Energy Delivery System Planning Process

UTC Rulemaking for Integrated Resource Planning Transmission and Distribution Workshop
March 10, 2017
Planning considerations differ between gas and electric

<table>
<thead>
<tr>
<th>Considerations</th>
<th>Natural Gas</th>
<th>Electric</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service obligations</td>
<td>Feasibly serve; Upon service - obligation to serve</td>
<td>Obligation to serve</td>
</tr>
<tr>
<td>Design demand</td>
<td>Typically planning for winter peak hour</td>
<td>Winter and summer peak depending on customer equipment</td>
</tr>
<tr>
<td>Outages</td>
<td>Outages pose safety risk and are avoided; typically design for colder temperatures than electric</td>
<td>Outages can occur and result in reliability concerns</td>
</tr>
<tr>
<td>System configuration</td>
<td>High pressure backbone; networked/2-way flow, where practical Intermediate/low pressure pipelines; highly networked/2-way flow</td>
<td>Transmission networked; 2-way flow Distribution feeders maybe networked: 1-way flow Distribution laterals typically radial</td>
</tr>
<tr>
<td>Focused and monitored regulation</td>
<td>Operations and Maintenance including design is heavily prescribed at all levels and audited by UTC routinely</td>
<td>Bulk Electric System is heavily regulated by FERC/NERC and audited every 2-3 years by WECC – focused prescribed planning Other codes – bit more flexibility, little monitoring</td>
</tr>
<tr>
<td>Source supply</td>
<td>Interstate pipelines - Williams Northwest Pipeline</td>
<td>Self supply with PSE owned generation or from other providers such as Bonneville Power Authority</td>
</tr>
<tr>
<td>Regional planning responsibility</td>
<td>Interstate pipeline operators</td>
<td>Columbia Grid</td>
</tr>
<tr>
<td>Source augmentation</td>
<td>Mobile or permanent liquefied natural gas or compressed natural gas injected on site from core supply, biogas</td>
<td>Battery storage, distributed generation</td>
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</tbody>
</table>

*Note - This is not meant to be a comprehensive list*
Detailed process used to determine infrastructure needs and investments

Natural gas and electric infrastructure planning uses the same core process

System evaluation
- System performance
- Load forecasts
- External Inputs
- Goals
- Commitments

System needs, modeling & analysis
- Issue(s) identification
- System modeling
- Probabilistic outcomes
- Alternatives
- Financial analysis
- Cost / Benefit

Alternatives & recommended solution
- Peer and Management Review

Optimize with other projects
- Investment Decision Optimization Tool process
- Resource planning

Final Plan: portfolio of projects
- Management review and approval
There are multiple drivers for evaluating need

Drivers/criteria

- Customer request
- Load growth
- Reliability
- Compliance
- External commitment
- Aging Infrastructure
- Integration of resources

<table>
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<tr>
<th>Electric delivery system performance criteria are defined by:</th>
<th>Gas delivery system performance criteria are defined by:</th>
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<tr>
<td>Safety and compliance</td>
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<tr>
<td>The temperature at which the system is expected to perform</td>
<td>The temperature at which the system is expected to perform</td>
</tr>
<tr>
<td>The nature of service and level of reliability that each type of customer is contracted for</td>
<td>The nature of service each type of customer has contracted for</td>
</tr>
<tr>
<td>The minimum voltage that must be maintained in the system</td>
<td>The minimum pressure that must be maintained in the system</td>
</tr>
<tr>
<td>The maximum voltage acceptable in the system</td>
<td>The maximum pressure acceptable in the system</td>
</tr>
<tr>
<td>The interconnectivity with other utility systems and resulting requirements, including compliance with NERC planning standards</td>
<td></td>
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</table>
Analysis tools are robust and comprehensive

<table>
<thead>
<tr>
<th>TOOL</th>
<th>USE</th>
<th>INPUTS</th>
<th>OUTPUTS</th>
</tr>
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<tr>
<td>SynerGi®</td>
<td>Network modeling</td>
<td><strong>Gas</strong> and <strong>electric</strong> distribution infrastructure and load characteristics</td>
<td>Predicted system performance</td>
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<td>Power World Simulator – Power Flow</td>
<td>Network modeling</td>
<td><strong>Electric</strong> transmission infrastructure and load/generation characteristics</td>
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<td>Electric Predictive Spreadsheet</td>
<td>Predictive analysis</td>
<td><strong>Electric</strong> outage history</td>
<td>Predicted outage savings</td>
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<tr>
<td>Gas Outage Spreadsheet</td>
<td>Predictive analysis</td>
<td><strong>Gas</strong> network model output for future capacity</td>
<td>Predicted outage savings</td>
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<tr>
<td>Estimated Unserved Energy (EUE) Spreadsheet</td>
<td>Electric financial analysis</td>
<td><strong>Electric</strong> project costs; hourly load data; load growth scenarios</td>
<td>Net Present Value; income statement; load growth vs. capacity comparisons; EUE</td>
</tr>
<tr>
<td>Investment Decision Optimization Tool (iDOT)</td>
<td>Project data storage &amp; portfolio optimization</td>
<td><strong>Gas</strong> and <strong>electric</strong> project scope, budget, justification, alternatives and benefits; resources/financial constraints</td>
<td>Optimized project portfolio; benefit cost ratio for each project; project scoping document</td>
</tr>
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</table>

*Note - This is not meant to be a comprehensive list*
Alternatives are evaluated for meeting the determined need

**Electric**
- Add energy source
  - Substation
- Strengthen feed to local area
  - New conductor
  - Replace conductor
- Improve existing facility
  - Substation modification
  - Expanded right-of-way
  - Uprate system
  - Rebalance load
  - Modify automatic switching scheme
- Load reduction
  - Fuel switching
  - Distributed energy resource
  - Natural gas conversion
  - Conservation / Demand response
  - Load control equipment
  - Possible new tariffs
- Do nothing

**Gas**
- Add energy source
  - City-gate station
  - District regulator
- Strengthen feed to local area
  - New high pressure main
  - New intermediate pressure main
  - Replace main
- Improve existing facility
  - Regulation equipment modification
  - Uprate system
- Load reduction
  - Fuel switching
  - Conservation
  - Load control equipment
  - Possible new tariffs
- Do nothing
Alternatives are evaluated and recommendations compared

Benefit analysis performed across multiple types of projects and risks – Both gas and electric projects are analyzed using this common platform
PSE welcomes transparency through several forums and processes

- Growth Management Act Comprehensive Plans
- Community engagements
- Permitting processes
- Project information and schedules on PSE website
- Specific project community engagements
- Regulatory avenues
  - Commission Policy on Accelerated Replacement of Pipeline Facilities with Elevated Risk
  - Reports such as Smart Grid Report and Electric Service and Reliability Quality Reports