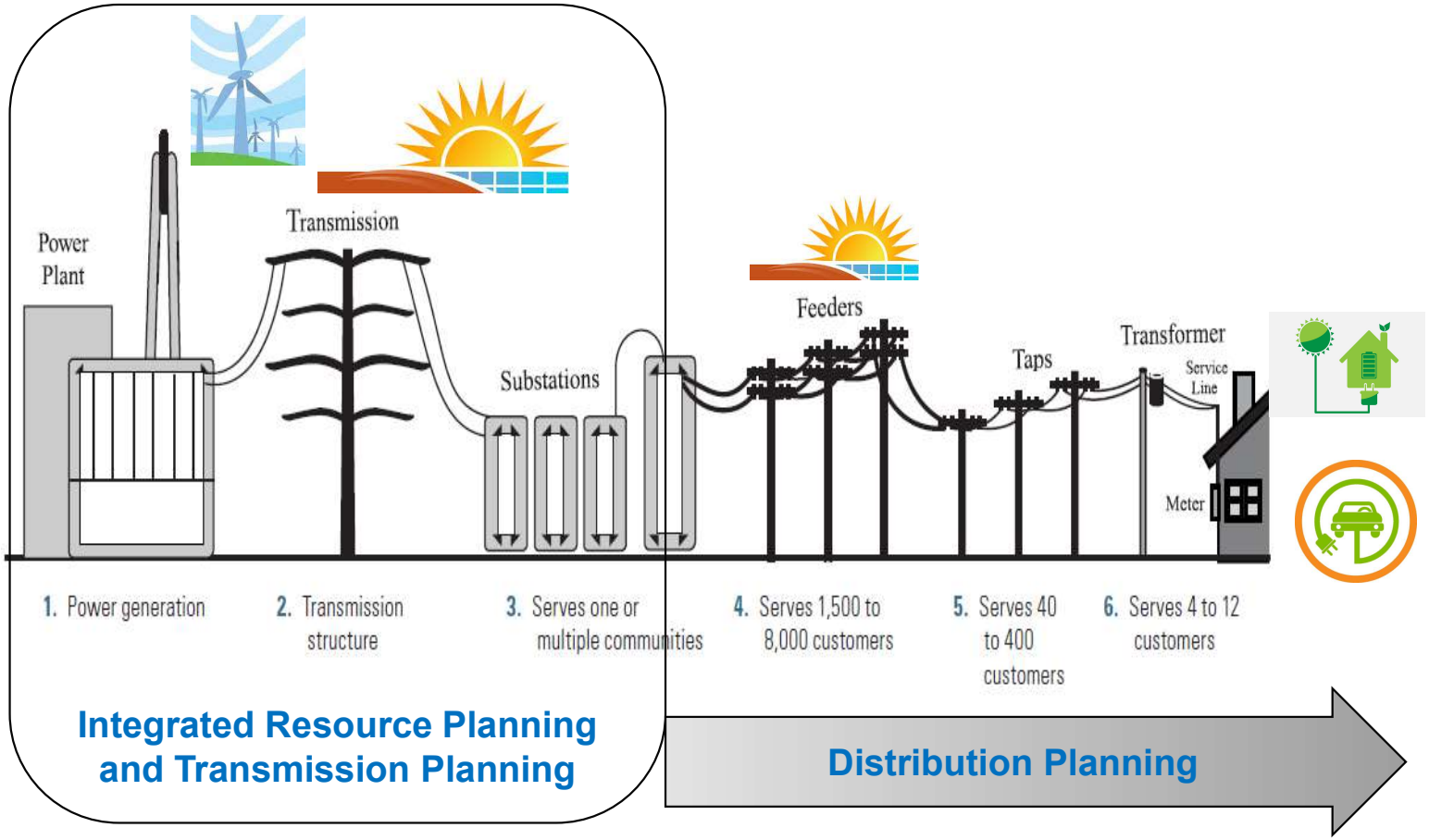
PLANNING FOR BENEFICIAL ELECTRIFICATION

June 2022

DISTRIBUTION SYSTEM PLANNING

Xcel Energy®

Electric power system planning



Planning process overview

System Peak Identification

Planning performs an annual review of SCADA data to identify peak loads for all distribution feeder and substation transformers. This requires removing abnormal data (load transfers, DER, faults) as well as extrapolating for missing data to identify the true system peak.

Load Forecasting

Distribution Planning conducts a 5-year load forecast for all distribution feeders and transformers. Forecasts include known load growth (applications, capacity checks, long-term development plans) and a fixed growth rate based on historic trends specific to that device.

System Risk Analysis

Distribution Planning uses the forecasts to determine the amount of risk on the system. System risk is presented as N-0 (overloads during normal configuration) and N-1 (ability to supply load during contingencies). The severity of each risk is studied to develop the full system risk profile.

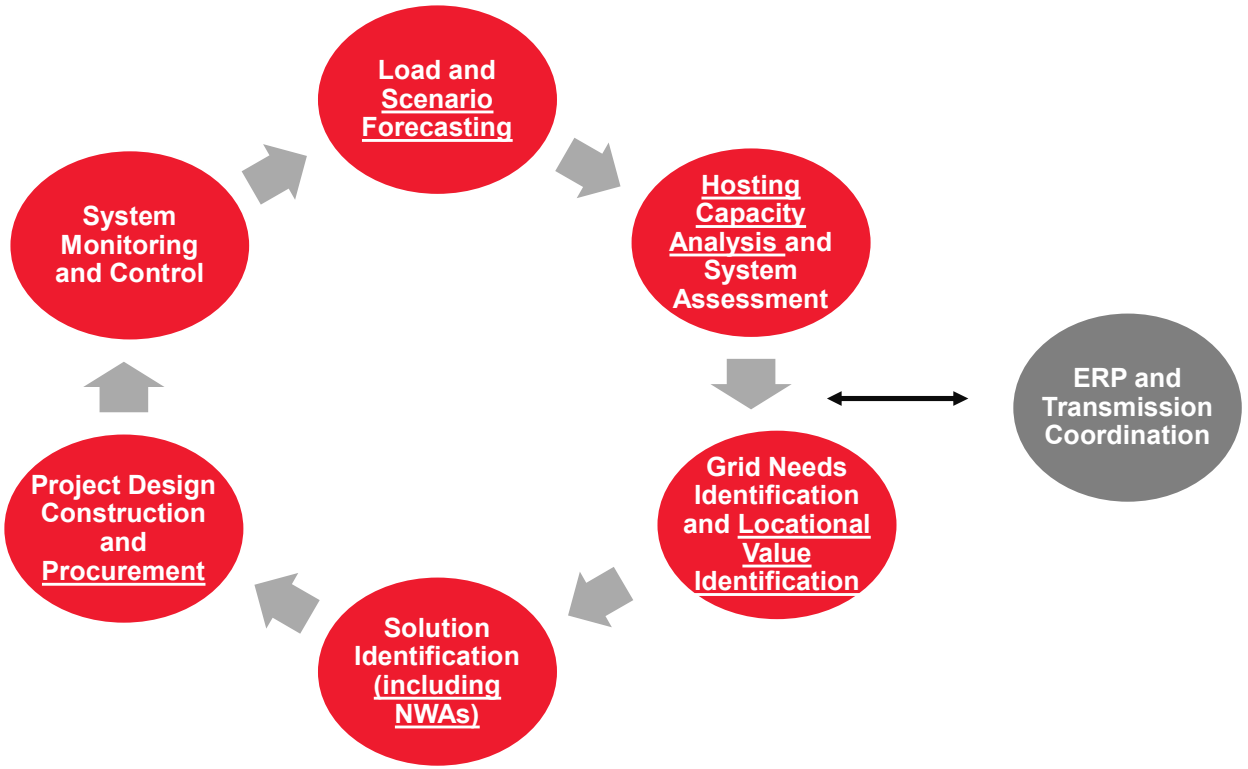
Mitigation Evaluation

Distribution Planning develops mitigations with order of magnitude estimates for all N-0 and most N-1 risks, depending on the level of risk. Mitigations undergo a cost-benefit analysis and a peer review to identify the least cost solution that satisfies long-term capacity needs.

Capital Project Development

The approved project is refined, developed into a design memo and prioritized into the budget depending on the level of risk and the system need date. The budget is reviewed annually and if necessary, adjusted to reflect changing system risks.

Distribution System Planning Evolution



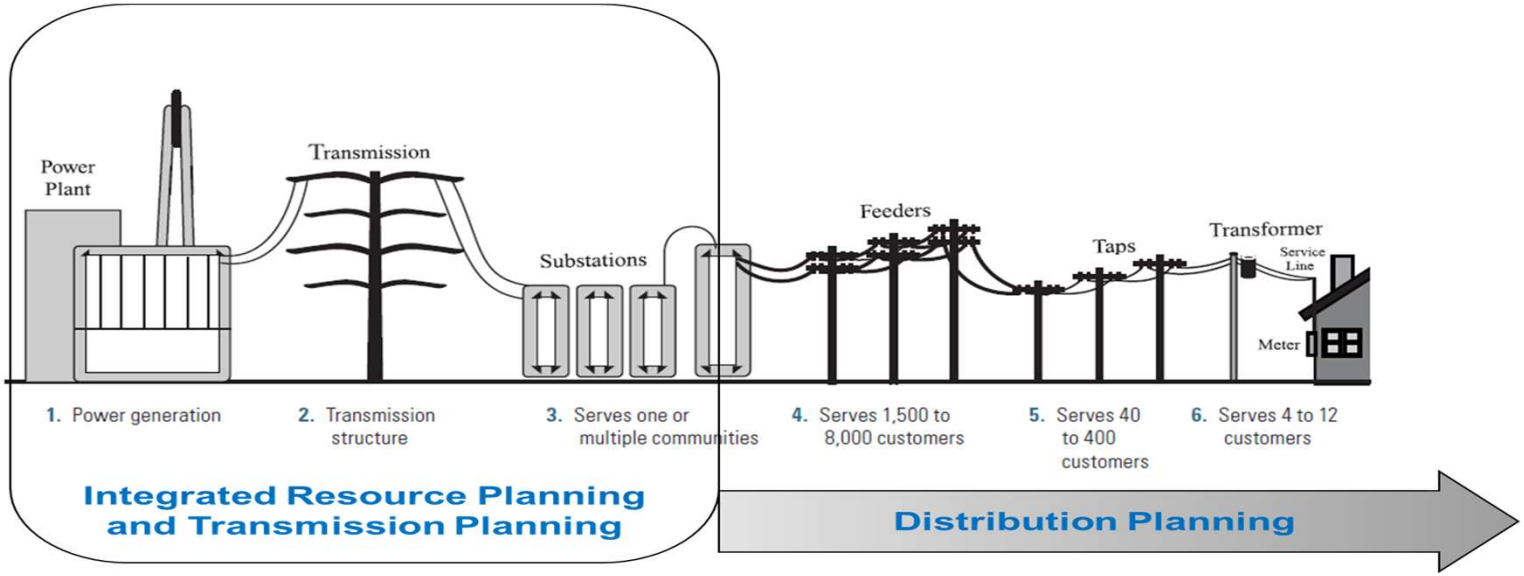
[1,2] Adapted from *Integrated System Distribution System Planning: A Path Forward*. GridLab. 2019.

BENEFICIAL ELECTRIFICATION STUDIES AND PLANNING

Grid readiness for building electrification

Ongoing studies focus on two major portions of the distribution system

- Grid edge: The taps, laterals, service drops, and distribution service transformers that connect to the customer meter
- Major distribution components: Load serving substation transformers and feeder lines including protective devices



Electric Vehicle (EV) readiness for electrification: studies

Grid-edge study to determine impact to service laterals and transformers

- Completed prior to 2020, studied impact of EV penetration by zip code
- System adequacy assessment to identify required upgrades
- Adoption rates and locational impacts

Distribution System Planning studies

- Identification of Feeder and Substation impacts study from EV integration
- Initial mitigation planning and projects identified

Gas to electric conversion studies

- Process developed to evaluate conversion to all electric

EV Study efforts

NREL (National Renewable Energy Lab)

- Partnered on a Department of Energy (DOE) project related to high-level impacts of managed charging
- PSCo distribution system specific: Residential Resiliency and Managed Charging Project
    - Examines impacts of residential charging at various adoption levels
    - Develop, refine and advance managed control strategies
    - More rigorous analysis than other company efforts
- Long term, working on more strategic partnerships with NREL, additional funding through DOE

EPRI (Electric Power Research Institute)

- Participating in EPRI Electric Transportation research program: high growth corridor
- Participating in Supplemental Study looking at fleet impacts – specific analysis for our customers on our system

Heat pump study efforts

NREL (National Renewable Energy Lab)

- Cold climate heat pump study
- 40 heat pumps, Front Range and Mountains, will be studied
- Learnings will help us help customers get the most energy savings from their heat pumps

CEE (Center for Energy and Environment)

- Based in MN with lots of existing heat pump research completed
- Participating in a study just launching that studies cold climate heat pumps that have non-matching indoor and outdoor components
- Knowledge will help us understand the energy savings impact and perhaps broaden the options for our customers

Heat pump study efforts (continued)

Department of Energy (DOE) Cold Climate Heat Pump Challenge

- DOE is challenging manufacturers to improve the cold climate operational capabilities
- DOE is talking with manufacturers, recruiting test subjects
- Xcel Energy's role is helping to identify the test subjects
- If viable, Xcel Energy will support the technology in future rebate offerings

Communication is Key

- We’re not waiting – we’re already planning for electrification
- Community input and feedback is integral to our planning
- Developers/customers sharing information on their electrification plans allows for:
  - Incorporation of electrification projections into load forecast
  - Identification and mitigation of grid needs to support the load growth

THANK YOU