Distribution System Workshop

Distribution System Plan Workshop # 3 | 24 – June 27, 2024

Meeting Logistics

- Audio
- Microphone
- Chat box
- Video
- Raise Hand
- Closed Caption

Operating Agreements

Establishing norms with our communities is foundational to building trust

To create a **safe space**, we established **common agreements** such as **respect, honoring diversity of thought**, and **inclusivity**

Practice curiosity and **seek to understand different perspectives**

- Stay Engaged
- Be Willing To Experience Discomfort
- Speak Your Truth
- Expect and Accept Non-closure
- Share the Airtime

The courageous conversations framework
by Glenn Singleton and Curtis Linton

Agenda

9:00 – Welcome & Meeting Logistics

9:05 - Distribution System Planning – Solution Identification

9:50 – Capital Planning Process

10:25 – Grid Needs Analysis: Supporting DER Integration & Operation

10:55 - Closing Remarks & Next Steps

11:00 - Adjourn

Distribution System Planning – Solution Identification

Fatima Colorado, Distribution System Planning Manager

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PGE An Oregon kind of energy.℠

Distribution Information

Service Territory

- 1.9 million population
- 4,000 square miles
- ~900,000 customers

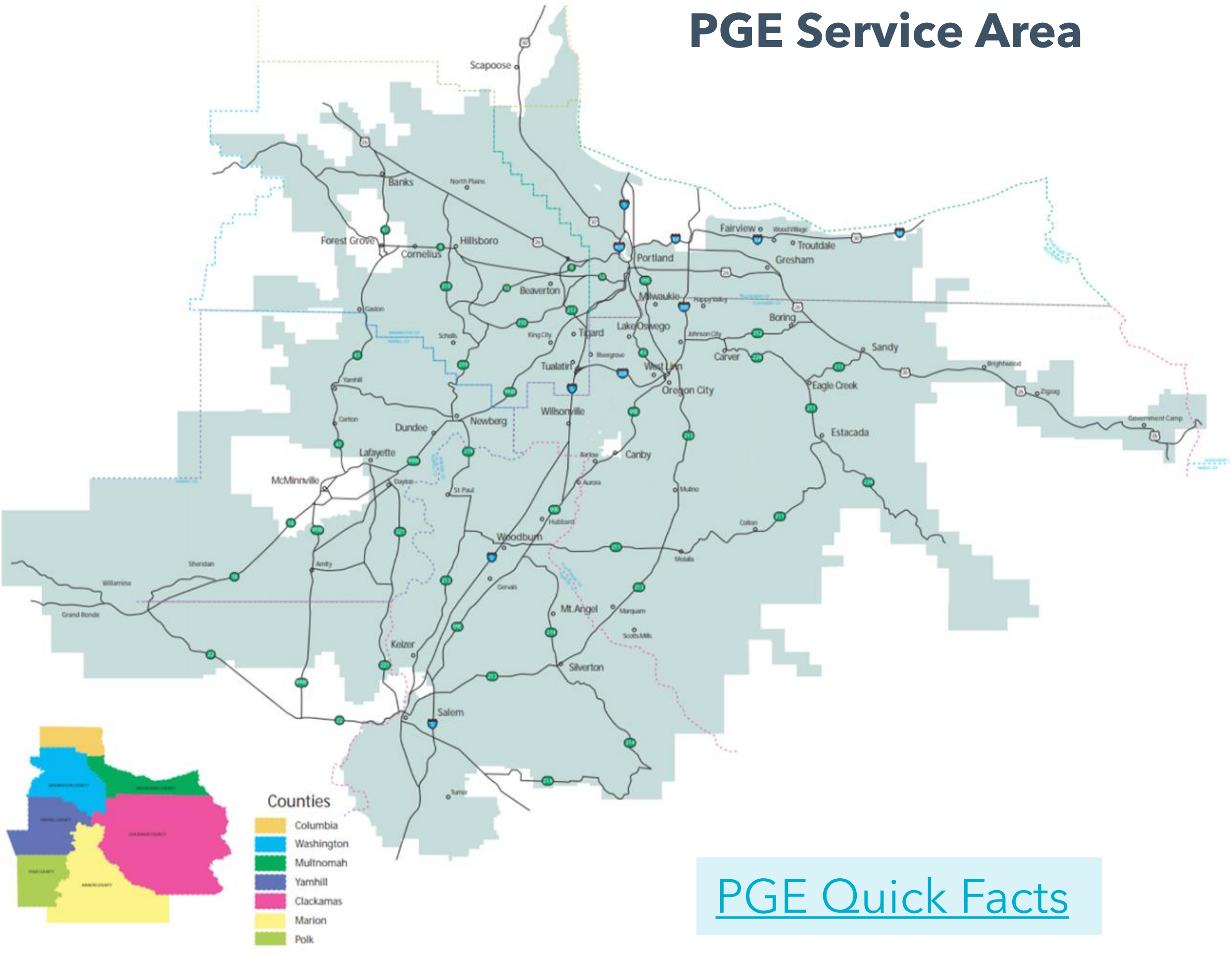
Big Equipment

- 152 Substations
- 280 Power Transformers
- 707 Feeders

Net System Peak Load

- Summer: 4,498 MW
- Winter: 4,113 MW

PGE Service Area



PGE Quick Facts

Peak Load

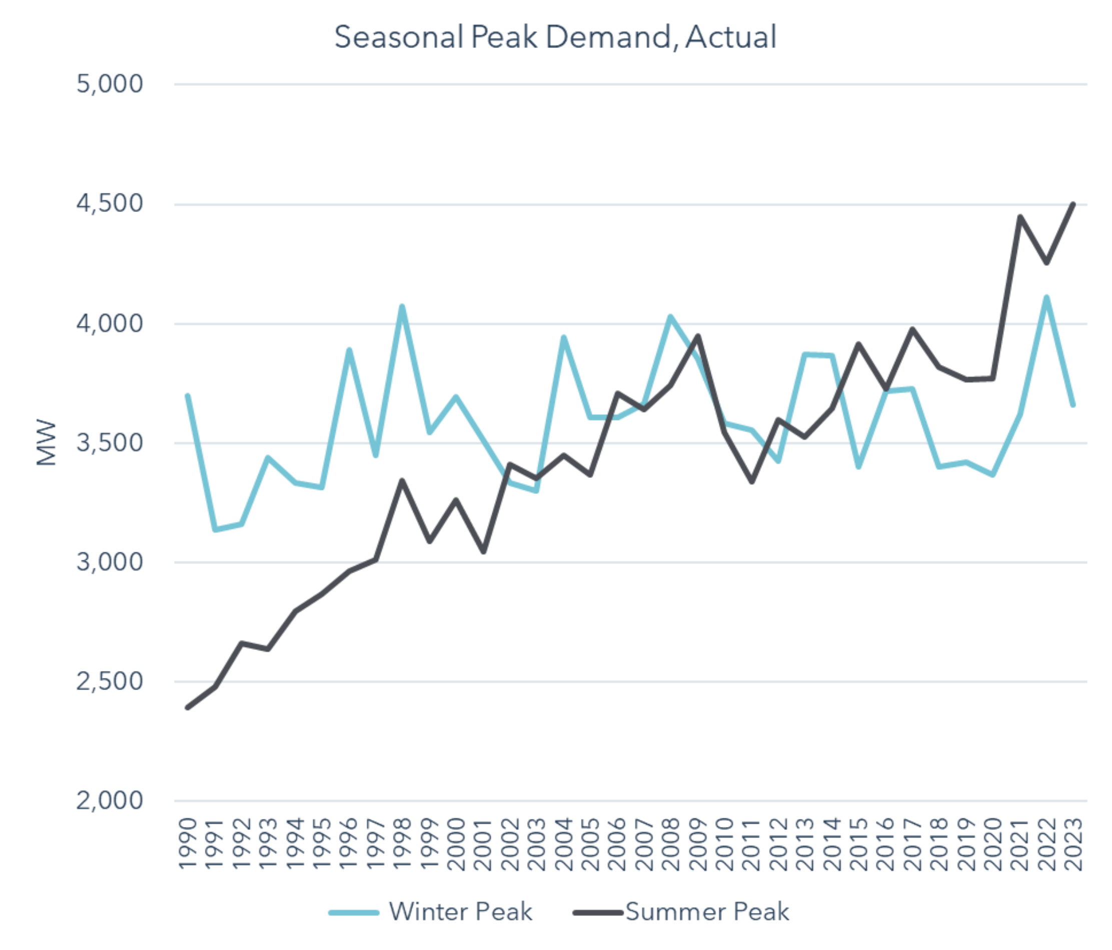
Is the highest electricity demand on a utility system

PGE typically experiences system-wide peak loads during both the hottest and the coldest days of the year

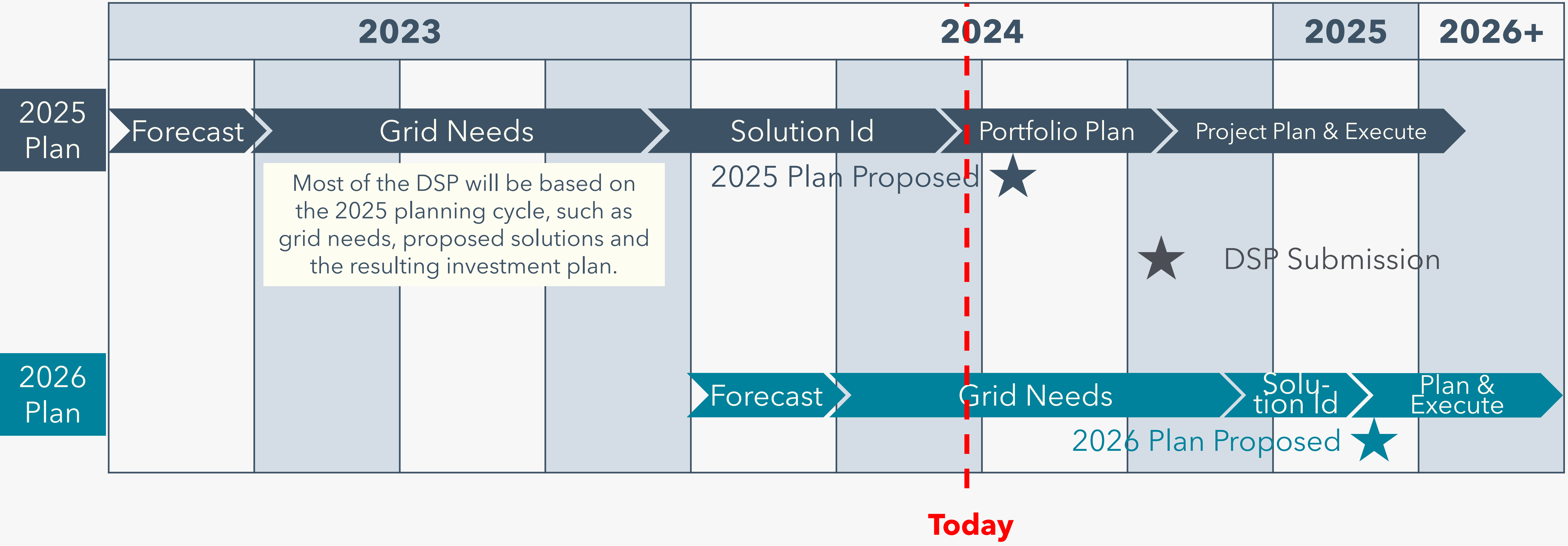
Summer: 4,498 MW

Winter: 4,113 MW

Knowing peak load helps utilities design systems to handle maximum demand



Investment Timeline: A 3-year Cycle



Solution Identification

Step 1

WHAT & WHERE IS THE PROBLEM

Step 2

CURRENT STATE ANALYSIS AND SOLUTION IDENTIFICATION

Step 3

OPTION ANALYSIS

Step 4

RECOMMENDATIONS

Step 1: What is the problem?

Determine **why the system needs to be upgraded to meet future needs (Identification Stage)**

Identification Tools

Analysis

Feeder Load (System Weak Link Report/Minimum Load): Indicates equipment and conductors approaching certain limits or thresholds

Forecast: Indicate future load growth

Reliability: Focuses on trouble spots in the distribution system based on historic outage events

Assessment

System Assessments: Indicates potential problematic areas when the system is most stressed

Modeling

Asset Risk Models: Identifies and quantifies risk related to certain equipment

Drivers

- Economic development
- Load growth/Forecasts
- Lumped load additions
- Modernization
- Policy regulatory requirements
- Safety
- Substandard equipment

Step 1: Where is the problem located?

Area affected by the problem

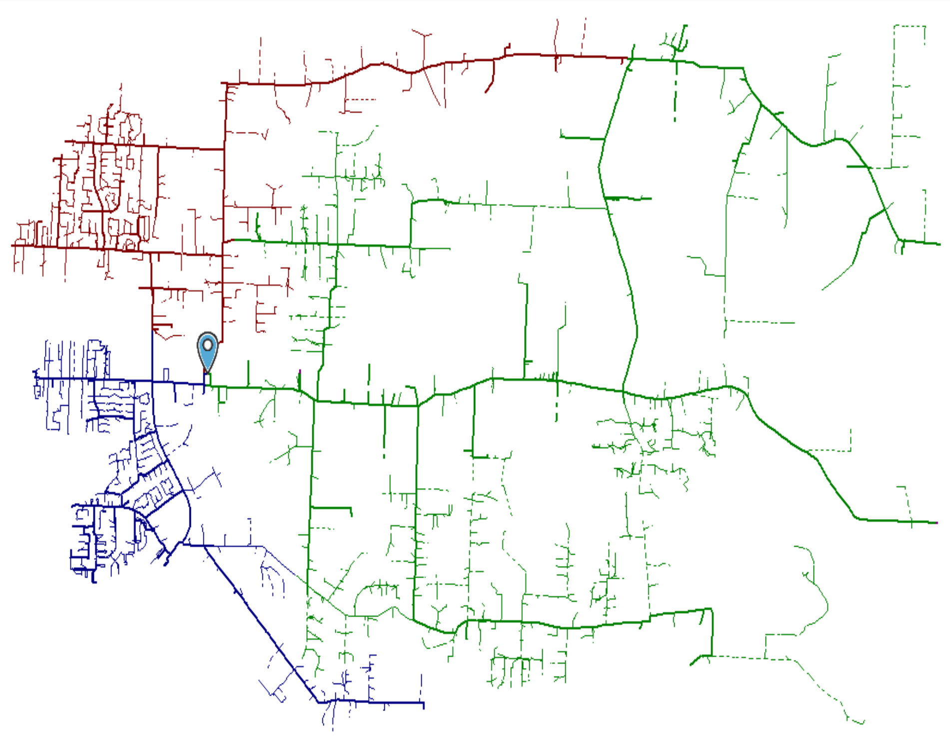
Review

- Geographic boundaries
- Affected customers
- Contractual obligations
- Approach to contingency analyses

Forecasting parameters

Load profiles/Allocation

Setup models



Step 2: Current State Analysis

Examine the **severity of the grid needs** and **identify additional issues** using software simulation (CYME)

Step One: Run CYME of the grid needs under peak-load of normal-conditions (N-0)

Step Two: If issues are identified under normal conditions investigate how to make corrections where needed

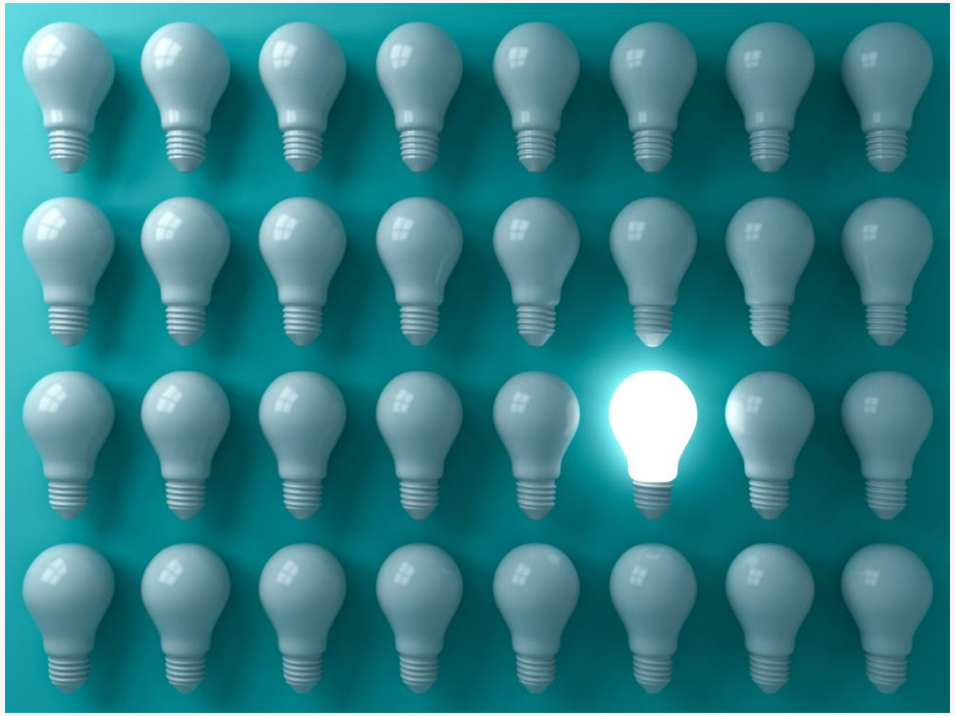
Step Three: Run a contingency-analysis (N-1)* at the grid needs

*N-1 take each feeder & transformer out of service in the model, one at a time, and determining if the load can be pick up on other feeders and transformers without causing overloads or voltage issues

Step 3a: Finding Solutions: Current State Analysis

Software simulation will further **define severity** of the **problem area** and **identify additional issues**

- Conductor loading violations
- Voltage violations
- Contingency analysis deficiencies
- Faulted equipment violations
- Load balancing / High neutral current
- Protection-related issues



Step 3b: Option Analysis

- Benefit vs Cost
- Risk reduction on assets and non-assets
- Stacked benefits
- Savings
- Improve resilience
- Reduce outage duration/ frequency

Leads to Step 4
Final Recommendation(s)

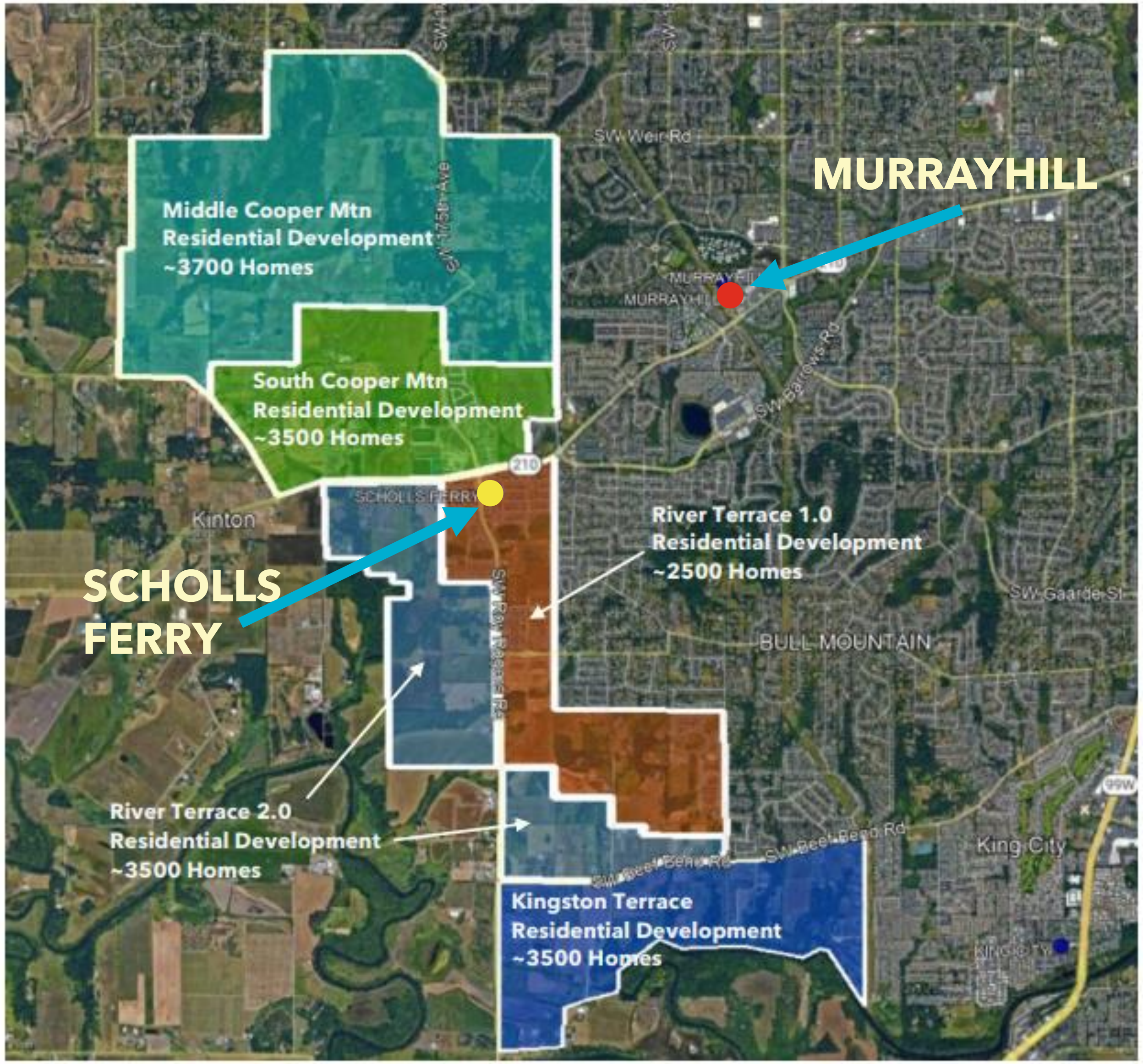
Example Solution Identification

Scholls Ferry Capacity Addition:

- The Scholls Ferry area consists of SW Beaverton, western Tigard, and western King City are experiencing large amounts of residential growth.
- Forecasted build out, the number of new homes is projected to reach approximately 15,000.

Scholls Ferry Capacity Addition

Project Area



Solution/Option Analysis

PGE

Step One: Start with the most basic option

Rebuild Scholls Ferry Substation & add capacity Murrayhill Substation

Step Two:

Define Option 1: Add 28 MVA equipment transformer (capacity)

Analyze Option 1: Determine if it meets needs before proceeding to Option 2 (more extensive)

Step Three:

Define Option 2: Add 50 MVA equipment transformer (capacity)

Analyze Option 2: Determine if it meets needs

Substation | Transformer | Feeder | Reconductor

Solution/Option 1 Results

Step Two: **<u>Define and analyze Option 1</u> to determine if it meets our needs before proceeding to Option 2 (more extensive)**

Define Option 1: Add 28 MVA transformer + 3 new feeders

Analyze Option 1: Add 28 MVA transformer + 3 new feeders

- Add a new 28 MVA <u>transformer</u> =>**N-1* redundancy is not achieved**
- Add three feeders at Scholls Ferry substation => **Does not alleviate load to Murrayhill**

*N-1 contingency analysis takes each feeder & transformer out of service in the model, one at a time, and determining if the load can be pick up on other feeders and transformers without causing overloads or voltage issues

Solution/Option 2 Results

Step Three: **<u>Define and analyze Option 2</u> to determine if it meets our needs**

Define Option 2: Add 50 MVA transformer + 6 new feeders

Analyze Option 2: Add 50 MVA transformer + 6 new feeders

- Install a <u>six new feeders</u> from the School Ferry substation to alleviate new load and to offload part Murrayhill Substation **=>Alleviates load**
- Establishes N-1 substation transformer redundancy at Scholls Ferry **=>N-1* achieved**

*N-1 contingency analysis takes each feeder & transformer out of service in the model, one at a time, and determining if the load can be pick up on other feeders and transformers without causing overloads or voltage issues

Solution Benefits

Option 1 Vs. Option 2

Option 1

The Scholls Ferry capacity addition with one additional 28 MVA transformer will

- add capacity into the area
- but will not increase reliability for the customers served by the substation or surrounded area.

Option 2

The Scholls Ferry capacity addition will provide increased reliability for the customers in the area because during unplanned outages

This additional capacity will allow for faster and more extensive restoration, especially true during high loading periods

This reliability benefit reaches beyond Scholls Ferry and Murrayhill substations, reaching surrounding substations such as Huber, King City, Progress, and Tigard

Provides capacity to the area and removes all equipment over planning thresholds

Project Option	Reduction of Cost of Ownership + Geo Risk, NPV	Reduction of Annual Truck Rolls Near-Term FP%	Reduction of Near-Term CMI	Reduction of Near-Term Risk	B/C Ratio
Option 1	$28,418,333	1	885,500	$3,467,112	2.04
Option 2	$31,155,506	1	935,954	$3,779,420	2.01

NWS Criteria Scholls Ferry Capacity Addition

Type of grid need – Does not meet NWS criteria

- Transformer Addition
- Capacity Addition of 50 MVA
- Reliability Need for N-1* condition

Forecast certainty

Lead time

Minimum of 30 months

Minimum project cost

*N-1 contingency analysis takes each feeder & transformer out of service in the model, one at a time, and determining if the load can be pick up on other feeders and transformers without causing overloads or voltage issues

Questions/ Comments

Capital Planning Process

Joe Boyles, Resource Planning Project Manager

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Objectives

Build awareness of what will be in the Near-term Action Plan

Provide opportunities for review and comment on the investment decision-making process

Discussion topics

- Pulling the thread through the DSP requirements and related data
- Bottom-up analysis and top-down governance – orientation to the decision-making process and framework
- Timing of activities – recap of prior discussions
- Categorization of investments/projects
- Overview of investments by category
- The project development funnel – from Grid Need to funded and initiated project
- Determining which projects to move forward – balancing the portfolio

Capital Planning Process Roles

Role	Description
Board of Directors (BOD)	The Board of Directors reviews and approves the annual capital budget. In addition, the BOD approves large strategic projects and future-year obligations for long-lead-time equipment purchases.
Capital Review Group (CRG)	The Capital Review Group is a standing committee with governance over capital projects and allocates capital resources based on business value and alignment with PGE's strategy.
Business Sponsor Group (BSG)	The Business Sponsor Group is a standing committee, empowered by the CRG to approve capital projects and manage the assigned portfolio to deliver the most value at the least cost. The BSG reviews and approves a proposed annual budget based on a five-year project road map that prioritizes projects based on PGE's initiatives and project readiness.
Generation, Transmission & Distribution Project Management Office (G-T&D PMO)	The G-T&D PMO is an organization that manages a standardized process for the governance and execution of assigned capital projects for Generation and T&D. The G-T&D PMO includes roles such as Project Managers, Project Controllers, Estimators and Construction Managers.
Capital Portfolio Management Team	The Portfolio Management team optimizes the project portfolio, acts as the primary interface with the BSG and CRG, and oversees the steps related to the planning and execution gates. The Portfolio Management team also monitors Portfolio health and execution risks throughout the year, escalating issues to the executive team and the CRG as needed.

Business Sponsor Group (BSG) Reporting Structure

PGE

Board of Directors

Establish the corporate vision and strategic objectives

Critique plans and performance

Approve budgets; ensure adequate funds

Chief Executive Officer

Lead executives and hold them accountable

Communicate direction and priorities

Executive Team

Determine Executive Steering Committee capital allocation

Executive Steering Committees

Customer / Operations / Strategy / People / Risk

Detail the strategies to reach the vision

Establish metrics and track progress towards goals

Capital Review Group

Optimize financial plan

Arbitrate funding allocation priorities

Business Sponsor Groups

Gen/Power Ops / IT / T&D / Customer / Grid Mod / Services

Translate strategies into actionable 3-year roadmaps
Allocate project funds within guidance

Resolve tactical project and portfolio tradeoffs and risks
Optimize business value through portfolio management

What do Business Sponsor Groups (BSGs) do?

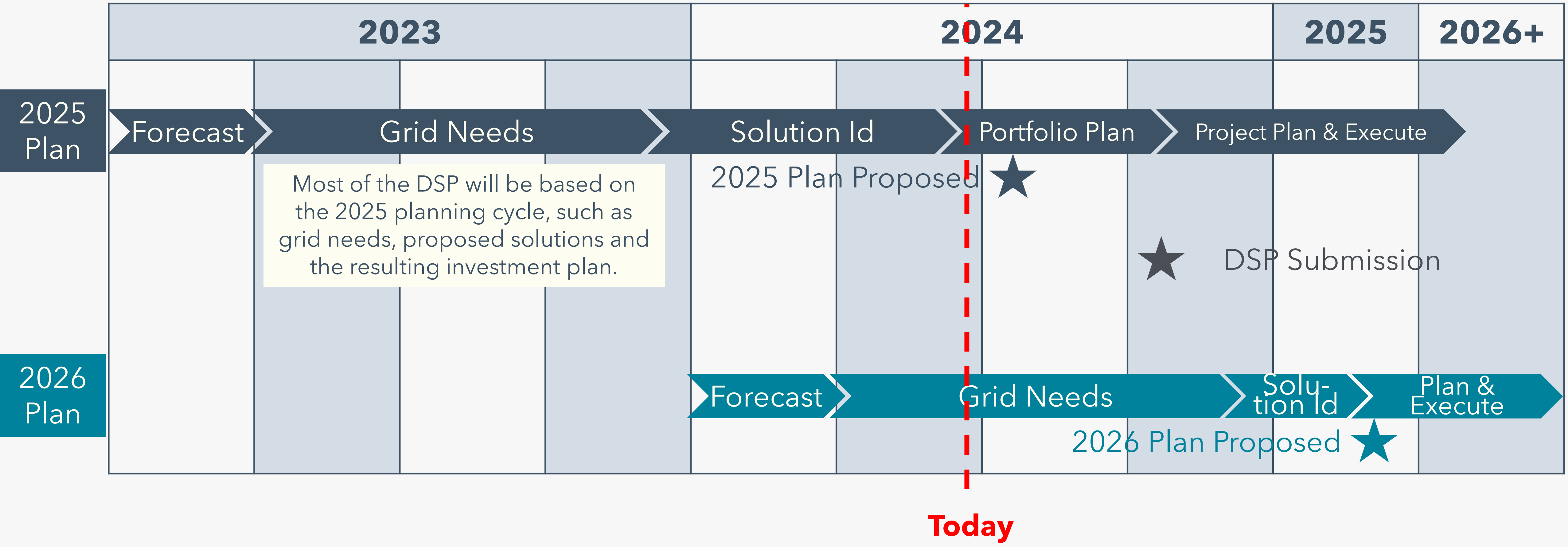
Portfolio Planning

- Develop 3–5-year project road maps that translate the corporate strategy into specific initiatives
- Prioritize projects based on business benefit (and de-prioritize)
- Executive Steering Committees (ESCs) endorse road maps as the best way to reach strategic goals
- Communicate road maps and planned work

Portfolio Management

- Decide when to promote projects from road map to active work
- Allocate budget to projects based on performance
- Monitor portfolio execution and benefits delivery
- Manage project exceptions
- Escalate issues to the CRG and ESC as needed

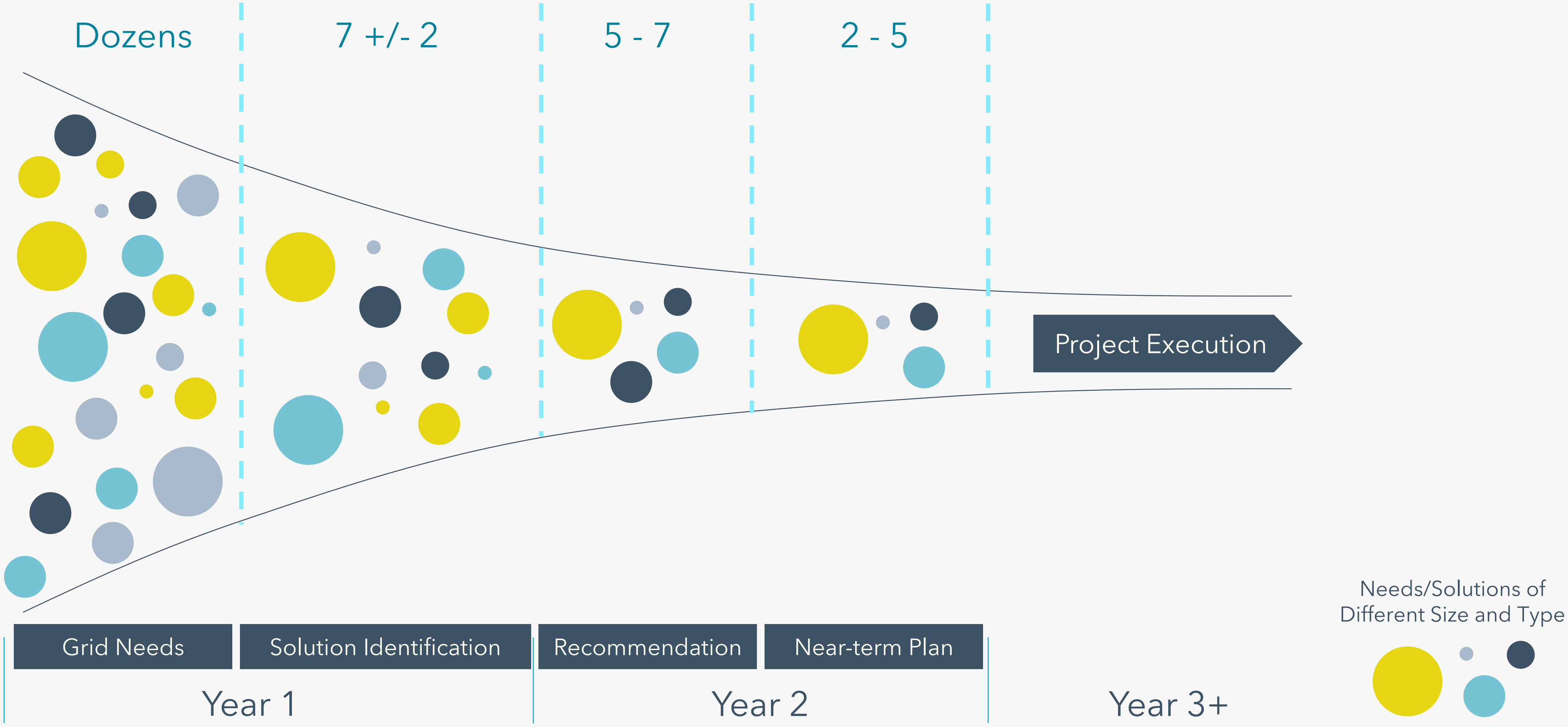
Investment Timeline: A 3-year Cycle



Current T&D Project Categorization

Portfolio	Sub-Portfolio	Category
Transmission & Distribution	**Grow** (load growth/ econ. dev.)	**Capacity/Flexibility** – increase capacity and/or flexibility to address load growth or increased demand; may include capacity-driven compliance and reliability projects
		Customer/Partner – investments involving a commitment to a customer, internal partner, municipality, or co-owner; includes critical service restoration and our obligation to serve; applicable to both sustaining and growth sub-portfolios
	Sustain (keep the lights on)	**Compliance** – address a non-capacity related compliance requirements from FERC, NERC, OPUC, EPA, DEQ or other regulatory body
		Reliability – enhance reliability, resiliency and security; includes proactive repair/replace in kind projects as well as broader improvement initiatives
		Operations – address tools, safety, restoration of non-critical services, and efficiency improvements

T&D Project Development Funnel



Portfolio Considerations

Alignment to Strategies and Goals

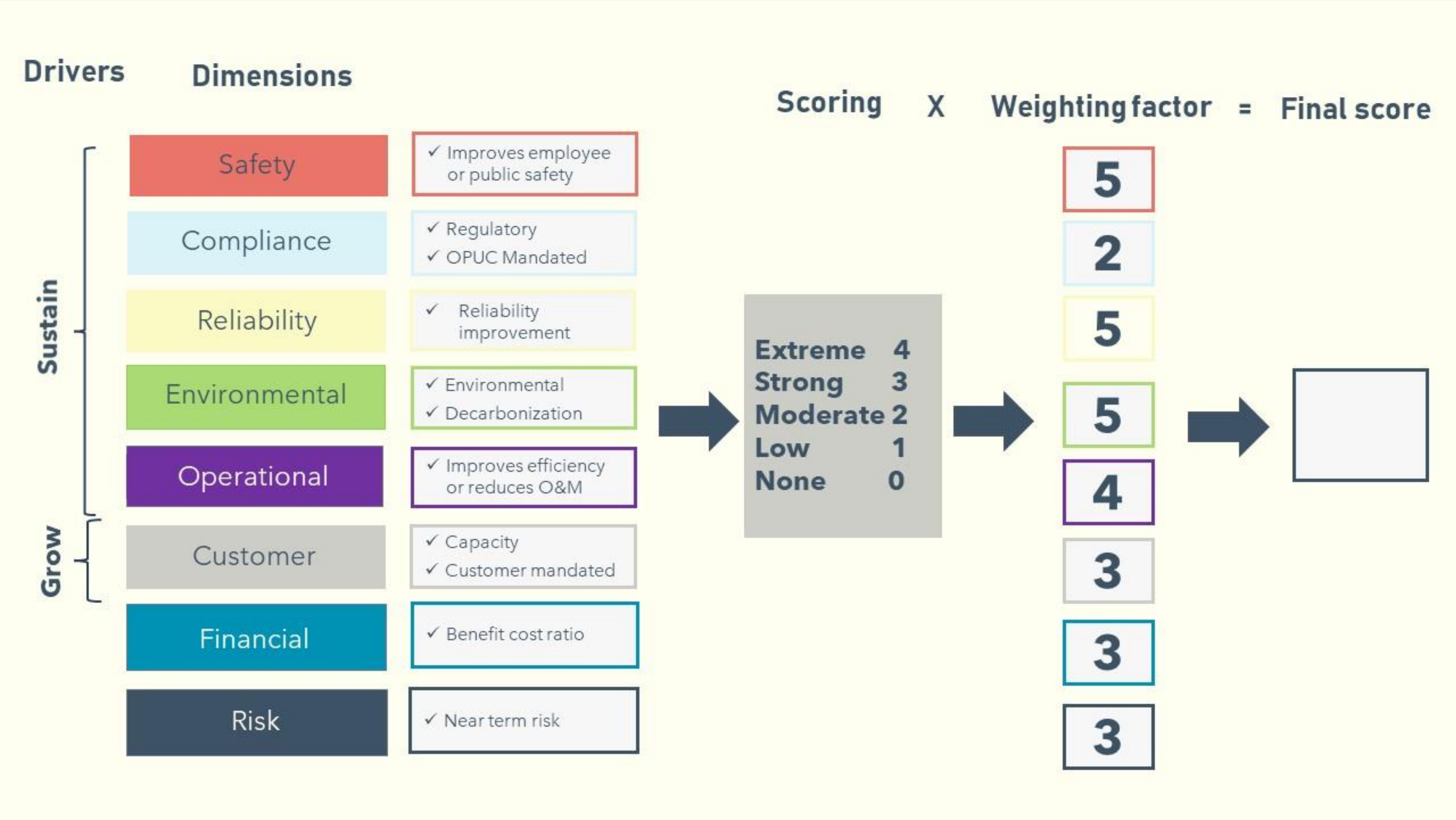
Firm commitments – customer and/or compliance

Execution readiness – cost estimate, resource and materials

Stage-gate approvals: minimize risk with planning-only approval

Quantified project benefits

Portfolio prioritization



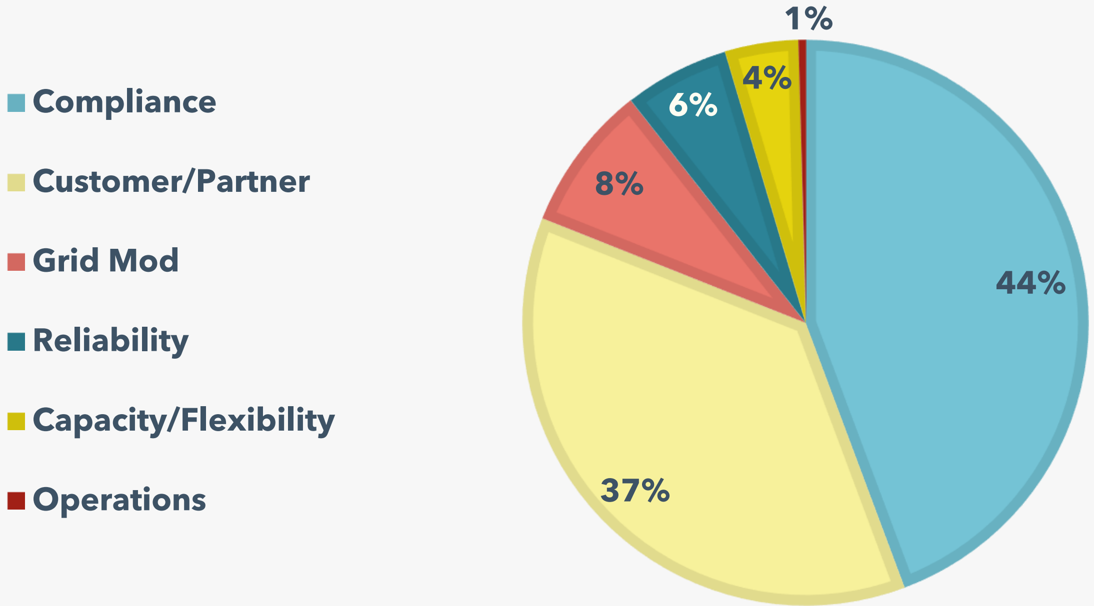
Portfolio prioritization evolution

Risk Impact Dimension Scoring Table					
Probability	**Safety**	**Customer Satisfaction**	**Compliance**	**Environmental**	**Reliability**
1-REMOTE: Likelihood of at least 1 event occurring in a given year is <1% (1-in-100-year event, at worst)	**1-MINOR:** Minor Injury to employee or member of the public	**1-MINOR:** Minimal customer complaint calls	**1-MINOR:** Self-reported incident, no violations	**1-MINOR:** Immediately correctable or easily contained, and/or no benefit to PGE's emissions reduction goals	**1-MINOR:** 200 total customer hours of interruption, OR avoided EFOR Hours >0-29, OR Tx Reliability Score 1
2-UNLIKELY: Likelihood of at least 1 event occurring in a given year is >1% - 25% (No more than once every 4 years)	**2-MODERATE:** Minor injury to multiple employees or members of public	**2-MODERATE:** Negative social media posts by customers	**2-MODERATE:** Regulatory testimony required, but no punitive action	**2-MODERATE:** Short-term impact requiring remediation, and/or hinders PGE's emissions reduction goals	**2-MODERATE:** Outage resulting in at least 2,000 total customer hours of interruption, OR avoided EFOR Hours >29-104, OR Tx Reliability Score 2
3-POSSIBLE: Likelihood of at least 1 event occurring in a given year is >25% - 50% (At least once or twice every 4 years)	**3-SERIOUS:** Permanent or serious injury to employee or member of the public	**3-SERIOUS:** Request by member of the public for a formal investigation from regulatory agency	**3-SERIOUS:** Investigation reveals violations	**3-SERIOUS:** Medium-term impact requiring more extensive remediation, and/or minor increase in PGE's emissions	**3-SERIOUS:** Outage resulting in at least 20,000 total customer hours of interruption, OR avoided EFOR Hours >104-1,480,OR Tx Reliability Score 3
4-LIKELY: Likelihood of at least 1 event occurring in a given year is >50% - 75% (At least once every 2 years)	**4-MAJOR:** Permanent or serious injury to multiple employees or members of public	**4-MAJOR:** Complaints by customers that result in regulatory response (Action)	**4-MAJOR:** Formal hearing, new regulatory restrictions	**4-MAJOR:** Long-term impact requiring extensive remediation, and/or medium sized increase in PGE's emissions	**4-MAJOR:** Outage resulting in at least 200,000 total customer hours of interruption, OR avoided EFOR Hours >1,480 - 480,000, OR Tx Reliability Score 4
5-EXPECTED: Likelihood of 1 or more similar events occurring in a given year is >75% (Imminent/more likely than not to occur in a given year)	**5-SEVERE:** One of more fatalities to employees or member of the public	**5-SEVERE:** En masse customer defections, negative national media attention	**5-SEVERE:** Threat of revocation of business licenses.	**5-SEVERE:** Irreversible environmental impacts, and/or sharp increase in PGE's emissions	**5-SEVERE:** Outage resulting in at least 2 million total customer hours of interruption, OR avoided EFOR hours >480,000, OR Tx Reliability Score 5

2023 Transmission and Distribution Spending

The distribution system planning process (i.e., Grid Needs Analysis and Solution Identification) determines a subset of projects/ investments in these categories.

2023 ACTUALS BY CATEGORY



Categories	2023 Actuals ($M)
Compliance	$ 204.6
Customer/Partner	$ 169.5
Grid Modernization	$ 38.7
Reliability	$ 27.7
Capacity/Flexibility	$ 19.4
Operations	$ 1.8
Grand Total	**$ 461.7**

Questions/ Comments

Grid Needs Analysis: Supporting DER Integration & Operation

Joe Boyles, Resource Planning Project Manager

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"The grid is the most complicated machine we've ever built. It's gigantic, it is complex, and to get the most efficient use out of the system, we have to use it in the most coordinated way that we can."

– **Carl Zichella**, environmental consultant focusing on climate change and the clean energy transition

Key Takeaways

- Pressure on the grid is increasing
- DERs contribute to that pressure
- Orchestration of DERs through a Virtual Power Plant (VPP) can relieve some pressure

Overview

Building capabilities to enable Non-wires Solutions and Virtual Power Plants

Background

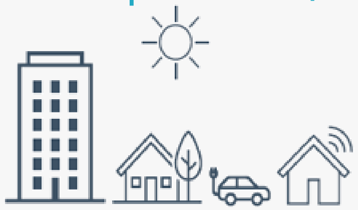
- DSP guidelines requested submission of two NWS concept proposals. We submitted:
  - Eastport substation: > 3 MW load relief
  - Dayton substation: >1.5 MW load relief
- Conceptualized how different combinations of DERs could cost-effectively provide load relief and defer capital investment
- Determined that there was not a pathway to execution due lack of:
  - project management,
  - regulatory approval,
  - capability to deploy, and
  - capability to call on/control DERs

Proposed direction for next iteration of DSP – develop a plan to do the following in 2025

- Demonstrate capabilities necessary to deliver an NWS and a VPP that involves customer-sited DERs
- Demonstrate delivery and measurement of community benefits
- Investigate how CBREs can deliver an NWS or otherwise address grid needs

What is accelerating the need for grid modernization?

Customer expectations for increasingly clean energy, without compromising reliability and keeping costs as low as possible, require increased integration of Distributed Energy Resources and Flexible Loads



RESIDENTIAL
(SINGLE-, MULTI-FAMILY)

- Rooftop Solar
- Distributed Batteries
- Smart Devices
- Vehicle Charging
- Heat Pumps
- Thermostats
- Hot water

IOC
(INTEGRATED OPERATIONS CENTER)

- Uniform standards
- Open-source API
- Plug-and-play connectivity

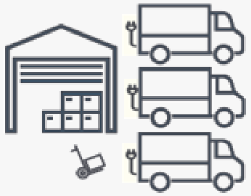
COMMERCIAL & INDUSTRIAL

- Heating Systems
- Building Management Systems
- Industrial Processes
- Warehouse Automation
- Chillers
- Data Center
- Back up Batteries & Generation

MUNICIPALITY, SCHOOL, UNIVERSITY, HOSPITAL

- Community-based renewables
- Microgrids
- School bus V2G
- Advanced Heating/Cooling

As Virtual Power Plant capabilities increase, customers have more choice and control of the energy that powers their home, work, life and community

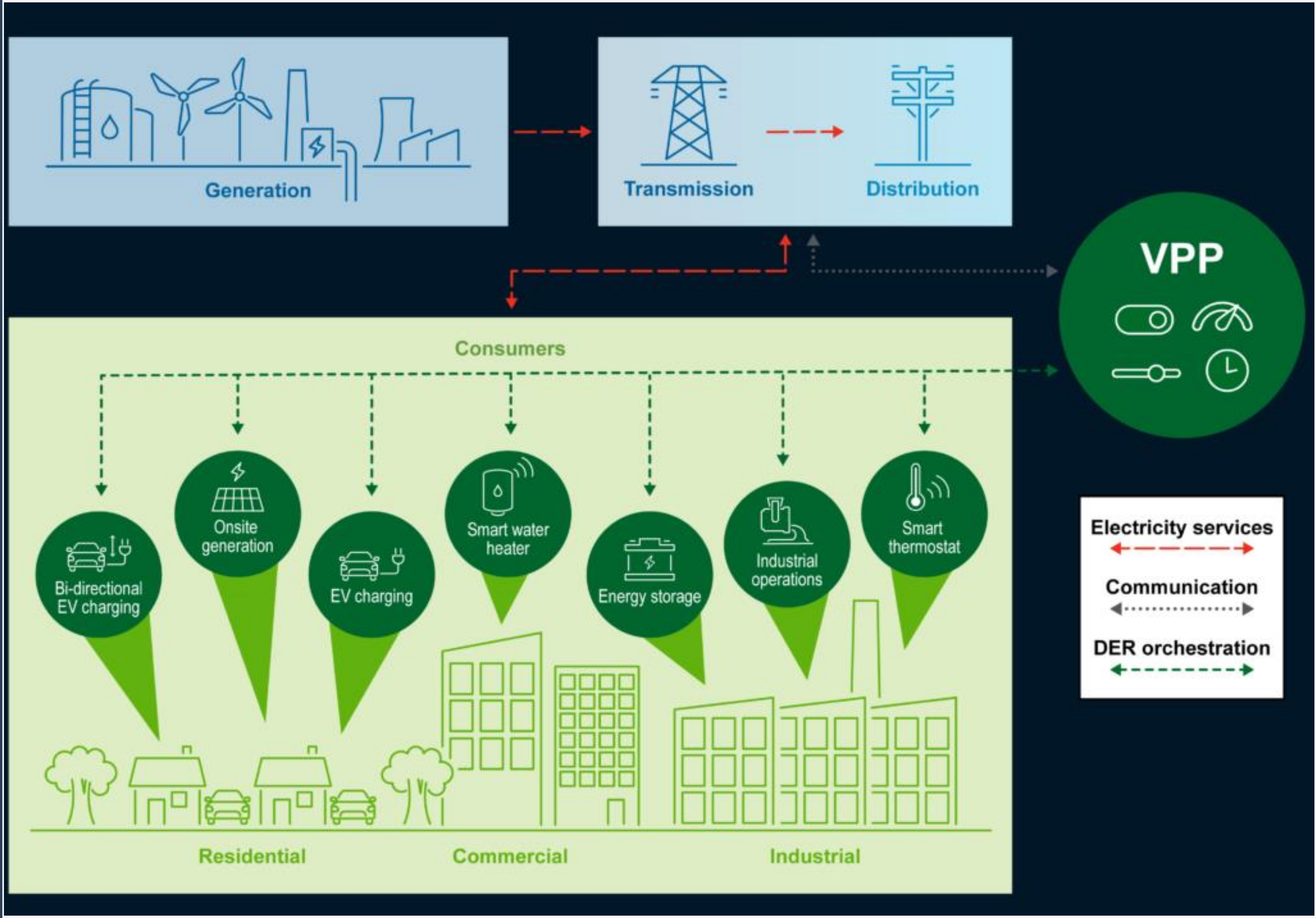


TRANSPORTATION ELECTRIFICATION

- Transit & Freight
- Fleet Charging
- Public Charging
- Rental Properties
- OEM V2G and V2X

What is a Virtual Power Plant (VPP)?

Aggregations of distributed energy resources (DERs) such as smart appliances, rooftop solar with batteries, EVs and chargers, and commercial and industrial loads that can balance electricity demand and supply and provide grid services like a traditional power plant.



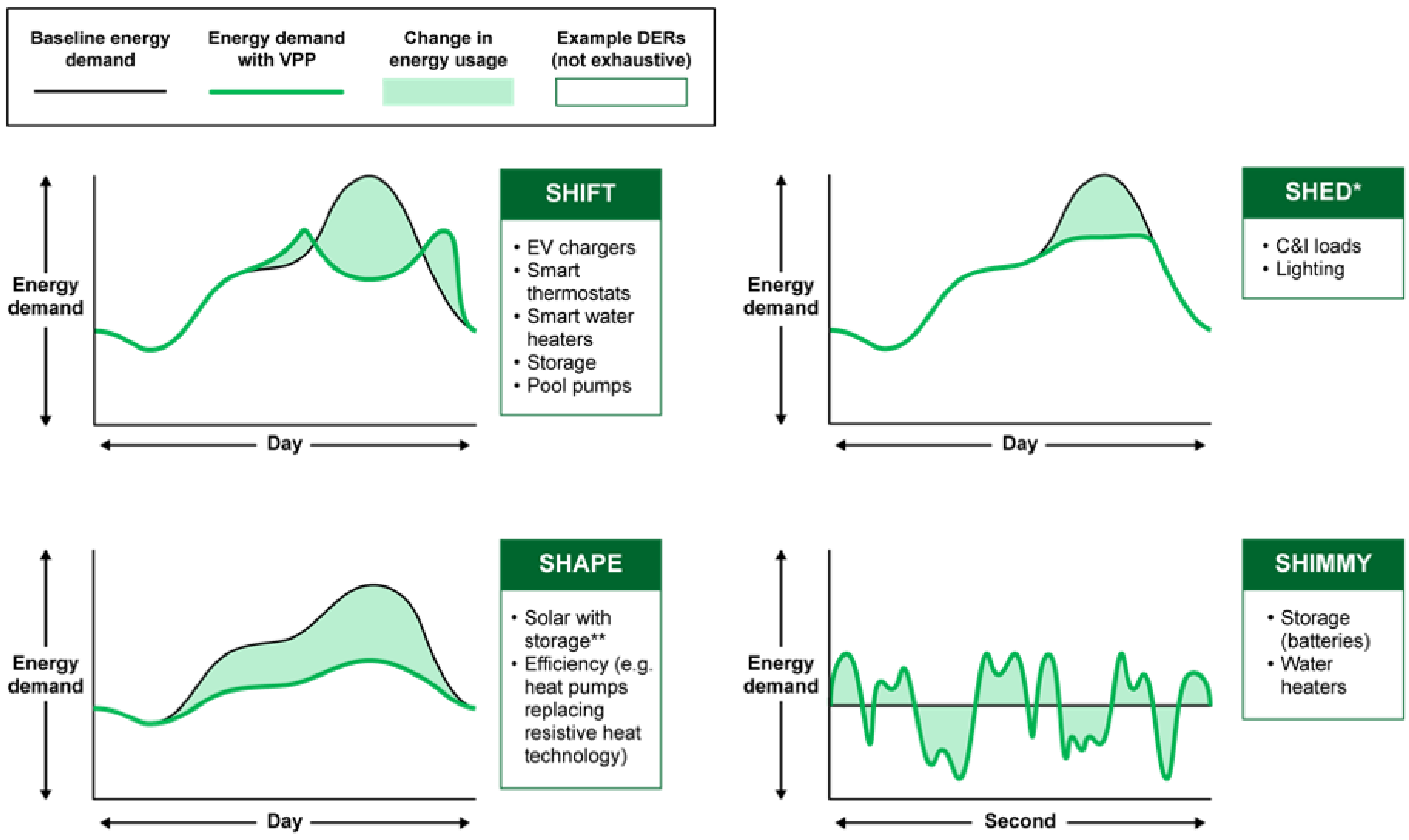
Source: https://liftoff.energy.gov/vpp/

VPPs function in different ways to meet needs

PGE

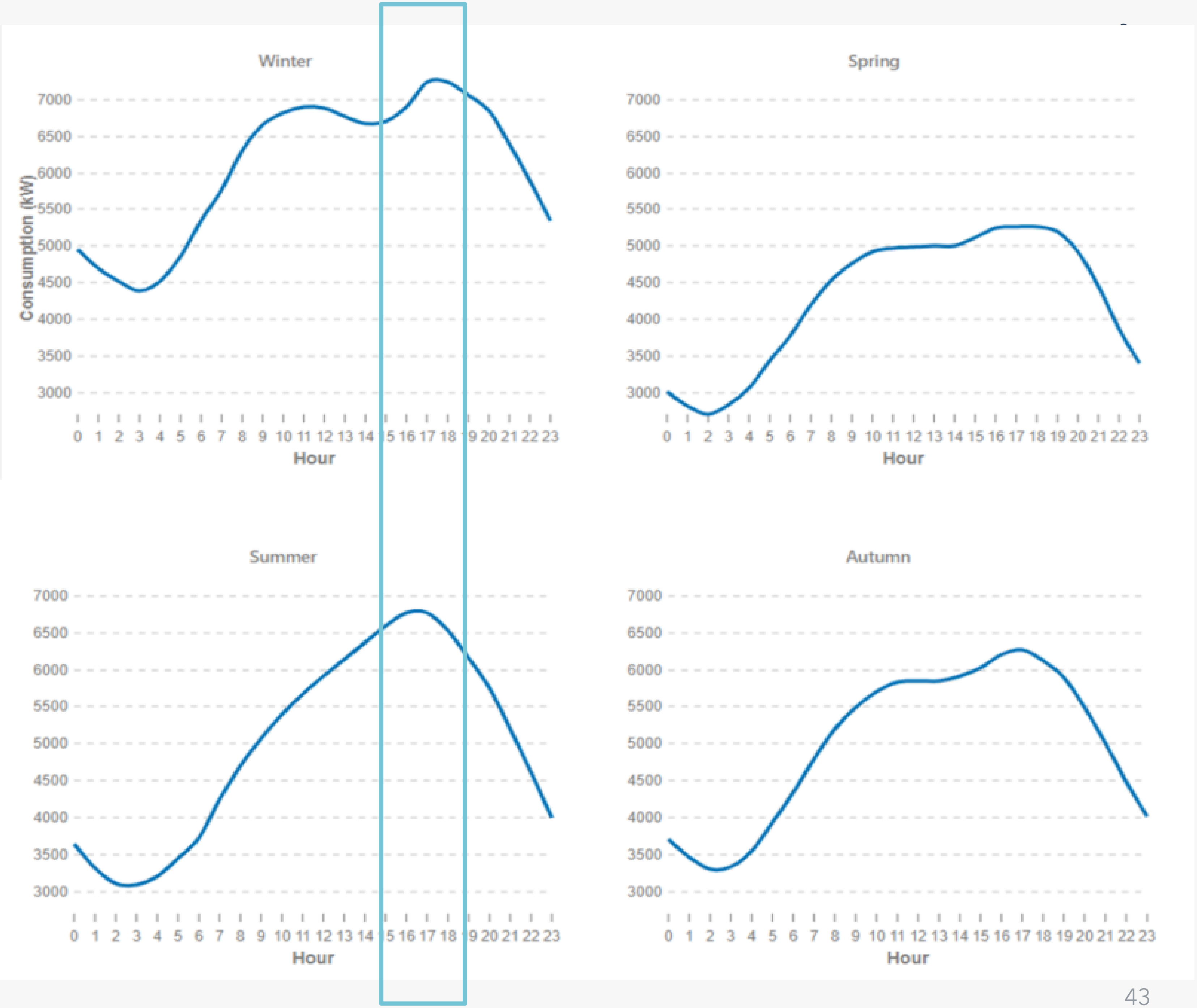
For example

- Supplying homes with energy from on-site solar-plus-storage systems during peak hours when bulk power generation is scarce
- Shifting the timing of EV charging to avoid overloading local distribution system equipment
- Charging distributed batteries (increasing demand) when clean electricity is abundant to reduce curtailment, for example, of utility-scale solar

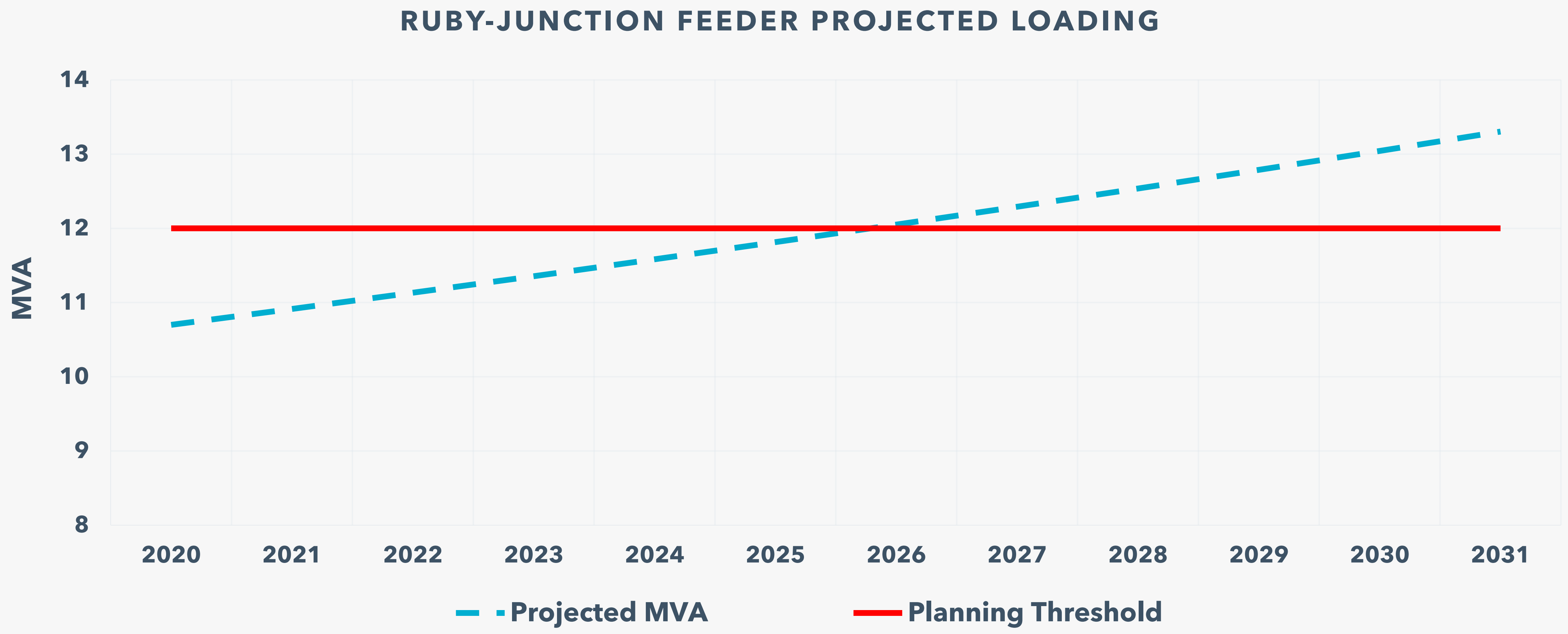


Source: https://liftoff.energy.gov/vpp/

Ruby Substation average seasonal load profiles (2021)



Load Growth vs Planning Threshold



Collectively, VPPs Can Deliver a Range of Benefits

Cost Control	Reliability & Resilience	Decarbonization	T&D Infrastructure Relief	Community Benefit
• Defer grid capex (generation, T & D) • Avoid fuel costs • Compensate consumers and businesses	• Integrate back-up power • Eliminate single-point-of-failure	• Add distributed renewable generation • Reduce curtailment of renewables • Reduce reliance on fossil fuels	• Increase efficiency by smoothing peaks • Alleviate congestion with local dispatch	• Enable consumers to optimize energy cost, use, and source • Retain and create good jobs

Source: https://liftoff.energy.gov/vpp/

Capabilities Required for NWS/VPP

Capability	Description
Grid Modeling & Analysis	Digital twin/network model development, including analysis of SCADA and field sensor data, typology models and control settings, and DER performance data.
DER Control & Dispatch	Design and implement DER controls, including DERMS alignment, lab simulation, hardware-interoperability and testing, OEM communication and coordination.
Product Design & Marketing	Analyze customer composition of chosen locations, assess customer preferences/needs, customize product offerings to maximize participation/adoption, incorporate considerations for disadvantaged populations, design and implement measurement and evaluation framework.
Contractor Training & Management	Identify installers who are willing to add NWS requirements to the install process, work with installers to design efficient installation processes, prepare installers to configure DERs to integrate with PGE systems/controls.
ADMS/DERMS Controls Integration	Configure ADMS/DERMS to recognize and operate NWS DERs, develop operations procedures to cover NWS use cases.
Equity Lens	Apply environmental justice principles in the deployment of DER-based solutions

Decarbonize

Electrify

Perform

Virtual Power Plant

PGE will enable customers to shift their power usage from peak times while providing reliable and affordable energy

Virtual Power Plant

The orchestration of
Distributed Energy Resources and Flexible Load,
through technology platforms,
to provide grid and power operations services.

Customer Programs	Distributed Solar	Distributed Thermal	Distributed Storage	Utility Storage

Technology Platforms

Policy and Regulation

To achieve a 25% peak usage offset while serving 100% of customer energy needs
PGE is targeting 2,000 VPP-enabled megawatts by 2030

Key Takeaways

- Pressure on the grid is increasing
- DERs contribute to that pressure
- Orchestration of DERs through a VPP can relieve some pressure

Questions/ Comments

Next Steps and Closing Remarks

Next Steps & Closing Remarks

- Wednesday July 10 | 2-4p | Zoom | UM 2005 Public Workshop | Guideline Updates
- Thursday July 11 | 9-11:30a | Zoom | CEP/IRP Roundtable
- Thursday July 11 | 12-1p | Zoom | Distribution System Workshop | OFFICE HOURS
- Wednesday July 24 | 10a-12p | Zoom | CBIAG Meeting
- Thursday July 25 | 9-11:30a | Zoom | Distribution System Workshop

Meeting materials and recording will be posted to our Plan's Engagement webpage at Plans Engagement | Portland General Electric

For more information or if you have questions, please email us at dsp@pgn.com

Thank You for your participation in our plans

An

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kind of energy