Topics

- Integrated Resource Plan (IRP) Purpose, Process, Objectives
- Stakeholder Involvement and Regulatory Process
- Generation Options & Economics
- Upper Midwest 2020-2034 Preferred Plan
What is the IRP?

• Traditionally, planning to meet capacity needs in least cost manner

• Identify new resource size, type, timing

• Transition to renewables is driving major changes
How is Planning Evolving?

**Energy Needs (All Hours)**

- Shift to renewables requires greater focus on all hourly energy needs (not just peak hour)
- Growing levels of intermittent renewables, decreasing levels of dispatchable generation presents load & resource balancing challenges
How is the Process Evolving?

Increased focus on front end coordination with internal & external stakeholders

- Stakeholder Feedback & Input
- Capacity & Energy Needs and Costs
- Resource Options
- Requirements & Objectives
- Increased Internal Coordination

Resource Plan
15 Year Plan filed every 2-3 years

Commission Approval

Plan Implementation
IRP Objectives

Our goal is to strike a balance between key priorities

Reliability
- Minimize Loss of Load Risk
- Ensure G, T&D Coordination
- Ensure Asset Optimization

Cost
- Minimize Customer Rates
- Minimize Portfolio Costs
- Weigh ST vs. LT Costs

Environmental
- Meet Policy Requirements
- Reduce Carbon Emissions
- Grow Renewable Energy

Risk
- Maintain Portfolio Diversity
- Retain Optionality
- Manage Market Exposure

Preferred 15 Year Plan
Stakeholder Engagement

- Workshops
- Surveys
- Host Communities
Next Steps

**July 1, 2019:** Plan filing with the Minnesota Public Utilities Commission

**July 2019 through late 2020:** Opportunity for public feedback, continued stakeholder discussions, and Commission hearings

**Late 2020:** Anticipated Commission decision

**Process to Date:**
- 13 Intervenors
- 520+ Information Requests
- 100s of Public Comments
Modeling Inputs & Process

Key Input Assumptions

Including
- Load Forecasts & MISO Reserve Requirements
  - Distributed Generation Forecasts
  - Electrification Impact Forecasts
- Market Energy & Fuel Price Forecasts
- Existing Generation Resource Costs/Characteristics
- New Generation Resource Price Forecasts
- Transmission Interconnection/Upgrade Costs
- Cost of Capital/Discount Rates
- Inflation Rates
- Carbon & Externality Costs
- Demand Side Management Costs/Options
- Renewable Integration & Congestion Costs

Utility Modeling

Modeling Objectives:
- Identify least cost generation portfolio plans
- Explore options for existing generation resources
- Identify optimal future resource additions to meet customer needs
- Evaluate risks with sensitivities/scenario analysis
- Cost, risk, emission, reliability metrics inform selection of a Preferred Plan

Preferred Resource Plan

- 15 Year Preferred Plan for the 2020-2034 Planning Period
Resource Options & Diversity

New generation resource options can generally be grouped into three categories:

1. **Portfolio diversity is important**
2. **“Firm” low-carbon resources including gas CTs and CCs are necessary components of the electric system**

Current Generation Resource Economics

Utility scale renewables have become least cost options

Production Costs by Resource Type

<table>
<thead>
<tr>
<th>Resource Type</th>
<th>Cost ($/MWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind</td>
<td>$20 - $25</td>
</tr>
<tr>
<td>Coal</td>
<td>$25 - $35</td>
</tr>
<tr>
<td>CC</td>
<td>$30 - $45</td>
</tr>
<tr>
<td>Biomass</td>
<td>$30 - $45</td>
</tr>
<tr>
<td>Nuclear</td>
<td>$35 - $45</td>
</tr>
<tr>
<td>Utility Scale Solar</td>
<td>$35 - $45</td>
</tr>
<tr>
<td>CSG</td>
<td>$35 - $45</td>
</tr>
</tbody>
</table>

Average MISO Market Energy Cost: $150

Cost ($/MWh) for CSG: $156

Cost ($/MWh) for Utility Scale Solar: $98

Cost ($/MWh) for Nuclear: $45

Cost ($/MWh) for Biomass: $35

Cost ($/MWh) for CC: $30

Cost ($/MWh) for Coal: $25

Cost ($/MWh) for Wind: $20

Production Cost = Fuel plus Operating & Maintenance Costs, CSG = Community Solar Gardens, CC = Natural Gas Combined Cycle

Wind & Solar Costs represent current estimated range for power purchase agreements (non-owned resources)

Sources: SNL Financial Power Plant Benchmarking Report 2018 values, Internal Xcel Energy Information
## Preferred Plan Key Components

<table>
<thead>
<tr>
<th>Resource</th>
<th>Plan Detail</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nuclear</strong></td>
<td>Extend Monti from 2030 to 2040, Prairie Island Units (PI) to current end of life (2033, 2034) Question of PI extension addressed in next IRP</td>
</tr>
<tr>
<td><strong>Coal</strong></td>
<td>Early King retirement (2028), Early Sherco 3 retirement (2030)</td>
</tr>
<tr>
<td><strong>Gas CC</strong></td>
<td>Mankato CC acquisition included, Sherco CC included</td>
</tr>
<tr>
<td><strong>Firm Peaking</strong></td>
<td>~1,700 MW of cumulative firm peaking (CT, pumped hydro, battery storage, DR, etc) additions by 2034 (first in 2031)</td>
</tr>
<tr>
<td><strong>Wind</strong></td>
<td>1,202 MW of cumulative wind replacement by 2034</td>
</tr>
<tr>
<td><strong>Solar</strong></td>
<td>4,000 MW of cumulative utility scale (first in 2025), ~450 MW distributed solar additions by 2034</td>
</tr>
<tr>
<td><strong>DSM (EE &amp; DR)</strong></td>
<td>2 out of 3 EE bundles (~2,000 MW avoided peak demand by 2034) 1 out of 3 incremental DR bundles (~550 MW of incremental DR resources by 2034)</td>
</tr>
</tbody>
</table>
Cumulative 2020-34 Resource Adds

Will evaluate multiple resource options to meet future need including battery storage, CT, CC, DR, etc.

~11,000 MW Cumulative Capacity Adds

“Firm” Dispatchable 24%

“Fast Burst” Demand Side Management 5%

“Fuel Saving” Renewable & EE 71%

EE = Energy Efficiency (Avoided Capacity)
DR = Demand Response
100% Renewable Challenges

Meeting Reliability Needs without Gas Resources

+ In the absence of dispatchable gas and coal resources, significant new investment in renewables and storage are needed for reliability
  - 36 GW of wind and solar
  - 24 GW of 5-hr storage
  + $4.4 billion/yr in incremental fixed costs
+ Results in sharply exponential cost increase to achieve final 5% GHG reductions

Portfolio Snapshot: 2045 Total Installed Capacity

- Natural gas resources are necessary to maintain reliability & keep costs down
- Eliminating all fossil resources would drive a quadrupling of our portfolio size
  - 2019: ~14 GW gen capacity
  - 2045: >60 GW gen capacity

$4.4 billion per year Incremental Fixed Costs

E3 Key Conclusions

1. **Early retirement of coal generation resources provides the lowest cost pathway to meet 2030 emissions reduction goals**
   - Coal generation produces approximately 95% of Xcel's GHG emissions in the 2020 Reference case
   - Capacity and energy from existing coal plants can be replaced at relatively low cost with a portfolio of efficiency, renewables, storage, and natural gas

2. **A diverse portfolio of resources—including nuclear—offers the least-cost pathway to deep carbon reductions**
   - Relicensing both nuclear plants will help Xcel meet its 2050 GHG goals while also ensuring a reliable system
   - Meeting all reliability needs with a combination of wind, solar, and storage will require prohibitively large investments

3. **Natural gas plants will be useful to ensure a reliable system, and will operate at low capacity factors**
   - Wind, solar, storage and demand response are limited in their ability to provide effective capacity
   - Disallowing new gas investment drives up the cost of the system while generating the same amount of GHG emissions
   - Between 2,000 and 4,000 MW of new gas resources are selected by 2045 when allowed as part of a least-cost portfolio to meet greenhouse gas goals