Distribution System Planning (DSP)

Angela Long, Manager, Distribution Resource Planning (DRP)

February 10, 2021 | Workshop 2

PGE

Meeting Logistics

- We are available at: DSP@pgn.com
- 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
  - There is now a meeting chat feature rather than a Q&A feature. Pull this up on the menu bar when you move your mouse and look for the little message icon

Agenda

- Runway
- DSP Timeline
- Distribution Planning 101
- Break
- DER Potential & Flex Load Assessment 101
- Community Engagement
- Question/Next Steps

Runway

Overview of last meeting

PGE's first DSP workshop, January 10, 2021, received a high turnout; with approximately 60 partners.

Topics include:

Distribution System Plan (DSP) Overview:

- Derrick Harris, PGE Manager of Distribution Planning, provided an overview of the Evolution of Distribution System Planning, reviewing the historical delivery paradigm and the modern grid and current/future demands.
- Andy Eiden, PGE Distributed Resource Planning (DRP) Senior Analyst, presented on grid edge technology, and history of Distributed Energy Resource (DER) modeling at PGE.

DSP Details:

- Angela Long, PGE Manager of DRP, reviewed the project timeline and gave a high-level overview of the requirements for the DSP. She provided details on the approach, key components for planning, and other requirements and recommendations that will be kept in the forefront of the planning process.
- McKena Miyashiro, PGE Principal Diversity Consultant, discussed the importance of engaging the community and ensuring equity and diversity of voice in the DSP planning process.

Workshop #1 – Topics of interest

Transparency	Active involvement in the community engagement process	Stronger partnerships between customers and utilities	Education because there is a steep learning curve for those without a utility background	Usable, understandable mapping and website design	Flexibility and innovation
Monthly Partner Meetings	Community Facilitator (discussed later in the presentation)	Community Facilitator	Distribution Planning 101	Host Capacity Analysis	Evolving Agendas
DSP Website		Community and Technical Workshops	DER Assessment	DSP Website	Community Facilitator
DSP Timeline					Non-wires Alternative

Workshop #1 – Topics of interest

Diversity, equity and inclusion throughout the process
- Community Engagement Plan

Keeping disadvantaged communities at the forefront of the project planning
- Community Facilitator
- Non-wires Alternatives
- Data & Analytics

Geographic equity
- Hosting Capacity Analysis
- DER Potential and Flex Load Study
- Non-wires Alternatives

Role of building decarbonization
- DER Forecasting

Data gathering and reporting
- DER Forecasting
- Hosting Capacity Analysis
- Baseline Data and System Assessment

Keep costs down for rate payers when implementing climate change initiatives
- DER Forecasting
- UM 2099
- UM 2111

Parking Lot

Question/Comment	Partner	Name	Response
Will you be implementing a green button/utility API type solution for the interval data from customers?	Community Energy Labs	Tanya Barham	Pending

DSP Timeline

Proposed partner engagement timeline

		2021									
		January	February	March	April	May	June	July	August	September	October
Distribution System Planning (DSP) plan - Part 1	Baseline data and system assessment	Data collection, organization, QA/QC, and visualization				Present to partners for feedback	Iterate as necessary	Final draft shared with partners		PGE review process	Filed on Oct 15th
	Hosting capacity	System evaluation map and hosting capacity option analysis					Present to partners for feedback	Iterate as necessary	Final draft shared with partners	PGE review process	Filed on Oct 15th
	Community engagement plan	Development of the Community Engagement Plan							Present to partners for feedback	PGE review process	Filed on Oct 15th
	Long term planning	Development of long-term plan						Present to partners for feedback	Final draft shared with partners	PGE review process	Filed on Oct 15th

Distribution Planning 101

Introduction

Derrick Harris, PGE, Distribution Planning Manager

About Me

- Portland Native (Grew up in Concordia Neighborhood)
- Benson Polytechnic High School Graduate (1995)
- Oregon State University Graduate, BSEE (2000)
- PGE Core Area Distribution Engineer (2000–2008)
- PGE T&D Planning Engineer (2008-2012)
- Distribution Planning Lead (2012-2015)
- Distribution Planning Manager (2015-Present)

PGE's Distribution Planning Team

Aaron Banks Beaverton/Wilsonville
- Non-Wires Alternative (NWA)

Justin Graff Hillsboro
- Load/DER Forecasting

Josh Davis Salem
- Interconnections

Amrit Rajagopal Oregon City
- Smart Grid

Luke Depiesse Gresham
- Transportation Electrification, NWA

TBD Portland
- Engineer #1 – System Modeling
- Engineer #2 – Secondary Network Modeling/Operations
- Summer Intern #1 – College Student
- Summer Intern #2 – High School (STEM)

Responsibilities

Perform	Perform system analysis and prepare plans to ensure that the distribution system will be operable and maintain functionality and flexibility in the near and long term
Provide	Provide support and guidance on distribution related investment decisions
Maintain and Deliver	Maintain and deliver distribution system models
Support	Support grid modernization plans

Distribution Information

1.9 million population

4,000 square miles

~900,000 customers

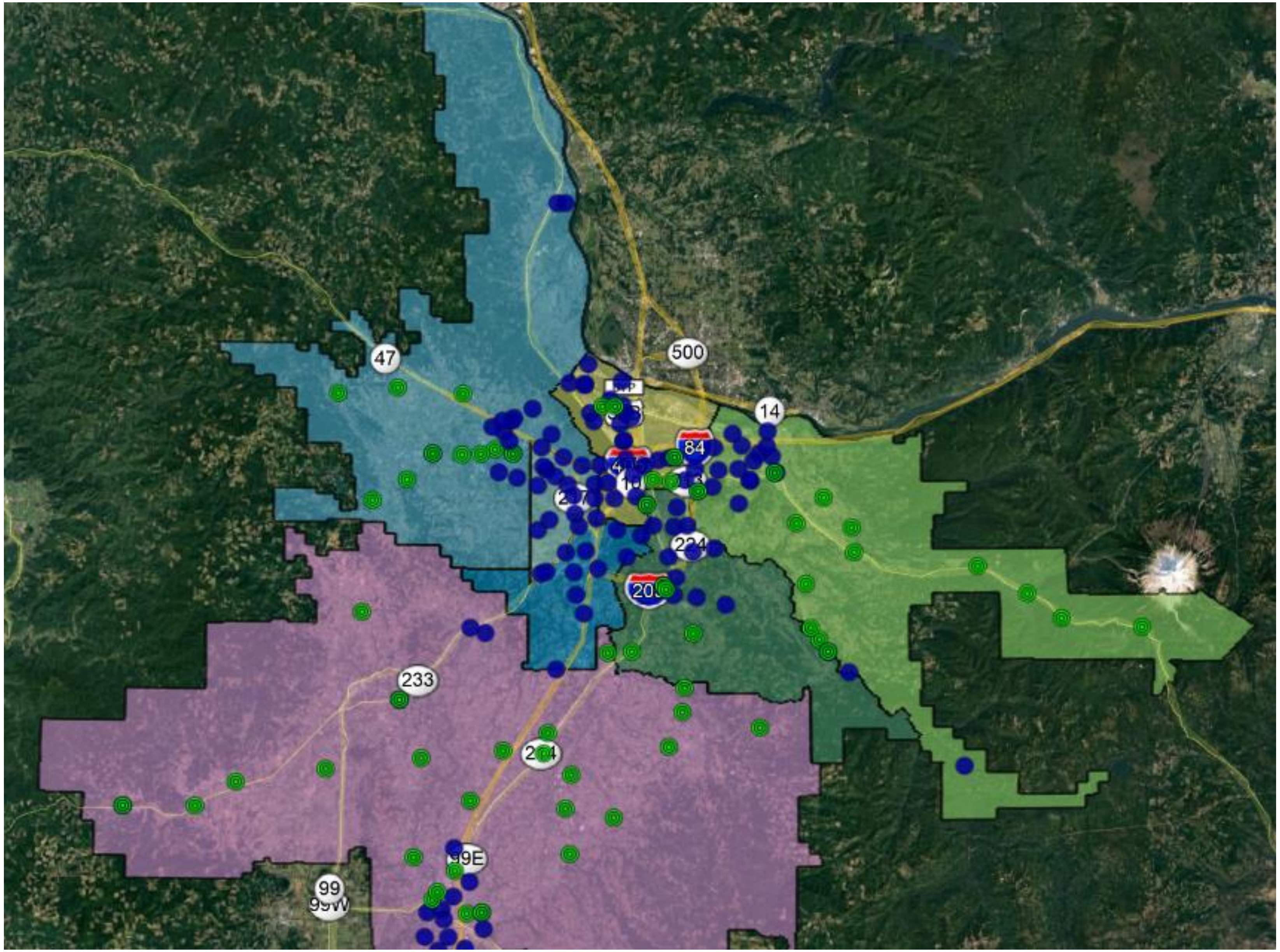
149 distribution substations

300 distribution power transformers

648 distribution feeders

Peak Summer Net System Load – 3,964 MW

Peak Winter Net System Load – 4,063 MW



Detailed Study Indicators

Drivers

- Economic development
- Load growth/Forecasts
- Lumped load additions
- Modernization
- Regulatory requirements
- Safety
- Substandard equipment
- Urban growth boundary expansion
- Zoning changes

Expected Results

Goals

- Enhance safety
- Increase reliability
- Meet customer needs
- Meet standards/Requirements
- Option optimization
- Reduce risk (Likelihood x Consequence)

Planning Process

PROBLEM STATEMENT

METHODOLOGY

STUDY AREA

ANALYSIS

CONTINGECIES AND CONSTRAINTS

BENEFITS AND RISKS

ADDITIONAL IMPACTS

RECOMMENDATIONS

Problem Statement

Determine reasoning as to why the current existing system is not adequate. This does not require any solutioning, just identification.

Key Indicators

System Weak Link Report / Minimum Load – Indicates equipment and conductors approaching certain limits or thresholds

System Assessments – Indicates potential problematic T&D areas when the system is most stressed

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

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

Methodology

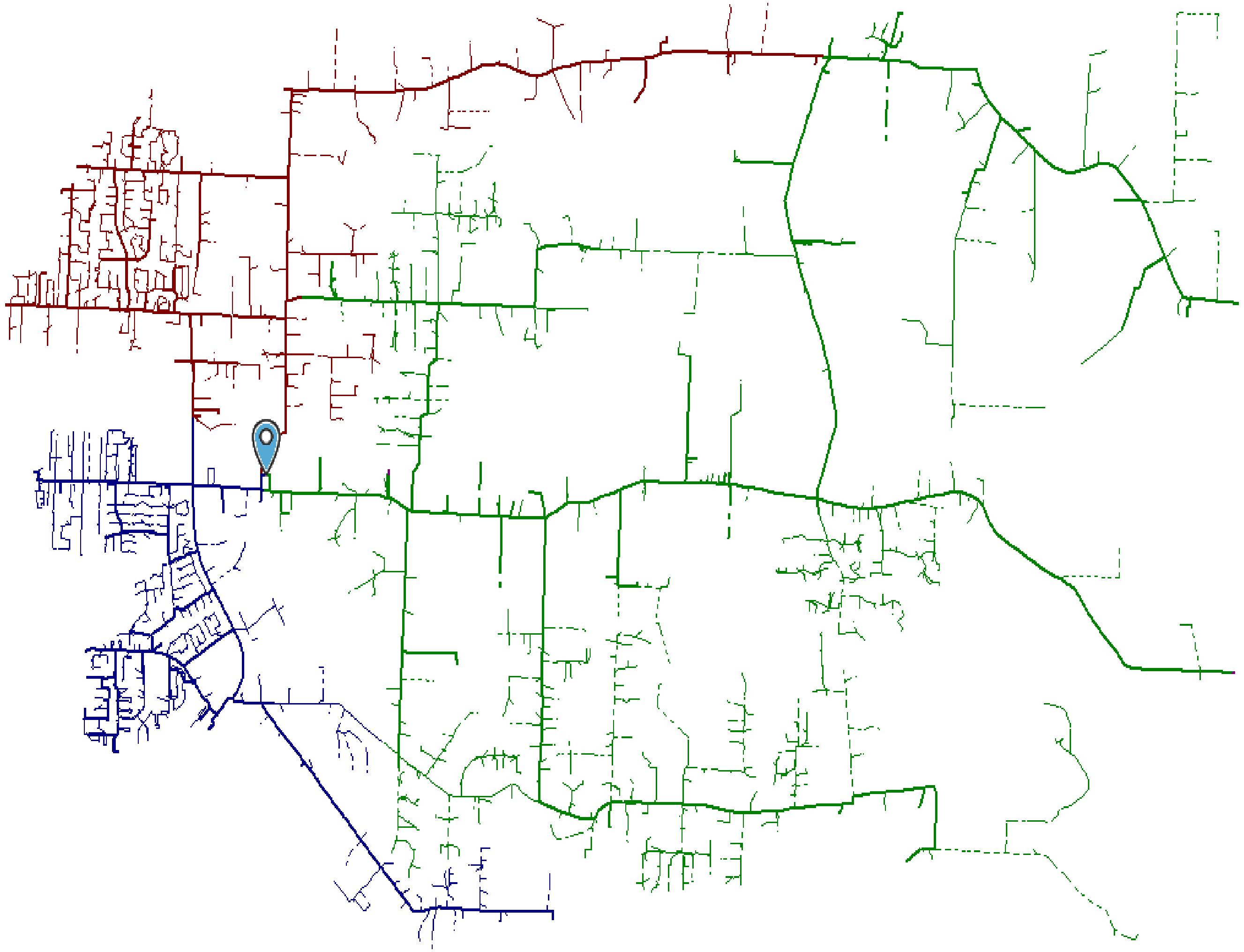
Approach to understanding and potentially solving the Problem Statement

Assumptions based on area knowledge, acquired information, historical trends, projections, etc.

Methods including tools used, how these tools are used, and data sources, etc.

Study Area

- Define area affected by Problem Statement
- Forecasting parameters
- Load profiles /Allocation
- Review natural geographic boundaries
- Review approach to contingency analyses
- Review affected customer
- Review contractual obligations
- Setup models

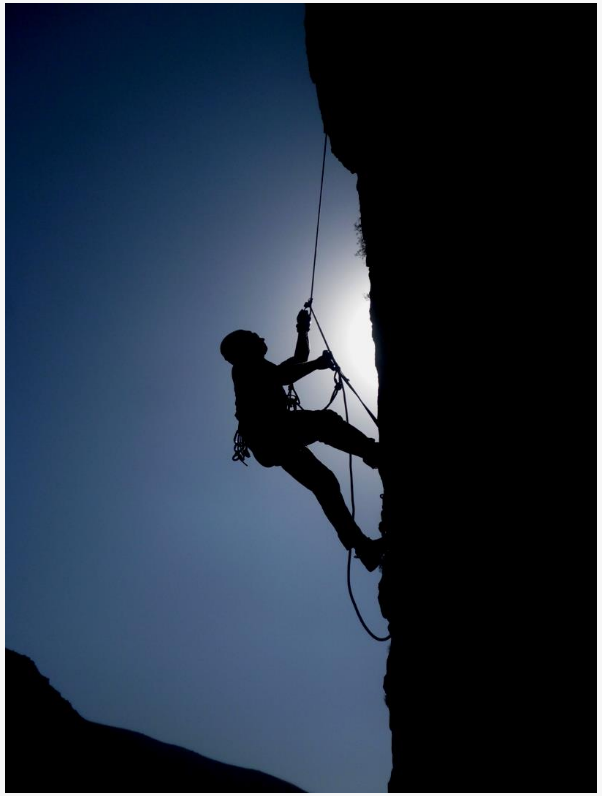


Base Case Analysis

Software simulation will further define severity of the Problem Statement and will also identify additional violations such as…

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

Options Analysis



Traditional

- Plan to peak
- Wired solutions
- Reliability-based
- Emissions agnostic
- Routine analysis
  - *Reconductors*
  - *Substations*
  - *Voltage Regulators*

Non-Traditional

- Plan to cycle(s)
- Non-Wires Alternative
- Flexibility
- Net-Zero targets
- Complex analysis
  - *Automation*
  - *Demand Response*
  - *Inverter-based tech*
  - *Microgrids*

Contingencies and Constraints

- Do options satisfy Problem Statement?
- Do options meet system needs under normal conditions?
- Do options meet system needs under contingent conditions?
- Do options satisfy additional discoveries during base analysis?
- Do options meet customer needs?
- Can options be considered optimal?
- Are options constructible?
- Do options meet regulatory/compliance guidelines?
- Is duration of short-term/intermediate option valid?

Benefits and Risks

- Integrated planning tool
- Benefits/Cost ratio
- Cost of ownership reduction
- Asset risk reduction
- Non-asset risk reduction
- Stacked benefits
- Hard/Soft savings

Additional Impacts

- Community impacts
- Customer impacts
- Environmental impacts
- Personnel and Public Safety
- Complexities
  - Construction sequencing
  - Introduction of newer technologies
  - Portable equipment scheduling
  - Newer concepts/procedures

Leads to Final Recommendation(s)

Key Internal Stakeholders

- Business Development
- Communications
- Cyber Security
- Distributed Resource Planning
- Distribution Automation
- Distribution Interconnections
- Distribution Operations Engineering
- Environmental Services
- Government Affairs
- Grid Asset Operations and Planning
- Grid Edge
- Key Customer Account Managers
- Portfolio Management
- Project Management
- Property Services
- Rates and Regulatory Affairs
- Strategic Asset Management
- Substation Design Engineering
- Substation Maintenance
- System Automation
- System Protection
- Transmission Engineering and Specialized Design
- Transmission Planning

Planning Challenges

- Predicting a future system with mostly limited and frequently changing information
- Setting up models to perform analysis
- Finding the right options
- Choosing the right options
- Project valuation
- Buy-in
- Documentation
- Resources
- Siting
- Sequencing, sequencing, sequencing

A New Era

- One-way distribution system transforming to a fluid multidirectional system
- Increased customer options
- More accessible data
- Planning for substantial generation
  - Net-metering and qualifying facilities
- Planning for substantial load growth
  - Transportation electrification
- Centralized simulation and control of assets
  - ADMS
- Exponential growth of data requirements
- Expanded data highway
- Significant changes to standards and policy
- Technology requires increased monitoring and operability

10-minute Break

DER Potential & Flex Load Assessment 101

PGE

DER Definition and Context

Distributed Energy Resource (DER)

Per **Order 20-485**, distributed energy resources (DERs) include the following resources that are connected to the electric distribution grid:

- Distributed generation resources
- Distributed energy storage
- Demand response
- Energy efficiency
- Electric vehicles

PGE is motivated to understand the resource potential for DERs and how these can help achieve our goal of a decarbonized grid that meets our customers needs.

Toward a Human-Centered Design

General interest in DER Forecasting – hope to gain feedback about specific topics of interest

What we heard during UM2005 dockets

- What are the implications for my community?
- How does DSP contribute to climate change abatement?
- How can we ensure that DER / program participation is equitable?
- How can DERs contribute to alleviating the energy burden?
- How can data and analytics for underserved communities / DEI be incorporated into DER Forecasting?

Why a Potential Study?

Develop reliable estimates of capacity (MW) and energy (MWh) resources/needs from DERs

Evaluate impact on system at different timescales (hourly, daily, seasonal)

Assess costs and benefits compared to supply-side alternatives

From our perspective, a DER Potential Study helps inform utility resource planning, both long-term and short-term. Though it can inform program planning, it is not a detailed program planning exercise.

Integrated Resource Plan (IRP)

- The IRP analyzes energy, capacity, and reliability needs across a variety of need futures
- DERs fit into the portfolio of supply- and demand-side options to serve customer load
- IRP is focused on bulk-system impacts

Distribution System Plan (DSP)

- Focused on parts of the system associated with final energy delivery to customers (substation to meter)
- More impacted by spatial differences in terms of grid assets and customer makeup
- Necessitates more granular planning efforts

Scope of Current DER Study

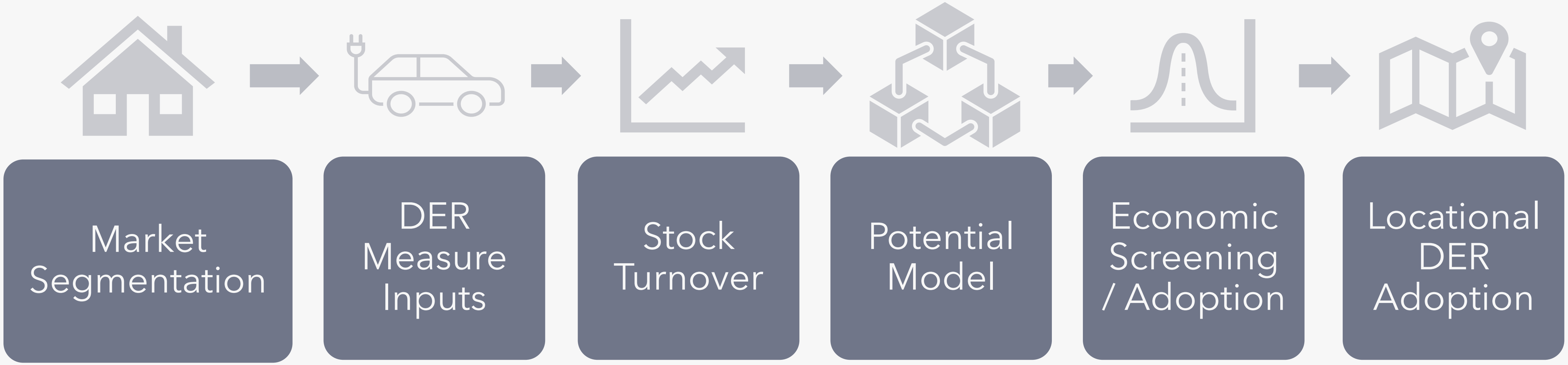
PGE is conducting a DER and Flex Load Potential study for the 2022 IRP, with consultant Cadeo and subcontractors Brattle and Lighthouse Energy Consulting

PGE developing capability to conduct future studies in-house to respond to changing landscape

Through the current study, PGE sought to:

- Increase transparency of modeling approach (inputs, outputs, algorithms)
- Better capture resource parameters and key assumptions
- Advance understanding of Flex Load potential to achieve range of grid needs
- Develop supply curves with levelized costs to inform resource selection within IRP analysis

Overall Workflow



Modeled DER Technology Overview

- **Solar and Storage**
  - Solar PV
  - Battery Energy Storage
  - Single-site microgrid
  - Campus microgrid
- **Electric Vehicles**
  - Light-Duty Vehicles
  - Medium-Duty Vehicles
  - Heavy-Duty Vehicles
- **Basic EVSE**
  - Res L2
  - Non-res L2
  - Non-res DCQC
- **Smart Charging**
  - Res Smart EVSE
  - Non-res Smart EVSE
- **Smart Water Heating**
  - ERWH retrofit switch
  - ERWH smart controls
  - Smart ERWH
  - HPWH smart controls
- **Smart HVAC**
  - Res smart tstat controls
  - Res line voltage tstat
  - Res DHP controls
- **C&I DR**
  - Commercial smart tstat
  - Irrigation load control
  - Large C&I tariff
  - Cold thermal storage
- **Non-firm DR**
  - Peak Time Rebates (PTR)
  - Time of Use (TOU) rates
  - EV-TOU

Goal: Measuring Net Load Impacts

Each device and technology investigated impacts net load that must be served by the utility. Impacts are in terms of:

- System capacity
- Energy
- Timing of demand

Program types

- Passive DER types
  - Non-dispatchable (no programmatic control available)
  - Examples: standalone solar, customer-operated batteries
- Active DER types
  - Dispatchable (programmatic control available)
  - Examples: DR, storage (enrolled in program)

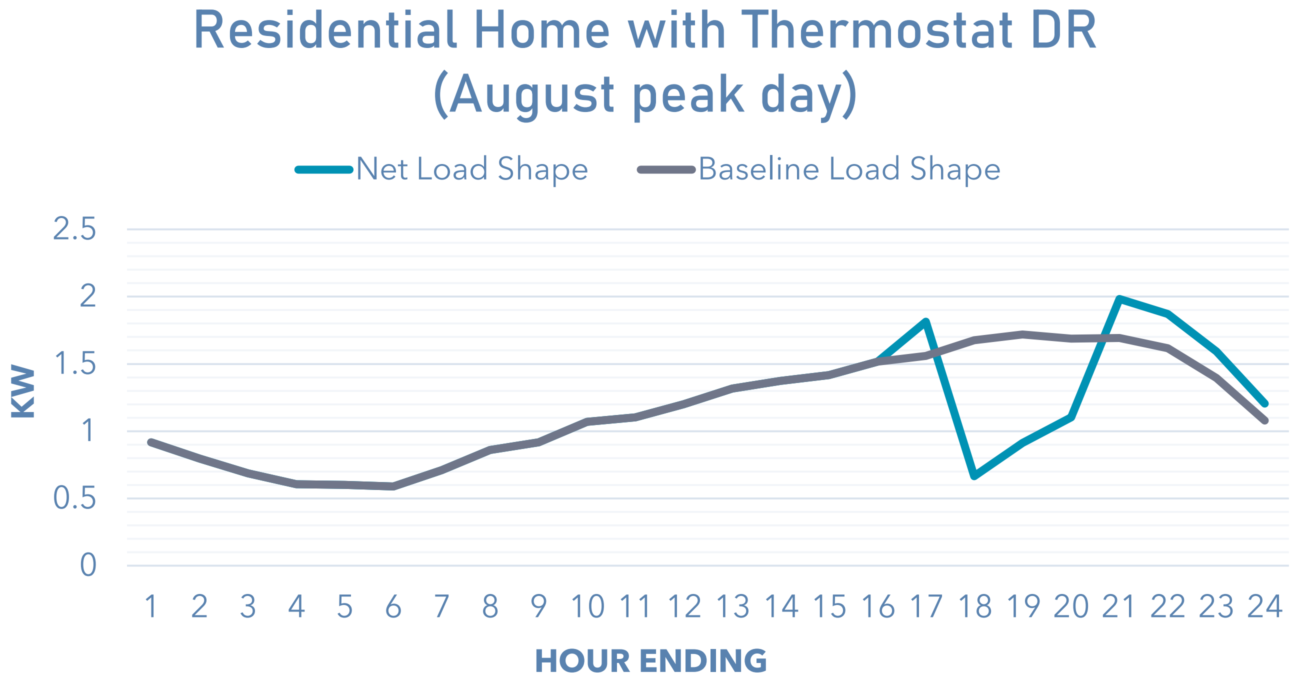
For each resource type, we calculate

- Baseline load shape
- DER resource shape (dispatch assumptions)
- Net load shape

Net Load Shape – Example

Example: Residential thermostat pilot

- Can be summer-only, winter-only, or dual season
- Event window summer weekday from 5-8pm
- Control strategy: send signal to enrolled, connected device to pre-cool home and raise setpoint 3°F



DER Adoption Modeling

Modeled Scenarios

Capture uncertainty around both DER trends and load forecast

Scenario forecasts will allow range of "what-ifs" and will be tied to explicit drivers whenever possible

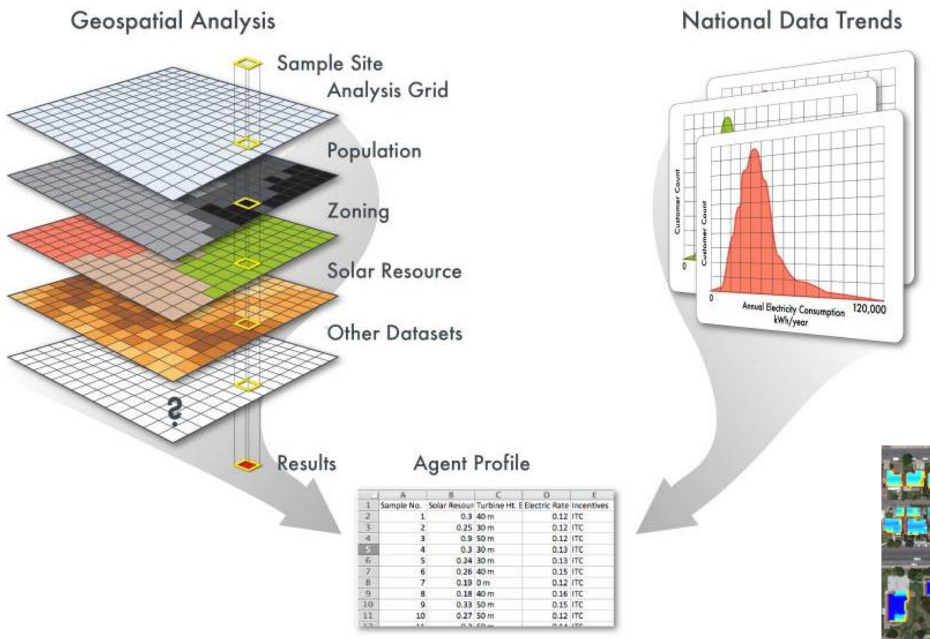
- Technology costs
- Codes & Standards
- Avoided costs
- Program incentives

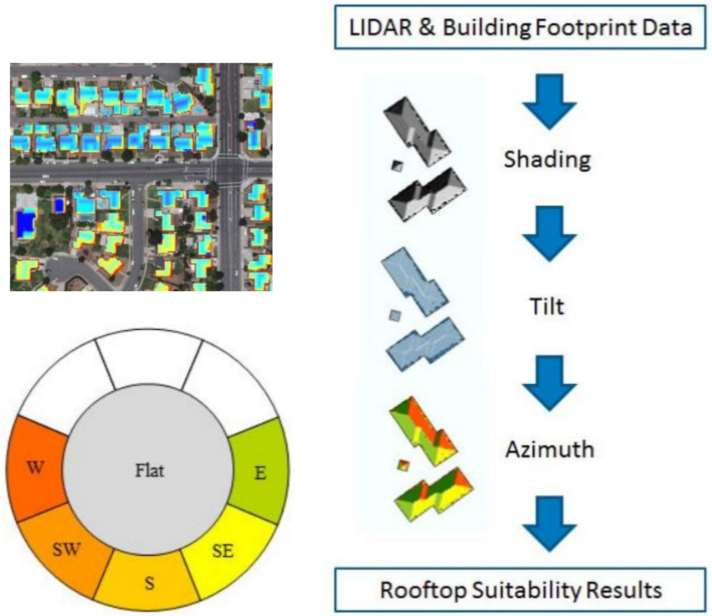
		Load Forecast Scenarios		
		Low	Reference	High
DER Adoption Scenarios	Low	Low Load Low DER	Ref Load Low DER	High Load Low DER
	Reference	Low Load Ref DER	Ref Load Ref DER	High Load Ref DER
	High	Low Load High DER	Ref Load High DER	High Load High DER

Modeling Solar + Storage

- NREL's dGEN tool forecasts adoption of distributed solar & storage by sector and county through 2050
- Agent-Based Model simulating consumer decision-making
- Incorporates detailed spatial and temporal data to understand regional adoption trends

NREL's dGEN tool example workflow





Combines solar resource data and adoption (above) with detailed rooftop suitability assessment (right)

Image credit: NREL

Modeling Electric Vehicles

- **Light-duty vehicles (LDV)**
  - Regression-based approach formulated on:
    - EV purchase price incentives
    - Relative price of electricity versus gasoline
    - State policies that are favorable to transportation electrification
    - Battery costs
    - High Occupancy Vehicle (HOV) lane access (combined with traffic density)
    - Vehicle model availability*
    - Range anxiety / charger coverage*
- **Medium- and Heavy-duty vehicle (MDHDV)**
  - Multi-round expert panel (Delphi approach) to estimate market adoption for short/medium/long term
  - Outputs fit to Bass diffusion using historical IHS Markit data and customer insights
- **EV charging requirements**
  - Using NREL's EVI-Pro Lite tool to analyze charging requirements of expected EV adoption

* Note: out of model adjustments

Modeling Demand Response

- Inherently a programmatic adoption question (i.e., requires aggregation and control)
- Resource cost-effectiveness determined by Total Resource Cost test.
    - Utilizes utility avoided costs for primary benefits stream
    - Leveraging PGE pilot experience for program costs and dispatch patterns
    - Working with IRP team to model additional flexibility of battery storage and water heaters
- Device functionality phased in over time
    - We expect industry standards to improve software/hardware and controls (e.g., CTA-2045 for grid-ready consumer appliances)
    - Accounted for in adoption rates and lower per-unit costs over time
    - Not including emerging technologies unless regional interest (line voltage thermostats)
- Study will result in "supply curve" showing amount of DR in terms of levelized $/MW
    - Will roll into PGE's 2022 IRP to study possible electric system needs for "non-cost effective" DR

Phase II Work – Locational Study

- Phase II activities set to kick off in May 2021
- Scope covers items of interest to UM2005 / DSP
    - Bottom-up load forecasting
    - Locational adoption potential
        - Break out customer types and fuel use / equipment by feeder and substation
        - Investigate net load impacts from different levels of DER adoption
        - Propensity to adopt modeling / spatial allocation
    - Both are important for understanding points of interest to DSP participants:
        - DER ability to influence climate goals
        - DER baseline adoption and potential impact on energy burden
        - Understanding how DSP can accelerate DER adoption
        - Good opportunity to investigate equitable adoption/participation by different communities (BIPOC, low-income communities, rural communities, seniors)

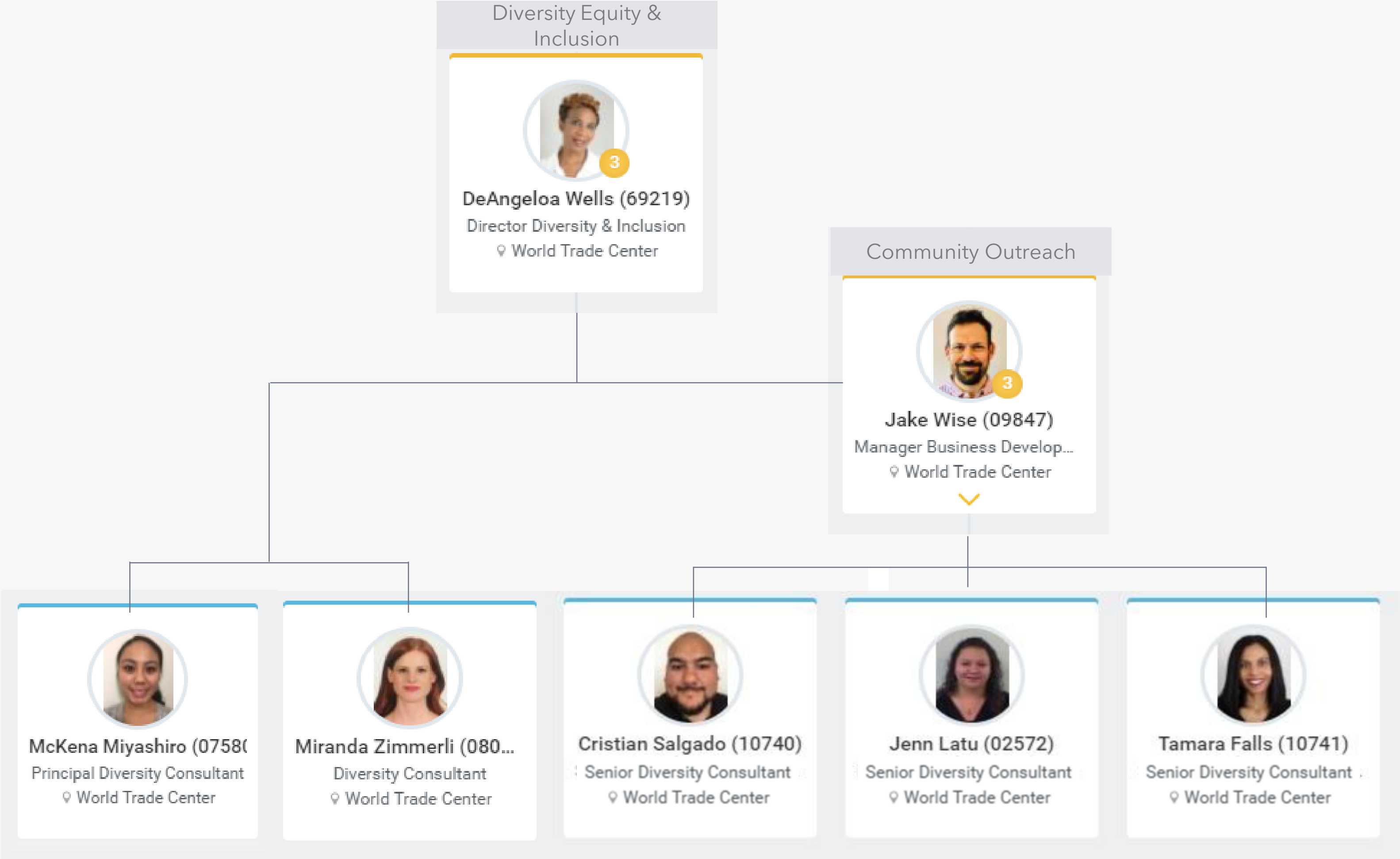
Next Steps

- Attend Flex Load Plan workshops (Feb 11 2021, Feb 18 2022)
- Draft results of Phase I study mid-March, 2021
- Final results of Phase I study end of April, 2021
- Coordinate with IRP team to integrate study results into PGE's 2022 IRP (now – ongoing)
- Gather feedback from DSP participants (that's now, also later)
- Iterate and present on Phase II locational DER Forecasting efforts May-August 2021
- Coordinate with Transportation Electrification Plan filing due October 1, 2021

Community Engagement

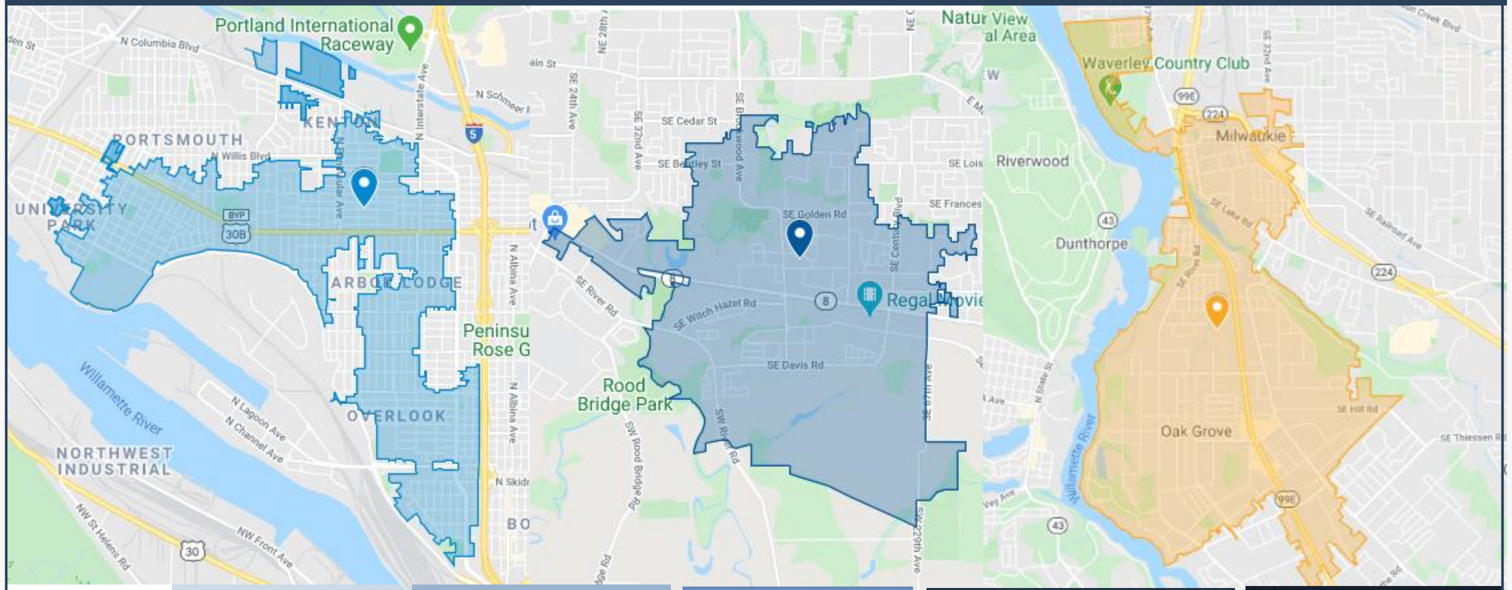
DEI Timeline

- The DEI Office was founded in Fall 2018
- Our Equity Strategy Paper and Equity Statement were shared in Spring and Summer 2019
- Smart Grid Test Bed (SGTB) community outreach team joined DEI in Summer 2020
- Together this OneDEI team contributes to progress made internally and externally (SGTB and beyond)



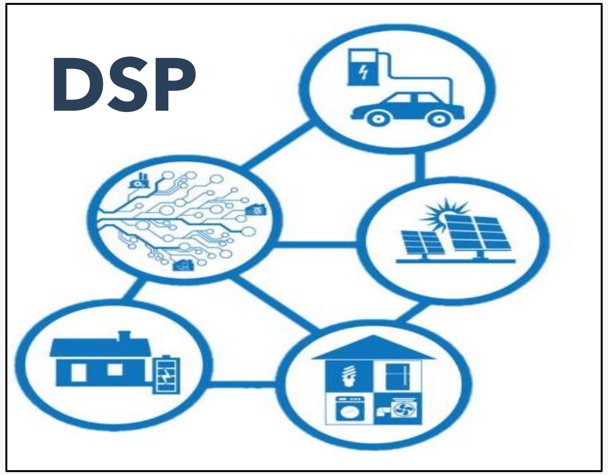
Learnings to Date

PORTLAND	HILLSBORO	MILWAUKIE



IAP2	Inform	Consult	Involve	Collaborate	Empower

Increasing Level of Trust →



Smart Grid Test Bed (SGTB)

- 2.5-year learning pilot concentrated in three Oregon communities
- Learning how adoption of new programs and technologies can be used to challenge traditional ways of looking at energy use and reduce our carbon footprint, with a focus on gaining insights from underserved/underrepresented communities
- Intent is to learn how to best accelerate the adoption of programs where customers can shift their energy use when demand is high

Community Engagement Workstreams

Intent of today's presentation

- Inform you about our approach for getting started in developing a Community Engagement Plan and gather your input on our approach

DSP Community Engagement Workstreams

- Monthly DSP workshop series on 2nd Wednesday of every month
- Additional meeting series focused on Community Engagement Plan development, as developed by DSP Community Engagement contractor
- Develop educational content (e.g., Energy 101/DSP 101) to support engagement in partnership with Community Energy Project and Energy Trust of Oregon

COMMUNITY ENERGY PROJECT

Energy Trust of Oregon

CBO Partnership

Draft DSP CE Scope of Work for Consultant

Coalition of Communities of Color

uniteoregon

- Partner with CBOs and community members to **ensure EJ community representation** in CE workshops
- **Facilitate and determine frequency and format** of PGE's CE workshops
- Learn about DSP to **help identify knowledge or communication gaps**, and any **education needed** to support meaningful integration of community feedback
- Assist with integrating **feedback from community** into the CE Plan
- Assist with **going beyond the minimum requirements** of UM 2005 by identifying and recommending innovative approaches to engaging in these planning efforts
- Assist with **interpreting expressed community needs** (identified through community needs assessment or reviewing workshop input)

Community Engagement Calendar

Mid-February 2021
- Energy/DSP 101 educational curriculum development
- Data requirements defined and collected

Late February 2021
- Consultant secured

March 2021
- Recruit CBOs and community members to attend PGE's community engagement workshops

April 2021
- Host kick-off meeting with community partners for the CE Plan

June 2021
- Draft CEP
- Develop and present the CE Plan to community partners

July 2021
- Compile feedback and review CE Plan

August 2021
- Final CEP
- Present the finalized CE Plan at monthly DSP workshop

Mid-March – June: CE outreach and research begins

- *Subject to change based on consultant's approach (defer to consultant to define best approach based on SOW articulated)*
- The contractor will also consult on implementation of the CE Plan in the leadup to submission of Part 2.

Questions/Next Steps

Next Steps

Propose Meeting Topics

- Email us at **DSP@pgn.com** with suggested topics by February 28, 2021

		2021									
		January	February	March	April	May	June	July	August	September	October
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Next Steps

Meeting Schedule	Technical Workshops	Community Workshops
✓ January 13, 2021		
✓ February 10, 2021		
March 10, 2021	Tentatively scheduled for 9am-11am	
April 14, 2021		Tentatively scheduled for 1am-3am
May 12, 2021		
June 9, 2021		
July 14, 2021		
August 11, 2021		
September 8, 2021		

You can reach us at:

DSP@PGN.com

An

Oregon

kind of energy

PGE

Abbreviation List

ADMS = Advanced Distribution Management System

BIPOC = Black, Indigenous, and People of Color

C&I = Commercial and Industrial

CBO = Community-Based Organization

CE = Community Engagement

CEP = Community Engagement Plan

CTA = Consumer Technology Association

DCQC = Direct Current Quick Charge

DEI = Diversity, Equity, and Inclusion

DER = Distributed Energy Resource

DHP = Ductless Heat Pump

DR = Demand Response

DSP = Distribution System Plan

EJ = Environmental Justice

ERWH = Electric Resistance Water Heater

EV = Electric Vehicle

EVSE = Electric Vehicle Supply Equipment

HPWH = Heat Pump Water Heater

HVAC = Heating, Ventilation, and Air Conditioning

IRP = Integrated Resource Plan

kW = kilowatt

L2 = Level 2 EV Charging

LDV = Light-duty Vehicle

LIDAR = Light Detection and Ranging

MDHDV = Medium- and Heavy-duty Vehicles

MW = Megawatt

MWh = Megawatt-hour

NREL = National Renewable Energy Lab

NWA = Non-Wires Alternative

PTR = Peak Time Rebates

PV = Photovoltaic

SGTB = Smart Grid Test Bed

T&D = Transmission & Distribution

Tstat = Thermostat

TOU = Time of Use