514	2,083	0.000	0.0	\$0.00	116%	116%	100%	12	0
Whole Home Efficiency - CO	Attic Insulation - Gas Heating / Electric Cooling	20	\$386	\$1,626	106	0.180	9.8	\$0.00	116%	116%	100%	82	75
Whole Home Efficiency - CO	Attic Insulation - Gas Heating Only	20	\$410	\$1,796	0	0.000	11.6	\$0.00	100%	100%	100%	0	19
Whole Home Efficiency - CO	Wall Insulation - Electric Heating and Cooling	20	\$308	\$2,570	3,593	0.595	0.0	\$0.00	116%	116%	100%	6	0
Whole Home Efficiency - CO	Wall Insulation - Electric Heating Only	20	\$350	\$3,541	5,637	0.000	0.0	\$0.00	116%	116%	100%	6	0
Whole Home Efficiency - CO	Wall Insulation - Gas Heating / Electric Cooling	20	\$112	\$2,696	285	0.483	26.4	\$0.00	116%	116%	100%	54	60
Whole Home Efficiency - CO	Wall Insulation - Gas Heating Only	20	\$310	\$1,897	0	0.000	31.1	\$0.00	100%	100%	100%	0	8
Whole Home Efficiency - CO	Air Sealing - Electric Heating and Cooling	10	\$200	\$1,137	2,619	0.191	0.0	\$0.00	116%	116%	100%	24	0
Whole Home Efficiency - CO	Air Sealing - Electric Heating Only	10	\$190	\$1,708	3,405	0.000	0.0	\$0.00	116%	116%	100%	39	0
Whole Home Efficiency - CO	Air Sealing - Gas Heating / Electric Cooling	10	\$142	\$934	113	0.191	15.1	\$0.00	116%	116%	100%	69	69
Whole Home Efficiency - CO	Air Sealing - Gas Heating Only	10	\$184	\$816	0	0.000	13.6	\$0.00	116%	116%	100%	0	29
Whole Home Efficiency - CO	High Efficiency Furnace	18	\$225	\$1,294	0	0.000	21.3	\$0.00	116%	116%	100%	0	40
Whole Home Efficiency - CO	Standard Efficiency AC with Qi	18	\$200	\$128	260	0.531	0.0	\$0.00	116%	116%	100%	30	0
Whole Home Efficiency - CO	High Efficiency AC with Qi	18	\$400	\$877	470	0.694	0.0	\$0.00	116%	116%	100%	80	0
Whole Home Efficiency - CO	Standard Efficiency AC with Qi and associated furnace	18	\$200	\$137	247	0.492	4.8	\$0.00	100%	100%	100%	15	15
Whole Home Efficiency - CO	High Efficiency AC without Qi and associated furnace	18	\$200	\$369	152	0.188	0.0	\$0.00	100%	100%	100%	2	2
Whole Home Efficiency - CO	Quality Install of High Efficiency AC with associated furnace	18	\$200	\$150	179	0.371	4.8	\$0.00	100%	100%	100%	20	20
Whole Home Efficiency - CO	High Efficiency Dual Fuel ASHP with Qi and associated furnace	18	\$1,500	\$1,407	485	0.661	38.8	\$0.00	100%	100%	100%	20	20
Whole Home Efficiency - CO	High Efficiency ASHP and Electric Resistance Heat Backup with Qi	18	\$1,500	\$694	4,710	0.463	0.0	\$0.00	100%	100%	100%	2	0
Whole Home Efficiency - CO	High Efficiency Mini-Split Heat Pump	18	\$500	\$2,973	4,897	0.249	0.0	\$0.00	100%	100%	100%	1	0
Whole Home Efficiency - CO	High Efficiency Dual Fuel Mini-Split Heat Pump	18	\$1,500	\$3,596	306	0.232	24.4	\$0.00	100%	100%	100%	4	4

Program	Measure Group	Measure Lifetime (years)	Rebate Amount (\$)	Incremental Cost (\$)	Annual Customer kWh Savings (kWh/yr)	Annual Customer Peak Coincident Demand Savings (PckW)	Gas Savings (Dth)	Non-Energy O&M Savings (\$)	Electric NTG (%)	Gas NTG (%)	Install Rate (%)	2023 Electric Units	2023 Gas Units
Whole Home Efficiency - CO	High Efficiency Dual Fuel ccASHP with QI and associated furnace	18	\$2,000	\$4,783	357	0.351	48.9	\$0.00	116%	116%	100%	2	2
Whole Home Efficiency - CO	High Efficiency ccASHP with QI with Electric Resistance Backup	18	\$2,000	\$4,667	9,410	0.349	0.0	\$0.00	116%	116%	100%	2	0
Whole Home Efficiency - CO	High Efficiency Dual Fuel Cold Climate Mini-Split Heat Pump	15	\$2,000	\$11,399	160	0.067	29.1	\$0.00	116%	116%	100%	2	2
Whole Home Efficiency - CO	High Efficiency Cold Climate Mini-Split Heat Pump with Electric Resistance Backup	15	\$2,000	\$11,276	4,683	0.014	0.0	\$0.00	116%	116%	100%	2	0
Whole Home Efficiency - CO	High Efficiency GSHHP with QI	20	\$2,500	\$22,519	24,929	1.482	0.0	\$0.00	116%	116%	100%	1	0
Whole Home Efficiency - CO	High Efficiency GSHHP with QI - AC & Gas Baseline	20	\$2,500	\$23,217	633	1.482	149.3	\$0.00	116%	116%	100%	1	0
Whole Home Efficiency - CO	Premium evaporative cooler	15	\$675	\$782	1,049	1.408	0.0	-\$17.91	116%	116%	100%	17	0
Whole Home Efficiency - CO	Energy Star Smart Thermostat	10	\$50	\$215	142	0.215	5.4	\$0.00	100%	100%	100%	105	80
Whole Home Efficiency - CO	Smart Thermostat Optimization	1	\$0	\$0	45	0.054	0.0	\$0.00	100%	100%	100%	12	12
Whole Home Efficiency - CO	Heat Pump Water Heater	12	\$721	\$3,110	2,660	0.351	0.0	-\$10.63	116%	116%	100%	53	0
Whole Home Efficiency - CO	Tankless Water Heater	20	\$100	\$960	0	0.000	7.4	\$0.00	100%	100%	100%	0	350
Whole Home Efficiency - CO	Heat Pump Water Heater - Gas WH Baseline	12	\$800	\$3,033	27	0.000	16.0	\$0.00	100%	100%	100%	0	12

Appendix I – EnCompass Model Emissions Data

The EnCompass Model Emissions Data section contains the modeled assumptions for Renewable Generation, Load Net of Renewables, Total Load, and Marginal CO₂ emissions presented in a 12 x 24 monthly-hourly average format over the EnCompass forecast window of 2023-2042. The emissions data is utilized to calculate the life-time emissions reductions and associated Social Cost of Carbon benefits utilized in the cost-benefit analysis of this Plan.

2023 DSM + BE Plan Appendix I

PSCo Renewable Generation

PSCo Renewable Generation (MW)																									
Year	Month	HE1	HE2	HE3	HE4	HE5	HE6	HE7	HE8	HE9	HE10	HE11	HE12	HE13	HE14	HE15	HE16	HE17	HE18	HE19	HE20	HE21	HE22	HE23	HE24
2022	Jan	1,876	1,898	1,868	1,770	1,641	1,559	1,539	1,558	1,852	2,054	2,111	2,157	2,143	2,097	2,073	1,982	1,705	1,692	1,731	1,734	1,736	1,731	1,737	1,798
2022	Feb	1,540	1,517	1,505	1,528	1,538	1,499	1,507	1,595	1,808	1,948	1,998	2,079	2,161	2,190	2,180	2,098	1,855	1,639	1,675	1,630	1,608	1,623	1,641	1,619
2022	Mar	1,787	1,748	1,671	1,653	1,635	1,630	1,671	1,881	2,142	2,282	2,431	2,435	2,392	2,363	2,390	2,363	2,252	1,972	2,054	2,160	2,210	2,127	1,946	1,828
2022	Apr	1,804	1,757	1,685	1,646	1,646	1,659	1,699	1,889	1,993	2,048	2,142	2,239	2,270	2,309	2,324	2,340	2,310	2,207	2,127	2,268	2,309	2,249	2,024	1,915
2022	May	1,478	1,425	1,360	1,368	1,359	1,332	1,465	1,660	1,840	1,970	2,011	1,998	2,041	2,111	2,171	2,259	2,217	2,064	1,835	1,846	1,881	1,782	1,577	1,527
2022	Jun	1,575	1,490	1,461	1,491	1,495	1,515	1,623	1,880	2,002	2,043	2,038	2,068	2,079	2,045	2,061	2,078	2,148	2,003	1,779	1,743	1,783	1,794	1,717	1,656
2022	Jul	1,766	1,714	1,676	1,617	1,537	1,550	1,735	1,935	2,024	2,052	2,009	1,931	1,862	1,779	1,829	1,839	1,913	1,918	1,864	1,951	1,976	1,980	1,982	1,870
2022	Aug	1,536	1,486	1,470	1,434	1,421	1,371	1,510	1,718	1,819	1,923	1,934	1,912	1,886	1,866	1,880	1,856	1,846	1,790	1,759	1,870	1,902	1,890	1,798	1,692
2022	Sep	1,865	1,784	1,719	1,671	1,682	1,671	1,722	1,999	2,134	2,200	2,265	2,254	2,254	2,345	2,387	2,368	2,217	2,015	2,185	2,337	2,324	2,248	2,099	1,981
2022	Oct	1,544	1,530	1,478	1,451	1,483	1,548	1,557	1,838	2,055	2,178	2,252	2,273	2,307	2,339	2,367	2,310	1,903	1,758	1,881	1,895	1,859	1,748	1,657	1,570
2022	Nov	1,586	1,560	1,576	1,565	1,560	1,590	1,658	1,860	2,201	2,293	2,306	2,281	2,229	2,268	2,250	1,991	1,614	1,698	1,744	1,758	1,757	1,740	1,689	1,653
2022	Dec	1,765	1,788	1,817	1,764	1,729	1,750	1,752	1,820	2,279	2,432	2,383	2,394	2,434	2,469	2,470	2,219	1,812	1,848	1,915	1,924	1,941	1,942	1,891	1,765
2023	Jan	1,959	1,974	1,946	1,838	1,709	1,603	1,537	1,584	2,190	2,599	2,659	2,664	2,648	2,634	2,601	2,426	1,843	1,686	1,723	1,726	1,736	1,743	1,790	1,873
2023	Feb	1,647	1,633	1,621	1,626	1,629	1,558	1,537	1,736	2,268	2,486	2,556	2,643	2,705	2,756	2,757	2,677	2,204	1,686	1,692	1,639	1,621	1,651	1,717	1,707
2023	Mar	1,876	1,824	1,726	1,704	1,703	1,687	1,752	2,264	2,702	2,888	3,027	3,016	2,973	2,942	2,928	2,860	2,698	2,104	2,055	2,154	2,234	2,189	2,058	1,921
2023	Apr	1,959	1,909	1,844	1,789	1,777	1,773	1,991	2,466	2,641	2,707	2,817	2,929	2,947	2,940	2,911	2,894	2,823	2,513	2,262	2,346	2,395	2,358	2,170	2,065
2023	May	1,637	1,601	1,552	1,541	1,488	1,500	1,912	2,282	2,546	2,689	2,727	2,696	2,722	2,776	2,778	2,768	2,679	2,404	1,934	1,893	1,922	1,839	1,698	1,650
2023	Jun	1,637	1,537	1,511	1,532	1,540	1,691	2,147	2,571	2,761	2,816	2,829	2,869	2,921	2,800	2,752	2,728	2,711	2,403	1,913	1,750	1,779	1,783	1,736	1,700
2023	Jul	1,824	1,785	1,747	1,663	1,583	1,717	2,324	2,704	2,838	2,870	2,823	2,763	2,666	2,544	2,561	2,386	2,338	2,238	1,953	1,945	1,970	1,984	2,007	1,937
2023	Aug	1,544	1,524	1,506	1,459	1,451	1,425	1,887	2,386	2,575	2,739	2,779	2,726	2,666	2,607	2,548	2,403	2,293	2,024	1,784	1,865	1,895	1,884	1,803	1,699
2023	Sep	1,952	1,854	1,778	1,729	1,741	1,679	1,921	2,572	2,810	2,900	2,971	2,983	2,991	3,059	3,048	2,981	2,647	2,120	2,179	2,343	2,358	2,295	2,188	2,071
2023	Oct	1,659	1,625	1,574	1,550	1,556	1,587	1,606	2,058	2,394	2,572	2,691	2,691	2,715	2,744	2,752	2,631	2,022	1,763	1,877	1,897	1,878	1,809	1,748	1,680
2023	Nov	1,625	1,599	1,629	1,625	1,622	1,631	1,720	2,035	2,585	2,730	2,757	2,688	2,646	2,677	2,618	2,242	1,676	1,691	1,728	1,748	1,779	1,759	1,715	1,677
2023	Dec	1,796	1,815	1,850	1,797	1,772	1,785	1,782	1,869	2,380	2,567	2,535	2,542	2,564	2,591	2,609	2,303	1,827	1,851	1,910	1,921	1,941	1,942	1,903	1,786
2024	Jan	1,970	1,983	1,951	1,846	1,720	1,612	1,554	1,610	2,237	2,665	2,735	2,749	2,722	2,737	2,709	2,502	1,879	1,687	1,723	1,726	1,736	1,750	1,808	1,893
2024	Feb	1,627	1,616	1,599	1,634	1,645	1,583	1,587	1,808	2,326	2,556	2,632	2,703	2,752	2,822	2,806	2,703	2,232	1,708	1,691	1,660	1,637	1,668	1,730	1,772
2024	Mar	1,906	1,843	1,746	1,728	1,722	1,693	1,755	2,285	2,775	2,966	3,079	3,055	3,011	3,000	2,998	2,919	2,742	2,108	2,047	2,151	2,234	2,205	2,081	1,943
2024	Apr	2,033	1,991	1,917	1,849	1,829	1,821	2,080	2,610	2,788	2,858	2,961	3,072	3,093	3,089	3,064	3,049	2,946	2,581	2,286	2,346	2,401	2,377	2,227	2,117
2024	May	1,630	1,598	1,538	1,533	1,477	1,497	1,950	2,350	2,632	2,764	2,774	2,757	2,769	2,815	2,804	2,795	2,676	2,402	1,930	1,920	1,969	1,880	1,718	1,633
2024	Jun	1,653	1,552	1,528	1,544	1,551	1,713	2,202	2,665	2,872	2,947	2,940	2,953	2,986	2,923	2,909	2,862	2,816	2,459	1,924	1,752	1,781	1,792	1,740	1,710
2024	Jul	1,830	1,796	1,742	1,661	1,581	1,718	2,350	2,753	2,901	2,932	2,877	2,822	2,709	2,597	2,616	2,431	2,375	2,259	1,959	1,945	1,970	1,988	2,014	1,947
2024	Aug	1,549	1,528	1,517	1,471	1,454	1,430	1,925	2,455	2,664	2,838	2,865	2,809	2,748	2,684	2,616	2,453	2,330	2,042	1,787	1,865	1,895	1,884	1,803	1,701
2024	Sep	1,922	1,839	1,768	1,714	1,718	1,681	1,917	2,607	2,849	2,937	2,998	2,939	2,940	3,036	3,052	3,009	2,647	2,095	2,149	2,329	2,348	2,292	2,169	2,019
2024	Oct	1,599	1,568	1,514	1,492	1,507	1,556	1,584	2,041	2,401	2,599	2,712	2,688	2,709	2,727	2,726	2,591	2,014	1,746	1,873	1,897	1,878	1,803	1,718	1,624
2024	Nov	1,648	1,626	1,639	1,630	1,630	1,657	1,743	2,092	2,650	2,818	2,834	2,760	2,721	2,747	2,702	2,305	1,699	1,711	1,749	1,769	1,785	1,782	1,751	1,703
2024	Dec	1,795	1,808	1,849	1,807	1,774	1,795	1,786	1,863	2,405	2,615	2,605	2,602	2,636	2,659	2,654	2,335	1,836	1,851	1,913	1,920	1,943	1,947	1,914	1,793
2025	Jan	2,536	2,567	2,544	2,377	2,213	2,095	2,058	2,108	2,714	3,147	3,208	3,248	3,265	3,252	3,183	2,970	2,329	2,140	2,192	2,232	2,240	2,256	2,291	2,401
2025	Feb	2,235	2,237	2,216	2,206	2,198	2,115	2,088	2,274	2,827	3,023	3,119	3,205	3,311	3,346	3,368	3,230	2,732	2,217	2,174	2,139	2,132	2,197	2,298	2,348
2025	Mar	2,551	2,497	2,361	2,313	2,295	2,229	2,286	2,841	3,301	3,487	3,602	3,587	3,497	3,467	3,445	3,412	3,210	2,615	2,614	2,753	2,838	2,817	2,730	2,573
2025	Apr	2,699	2,624	2,520	2,477	2,413	2,369	2,619	3,096	3,249	3,341	3,436	3,553	3,597	3,615	3,607	3,600	3,525	3,168	2,899	2,993	3,075	3,049	2,891	2,787
2025	May	2,247	2,272	2,161	2,105	2,033	2,047	2,430	2,799	3,055	3,159	3,193	3,169	3,181	3,238	3,311	3,342	3,222	2,997	2,498	2,512	2,568	2,455	2,259	2,218
2025	Jun	2,248	2,122	2,076	2,079	2,085	2,235	2,698	3,161	3,321	3,359	3,341	3,347	3,376	3,304	3,323	3,293	3,282	2,935	2,433	2,295	2,334	2,374	2,303	2,306
2025	Jul	2,487	2,444	2,395	2,323	2,185	2,267	2,888	3,248	3,400	3,376	3,297	3,196	3,063	2,921	2,944	2,801	2,768	2,743	2,517	2,555	2,624	2,657	2,676	2,605
2025	Aug	2,142	2,110	2,065	2,022	1,960	1,904	2,366	2,862	3,057	3,204	3,222	3,156	3,096	3,023	2,966	2,852	2,750	2,529	2,352	2,492	2,546	2,536	2,420	2,286
2025	Sep	2,663	2,550	2,458	2,355	2,311	2,270	2,486	3,154	3,398	3,458	3,485	3,410	3,415	3,511	3,538	3,511	3,153	2,629	2,750	3,003	3,085	3,079	2,960	2,781
2025	Oct	2,149	2,103	2,034	1,985	2,004	2,029	2,071	2,521	2,850	3,026	3,177	3,151	3,167	3,226	3,234	3,129	2,514	2,249						

2023 DSM + BE Plan Appendix I

PSCo Renewable Generation

2027	Jan	2,817	2,864	2,822	2,632	2,464	2,379	2,360	2,448	3,282	3,851	3,936	3,891	3,792	3,768	3,771	3,535	2,759	2,457	2,524	2,592	2,597	2,597	2,602	2,678
2027	Feb	2,493	2,488	2,474	2,460	2,455	2,370	2,408	2,713	3,263	3,499	3,585	3,678	3,820	3,940	3,955	3,896	3,278	2,526	2,499	2,474	2,460	2,526	2,632	2,600
2027	Mar	2,817	2,702	2,612	2,592	2,591	2,544	2,675	3,383	3,957	4,159	4,278	4,218	4,231	4,269	4,247	4,122	3,890	3,074	2,956	3,135	3,241	3,129	2,984	2,826
2027	Apr	2,941	2,863	2,753	2,643	2,598	2,522	2,700	3,147	3,676	3,882	3,937	4,064	4,143	4,183	4,189	4,164	4,081	4,025	3,613	3,261	3,351	3,401	3,346	3,207
2027	May	2,619	2,575	2,468	2,417	2,321	2,516	3,038	3,510	3,814	3,977	4,039	4,025	4,053	4,084	4,144	4,113	4,000	3,637	2,978	2,888	3,001	2,867	2,630	2,539
2027	Jun	2,587	2,467	2,386	2,401	2,404	2,780	3,466	3,971	4,267	4,413	4,408	4,436	4,460	4,363	4,355	4,234	4,240	3,770	2,991	2,656	2,703	2,768	2,673	2,646
2027	Jul	2,777	2,717	2,659	2,598	2,481	2,741	3,587	4,099	4,311	4,379	4,393	4,300	4,140	3,985	3,908	3,674	3,544	3,434	3,007	2,951	3,046	3,084	3,054	2,933
2027	Aug	2,494	2,409	2,349	2,307	2,236	2,263	2,929	3,631	3,976	4,186	4,276	4,244	4,152	4,013	3,916	3,767	3,527	3,132	2,759	2,894	2,964	2,956	2,809	2,639
2027	Sep	2,949	2,854	2,744	2,674	2,636	2,540	2,936	3,791	4,029	4,177	4,277	4,218	4,262	4,368	4,383	4,236	3,765	3,010	3,080	3,371	3,457	3,418	3,292	3,105
2027	Oct	2,386	2,346	2,296	2,252	2,274	2,339	2,465	3,150	3,605	3,781	3,968	3,948	3,951	3,968	3,967	3,856	3,012	2,559	2,750	2,779	2,768	2,670	2,524	2,416
2027	Nov	2,375	2,402	2,401	2,383	2,377	2,396	2,496	2,968	3,746	3,946	3,978	3,883	3,831	3,784	3,748	3,208	2,396	2,412	2,522	2,585	2,646	2,647	2,577	2,482
2027	Dec	2,569	2,578	2,594	2,504	2,470	2,487	2,504	2,574	3,273	3,588	3,582	3,616	3,700	3,757	3,731	3,234	2,518	2,549	2,609	2,672	2,717	2,719	2,649	2,534
2028	Jan	2,927	2,993	2,946	2,730	2,543	2,435	2,402	2,465	3,319	3,981	3,992	3,986	3,874	3,808	3,797	3,488	2,784	2,531	2,603	2,702	2,707	2,725	2,727	2,822
2028	Feb	2,514	2,569	2,559	2,561	2,541	2,470	2,514	2,838	3,536	3,694	3,812	3,903	3,909	3,941	4,002	3,883	3,340	2,649	2,580	2,557	2,565	2,637	2,732	2,708
2028	Mar	2,955	2,806	2,746	2,703	2,744	2,700	2,803	3,484	4,130	4,297	4,456	4,337	4,348	4,262	4,309	4,133	3,890	3,217	3,113	3,301	3,415	3,341	3,163	3,022
2028	Apr	3,064	2,960	2,882	2,815	2,786	2,829	3,265	3,792	3,994	4,026	4,145	4,165	4,206	4,193	4,187	4,061	4,006	3,715	3,350	3,475	3,534	3,486	3,313	3,218
2028	May	2,739	2,701	2,566	2,530	2,461	2,582	3,247	3,681	3,972	4,097	4,104	4,105	4,114	4,134	4,190	4,157	3,999	3,712	3,086	3,007	3,051	2,898	2,757	2,619
2028	Jun	2,775	2,621	2,541	2,531	2,535	2,893	3,585	4,150	4,359	4,427	4,497	4,517	4,590	4,456	4,456	4,297	4,285	3,865	3,135	2,799	2,835	2,910	2,811	2,797
2028	Jul	2,964	2,912	2,878	2,759	2,656	2,910	3,794	4,237	4,402	4,461	4,454	4,408	4,243	4,072	4,011	3,823	3,687	3,614	3,199	3,149	3,243	3,306	3,264	3,108
2028	Aug	2,726	2,668	2,584	2,522	2,444	2,451	3,066	3,768	4,113	4,313	4,362	4,342	4,299	4,135	4,033	3,882	3,651	3,305	2,954	3,108	3,178	3,161	3,018	2,846
2028	Sep	3,131	3,054	2,937	2,843	2,749	2,670	3,061	3,954	4,254	4,363	4,386	4,358	4,405	4,517	4,477	4,386	3,908	3,220	3,268	3,575	3,687	3,573	3,461	3,259
2028	Oct	2,546	2,511	2,431	2,405	2,421	2,460	2,632	3,359	3,821	3,995	4,167	4,072	4,083	4,142	4,115	3,957	3,150	2,706	2,909	2,949	2,949	2,843	2,734	2,549
2028	Nov	2,556	2,566	2,606	2,586	2,548	2,594	2,685	3,127	3,932	4,101	4,105	3,976	3,885	3,840	3,747	3,229	2,509	2,540	2,698	2,784	2,821	2,858	2,763	2,671
2028	Dec	2,848	2,896	2,874	2,776	2,710	2,737	2,714	2,801	3,517	3,774	3,730	3,792	3,857	3,901	3,845	3,367	2,742	2,818	2,885	2,952	3,001	2,989	2,939	2,804
2029	Jan	3,042	3,100	3,057	2,860	2,661	2,567	2,527	2,606	3,462	4,078	4,111	4,093	3,996	3,966	3,992	3,695	2,946	2,668	2,744	2,858	2,874	2,871	2,881	2,945
2029	Feb	2,721	2,767	2,767	2,740	2,703	2,591	2,630	2,967	3,530	3,733	3,834	3,979	4,042	4,116	4,117	4,072	3,464	2,767	2,722	2,688	2,694	2,775	2,896	2,852
2029	Mar	3,081	2,957	2,858	2,818	2,834	2,854	2,953	3,674	4,235	4,498	4,559	4,517	4,465	4,426	4,418	4,213	3,996	3,378	3,282	3,489	3,565	3,483	3,321	3,195
2029	Apr	3,147	3,073	2,997	2,863	2,866	2,974	3,418	3,889	4,047	4,083	4,178	4,289	4,236	4,266	4,168	4,117	4,054	3,840	3,498	3,620	3,658	3,513	3,412	3,259
2029	May	2,874	2,842	2,688	2,636	2,594	2,679	3,282	3,809	4,108	4,263	4,248	4,186	4,160	4,251	4,259	4,305	3,797	3,233	3,202	3,292	3,112	2,872	2,731	
2029	Jun	2,913	2,746	2,676	2,656	2,664	3,044	3,751	4,248	4,517	4,585	4,627	4,617	4,668	4,551	4,561	4,484	4,428	4,015	3,270	2,953	2,989	3,079	2,959	2,916
2029	Jul	3,124	3,056	3,007	2,910	2,807	3,064	3,848	4,305	4,570	4,562	4,532	4,473	4,330	4,169	4,116	3,900	3,785	3,727	3,342	3,303	3,434	3,498	3,429	3,310
2029	Aug	2,882	2,804	2,727	2,658	2,608	2,553	3,212	3,883	4,239	4,468	4,490	4,465	4,454	4,287	4,191	4,060	3,814	3,466	3,126	3,297	3,373	3,356	3,170	2,981
2029	Sep	3,277	3,179	3,067	2,935	2,842	2,755	3,111	4,045	4,277	4,404	4,435	4,347	4,340	4,468	4,421	4,415	4,007	3,328	3,388	3,762	3,850	3,779	3,634	3,440
2029	Oct	2,684	2,595	2,546	2,488	2,517	2,581	2,757	3,476	3,943	4,105	4,264	4,213	4,214	4,272	4,230	4,082	3,271	2,818	3,053	3,086	3,086	2,981	2,830	2,670
2029	Nov	2,641	2,695	2,726	2,675	2,667	2,746	2,801	3,279	4,048	4,228	4,217	4,125	4,060	3,954	3,860	3,424	2,623	2,661	2,846	2,905	2,990	2,996	2,918	2,768
2029	Dec	2,959	2,974	2,972	2,899	2,876	2,875	2,850	2,958	3,634	3,865	3,855	3,933	3,944	3,988	3,959	3,484	2,855	2,931	3,012	3,110	3,173	3,148	3,042	2,902
2030	Jan	3,061	3,145	3,091	2,871	2,689	2,586	2,562	2,672	3,739	4,470	4,528	4,484	4,380	4,426	4,426	4,110	3,088	2,678	2,754	2,870	2,871	2,844	2,862	2,943
2030	Feb	2,740	2,794	2,772	2,764	2,735	2,634	2,651	3,087	3,747	4,025	4,158	4,333	4,337	4,420	4,476	4,401	3,765	2,848	2,735	2,736	2,744	2,820	2,928	2,868
2030	Mar	3,073	2,952	2,876	2,827	2,861	2,825	3,003	3,845	4,547	4,687	4,840	4,784	4,805	4,830	4,790	4,597	4,400	3,516	3,273	3,454	3,552	3,431	3,276	3,146
2030	Apr	3,152	3,105	2,998	2,889	2,885	2,998	3,564	4,086	4,357	4,399	4,533	4,544	4,543	4,502	4,466	4,335	4,359	3,997	3,538	3,627	3,671	3,590	3,428	3,339
2030	May	2,815	2,724	2,591	2,581	2,528	2,821	3,420	4,018	4,452	4,675	4,687	4,631	4,718	4,691	4,726	4,673	4,440	4,070	3,312	3,214	3,257	3,084	2,861	2,690
2030	Jun	2,890	2,765	2,673	2,661	2,661	3,224	3,981	4,571	4,956	5,190	5,245	5,307	5,412	5,364	5,331	5,232	5,082	4,629	3,583	2,988	3,026	3,099	2,981	2,922
2030	Jul	3,103	3,028	2,985	2,898	2,808	3,203	4,246	4,798	5,199	5,247	5,303	5,317	5,199	4,994	4,864	4,561	4,353	4,158	3,520	3,355	3,476	3,529	3,443	3,315
2030	Aug	2,869	2,783	2,720	2,686	2,600	2,603	3,514	4,432	4,903	5,126	5,316	5,311	5,297	5,109	4,972	4,765	4,374	3,799	3,197	3,320	3,396	3,377	3,199	2,991
2030	Sep	3,332	3,191	3,091	2,967	2,893	2,801	3,363	4,335	4,621	4,781	4,892	4,855	4,882	4,997	4,960	4,920	4,411	3,431	3,408	3,769	3,863	3,814	3,669	3,471
2030	Oct	2,709	2,624	2,587	2,534	2,560	2,604	2,822	3,774	4,234	4,415	4,651	4,534	4,623	4,641	4,641	4,573	3,485	2,863	3,082	3,125	3,107	2,992	2,838	2,683
2030	Nov	2,666	2,709	2,713	2,680	2,677	2,737	2,813	3,415	4,325	4,453	4,528	4,436	4,357	4,350	4,261	3,698	2,729	2,710	2,870</					

2023 DSM + BE Plan Appendix I

PSCo Renewable Generation

2032	Jan	3,223	3,291	3,232	2,982	2,792	2,681	2,683	2,806	3,895	4,684	4,765	4,735	4,638	4,673	4,683	4,325	3,218	2,744	2,842	2,971	2,964	2,978	2,995	3,064
2032	Feb	2,826	2,842	2,871	2,855	2,824	2,735	2,780	3,229	3,887	4,172	4,311	4,395	4,530	4,557	4,696	4,595	3,929	2,914	2,805	2,829	2,828	2,955	3,083	3,026
2032	Mar	3,216	3,120	3,023	2,995	3,004	2,935	3,107	3,987	4,731	4,860	5,043	4,984	4,999	5,029	5,007	4,831	4,572	3,584	3,348	3,558	3,655	3,550	3,442	3,251
2032	Apr	3,308	3,224	3,111	3,014	2,993	3,112	3,737	4,188	4,390	4,492	4,557	4,629	4,683	4,669	4,685	4,608	4,524	4,120	3,641	3,747	3,795	3,730	3,593	3,489
2032	May	3,028	2,939	2,777	2,768	2,674	3,031	3,626	4,124	4,569	4,697	4,788	4,836	4,845	4,922	4,901	4,821	4,659	4,279	3,488	3,360	3,431	3,286	3,054	2,905
2032	Jun	3,039	2,910	2,785	2,774	2,775	3,320	4,208	4,783	5,196	5,366	5,479	5,504	5,633	5,599	5,579	5,414	5,372	4,769	3,656	3,090	3,136	3,227	3,104	3,082
2032	Jul	3,226	3,123	3,103	3,032	2,933	3,372	4,442	5,073	5,445	5,522	5,569	5,612	5,473	5,297	5,105	4,803	4,509	4,317	3,646	3,484	3,310	3,262	3,575	3,432
2032	Aug	3,043	2,923	2,843	2,770	2,713	2,740	3,654	4,622	5,140	5,426	5,592	5,531	5,493	5,313	5,135	4,940	4,533	3,934	3,332	3,456	3,539	3,513	3,335	3,142
2032	Sep	3,428	3,299	3,199	3,117	3,034	2,931	3,466	4,323	4,570	4,778	4,896	4,880	4,973	5,092	5,148	4,950	4,452	3,486	3,494	3,842	3,934	3,856	3,714	3,540
2032	Oct	2,839	2,741	2,706	2,653	2,672	2,723	2,961	3,934	4,523	4,697	4,864	4,838	4,852	4,914	4,934	4,755	3,644	2,957	3,175	3,230	3,252	3,151	2,996	2,823
2032	Nov	2,803	2,846	2,831	2,802	2,768	2,817	2,910	3,524	4,477	4,679	4,704	4,681	4,607	4,543	4,481	3,838	2,794	2,790	2,966	3,053	3,139	3,149	3,065	2,939
2032	Dec	3,123	3,131	3,087	2,987	2,933	2,928	2,943	3,065	3,993	4,446	4,443	4,538	4,645	4,699	4,609	3,972	3,000	3,028	3,102	3,202	3,259	3,266	3,155	3,067
2033	Jan	3,341	3,398	3,339	3,099	2,885	2,765	2,740	2,848	3,973	4,780	4,801	4,783	4,685	4,696	4,759	4,403	3,318	2,850	2,946	3,094	3,094	3,125	3,139	3,208
2033	Feb	3,005	3,034	3,016	2,988	2,927	2,837	2,900	3,389	4,132	4,413	4,625	4,714	4,763	4,863	4,910	4,837	4,101	3,049	2,934	2,936	2,986	3,084	3,179	3,091
2033	Mar	3,334	3,244	3,137	3,122	3,125	3,053	3,226	4,163	4,906	4,984	5,110	5,107	5,100	5,152	5,139	4,981	4,717	3,734	3,506	3,702	3,783	3,665	3,521	3,364
2033	Apr	3,380	3,303	3,182	3,085	3,084	3,211	3,756	4,206	4,453	4,555	4,616	4,682	4,692	4,692	4,680	4,591	4,489	4,157	3,728	3,825	3,861	3,809	3,685	3,573
2033	May	3,131	3,022	2,856	2,832	2,776	3,097	3,704	4,209	4,577	4,796	4,932	4,935	5,002	5,068	5,088	4,974	4,828	4,401	3,663	3,463	3,542	3,391	3,167	3,018
2033	Jun	3,193	3,064	2,916	2,876	2,877	3,462	4,361	4,902	5,232	5,433	5,547	5,579	5,702	5,674	5,682	5,514	5,484	4,878	3,790	3,224	3,272	3,370	3,228	3,218
2033	Jul	3,374	3,259	3,227	3,154	3,050	3,446	4,666	5,228	5,623	5,658	5,727	5,746	5,594	5,415	5,183	4,940	4,657	4,473	3,828	3,656	3,790	3,832	3,731	3,594
2033	Aug	3,172	3,053	3,008	2,941	2,854	2,854	3,819	4,692	5,280	5,567	5,712	5,661	5,585	5,437	5,280	5,085	4,658	4,096	3,505	3,639	3,724	3,686	3,503	3,279
2033	Sep	3,555	3,453	3,356	3,250	3,132	3,032	3,593	4,435	4,738	4,937	5,094	5,039	5,108	5,281	5,288	5,113	4,534	3,625	3,648	3,989	4,039	3,969	3,887	3,658
2033	Oct	2,944	2,865	2,813	2,744	2,773	2,823	3,087	4,082	4,599	4,794	4,978	4,987	5,055	5,064	5,082	4,950	3,784	3,081	3,309	3,361	3,371	3,274	3,114	2,946
2033	Nov	2,908	2,970	2,948	2,911	2,865	2,908	2,995	3,611	4,545	4,767	4,796	4,720	4,676	4,593	4,551	3,936	2,868	2,881	3,082	3,183	3,288	3,298	3,208	3,069
2033	Dec	3,315	3,305	3,254	3,131	3,069	3,054	3,082	3,171	4,070	4,503	4,554	4,661	4,767	4,825	4,764	4,081	3,139	3,178	3,264	3,385	3,443	3,440	3,333	3,248
2034	Jan	3,413	3,520	3,461	3,171	2,972	2,855	2,803	2,929	4,087	4,914	4,982	4,899	4,827	4,842	4,928	4,566	3,422	2,928	3,029	3,185	3,195	3,217	3,238	3,320
2034	Feb	3,099	3,139	3,123	3,102	3,022	2,920	2,957	3,425	4,182	4,481	4,657	4,792	4,886	4,998	5,024	4,932	4,199	3,109	2,995	3,015	3,054	3,157	3,289	3,206
2034	Mar	3,410	3,314	3,190	3,162	3,169	3,122	3,315	4,260	4,930	5,083	5,227	5,202	5,234	5,326	5,360	5,141	4,875	3,861	3,634	3,837	3,899	3,802	3,651	3,473
2034	Apr	3,459	3,370	3,279	3,173	3,208	3,320	3,907	4,330	4,568	4,666	4,714	4,791	4,844	4,873	4,885	4,721	4,721	4,266	3,817	3,940	3,945	3,893	3,799	3,641
2034	May	3,199	3,118	2,943	2,919	2,838	3,172	3,790	4,335	4,667	4,966	5,006	5,038	5,100	5,175	5,155	5,095	4,881	4,511	3,716	3,543	3,568	3,421	3,229	3,096
2034	Jun	3,269	3,113	2,987	2,933	2,952	3,520	4,382	5,015	5,340	5,588	5,724	5,760	5,893	5,828	5,862	5,680	5,516	4,971	3,886	3,319	3,361	3,451	3,323	3,316
2034	Jul	3,498	3,357	3,323	3,268	3,207	3,604	4,717	5,329	5,730	5,812	5,928	5,928	5,794	5,581	5,349	5,103	4,817	4,610	3,952	3,776	3,917	3,961	3,855	3,707
2034	Aug	3,295	3,209	3,101	3,021	2,936	2,971	3,927	4,867	5,443	5,711	5,877	5,813	5,815	5,598	5,451	5,245	4,812	4,226	3,619	3,759	3,850	3,830	3,625	3,400
2034	Sep	3,644	3,526	3,439	3,317	3,189	3,053	3,620	4,590	4,881	5,106	5,280	5,230	5,317	5,452	5,455	5,320	4,704	3,726	3,735	4,088	4,150	4,071	3,960	3,818
2034	Oct	3,006	2,924	2,891	2,797	2,826	2,855	3,127	4,191	4,719	4,944	5,136	5,109	5,187	5,219	5,199	5,056	3,849	3,136	3,367	3,426	3,421	3,342	3,180	2,979
2034	Nov	2,953	3,057	3,045	2,968	2,938	2,973	3,110	3,668	4,741	4,944	4,917	4,907	4,842	4,773	4,670	4,062	2,912	2,952	3,160	3,253	3,353	3,368	3,242	3,142
2034	Dec	3,404	3,360	3,303	3,193	3,118	3,134	3,151	3,256	4,260	4,649	4,708	4,764	4,868	4,945	4,908	4,198	3,217	3,242	3,315	3,413	3,480	3,481	3,377	3,322
2035	Jan	3,495	3,547	3,528	3,232	3,047	2,920	2,858	2,962	4,203	5,050	5,134	5,100	5,078	5,148	5,171	4,763	3,504	2,986	3,091	3,259	3,263	3,284	3,321	3,399
2035	Feb	3,194	3,229	3,217	3,169	3,106	2,993	3,019	3,467	4,243	4,556	4,720	4,865	5,045	5,174	5,252	5,133	4,332	3,198	3,075	3,098	3,144	3,254	3,378	3,293
2035	Mar	3,505	3,387	3,281	3,224	3,250	3,199	3,403	4,353	5,104	5,202	5,434	5,367	5,449	5,481	5,551	5,352	5,014	3,956	3,699	3,896	3,985	3,861	3,753	3,572
2035	Apr	3,512	3,454	3,305	3,212	3,226	3,389	3,970	4,462	4,705	4,772	4,866	4,883	4,937	4,929	4,950	4,803	4,770	4,357	3,902	3,974	4,012	3,939	3,827	3,697
2035	May	3,299	3,211	3,022	2,986	2,937	3,237	3,961	4,576	5,057	5,201	5,284	5,198	5,273	5,276	5,326	5,290	4,981	4,601	3,807	3,688	3,760	3,597	3,334	3,160
2035	Jun	3,351	3,207	3,070	3,042	3,023	3,649	4,505	5,257	5,680	5,864	5,918	5,914	6,007	5,899	5,918	5,802	5,652	5,081	3,993	3,389	3,418	3,512	3,402	3,372
2035	Jul	3,603	3,505	3,465	3,426	3,296	3,698	4,904	5,577	6,020	6,077	6,113	6,158	5,961	5,712	5,524	5,198	4,884	4,659	3,989	3,817	3,986	4,055	3,959	3,779
2035	Aug	3,388	3,250	3,183	3,124	3,026	3,046	4,076	5,110	5,617	5,863	6,066	5,995	6,057	5,821	5,659	5,433	4,944	4,330	3,698	3,839	3,931	3,894	3,714	3,462
2035	Sep	3,800	3,679	3,513	3,373	3,258	3,101	3,710	4,823	5,186	5,398	5,473	5,405	5,442	5,567	5,588	5,505	4,886	3,867	3,833	4,262	4,376	4,338	4,183	3,960
2035	Oct	3,110	3,013	2,993	2,924	2,899	2,916	3,194	4,242	4,800	4,998	5,217	5,214	5,308	5,334	5,352	5,173	3,947	3,228	3,467	3,512	3,487	3,444	3,232	3,031
2035	Nov	3,073	3,106	3,133	3,066	3,061	3,121	3,216	3,849	4,965	5,061	5,177	5,166	5,032	4,983	4,958	4,259	2,998	3,053</						

2023 DSM + BE Plan Appendix I

PSCo Renewable Generation

2037	Mar	3,748	3,616	3,522	3,470	3,498	3,473	3,623	4,512	5,232	5,424	5,588	5,587	5,572	5,653	5,685	5,506	5,227	4,194	3,971	4,222	4,264	4,113	4,017	3,831
2037	Apr	3,840	3,737	3,640	3,514	3,512	3,603	4,194	4,684	4,909	5,004	5,082	5,071	5,128	5,187	5,159	5,060	4,957	4,539	4,149	4,271	4,328	4,216	4,129	4,014
2037	May	3,583	3,479	3,270	3,220	3,178	3,536	4,126	4,672	5,060	5,274	5,308	5,364	5,403	5,457	5,490	5,591	5,400	4,985	4,156	4,035	4,049	3,894	3,611	3,421
2037	Jun	3,694	3,508	3,339	3,265	3,267	3,816	4,743	5,460	5,840	6,120	6,209	6,305	6,440	6,308	6,478	6,220	6,108	5,493	4,371	3,765	3,810	3,903	3,767	3,729
2037	Jul	3,805	3,737	3,719	3,631	3,573	3,974	5,137	5,806	6,257	6,353	6,448	6,515	6,372	6,171	5,907	5,612	5,264	5,096	4,443	4,285	4,473	4,495	4,317	4,042
2037	Aug	3,693	3,553	3,456	3,395	3,322	3,327	4,353	5,311	6,028	6,283	6,489	6,409	6,385	6,119	5,977	5,782	5,297	4,718	4,105	4,287	4,382	4,324	4,107	3,814
2037	Sep	4,018	3,921	3,813	3,725	3,599	3,474	4,054	5,005	5,273	5,465	5,549	5,505	5,635	5,775	5,899	5,769	5,217	4,164	4,197	4,637	4,700	4,600	4,478	4,203
2037	Oct	3,390	3,275	3,214	3,152	3,164	3,209	3,501	4,510	5,105	5,284	5,458	5,433	5,473	5,529	5,556	5,398	4,138	3,468	3,776	3,853	3,823	3,716	3,547	3,329
2037	Nov	3,295	3,354	3,342	3,317	3,266	3,281	3,353	4,078	5,080	5,376	5,389	5,332	5,276	5,162	5,049	4,363	3,102	3,180	3,463	3,587	3,749	3,699	3,634	3,448
2037	Dec	3,748	3,723	3,646	3,459	3,364	3,385	3,384	3,449	4,479	4,989	5,001	5,133	5,227	5,313	5,176	4,457	3,506	3,520	3,607	3,756	3,817	3,804	3,696	3,629
2038	Jan	3,795	3,891	3,780	3,498	3,272	3,194	3,162	3,249	4,449	5,384	5,455	5,401	5,387	5,433	5,489	5,009	3,736	3,224	3,344	3,549	3,532	3,558	3,563	3,642
2038	Feb	3,499	3,564	3,525	3,461	3,385	3,305	3,374	3,781	4,513	4,851	5,063	5,217	5,363	5,539	5,648	5,511	4,610	3,496	3,335	3,385	3,441	3,549	3,689	3,617
2038	Mar	3,799	3,670	3,588	3,546	3,589	3,501	3,666	4,530	5,342	5,487	5,704	5,711	5,628	5,829	5,830	5,633	5,223	4,165	3,937	4,182	4,246	4,132	4,037	3,856
2038	Apr	3,861	3,785	3,654	3,531	3,532	3,682	4,279	4,749	5,051	5,110	5,174	5,205	5,286	5,320	5,341	5,219	5,151	4,652	4,180	4,269	4,313	4,238	4,158	4,051
2038	May	3,666	3,551	3,294	3,301	3,251	3,590	4,148	4,735	5,188	5,351	5,483	5,486	5,520	5,600	5,620	5,539	5,308	4,904	4,072	3,949	4,022	3,905	3,666	3,479
2038	Jun	3,741	3,569	3,395	3,307	3,312	3,863	4,806	5,543	5,930	6,222	6,315	6,390	6,507	6,527	6,492	6,272	6,151	5,552	4,316	3,752	3,795	3,893	3,765	3,742
2038	Jul	3,897	3,764	3,745	3,684	3,562	3,995	5,232	5,947	6,421	6,473	6,531	6,598	6,355	6,158	5,870	5,604	5,224	5,017	4,372	4,242	4,419	4,463	4,333	4,102
2038	Aug	3,757	3,605	3,523	3,436	3,320	3,323	4,318	5,393	6,027	6,345	6,512	6,429	6,383	6,137	5,978	5,799	5,286	4,669	4,068	4,241	4,349	4,304	4,103	3,822
2038	Sep	4,035	3,920	3,867	3,766	3,628	3,516	4,086	5,003	5,307	5,460	5,553	5,536	5,662	5,861	5,794	5,630	5,007	4,062	4,079	4,512	4,540	4,474	4,381	4,171
2038	Oct	3,422	3,254	3,212	3,174	3,168	3,207	3,528	4,609	5,200	5,451	5,559	5,593	5,615	5,682	5,733	5,494	4,211	3,454	3,735	3,796	3,812	3,743	3,549	3,365
2038	Nov	3,387	3,486	3,411	3,320	3,299	3,389	3,431	4,111	5,187	5,437	5,524	5,376	5,384	5,298	5,109	4,396	3,189	3,255	3,536	3,669	3,792	3,797	3,680	3,508
2038	Dec	3,823	3,783	3,729	3,588	3,503	3,479	3,523	3,615	4,628	5,159	5,197	5,341	5,386	5,420	5,323	4,594	3,584	3,617	3,692	3,831	3,881	3,919	3,768	3,673
2039	Jan	3,947	4,022	3,936	3,629	3,377	3,283	3,263	3,355	4,545	5,458	5,514	5,482	5,444	5,517	5,563	5,144	3,906	3,360	3,483	3,699	3,678	3,716	3,739	3,812
2039	Feb	3,580	3,639	3,619	3,529	3,469	3,377	3,484	3,924	4,714	5,058	5,234	5,379	5,530	5,708	5,732	5,610	4,791	3,617	3,441	3,486	3,560	3,672	3,793	3,718
2039	Mar	3,927	3,770	3,645	3,646	3,671	3,591	3,781	4,729	5,476	5,594	5,859	5,755	5,807	5,874	5,901	5,751	5,387	4,287	4,070	4,285	4,349	4,239	4,126	3,949
2039	Apr	3,932	3,853	3,730	3,606	3,633	3,780	4,299	4,811	5,079	5,167	5,243	5,339	5,364	5,348	5,387	5,265	5,203	4,694	4,277	4,384	4,398	4,349	4,282	4,168
2039	May	3,706	3,595	3,374	3,321	3,303	3,660	4,236	4,791	5,236	5,429	5,480	5,558	5,587	5,714	5,754	5,757	5,439	5,026	4,206	4,046	4,108	3,962	3,750	3,525
2039	Jun	3,857	3,668	3,508	3,430	3,418	3,968	4,926	5,621	6,045	6,361	6,367	6,432	6,591	6,438	6,533	6,327	6,234	5,548	4,404	3,802	3,885	3,984	3,826	3,845
2039	Jul	3,993	3,891	3,843	3,793	3,627	4,091	5,394	6,118	6,605	6,588	6,650	6,680	6,409	6,223	5,935	5,660	5,336	5,147	4,508	4,363	4,549	4,591	4,456	4,244
2039	Aug	3,833	3,695	3,580	3,524	3,397	3,428	4,444	5,423	6,113	6,350	6,565	6,491	6,444	6,190	6,059	5,887	5,363	4,781	4,182	4,372	4,484	4,435	4,235	3,907
2039	Sep	4,160	4,038	3,931	3,844	3,723	3,570	4,098	5,142	5,373	5,651	5,662	5,780	5,779	5,969	6,035	5,823	5,098	4,075	4,226	4,591	4,637	4,548	4,461	4,322
2039	Oct	3,501	3,320	3,254	3,216	3,236	3,268	3,581	4,670	5,294	5,523	5,794	5,702	5,776	5,828	5,821	5,595	4,294	3,501	3,779	3,861	3,847	3,770	3,614	3,423
2039	Nov	3,389	3,538	3,499	3,406	3,340	3,401	3,509	4,155	5,233	5,452	5,565	5,520	5,387	5,370	5,193	4,519	3,258	3,323	3,613	3,688	3,862	3,868	3,759	3,554
2039	Dec	3,923	3,901	3,809	3,660	3,529	3,546	3,535	3,610	4,654	5,189	5,140	5,424	5,528	5,562	5,433	4,714	3,585	3,676	3,759	3,897	3,959	3,965	3,805	3,809
2040	Jan	3,872	3,950	3,856	3,522	3,306	3,216	3,193	3,319	4,566	5,582	5,635	5,647	5,573	5,665	5,743	5,231	3,831	3,230	3,344	3,562	3,592	3,629	3,662	3,744
2040	Feb	3,447	3,522	3,538	3,475	3,396	3,308	3,396	3,877	4,638	4,991	5,171	5,266	5,450	5,589	5,626	5,520	4,752	3,536	3,364	3,398	3,462	3,613	3,765	3,721
2040	Mar	3,880	3,748	3,645	3,605	3,635	3,596	3,771	4,717	5,440	5,679	5,870	5,894	5,962	6,057	6,117	5,890	5,496	4,315	4,054	4,245	4,312	4,224	4,143	3,974
2040	Apr	3,972	3,886	3,751	3,586	3,639	3,754	4,389	4,914	5,197	5,284	5,334	5,463	5,541	5,580	5,560	5,436	5,349	4,794	4,276	4,360	4,388	4,350	4,317	4,190
2040	May	3,713	3,621	3,395	3,381	3,289	3,670	4,293	4,922	5,399	5,641	5,722	5,702	5,776	5,845	5,881	5,816	5,514	5,108	4,234	4,014	4,042	3,869	3,675	3,482
2040	Jun	3,760	3,634	3,439	3,395	3,363	4,016	4,932	5,806	6,222	6,462	6,593	6,566	6,618	6,562	6,627	6,406	6,248	5,592	4,348	3,771	3,797	3,923	3,785	3,784
2040	Jul	4,047	3,893	3,863	3,856	3,732	4,148	5,419	6,186	6,618	6,671	6,693	6,727	6,517	6,225	5,978	5,652	5,366	5,095	4,419	4,274	4,479	4,525	4,412	4,230
2040	Aug	3,852	3,726	3,573	3,513	3,389	3,402	4,440	5,613	6,252	6,566	6,755	6,591	6,539	6,251	6,128	5,908	5,356	4,680	4,094	4,282	4,408	4,382	4,174	3,896
2040	Sep	4,134	4,037	3,950	3,832	3,658	3,495	4,059	5,106	5,506	5,775	5,865	5,824	5,953	6,044	6,089	5,970	5,227	4,150	4,158	4,613	4,686	4,628	4,498	4,323
2040	Oct	3,426	3,252	3,212	3,199	3,194	3,211	3,545	4,642	5,262	5,461	5,732	5,755	5,852	5,927	5,931	5,660	4,293	3,480	3,736	3,799	3,783	3,743	3,577	3,396
2040	Nov	3,350	3,504	3,508	3,412	3,411	3,473	3,477	4,242	5,578	5,524	5,804	5,718	5,477	5,574	5,497	4,606	3,276	3,300	3,563	3,663	3,768	3,811	3,702	3,594
2040	Dec	3,868	3,875	3,733	3,602	3,528	3,551	3,557	3,634	4,720	5,298	5,227	5,434	5,599	5,657	5,577	4,670	3,624	3,595	3,658	3,843	3,906	3,907	3,800	3,735
2041	Jan	3,923	4,017	3,944	3,620	3,426	3,333	3,300	3,452	4,705	5,684	5,795	5,793	5,723	5,808	5,859	5,323	3,894	3,303</						

2023 DSM + BE Plan Appendix I

PSCo Renewable Generation

2042	May	3,925	3,831	3,533	3,561	3,511	3,900	4,469	5,030	5,435	5,691	5,819	5,525	5,643	5,952	5,875	5,910	5,701	5,220	4,382	4,202	4,234	4,094	3,897	3,680
2042	Jun	3,969	3,822	3,645	3,557	3,580	4,236	5,111	5,898	6,482	6,774	6,911	6,973	6,927	6,834	6,975	6,678	6,486	5,811	4,663	4,054	4,080	4,207	4,027	4,008
2042	Jul	4,275	4,225	4,135	4,136	4,040	4,424	5,632	6,511	6,950	6,941	6,980	6,964	6,742	6,466	6,098	5,847	5,545	5,298	4,662	4,550	4,773	4,854	4,725	4,488
2042	Aug	4,073	3,880	3,819	3,730	3,612	3,615	4,577	5,642	6,481	6,786	6,989	6,788	6,729	6,412	6,275	6,163	5,588	4,965	4,362	4,579	4,689	4,678	4,475	4,132
2042	Sep	4,457	4,348	4,229	4,068	3,939	3,798	4,365	5,393	5,861	6,043	6,118	6,062	6,171	6,382	6,385	6,153	5,361	4,323	4,379	4,895	5,009	4,959	4,837	4,610
2042	Oct	3,682	3,512	3,469	3,440	3,452	3,450	3,784	4,967	5,638	5,742	5,991	5,949	5,871	5,995	6,060	5,789	4,487	3,661	3,970	4,089	4,049	3,983	3,834	3,595
2042	Nov	3,644	3,728	3,695	3,589	3,679	3,645	3,718	4,441	5,602	5,848	5,876	5,744	5,776	5,574	5,427	4,722	3,467	3,492	3,767	3,886	4,083	4,055	3,976	3,838
2042	Dec	4,145	4,143	3,998	3,856	3,776	3,762	3,778	3,800	4,857	5,397	5,460	5,644	5,723	5,805	5,662	4,845	3,803	3,831	3,948	4,113	4,176	4,242	4,069	4,050

2023 DSM + BE Plan Appendix I

PSCo Load Net of Renewables

PSCo Load Net of Renewables (MW)																									
Year	Month	HE1	HE2	HE3	HE4	HE5	HE6	HE7	HE8	HE9	HE10	HE11	HE12	HE13	HE14	HE15	HE16	HE17	HE18	HE19	HE20	HE21	HE22	HE23	HE24
2022	Jan	1,462	1,387	1,396	1,500	1,684	1,927	2,271	2,410	2,155	1,965	1,890	1,801	1,764	1,772	1,773	1,881	2,329	2,857	2,936	2,799	2,611	2,306	1,944	1,663
2022	Feb	1,610	1,601	1,605	1,589	1,626	1,819	2,120	2,158	1,986	1,854	1,791	1,671	1,542	1,476	1,463	1,547	1,878	2,381	2,676	2,638	2,467	2,114	1,763	1,610
2022	Mar	1,308	1,319	1,391	1,429	1,535	1,774	2,015	1,950	1,741	1,623	1,462	1,413	1,415	1,414	1,357	1,380	1,532	1,898	2,072	2,066	1,826	1,537	1,397	1,342
2022	Apr	1,026	1,031	1,091	1,154	1,258	1,442	1,598	1,544	1,532	1,532	1,463	1,363	1,330	1,277	1,255	1,240	1,290	1,388	1,540	1,557	1,406	1,151	1,069	1,003
2022	May	1,149	1,132	1,171	1,185	1,288	1,507	1,647	1,697	1,697	1,705	1,758	1,829	1,855	1,845	1,825	1,785	1,850	1,952	2,120	2,195	2,086	1,793	1,522	1,263
2022	Jun	1,553	1,544	1,522	1,489	1,520	1,597	1,667	1,625	1,706	1,870	2,064	2,198	2,332	2,495	2,593	2,661	2,613	2,651	2,705	2,609	2,447	2,110	1,814	1,618
2022	Jul	1,564	1,536	1,535	1,590	1,704	1,767	1,732	1,731	1,886	2,129	2,440	2,775	3,094	3,383	3,487	3,540	3,433	3,235	3,035	2,766	2,551	2,156	1,753	1,615
2022	Aug	1,891	1,855	1,827	1,865	1,952	2,137	2,176	2,161	2,269	2,386	2,584	2,802	3,029	3,229	3,346	3,442	3,443	3,349	3,188	2,988	2,725	2,281	1,984	1,859
2022	Sep	1,091	1,141	1,197	1,260	1,313	1,497	1,636	1,493	1,486	1,555	1,601	1,710	1,820	1,841	1,888	1,995	2,194	2,346	2,203	1,955	1,641	1,297	1,128	1,078
2022	Oct	1,483	1,438	1,467	1,526	1,628	1,842	2,113	1,949	1,784	1,695	1,634	1,604	1,573	1,545	1,523	1,615	2,103	2,436	2,420	2,308	2,114	1,947	1,724	1,586
2022	Nov	1,528	1,498	1,460	1,480	1,551	1,700	1,917	1,838	1,547	1,460	1,436	1,439	1,460	1,398	1,419	1,720	2,324	2,700	2,633	2,484	2,321	2,098	1,820	1,609
2022	Dec	1,623	1,510	1,446	1,501	1,609	1,769	2,065	2,157	1,747	1,604	1,639	1,575	1,473	1,410	1,400	1,699	2,377	2,818	2,727	2,621	2,474	2,231	1,938	1,784
2023	Jan	1,432	1,364	1,374	1,488	1,672	1,947	2,352	2,469	1,902	1,502	1,424	1,373	1,336	1,309	1,319	1,510	2,269	2,954	3,045	2,902	2,698	2,369	1,956	1,647
2023	Feb	1,573	1,553	1,555	1,559	1,607	1,843	2,184	2,113	1,623	1,412	1,328	1,198	1,088	1,000	973	1,055	1,616	2,417	2,750	2,725	2,545	2,170	1,765	1,593
2023	Mar	1,298	1,314	1,405	1,452	1,557	1,824	2,037	1,668	1,282	1,115	963	932	936	938	923	986	1,186	1,856	2,143	2,145	1,887	1,576	1,386	1,336
2023	Apr	957	959	1,009	1,091	1,215	1,418	1,394	1,056	980	973	894	784	767	764	790	812	906	1,214	1,531	1,599	1,443	1,166	1,039	954
2023	May	1,067	1,038	1,061	1,093	1,238	1,415	1,275	1,144	1,053	1,038	1,090	1,176	1,219	1,225	1,266	1,321	1,430	1,648	2,052	2,166	2,066	1,775	1,459	1,208
2023	Jun	1,539	1,541	1,515	1,491	1,518	1,465	1,189	985	1,003	1,156	1,336	1,460	1,556	1,809	1,970	2,076	2,113	2,311	2,628	2,655	2,504	2,178	1,853	1,627
2023	Jul	1,564	1,520	1,516	1,597	1,715	1,662	1,214	1,040	1,157	1,399	1,717	2,034	2,383	2,712	2,849	3,089	3,105	3,013	3,044	2,870	2,649	2,234	1,801	1,613
2023	Aug	1,953	1,879	1,847	1,896	1,989	2,163	1,890	1,591	1,612	1,666	1,830	2,070	2,325	2,557	2,744	2,960	3,064	3,190	3,251	3,086	2,826	2,383	2,068	1,926
2023	Sep	1,064	1,126	1,192	1,256	1,313	1,555	1,507	993	888	936	975	1,056	1,156	1,195	1,292	1,448	1,832	2,319	2,296	2,036	1,690	1,331	1,114	1,054
2023	Oct	1,467	1,433	1,457	1,520	1,668	1,943	2,213	1,877	1,591	1,441	1,331	1,322	1,300	1,274	1,271	1,425	2,115	2,559	2,537	2,425	2,230	2,033	1,773	1,596
2023	Nov	1,546	1,515	1,464	1,476	1,545	1,715	1,915	1,727	1,225	1,084	1,044	1,088	1,097	1,042	1,104	1,522	2,323	2,776	2,718	2,562	2,366	2,144	1,858	1,644
2023	Dec	1,675	1,558	1,485	1,538	1,638	1,811	2,118	2,193	1,734	1,556	1,575	1,514	1,428	1,375	1,348	1,704	2,454	2,904	2,820	2,714	2,566	2,329	2,024	1,851
2024	Jan	1,487	1,418	1,428	1,540	1,727	2,015	2,418	2,533	1,941	1,520	1,429	1,368	1,344	1,290	1,295	1,520	2,324	3,064	3,114	2,969	2,760	2,430	2,008	1,693
2024	Feb	1,659	1,629	1,636	1,608	1,648	1,870	2,193	2,102	1,625	1,397	1,306	1,193	1,095	990	982	1,090	1,659	2,509	2,840	2,762	2,598	2,243	1,840	1,607
2024	Mar	1,355	1,373	1,459	1,504	1,616	1,891	2,112	1,719	1,285	1,115	989	965	963	943	917	994	1,216	1,957	2,278	2,248	1,992	1,683	1,482	1,415
2024	Apr	1,071	1,039	1,093	1,212	1,410	1,688	1,635	1,230	1,131	1,099	1,012	895	867	855	871	887	1,013	1,383	1,750	1,808	1,662	1,423	1,259	1,136
2024	May	1,099	1,056	1,089	1,119	1,289	1,496	1,355	1,223	1,128	1,124	1,195	1,252	1,298	1,299	1,338	1,382	1,517	1,738	2,164	2,297	2,176	1,855	1,516	1,266
2024	Jun	1,628	1,622	1,588	1,568	1,600	1,549	1,254	1,024	1,027	1,153	1,343	1,483	1,586	1,773	1,898	2,033	2,112	2,373	2,747	2,797	2,648	2,300	1,969	1,724
2024	Jul	1,651	1,592	1,597	1,675	1,793	1,745	1,289	1,105	1,214	1,458	1,785	2,093	2,449	2,762	2,895	3,144	3,169	3,105	3,161	2,984	2,773	2,380	1,939	1,726
2024	Aug	2,023	1,945	1,907	1,952	2,046	2,207	1,903	1,587	1,612	1,683	1,890	2,159	2,437	2,693	2,895	3,125	3,222	3,337	3,368	3,187	2,926	2,472	2,153	2,007
2024	Sep	1,185	1,211	1,255	1,322	1,398	1,610	1,543	989	886	933	985	1,149	1,269	1,289	1,374	1,509	1,917	2,409	2,349	2,088	1,786	1,449	1,248	1,196
2024	Oct	1,616	1,574	1,600	1,666	1,819	2,097	2,361	2,021	1,716	1,553	1,457	1,476	1,467	1,460	1,470	1,637	2,278	2,684	2,659	2,551	2,344	2,135	1,894	1,739
2024	Nov	1,601	1,558	1,520	1,542	1,623	1,800	2,013	1,791	1,287	1,121	1,091	1,139	1,147	1,094	1,140	1,579	2,398	2,824	2,770	2,618	2,438	2,220	1,931	1,719
2024	Dec	1,733	1,627	1,551	1,596	1,703	1,873	2,199	2,288	1,798	1,594	1,589	1,537	1,438	1,387	1,381	1,751	2,543	3,026	2,952	2,844	2,682	2,423	2,099	1,922
2025	Jan	998	906	905	1,080	1,311	1,619	2,014	2,136	1,562	1,129	1,045	955	884	859	903	1,131	1,949	2,669	2,714	2,535	2,335	2,011	1,615	1,267
2025	Feb	1,119	1,074	1,084	1,102	1,163	1,414	1,771	1,716	1,205	1,009	897	767	612	540	495	636	1,231	2,062	2,426	2,359	2,176	1,785	1,345	1,100
2025	Mar	792	798	922	1,000	1,134	1,460	1,689	1,275	873	708	579	548	591	590	583	614	865	1,563	1,824	1,764	1,503	1,180	935	878
2025	Apr	387	407	495	574	777	1,064	1,034	695	629	577	500	374	323	289	287	295	394	751	1,104	1,162	963	675	514	412
2025	May	614	515	599	679	858	1,060	975	868	797	819	865	930	976	966	923	929	1,066	1,242	1,692	1,791	1,665	1,386	1,099	812
2025	Jun	1,123	1,137	1,123	1,116	1,154	1,123	865	644	701	867	1,074	1,224	1,337	1,537	1,631	1,748	1,790	2,038	2,374	2,384	2,221	1,839	1,516	1,228
2025	Jul	1,082	1,026	1,023	1,091	1,273	1,284	846	714	826	1,128	1,482	1,840	2,220	2,566	2,697	2,903	2,904	2,745	2,722	2,493	2,233	1,817	1,376	1,159
2025	Aug	1,534	1,459	1,450	1,492	1,634	1,832	1,566	1,291	1,339	1,440	1,658	1,938	2,214	2,478	2,672	2,856	2,939	2,994	2,953	2,711	2,422	1,961	1,664	1,536
2025	Sep	502	566	637	754	874	1,093	1,055	523	414	485	570	748	862	884	955	1,074	1,479	1,943	1,823	1,484	1,100	703	501	489
2025	Oct	1,179	1,143	1,180	1,279	1,448	1,773	2,030	1,694	1,419	1,273	1,137	1,155	1,146	1,095	1,094	1,230	1,908	2,310	2,239	2,128	1,941	1,731	1,507	1,341
2025	Nov	1,195	1,123	1,034	1,083	1,166	1,399	1,623	1,387	884	683	669	701	770	762	853	1,286	2,097	2,512						

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PSCo Load Net of Renewables

2027	Jan	766	644	655	851	1,093	1,379	1,751	1,824	1,028	458	352	348	395	380	355	608	1,553	2,331	2,362	2,173	2,001	1,730	1,383	1,055
2027	Feb	900	855	853	877	947	1,221	1,520	1,344	835	593	490	352	161	6	(34)	29	740	1,782	2,115	2,054	1,886	1,512	1,076	897
2027	Mar	587	637	712	775	933	1,288	1,447	873	350	158	25	40	(12)	(78)	(83)	39	313	1,212	1,548	1,443	1,185	986	800	710
2027	Apr	228	235	324	478	657	842	608	214	93	74	(35)	(124)	(168)	(188)	(170)	(86)	(11)	399	816	856	711	494	324	225
2027	May	350	321	401	474	667	671	432	213	94	55	78	137	172	195	171	246	385	702	1,307	1,491	1,305	1,061	831	600
2027	Jun	859	860	877	858	900	647	175	(82)	(153)	(92)	105	237	357	584	705	911	932	1,299	1,908	2,110	1,935	1,538	1,242	974
2027	Jul	836	798	804	862	1,022	857	194	(88)	(33)	180	444	796	1,209	1,574	1,806	2,101	2,195	2,109	2,278	2,142	1,851	1,422	1,033	867
2027	Aug	1,227	1,197	1,197	1,238	1,402	1,534	1,076	601	495	520	651	880	1,176	1,494	1,720	1,940	2,172	2,421	2,602	2,376	2,072	1,614	1,343	1,235
2027	Sep	260	317	413	499	607	886	687	(30)	(137)	(157)	(147)	8	81	93	174	415	934	1,636	1,586	1,197	779	398	204	209
2027	Oct	1,025	970	980	1,077	1,255	1,549	1,714	1,142	744	593	415	424	422	408	413	556	1,470	2,067	1,956	1,855	1,683	1,540	1,366	1,184
2027	Nov	1,002	887	853	885	992	1,216	1,447	1,106	382	176	130	196	216	238	277	860	1,894	2,283	2,154	1,975	1,766	1,559	1,308	1,104
2027	Dec	1,077	957	897	990	1,116	1,322	1,647	1,747	1,097	779	764	669	518	433	448	996	1,995	2,419	2,337	2,182	2,011	1,784	1,513	1,311
2028	Jan	738	595	610	834	1,097	1,413	1,809	1,910	1,096	431	399	354	413	439	426	752	1,630	2,362	2,396	2,175	2,000	1,708	1,361	1,006
2028	Feb	851	763	765	772	840	1,075	1,366	1,178	522	354	215	72	13	(57)	(146)	(26)	610	1,602	2,025	1,959	1,738	1,325	899	739
2028	Mar	535	611	653	744	878	1,247	1,428	879	284	123	(50)	26	(22)	37	(36)	137	418	1,161	1,466	1,357	1,101	878	725	603
2028	Apr	194	220	272	382	575	780	549	161	57	69	(27)	(51)	(93)	(91)	(89)	43	120	411	835	837	687	468	331	187
2028	May	340	308	416	473	636	711	329	143	28	19	97	144	204	245	231	309	488	718	1,276	1,427	1,307	1,097	791	618
2028	Jun	761	790	801	805	845	611	138	(169)	(143)	3	133	277	353	621	734	976	1,009	1,321	1,877	2,072	1,908	1,510	1,216	923
2028	Jul	743	691	671	786	936	781	84	(122)	(12)	213	501	807	1,228	1,610	1,826	2,078	2,182	2,063	2,220	2,082	1,782	1,315	928	790
2028	Aug	1,091	1,026	1,044	1,108	1,295	1,474	1,085	615	506	529	690	896	1,132	1,468	1,694	1,915	2,142	2,352	2,527	2,287	1,981	1,534	1,251	1,130
2028	Sep	140	182	289	399	562	830	648	(98)	(257)	(233)	(143)	(22)	45	48	180	365	897	1,544	1,535	1,119	649	327	112	128
2028	Oct	948	885	925	1,005	1,197	1,530	1,663	1,049	638	479	313	393	382	323	355	544	1,427	2,030	1,899	1,786	1,604	1,477	1,263	1,147
2028	Nov	912	808	730	763	904	1,106	1,355	1,046	296	116	96	193	249	267	362	925	1,876	2,250	2,076	1,878	1,697	1,456	1,231	1,014
2028	Dec	907	732	701	798	959	1,159	1,529	1,616	956	695	720	595	460	387	434	966	1,877	2,248	2,159	2,003	1,834	1,635	1,350	1,152
2029	Jan	681	543	553	760	1,043	1,360	1,777	1,870	1,048	424	366	332	376	368	318	632	1,561	2,340	2,342	2,099	1,903	1,630	1,271	942
2029	Feb	834	728	710	746	849	1,155	1,470	1,267	745	530	409	214	101	(10)	(34)	16	727	1,749	2,087	2,012	1,830	1,457	1,004	822
2029	Mar	502	554	630	713	855	1,147	1,353	765	257	(1)	(80)	(89)	(85)	(74)	(93)	108	370	1,090	1,420	1,271	1,045	836	669	529
2029	Apr	178	175	228	410	586	753	525	186	113	102	18	(108)	(65)	(115)	(28)	24	116	342	770	775	634	512	306	218
2029	May	282	272	412	477	589	690	383	120	7	(35)	55	148	234	195	215	202	469	669	1,185	1,351	1,172	931	695	547
2029	Jun	729	775	779	795	834	584	97	(146)	(193)	(65)	77	237	324	567	670	836	927	1,240	1,817	2,007	1,844	1,417	1,150	895
2029	Jul	674	627	615	706	852	694	111	(99)	(81)	209	521	834	1,225	1,588	1,795	2,074	2,163	2,046	2,186	2,026	1,704	1,271	912	714
2029	Aug	999	958	974	1,043	1,186	1,404	969	539	437	456	675	914	1,146	1,510	1,740	1,934	2,152	2,322	2,432	2,153	1,838	1,382	1,147	1,055
2029	Sep	122	157	236	379	552	813	627	(165)	(248)	(243)	(155)	42	179	178	335	441	898	1,507	1,430	967	584	265	91	69
2029	Oct	855	847	857	973	1,158	1,479	1,609	1,006	597	458	314	355	365	320	370	547	1,419	1,991	1,844	1,737	1,530	1,373	1,196	1,058
2029	Nov	884	743	678	747	868	1,050	1,336	992	275	51	72	130	160	237	329	808	1,820	2,190	1,995	1,813	1,568	1,366	1,133	981
2029	Dec	855	724	678	753	863	1,087	1,465	1,533	915	677	667	523	441	366	384	917	1,850	2,252	2,161	1,967	1,770	1,568	1,331	1,138
2030	Jan	737	573	593	821	1,089	1,418	1,829	1,891	854	106	19	7	57	(28)	(52)	280	1,481	2,396	2,404	2,159	1,975	1,728	1,365	1,016
2030	Feb	887	771	775	792	889	1,190	1,533	1,232	614	316	162	(66)	(122)	(243)	(323)	(244)	495	1,734	2,148	2,041	1,851	1,483	1,048	878
2030	Mar	591	635	686	778	906	1,256	1,375	666	20	(118)	(289)	(284)	(352)	(407)	(394)	(204)	42	1,028	1,501	1,383	1,138	977	806	663
2030	Apr	236	202	286	446	636	810	470	83	(105)	(128)	(251)	(279)	(288)	(264)	(239)	(108)	(106)	262	801	838	690	507	365	206
2030	May	315	321	422	459	634	590	334	27	(207)	(319)	(257)	(172)	(199)	(122)	(128)	(40)	211	526	1,235	1,459	1,333	1,104	825	628
2030	Jun	817	810	829	834	882	452	(75)	(397)	(547)	(580)	(444)	(352)	(315)	(137)	11	202	388	742	1,621	2,084	1,915	1,504	1,224	966
2030	Jul	768	727	709	790	927	639	(196)	(495)	(611)	(378)	(150)	92	462	874	1,161	1,527	1,705	1,717	2,102	2,065	1,745	1,317	974	781
2030	Aug	1,095	1,058	1,057	1,091	1,270	1,432	748	75	(137)	(113)	(61)	156	393	776	1,049	1,322	1,689	2,090	2,464	2,232	1,912	1,458	1,218	1,137
2030	Sep	134	216	291	427	580	850	468	(361)	(502)	(536)	(532)	(390)	(290)	(279)	(133)	5	566	1,481	1,497	1,043	637	289	119	106
2030	Oct	911	898	895	1,004	1,191	1,535	1,631	796	392	226	0	104	22	15	23	122	1,274	2,026	1,898	1,777	1,582	1,437	1,270	1,126
2030	Nov	943	805	763	811	925	1,127	1,393	926	73	(74)	(171)	(115)	(74)	(96)	(7)	599	1,786	2,214	2,041	1,846	1,605	1,417	1,201	1,019
2030	Dec	893	748	698	811	955	1,171	1,527	1,611	770	353	315	181	45	(50)	(12)	662	1,851	2,262	2,175	1,978	1,789	1,589	1,355	1,151
2031	Jan	749	596	590	846	1,132	1,466	1,872	1,926	900	79	23	(40)	18	(55)	(63)	271	1,501	2,423	2,429	2,186	2,010	1,748	1,405	1,045
2031	Feb	906	788	785	804	918	1,220	1,564	1,234	548	260	99	(88)	(206)	(288)	(398)	(351)	466	1,752	2,158	2,077	1,868	1,493	1,066	886
2031	Mar	621	625	737	795	959	1,303	1,425	719	51	(111)	(224)	(162)	(214)	(289)	(270)	(158)	85	1,096	1,567	1,431	1,167	1,012	816	717
2031	Apr	262	263	336	467	661	862	486	73	(50)	(66)	(140)	(217)	(192)	(213)	(187)	(79)	(11)	313	818	885	744	552	397	244
2031	May	374	363	497	520	685	638	373	123	(87)	(222)	(191)	(126)	(121)	(103)	(85)	(60)	168	580	1,240	1,487	1,379	1,160	911	669
2031	Jun	857	859	866	875	897	484	(29)	(369)	(516)	(575)	(429)	(371)	(258)	(94)	(38)	164	353	767	1,658	2				

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PSCo Load Net of Renewables

2032	Jan	766	602	618	876	1,160	1,517	1,914	1,960	907	91	(21)	(54)	(14)	(91)	(127)	245	1,530	2,475	2,464	2,217	2,057	1,805	1,465	1,108
2032	Feb	864	798	753	777	865	1,135	1,441	1,129	513	195	29	(116)	(305)	(369)	(534)	(430)	335	1,669	2,113	1,987	1,785	1,365	926	766
2032	Mar	600	608	680	761	943	1,365	1,497	751	56	(85)	(289)	(284)	(342)	(400)	(406)	(232)	70	1,143	1,591	1,451	1,209	1,045	832	728
2032	Apr	264	258	341	488	700	871	480	172	58	(31)	(87)	(181)	(242)	(242)	(267)	(190)	(85)	319	865	889	739	553	397	241
2032	May	355	362	491	521	721	580	295	70	(179)	(206)	(218)	(235)	(181)	(202)	(144)	(20)	171	505	1,239	1,461	1,306	1,094	869	665
2032	Jun	842	829	875	880	929	528	(114)	(409)	(575)	(542)	(455)	(322)	(299)	(128)	11	264	337	833	1,767	2,187	2,000	1,584	1,313	999
2032	Jul	833	813	766	832	983	660	(191)	(557)	(630)	(423)	(180)	39	439	831	1,181	1,545	1,804	1,796	2,200	2,159	1,821	1,383	1,040	852
2032	Aug	1,123	1,103	1,107	1,178	1,344	1,504	833	121	(131)	(184)	(120)	140	390	757	1,067	1,334	1,735	2,185	2,588	2,366	2,029	1,584	1,331	1,205
2032	Sep	175	262	347	444	603	905	586	(119)	(226)	(320)	(329)	(223)	(194)	(187)	(141)	155	707	1,617	1,630	1,174	721	382	207	181
2032	Oct	979	961	944	1,055	1,265	1,617	1,694	837	306	135	(29)	(27)	(42)	(103)	(120)	92	1,279	2,113	1,974	1,847	1,635	1,514	1,366	1,214
2032	Nov	971	818	785	829	981	1,215	1,490	1,014	116	(119)	(170)	(189)	(152)	(116)	(53)	635	1,912	2,320	2,128	1,923	1,687	1,503	1,292	1,082
2032	Dec	954	810	796	898	1,057	1,318	1,683	1,743	864	380	353	179	(4)	(89)	(12)	679	1,953	2,390	2,295	2,099	1,910	1,708	1,501	1,237
2033	Jan	734	574	588	834	1,143	1,511	1,938	1,996	910	74	22	(24)	16	(36)	(125)	248	1,513	2,440	2,441	2,179	2,017	1,759	1,429	1,065
2033	Feb	872	770	763	804	949	1,273	1,592	1,240	537	214	(28)	(182)	(285)	(424)	(498)	(424)	411	1,755	2,177	2,090	1,852	1,485	1,081	916
2033	Mar	571	569	649	717	909	1,337	1,469	667	(27)	(124)	(273)	(327)	(363)	(444)	(459)	(305)	4	1,068	1,507	1,388	1,159	1,015	844	702
2033	Apr	279	258	344	490	688	853	539	232	77	(15)	(68)	(156)	(174)	(188)	(184)	(95)	30	363	855	883	751	567	407	250
2033	May	322	347	480	526	687	585	295	68	(104)	(226)	(281)	(249)	(247)	(249)	(227)	(66)	109	484	1,155	1,438	1,267	1,064	834	625
2033	Jun	774	757	823	855	906	462	(186)	(443)	(520)	(518)	(429)	(300)	(268)	(99)	13	269	328	824	1,729	2,143	1,951	1,536	1,288	955
2033	Jul	782	765	727	792	951	672	(325)	(615)	(704)	(456)	(236)	2	415	808	1,197	1,502	1,754	1,744	2,124	2,098	1,750	1,323	993	790
2033	Aug	1,080	1,056	1,023	1,090	1,295	1,499	789	176	(151)	(215)	(136)	107	392	725	1,014	1,281	1,703	2,118	2,513	2,281	1,937	1,505	1,260	1,156
2033	Sep	108	174	260	381	570	871	541	(144)	(303)	(388)	(435)	(291)	(238)	(285)	(192)	81	717	1,573	1,580	1,119	684	330	97	127
2033	Oct	959	919	917	1,042	1,246	1,602	1,659	781	319	119	(66)	(102)	(173)	(183)	(197)	(32)	1,214	2,075	1,923	1,798	1,596	1,481	1,345	1,182
2033	Nov	956	782	756	805	966	1,203	1,487	1,010	130	(132)	(189)	(162)	(158)	(103)	(60)	600	1,910	2,313	2,096	1,874	1,615	1,437	1,238	1,040
2033	Dec	860	726	715	835	1,003	1,274	1,629	1,725	878	407	324	134	(52)	(142)	(93)	645	1,894	2,324	2,215	1,997	1,808	1,626	1,426	1,152
2034	Jan	746	537	553	850	1,144	1,515	1,981	2,024	904	40	(62)	(47)	(36)	(94)	(207)	171	1,499	2,464	2,469	2,192	2,011	1,759	1,423	1,042
2034	Feb	869	757	747	781	947	1,286	1,639	1,311	595	244	33	(172)	(322)	(474)	(529)	(437)	395	1,776	2,211	2,107	1,870	1,499	1,062	890
2034	Mar	590	587	680	763	961	1,377	1,486	676	53	(125)	(294)	(328)	(402)	(522)	(583)	(369)	(61)	1,027	1,458	1,335	1,130	980	824	690
2034	Apr	289	275	328	481	641	816	458	183	46	(42)	(77)	(175)	(234)	(275)	(292)	(124)	(97)	360	869	869	767	589	403	285
2034	May	361	356	497	543	730	619	323	57	(85)	(240)	(262)	(265)	(259)	(266)	(203)	(99)	141	452	1,174	1,417	1,301	1,116	875	650
2034	Jun	795	797	838	883	914	491	(115)	(455)	(519)	(564)	(494)	(368)	(343)	(136)	(50)	218	408	840	1,739	2,150	1,962	1,565	1,307	962
2034	Jul	750	755	717	764	884	610	(272)	(605)	(694)	(494)	(319)	(61)	337	767	1,157	1,467	1,722	1,734	2,126	2,103	1,739	1,303	976	776
2034	Aug	1,062	996	1,020	1,100	1,312	1,496	807	132	(182)	(236)	(184)	63	265	664	941	1,218	1,649	2,094	2,515	2,280	1,929	1,484	1,261	1,145
2034	Sep	103	181	256	395	595	939	605	(204)	(343)	(458)	(523)	(390)	(359)	(370)	(276)	(42)	636	1,570	1,604	1,128	669	327	123	58
2034	Oct	982	942	918	1,070	1,280	1,671	1,732	785	307	67	(130)	(133)	(216)	(248)	(226)	(50)	1,241	2,120	1,962	1,825	1,637	1,511	1,381	1,243
2034	Nov	1,006	784	743	832	979	1,226	1,469	1,052	32	(219)	(223)	(265)	(243)	(203)	(101)	554	1,953	2,330	2,107	1,895	1,642	1,466	1,311	1,066
2034	Dec	878	767	756	859	1,039	1,283	1,653	1,736	788	356	263	120	(65)	(175)	(150)	619	1,914	2,360	2,264	2,070	1,871	1,697	1,501	1,188
2035	Jan	763	601	569	874	1,165	1,566	2,050	2,123	914	22	(100)	(136)	(174)	(284)	(334)	90	1,537	2,536	2,502	2,213	2,035	1,795	1,451	1,064
2035	Feb	889	768	751	806	952	1,300	1,675	1,369	633	262	63	(154)	(391)	(560)	(664)	(541)	373	1,841	2,253	2,117	1,889	1,541	1,121	938
2035	Mar	623	639	706	811	976	1,386	1,506	688	(13)	(139)	(399)	(399)	(534)	(596)	(695)	(500)	(113)	1,052	1,537	1,398	1,164	1,060	868	732
2035	Apr	331	284	397	545	748	905	560	205	47	(30)	(123)	(174)	(242)	(255)	(289)	(142)	(76)	351	894	943	799	647	487	334
2035	May	383	418	589	638	766	674	285	(36)	(318)	(394)	(415)	(323)	(339)	(289)	(311)	(243)	87	408	1,152	1,406	1,228	1,016	824	665
2035	Jun	847	837	888	907	982	514	(76)	(533)	(707)	(709)	(575)	(427)	(376)	(136)	(36)	172	362	830	1,741	2,205	2,032	1,622	1,349	1,028
2035	Jul	766	712	669	697	881	603	(351)	(729)	(848)	(624)	(369)	(159)	290	748	1,092	1,481	1,771	1,819	2,238	2,200	1,823	1,402	1,067	869
2035	Aug	1,063	1,046	1,032	1,087	1,299	1,480	721	(33)	(255)	(261)	(217)	64	230	669	967	1,256	1,719	2,152	2,546	2,288	1,935	1,505	1,262	1,178
2035	Sep	110	154	281	430	634	985	569	(387)	(590)	(693)	(651)	(482)	(384)	(373)	(277)	(89)	585	1,532	1,547	1,018	578	243	95	75
2035	Oct	949	917	880	1,013	1,293	1,722	1,777	847	345	138	(77)	(100)	(187)	(201)	(211)	(3)	1,287	2,127	1,970	1,852	1,667	1,483	1,399	1,256
2035	Nov	966	817	741	825	964	1,212	1,498	1,007	(58)	(208)	(360)	(404)	(312)	(295)	(274)	469	1,955	2,308	2,092	1,882	1,609	1,448	1,280	1,052
2035	Dec	859	699	705	877	992	1,268	1,643	1,762	752	329	286	(0)	(20)	(244)	(210)	610	1,972	2,389	2,332	2,073	1,873	1,691	1,495	1,183
2036	Jan	718	513	510	836	1,109	1,510	1,989	2,049	874	(17)	(161)	(209)	(201)	(315)	(376)	39	1,487	2,481	2,444	2,146	1,982	1,774	1,457	1,064
2036	Feb	871	713	663	701	817	1,103	1,452	1,116	513	116	(119)	(256)	(448)	(672)	(787)	(738)	196	1,608	2,041	1,903	1,649	1,266	873	723
2036	Mar	627	602	677	772	950	1,347	1,495	761	77	(55)	(300)	(313)	(444)	(507)	(598)	(423)	(90)	1,064	1,517	1,346	1,138	1,061	879	739
2036	Apr	272	252	297	491	653	888	528	153	35	(16)	(133)	(137)	(253)	(284)	(286)	(156)	(33)	399	888	885	747	593	438	281
2036	May	316	361	503	517	690	641	402	136	(81)	(248)	(244)	(177)	(130)	(195)	(197)	(222)	31	415	1,132	1,413	1,290	1,112	901	692
2036	Jun	769	748	792	852	895	527	15	(432)	(581)	(715)	(652)	(533)	(493)	(253)	(222)	16	221	711	1,651	2,109				

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PSCo Load Net of Renewables

2037	Mar	591	609	661	767	947	1,352	1,520	765	96	(134)	(327)	(395)	(430)	(542)	(604)	(427)	(95)	1,037	1,484	1,303	1,115	1,048	851	701
2037	Apr	213	202	256	438	663	904	568	224	84	(32)	(113)	(140)	(209)	(283)	(266)	(169)	(39)	384	849	854	686	581	403	223
2037	May	276	281	449	522	683	572	335	90	(89)	(240)	(209)	(256)	(236)	(233)	(233)	(294)	(72)	294	1,064	1,286	1,176	1,012	858	650
2037	Jun	701	715	786	851	911	537	(95)	(495)	(608)	(703)	(595)	(542)	(525)	(252)	(303)	45	193	702	1,643	2,094	1,896	1,494	1,241	896
2037	Jul	785	692	620	698	822	565	(326)	(684)	(800)	(617)	(415)	(227)	179	596	1,018	1,373	1,691	1,665	2,051	1,997	1,584	1,201	947	829
2037	Aug	1,005	969	967	1,020	1,214	1,420	671	10	(402)	(422)	(381)	(98)	148	609	888	1,155	1,634	2,058	2,459	2,167	1,800	1,390	1,176	1,099
2037	Sep	59	97	181	285	499	844	498	(288)	(406)	(500)	(482)	(354)	(357)	(361)	(377)	(145)	465	1,455	1,433	881	438	146	(34)	8
2037	Oct	902	871	863	991	1,252	1,673	1,723	831	290	87	(93)	(105)	(150)	(204)	(228)	(39)	1,295	2,104	1,873	1,726	1,557	1,469	1,363	1,217
2037	Nov	969	772	720	755	937	1,239	1,565	986	43	(320)	(371)	(375)	(362)	(278)	(165)	570	2,081	2,419	2,121	1,876	1,555	1,476	1,285	1,100
2037	Dec	845	711	717	902	1,110	1,372	1,793	1,922	940	363	307	75	(106)	(226)	(104)	673	1,958	2,439	2,333	2,080	1,874	1,720	1,538	1,221
2038	Jan	788	559	606	890	1,225	1,591	2,062	2,147	983	(14)	(129)	(156)	(207)	(299)	(383)	113	1,577	2,545	2,510	2,196	2,052	1,850	1,571	1,164
2038	Feb	868	708	709	782	955	1,298	1,650	1,386	692	271	14	(224)	(431)	(648)	(786)	(650)	361	1,786	2,253	2,107	1,857	1,532	1,120	905
2038	Mar	607	620	658	756	931	1,414	1,570	839	74	(118)	(367)	(447)	(413)	(645)	(676)	(483)	(24)	1,125	1,571	1,401	1,189	1,095	903	743
2038	Apr	266	221	303	484	711	897	555	232	17	(68)	(135)	(206)	(299)	(348)	(381)	(260)	(166)	336	877	910	760	633	463	269
2038	May	283	295	509	523	691	593	380	93	(153)	(260)	(326)	(321)	(296)	(317)	(301)	(177)	88	447	1,220	1,433	1,263	1,079	897	686
2038	Jun	733	726	799	875	929	549	(98)	(514)	(626)	(732)	(622)	(545)	(506)	(382)	(225)	86	243	733	1,783	2,186	1,986	1,591	1,339	971
2038	Jul	772	739	666	716	905	619	(342)	(740)	(873)	(646)	(407)	(219)	288	703	1,148	1,473	1,822	1,832	2,208	2,127	1,721	1,314	1,015	848
2038	Aug	1,016	986	966	1,046	1,295	1,522	822	46	(288)	(386)	(315)	(39)	225	662	956	1,205	1,716	2,186	2,584	2,304	1,921	1,503	1,273	1,171
2038	Sep	99	160	192	309	533	871	548	(202)	(355)	(421)	(411)	(317)	(317)	(382)	(210)	56	739	1,628	1,634	1,080	659	331	123	100
2038	Oct	957	972	940	1,040	1,316	1,739	1,756	792	258	(22)	(138)	(213)	(241)	(309)	(357)	(85)	1,281	2,188	1,981	1,849	1,640	1,529	1,461	1,275
2038	Nov	943	704	715	816	971	1,204	1,570	1,038	15	(311)	(440)	(359)	(412)	(357)	(169)	591	2,053	2,405	2,108	1,851	1,567	1,438	1,308	1,107
2038	Dec	852	725	704	840	1,042	1,356	1,738	1,841	876	270	185	(64)	(198)	(268)	(186)	600	1,946	2,402	2,304	2,063	1,869	1,678	1,554	1,260
2039	Jan	709	498	518	827	1,191	1,577	2,041	2,119	966	(37)	(115)	(168)	(197)	(316)	(391)	45	1,476	2,475	2,444	2,118	1,979	1,771	1,483	1,079
2039	Feb	859	703	683	784	943	1,306	1,623	1,327	575	138	(85)	(319)	(533)	(753)	(807)	(686)	241	1,720	2,205	2,070	1,798	1,477	1,094	879
2039	Mar	561	596	674	730	929	1,408	1,535	719	18	(154)	(453)	(423)	(524)	(622)	(678)	(533)	(121)	1,066	1,498	1,362	1,152	1,066	903	733
2039	Apr	278	224	292	471	681	870	601	236	58	(57)	(138)	(275)	(312)	(311)	(360)	(238)	(149)	363	844	855	741	608	439	243
2039	May	312	318	493	567	703	590	366	111	(128)	(272)	(255)	(322)	(286)	(347)	(347)	(304)	48	411	1,163	1,399	1,232	1,087	890	714
2039	Jun	697	701	754	818	889	510	(147)	(514)	(657)	(789)	(589)	(503)	(503)	(204)	(176)	120	246	822	1,778	2,216	1,973	1,589	1,374	956
2039	Jul	767	696	648	684	918	600	(425)	(826)	(965)	(673)	(439)	(217)	316	719	1,162	1,497	1,794	2,164	2,103	1,686	1,285	993	800	
2039	Aug	1,016	967	977	1,028	1,300	1,521	816	139	(257)	(286)	(273)	(16)	243	686	948	1,190	1,714	2,151	2,555	2,260	1,868	1,460	1,234	1,170
2039	Sep	25	97	187	291	496	881	612	(257)	(333)	(528)	(435)	(479)	(356)	(412)	(377)	(64)	724	1,694	1,574	1,079	621	315	103	9
2039	Oct	956	980	968	1,067	1,320	1,753	1,781	808	238	(26)	(310)	(262)	(344)	(398)	(389)	(130)	1,257	2,208	1,999	1,848	1,671	1,580	1,486	1,303
2039	Nov	1,023	729	699	801	1,000	1,261	1,566	1,067	42	(263)	(420)	(446)	(362)	(377)	(201)	520	2,043	2,397	2,092	1,895	1,560	1,439	1,313	1,143
2039	Dec	844	686	695	833	1,083	1,361	1,803	1,925	932	316	316	(79)	(276)	(346)	(234)	545	2,013	2,407	2,301	2,062	1,859	1,719	1,618	1,218
2040	Jan	863	648	676	1,014	1,345	1,738	2,214	2,257	1,045	(46)	(147)	(246)	(270)	(378)	(486)	41	1,635	2,684	2,665	2,339	2,146	1,945	1,654	1,239
2040	Feb	920	775	732	805	962	1,289	1,628	1,302	576	114	(122)	(314)	(563)	(744)	(813)	(710)	159	1,684	2,218	2,085	1,788	1,408	995	774
2040	Mar	705	698	744	844	1,056	1,507	1,633	815	141	(153)	(378)	(476)	(593)	(718)	(808)	(585)	(143)	1,117	1,577	1,468	1,269	1,188	1,008	811
2040	Apr	306	256	333	553	735	952	571	200	14	(96)	(144)	(310)	(394)	(444)	(430)	(304)	(188)	370	943	972	844	703	503	314
2040	May	426	405	578	611	821	682	405	68	(212)	(412)	(425)	(390)	(396)	(393)	(382)	(272)	58	404	1,197	1,466	1,338	1,254	1,071	871
2040	Jun	899	824	901	928	1,017	534	(74)	(607)	(728)	(784)	(709)	(532)	(428)	(228)	(175)	129	317	865	1,925	2,337	2,156	1,768	1,544	1,132
2040	Jul	791	770	702	698	899	645	(337)	(777)	(863)	(646)	(374)	(157)	319	830	1,234	1,621	1,879	1,956	2,364	2,306	1,857	1,439	1,123	894
2040	Aug	1,096	1,022	1,060	1,116	1,400	1,663	953	87	(259)	(380)	(355)	(19)	233	702	950	1,240	1,796	2,338	2,747	2,460	2,055	1,636	1,421	1,287
2040	Sep	133	178	246	380	637	1,030	726	(145)	(381)	(568)	(557)	(451)	(466)	(432)	(380)	(158)	662	1,717	1,774	1,184	680	342	170	100
2040	Oct	1,106	1,115	1,075	1,152	1,445	1,918	1,938	952	374	127	(165)	(236)	(344)	(423)	(427)	(125)	1,333	2,309	2,110	1,977	1,810	1,697	1,622	1,418
2040	Nov	1,155	846	766	868	1,002	1,269	1,687	1,069	(215)	(251)	(579)	(570)	(384)	(514)	(442)	497	2,099	2,484	2,209	1,994	1,736	1,592	1,481	1,206
2040	Dec	1,003	795	840	953	1,150	1,433	1,866	1,990	961	295	315	(8)	(270)	(365)	(298)	676	2,072	2,574	2,488	2,204	2,002	1,880	1,742	1,399
2041	Jan	876	634	630	958	1,281	1,700	2,193	2,210	982	(82)	(245)	(334)	(330)	(458)	(539)	12	1,634	2,667	2,623	2,298	2,134	1,932	1,698	1,266
2041	Feb	934	727	709	765	969	1,363	1,747	1,469	681	210	(37)	(281)	(594)	(771)	(879)	(704)	360	1,901	2,382	2,188	1,935	1,616	1,193	988
2041	Mar	704	719	770	881	1,064	1,493	1,635	880	187	(103)	(432)	(446)	(518)	(547)	(620)	(536)	(90)	1,148	1,634	1,451	1,230	1,188	1,023	841
2041	Apr	362	316	394	584	804	1,015	656	210	31	7	(119)	(186)	(276)	(285)	(299)	(225)	(31)	458	984	1,022	838	746	553	349
2041	May	402	390	639	642	815	745	506	135	(109)	(338)	(325)	(239)	(176)	(157)	(256)	(338)	86	464	1,318	1,556	1,361	1,260	1,040	834
2041	Jun	902	829	860	924	1,023	609	76	(377)	(717)	(889)	(692)	(536)	(521)	(268)	(237)	77	322	884	1,892	2,326	2,156	1,749	1,527	1,128
2041	Jul	802	720	621	653	846	646	(268)	(807)	(887)	(658)	(430)	(151)	341	782	1,196	1,567	1,896	1,972	2,389	2,298	1,843	1,446	1,135	887
2041	Aug	1,073	1,010	1,030	1,096	1,377	1,616	921	37	(309)	(377)	(338)	(49)	232	734										

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PSCo Load Net of Renewables

2042	May	317	296	543	538	720	604	418	174	(23)	(271)	(355)	(81)	(150)	(406)	(304)	(308)	(69)	365	1,150	1,435	1,300	1,187	1,001	791
2042	Jun	826	770	827	899	940	476	(73)	(512)	(813)	(945)	(889)	(815)	(619)	(383)	(404)	(17)	219	794	1,763	2,215	2,026	1,627	1,447	1,045
2042	Jul	719	573	551	535	703	485	(410)	(941)	(1,021)	(750)	(495)	(236)	242	730	1,251	1,560	1,838	1,904	2,284	2,182	1,726	1,323	1,039	835
2042	Aug	1,021	1,005	946	1,022	1,278	1,519	879	143	(371)	(458)	(414)	(19)	261	775	1,043	1,220	1,784	2,250	2,633	2,298	1,907	1,482	1,278	1,211
2042	Sep	(22)	3	82	257	490	871	548	(306)	(614)	(730)	(705)	(576)	(557)	(632)	(525)	(192)	660	1,635	1,582	952	468	172	18	(24)
2042	Oct	959	954	907	1,005	1,299	1,813	1,826	751	127	(24)	(288)	(293)	(219)	(337)	(399)	(100)	1,273	2,224	1,983	1,800	1,644	1,554	1,478	1,326
2042	Nov	991	742	691	801	854	1,230	1,570	994	(108)	(457)	(536)	(486)	(572)	(406)	(261)	494	2,009	2,389	2,106	1,872	1,514	1,471	1,358	1,112
2042	Dec	840	649	703	835	1,040	1,371	1,810	1,983	972	330	209	(96)	(272)	(391)	(267)	611	2,007	2,453	2,321	2,058	1,853	1,675	1,618	1,230

2023 DSM + BE Plan Appendix I

PSCo Total Load

		PSCo Total Load (MW)																							
Year	Month	HE1	HE2	HE3	HE4	HE5	HE6	HE7	HE8	HE9	HE10	HE11	HE12	HE13	HE14	HE15	HE16	HE17	HE18	HE19	HE20	HE21	HE22	HE23	HE24
2022	Jan	3,338	3,285	3,265	3,270	3,324	3,486	3,810	3,969	4,007	4,019	4,002	3,958	3,907	3,869	3,846	3,863	4,034	4,549	4,667	4,533	4,347	4,037	3,682	3,461
2022	Feb	3,151	3,118	3,109	3,117	3,164	3,318	3,627	3,753	3,794	3,802	3,790	3,750	3,702	3,666	3,642	3,645	3,733	4,021	4,351	4,268	4,075	3,737	3,404	3,229
2022	Mar	3,096	3,067	3,061	3,082	3,170	3,404	3,686	3,831	3,883	3,905	3,893	3,849	3,807	3,776	3,746	3,742	3,784	3,870	4,126	4,226	4,037	3,665	3,343	3,170
2022	Apr	2,830	2,788	2,775	2,800	2,904	3,101	3,297	3,433	3,525	3,580	3,605	3,602	3,600	3,587	3,580	3,581	3,600	3,596	3,667	3,825	3,715	3,400	3,093	2,918
2022	May	2,626	2,558	2,532	2,553	2,647	2,838	3,112	3,357	3,537	3,675	3,769	3,827	3,896	3,955	3,997	4,043	4,067	4,016	3,955	4,040	3,968	3,576	3,099	2,790
2022	Jun	3,128	3,033	2,983	2,980	3,015	3,112	3,289	3,505	3,709	3,913	4,103	4,265	4,410	4,540	4,654	4,739	4,761	4,654	4,484	4,352	4,230	3,904	3,531	3,275
2022	Jul	3,329	3,250	3,210	3,207	3,241	3,316	3,467	3,666	3,910	4,180	4,449	4,706	4,956	5,162	5,316	5,379	5,346	5,153	4,899	4,717	4,527	4,137	3,735	3,484
2022	Aug	3,427	3,341	3,296	3,299	3,373	3,508	3,686	3,879	4,087	4,309	4,519	4,714	4,915	5,095	5,226	5,299	5,289	5,139	4,947	4,859	4,627	4,171	3,782	3,551
2022	Sep	2,956	2,925	2,916	2,931	2,995	3,168	3,358	3,493	3,620	3,755	3,866	3,963	4,074	4,186	4,275	4,363	4,410	4,362	4,388	4,292	3,965	3,544	3,226	3,059
2022	Oct	3,027	2,968	2,945	2,977	3,111	3,390	3,670	3,786	3,839	3,873	3,886	3,877	3,880	3,884	3,890	3,925	4,006	4,194	4,301	4,203	3,973	3,695	3,381	3,156
2022	Nov	3,114	3,058	3,036	3,045	3,111	3,289	3,575	3,699	3,748	3,753	3,742	3,720	3,689	3,666	3,669	3,711	3,938	4,398	4,377	4,243	4,079	3,838	3,509	3,262
2022	Dec	3,387	3,298	3,263	3,265	3,338	3,519	3,818	3,977	4,026	4,036	4,022	3,969	3,906	3,880	3,870	3,918	4,189	4,667	4,642	4,545	4,415	4,173	3,828	3,548
2023	Jan	3,391	3,339	3,319	3,326	3,382	3,550	3,889	4,052	4,091	4,101	4,083	4,037	3,983	3,944	3,920	3,936	4,112	4,640	4,769	4,628	4,434	4,112	3,746	3,520
2023	Feb	3,220	3,185	3,176	3,185	3,236	3,401	3,720	3,849	3,891	3,897	3,884	3,842	3,793	3,756	3,731	3,733	3,820	4,104	4,442	4,364	4,166	3,821	3,482	3,300
2023	Mar	3,175	3,138	3,130	3,156	3,260	3,511	3,790	3,932	3,984	4,003	3,991	3,948	3,909	3,880	3,851	3,846	3,885	3,960	4,199	4,299	4,121	3,766	3,445	3,257
2023	Apr	2,916	2,867	2,852	2,879	2,991	3,192	3,385	3,522	3,621	3,680	3,711	3,713	3,714	3,704	3,700	3,706	3,729	3,727	3,794	3,945	3,838	3,524	3,209	3,020
2023	May	2,705	2,638	2,613	2,634	2,726	2,915	3,186	3,426	3,598	3,728	3,817	3,873	3,941	4,002	4,044	4,089	4,108	4,052	3,986	4,059	3,988	3,614	3,157	2,858
2023	Jun	3,176	3,078	3,026	3,023	3,058	3,156	3,336	3,555	3,764	3,972	4,164	4,329	4,477	4,609	4,722	4,804	4,824	4,714	4,541	4,405	4,283	3,961	3,588	3,327
2023	Jul	3,388	3,305	3,263	3,259	3,297	3,379	3,538	3,745	3,994	4,269	4,540	4,797	5,049	5,257	5,410	5,475	5,442	5,250	4,997	4,815	4,619	4,218	3,808	3,550
2023	Aug	3,497	3,403	3,353	3,356	3,440	3,588	3,778	3,977	4,188	4,405	4,609	4,796	4,990	5,164	5,292	5,363	5,357	5,215	5,035	4,951	4,721	4,267	3,871	3,626
2023	Sep	3,015	2,980	2,969	2,985	3,053	3,234	3,428	3,566	3,699	3,836	3,946	4,039	4,146	4,254	4,340	4,428	4,478	4,439	4,475	4,378	4,048	3,625	3,302	3,125
2023	Oct	3,126	3,058	3,031	3,070	3,224	3,530	3,819	3,935	3,985	4,013	4,022	4,013	4,015	4,017	4,023	4,056	4,137	4,322	4,414	4,322	4,107	3,841	3,521	3,276
2023	Nov	3,172	3,114	3,092	3,101	3,167	3,346	3,636	3,761	3,811	3,813	3,801	3,776	3,743	3,719	3,722	3,765	3,998	4,466	4,446	4,311	4,145	3,903	3,573	3,322
2023	Dec	3,471	3,374	3,335	3,335	3,411	3,597	3,899	4,062	4,114	4,123	4,109	4,055	3,992	3,965	3,957	4,007	4,281	4,755	4,730	4,634	4,507	4,271	3,927	3,637
2024	Jan	3,457	3,401	3,379	3,386	3,448	3,627	3,972	4,143	4,178	4,185	4,164	4,118	4,066	4,027	4,004	4,022	4,203	4,751	4,838	4,695	4,496	4,179	3,816	3,585
2024	Feb	3,286	3,246	3,235	3,242	3,292	3,453	3,779	3,910	3,951	3,953	3,939	3,896	3,847	3,812	3,789	3,793	3,891	4,218	4,531	4,421	4,236	3,910	3,570	3,379
2024	Mar	3,261	3,217	3,205	3,232	3,338	3,585	3,868	4,004	4,060	4,081	4,068	4,021	3,974	3,944	3,915	3,912	3,959	4,064	4,325	4,399	4,226	3,888	3,563	3,358
2024	Apr	3,104	3,030	3,010	3,060	3,239	3,509	3,715	3,840	3,920	3,957	3,974	3,967	3,960	3,944	3,935	3,936	3,959	3,964	4,037	4,154	4,064	3,800	3,486	3,253
2024	May	2,729	2,654	2,627	2,652	2,765	2,993	3,304	3,572	3,760	3,888	3,969	4,009	4,067	4,115	4,143	4,177	4,193	4,140	4,094	4,217	4,145	3,735	3,234	2,899
2024	Jun	3,281	3,174	3,116	3,112	3,152	3,263	3,457	3,689	3,900	4,100	4,383	4,436	4,573	4,696	4,807	4,895	4,928	4,832	4,671	4,549	4,429	4,092	3,708	3,434
2024	Jul	3,481	3,387	3,339	3,335	3,375	3,463	3,639	3,859	4,116	4,390	4,661	4,915	5,158	5,359	5,511	5,574	5,544	5,365	5,120	4,929	4,743	4,368	3,953	3,673
2024	Aug	3,572	3,473	3,423	3,424	3,500	3,637	3,828	4,042	4,276	4,521	4,755	4,967	5,185	5,377	5,511	5,579	5,553	5,379	5,155	5,052	4,822	4,356	3,955	3,708
2024	Sep	3,107	3,050	3,023	3,036	3,116	3,291	3,460	3,596	3,734	3,869	3,983	4,089	4,209	4,325	4,426	4,518	4,564	4,504	4,498	4,417	4,133	3,740	3,417	3,215
2024	Oct	3,214	3,143	3,115	3,159	3,327	3,654	3,946	4,062	4,117	4,152	4,169	4,165	4,175	4,187	4,196	4,228	4,292	4,430	4,532	4,447	4,222	3,938	3,612	3,363
2024	Nov	3,249	3,184	3,160	3,172	3,253	3,457	3,756	3,883	3,937	3,939	3,925	3,900	3,868	3,841	3,842	3,884	4,097	4,535	4,520	4,387	4,223	4,003	3,682	3,421
2024	Dec	3,528	3,435	3,400	3,403	3,477	3,667	3,985	4,150	4,202	4,209	4,194	4,139	4,074	4,046	4,035	4,087	4,379	4,876	4,865	4,764	4,625	4,370	4,013	3,715
2025	Jan	3,534	3,474	3,450	3,457	3,524	3,714	4,073	4,243	4,276	4,277	4,253	4,203	4,149	4,110	4,086	4,101	4,278	4,809	4,906	4,767	4,575	4,267	3,906	3,668
2025	Feb	3,354	3,312	3,300	3,308	3,361	3,529	3,859	3,990	4,032	4,031	4,016	3,972	3,923	3,886	3,862	3,866	3,963	4,279	4,601	4,497	4,308	3,982	3,643	3,447
2025	Mar	3,343	3,295	3,283	3,313	3,429	3,689	3,976	4,116	4,174	4,195	4,181	4,134	4,089	4,057	4,028	4,026	4,074	4,178	4,438	4,516	4,341	3,997	3,665	3,450
2025	Apr	3,086	3,030	3,015	3,050	3,189	3,433	3,652	3,791	3,878	3,917	3,936	3,926	3,920	3,904	3,895	3,895	3,918	3,919	4,003	4,155	4,038	3,724	3,404	3,198
2025	May	2,861	2,788	2,760	2,784	2,891	3,107	3,406	3,667	3,852	3,978	4,059	4,099	4,157	4,205	4,234	4,271	4,289	4,238	4,190	4,303	4,233	3,841	3,357	3,030
2025	Jun	3,371	3,259	3,199	3,195	3,239	3,357	3,563	3,805	4,022	4,227	4,414	4,571	4,713	4,841	4,953	5,040	5,072	4,972	4,807	4,680	4,555	4,213	3,819	3,534
2025	Jul	3,569	3,470	3,418	3,415	3,457	3,551	3,735	3,962	4,226	4,504	4,780	5,036	5,283	5,487	5,640	5,704	5,672	5,488	5,239	5,048	4,857	4,474	4,052	3,764
2025	Aug	3,676	3,569	3,515	3,513	3,594	3,736	3,932	4,153	4,396	4,644	4,880	5,094	5,310	5,501	5,637	5,708	5,689	5,522	5,305	5,203	4,968	4,496	4,084	3,823
2025	Sep	3,165	3,116	3,095	3,109	3,185	3,362	3,541	3,677	3,811	3,943	4,055	4,157	4,277	4,394	4,494	4,586	4,632	4,572	4,573	4,487	4,185	3,782	3,462	3,270
2025	Oct	3,328	3,246	3,214	3,264	3,452	3,802	4,100	4,215	4,269	4,300	4,314	4,306	4,313	4,321	4,328	4,359	4,423							

2023 DSM + BE Plan Appendix I

PSCo Total Load

2027	Jan	3,583	3,508	3,477	3,483	3,557	3,758	4,111	4,271	4,310	4,309	4,288	4,239	4,187	4,149	4,126	4,142	4,312	4,788	4,885	4,765	4,598	4,327	3,986	3,733
2027	Feb	3,394	3,342	3,327	3,337	3,402	3,591	3,928	4,056	4,098	4,092	4,076	4,030	3,981	3,945	3,921	3,925	4,018	4,308	4,614	4,527	4,346	4,038	3,707	3,497
2027	Mar	3,404	3,339	3,324	3,367	3,524	3,832	4,122	4,256	4,306	4,317	4,303	4,259	4,219	4,191	4,164	4,161	4,203	4,286	4,504	4,578	4,426	4,115	3,783	3,535
2027	Apr	3,169	3,098	3,076	3,120	3,285	3,542	3,755	3,889	3,975	4,011	4,029	4,019	4,015	4,002	3,994	3,995	4,014	4,012	4,077	4,207	4,112	3,840	3,532	3,304
2027	May	2,969	2,897	2,869	2,890	2,988	3,187	3,469	3,723	3,908	4,032	4,117	4,162	4,225	4,278	4,315	4,359	4,385	4,339	4,285	4,379	4,306	3,928	3,461	3,139
2027	Jun	3,446	3,328	3,263	3,259	3,304	3,427	3,641	3,889	4,114	4,321	4,513	4,673	4,817	4,947	5,060	5,145	5,173	5,069	4,900	4,765	4,638	4,307	3,915	3,620
2027	Jul	3,613	3,514	3,464	3,460	3,503	3,598	3,781	4,010	4,279	4,559	4,837	5,096	5,350	5,559	5,713	5,775	5,739	5,543	5,285	5,093	4,896	4,506	4,087	3,801
2027	Aug	3,721	3,606	3,545	3,545	3,638	3,798	4,006	4,232	4,471	4,706	4,927	5,125	5,328	5,507	5,636	5,706	5,699	5,553	5,361	5,270	5,036	4,570	4,152	3,874
2027	Sep	3,209	3,171	3,158	3,173	3,243	3,426	3,622	3,762	3,893	4,021	4,130	4,227	4,343	4,461	4,557	4,651	4,699	4,646	4,665	4,569	4,236	3,816	3,496	3,314
2027	Oct	3,411	3,316	3,276	3,328	3,529	3,888	4,179	4,292	4,348	4,373	4,383	4,372	4,373	4,375	4,380	4,411	4,482	4,625	4,705	4,634	4,450	4,210	3,890	3,600
2027	Nov	3,377	3,289	3,254	3,268	3,369	3,613	3,943	4,074	4,128	4,122	4,108	4,080	4,048	4,023	4,025	4,068	4,289	4,694	4,676	4,559	4,412	4,206	3,885	3,586
2027	Dec	3,646	3,534	3,491	3,494	3,587	3,809	4,151	4,321	4,370	4,366	4,347	4,286	4,218	4,190	4,179	4,230	4,512	4,968	4,947	4,854	4,728	4,503	4,162	3,844
2028	Jan	3,666	3,588	3,556	3,563	3,640	3,848	4,212	4,375	4,415	4,412	4,390	4,340	4,287	4,247	4,223	4,241	4,414	4,894	4,999	4,877	4,707	4,434	4,088	3,827
2028	Feb	3,364	3,332	3,324	3,332	3,380	3,545	3,880	4,016	4,058	4,048	4,027	3,975	3,922	3,883	3,857	3,857	3,949	4,251	4,605	4,515	4,303	3,962	3,631	3,447
2028	Mar	3,490	3,417	3,398	3,447	3,621	3,947	4,231	4,364	4,414	4,420	4,406	4,362	4,326	4,299	4,273	4,270	4,308	4,377	4,578	4,658	4,516	4,219	3,888	3,625
2028	Apr	3,258	3,180	3,154	3,197	3,361	3,609	3,814	3,953	4,051	4,095	4,118	4,113	4,112	4,102	4,098	4,103	4,127	4,126	4,185	4,312	4,220	3,953	3,644	3,405
2028	May	3,078	3,008	2,982	3,003	3,097	3,293	3,576	3,824	4,000	4,116	4,202	4,249	4,317	4,379	4,421	4,466	4,487	4,430	4,362	4,434	4,358	3,995	3,548	3,238
2028	Jun	3,536	3,410	3,341	3,336	3,381	3,504	3,724	3,980	4,216	4,430	4,629	4,794	4,944	5,077	5,190	5,272	5,294	5,186	5,012	4,871	4,743	4,419	4,027	3,720
2028	Jul	3,707	3,603	3,549	3,545	3,592	3,691	3,879	4,115	4,391	4,674	4,955	5,215	5,471	5,682	5,837	5,901	5,870	5,677	5,419	5,231	5,026	4,621	4,192	3,898
2028	Aug	3,817	3,694	3,628	3,631	3,739	3,924	4,152	4,383	4,620	4,843	5,052	5,238	5,431	5,603	5,728	5,797	5,793	5,656	5,480	5,395	5,159	4,695	4,268	3,975
2028	Sep	3,272	3,236	3,226	3,242	3,311	3,500	3,709	3,856	3,996	4,130	4,243	4,336	4,449	4,565	4,657	4,751	4,806	4,764	4,802	4,695	4,336	3,901	3,573	3,387
2028	Oct	3,494	3,396	3,356	3,410	3,619	3,990	4,295	4,408	4,458	4,474	4,480	4,465	4,465	4,465	4,469	4,501	4,577	4,735	4,808	4,735	4,553	4,319	3,997	3,696
2028	Nov	3,468	3,374	3,336	3,349	3,452	3,700	4,040	4,173	4,227	4,218	4,201	4,169	4,133	4,107	4,109	4,154	4,385	4,790	4,775	4,662	4,518	4,314	3,994	3,684
2028	Dec	3,755	3,628	3,575	3,574	3,669	3,897	4,242	4,417	4,473	4,469	4,450	4,387	4,317	4,288	4,279	4,333	4,619	5,066	5,044	4,955	4,835	4,625	4,289	3,956
2029	Jan	3,723	3,644	3,610	3,620	3,704	3,927	4,304	4,475	4,510	4,502	4,478	4,425	4,372	4,333	4,309	4,327	4,507	5,008	5,085	4,958	4,777	4,501	4,152	3,887
2029	Feb	3,555	3,495	3,477	3,485	3,552	3,746	4,100	4,234	4,276	4,262	4,243	4,193	4,143	4,106	4,082	4,088	4,192	4,516	4,808	4,700	4,524	4,232	3,900	3,674
2029	Mar	3,584	3,511	3,488	3,531	3,689	4,001	4,307	4,440	4,492	4,497	4,479	4,428	4,381	4,352	4,325	4,321	4,366	4,469	4,702	4,760	4,610	4,319	3,989	3,724
2029	Apr	3,324	3,247	3,225	3,274	3,452	3,728	3,943	4,075	4,159	4,184	4,197	4,181	4,171	4,152	4,140	4,142	4,170	4,181	4,268	4,395	4,292	4,025	3,718	3,477
2029	May	3,156	3,113	3,100	3,113	3,183	3,368	3,665	3,930	4,115	4,227	4,303	4,334	4,395	4,446	4,474	4,508	4,524	4,465	4,418	4,554	4,464	4,043	3,568	3,278
2029	Jun	3,642	3,521	3,455	3,451	3,498	3,628	3,848	4,103	4,325	4,520	4,704	4,854	4,992	5,118	5,231	5,320	5,355	5,255	5,087	4,960	4,833	4,497	4,109	3,810
2029	Jul	3,798	3,683	3,622	3,615	3,659	3,758	3,959	4,207	4,490	4,771	5,052	5,308	5,554	5,757	5,910	5,974	5,948	5,772	5,528	5,330	5,138	4,769	4,341	4,024
2029	Aug	3,881	3,762	3,701	3,701	3,793	3,957	4,181	4,422	4,676	4,924	5,165	5,379	5,601	5,796	5,931	5,995	5,966	5,788	5,557	5,450	5,211	4,737	4,317	4,036
2029	Sep	3,400	3,336	3,304	3,314	3,394	3,568	3,738	3,880	4,029	4,161	4,280	4,389	4,519	4,646	4,757	4,856	4,905	4,835	4,818	4,730	4,434	4,044	3,725	3,509
2029	Oct	3,539	3,442	3,403	3,461	3,674	4,060	4,366	4,482	4,540	4,563	4,577	4,568	4,579	4,591	4,600	4,630	4,690	4,810	4,896	4,823	4,616	4,354	4,026	3,729
2029	Nov	3,525	3,438	3,404	3,422	3,535	3,797	4,137	4,271	4,324	4,310	4,289	4,255	4,220	4,191	4,190	4,233	4,443	4,850	4,841	4,718	4,558	4,362	4,050	3,749
2029	Dec	3,813	3,697	3,650	3,653	3,740	3,962	4,316	4,491	4,548	4,542	4,521	4,456	4,386	4,354	4,344	4,400	4,704	5,183	5,174	5,077	4,943	4,716	4,373	4,040
2030	Jan	3,798	3,718	3,684	3,693	3,778	4,004	4,391	4,563	4,593	4,576	4,547	4,491	4,437	4,398	4,374	4,390	4,569	5,074	5,158	5,029	4,846	4,572	4,227	3,958
2030	Feb	3,626	3,566	3,547	3,556	3,625	3,824	4,184	4,320	4,361	4,341	4,319	4,266	4,215	4,177	4,153	4,157	4,260	4,581	4,883	4,777	4,595	4,304	3,975	3,746
2030	Mar	3,665	3,587	3,562	3,605	3,767	4,081	4,378	4,511	4,567	4,569	4,552	4,500	4,453	4,423	4,396	4,394	4,442	4,544	4,774	4,837	4,690	4,408	4,082	3,809
2030	Apr	3,388	3,308	3,284	3,335	3,521	3,808	4,034	4,169	4,252	4,271	4,282	4,265	4,255	4,238	4,227	4,227	4,253	4,259	4,339	4,465	4,361	4,097	3,793	3,545
2030	May	3,130	3,045	3,013	3,040	3,162	3,412	3,754	4,045	4,245	4,356	4,431	4,460	4,519	4,569	4,588	4,633	4,651	4,596	4,547	4,673	4,590	4,188	3,685	3,317
2030	Jun	3,707	3,575	3,502	3,495	3,543	3,676	3,906	4,173	4,408	4,610	4,801	4,955	5,097	5,227	5,342	5,433	5,470	5,371	5,203	5,072	4,940	4,603	4,205	3,888
2030	Jul	3,870	3,754	3,693	3,688	3,736	3,842	4,050	4,302	4,588	4,869	5,152	5,409	5,661	5,868	6,024	6,088	6,058	5,875	5,622	5,420	5,221	4,846	4,417	4,096
2030	Aug	3,964	3,841	3,777	3,776	3,870	4,035	4,261	4,506	4,766	5,013	5,255	5,468	5,689	5,885	6,021	6,088	6,063	5,888	5,661	5,552	5,308	4,835	4,417	4,128
2030	Sep	3,465	3,408	3,381	3,394	3,472	3,651	3,831	3,974	4,119	4,245	4,360	4,465	4,592	4,719	4,827	4,926	4,977	4,912	4,905	4,813	4,500	4,104	3,787	3,577
2030	Oct	3,620	3,522	3,482	3,538	3,751	4,139	4,453	4,570	4,625	4,641	4,651	4,637	4,645	4,656	4,664	4,695	4,759	4,889	4,980	4,902	4,689	4,430	4,107	3,808
2030	Nov	3,609	3,514	3,476	3,491	3,602	3,864	4,206	4,341	4,398	4,379	4,357	4,320	4,284	4,254	4,298	4,515	4,924	4,911</						

2023 DSM + BE Plan Appendix I

PSCo Total Load

2032	Jan	3,989	3,893	3,851	3,858	3,952	4,198	4,597	4,766	4,801	4,775	4,744	4,681	4,623	4,582	4,556	4,571	4,748	5,219	5,306	5,188	5,021	4,783	4,460	4,173
2032	Feb	3,690	3,640	3,624	3,632	3,689	3,870	4,222	4,359	4,400	4,367	4,340	4,279	4,225	4,188	4,162	4,165	4,265	4,582	4,919	4,816	4,613	4,321	4,009	3,792
2032	Mar	3,816	3,728	3,703	3,756	3,947	4,300	4,605	4,738	4,787	4,775	4,754	4,700	4,657	4,629	4,601	4,598	4,642	4,727	4,938	5,009	4,864	4,595	4,274	3,979
2032	Apr	3,572	3,483	3,452	3,502	3,693	3,984	4,218	4,360	4,448	4,460	4,470	4,448	4,441	4,427	4,418	4,417	4,440	4,439	4,507	4,636	4,534	4,283	3,989	3,730
2032	May	3,383	3,300	3,268	3,290	3,395	3,611	3,920	4,194	4,391	4,491	4,570	4,601	4,664	4,720	4,757	4,801	4,831	4,784	4,726	4,821	4,737	4,380	3,923	3,570
2032	Jun	3,881	3,739	3,660	3,654	3,705	3,847	4,095	4,375	4,621	4,824	5,024	5,183	5,334	5,471	5,589	5,678	5,709	5,602	5,423	5,277	5,136	4,811	4,416	4,081
2032	Jul	4,059	3,935	3,870	3,864	3,917	4,032	4,251	4,515	4,815	5,099	5,389	5,650	5,912	6,128	6,286	6,348	6,313	6,113	5,846	5,643	5,431	5,045	4,615	4,284
2032	Aug	4,166	4,026	3,950	3,948	4,057	4,245	4,487	4,743	5,009	5,242	5,473	5,671	5,883	6,070	6,202	6,274	6,268	6,119	5,920	5,822	5,569	5,097	4,666	4,346
2032	Sep	3,604	3,561	3,546	3,561	3,637	3,836	4,052	4,204	4,344	4,458	4,567	4,657	4,779	4,905	5,007	5,105	5,159	5,103	5,124	5,016	4,654	4,237	3,921	3,720
2032	Oct	3,818	3,702	3,650	3,708	3,937	4,340	4,655	4,772	4,829	4,832	4,834	4,811	4,810	4,811	4,815	4,847	4,922	5,070	5,149	5,077	4,886	4,666	4,362	4,037
2032	Nov	3,774	3,664	3,616	3,631	3,750	4,032	4,399	4,538	4,593	4,560	4,534	4,492	4,454	4,427	4,428	4,473	4,706	5,110	5,094	4,976	4,826	4,652	4,357	4,021
2032	Dec	4,077	3,940	3,884	3,884	3,990	4,245	4,626	4,808	4,857	4,826	4,796	4,717	4,641	4,610	4,597	4,651	4,954	5,418	5,396	5,301	5,169	4,974	4,656	4,304
2033	Jan	4,075	3,972	3,927	3,933	4,028	4,276	4,677	4,844	4,883	4,854	4,823	4,760	4,701	4,659	4,634	4,651	4,831	5,290	5,387	5,273	5,111	4,884	4,568	4,272
2033	Feb	3,877	3,805	3,779	3,791	3,877	4,110	4,492	4,629	4,669	4,627	4,597	4,533	4,478	4,439	4,412	4,413	4,512	4,803	5,111	5,026	4,838	4,569	4,260	4,007
2033	Mar	3,904	3,814	3,786	3,839	4,034	4,391	4,695	4,830	4,879	4,860	4,837	4,779	4,737	4,708	4,680	4,676	4,721	4,802	5,013	5,090	4,943	4,680	4,365	4,066
2033	Apr	3,659	3,561	3,526	3,575	3,772	4,063	4,294	4,438	4,530	4,540	4,548	4,525	4,518	4,504	4,496	4,497	4,520	4,520	4,583	4,708	4,612	4,376	4,092	3,823
2033	May	3,453	3,369	3,336	3,358	3,463	3,682	3,999	4,277	4,474	4,570	4,652	4,686	4,755	4,819	4,861	4,908	4,938	4,885	4,818	4,901	4,809	4,455	4,001	3,643
2033	Jun	3,967	3,821	3,740	3,732	3,782	3,924	4,175	4,459	4,712	4,915	5,118	5,279	5,434	5,575	5,695	5,783	5,812	5,702	5,519	5,367	5,223	4,906	4,515	4,173
2033	Jul	4,156	4,025	3,954	3,946	4,001	4,118	4,341	4,613	4,919	5,202	5,491	5,748	6,009	6,224	6,380	6,442	6,411	6,216	5,953	5,754	5,540	5,155	4,725	4,384
2033	Aug	4,251	4,109	4,031	4,031	4,149	4,353	4,608	4,867	5,129	5,352	5,576	5,768	5,977	6,163	6,295	6,366	6,361	6,213	6,018	5,920	5,661	5,191	4,763	4,436
2033	Sep	3,663	3,626	3,616	3,632	3,703	3,904	4,133	4,291	4,435	4,549	4,660	4,747	4,869	4,997	5,096	5,194	5,252	5,198	5,228	5,108	4,723	4,299	3,984	3,785
2033	Oct	3,904	3,784	3,730	3,787	4,018	4,426	4,746	4,863	4,918	4,913	4,912	4,885	4,882	4,881	4,885	4,918	4,998	5,156	5,233	5,159	4,968	4,755	4,459	4,128
2033	Nov	3,864	3,752	3,703	3,716	3,831	4,110	4,482	4,622	4,676	4,635	4,606	4,559	4,518	4,490	4,490	4,536	4,778	5,194	5,178	5,057	4,904	4,735	4,446	4,109
2033	Dec	4,175	4,031	3,969	3,967	4,072	4,328	4,711	4,896	4,948	4,911	4,878	4,795	4,716	4,683	4,671	4,726	5,033	5,502	5,479	5,382	5,251	5,067	4,759	4,401
2034	Jan	4,158	4,057	4,013	4,021	4,117	4,367	4,714	4,784	4,954	4,991	4,954	4,920	4,851	4,748	4,721	4,738	4,920	5,392	5,498	5,377	5,206	4,976	4,661	4,363
2034	Feb	3,967	3,896	3,870	3,883	3,969	4,206	4,596	4,737	4,777	4,725	4,691	4,620	4,564	4,524	4,495	4,495	4,593	4,884	5,206	5,122	4,924	4,656	4,351	4,096
2034	Mar	4,000	3,901	3,870	3,925	4,130	4,499	4,801	4,935	4,983	4,958	4,933	4,874	4,832	4,804	4,776	4,772	4,814	4,888	5,092	5,172	5,029	4,782	4,474	4,163
2034	Apr	3,748	3,645	3,606	3,655	3,849	4,136	4,365	4,513	4,613	4,624	4,636	4,615	4,610	4,598	4,593	4,597	4,624	4,626	4,686	4,810	4,712	4,482	4,202	3,926
2034	May	3,560	3,474	3,439	3,461	3,568	3,791	4,114	4,391	4,582	4,666	4,743	4,773	4,842	4,908	4,951	4,996	5,022	4,963	4,890	4,960	4,869	4,537	4,103	3,747
2034	Jun	4,064	3,910	3,825	3,816	3,866	4,011	4,268	4,560	4,820	5,024	5,230	5,392	5,549	5,692	5,812	5,898	5,924	5,811	5,625	5,468	5,323	5,016	4,630	4,278
2034	Jul	4,248	4,112	4,040	4,032	4,090	4,214	4,445	4,723	5,036	5,318	5,608	5,867	6,131	6,348	6,506	6,569	6,540	6,344	6,078	5,879	5,656	5,264	4,831	4,483
2034	Aug	4,357	4,205	4,121	4,121	4,248	4,467	4,735	4,999	5,262	5,476	5,693	5,877	6,080	6,262	6,391	6,463	6,461	6,320	6,135	6,040	5,779	5,314	4,886	4,545
2034	Sep	3,747	3,708	3,696	3,712	3,785	3,991	4,225	4,387	4,537	4,649	4,758	4,840	4,957	5,082	5,179	5,278	5,340	5,297	5,339	5,215	4,820	4,398	4,083	3,876
2034	Oct	3,989	3,865	3,809	3,868	4,106	4,526	4,859	4,976	5,026	5,012	5,006	4,976	4,971	4,970	4,973	5,006	5,090	5,256	5,329	5,251	5,058	4,853	4,561	4,222
2034	Nov	3,959	3,841	3,789	3,800	3,916	4,200	4,578	4,720	4,773	4,725	4,694	4,642	4,599	4,569	4,569	4,616	4,865	5,282	5,267	5,148	4,995	4,834	4,553	4,208
2034	Dec	4,282	4,127	4,058	4,051	4,158	4,416	4,803	4,992	5,048	5,005	4,971	4,884	4,802	4,770	4,758	4,817	5,131	5,602	5,579	5,483	5,351	5,178	4,879	4,510
2035	Jan	4,259	4,148	4,097	4,106	4,212	4,486	4,908	5,085	5,117	5,072	5,035	4,964	4,905	4,863	4,837	4,853	5,041	5,522	5,593	5,472	5,298	5,079	4,772	4,463
2035	Feb	4,083	3,997	3,967	3,975	4,058	4,293	4,694	4,836	4,876	4,818	4,783	4,711	4,654	4,614	4,587	4,591	4,704	5,038	5,327	5,215	5,033	4,795	4,500	4,231
2035	Mar	4,128	4,026	3,986	4,035	4,226	4,585	4,909	5,041	5,091	5,063	5,035	4,968	4,915	4,885	4,856	4,851	4,901	5,008	5,236	5,294	5,149	4,920	4,621	4,304
2035	Apr	3,843	3,738	3,701	3,758	3,974	4,294	4,530	4,667	4,752	4,742	4,742	4,709	4,695	4,674	4,661	4,661	4,694	4,709	4,797	4,918	4,811	4,586	4,314	4,031
2035	May	3,682	3,629	3,611	3,624	3,702	3,910	4,247	4,541	4,739	4,807	4,869	4,876	4,934	4,988	5,014	5,047	5,067	5,009	4,958	5,094	4,988	4,612	4,158	3,825
2035	Jun	4,198	4,044	3,958	3,950	4,005	4,163	4,429	4,724	4,972	5,155	5,343	5,487	5,630	5,764	5,882	5,974	6,014	5,911	5,735	5,594	5,450	5,133	4,752	4,401
2035	Jul	4,369	4,217	4,133	4,122	4,177	4,301	4,552	4,848	5,172	5,453	5,745	5,998	6,252	6,460	6,616	6,679	6,655	6,478	6,228	6,017	5,808	5,457	5,026	4,647
2035	Aug	4,451	4,297	4,215	4,212	4,325	4,526	4,797	5,077	5,362	5,601	5,849	6,059	6,287	6,490	6,626	6,689	6,663	6,482	6,244	6,127	5,867	5,399	4,975	4,640
2035	Sep	3,910	3,833	3,794	3,803	3,892	4,086	4,279	4,435	4,595	4,705	4,822	4,923	5,058	5,194	5,311	5,416	5,471	5,398	5,381	5,280	4,955	4,581	4,278	4,035
2035	Oct	4,058	3,930	3,873	3,938	4,192	4,638	4,971	5,089	5,145	5,137	5,139	5,114	5,121	5,133	5,141	5,170	5,234	5,355	5,437	5,364	5,154	4,927	4,631	4,287
2035	Nov	4,038	3,923	3,873	3,891	4,025	4,333	4,714	4,855	4,907	4,853	4,817	4,762	4,720	4,688	4,644	4,728	4,953	5,361</						

2023 DSM + BE Plan Appendix I

PSCo Total Load

2037	Mar	4,338	4,225	4,183	4,237	4,446	4,825	5,143	5,277	5,329	5,291	5,261	5,192	5,142	5,111	5,081	5,079	5,132	5,231	5,454	5,525	5,379	5,161	4,867	4,532
2037	Apr	4,054	3,940	3,895	3,951	4,174	4,507	4,762	4,908	4,993	4,971	4,969	4,931	4,919	4,903	4,893	4,891	4,919	4,923	4,998	5,125	5,014	4,796	4,532	4,237
2037	May	3,859	3,760	3,719	3,742	3,861	4,108	4,460	4,762	4,972	5,034	5,099	5,108	5,167	5,224	5,257	5,298	5,329	5,279	5,220	5,321	5,225	4,906	4,469	4,071
2037	Jun	4,395	4,223	4,125	4,116	4,178	4,353	4,648	4,966	5,232	5,417	5,614	5,763	5,915	6,056	6,176	6,265	6,302	6,195	6,013	5,859	5,706	5,397	5,008	4,625
2037	Jul	4,590	4,428	4,339	4,329	4,395	4,539	4,811	5,122	5,457	5,736	6,033	6,288	6,550	6,767	6,925	6,985	6,954	6,761	6,494	6,282	6,058	5,696	5,264	4,871
2037	Aug	4,698	4,522	4,424	4,415	4,536	4,746	5,024	5,321	5,626	5,861	6,107	6,310	6,533	6,729	6,865	6,936	6,931	6,776	6,564	6,454	6,182	5,715	5,283	4,913
2037	Sep	4,077	4,018	3,994	4,009	4,097	4,318	4,552	4,717	4,868	4,961	5,067	5,151	5,279	5,413	5,522	5,624	5,681	5,619	5,630	5,513	5,138	4,746	4,443	4,211
2037	Oct	4,291	4,146	4,077	4,143	4,416	4,882	5,224	5,341	5,395	5,371	5,365	5,327	5,323	5,325	5,327	5,358	5,433	5,572	5,650	5,579	5,380	5,185	4,910	4,546
2037	Nov	4,264	4,126	4,062	4,071	4,203	4,519	4,917	5,064	5,123	5,056	5,018	4,958	4,914	4,884	4,884	4,932	5,183	5,599	5,584	5,463	5,304	5,175	4,919	4,548
2037	Dec	4,593	4,434	4,364	4,360	4,474	4,757	5,177	5,371	5,419	5,352	5,308	5,208	5,122	5,087	5,072	5,130	5,464	5,959	5,940	5,836	5,690	5,523	5,234	4,850
2038	Jan	4,583	4,451	4,386	4,388	4,498	4,786	5,225	5,396	5,432	5,370	5,326	5,244	5,179	5,134	5,106	5,122	5,313	5,769	5,855	5,745	5,585	5,408	5,134	4,806
2038	Feb	4,367	4,271	4,234	4,243	4,339	4,603	5,024	5,167	5,205	5,122	5,077	4,993	4,932	4,891	4,861	4,862	4,971	5,282	5,588	5,492	5,298	5,080	4,809	4,522
2038	Mar	4,406	4,289	4,246	4,302	4,521	4,914	5,236	5,369	5,416	5,369	5,336	5,264	5,215	5,184	5,154	5,150	5,199	5,290	5,508	5,583	5,435	5,227	4,940	4,599
2038	Apr	4,126	4,006	3,958	4,014	4,243	4,579	4,834	4,981	5,068	5,042	5,038	4,999	4,987	4,971	4,961	4,958	4,985	4,987	5,057	5,180	5,073	4,871	4,620	4,320
2038	May	3,949	3,846	3,802	3,824	3,941	4,183	4,529	4,828	5,035	5,091	5,156	5,165	5,224	5,283	5,319	5,362	5,397	5,351	5,292	5,382	5,285	4,983	4,563	4,165
2038	Jun	4,474	4,296	4,194	4,182	4,241	4,412	4,707	5,030	5,304	5,490	5,693	5,845	6,001	6,145	6,268	6,358	6,394	6,286	6,099	5,939	5,781	5,484	5,103	4,713
2038	Jul	4,669	4,503	4,411	4,400	4,467	4,614	4,890	5,207	5,548	5,827	6,124	6,379	6,643	6,861	7,018	7,077	7,046	6,848	6,579	6,368	6,139	5,777	5,348	4,950
2038	Aug	4,773	4,591	4,489	4,482	4,615	4,845	5,139	5,439	5,738	5,960	6,197	6,390	6,608	6,800	6,933	7,004	7,002	6,855	6,652	6,545	6,270	5,807	5,376	4,994
2038	Sep	4,135	4,080	4,059	4,075	4,162	4,388	4,634	4,802	4,952	5,039	5,142	5,220	5,345	5,479	5,585	5,686	5,746	5,690	5,713	5,592	5,199	4,805	4,504	4,271
2038	Oct	4,379	4,226	4,151	4,214	4,484	4,946	5,284	5,401	5,458	5,429	5,421	5,381	5,374	5,374	5,376	5,409	5,492	5,642	5,715	5,645	5,452	5,272	5,010	4,640
2038	Nov	4,330	4,191	4,125	4,136	4,270	4,593	5,002	5,148	5,202	5,125	5,084	5,018	4,972	4,941	4,940	4,987	5,242	5,659	5,643	5,520	5,359	5,235	4,988	4,615
2038	Dec	4,675	4,508	4,433	4,428	4,545	4,835	5,261	5,456	5,504	5,429	5,382	5,277	5,188	5,153	5,137	5,195	5,529	6,019	5,997	5,894	5,749	5,598	5,322	4,933
2039	Jan	4,656	4,520	4,454	4,456	4,568	4,860	5,304	5,474	5,511	5,443	5,398	5,313	5,247	5,201	5,172	5,189	5,382	5,836	5,927	5,818	5,657	5,487	5,222	4,891
2039	Feb	4,439	4,342	4,303	4,313	4,412	4,683	5,108	5,251	5,289	5,197	5,149	5,060	4,997	4,956	4,925	4,924	5,033	5,337	5,647	5,555	5,358	5,149	4,887	4,596
2039	Mar	4,488	4,366	4,319	4,376	4,600	4,999	5,316	5,448	5,494	5,441	5,406	5,332	5,282	5,252	5,222	5,218	5,267	5,354	5,568	5,647	5,501	5,305	5,029	4,682
2039	Apr	4,210	4,077	4,022	4,078	4,314	4,650	4,900	5,047	5,137	5,109	5,105	5,064	5,052	5,037	5,027	5,026	5,054	5,057	5,121	5,239	5,140	4,957	4,721	4,411
2039	May	4,018	3,913	3,867	3,888	4,006	4,250	4,602	4,902	5,108	5,158	5,225	5,237	5,302	5,367	5,408	5,453	5,487	5,437	5,368	5,445	5,341	5,050	4,640	4,238
2039	Jun	4,554	4,369	4,262	4,248	4,307	4,479	4,779	5,107	5,388	5,572	5,778	5,930	6,088	6,234	6,357	6,446	6,480	6,370	6,182	6,018	5,859	5,573	5,199	4,801
2039	Jul	4,760	4,587	4,490	4,477	4,544	4,692	4,969	5,292	5,640	5,915	6,211	6,462	6,726	6,942	7,097	7,157	7,130	6,937	6,672	6,465	6,234	5,875	5,449	5,043
2039	Aug	4,849	4,662	4,557	4,552	4,697	4,949	5,260	5,562	5,856	6,063	6,291	6,476	6,687	6,876	7,007	7,077	7,076	6,932	6,737	6,632	6,352	5,895	5,469	5,077
2039	Sep	4,185	4,135	4,118	4,135	4,220	4,451	4,710	4,884	5,039	5,124	5,227	5,300	5,423	5,557	5,658	5,768	5,821	5,769	5,801	5,669	5,258	4,863	4,564	4,330
2039	Oct	4,458	4,300	4,222	4,283	4,556	5,022	5,362	5,478	5,532	5,496	5,484	5,440	5,432	5,430	5,432	5,458	5,552	5,708	5,778	5,708	5,518	5,350	5,100	4,725
2039	Nov	4,412	4,267	4,198	4,207	4,339	4,662	5,075	5,222	5,274	5,190	5,145	5,074	5,025	4,993	4,991	5,039	5,301	5,720	5,705	5,583	5,422	5,308	5,072	4,697
2039	Dec	4,767	4,587	4,503	4,493	4,613	4,907	5,338	5,536	5,587	5,505	5,456	5,345	5,252	5,215	5,199	5,259	5,598	6,083	6,060	5,959	5,818	5,683	5,424	5,027
2040	Jan	4,735	4,598	4,532	4,536	4,651	4,954	5,407	5,576	5,610	5,535	5,488	5,400	5,333	5,287	5,256	5,272	5,466	5,915	6,009	5,900	5,738	5,574	5,316	4,982
2040	Feb	4,368	4,297	4,270	4,279	4,358	4,597	5,024	5,179	5,214	5,105	5,049	4,952	4,887	4,845	4,813	4,809	4,911	5,220	5,581	5,483	5,250	5,021	4,760	4,495
2040	Mar	4,585	4,446	4,389	4,449	4,691	5,103	5,404	5,532	5,581	5,526	5,493	5,418	5,369	5,339	5,309	5,305	5,353	5,431	5,631	5,713	5,581	5,412	5,151	4,785
2040	Apr	4,278	4,142	4,085	4,139	4,373	4,706	4,961	5,114	5,212	5,188	5,189	5,153	5,146	5,136	5,130	5,132	5,161	5,164	5,219	5,332	5,231	5,052	4,819	4,504
2040	May	4,139	4,025	3,973	3,992	4,110	4,352	4,698	4,990	5,187	5,229	5,297	5,311	5,380	5,452	5,499	5,544	5,572	5,512	5,431	5,480	5,380	5,123	4,747	4,353
2040	Jun	4,659	4,458	4,341	4,322	4,379	4,550	4,858	5,198	5,493	5,678	5,884	6,033	6,190	6,333	6,451	6,535	6,565	6,458	6,273	6,108	5,953	5,691	5,329	4,917
2040	Jul	4,838	4,663	4,566	4,554	4,630	4,792	5,082	5,409	5,755	6,025	6,319	6,569	6,836	7,056	7,212	7,273	7,245	7,051	6,783	6,580	6,336	5,964	5,534	5,124
2040	Aug	4,949	4,748	4,633	4,629	4,789	5,066	5,393	5,701	5,993	6,185	6,401	6,571	6,773	6,953	7,078	7,147	7,152	7,019	6,841	6,743	6,462	6,017	5,595	5,183
2040	Sep	4,267	4,214	4,196	4,213	4,295	4,526	4,785	4,961	5,125	5,207	5,308	5,373	5,487	5,613	5,709	5,812	5,890	5,867	5,932	5,797	5,366	4,970	4,668	4,424
2040	Oct	4,532	4,368	4,286	4,351	4,639	5,129	5,483	5,594	5,636	5,587	5,568	5,519	5,508	5,504	5,504	5,535	5,625	5,789	5,846	5,777	5,592	5,440	5,199	4,814
2040	Nov	4,505	4,350	4,274	4,280	4,414	4,742	5,163	5,311	5,364	5,273	5,226	5,148	5,094	5,059	5,055	5,104	5,376	5,784	5,772	5,657	5,504	5,403	5,183	4,800
2040	Dec	4,871	4,670	4,573	4,554	4,678	4,984	5,423	5,624	5,681	5,593	5,542	5,426	5,329	5,293	5,279	5,346	5,696	6,170	6,146	6,047	5,908	5,787	5,542	5,135
2041	Jan	4,799	4,651	4,574	4,578	4,707	5,034	5,493	5,661	5,686	5,602	5,550	5,459	5,393	5,350	5,320	5,335	5,528	5,971</						

PSCo Total Load

2042	May	4,243	4,127	4,076	4,099	4,231	4,503	4,887	5,204	5,411	5,420	5,463	5,444	5,493	5,545	5,571	5,603	5,632	5,585	5,532	5,637	5,534	5,282	4,897	4,471
2042	Jun	4,795	4,592	4,472	4,455	4,520	4,712	5,038	5,385	5,669	5,829	6,022	6,158	6,309	6,451	6,570	6,661	6,705	6,605	6,425	6,269	6,106	5,834	5,474	5,053
2042	Jul	4,994	4,798	4,686	4,671	4,743	4,908	5,223	5,569	5,929	6,191	6,486	6,728	6,984	7,196	7,349	7,408	7,383	7,202	6,945	6,732	6,499	6,177	5,764	5,323
2042	Aug	5,095	4,885	4,765	4,752	4,890	5,133	5,456	5,785	6,111	6,328	6,575	6,768	6,990	7,186	7,318	7,383	7,372	7,215	6,996	6,877	6,596	6,159	5,754	5,344
2042	Sep	4,435	4,352	4,311	4,326	4,429	4,669	4,913	5,087	5,247	5,313	5,413	5,486	5,614	5,750	5,860	5,960	6,021	5,958	5,962	5,848	5,477	5,131	4,855	4,586
2042	Oct	4,642	4,466	4,376	4,445	4,751	5,263	5,610	5,717	5,765	5,718	5,704	5,656	5,653	5,658	5,661	5,690	5,761	5,885	5,953	5,889	5,693	5,537	5,312	4,921
2042	Nov	4,636	4,470	4,387	4,390	4,533	4,875	5,289	5,435	5,494	5,392	5,339	5,258	5,205	5,168	5,165	5,216	5,476	5,881	5,873	5,757	5,597	5,526	5,334	4,950
2042	Dec	4,985	4,793	4,701	4,690	4,816	5,133	5,588	5,783	5,830	5,727	5,670	5,548	5,452	5,414	5,395	5,457	5,811	6,284	6,269	6,171	6,028	5,917	5,687	5,280

2023 DSM + BE Plan Appendix I

PSCo Marginal CO2 Emissions

		PSCo Marginal Emissions (CO2 tons/MW)																							
Year	Month	HE1	HE2	HE3	HE4	HE5	HE6	HE7	HE8	HE9	HE10	HE11	HE12	HE13	HE14	HE15	HE16	HE17	HE18	HE19	HE20	HE21	HE22	HE23	HE24
2022	Jan	0.581	0.573	0.636	0.714	0.492	0.536	0.621	0.665	0.687	0.631	0.619	0.582	0.433	0.494	0.495	0.649	0.623	0.708	0.608	0.626	0.569	0.519	0.568	0.508
2022	Feb	0.518	0.561	0.526	0.542	0.562	0.550	0.499	0.584	0.644	0.616	0.505	0.480	0.546	0.475	0.455	0.422	0.451	0.654	0.560	0.624	0.561	0.548	0.511	0.523
2022	Mar	0.483	0.449	0.458	0.400	0.486	0.423	0.462	0.528	0.416	0.371	0.468	0.485	0.444	0.379	0.332	0.340	0.526	0.564	0.595	0.598	0.632	0.491	0.382	0.493
2022	Apr	0.349	0.258	0.301	0.517	0.522	0.589	0.459	0.487	0.544	0.522	0.539	0.502	0.476	0.538	0.464	0.380	0.381	0.419	0.530	0.563	0.549	0.522	0.332	0.372
2022	May	0.513	0.476	0.393	0.418	0.365	0.473	0.678	0.646	0.611	0.682	0.550	0.612	0.578	0.525	0.609	0.564	0.620	0.643	0.687	0.484	0.535	0.525	0.461	0.569
2022	Jun	0.319	0.338	0.278	0.312	0.301	0.364	0.372	0.398	0.440	0.529	0.585	0.501	0.562	0.536	0.639	0.653	0.618	0.722	0.700	0.663	0.620	0.520	0.434	0.325
2022	Jul	0.293	0.311	0.302	0.316	0.351	0.376	0.375	0.457	0.425	0.498	0.612	0.653	0.763	0.837	0.813	0.870	0.844	0.916	0.792	0.758	0.637	0.584	0.407	0.322
2022	Aug	0.429	0.383	0.410	0.381	0.410	0.442	0.457	0.540	0.534	0.624	0.639	0.674	0.770	0.802	0.774	0.802	0.867	0.849	0.834	0.747	0.722	0.597	0.490	0.397
2022	Sep	0.191	0.193	0.254	0.261	0.241	0.305	0.426	0.346	0.366	0.344	0.435	0.477	0.489	0.453	0.466	0.509	0.610	0.664	0.609	0.584	0.404	0.270	0.189	0.182
2022	Oct	0.314	0.296	0.341	0.321	0.347	0.425	0.451	0.511	0.436	0.416	0.425	0.433	0.443	0.424	0.409	0.403	0.588	0.554	0.526	0.522	0.470	0.457	0.446	0.318
2022	Nov	0.328	0.311	0.283	0.298	0.332	0.347	0.395	0.465	0.401	0.396	0.374	0.404	0.402	0.394	0.424	0.437	0.600	0.672	0.731	0.653	0.629	0.549	0.489	0.359
2022	Dec	0.361	0.355	0.327	0.320	0.370	0.383	0.433	0.523	0.531	0.455	0.465	0.418	0.396	0.366	0.385	0.464	0.599	0.634	0.634	0.598	0.660	0.574	0.549	0.415
2023	Jan	0.446	0.371	0.381	0.424	0.450	0.505	0.644	0.662	0.572	0.534	0.512	0.429	0.418	0.416	0.447	0.469	0.648	0.702	0.774	0.713	0.714	0.643	0.550	0.435
2023	Feb	0.443	0.423	0.398	0.402	0.430	0.491	0.646	0.655	0.535	0.448	0.446	0.401	0.339	0.338	0.261	0.276	0.491	0.671	0.747	0.772	0.703	0.635	0.547	0.495
2023	Mar	0.297	0.323	0.325	0.357	0.365	0.473	0.543	0.502	0.430	0.344	0.314	0.277	0.239	0.272	0.299	0.299	0.375	0.564	0.699	0.679	0.589	0.486	0.399	0.312
2023	Apr	0.208	0.215	0.241	0.251	0.267	0.339	0.389	0.309	0.276	0.217	0.229	0.172	0.233	0.213	0.193	0.195	0.246	0.334	0.429	0.489	0.363	0.283	0.260	0.247
2023	May	0.243	0.227	0.193	0.249	0.312	0.313	0.377	0.395	0.365	0.338	0.345	0.369	0.318	0.298	0.353	0.363	0.334	0.384	0.482	0.516	0.466	0.402	0.375	0.287
2023	Jun	0.425	0.357	0.345	0.398	0.390	0.370	0.405	0.344	0.374	0.429	0.450	0.413	0.518	0.517	0.563	0.549	0.572	0.598	0.726	0.742	0.751	0.558	0.485	0.398
2023	Jul	0.374	0.425	0.424	0.408	0.405	0.423	0.356	0.381	0.396	0.438	0.491	0.543	0.661	0.695	0.716	0.746	0.779	0.785	0.818	0.742	0.722	0.631	0.517	0.402
2023	Aug	0.455	0.477	0.438	0.465	0.451	0.540	0.501	0.477	0.541	0.541	0.556	0.576	0.652	0.729	0.709	0.728	0.765	0.836	0.824	0.730	0.778	0.667	0.651	0.556
2023	Sep	0.330	0.288	0.302	0.318	0.349	0.374	0.382	0.348	0.332	0.305	0.354	0.334	0.344	0.303	0.400	0.374	0.576	0.702	0.676	0.646	0.524	0.386	0.320	0.289
2023	Oct	0.446	0.452	0.363	0.408	0.460	0.548	0.642	0.651	0.557	0.536	0.478	0.488	0.530	0.470	0.426	0.494	0.668	0.780	0.807	0.773	0.683	0.570	0.525	0.439
2023	Nov	0.392	0.383	0.333	0.432	0.401	0.452	0.416	0.504	0.395	0.396	0.340	0.378	0.318	0.359	0.334	0.528	0.699	0.683	0.672	0.676	0.620	0.646	0.540	0.474
2023	Dec	0.383	0.392	0.382	0.401	0.446	0.435	0.445	0.632	0.503	0.501	0.527	0.485	0.503	0.360	0.451	0.529	0.618	0.698	0.727	0.688	0.671	0.615	0.565	0.419
2024	Jan	0.482	0.517	0.557	0.533	0.480	0.565	0.515	0.563	0.574	0.597	0.386	0.491	0.481	0.522	0.574	0.659	0.702	0.703	0.663	0.608	0.602	0.695	0.584	0.562
2024	Feb	0.538	0.570	0.515	0.544	0.488	0.466	0.578	0.689	0.520	0.527	0.412	0.431	0.395	0.445	0.425	0.476	0.638	0.634	0.761	0.754	0.738	0.737	0.657	0.574
2024	Mar	0.402	0.461	0.478	0.435	0.549	0.670	0.620	0.628	0.574	0.434	0.438	0.376	0.358	0.350	0.453	0.554	0.523	0.655	0.633	0.646	0.637	0.613	0.453	0.358
2024	Apr	0.535	0.513	0.481	0.455	0.494	0.593	0.603	0.535	0.420	0.362	0.449	0.398	0.480	0.397	0.415	0.510	0.609	0.600	0.608	0.582	0.594	0.629	0.610	0.531
2024	May	0.421	0.431	0.252	0.373	0.458	0.487	0.426	0.525	0.462	0.571	0.458	0.458	0.332	0.449	0.385	0.333	0.328	0.518	0.626	0.725	0.628	0.547	0.437	0.519
2024	Jun	0.553	0.549	0.584	0.609	0.548	0.584	0.545	0.456	0.518	0.612	0.576	0.662	0.506	0.621	0.638	0.642	0.700	0.551	0.559	0.628	0.538	0.553	0.546	0.511
2024	Jul	0.552	0.561	0.499	0.567	0.573	0.540	0.479	0.462	0.420	0.425	0.489	0.539	0.490	0.582	0.570	0.603	0.616	0.645	0.635	0.586	0.549	0.595	0.630	0.585
2024	Aug	0.503	0.546	0.458	0.488	0.434	0.525	0.500	0.557	0.470	0.523	0.550	0.572	0.514	0.598	0.633	0.549	0.735	0.645	0.698	0.781	0.553	0.641	0.591	0.643
2024	Sep	0.607	0.531	0.511	0.452	0.456	0.472	0.546	0.513	0.537	0.443	0.479	0.559	0.478	0.504	0.581	0.580	0.536	0.571	0.636	0.610	0.585	0.632	0.653	0.578
2024	Oct	0.522	0.439	0.561	0.422	0.570	0.540	0.491	0.449	0.514	0.532	0.578	0.507	0.417	0.462	0.490	0.452	0.634	0.645	0.613	0.694	0.663	0.611	0.486	0.383
2024	Nov	0.569	0.522	0.478	0.462	0.487	0.473	0.511	0.689	0.549	0.446	0.533	0.468	0.486	0.546	0.590	0.544	0.608	0.752	0.715	0.646	0.640	0.680	0.576	0.595
2024	Dec	0.605	0.545	0.566	0.482	0.470	0.445	0.506	0.574	0.527	0.564	0.515	0.482	0.538	0.439	0.446	0.755	0.652	0.694	0.670	0.705	0.644	0.650	0.659	0.584
2025	Jan	0.553	0.613	0.638	0.614	0.528	0.593	0.599	0.668	0.780	0.560	0.526	0.473	0.388	0.424	0.495	0.465	0.658	0.634	0.679	0.603	0.662	0.646	0.577	0.498
2025	Feb	0.481	0.467	0.463	0.554	0.507	0.499	0.550	0.608	0.579	0.463	0.460	0.451	0.429	0.426	0.481	0.508	0.527	0.523	0.550	0.602	0.666	0.602	0.545	0.481
2025	Mar	0.532	0.547	0.480	0.539	0.473	0.598	0.640	0.553	0.469	0.567	0.515	0.408	0.465	0.496	0.525	0.486	0.530	0.612	0.586	0.587	0.639	0.622	0.581	0.502
2025	Apr	0.349	0.354	0.376	0.425	0.456	0.555	0.415	0.529	0.489	0.486	0.364	0.325	0.455	0.355	0.386	0.382	0.497	0.554	0.503	0.525	0.512	0.440	0.538	0.407
2025	May	0.486	0.409	0.368	0.510	0.497	0.565	0.523	0.561	0.493	0.531	0.502	0.528	0.507	0.470	0.418	0.437	0.473	0.579	0.621	0.594	0.521	0.479	0.485	0.466
2025	Jun	0.550	0.689	0.614	0.671	0.630	0.648	0.677	0.718	0.671	0.716	0.658	0.607	0.645	0.637	0.622	0.706	0.689	0.685	0.634	0.615	0.662	0.680	0.584	0.570
2025	Jul	0.528	0.511	0.552	0.525	0.545	0.528	0.525	0.585	0.503	0.498	0.470	0.475	0.491	0.504	0.532	0.557	0.632	0.621	0.569	0.575	0.599	0.607	0.641	0.615
2025	Aug	0.590	0.562	0.558	0.565	0.578	0.562	0.518	0.520	0.575	0.562	0.518	0.583	0.493	0.580	0.584	0.618	0.626	0.652	0.533	0.557	0.596	0.617	0.644	0.607
2025	Sep	0.591	0.628	0.667	0.647	0.623	0.541	0.657	0.640	0.578	0.606	0.675	0.642	0.659	0.655	0.571	0.664	0.684	0.631	0.594	0.672	0.745	0.683	0.639	0.659
2025	Oct	0.553	0.553	0.555	0.606	0.577	0.525	0.575	0.677	0.677	0.616	0.595	0.587	0.547	0.590	0.553	0.573								

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2027	Jan	0.410	0.429	0.485	0.446	0.469	0.429	0.527	0.571	0.532	0.416	0.490	0.290	0.265	0.284	0.387	0.409	0.572	0.638	0.624	0.620	0.538	0.576	0.461	0.413
2027	Feb	0.339	0.440	0.460	0.445	0.400	0.428	0.516	0.517	0.466	0.332	0.381	0.392	0.324	0.296	0.319	0.383	0.403	0.539	0.621	0.509	0.541	0.532	0.457	0.510
2027	Mar	0.380	0.398	0.395	0.421	0.442	0.414	0.535	0.504	0.367	0.292	0.293	0.257	0.303	0.254	0.246	0.302	0.382	0.565	0.588	0.483	0.497	0.386	0.365	0.400
2027	Apr	0.377	0.334	0.371	0.336	0.326	0.336	0.312	0.178	0.181	0.235	0.211	0.154	0.163	0.131	0.166	0.173	0.221	0.331	0.427	0.382	0.465	0.391	0.381	0.299
2027	May	0.403	0.411	0.373	0.402	0.391	0.479	0.313	0.365	0.332	0.290	0.319	0.308	0.372	0.370	0.333	0.313	0.316	0.383	0.462	0.469	0.519	0.457	0.414	0.437
2027	Jun	0.414	0.489	0.430	0.415	0.449	0.433	0.307	0.226	0.392	0.485	0.486	0.478	0.493	0.530	0.494	0.512	0.604	0.564	0.632	0.549	0.621	0.616	0.639	0.535
2027	Jul	0.395	0.410	0.388	0.425	0.467	0.436	0.453	0.492	0.529	0.466	0.450	0.448	0.464	0.520	0.481	0.611	0.552	0.525	0.600	0.545	0.548	0.608	0.550	0.400
2027	Aug	0.499	0.397	0.443	0.432	0.502	0.466	0.457	0.456	0.423	0.386	0.406	0.479	0.514	0.611	0.562	0.583	0.695	0.663	0.591	0.615	0.654	0.594	0.539	0.523
2027	Sep	0.401	0.442	0.388	0.363	0.392	0.392	0.524	0.313	0.364	0.390	0.414	0.297	0.401	0.409	0.402	0.388	0.484	0.535	0.509	0.544	0.559	0.383	0.517	0.335
2027	Oct	0.541	0.435	0.478	0.488	0.526	0.570	0.472	0.564	0.506	0.486	0.406	0.462	0.467	0.453	0.359	0.406	0.527	0.634	0.575	0.638	0.641	0.529	0.557	0.474
2027	Nov	0.449	0.435	0.482	0.474	0.477	0.405	0.401	0.493	0.351	0.345	0.400	0.295	0.402	0.436	0.475	0.533	0.679	0.617	0.652	0.618	0.621	0.667	0.625	0.561
2027	Dec	0.472	0.500	0.431	0.445	0.428	0.387	0.598	0.626	0.494	0.425	0.426	0.453	0.447	0.440	0.442	0.547	0.629	0.705	0.678	0.689	0.623	0.632	0.549	0.479
2028	Jan	0.431	0.555	0.510	0.433	0.382	0.430	0.562	0.580	0.552	0.428	0.481	0.373	0.292	0.380	0.341	0.401	0.608	0.639	0.642	0.609	0.719	0.601	0.595	0.433
2028	Feb	0.450	0.388	0.431	0.523	0.414	0.428	0.471	0.520	0.380	0.370	0.398	0.363	0.346	0.285	0.242	0.387	0.503	0.545	0.683	0.684	0.688	0.569	0.477	0.423
2028	Mar	0.414	0.345	0.384	0.497	0.393	0.521	0.480	0.552	0.491	0.402	0.375	0.411	0.385	0.277	0.337	0.327	0.473	0.543	0.689	0.700	0.571	0.510	0.414	0.389
2028	Apr	0.424	0.345	0.279	0.293	0.312	0.515	0.303	0.289	0.197	0.213	0.157	0.135	0.103	0.232	0.144	0.195	0.267	0.400	0.501	0.517	0.365	0.312	0.373	0.287
2028	May	0.396	0.372	0.360	0.311	0.350	0.381	0.309	0.382	0.445	0.312	0.376	0.444	0.424	0.364	0.406	0.277	0.340	0.391	0.486	0.538	0.553	0.499	0.425	0.421
2028	Jun	0.412	0.500	0.419	0.446	0.486	0.475	0.442	0.435	0.306	0.316	0.439	0.399	0.410	0.451	0.551	0.494	0.494	0.526	0.595	0.666	0.630	0.658	0.557	0.488
2028	Jul	0.368	0.364	0.415	0.365	0.333	0.389	0.423	0.358	0.477	0.434	0.408	0.543	0.536	0.530	0.644	0.683	0.646	0.581	0.671	0.638	0.565	0.621	0.484	0.444
2028	Aug	0.537	0.438	0.524	0.477	0.447	0.589	0.474	0.472	0.514	0.461	0.572	0.522	0.665	0.594	0.616	0.574	0.617	0.622	0.642	0.616	0.661	0.594	0.635	0.548
2028	Sep	0.417	0.411	0.437	0.431	0.404	0.442	0.444	0.422	0.309	0.430	0.337	0.443	0.373	0.397	0.478	0.400	0.489	0.632	0.585	0.548	0.508	0.432	0.480	0.387
2028	Oct	0.504	0.403	0.475	0.611	0.431	0.483	0.476	0.557	0.517	0.509	0.547	0.510	0.487	0.466	0.418	0.423	0.589	0.688	0.744	0.656	0.598	0.557	0.523	0.511
2028	Nov	0.478	0.449	0.464	0.499	0.497	0.380	0.516	0.491	0.406	0.312	0.387	0.364	0.273	0.306	0.354	0.462	0.640	0.655	0.568	0.584	0.619	0.656	0.626	0.497
2028	Dec	0.516	0.558	0.515	0.459	0.464	0.360	0.399	0.494	0.498	0.444	0.382	0.403	0.385	0.392	0.405	0.531	0.607	0.669	0.660	0.644	0.686	0.650	0.604	0.572
2029	Jan	0.461	0.397	0.440	0.472	0.401	0.490	0.552	0.548	0.566	0.490	0.418	0.401	0.338	0.335	0.349	0.392	0.512	0.643	0.565	0.537	0.566	0.512	0.492	0.444
2029	Feb	0.459	0.404	0.408	0.427	0.446	0.509	0.571	0.476	0.402	0.403	0.377	0.326	0.270	0.253	0.184	0.215	0.472	0.632	0.609	0.584	0.566	0.544	0.572	0.447
2029	Mar	0.363	0.391	0.362	0.391	0.384	0.437	0.471	0.471	0.304	0.270	0.221	0.204	0.209	0.177	0.258	0.281	0.341	0.512	0.573	0.537	0.481	0.421	0.389	0.370
2029	Apr	0.232	0.223	0.238	0.240	0.271	0.319	0.271	0.193	0.184	0.161	0.127	0.121	0.130	0.148	0.136	0.157	0.167	0.271	0.335	0.305	0.293	0.281	0.198	0.200
2029	May	0.255	0.321	0.292	0.316	0.325	0.320	0.336	0.282	0.274	0.271	0.281	0.343	0.341	0.330	0.337	0.278	0.358	0.347	0.483	0.446	0.452	0.404	0.360	0.304
2029	Jun	0.418	0.386	0.393	0.398	0.491	0.380	0.319	0.229	0.281	0.300	0.316	0.354	0.321	0.390	0.474	0.477	0.516	0.623	0.616	0.662	0.638	0.575	0.510	0.468
2029	Jul	0.436	0.406	0.335	0.367	0.384	0.403	0.288	0.333	0.336	0.392	0.394	0.413	0.482	0.512	0.556	0.672	0.575	0.615	0.609	0.644	0.599	0.570	0.420	0.408
2029	Aug	0.485	0.574	0.478	0.458	0.457	0.491	0.495	0.446	0.402	0.441	0.476	0.509	0.548	0.643	0.680	0.676	0.619	0.668	0.733	0.671	0.665	0.583	0.500	0.487
2029	Sep	0.330	0.276	0.272	0.311	0.416	0.373	0.401	0.215	0.263	0.252	0.230	0.193	0.261	0.307	0.330	0.330	0.370	0.506	0.459	0.486	0.503	0.276	0.389	0.272
2029	Oct	0.422	0.407	0.432	0.539	0.568	0.492	0.524	0.509	0.389	0.345	0.373	0.383	0.389	0.354	0.336	0.387	0.497	0.579	0.596	0.523	0.497	0.522	0.535	0.459
2029	Nov	0.487	0.447	0.425	0.471	0.489	0.561	0.542	0.503	0.364	0.355	0.334	0.310	0.317	0.288	0.318	0.377	0.549	0.618	0.512	0.582	0.574	0.534	0.530	0.469
2029	Dec	0.456	0.439	0.439	0.410	0.378	0.379	0.461	0.545	0.519	0.355	0.445	0.438	0.384	0.423	0.327	0.481	0.501	0.542	0.564	0.541	0.583	0.586	0.553	0.475
2030	Jan	0.353	0.442	0.469	0.449	0.402	0.450	0.510	0.552	0.516	0.367	0.294	0.256	0.221	0.258	0.326	0.370	0.531	0.644	0.547	0.594	0.539	0.473	0.521	0.451
2030	Feb	0.507	0.494	0.433	0.490	0.552	0.551	0.570	0.500	0.445	0.324	0.300	0.238	0.233	0.203	0.144	0.219	0.370	0.582	0.643	0.660	0.634	0.553	0.515	0.487
2030	Mar	0.341	0.326	0.410	0.379	0.361	0.423	0.438	0.378	0.218	0.135	0.081	0.098	0.090	0.103	0.118	0.168	0.240	0.450	0.489	0.532	0.494	0.442	0.384	0.406
2030	Apr	0.219	0.188	0.214	0.197	0.237	0.301	0.235	0.102	0.094	0.067	0.061	0.050	0.061	0.078	0.082	0.085	0.101	0.210	0.310	0.378	0.290	0.225	0.235	0.211
2030	May	0.290	0.235	0.263	0.316	0.340	0.272	0.224	0.183	0.184	0.137	0.141	0.171	0.157	0.183	0.225	0.190	0.245	0.323	0.409	0.472	0.462	0.417	0.383	0.331
2030	Jun	0.418	0.365	0.346	0.392	0.372	0.228	0.163	0.103	0.087	0.083	0.071	0.112	0.158	0.170	0.255	0.267	0.330	0.412	0.555	0.667	0.587	0.534	0.479	0.413
2030	Jul	0.372	0.426	0.450	0.336	0.392	0.413	0.277	0.160	0.172	0.240	0.254	0.325	0.458	0.492	0.502	0.657	0.630	0.632	0.684	0.652	0.620	0.551	0.454	0.362
2030	Aug	0.419	0.468	0.500	0.466	0.518	0.505	0.476	0.387	0.353	0.327	0.389	0.344	0.465	0.529	0.522	0.570	0.673	0.699	0.781	0.677	0.553	0.542	0.544	0.460
2030	Sep	0.315	0.218	0.287	0.295	0.345	0.384	0.406	0.187	0.123	0.075	0.077	0.068	0.170	0.117	0.142	0.236	0.368	0.455	0.517	0.466	0.367	0.252	0.391	0.251
2030	Oct	0.460	0.481	0.477	0.492	0.430	0.465	0.571	0.417	0.285	0.269	0.284	0.288	0.310	0.214	0.278	0.349	0.565	0.639	0.636	0.533	0.547	0.507	0.495	0.513
2030	Nov	0.488	0.433	0.361	0.367	0.333	0.463	0.520	0.394	0.273	0.174	0.209	0.245	0.167	0.221	0.260	0.418	0.622	0.						

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PSCo Marginal CO2 Emissions

2032	Jan	0.488	0.430	0.398	0.421	0.435	0.504	0.548	0.557	0.452	0.317	0.300	0.318	0.287	0.317	0.270	0.361	0.505	0.580	0.574	0.556	0.561	0.616	0.574	0.434	
2032	Feb	0.414	0.440	0.394	0.404	0.394	0.435	0.478	0.408	0.310	0.224	0.206	0.135	0.144	0.136	0.116	0.139	0.278	0.543	0.520	0.521	0.560	0.507	0.456	0.422	
2032	Mar	0.349	0.363	0.395	0.352	0.380	0.456	0.473	0.306	0.166	0.131	0.073	0.085	0.080	0.123	0.111	0.155	0.234	0.535	0.556	0.501	0.453	0.410	0.431	0.393	
2032	Apr	0.188	0.154	0.147	0.193	0.226	0.267	0.189	0.120	0.105	0.064	0.072	0.064	0.078	0.069	0.059	0.083	0.094	0.205	0.282	0.254	0.286	0.228	0.200	0.163	
2032	May	0.223	0.183	0.222	0.239	0.245	0.252	0.241	0.191	0.136	0.149	0.136	0.151	0.156	0.173	0.157	0.176	0.192	0.279	0.444	0.462	0.415	0.441	0.298	0.351	
2032	Jun	0.384	0.365	0.334	0.311	0.337	0.259	0.185	0.109	0.098	0.094	0.099	0.133	0.129	0.181	0.237	0.292	0.286	0.405	0.584	0.573	0.610	0.522	0.441	0.452	
2032	Jul	0.390	0.379	0.385	0.362	0.345	0.302	0.249	0.129	0.133	0.202	0.242	0.265	0.383	0.526	0.577	0.589	0.574	0.621	0.671	0.635	0.665	0.544	0.480	0.518	
2032	Aug	0.527	0.489	0.465	0.504	0.458	0.510	0.476	0.405	0.280	0.261	0.275	0.357	0.431	0.441	0.537	0.631	0.612	0.605	0.718	0.649	0.684	0.497	0.526	0.448	
2032	Sep	0.256	0.259	0.315	0.363	0.334	0.364	0.316	0.163	0.124	0.089	0.077	0.101	0.130	0.105	0.170	0.175	0.309	0.418	0.450	0.407	0.363	0.278	0.292	0.283	
2032	Oct	0.445	0.453	0.435	0.465	0.485	0.517	0.565	0.416	0.280	0.262	0.266	0.259	0.256	0.250	0.242	0.297	0.485	0.580	0.568	0.532	0.555	0.495	0.521	0.507	
2032	Nov	0.467	0.392	0.406	0.385	0.415	0.486	0.556	0.426	0.260	0.291	0.227	0.226	0.232	0.230	0.287	0.419	0.579	0.603	0.567	0.602	0.571	0.537	0.513	0.371	
2032	Dec	0.420	0.398	0.417	0.399	0.461	0.503	0.535	0.465	0.422	0.371	0.336	0.318	0.318	0.306	0.285	0.433	0.544	0.581	0.608	0.547	0.525	0.530	0.536	0.498	
2033	Jan	0.498	0.512	0.458	0.464	0.501	0.520	0.560	0.529	0.426	0.344	0.313	0.280	0.267	0.266	0.287	0.330	0.547	0.582	0.591	0.580	0.526	0.522	0.526	0.465	
2033	Feb	0.416	0.443	0.375	0.392	0.397	0.444	0.467	0.400	0.322	0.232	0.212	0.182	0.142	0.106	0.141	0.138	0.320	0.539	0.563	0.512	0.537	0.533	0.458	0.379	
2033	Mar	0.302	0.326	0.321	0.360	0.290	0.418	0.401	0.337	0.125	0.086	0.103	0.093	0.089	0.076	0.091	0.139	0.221	0.447	0.536	0.427	0.413	0.415	0.390	0.372	
2033	Apr	0.170	0.148	0.148	0.186	0.222	0.276	0.216	0.136	0.059	0.083	0.072	0.075	0.048	0.055	0.060	0.071	0.108	0.176	0.292	0.287	0.247	0.189	0.202	0.159	
2033	May	0.198	0.194	0.203	0.217	0.241	0.232	0.196	0.145	0.132	0.154	0.127	0.125	0.128	0.119	0.119	0.120	0.202	0.262	0.375	0.374	0.427	0.432	0.312	0.303	
2033	Jun	0.328	0.306	0.297	0.266	0.373	0.238	0.180	0.079	0.116	0.099	0.092	0.152	0.156	0.197	0.277	0.263	0.258	0.384	0.529	0.480	0.526	0.504	0.407	0.482	
2033	Jul	0.424	0.385	0.416	0.372	0.383	0.344	0.243	0.148	0.154	0.190	0.233	0.311	0.343	0.507	0.532	0.506	0.467	0.650	0.610	0.650	0.623	0.487	0.480	0.547	
2033	Aug	0.467	0.476	0.485	0.506	0.468	0.504	0.441	0.318	0.283	0.264	0.270	0.334	0.392	0.406	0.514	0.513	0.531	0.700	0.667	0.582	0.583	0.520	0.514	0.442	
2033	Sep	0.244	0.226	0.250	0.309	0.303	0.340	0.306	0.133	0.092	0.132	0.101	0.095	0.128	0.090	0.099	0.143	0.301	0.485	0.430	0.439	0.330	0.267	0.281	0.242	
2033	Oct	0.410	0.459	0.443	0.429	0.505	0.501	0.539	0.381	0.303	0.292	0.250	0.224	0.217	0.233	0.254	0.283	0.474	0.543	0.573	0.515	0.447	0.448	0.482	0.490	
2033	Nov	0.480	0.435	0.393	0.410	0.391	0.407	0.423	0.483	0.357	0.246	0.222	0.197	0.250	0.240	0.244	0.381	0.598	0.553	0.543	0.531	0.561	0.513	0.532	0.455	
2033	Dec	0.428	0.401	0.390	0.383	0.437	0.483	0.496	0.473	0.430	0.340	0.353	0.319	0.291	0.283	0.240	0.378	0.539	0.543	0.547	0.498	0.496	0.499	0.495	0.489	
2034	Jan	0.462	0.501	0.406	0.416	0.472	0.530	0.531	0.546	0.453	0.334	0.277	0.277	0.286	0.268	0.274	0.334	0.497	0.572	0.560	0.515	0.494	0.474	0.499	0.479	
2034	Feb	0.438	0.425	0.420	0.466	0.409	0.485	0.528	0.428	0.271	0.270	0.263	0.173	0.202	0.172	0.126	0.217	0.382	0.460	0.488	0.472	0.455	0.437	0.408	0.428	
2034	Mar	0.308	0.308	0.338	0.341	0.356	0.413	0.442	0.305	0.184	0.147	0.113	0.121	0.096	0.115	0.100	0.148	0.201	0.413	0.523	0.434	0.398	0.405	0.347	0.362	
2034	Apr	0.206	0.203	0.192	0.176	0.200	0.250	0.206	0.102	0.093	0.081	0.060	0.045	0.050	0.050	0.057	0.094	0.123	0.215	0.290	0.268	0.255	0.225	0.198	0.166	
2034	May	0.235	0.213	0.248	0.242	0.222	0.235	0.217	0.168	0.158	0.171	0.142	0.108	0.130	0.125	0.125	0.134	0.192	0.278	0.382	0.392	0.410	0.410	0.353	0.304	
2034	Jun	0.363	0.314	0.285	0.301	0.346	0.236	0.172	0.105	0.131	0.093	0.097	0.126	0.132	0.190	0.215	0.272	0.351	0.450	0.549	0.559	0.535	0.511	0.476	0.407	
2034	Jul	0.368	0.336	0.352	0.353	0.380	0.333	0.222	0.169	0.162	0.199	0.236	0.249	0.350	0.452	0.497	0.562	0.508	0.560	0.607	0.614	0.575	0.527	0.514	0.440	
2034	Aug	0.495	0.481	0.478	0.494	0.426	0.445	0.423	0.278	0.256	0.254	0.271	0.322	0.373	0.432	0.432	0.548	0.569	0.571	0.573	0.661	0.637	0.611	0.558	0.526	0.408
2034	Sep	0.247	0.300	0.281	0.315	0.289	0.281	0.285	0.120	0.105	0.106	0.079	0.081	0.096	0.103	0.130	0.191	0.250	0.430	0.439	0.357	0.289	0.226	0.192	0.262	
2034	Oct	0.479	0.470	0.403	0.462	0.467	0.521	0.531	0.398	0.256	0.255	0.204	0.185	0.214	0.220	0.238	0.277	0.509	0.554	0.510	0.494	0.453	0.465	0.472	0.513	
2034	Nov	0.438	0.432	0.388	0.452	0.450	0.401	0.431	0.424	0.327	0.255	0.215	0.250	0.215	0.256	0.198	0.437	0.549	0.516	0.496	0.520	0.508	0.516	0.493	0.515	
2034	Dec	0.478	0.435	0.433	0.425	0.401	0.423	0.476	0.453	0.384	0.338	0.314	0.326	0.267	0.276	0.269	0.388	0.524	0.525	0.522	0.513	0.518	0.553	0.500	0.491	
2035	Jan	0.468	0.454	0.415	0.395	0.459	0.485	0.534	0.506	0.465	0.363	0.342	0.332	0.294	0.286	0.323	0.371	0.441	0.595	0.536	0.522	0.529	0.545	0.497	0.424	
2035	Feb	0.424	0.406	0.448	0.414	0.462	0.467	0.518	0.418	0.348	0.296	0.279	0.255	0.181	0.177	0.191	0.234	0.409	0.487	0.519	0.505	0.530	0.516	0.455	0.458	
2035	Mar	0.320	0.330	0.301	0.367	0.351	0.361	0.392	0.306	0.191	0.126	0.099	0.097	0.103	0.080	0.103	0.120	0.187	0.448	0.471	0.453	0.371	0.384	0.398	0.393	
2035	Apr	0.185	0.167	0.191	0.167	0.208	0.280	0.207	0.128	0.080	0.061	0.061	0.061	0.057	0.069	0.065	0.091	0.137	0.211	0.256	0.275	0.228	0.223	0.202	0.158	
2035	May	0.259	0.233	0.238	0.244	0.265	0.255	0.192	0.170	0.186	0.152	0.111	0.105	0.148	0.156	0.154	0.120	0.201	0.271	0.376	0.386	0.384	0.377	0.313	0.324	
2035	Jun	0.404	0.375	0.326	0.335	0.376	0.278	0.220	0.103	0.095	0.103	0.106	0.124	0.155	0.219	0.260	0.260	0.308	0.358	0.564	0.549	0.525	0.495	0.474	0.430	
2035	Jul	0.398	0.321	0.370	0.337	0.369	0.341	0.218	0.175	0.183	0.186	0.201	0.214	0.387	0.398	0.474	0.511	0.533	0.594	0.608	0.638	0.582	0.584	0.537	0.378	
2035	Aug	0.538	0.512	0.484	0.501	0.467	0.482	0.449	0.303	0.291	0.316	0.314	0.398	0.463	0.511	0.550	0.612	0.599	0.697	0.717	0.653	0.562	0.548	0.512	0.471	
2035	Sep	0.300	0.266	0.370	0.303	0.298	0.296	0.309	0.119	0.089	0.064	0.081	0.089	0.093	0.098	0.127	0.197	0.244	0.407	0.350	0.362	0.282	0.225	0.232	0.305	
2035	Oct	0.473	0.481	0.433	0.461	0.453	0.487	0.551	0.407	0.285	0.283	0.280	0.246	0.287	0.272	0.258	0.294	0.470	0.533	0.541	0.515	0.448	0.481	0.510	0.482	
2035	Nov	0.448	0.365	0.372	0.401	0.450	0.429	0.499	0.443	0.251	0.259	0.222	0.231	0.221	0.230	0.257	0.389	0.								

2023 DSM + BE Plan Appendix I

PSCo Marginal CO2 Emissions

2037	Mar	0.297	0.279	0.289	0.312	0.280	0.303	0.380	0.305	0.167	0.156	0.101	0.109	0.151	0.136	0.160	0.189	0.228	0.369	0.486	0.403	0.393	0.368	0.317	0.338
2037	Apr	0.181	0.147	0.174	0.170	0.179	0.200	0.206	0.104	0.100	0.083	0.089	0.070	0.073	0.058	0.074	0.084	0.099	0.157	0.245	0.256	0.231	0.184	0.172	0.137
2037	May	0.201	0.172	0.215	0.224	0.236	0.240	0.220	0.172	0.162	0.153	0.112	0.115	0.125	0.155	0.156	0.140	0.178	0.226	0.285	0.355	0.362	0.358	0.275	0.267
2037	Jun	0.376	0.324	0.277	0.251	0.271	0.263	0.178	0.080	0.073	0.058	0.069	0.083	0.091	0.151	0.154	0.187	0.222	0.318	0.429	0.402	0.416	0.405	0.402	0.378
2037	Jul	0.360	0.331	0.287	0.307	0.364	0.289	0.244	0.139	0.143	0.189	0.194	0.269	0.320	0.367	0.499	0.448	0.487	0.498	0.531	0.578	0.546	0.437	0.439	0.348
2037	Aug	0.431	0.378	0.357	0.405	0.373	0.458	0.414	0.261	0.226	0.229	0.243	0.288	0.366	0.460	0.527	0.519	0.567	0.575	0.595	0.608	0.471	0.409	0.420	0.392
2037	Sep	0.251	0.207	0.219	0.233	0.263	0.312	0.214	0.109	0.107	0.112	0.059	0.089	0.087	0.066	0.117	0.154	0.232	0.316	0.325	0.270	0.239	0.218	0.174	0.233
2037	Oct	0.449	0.453	0.417	0.437	0.418	0.488	0.520	0.402	0.278	0.252	0.252	0.256	0.233	0.236	0.218	0.262	0.473	0.512	0.498	0.514	0.461	0.492	0.458	0.456
2037	Nov	0.431	0.391	0.380	0.321	0.324	0.455	0.496	0.403	0.219	0.247	0.220	0.220	0.258	0.276	0.270	0.406	0.558	0.553	0.611	0.559	0.490	0.499	0.504	0.436
2037	Dec	0.448	0.425	0.388	0.452	0.395	0.462	0.533	0.486	0.410	0.352	0.321	0.338	0.288	0.294	0.339	0.423	0.493	0.565	0.543	0.463	0.484	0.496	0.468	0.470
2038	Jan	0.468	0.482	0.459	0.506	0.504	0.510	0.433	0.483	0.403	0.301	0.286	0.280	0.262	0.235	0.266	0.333	0.496	0.499	0.555	0.577	0.529	0.505	0.530	0.502
2038	Feb	0.367	0.380	0.412	0.406	0.422	0.442	0.483	0.345	0.295	0.228	0.218	0.210	0.153	0.143	0.161	0.158	0.342	0.561	0.527	0.489	0.457	0.444	0.416	0.393
2038	Mar	0.349	0.310	0.307	0.236	0.336	0.394	0.385	0.300	0.162	0.137	0.102	0.096	0.136	0.131	0.174	0.185	0.258	0.424	0.523	0.430	0.381	0.372	0.387	0.360
2038	Apr	0.199	0.143	0.180	0.163	0.188	0.197	0.180	0.116	0.068	0.075	0.084	0.071	0.086	0.050	0.055	0.091	0.105	0.208	0.241	0.274	0.244	0.233	0.231	0.170
2038	May	0.200	0.214	0.246	0.231	0.232	0.222	0.183	0.174	0.168	0.131	0.133	0.113	0.136	0.153	0.157	0.146	0.179	0.181	0.317	0.338	0.388	0.362	0.271	0.245
2038	Jun	0.392	0.365	0.325	0.291	0.281	0.266	0.183	0.090	0.080	0.084	0.091	0.102	0.114	0.139	0.173	0.191	0.237	0.394	0.481	0.499	0.444	0.418	0.355	0.404
2038	Jul	0.348	0.337	0.346	0.328	0.380	0.331	0.306	0.171	0.168	0.245	0.246	0.277	0.367	0.485	0.462	0.525	0.559	0.520	0.586	0.604	0.475	0.474	0.395	0.420
2038	Aug	0.460	0.431	0.441	0.427	0.399	0.494	0.463	0.320	0.304	0.290	0.297	0.361	0.370	0.474	0.554	0.581	0.582	0.612	0.614	0.530	0.487	0.480	0.524	0.420
2038	Sep	0.261	0.234	0.278	0.316	0.362	0.359	0.300	0.151	0.118	0.130	0.097	0.135	0.120	0.120	0.148	0.215	0.268	0.358	0.358	0.334	0.299	0.250	0.228	0.222
2038	Oct	0.467	0.441	0.439	0.491	0.473	0.492	0.493	0.372	0.267	0.249	0.217	0.226	0.246	0.270	0.239	0.259	0.565	0.527	0.540	0.541	0.479	0.448	0.417	0.503
2038	Nov	0.453	0.431	0.334	0.345	0.419	0.378	0.489	0.438	0.235	0.247	0.201	0.218	0.256	0.262	0.272	0.381	0.576	0.525	0.533	0.554	0.552	0.498	0.466	0.451
2038	Dec	0.429	0.403	0.419	0.407	0.444	0.467	0.495	0.453	0.390	0.358	0.325	0.328	0.310	0.290	0.291	0.375	0.516	0.584	0.547	0.536	0.499	0.514	0.502	0.506
2039	Jan	0.500	0.494	0.502	0.440	0.452	0.508	0.504	0.474	0.375	0.302	0.293	0.268	0.250	0.254	0.265	0.335	0.499	0.556	0.538	0.576	0.557	0.492	0.498	0.534
2039	Feb	0.369	0.360	0.382	0.391	0.391	0.458	0.447	0.364	0.236	0.161	0.163	0.158	0.161	0.121	0.172	0.139	0.342	0.465	0.440	0.446	0.459	0.431	0.364	0.383
2039	Mar	0.316	0.340	0.257	0.320	0.334	0.361	0.403	0.310	0.158	0.140	0.096	0.105	0.145	0.154	0.125	0.168	0.222	0.344	0.472	0.419	0.345	0.380	0.363	0.367
2039	Apr	0.209	0.160	0.171	0.188	0.176	0.212	0.192	0.106	0.082	0.062	0.083	0.075	0.068	0.064	0.061	0.073	0.107	0.172	0.265	0.220	0.232	0.234	0.238	0.141
2039	May	0.221	0.233	0.234	0.216	0.262	0.232	0.181	0.160	0.157	0.140	0.120	0.126	0.122	0.132	0.106	0.130	0.187	0.252	0.331	0.329	0.349	0.395	0.325	0.300
2039	Jun	0.293	0.286	0.265	0.233	0.227	0.225	0.182	0.112	0.117	0.128	0.110	0.122	0.137	0.181	0.188	0.193	0.250	0.406	0.462	0.551	0.459	0.465	0.364	0.397
2039	Jul	0.353	0.385	0.350	0.327	0.338	0.334	0.218	0.161	0.192	0.224	0.242	0.244	0.365	0.474	0.490	0.449	0.494	0.562	0.618	0.589	0.530	0.448	0.427	0.351
2039	Aug	0.437	0.476	0.432	0.457	0.412	0.527	0.421	0.343	0.341	0.319	0.336	0.332	0.395	0.448	0.508	0.584	0.542	0.582	0.576	0.593	0.527	0.480	0.486	0.431
2039	Sep	0.244	0.250	0.248	0.276	0.301	0.332	0.266	0.126	0.088	0.104	0.086	0.086	0.098	0.127	0.157	0.175	0.263	0.404	0.390	0.311	0.270	0.235	0.212	0.230
2039	Oct	0.452	0.485	0.451	0.493	0.494	0.488	0.502	0.345	0.266	0.252	0.213	0.225	0.231	0.221	0.207	0.276	0.491	0.557	0.499	0.464	0.424	0.415	0.429	0.499
2039	Nov	0.452	0.390	0.334	0.365	0.374	0.420	0.469	0.428	0.261	0.273	0.254	0.276	0.286	0.232	0.276	0.465	0.549	0.514	0.532	0.521	0.536	0.483	0.492	0.464
2039	Dec	0.483	0.413	0.419	0.443	0.467	0.477	0.468	0.448	0.448	0.337	0.345	0.358	0.349	0.328	0.363	0.427	0.512	0.557	0.509	0.498	0.477	0.497	0.489	0.496
2040	Jan	0.493	0.443	0.464	0.470	0.520	0.528	0.588	0.548	0.450	0.338	0.336	0.297	0.288	0.252	0.249	0.377	0.546	0.567	0.557	0.570	0.516	0.552	0.478	0.458
2040	Feb	0.394	0.369	0.363	0.377	0.395	0.467	0.447	0.355	0.253	0.180	0.159	0.139	0.124	0.124	0.111	0.138	0.317	0.392	0.449	0.401	0.417	0.381	0.365	0.401
2040	Mar	0.352	0.372	0.352	0.360	0.327	0.378	0.366	0.311	0.203	0.152	0.108	0.118	0.103	0.091	0.111	0.146	0.199	0.343	0.446	0.447	0.393	0.357	0.374	0.383
2040	Apr	0.216	0.174	0.164	0.198	0.211	0.262	0.202	0.112	0.107	0.107	0.113	0.117	0.117	0.110	0.089	0.083	0.107	0.164	0.243	0.233	0.225	0.203	0.188	0.177
2040	May	0.254	0.269	0.281	0.254	0.270	0.236	0.206	0.197	0.157	0.174	0.126	0.113	0.103	0.143	0.139	0.159	0.214	0.258	0.343	0.353	0.398	0.376	0.290	0.321
2040	Jun	0.370	0.299	0.298	0.277	0.268	0.244	0.178	0.113	0.102	0.110	0.106	0.128	0.127	0.196	0.185	0.215	0.361	0.382	0.492	0.526	0.533	0.550	0.519	0.437
2040	Jul	0.350	0.379	0.384	0.393	0.431	0.356	0.279	0.143	0.194	0.209	0.197	0.230	0.419	0.505	0.533	0.573	0.526	0.564	0.656	0.621	0.592	0.514	0.426	0.386
2040	Aug	0.474	0.468	0.431	0.444	0.517	0.461	0.471	0.363	0.337	0.300	0.320	0.374	0.393	0.436	0.475	0.516	0.534	0.610	0.633	0.529	0.553	0.506	0.411	0.449
2040	Sep	0.195	0.195	0.191	0.197	0.199	0.240	0.248	0.123	0.133	0.130	0.096	0.129	0.165	0.147	0.176	0.201	0.232	0.395	0.365	0.294	0.300	0.193	0.171	0.174
2040	Oct	0.415	0.465	0.472	0.522	0.476	0.495	0.505	0.382	0.313	0.301	0.249	0.255	0.228	0.243	0.230	0.258	0.464	0.519	0.513	0.463	0.430	0.401	0.446	0.462
2040	Nov	0.453	0.379	0.355	0.366	0.403	0.398	0.443	0.417	0.295	0.295	0.244	0.271	0.211	0.232	0.298	0.386	0.574	0.557	0.511	0.505	0.491	0.481	0.414	0.496
2040	Dec	0.421	0.427	0.435	0.451	0.444	0.429	0.520	0.501	0.400	0.353	0.328	0.349	0.326	0.336	0.374	0.433	0.511	0.551	0.549	0.581	0.550	0.548	0.485	0.502
2041	Jan	0.404	0.348	0.374	0.407	0.453	0.469	0.486	0.479	0.388	0.309	0.305	0.300	0.285	0.257	0.242	0.317	0.451	0.						

2023 DSM + BE Plan Appendix I

PSCo Marginal CO2 Emissions

2042	May	0.227	0.210	0.227	0.214	0.239	0.227	0.208	0.180	0.178	0.160	0.168	0.161	0.172	0.166	0.179	0.168	0.177	0.224	0.253	0.247	0.275	0.311	0.280	0.262
2042	Jun	0.231	0.208	0.184	0.165	0.158	0.148	0.159	0.121	0.103	0.076	0.078	0.091	0.108	0.132	0.144	0.155	0.258	0.303	0.376	0.361	0.339	0.325	0.330	0.274
2042	Jul	0.297	0.266	0.258	0.268	0.244	0.256	0.224	0.181	0.203	0.236	0.243	0.279	0.317	0.447	0.472	0.474	0.438	0.453	0.461	0.452	0.441	0.417	0.360	0.306
2042	Aug	0.399	0.405	0.365	0.387	0.377	0.396	0.378	0.396	0.373	0.374	0.368	0.424	0.403	0.478	0.468	0.433	0.463	0.499	0.554	0.497	0.511	0.452	0.411	0.394
2042	Sep	0.144	0.141	0.155	0.151	0.152	0.166	0.193	0.088	0.052	0.047	0.049	0.070	0.087	0.082	0.083	0.112	0.148	0.232	0.231	0.179	0.181	0.164	0.141	0.166
2042	Oct	0.342	0.346	0.355	0.335	0.342	0.323	0.363	0.292	0.227	0.191	0.193	0.177	0.230	0.211	0.199	0.236	0.328	0.385	0.400	0.389	0.333	0.366	0.347	0.356
2042	Nov	0.347	0.286	0.276	0.282	0.249	0.302	0.289	0.295	0.234	0.201	0.226	0.224	0.224	0.237	0.223	0.313	0.383	0.385	0.384	0.386	0.408	0.356	0.282	0.307
2042	Dec	0.323	0.311	0.346	0.352	0.335	0.347	0.384	0.381	0.321	0.324	0.307	0.291	0.286	0.275	0.257	0.313	0.374	0.412	0.393	0.383	0.377	0.367	0.363	0.340

