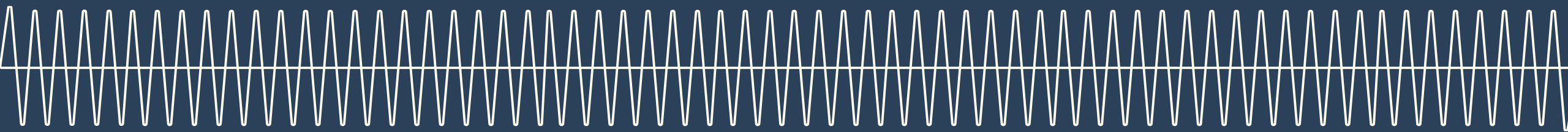
PGE Distribution System Plan Partners Monthly Workshop # 17

Aug 3, 2022



Waiting Room

One moment please, while we wait for people to join

Song by artist:

Rhiannon Giddens - Following the North Star

Please use the QR code to check-in:
Name and Organization

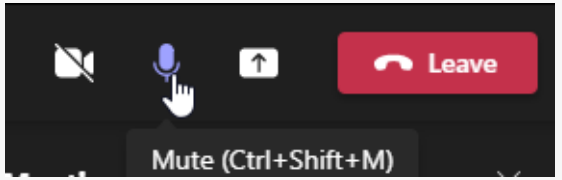
Meeting Logistics

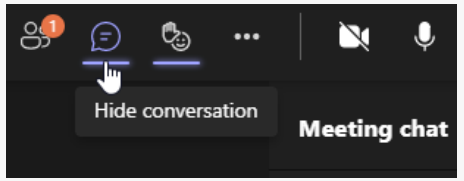
Teams Meeting

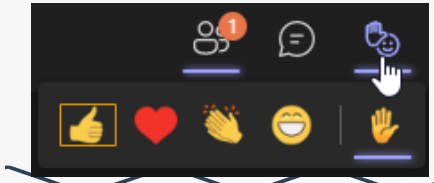
- Please click the meeting link sent to your email or [Click here to join the meeting]
  - +1 971-277-2317 (dial this number into your phone for best results)
  - PW: 885 018 032#
- Please use **Microsoft Edge** or **Google Chrome** with Teams as it will give you the best experience

During the presentation:

- All attendees will be muted; to unmute yourself via computer, click on the microphone that appears on the screen when you move your mouse
- To unmute yourself over the phone, **press *6**
- If you call in using your phone in addition to joining via the online link, please make sure to **mute your computer audio**
- Use the chat feature to share your comments and questions.
- Raise your hand icon to let us know you have a question







Quick Updates!

Please visit us at www.portlandgeneral.com/dsp

You can email us at: DSP@pgn.com

Online Feedback Form

DSP Mailing list: Sign-up form / Opt-out form

Important dates in 2022:

- PGE Multi-year Plan filing date
  - **Monday, Aug 15**
- DSP Part 2 filing date
  - **Monday, Aug 15**

Agenda

9:00 – 9:15 am – Opening Remarks (15 min)

9:15 – 9:35 am – DSP Part 2 – **DSP Goals & Integration with the CEP** (Executive Summary) (20 min)

9:35 – 10:00 am – **Non-wires Solutions** (Ch 6) (25 min)

10:00 – 10:20 am – **Human-centered Planning** (Ch 2) (20 min)

10:20 – 10:50 am – **Distribution System Planning** (Ch 1, 4 & 5) (30 min)

10:50 – 10:55 am – Break (5 min)

10:55 – 11:25 am – **Load Forecast and DER Adoption** (Ch 3) (30 min)

11:25 -11:55 am – **Near Term Action Plan** (Ch 7) (30 min)

11:55 am – 12:00 pm – Next Steps (5 min)

Operating Agreements

Establishing norms with our communities is foundational to building trust.

To create a **safe space**, we establish **common agreements** such as **respect** and **inclusivity**.

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

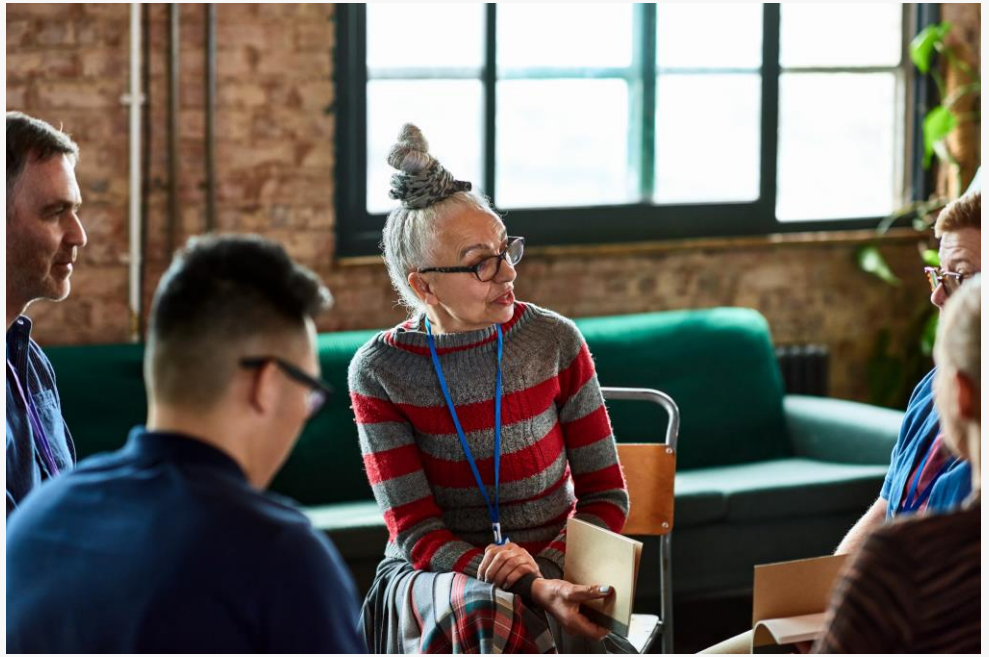
Stay Engaged

Experience Discomfort

Speak your Truth
(knowing it's only part of the truth)

Expect and Accept Non-closure

Share the Airtime. Step up, Step back.



The courageous conversations framework
By Glenn Singleton and Curtis Linton

DSP Part 2 – DSP Goals & Integration with the Clean Energy Plan

Angela Long, Distributed Resources Planning, Manager

August 3, 2022

Report Structure

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Appendix J. Description of solutions to address grid needs
Appendix K. Modernized grid action plan
Appendix L. Capital planning process

Chapter structure sample

Chapter 4. Grid needs analysis

"Prediction is very difficult, especially if it is about the future."
– Niels Bohr

4.1 Reader's guide

PGE's Distribution System Plan (DSP) takes the first step toward outlining and developing a 21st century community-centered distribution system. This system primarily uses distributed energy resources (DERs) to accelerate decarbonization and electrification and provide direct benefits to communities, especially environmental justice communities.[49] It's designed to improve safety and reliability, ensure resilience and security, and apply an equity lens when considering fair and reasonable costs.

WHAT WE WILL COVER IN THIS CHAPTER

The analytical framework for identification of grid needs

A discussion of assessing risk within the distribution system

How grid needs are ranked and prioritized according to the Distribution Planning Ranking Matrix

Identifies 12 grid needs to be prioritized

This chapter provides an overview of PGE's current capabilities, distribution system analysis, the demands on that system, and how we prioritize grid needs. We describe the technical requirements needed to ensure a safe, reliable and resilient system that provides adequate power quality to the customers it serves. We also discuss the process for identifying needs and constraints in the distribution system and include a review of our risk assessment framework.

Table 19 illustrates how PGE has met OPUC's DSP guidelines under Docket UM 2005, Order 20-485.[50]

Table 19. Distribution system overview: Guideline mapping

DSP guidelines	Chapter section
5.2. a	Section 4.2, 4.3
5.2. b	Section 4.4
5.2. c	Section 4.5

DSP… Let's Get Started

Completion of this inaugural DSP sets the stage for us to collaborate on creating the 21st century community-centered distribution system

Goals of the DSP…

- Promote the safe, secure, reliable, resilient, and fair and reasonable distribution system for all customers.
- Be customer-focused and promote inclusion of underserved populations, including frontline, environmental justice communities.
- Ensure optimized operation of the distribution system.
- Enable a clean energy future through efficient integration of DERs and other clean energy technologies.
- Strive for regulatory efficiency through aligned, streamlined processes.

Learning objectives for Part 2…

- How and where utilities are forecasting load growth, DER, and EV adoption.
- How and where utilities identify areas of the distribution system which need investment.
- How utilities consider and evaluate various investments to address grid needs.
- How utilities have evaluated non-wires solutions pilot concept proposals.
- How utilities' community engagement plans were implemented.
- And finally, what investments utilities are planning in the next several years.

PGE's Goals for DSP Part Two

Community Engagement

- Two-way flow of information

- Co-created education material

- Continued partnerships with community experts

Metrics & Data

- Resilience metrics for customer and utility

- Socio-economics

- Demographics

- Cost-benefit analysis

DER Resource Planning

- Adoption analysis for climate change, policy and market transformation

- DEI analysis

- Estimated impacts of electrification adoption

Portfolio Analysis

- Cost-effective DER

- Environmental and social justice community

- Resilience/Outage

- High DER adoption

Strategic Initiatives for Execution

Empowered Communities

Enabling equitable participation in the clean energy transition

Grid Modernization

Enabling an optimized grid platform for a safe, secure, reliable system

Resilience

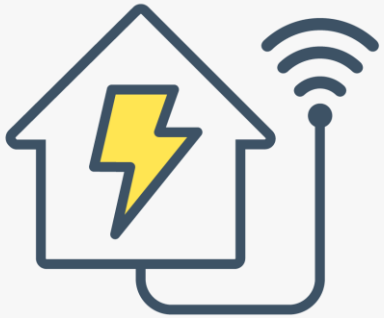
Anticipating, adapting to, withstanding, and quickly recovering from disruptive events

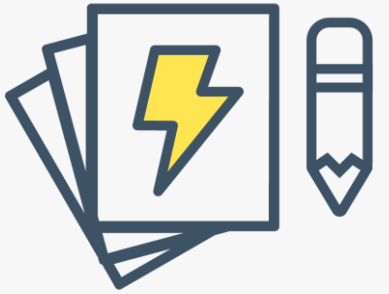
Plug and Play

Improving access to grid edge investments to accelerate customers' clean energy transition

Evolved Regulatory Framework

Evolving the regulatory framework to support utility investment in customer and community centered solutions





Coordinating Plans

Engagement and outreach with regulators, stakeholders, partners, communities, and customers through community-based workshops, technical partnership meetings and the Community Benefits & Impacts Advisory Group (CBIAG

Clean Energy Plan (CEP)

Purpose: Reports emissions reduction progress; defines regular progress and compliance actions. Emerging requirements re: resilience and community energy projects and benefits.

Timeline: March 2023

Differences: Communicates PGE's vision through the lens of HB 2021's requirements

Inputs: IRP action plan; actual and forecasted emissions.

Outputs: Forecast emissions by year; action plan.

Distribution System Plan (DSP)

Purpose: Details vision, goals, and strategic initiatives for the distribution system, develops community engagement (CE) strategies, and DER forecasting and load

Timeline: August 2022

Differences: Accelerates DER adoption; maximizes grid benefits

Inputs: Distribution load forecasting; DER and TE/BE scenario forecasting; cost-effectiveness assumptions; locational forecasting and action plan for T&D and DERs

Outputs: System and feeder-level DER and load forecast; CE Plan; NWS action plan

Integrated Resource Plan (IRP)

Purpose: Identifies long-term resource needs; select best portfolio of resources to meet needs

Timeline: March 2023

Differences: Less flexible process and less nimble than other plans

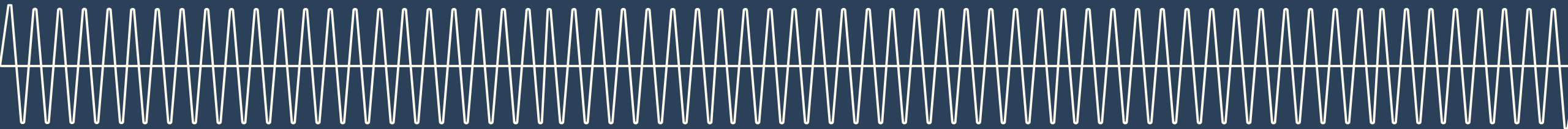
Inputs: Existing resource characteristics; new resource characteristics

Outputs: Action plan of system resource needs

Non-wires Solution

Andy Eiden, Distributed Resource Planning,
Principal Planning & Strategy Analyst

August 3, 2022



DSP Requirements

Requirements for NWS

5.3 d) Evaluate at least two pilot concept proposals in which NWS would be used in place of traditional utility infrastructure investments. Evaluation of these proposals should utilize the community engagement process developed in DSP Part 1and address:

5.3 d.i) Community interest in clean energy planning and projects

5.3 d.ii) Community energy needs and desires

5.3 d.iii) Community barriers to clean energy needs, desires, and opportunities

5.3 d.iv) Energy burden with the community

5.3 d.iv) Community demographics

5.3 d.iv) Any carbon reductions resulting from implementing a NWS rather than providing electricity from the grid's incumbent generation mix

Our approach to addressing these requirements

- Collaborate with community partners to host series of 4 workshops translating technical DSP content to engender authentic input around community needs
- Develop robust portfolios for DER solutions to resolve grid constraints in the NWS proposals based on feedback gathered throughout the DSP monthly Partner Meetings
- Incorporate customer demographic data and community needs into planning, while keeping open dialogue to other ongoing workstreams around development of DEI metrics and data

Non-wires Solutions (NWS)

Definition

- An **investment** intended to **defer**, **reduce**, or **remove** the need for a **specific wired solution** in a specific geographical region to mitigate an identified grid need such as risk of thermal overload, voltage violation, and/or other wide-ranging grid needs.

Location

- An NWS can be located at the transmission system, sub-transmission system, distribution system, and/or a customer site. We will focus on distribution and customer-sited NWS.

NWS Screening

Larger Job Type

- Typical lead time > 2 years to design and construct
- Cost of project is typically higher (>$1 million)
- Geographic footprint is likely to cover a larger area

Smaller Job Type

- Typical lead time 9 months to 2 years to design
- Cost of project is typically lower (<$1 million)
- Geographic footprint is also likely to cover a smaller area than a large project

Grid Needs

Forecasting Certainty

Lead time

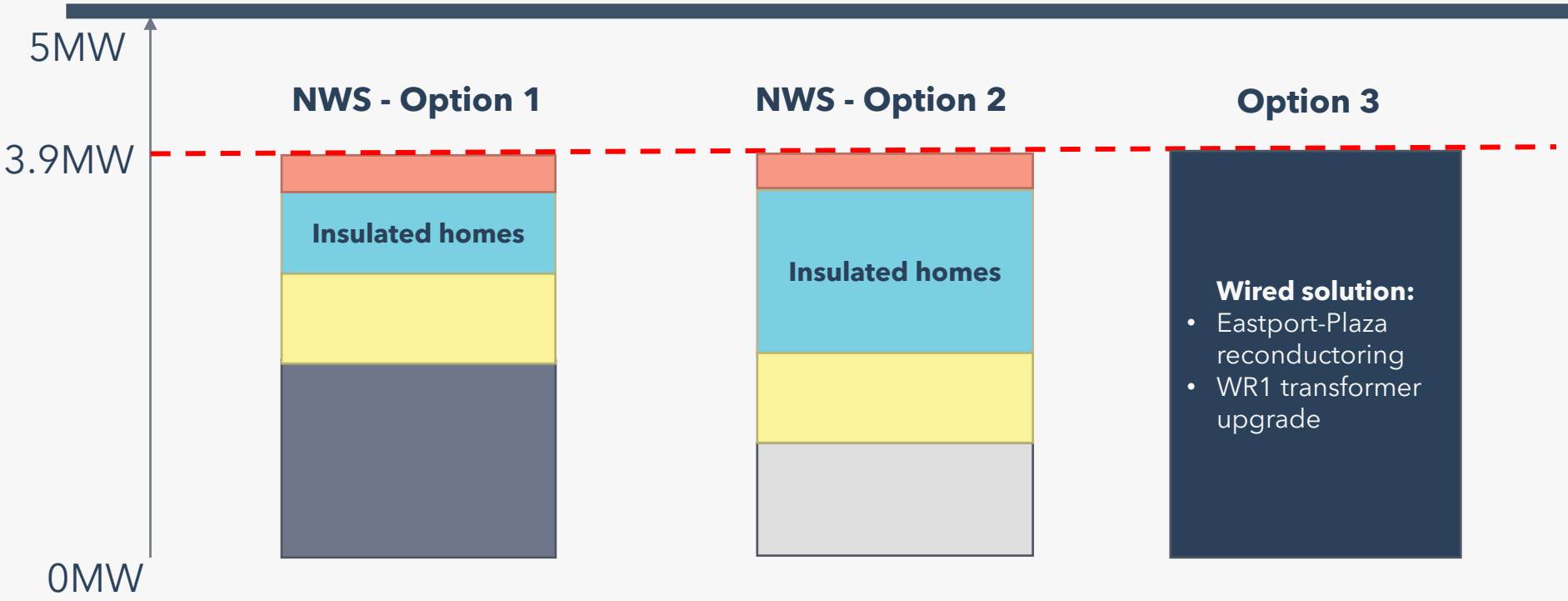
Project Costs

Community Engagement (notify community)

Potential NWS Candidates

Project	Grid Need
Ruby	Heavily loaded feeders
Dayton	**Heavily loaded feeder and transformer**
West Union	Heavily loaded feeders and undervoltage issues
Eastport	**Heavily loaded feeder and transformer**
Clackamas	Heavily loaded feeder

Illustrative Example Only



DER Solutions

Thermostats	$
Energy Efficiency	$$
Battery - Utility	$$$
Solar	$$$
Battery - Customer	$$

Wired Solutions

	$$

Outcomes	Option 1 Community resilience focused	Option 2 Customer bill-relief focused	Option 3 Wired solution
Short-term rate impact	Higher ($$$)	Highest ($$$$)	Lowest ($)
Long-term rate impact	Lower ($$)	Lowest ($)	Higher ($$$)
Community impacts	Short-duration outage resilience	Some customers see reduced outages	More resilient to short-term extreme weather Applicable to all customers
Customer participation	Low-average	Aggressive	None

NWS Portfolio Results

	Eastport			Dayton		
NWS element	**Wired solution**	**Option 1 - Community resilience focused**	**Option 2 - Customer bill - relief focused**	**Wired solution**	**Option 1 - Community resilience focused**	**Option 2 - Customer bill - relief focused**
Total cost	$2.8M	$5.9M	$5.9M	$3.3M	$4.0M	$4.9M
EE potential	N/A	4,000 MWh/yr	5,500 MWh/yr	N/A	0	1,733 MWh/yr
DR / Flex potential	N/A	1.6 MW	2.2 MW	N/A	0	1.5 MW
Solar potential	N/A	2.1 MW (nameplate)	4.7 MW (nameplate)	N/A	0	0.65 MW (nameplate)
Distributed customer storage	N/A	1.2 MW / 2.4 MWh (2-hr)	1.8 MW / 3.6 MWh (2-hr)	N/A	0	0.2 MW / 0.4 MWh (2-hr)
Utility-scale storage	N/A	1.5 MW / 6 MWh (3-hr)	250 kW / 500 kWh (4-hr)	N/A	1.5 MW / 6 MWh (3-hr)	0.25 MW / 1 MWh (4-hr)

NWS Option 1: Community resilience focused includes larger utility-scale storage option
NWS Option 2: Customer bill relief focused includes aggressive customer DER deployment and smaller utility-scale storage

Note: Costs shown are estimates only and may change substantially after further project scoping

Community Needs & Equity Variables

Community Needs

- Reduce energy burden
- Safety during emergencies
  - ✓Protect from smoke during wildfires
  - ✓Manage temperatures during power outrages
  - ✓Maintain power for critical medical equipment customers
- No community left behind with poorly maintained system

Equity Variables

- Energy burden
- Housing type
- Race
- Household without internet
- Household with disabilities
- Rent vs Own

Human-centered Design & Planning

Jenn Latu, Diversity Equity & Inclusion,
Principal Diversity Consultant

Walle Brown
Principal Diversity Consultant, Distributed Resource Planning

Aug 3, 2022

DSP Requirements

Requirements that call for community engagement

- Development of a community needs assessment process
- Co-creating NWS with community
- Reviewing Needs and investments with community

Our approach to addressing these requirements

- Use the practices outlined in the Community Engagement Plan
- Engage CBOs in the development of NWS & learn together:
  - ✓ What it means to co-create
  - ✓ What equity means to CBOs and how it applies to the energy space
  - ✓ How to define community needs

Increasing Competency

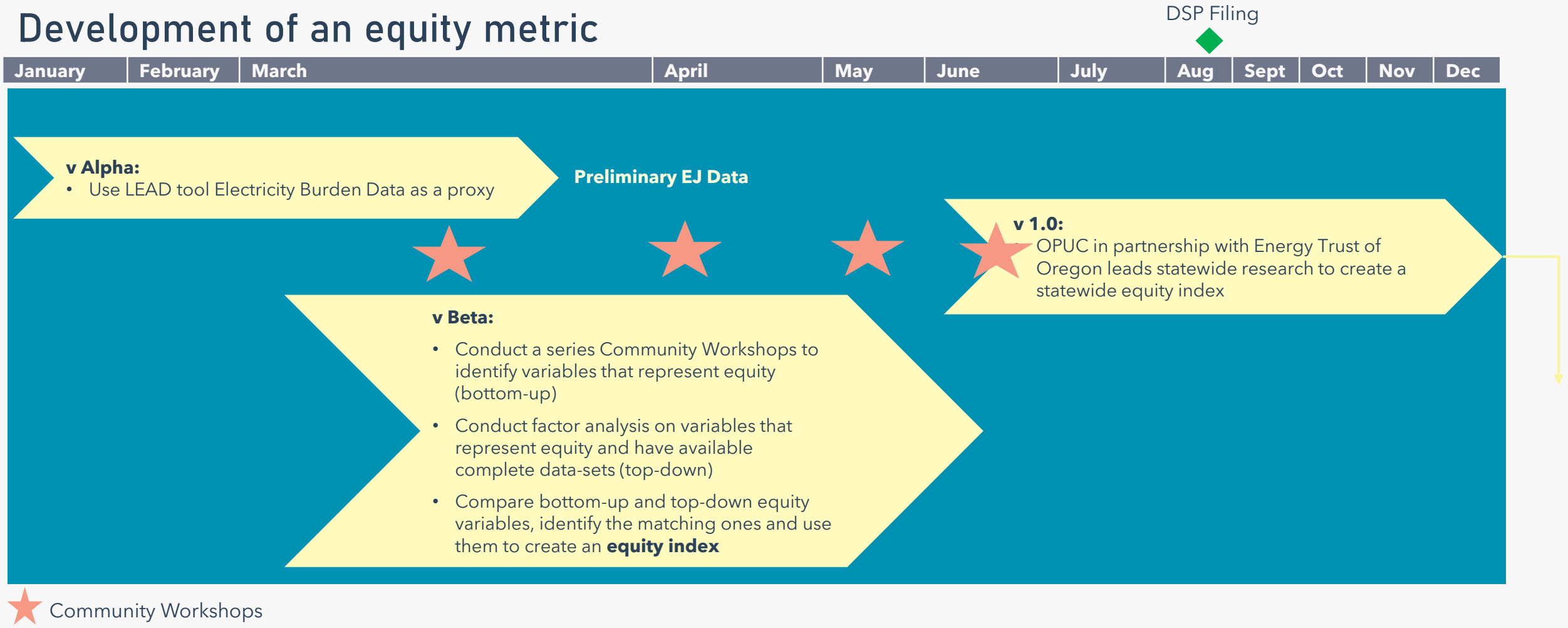
Focus Area	Progress to Date
Develop Competency Build skills and resources that help PGE address our gap in competency in community engagement and operationalizing equity	• Building capacity with the addition of two new DEI-focused community outreach and engagement positions • Internal alignment and coordination efforts ✓ PGE is developing a portfolio-based program approach to how we conduct community outreach and community engagement across our organization ✓ Standing up of the DEI Alignment Council (an internal group that is overseen by the Community Outreach) and Engagement Team whose purpose is to ensure we show up appropriately in our outreach and engagement efforts

Activating Participation

Focus Area	Progress to Date
Activate CBO Participation Center meaningful participation of environmental justice communities	• Continued technically translated monthly Partner Meetings • Creation of a new venue, **Community Workshops**, where the focus is on unpacking the technical aspects of the DSP into more relevant and translatable topics and content ✓ Each workshop in the series informed the content creation for the next ✓ Iterative approach intended to be responsive to the audience and the opportunity to incorporate lessons learned

Unlocking Data

Development of an equity metric



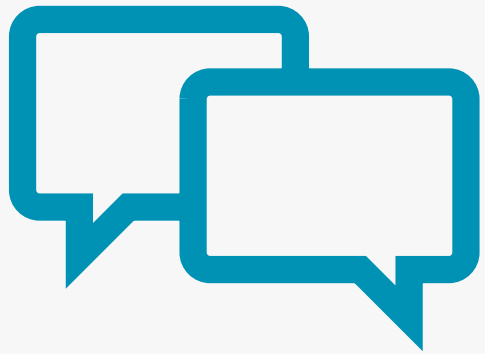
What Did We Do During DSP Part 2?

4
Community Workshops

9
Partner Workshops

Led & Organized Workshops

Designed Survey



Conducted Interviews

What We Heard

Top Themes:

Trust

Community

Finance

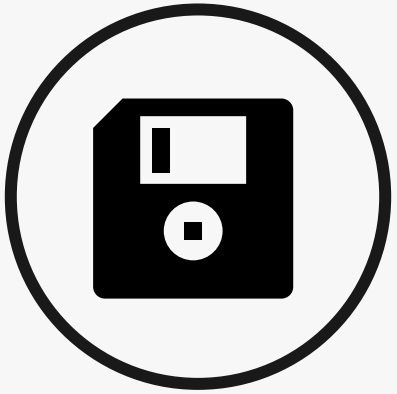
Appreciation

- Accessible facilitation and format
- Real world examples
- Progression and level setting of topics
- NWS and DER stacking

Opportunities

- Compensation
- Duration of meetings and advance notice of meeting times
- Establish a regular schedule/meeting cadence
- Clarity on how participation effects PGE policies and goals
- Need a broader array of people in workshops

What are We Planning for the Future?



Be Data-informed

Surveys & Interviews

Leverage CBO expertise

Be Transparent & Build Trust

Diversify External Stakeholders





Distribution System Planning Chap 1, 4, 5

Jennifer Galaway, Distribution Planning, Manager

August 3, 2022

PGE

DSP Requirements – Grid Needs

Requirements for Grid Needs Analysis

5.2 a) Document the process used to assess grid adequacy and identify needs.

5.2 b) Discuss criteria used to assess reliability and risk, and methods and modeling tools used to identify needs.

5.2 c) Present a summary of prioritized grid constraints publicly, including criteria used for prioritization.

5.2 d) Provide a timeline by which the grid need(s) must be resolved to avoid potential adverse impacts.

Our approach to addressing these requirements

- Described the current state process, our planning criteria, and guiding principles
- Prioritized the identified grid needs using a ranking matrix and presented to stakeholders
- Presented grid needs to DSP stakeholders
- Discussed size/need and timing of constraints

DSP Requirements – Solutions

Requirements for Solution Identification:

5.3 a) Document the process to identify the range of possible solutions to address priority grid needs.

5.3 b) For each identified Grid Need provide a summary and description of data used for distribution system investment decisions including: discussion of the proposed and various alternative solutions considered, a detailed accounting of the relative costs and benefits of the chosen and alternative solutions, feeder level details (such as customer types on the feeder; loading information), DER forecasts and EV adoption rates.

5.3 c) For larger projects (this may exclude, for example, regular maintenance projects, or inspection projects), engage with impacted communities early in solution identification. Facilitate discussion of proposed investments that allow for mutual understanding of the value and risks associated with resource investment options.

5.3 d) Evaluate at least two pilot concept proposals in which non-wire solutions would be used in the place of traditional utility infrastructure investment. The purpose of these pilots is to gain experience and insight into the evaluation of non-wire solutions to address priority issues such as the need for new capacity to serve local load growth, power quality improvements in underserved communities.

DSP Requirements – Solutions

Our approach to addressing Solution Identification requirements

- Documented the process used to identify possible solutions and presented to stakeholders
- Presented a high-level overview of each project/solution to stakeholders, with a more detailed description of each project in the report
- Described our planning and capital budget cycles and how Community Engagement will begin with this year's cycle (for 2024 capital planning)
- Two NWS pilot projects developed in coordination with DRP team, discussed with stakeholders and in document (NWS chapter)

The Seven Steps of the Current Planning Process

1 

WHAT IS THE PROBLEM

2 

WHERE IS THE PROBLEM LOCATED

3 

FINDING SOLUTIONS

4 

WHAT ARE THE LIMITATIONS TO THE SOLUTIONS

5 

WHAT ARE THE BENEFITS AND RISKS OF THE SOLUTIONS

6 

ARE THERE ADDITIONAL IMPACTS TO THE SOLUTIONS

7 

RECOMMENDATIONS

Current Planning Process: Guiding Principles

Plan to peak

PGE plans the distribution system to serve customers even at extreme temperatures, at the largest power demand at a given point during a year

Planning criteria for equipment loading

target loading is less than 67% for feeders, less than 80% for transformers to have capacity to move load around on the system

Target system flexibility at both the transformer and feeder level

all load picked up by switching to other equipment for the loss of a single element

Customer-driven projects

take priority, e.g., large housing development, manufacturing facility, industrial park

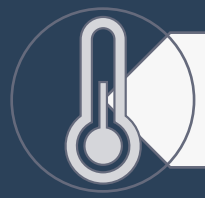
Ensure new infrastructure is planned for the long-term forecasted load in the area

when PGE implements a project, we aim to not have to do another project on the affected equipment for at least 10 years

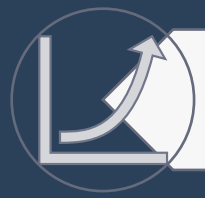
Prioritizing Grid Needs: Ranking Matrix

Level 5: Safety and customer commitment

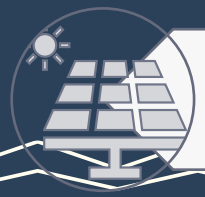
Level 4: Impacts to other facilities



Level 3: Heavy loading, telemetry, & substation risk



Level 2: Feeder risk, load growth, & redundancy



Level 1: System utilization & DG readiness

Prioritized List of Grid Needs

Ranking	Grid Need	Type of Need/Constraint	Size of Need/Constraint	Timing/Duration of Need/Constraint	Level 5 Score	Level 4 Score	Level 3 Score	Level 2 Score	Level 1 Score	Total
1	Industrial load growth in North Hillsboro	Overload, Load Growth	From 91 MVA in 2024 to 270 MVA in 2030 serving multiple large data centers	24/7 due to the nature of data center operations	75	40	18	14	2	**149**
2	Commercial load growth in Woodburn area and 57 kV system constraints	Overload (Distribution and Sub-Transmission), Voltage Issues (Sub-Transmission), DG Readiness, Load Growth	7 MVA on the distribution system	Approximately 5-11 PM, summer for distribution. Summer and Winter seasons for Sub-Transmission.	0	80	9	12	1	**102**
3	Existing loading issues and industrial load growth in Silverton	Overload, Load Growth	8 MVA starting in 2023/2024	Afternoon through late evening, summer	75	0	9	12	0	**96**
4	Aging infrastructure, heavily loaded transformer and feeders, lack of telemetry east of Oregon City	Overload, Aging Infrastructure, Lack of SCADA Telemetry	10 MVA	Summer and Winter seasons, evenings for overload; 24/7 for aging infrastructure, lack of telemetry	0	20	36	26	2	**84**
5	Substation with high arc flash concerns, commercial load growth in St Helens	Aging Infrastructure, Safety, Lack of Facilities to serve new load	7 MVA	24/7	75	0	0	8	0	**83**
6	Industrial load growth in Gresham	Overload, Load Growth	6 MVA starting in 2023/2024	24/7 due to nature of load being served	75	0	0	6	0	**81**

Prioritized List of Grid Needs

Ranking	Grid Need	Type of Need/Constraint	Size of Need/Constraint	Timing/Duration of Need/Constraint	Level 5 Score	Level 4 Score	Level 3 Score	Level 2 Score	Level 1 Score	Total
7	Commercial load growth south of Woodburn and 57 kV system constraints	Overload (Sub-Transmission), Voltage Issues (Sub-Transmission), DG Readiness	Sub-Transmission System Issue	Summer and Winter seasons for Sub-Transmission.	0	60	3	14	1	**78**
8	Capacity addition to implement other grid need mitigations, temporary equipment being utilized for support in inner SE Portland	Temporary Equipment, Aging Infrastructure, Non-Standard Equipment, Dependency for other Projects	Transformer and feeder capacity needed to support adjacent substation rebuilds	24/7	0	60	3	10	0	**73**
9	Residential load growth in the Happy Valley area, temporary equipment being utilized for support	Overload, Load Growth	2 MVA, increasing to 14 MVA by 2025	Summer, approximately 2-9 PM	0	20	18	20	0	**58**
10	Transformer failure resulting in capacity constraints, aging infrastructure in the Boring area	Overload, Aging Infrastructure	2 MVA, increasing to 5 MVA by 2025	Aging infrastructure 24/7; overload in summer, approximately 2-7 pm	0	20	18	16	1	**55**
11	Capacity addition to implement other grid need mitigations in SW Portland, lack of SCADA telemetry, feeder reliability improvements	Aging Infrastructure, non-standard equipment, capacity to support other rebuilds, lack of SCADA telemetry	33 MVA to support adjacent substation substation rebuilds	Aging infrastructure 24/7; overload in summer, approximately 2-7 pm	0	40	9	4	1	**54**
12	Existing loading issues and residential development in the Murrayhill/Scholls areas resulting in capacity constraints	Overload, Load Growth	2 MVA, increasing to 13 MVA by 2027	Currently summer late afternoons to early evenings; more prevelant as load increases	0	0	18	20	0	**38**

Prioritized List of Solutions

Solutions are ranked using same matrix as the Grid Needs at the project level

Rankings between grid needs & solutions did not change for 2023 capital cycle. This will not always be the case.

Prioritized list of solutions presented were the solutions identified in 2021 that were submitted for the 2023 capital planning cycle

Twelve total solutions prioritized for portfolio to consider

Prioritized List of Solutions

	Grid Need	Project	Ranking Total
1	Industrial load growth in North Hillsboro	Evergreen	149
2	Commercial load growth in Woodburn area and 57 kV system constraints	St Louis	102
3	Existing loading issues and industrial load growth in Silverton	Silverton	96
4	Aging infrastructure, heavily loaded transformer and feeders, lack of telemetry east of Oregon City	Redland	84
5	Substation with high arc flash concerns, commercial load growth in St Helens	Kaster	83
6	Industrial load growth in Gresham	Glisan	81

Prioritized List of Solutions

	Grid Need	Project	Ranking Total
7	Commercial load growth south of Woodburn and 57 kV system constraints	Waconda	78
8	Capacity addition to implement other grid need mitigations, temporary equipment being utilized for support in inner SE Portland	Harrison	73
9	Residential load growth in the Happy Valley area, temporary equipment being utilized for support	Linneman	58
10	Transformer failure resulting in capacity constraints, aging infrastructure in the Boring area	Boring	55
11	Capacity addition to implement other grid need mitigations in SW Portland, lack of SCADA telemetry, feeder reliability improvements	Glencullen	54
12	Existing loading issues and residential development in the Murrayhill/Scholls areas resulting in capacity constraints	Scholls Ferry	38

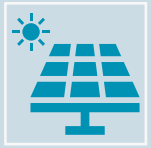
Future State

- Using **DER forecast** for Grid Needs
- Incorporate **Equity** into Ranking Matrix (Level 3)
- Evaluate all Grid Needs with the **Non-Wires Solutions** criteria to determine if they should be considered for Non-Wires Solutions
- **Community Engagement** at both the Grid Needs and Solution Identification stages

Next Steps

Meeting in early Fall to present 2024 Grid Needs

Begin Community Engagement process shortly after for 2024 Grid Needs



Evaluate 2024 Grid Needs for both Traditional (“Wired”) and Non-Wires Solutions (if applicable)

5 Minute Break

Load & DER Forecast

Andy Eiden, Distributed Resource Planning,
Principal Planning & Strategy Analyst

August 3, 2022

DSP Requirements

Requirements for Load and DER Forecast

5.1 a) Discussion of current utility processes for distribution system load growth

5.1 b) Forecast of DER adoption and EV adoption by substation

5.1 c) Results of load growth, DER adoption, and EV adoption

Our approach to addressing these requirements

- Report on both current and future state practices to provide baseline knowledge about existing load forecasting methods while also highlighting areas we've identified to improve
- Elaborate distribution system load growth methodologies and DER forecasting methodologies separately, indicating areas for potential synergy in subsequent DSP rounds
- Provided high-level results in the body of the report for purposes of readability and included detailed substation-level DER adoption results in separate appendix table

Load and DER Forecasting Overview

As we modernize the grid, we are also increasing our ability to plan for expected contributions and impacts from distributed energy resources (DERs)

We are improving our DER forecasting tools to provide locational insights and integrating these practices and forecast results into our core distribution system planning functions

The load and DER forecasts that drive PGE's distribution system-needs-assessment & solutions-identification-activities include:

- **Corporate load forecast:** We review the key assumptions and drivers, as well as highlight areas for improvement to better forecast growth on the distribution level
- **Bottom-up load additions:** Throughout the year, our teams collect detailed information across a range of areas that impact the distribution grid (e.g., new permit activity, zoning changes, announced customer plans, and new service requests)
- **DER locational forecasting:** We describe our DER forecasting methodology, using our AdopDER tool, including results of the disaggregated forecast at the locational level

DER and Flex Load Potential Study

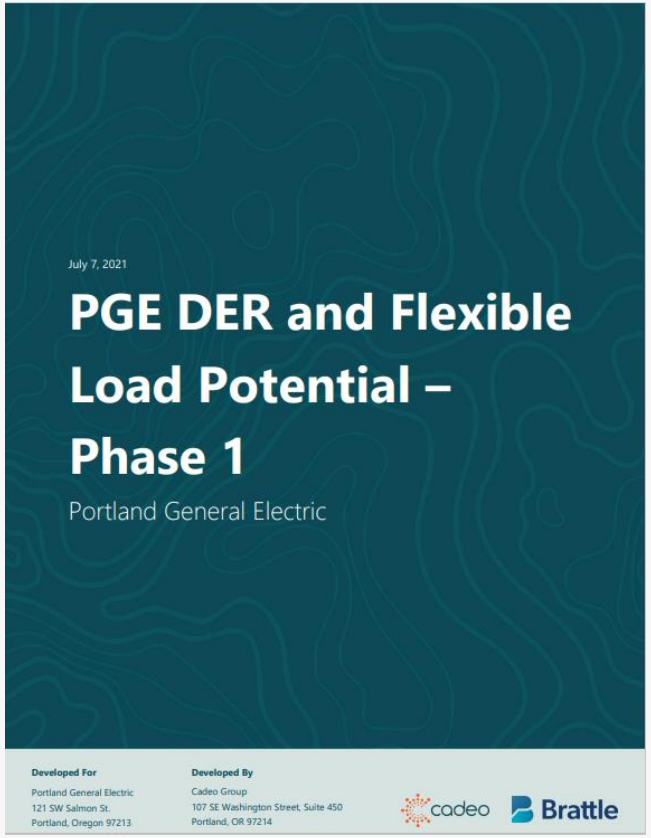
PGE is required to include forecasted demand-side resources in the IRP and DSP

- IRP has long history of forecasting DR and EE
- DSP forecast is new this year as result of UM 2005

Study covers forecast of the following distributed energy resources (DERs)

- Energy efficiency (done by Energy Trust)
- Demand response / flex loads
- Distributed rooftop PV
- Distributed battery storage
- Electric vehicles and charging needs

Full study available online as Appendix G to the DSP Part I, available at: https://portlandgeneral.com/about/who-we-are/resource-planning/distribution-system-planning



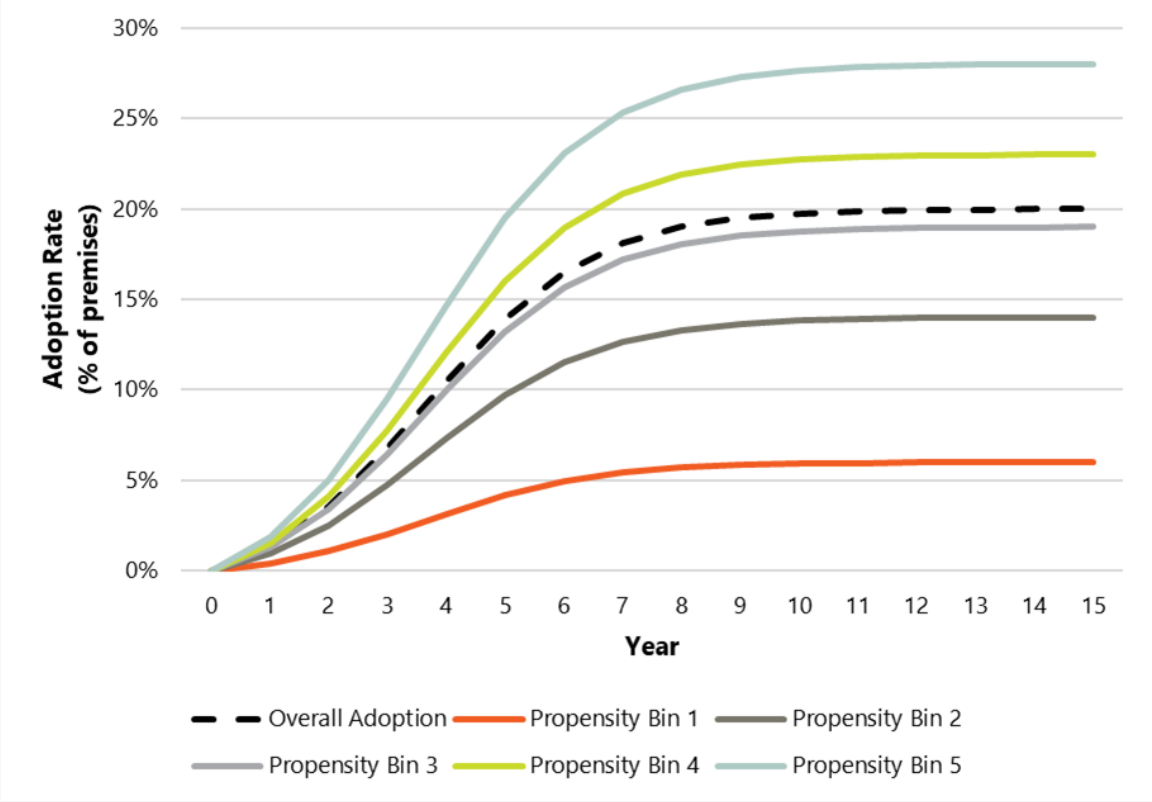
Locational Propensity Modeling

AdopDER generates propensity models to predict consumer differences in DER adoption patterns **across spatial dimensions**

Model calculates propensity in probabilistic fashion that **evolves over time**

- Calculates propensity score for each year / customer premise / DER type
- For example, if someone adopts solar, their neighbors become more likely to adopt in the next time-step given the "neighbor" effect
- Cumulative impact is to disaggregate "overall adoption" at service area level into feeders and substations

Illustration: Scorecard-based Adjustment to Adoption Rate



DER Forecast Results – Flex Loads
(cumulative)

Demand Response Summer MW Peak Impacts									
All Achievable Potential									
Scenario	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
High	200	250	271	298	310	326	343	359	385
Ref	81	112	146	183	211	236	257	274	294
Low	70	82	98	118	137	155	173	187	201
Cost-effective Achievable Potential (TRC >=1)									
Scenario	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
High	195	239	256	273	278	282	287	287	294
Ref	78	105	133	162	183	199	211	218	228
Low	68	79	93	110	126	141	155	166	177

DER Forecast Results – Flex Loads
(cumulative)

Demand Response Winter MW Peak Impacts									
All Achievable Potential									
Scenario	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
High	102	145	174	191	204	219	234	259	282
Ref	56	78	106	134	158	177	194	213	231
Low	48	57	68	83	99	113	127	141	152
Cost-effective Achievable Potential (TRC >=1)									
Scenario	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
High	100	139	165	176	183	188	192	199	205
Ref	54	74	98	119	137	149	158	167	174
Low	47	55	66	79	92	104	115	126	134

DER Forecast Results – Solar + Storage (cumulative)

Solar PV Potential (Nameplate MW-dc)									
Scenario	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
High	148	155	161	186	210	253	297	377	458
Ref	144	149	154	173	192	226	261	318	377
Low	144	147	150	154	157	160	164	167	172

Energy Storage Potential (Nameplate MW-dc)									
Scenario	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
High	5	6	7	13	21	35	49	77	105
Ref	4	5	5	9	13	22	31	46	61
Low	4	4	5	5	6	6	7	8	9

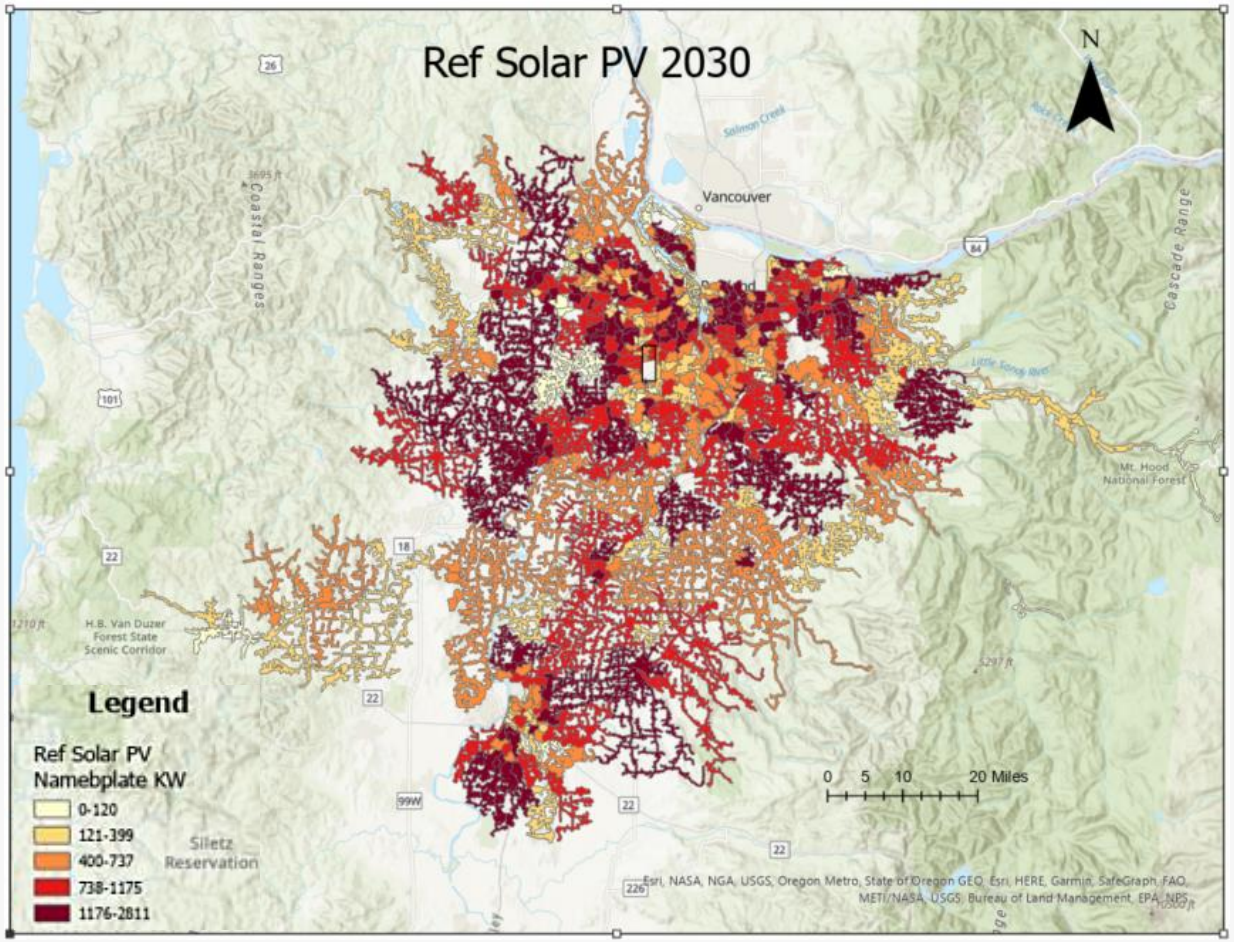
DER Forecast Results – Electrification (cumulative)

Transportation Electrification Potential (MWa)									
Scenario	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
High	13	21	30	40	53	68	86	109	135
Ref	12	19	26	35	45	57	72	90	111
Low	12	17	22	29	36	45	55	67	82

Building Electrification Potential (MWa)									
Scenario	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
High	3	7	10	16	21	27	33	39	45
Ref	3	7	10	14	18	22	27	31	36

DER Forecast – Locational Results

- Forecast disaggregated to feeder-level and reported at substation for each DER type
- Worked into T&D 5-year forecast and will be included in 2024 capital planning cycle
- Solar PV locational forecast will be compared with “DG-ready” substation plans and hosting capacity results
- Working with TE team to identify new data sources and methods for MDHDV growth and improve ability to identify large capacity additions early



Lessons Learned & Next Steps

The planning function for DER forecasting is a critical need at PGE as we scale the Virtual Power Plant

- Integrating DER forecast into IRP for their capacity and energy contributions
- Coordinating with Flex Load Multi-year Plan team to inform near-term budget exercises
- Working with TE team to ensure alignment between DSP forecast and TE Plan

Detailed DER forecasting for enterprise-wide applications requires more resources

- More resources to integrate AdopDER into distribution planning systems
- More analyst time for detailed model quality accuracy & quality control (QA/QC) resulting from distribution level forecast
- Outputs from DER forecasting feed into multiple other channels (CEP, IRP, TE)

Need better alignment in tools and process between groups

- Leverage in-house GIS database and capabilities to store AdopDER spatial data
- Coordinate DER forecast methodology with corporate load forecasting

Near Term Action Plan

Joe Boyles, Distributed Resource Planning,
Project Manager

Aug 3, 2022

DSP Requirements

Requirements for Near-term action plan

5.4.a) Action Plan: Provide a 2–4-year plan consisting of the utility's proposed solutions to address grid needs and other investments in the distribution system

5.4.b) Projected spending: Disclose projected system spending to implement the action plan, timeline for improvement, and anticipated requests for a cost recovery mechanism

5.4.c) Relation to other investments: As applicable, the Action Plan should identify areas of relation and interaction with other investments such as transmission projects and demand response programs

5.4.d) Document current innovations and pilots being conducted to improve, modernize, and/or enhance the grid beyond its current capabilities

Our approach to addressing these requirements

- Presented two sets of investments (projects/programs) and dollars:
  - ✓ specific projects that address the prioritized grid needs identified in the Grid Needs Analysis chapter – constraints and asset health
  - ✓ investments, by category, that are in the T&D Capital Portfolio
- Presented the costs over the next four years. There are no new cost recovery mechanisms being proposed.
- Describe Modernized Grid, Resilience and Plug and play investments:
  - ✓ supporting future DER adoption
  - ✓ represent PGE's efforts to improve, modernize and enhance the grid beyond its current capabilities.

T&D Investments by Category

Investment types (# of projects)	2023	2024	2025	2026	Total
Capacity/Flexibility	9	10	13	7	39
Customer/Partner	24	19	17	13	73
Compliance	22	18	14	9	63
Reliability	21	21	24	19	85
Operations	4	4	4	4	16
Total	**80**	**72**	**72**	**52**	**276**

Note: Investments may change considerably depending on regulatory and other priorities

Current T&D Project Categorization

Portfolio	Sub-Portfolio	Category
Transmission and 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 requirement 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

DSP Investment Categories

- System expansion or upgrades for capacity
- New Customer Projects
- System expansion or upgrades for reliability and power quality
- Preventive maintenance
- Age-related replacements
- Metering
- Grid modernization*

*** Not included in the T&D portfolio**

Grid Modernization Investments

Grid modernization investments
Investments into customer DER portal needed to develop a customer DER device management platform, enhance customer billing and settlements, streamline interconnections and customer communications
Design of a Virtual Power Plant with expansion capabilities needed to meet HB 2021 targets
Investments for planning and engineering capabilities needed to enhance PGE's AdopDER model, development of a Next Generation Planning Tool, DER data management systems, and updates to cost-benefit model and tools for NWS
Investments into grid management systems for ADMS for critical infrastructure and distribution automation (DA)
Investments into sensing, measurement, and automation, telecommunication and cybersecurity

Long-term Actions

DG-readiness updates for system protection

EV charging readiness

Utility incentives for operator role

Comparable treatment of NWS and VPP and traditional investments

Distributed energy resource cost-effectiveness

- Consistency and alignment
- Robust decision-making framework
- Operational efficiencies
- Program development and implementation

High Level – DSP Action Plan

Investment Summary ($M, incurred)	2023	2024	2025	2026	Total
Traditional T&D Investments for Customers, Reliability, Safety and Compliance	**$ 285.0**	**$ 285.0**	**$ 285.0**	**$ 285.0**	**$ 1,140.0**
Prioritized Grid Needs (included in Traditional T&D investments)	$ 55.3	$ 56.3	$ 87.1	$ 28.7	$ 227.4
Grid Modernization Investments	**$ 40.0**	**$ 40.0**	**$ 40.0**	**$ 40.0**	**$ 160.0**
Total T&D & Grid Mod Investments	**$ 325.0**	**$ 325.0**	**$ 325.0**	**$ 325.0**	**$ 1,300.0**

Note: Investments may change considerably depending on regulatory and other priorities

Prioritized Grid Needs

Prioritized Grid Needs Investment Summary
1 Evergreen
2 St. Louis
3 Silverton
4 Redland
5 Kaster
6 Glisan
7 Waconda
8 Harrison
9 Linneman
10 Boring
11 Glencullen
12 Scholls Ferry
Total Investment - $227.4M over four years (2023-2026)

Note: Investments may change considerably depending on regulatory and other priorities

Future State

Continue to work toward **transparency** –
focus on providing **information that delivers value**

Incorporating actions related to the
Clean Energy Plan

Investments in **non-wires solutions**

Let's meet the future together.

You can reach us at:

DSP@PGN.com

Next Steps

Important Dates

Aug 15	Aug- Jan	Sep 15	2023
DSP Part 2 Report filing	Public Review	Special Public Meeting	DSP Revised Guidelines

Appendix

DSP Part Two Framing

Angela Long, Distributed Resources Planning, Manager

DSP Part Two Requirements Summary

Due August 15, 2022

Forecasting of Load Growth, EV/DER Adoption

- Describe **current state for Load Forecast** – process, tools, data
- DER/EV:
  - Forecast methodology and geographic allocation
  - **Adoption by substation** - high/med/low scenarios
  - Forecast of load growth and adoption

Grid Needs Analysis

- Document process to assess grid adequacy and identify grid needs
- Discuss criteria used to assess reliability and risk – methods and modeling tools used
- **Present prioritized constraints publicly**, including prioritization criteria and timeline to resolve constraints

Solution Identification

- Document process for identifying the range of solutions to address grid needs
- **For each need, describe the data used to support investment decisions**
- For large projects, describe process for engaging communities and getting input
- **Propose 2 NWS pilot projects**

Near-term Action Plan (2-4yrs)

- Provide 2-4 yr. plan to address grid needs
- **Disclose planned spending, timeline and recovery mechanism**
- Discuss relationship between planned investments
- Discuss pilots being conducted to enhance the grid

Goals of DSP Part Two

Community Engagement

- Two-way flow of information

- Co-created education material

- Continued partnerships with community experts

Metrics & Data

- Resilience metrics for customer and utility

- Socio-economics & Demographics

- Cost-benefit analysis

DER Resource Planning

- Climate risk modeling

- Decarbonization

- NWS, Locational

- DEI/Equity

- Estimated impacts of electrification adoption

Portfolio Analysis

- Cost-effective DER

- Environmental and social justice community

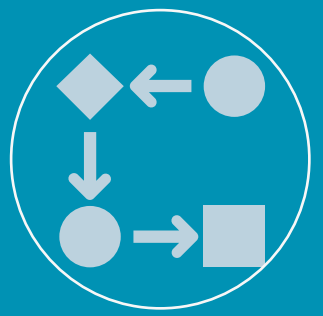
- Resilience/Outage

- High DER adoption

High Level – Project Timeline

Planning: Developing the approach to address Part 2 requirements

Oct – Dec 2021



Executing: Co-creating an inclusive Distribution Planning process

Jan – May 2022

Reporting: Documenting the process changes and the plan to enact them

Jun – Aug 2022

Filing DSP Part 2

Aug 15, 2022

Engaging Our Communities

Our objective is to foster **procedural equity and ensure diversity of voice** in the DSP planning process.

To accomplish this, we will continue to partner with Community-based Organizations (**CBOs) and other organizations that have longstanding relationships and establish trust in environmental justice communities** to:

- Co-develop solutions for NWA pilot projects
- Co-create community workshops to identify community energy needs, desires, barriers and interest in clean energy planning and projects
- Co-develop community education around key DSP practices and relevant energy related concepts

Identifying Grid Needs for NWS Pilots

Step 1: What is the problem?

Prioritized grid needs for capital cycle

Potential future grid needs/ lower priority grid needs

NWS pilot candidates for the DSP