

AIR SOURCE HEAT PUMP APPLICATIONS



ASHP Market Potential

Furnace and AC Homes

- 81% of Xcel's residential customers have furnaces and/or air-conditioners
- 1,300,000 customers are a great application for ducted ccASHPs
- 40,000 - 50,000 customers replace AC annually

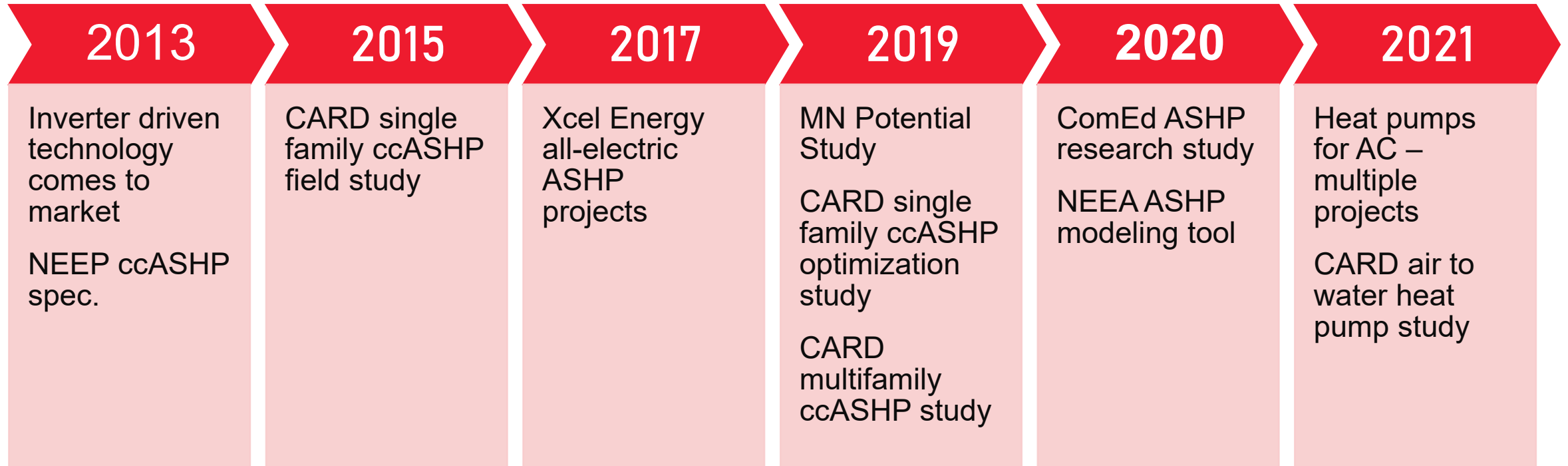
Electrically Heated Homes

- 6% of Xcel's residential customers heat with electricity
- 96,000 customers can save over 55% from a heat pump install

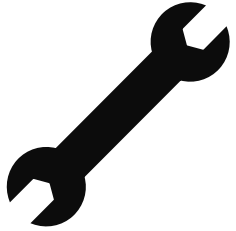
Boiler Heated Homes

- 9% of Xcel's residential customer heat with boilers
- 144,000 customers could use ductless mini-splits for cooling and heating

CEE ASHP Research Timeline



Application Overview



Ducted Dual-Fuel ASHPs

Discuss good, better, and best options and application

Design and install guidance



All-electric ccASHP

Applications

Design and install guidance



Ductless Minisplit

Applications

Design and Install Guidance

DUAL FUEL ASHP APPLICATIONS

Largest market potential – 1,300,000 Xcel Customers

40,000 – 50,000 annual AC replacements



Discussing Good, Better, Best

- How many use a good, better, best approach for air-conditioners?
- What are your typical AC good, better, best options?
 - Code AC – 13-14 SEER
 - 15-16 SEER Option
 - 18+ SEER or multi-stage option
- Next: Good – better – best in heat pumps

Scenario – Customer Calls for New AC

- Average Existing Home
 - 80% furnace
 - 13-14 SEER AC
- Customer looking for a new AC



GOOD: ENTRY-LEVEL HEAT PUMP



Good – Entry Level HP

Never install an AC again!!!

- AC and single-stage ASHPs are very similar
- The heat pump has a \$25 reversing valve
- Heat pumps can be the new “good” option
- Offers more benefits than AC



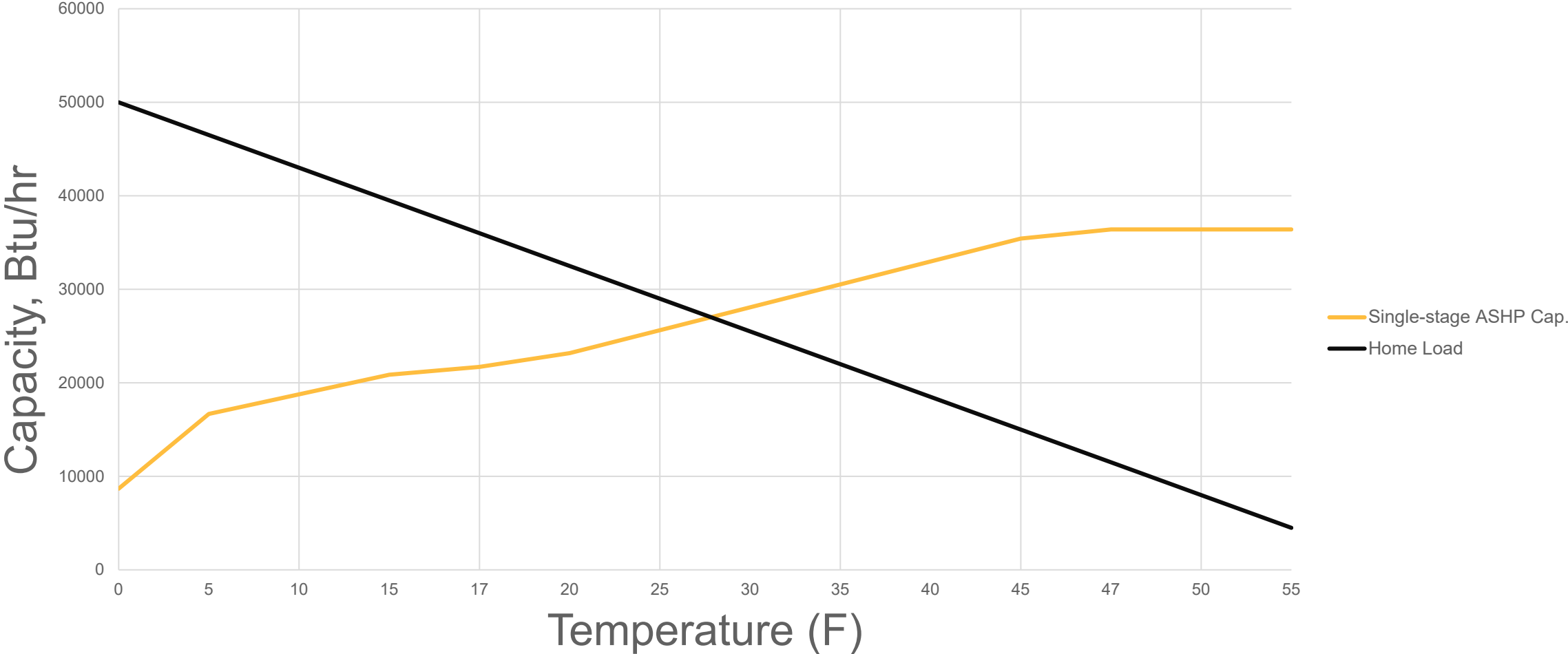
Application Considerations

- Applicable to any home with ductwork
- Very similar to AC install
- Size for AC
 - Ability to heat at moderate temps ~ 35°F
- Install with existing furnace
 - Can upsell new furnace



Sizing and Capacity – 3 ton Entry-level ASHP

Air Source Heat Pump Capacity Comparison

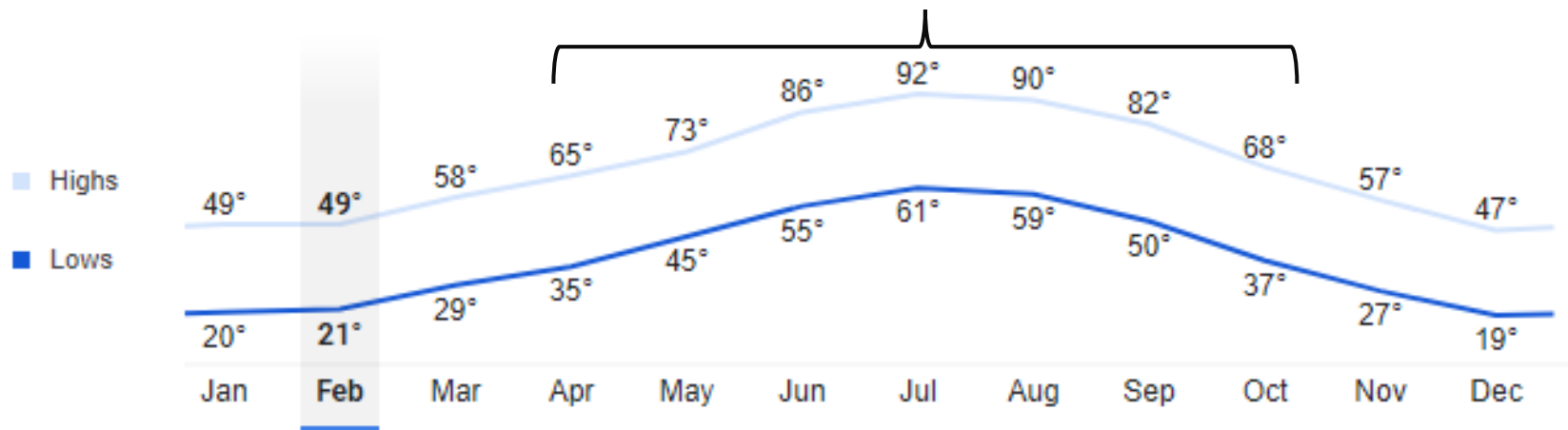


Customer Benefits

- Heat pump provides heating and cooling
 - 6 months of operation compared to 3 months for AC
- Offers flexibility – gas or electric
 - avoids furnace use at moderate temps
- \$800 HP rebate!
 - 15+ SEER and 12.5 EER

Denver Weather

Temperatures (°F)



Customer Costs – Entry Level Heat Pump

Heat Pump or AC	Annual Heating and Cooling Costs	Cost Comparison	Heat Pump Heating Hours
Baseline ~14 SEER	\$910	-	-
Entry-level HP w/ 45°F switchover	\$880	(\$30)	44%
w/ 35°F switchover	\$940	\$30	69%
w/ 25°F switchover	\$1,010	\$100	87%

Using Current Energy Pricing

- Xcel's new TOU electric rates
- Average gas cost = \$0.66/therm
- Note - winter 2022 = \$0.81/therm

Emissions Savings

Heat Pump or AC	Carbon Emissions (tons)	Emissions Savings (tons)	% Carbon Reduction
Baseline ~14 SEER	5.7	-	-
Entry-level HP w/ 45°F switchover	5.1	0.6	11%
w/ 35°F switchover	3.9	1.8	32%
w/ 25°F switchover	2.5	3.2	56%

Carbon Equivalents

- Home Furnace and AC = 5.7 tons
- Average Car = 4.6 tons
 - Assumes 11,500 miles per year
- 35°F switchover – offsets 4,500 miles traveled
- 25°F switchover – offsets 7,900 miles

Entry level HP Considerations

- Lower up-front costs compared to variable-speed heat pumps
- Good performance at shoulder season air temperatures
- Single (or two stage) heat pumps cannot increase compressor speed at cold temperatures
 - Capacity decreases quicker as it gets cold outside
 - Leads to less operating hours for the HP

BETTER – VARIABLE CAPACITY HEAT PUMP (VCHP)

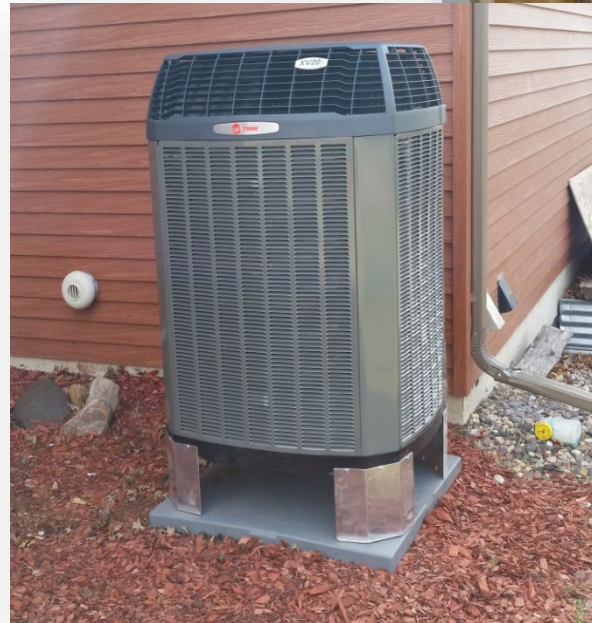
Better – Variable Capacity ASHP

Dual fuel VCHP

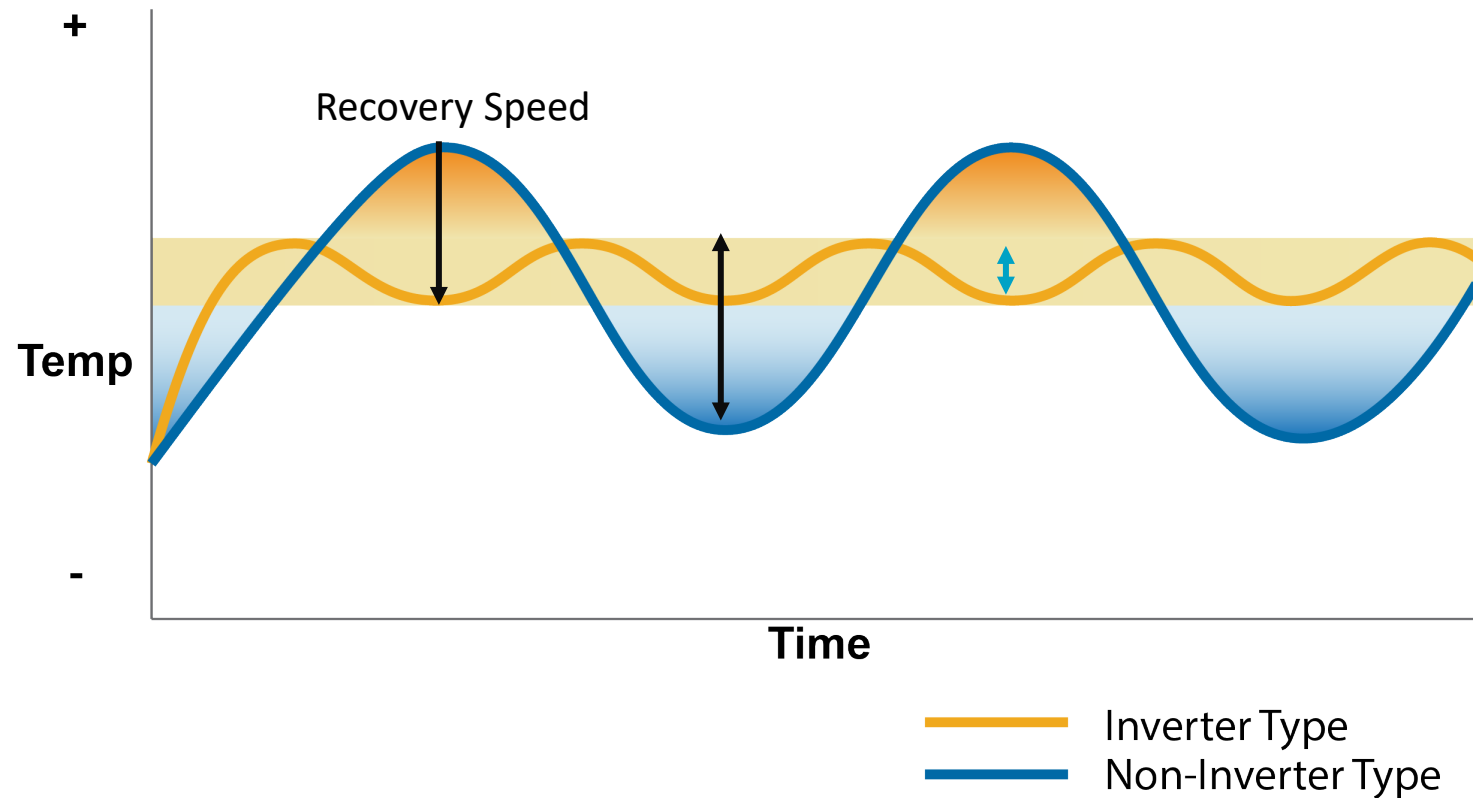
- VCHP outdoor unit
- Paired with gas furnace

Offered by every major manufacturer

- Trane, Bryant, Lennox, etc.



How Modulation Helps Control



VCHPs Offer –

- More control
- Less waste
- Improved comfort

Application Considerations

Full system replacement

- New ASHP and furnace

Sizing – simply size for AC

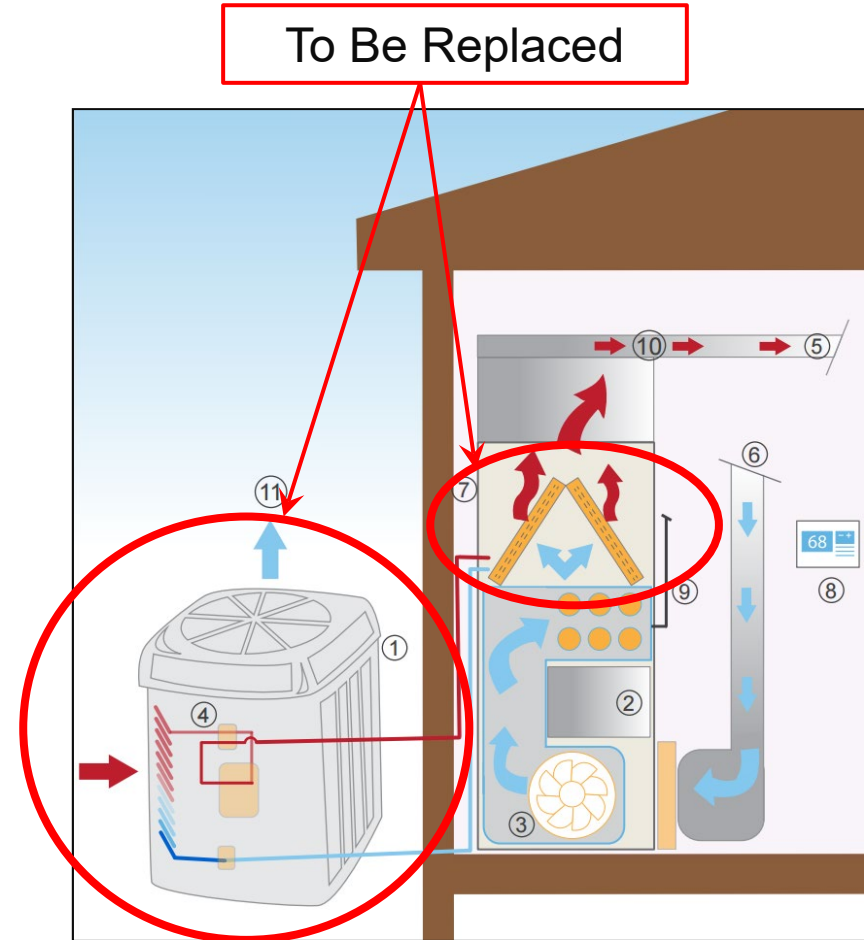
- Review heating capacity

Switchover temperature

- Understand system capacity and home load

VCHP A-coil systems

- Pairs with existing furnace



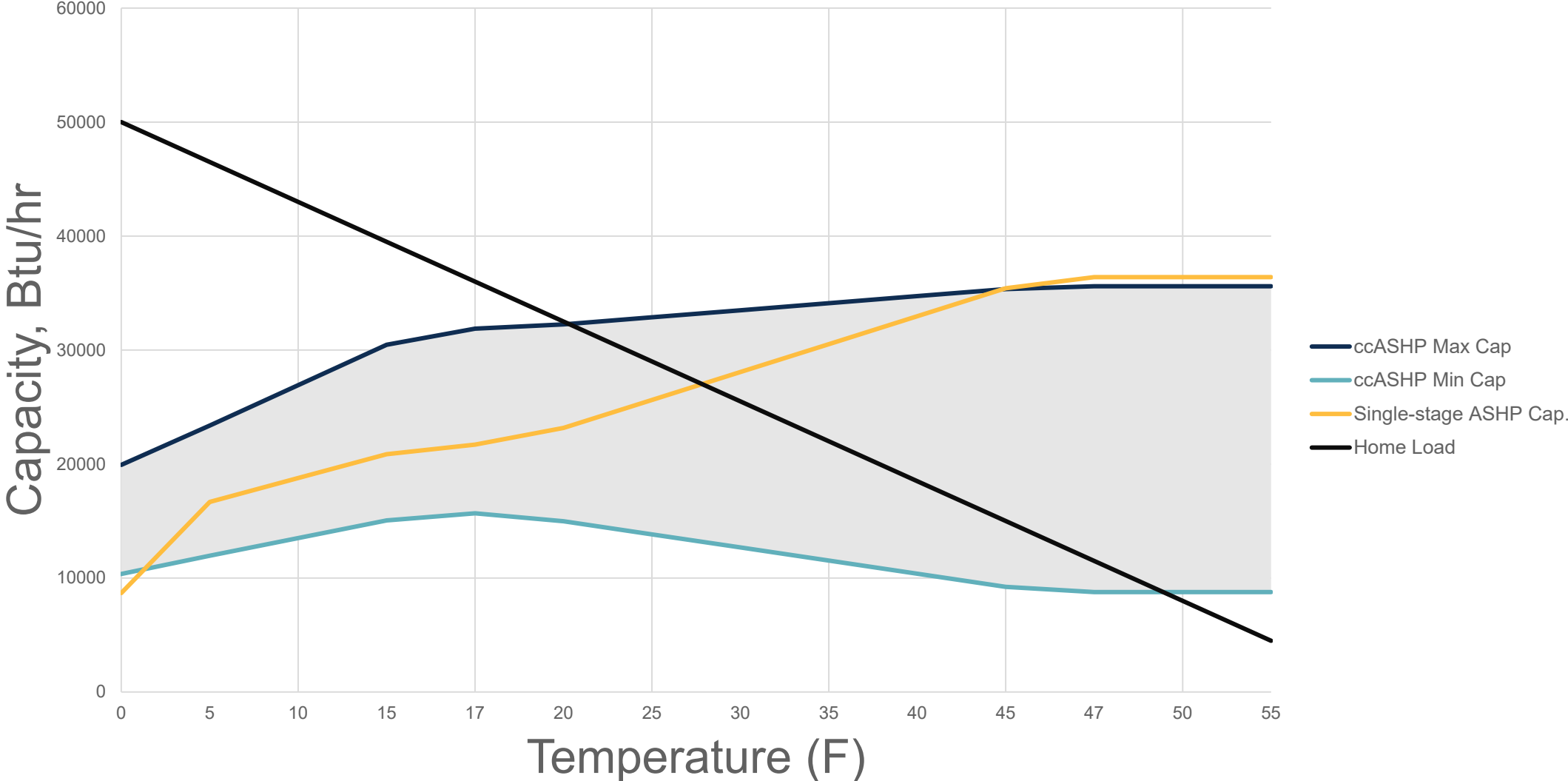
VCHP A-Coil Only Systems

- Must have AHRI rating for the A-coil pairing
- Must meet rebate criteria
 - Likely falls in the ASHP rebate category
- If there is not an AHRI rating, then there is no rebate
 - Consider furnace pairing options

	SEER	EER		HSPF		Rebates
Heat pump type	no change	Now	Probable	Now	Probable	no change
ASHP	15	12.5	11.5	9	9	\$800
ccASHP	18	12.5	11.5	10.5	9.5	\$1,000

Variable Capacity aka Variable Speed

Air Source Heat Pump Capacity Comparison



Customer Benefits

- Energy Savings –
 - Efficient heating and cooling
 - Operate ~10 months of the year
- Comfort
 - Filtration, continual mix
- Flexibility – choice between furnace and ASHP
- Emissions reduction

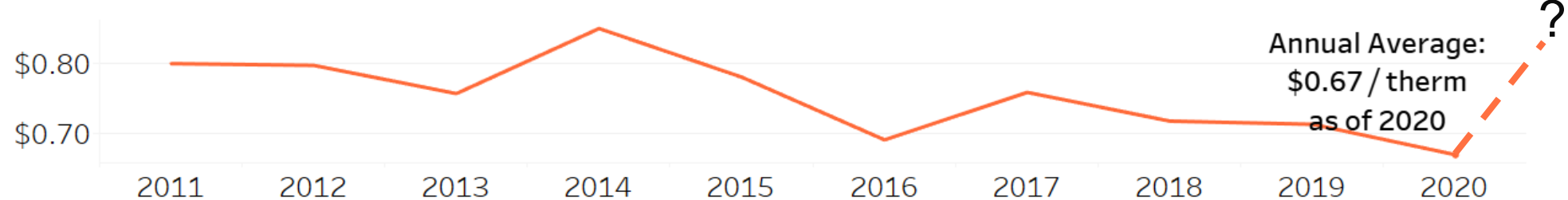


Future Proof By Offering Flexibility

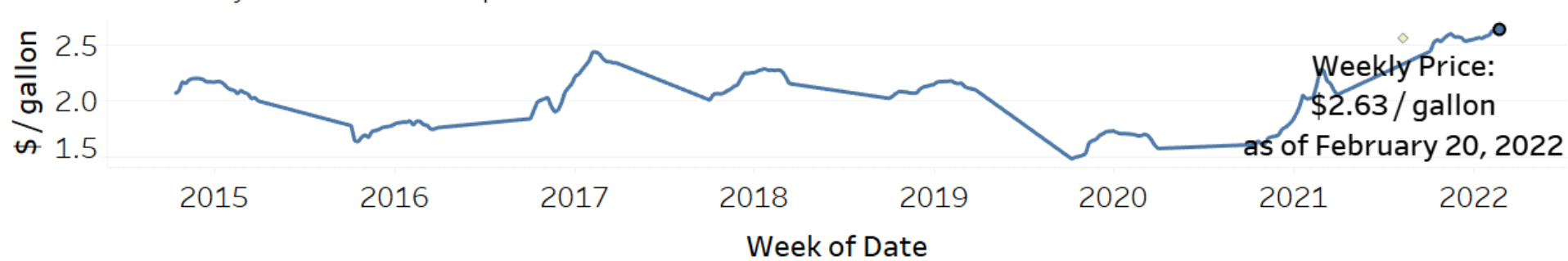
Colorado Annual Residential Electricity Price



Colorado Annual Residential Natural Gas Price



Colorado Weekly Residential Propane Price



Data source: U.S. Energy Information Administration (EIA)

Customer Costs - VCHP

Heat Pump or AC	Annual Heating and Cooling Costs	Cost Comparison	Heat Pump Heating Hours
Baseline ~14 SEER	\$910	-	-
VSHP w/ 35°F switchover	\$890	(\$20)	69%
w/ 25°F switchover	\$960	\$50	87%
w/ 5°F switchover (requires 6 ton VSHP)	\$1,050	\$140	99%

Using Current Energy Pricing

- Xcel's new TOU electric rates
- Average gas cost = \$0.66/therm
- Note - winter 2022 = \$0.81/therm

Emissions Savings

Heat Pump or AC	Carbon Emissions (tons)	Emissions Savings (tons)	% Carbon Reduction
Baseline ~14 SEER	5.7	-	-
VSHP w/ 35°F switchover	3.8	1.9	33%
w/ 25°F switchover	2.5	3.2	57%
w/ 5°F switchover (requires 6 ton VSHP)	1.2	4.5	78%

Don't recommend a 6 ton HP
Need a cold-climate HP at 5°F

Carbon Equivalents

- Average Car = 4.64 tons
- Assumes 11,520 miles per year
- 35°F switchover – offsets 4,700 miles traveled
- 25°F switchover – offsets 7,900 miles

**BEST:
COLD CLIMATE HEAT PUMP (ccASHP)**

Best – Cold Climate ASHP (ccASHP)

\$1,000 ccASHP Rebate

≥18 SEER

≥12.5 EER 11.5 EER

≥10.5 HSPF 9.5 HSPF

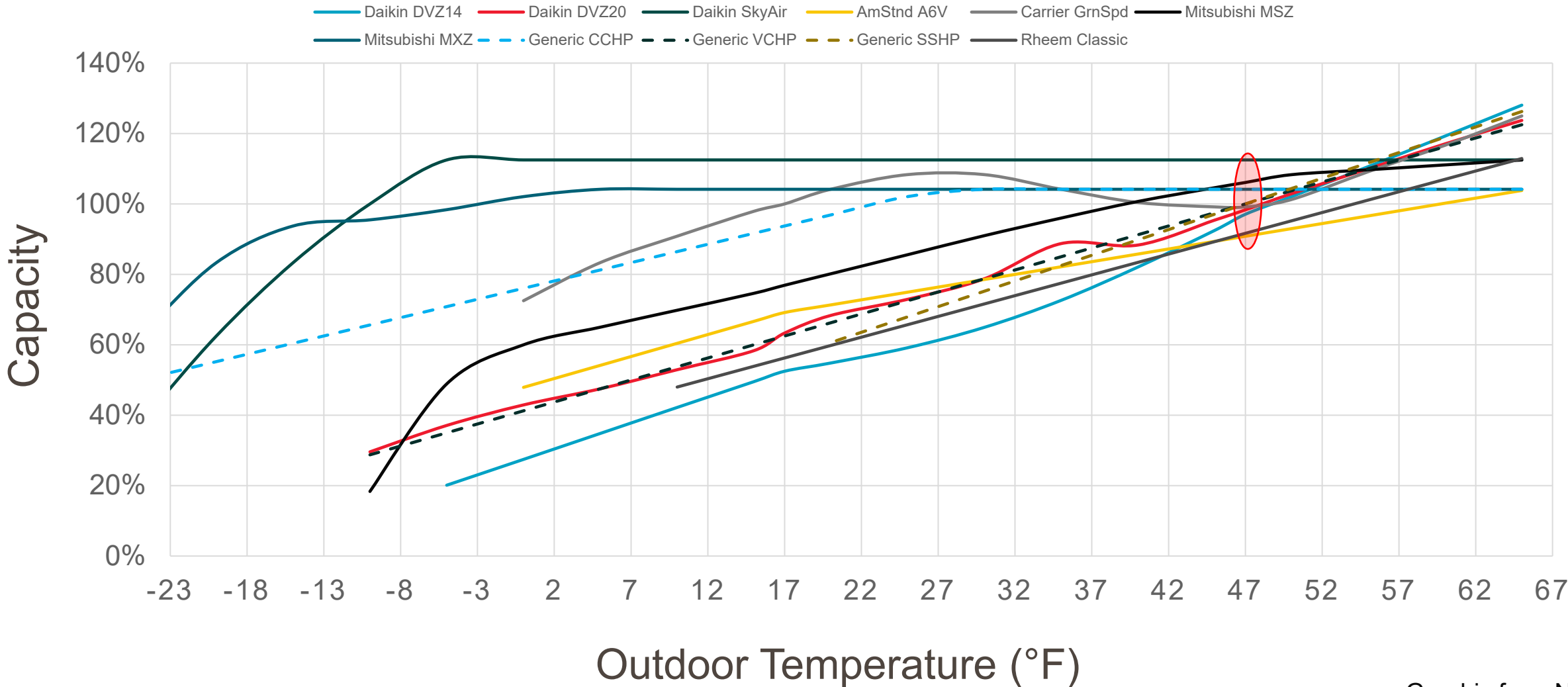
NOTE: Likely change to EER
and HSPF soon

Max capacity at 5°F is at least 70% of rated capacity at 47°F

Capacity is biggest differentiator



Capacities are Not All Alike – Reference the Capacity Tables



Application Considerations

Understanding customer goals

- Do they prefer HP operation?
- Do they want flexibility and choice at colder temperatures?
- Do they have emission reduction goals?

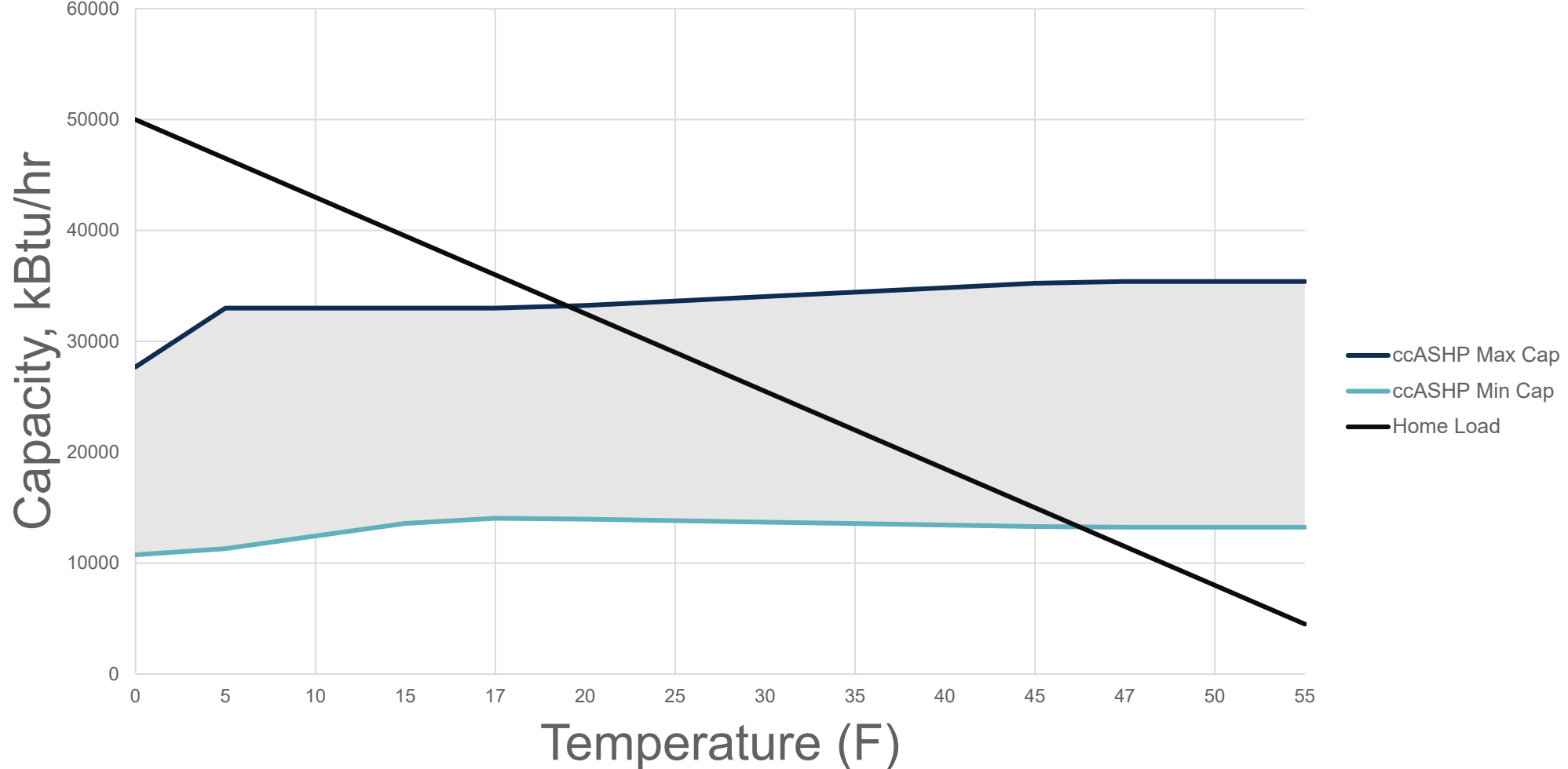
Size and select equipment to achieve goals

- ccASHP needed for low-temp capacity



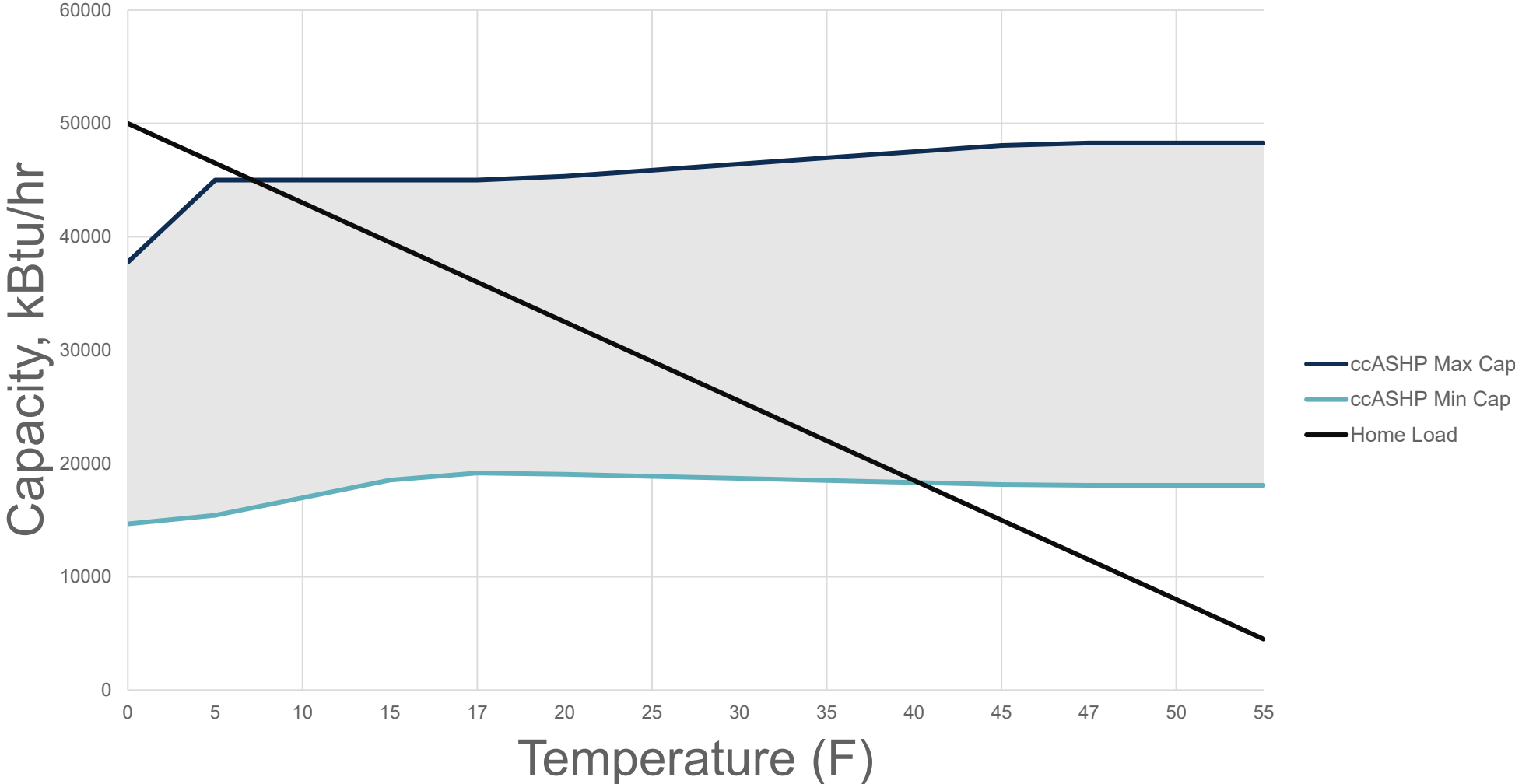
ccASHP Capacity – 3 ton

Air Source Heat Pump Capacity Comparison



ccASHP Capacity – 4 ton

Air Source Heat Pump Capacity Comparison



Customer Benefits

- Maximum flexibility and performance
 - Operate 12 months of the year
 - Very efficient, maximum energy savings
- Future proof – either gas or electric at any temp
- Emissions savings



Customer Costs - VCHP

Heat Pump or AC	Annual Heating and Cooling Costs	Cost Comparison	Heat Pump Heating Hours
Baseline ~14 SEER	\$910	-	-
ccASHP w/ 25°F switchover	\$910	\$0	87%
w/ 5°F switchover – 4 ton ccVSHP	\$1,000	\$90	99%

Using Current Energy Pricing

- Xcel's new TOU electric rates
- Average gas cost = \$0.66/therm
- Note - winter 2022 = \$0.81/therm

Emissions Savings

Heat Pump or AC	Carbon Emissions (tons)	Emissions Savings (tons)	% Carbon Reduction
Baseline ~14 SEER	5.7	-	-
ccVSHP w/ 25°F switchover	2.5	3.3	57%
w/ 5°F switchover (4 ton ccVSHP)	1.2	4.5	79%

Carbon Reduction

- Average Car = 4.64 tons
- Assumes 11,520 miles per year
- 5°F switchover – offsets 11,000 miles

Customer message -

- Offset the emissions from a car with a ccVSHP!

Heat Pump Good, Better, and Best

Good – entry level HP

- 15+ SEER and 12.5 EER
- 6 months of operation

Better – VCHP

- Provides comfort and flexibility
- Heat down to 25°F

Best – ccASHP

- Low-temp performance and capacity
- Heat down to 5°F
- Ultimate flexibility

