AGENDA

SECTION 1  Non-Wires Alternative Definition
SECTION 2  Introduction
SECTION 3  PSE T&D System Planning Process
SECTION 4  NWA Analysis Process and Results
SECTION 5  Utility Perspective and Next Steps
**Definition:** An electricity grid investment or project that uses non-traditional transmission and distribution (T&D) solutions, such as distributed generation (DG), energy storage, energy efficiency (EE), demand response (DR), and grid software and controls, to defer or replace the need for specific equipment upgrades, such as T&D lines or transformers, by reducing load at a substation or circuit level.
INTRODUCTION TO PSE

- Headquarters: Bellevue, Washington
- Employees: 3100
- Customers: Approximately 1.1 million electric and 800,000 natural gas
- Service area: 6,000 square miles—mostly Puget Sound region of Western Washington

Source: Puget Sound Energy
PROJECT INTRODUCTION

• Island within PSE service territory
  – Population under 25,000
  – Served by two transmission lines
  – Winter peaking
  – Wind storms throughout service territory, large trees and densely forested

• Needs and concerns on transmission and distribution system
  – Three distribution substations
  – Some radial transmission lines

• Engaged customer with a history of community efforts to reduce energy demand

Accessing Transmission Poles

Source: Puget Sound Energy
Key impetus for updating process:
- Customer expectations
- Regulatory requirements
- Opportunity to reduce investment costs
- Greater transparency to customers and regulators
- Keeping pace with rapidly changing technologies and industry practices

PSE’s Traditional Planning Process

Source: Puget Sound Energy
RESULTING PROCESS CHANGES

• **Key process updates:**
  – Involvement of project manager and team much earlier in process
    ▪ Including staff with expertise in our energy efficiency portfolio
  – NWAs studied in greater depth
    ▪ New role of DER Planner
    ▪ Involvement of consultants, EPRI

PSE’s Enhanced Planning Process

Source: Puget Sound Energy
CATEGORIZE THE TYPES OF NEEDS AND CONCERNS ON THE SYSTEM

**CAPACITY**
- Needs consisting of distribution capacity shortfall over the next ten years including N-0 Capacity (i.e., normal operation) and N-0 Planning Trigger threshold.

**RELIABILITY**
- Need consisting of transmission reliability items including the SAIDI and SAIFI metric reduction and transmission outages.

**AGING INFRASTRUCTURE**
- Needs related to equipment nearing end of useful life and reduction of loading on equipment to effectively prolong lifespan.

**OPERATIONAL FLEXIBILITY**
- Concern related to the ability to transfer load to support routine maintenance, outage management, and planned seasonal switching.

Source: Navigant Analysis
• Navigant worked with PSE to divide the NWA analysis into four discrete steps
• At the conclusion of each step, the team reviewed the results and decided based on multiple screening criteria whether or not to continue the analysis of the NWA project
• This process allowed for multiple touchpoints between the two groups

NWA ANALYSIS PROCESS OVERVIEW

- Needs Assessment and Problem Definition
  - What are the distributed energy resources (DER) that are included? What is our solution approach?
- Technical DER Potential
  - Is there enough local potential from the DER selected?
- Economic Analysis
  - Would it make financial sense to deploy DER and energy storage instead of a wired solution?
- Recommended Solution
  - What solution meets our technical, economic, and stakeholder criteria?

Source: Navigant Analysis
## SELECTION OF NWA PORTFOLIO OPTIONS

<table>
<thead>
<tr>
<th>Resource Name</th>
<th>Description</th>
<th>Included in Analysis</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Efficiency (EE)</td>
<td>Utility run efficiency measures</td>
<td>Yes</td>
<td>Largest and most diverse DER</td>
</tr>
<tr>
<td>Codes and Standards</td>
<td>A cost-free resource that make new construction more energy efficient</td>
<td>No</td>
<td>Limited additional incremental savings on top of savings estimated in IRP</td>
</tr>
<tr>
<td>Fuel Conversion</td>
<td>Replacing electric equipment with natural gas-consuming equipment</td>
<td>No</td>
<td>No gas access on island</td>
</tr>
<tr>
<td>Demand Response (DR)</td>
<td>Flexible, price-responsive loads which can be curtailed</td>
<td>Yes</td>
<td>Potential for targeted peak curtailment</td>
</tr>
<tr>
<td>Distributed Generation (DG)– Solar Photovoltaics (PV)</td>
<td>Customer-side solar installations</td>
<td>Yes</td>
<td>Growing resource adoption</td>
</tr>
<tr>
<td>Distributed Generation (DG)– Combustion</td>
<td>Includes renewable and non-renewable combustion</td>
<td>Yes—Limited to only renewable combined heat and power (CHP)</td>
<td>Robust option for peak reduction</td>
</tr>
<tr>
<td>Distribution Efficiency</td>
<td>Combination of CVR and load phase balancing</td>
<td>No</td>
<td>This option was not considered because AMI was not fully deployed in the region</td>
</tr>
<tr>
<td>Generation Efficiency</td>
<td>Applies to parasitic loads served by a generator</td>
<td>No</td>
<td>Not applicable to region of interest</td>
</tr>
<tr>
<td>Energy Storage Systems (ESS)</td>
<td>Grid-scale battery storage</td>
<td>Yes</td>
<td>Provides a highly flexible resource</td>
</tr>
</tbody>
</table>

Source: Navigant Analysis
Using exclusively NWAs

- Broadly defined: Solutions leveraging both the narrower definition of DER and the broader definition of NWAs (i.e., including vegetation management).

Hybrid Non-Wired Solution

- Where some needs are met with aspects of the traditional wired solution and other needs are met with NWA solution components (i.e., DER).
NEEDS AND SOLUTION DECONSTRUCTION

What are the elements of the proposed wired solution that a non-wired solution may address?

Symbols
- DER
- Storage
- Block load curtailment
- Targeted tree trimming
- Transmission line

Need or Concern
- Aging infrastructure
- Operational flexibility (tied to capacity)
- Reliability (typically tied to capacity)
- Capacity

Grid
- Distribution
- Transmission
- Distribution
- Transmission
- Distribution
- Transmission

Solution
- Pursue combo
- Pursue combo to stay below N-1 criteria, cannot achieve N-1
- Pursue combo transmission loop and targeted tree trimming
- Requires analysis at a more granular level of grid decomposition
- Insist on the quick to provide operational flexibility
- While NWAs can generally extend equipment life, the aging infrastructure must continually be replaced

Source: Navigant Analysis
The next step was to determine the incremental achievable technical potential available to determine the least cost portfolio of NWA solution elements to meet the need.

To define which portion of the achievable technical potential is “incremental,” Navigant assumed “business-as-usual” procurement of demand-side resources by PSE.

### DETERMINE INCREMENTAL ACHIEVABLE TECHNICAL POTENTIAL

1. **Block Load Curtailment**
   - PSE has some potential block load coming online on the island over the next 3-5 years.
   - Navigant analyzed connecting the block load on an interruptible rate. We found that the number of hours of curtailment needed to eliminate the load from impacting planning needs are less than the maximum allowed.

2. **Energy Efficiency and Distributed Generation**
   - PSE commits to pursuing bundles based on the levelized cost of electricity.
   - The analysis of incremental EE and combustion DG only considers measures that were not in committed bundles and not part of PSE’s current EE portfolio.

3. **Solar PV**
   - The team assumed PSE has no business-as-usual customer incentives for distributed PV adoption—therefore all achievable technical PV potential is eligible as incremental.

4. **Demand Response**
   - The team assumed PSE has no immediate plans for DR—therefore all achievable technical DR potential is available as incremental.
   - Four-hour DR events were assumed.

5. **Storage**
   - Technically, grid-scale storage might be sized to meet essentially the entire need. So, the technical potential for storage is almost limitless. Therefore, storage is considered in the economic analysis.

Source: Navigant Analysis
Navigant forecasted the winter peak load under three conditions:

1. Baseline with the full block load addition (purple)
2. Baseline with the block load curtailed (yellow)
3. Load with the incremental achievable technical potential (excluding storage) and the block load curtailed (green)
   - This does not include storage because, technically, enough storage could defer the entire need in perpetuity. Storage is an economic consideration.
The largest portion of achievable incremental capacity potential comes from energy efficiency measures, and secondly from demand response.
ECONOMIC ANALYSIS PARAMETERS

Storage

Sources include: Navigant, PSE, and Quanta

BENEFITS:
• Bulk system generation capacity deferral
• Hourly avoided energy costs

COSTS:
• Capital Cost
• Fixed O&M
• Variable O&M
• Charging Energy
• Augmentation

DR, PV, EE, DG

Sources include: PSE IRP, 2017 DER Potential Study

BENEFITS:
• O&M Savings
• Hourly avoided energy costs
• Bulk system generation capacity deferral
• Non-energy benefits

COSTS:
• Incremental measure cost
• Incremental O&M costs
• Administrative costs (assumed as 20% of incremental measure costs)

Source: Navigant Analysis
The team took a phased approach to adding storage to determine the optimal storage size.

**Note:**
- Demand response was not included in the final portfolio because the team determined the costs were not appropriate for a geographically targeted DR program without a system wide DR program.
- Navigant recommended PSE further analyze the potential from DR.
Distribution capacity related needs can likely be met on the island with NWAs. The portfolio identified may also improve distribution reliability and operational flexibility.

- PSE can likely cost-effectively delay reaching the planning trigger for the 3-substation group on the island from 2020 to 2030 by leveraging the block load as a curtailable resource, by aggressively pursuing the DER portfolio, and adding a large battery.
- PSE will need to move forward with construction of the transmission loop to address all needs.

Areas of research Navigant identified for further refining the analysis:

- **Unforeseen Costs:** Are there unforeseen costs associated with developing a targeted implementation of DER?
- **DER Derating Factor:** Is there an appropriate “derating” factor to apply to behind-the-meter capacity resources to increase confidence in availability?
- **Customer Adoption:** Are there any indications customers on the island will adopt DER at a rate faster or slower than the typical power customer in the Pacific Northwest?
GENERAL LEARNINGS: UTILITY PERSPECTIVE

- More time intensive than planned
- Being agile is key
- External technical expertise was critical
- Technical considerations; “the devil is in the details”
- Better understanding of how to apply NWA and develop hybrid solutions
- Requirements for new local level data
- Internal stakeholder coordination
- Incremental achievable potential can include targeted EE and DR programs

Source: Puget Sound Energy
NEXT STEPS FOR PROJECT

- Cross-functional sub-teams responsible for key project components
  - Advanced analysis of DER potential
  - Detailed storage modeling moving into technical specification

- Project announced to community in Fall 2019

- Proceeding into execution

- Continued involvement of technical experts (EPRI, etc)
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