UNIQUE CHALLENGES WITH COST-EFFECTIVENESS EVALUATION OF NON-WIRES ALTERNATIVES

IEPEC DENVER 2019

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PSE PUGET SOUND ENERGY

IEPEC

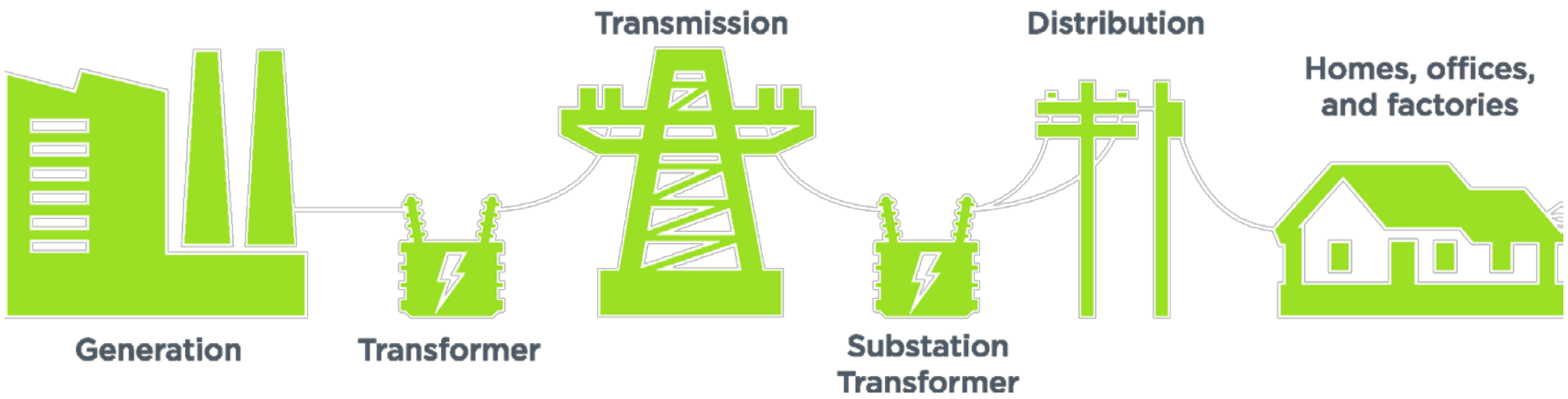
NAVIGANT

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

NON WIRES ALTERNATIVE DEFINITION

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.*



Source: Navigant

INTRODUCTION TO PSE

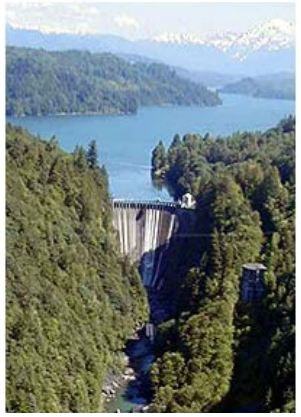
- Headquarters: Bellevue, Washington
- Employees: 3100
- Customers: Approximately 1.1 million electric and 800,000 natural gas
- Service area: 6,000 square miles—mostly Puget Sound region of Western Washington

Wild Horse Wind and Solar Facility

Goldendale Generating Station

Glacier Battery Storage Project

Baker River Hydroelectric Project



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

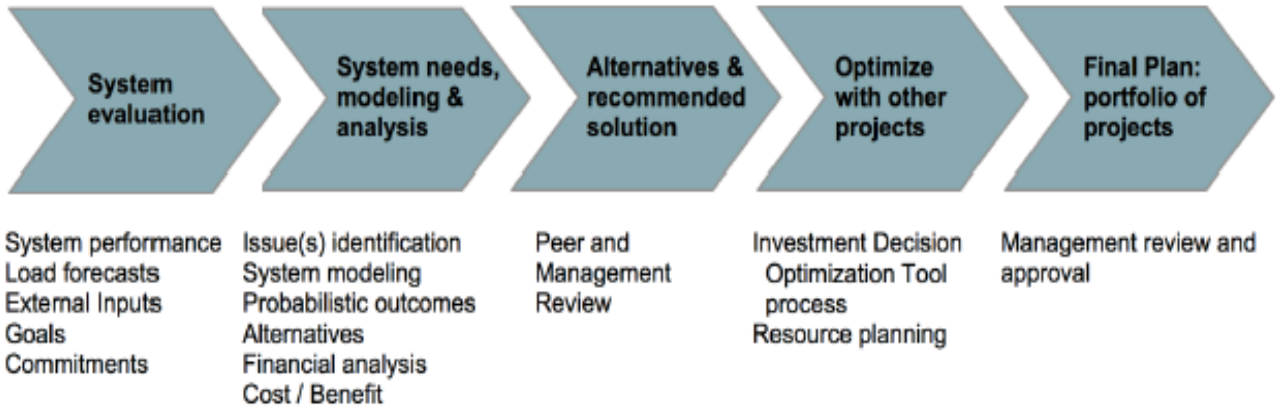
Accessing Transmission Poles

Source: Puget Sound Energy

TRADITIONAL PLANNING PROCESS

- **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

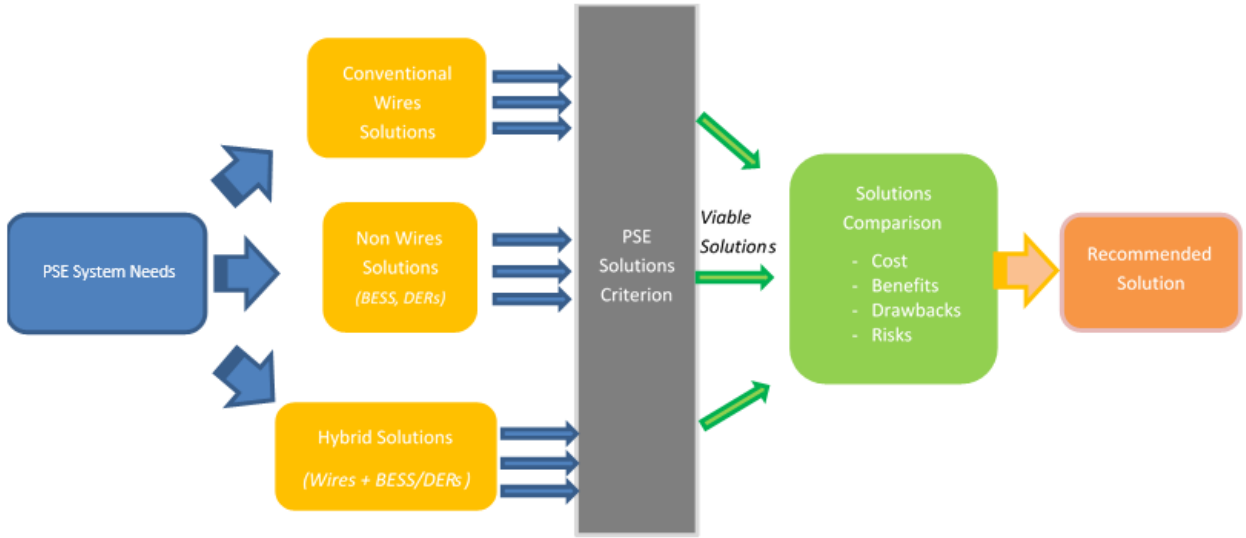


Source: Puget Sound Energy

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

Needs **Concerns**

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.

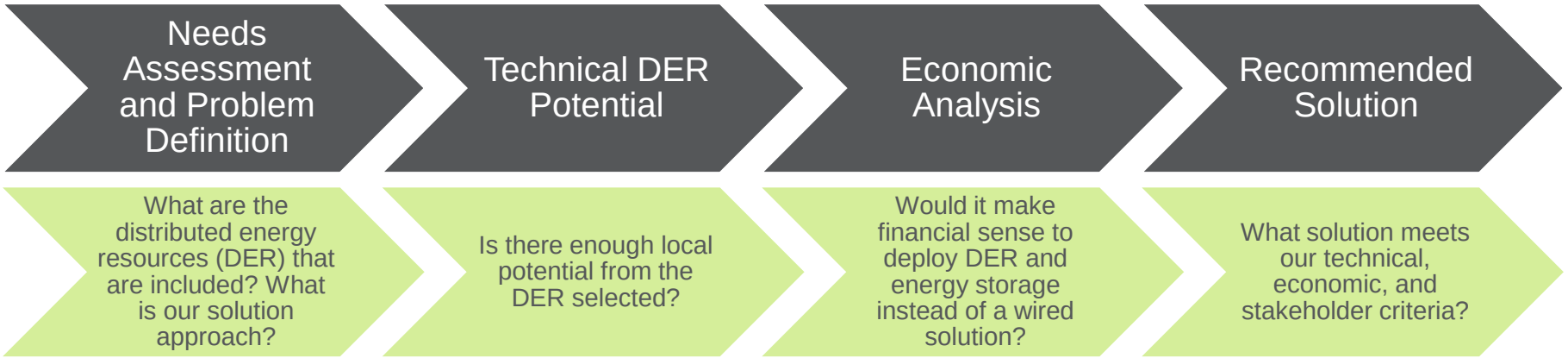
OPERATIONAL FLEXIBILITY

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

Source: Navigant Analysis

NWA ANALYSIS PROCESS OVERVIEW

- 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



Source: Navigant Analysis

SELECTION OF NWA PORTFOLIO OPTIONS

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

Source: Navigant Analysis

NWA ANALYSIS SOLUTION APPROACH

Using exclusively NWAs

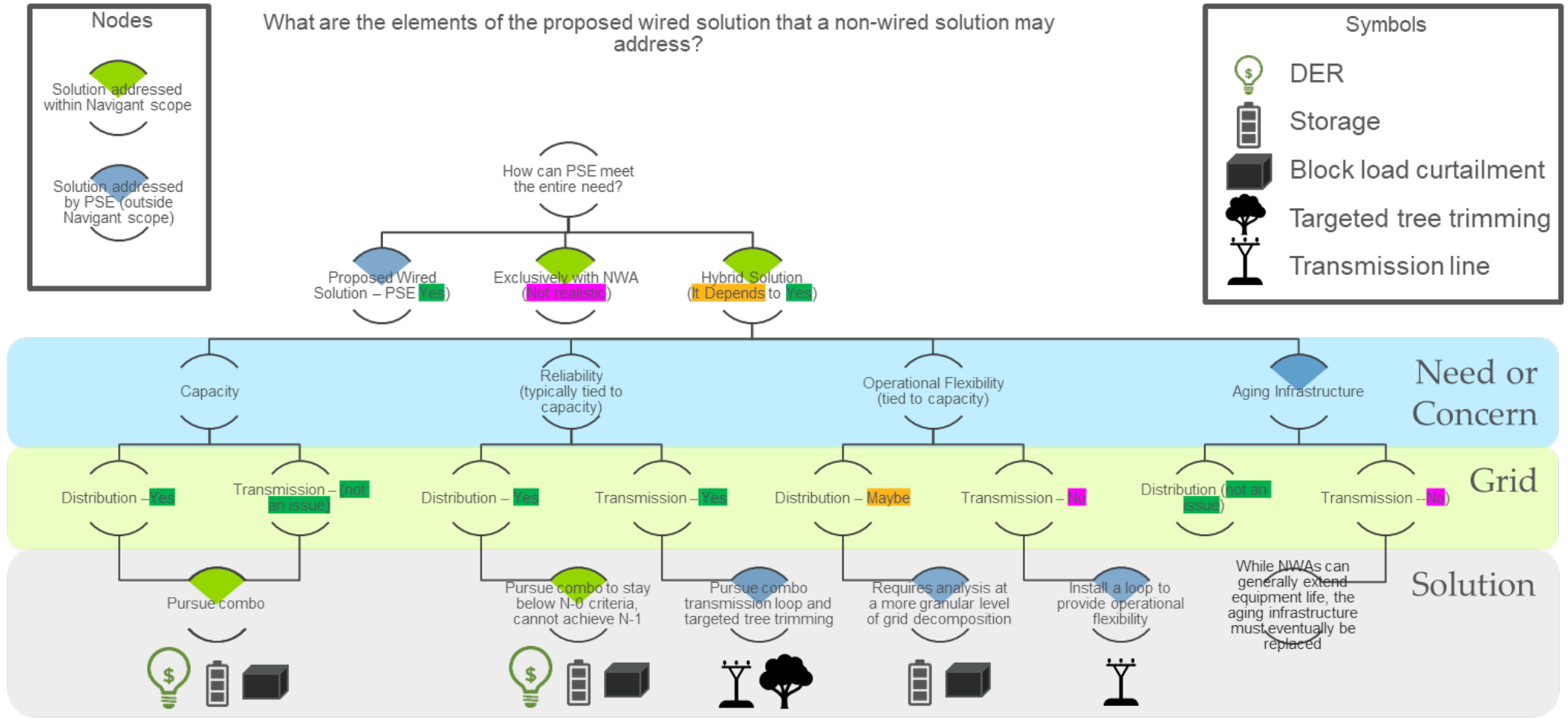
- Broadly defined: Solutions leveraging both the narrower definition of DER and the broader definition of NWAs (i.e., including vegetation management).

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).

Source: Navigant Analysis

NEEDS AND SOLUTION DECONSTRUCTION



Source: Navigant Analysis

DETERMINE INCREMENTAL ACHIEVABLE TECHNICAL POTENTIAL

- 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.

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.

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.

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.

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.

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

INCREMENTAL TECHNICAL POTENTIAL

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.

Effect of Incremental Technical Potential on Baseline Load Forecast

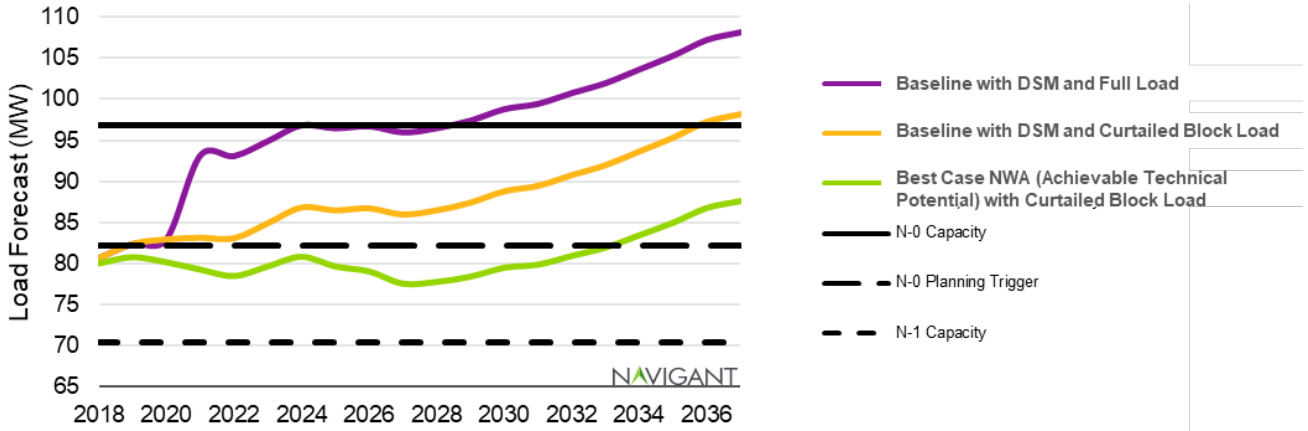
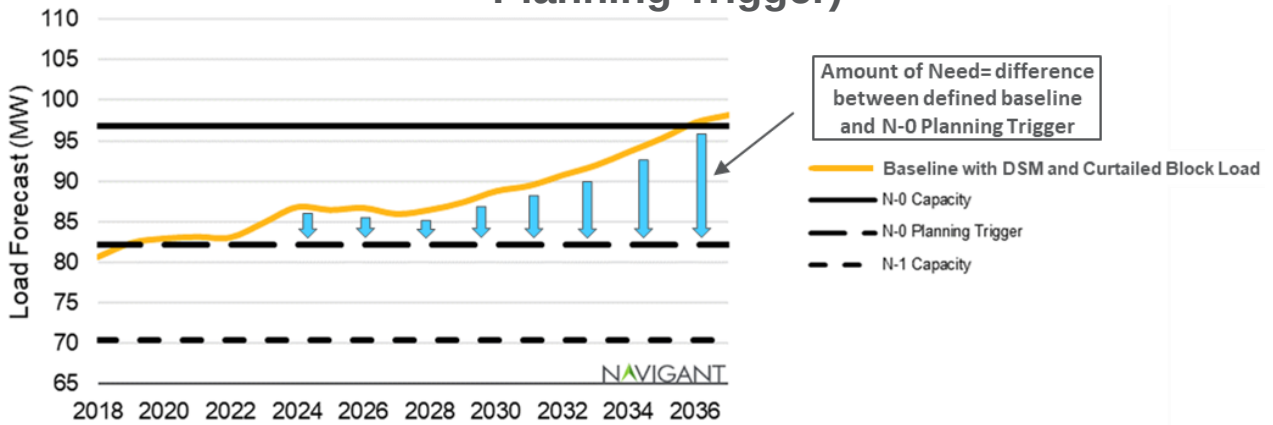
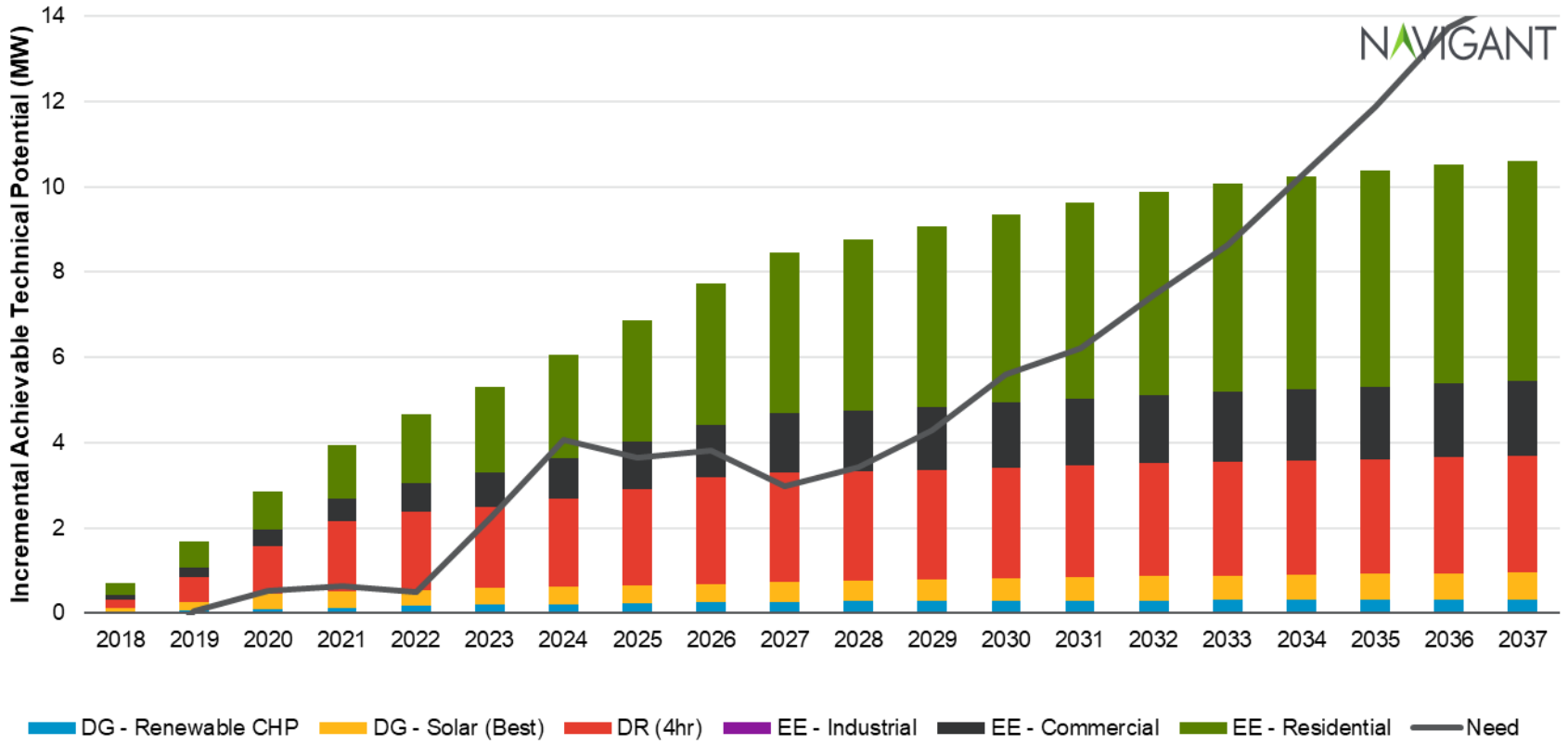


Illustration of Defined Need (Difference between Baseline and N-0 Planning Trigger)



INCREMENTAL ACHIEVABLE TECHNICAL POTENTIAL BY RESOURCE COMPARED TO DEFINED NEED

The largest portion of achievable incremental capacity potential comes from energy efficiency measures, and secondly from demand response.



Source: Navigant Analysis

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

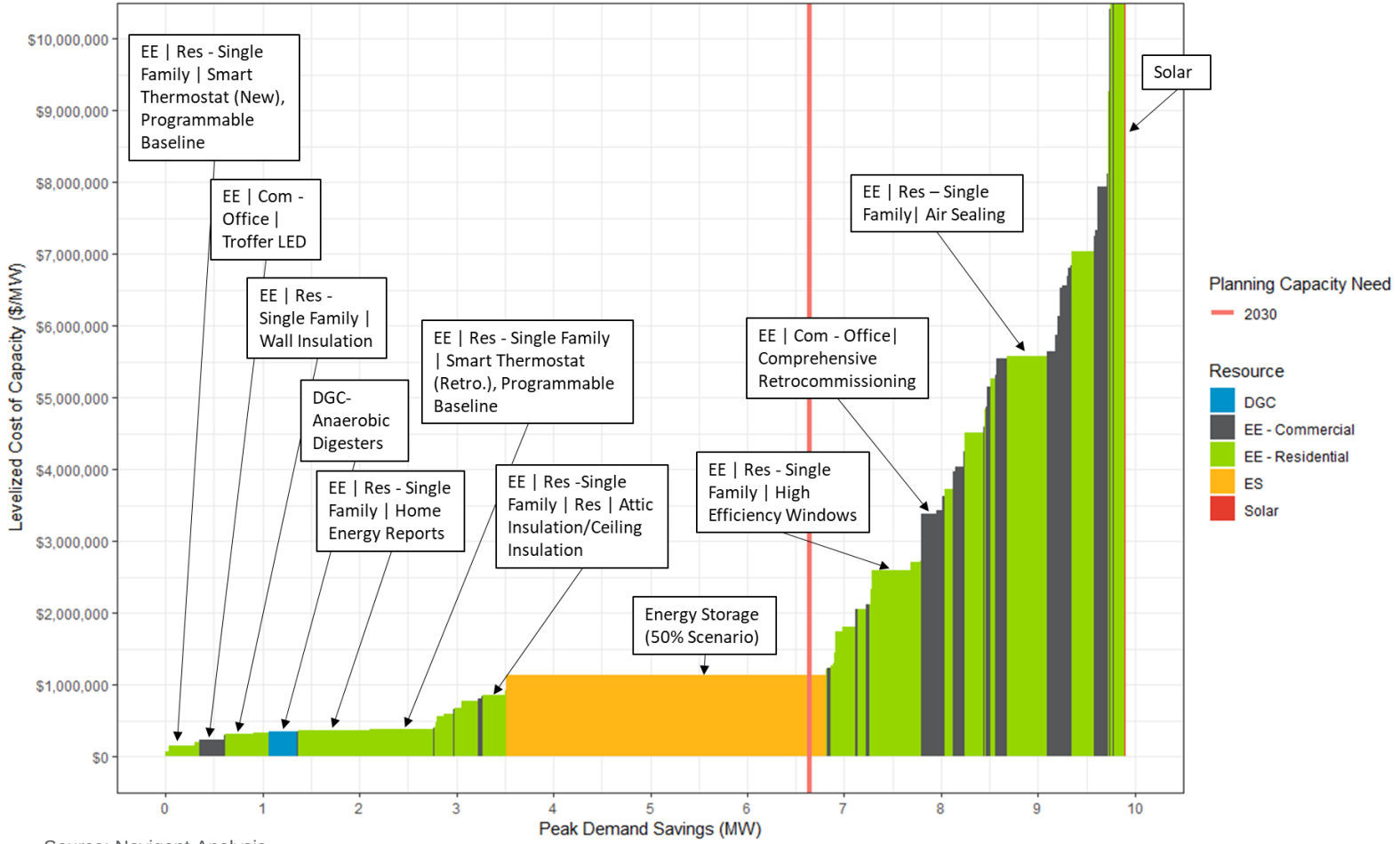
COSTS:

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

Source: Navigant Analysis

STORAGE SIZING APPROACH

The team took a phased approach to adding storage to determine the optimal storage size.



Source: Navigant Analysis

Note:

- Demand response was not included in the final portfolio because the team determined the costs were not appropriate for a geo-targeted DR program without a system wide DR program.
- Navigant recommended PSE further analyze the potential from DR

ANALYSIS RESULTS

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)

Source: Puget Sound Energy

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