Integrated Resource Planning

Roundtable Meeting #20-8

December 10, 2020

MEETING LOGISTICS

- Electronic version of presentation:
  - *https://www.portlandgeneral.com/our-company/energy-strategy/resource-planning/integrated-resource-planning/irp-public-meetings*
- Teams Meeting
  - Please click the meeting link sent to your email or here:
    - Join Microsoft Teams Meeting
    - +1 971-277-2317 (dial this number into your phone for best results)
    - PW: 432 197 367#
  - 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

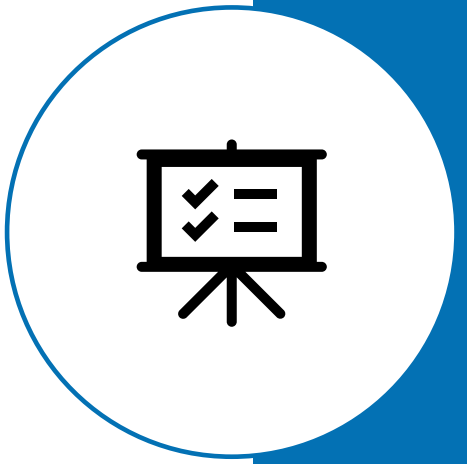
SAFETY MOMENT

Winter and holiday connection

- COVID-19 spreads easily from person to person
- Travel increases the chance of getting and spreading the virus that causes COVID-19
- Avoid these higher risk activities – shopping in crowded stores, attending large indoor gatherings with people from outside your household
- Connect with your community in the absence of personal interaction – support a family in need, host a virtual dinner or recipe making, make favorite foods and deliver with no contact to loved ones, take breaks from watching the news, check out library books and read with a friend
- www.cdc.gov/coronavirus

AGENDA

- Welcome and introductions
- 2019 IRP update: draft portfolio analysis
  - 30 minutes
  - Informational
- 2020 Distributed Energy Resources (DER) and Flex Load Potential study
  - 60 min
  - Informational



2019 IRP Update: Draft Portfolio Analysis

Seth Wiggins

2019 IRP Update: Portfolio Analysis History

The 2019 IRP portfolio analysis included:

- The evaluation of 44 unique portfolios that tested various resource options
- Detailed scoring of portfolios using traditional and non-traditional metrics
- A selection and further examination of the preferred portfolio

In LC 73 PGE provided additional portfolio analysis to examine new sensitivities:

- Nov 2019 Reply Comments: Wind capacity factor, RPS sensitivities
- Jan 2020 Final Comments: New PTC, Colstrip information

2019 IRP Update: Portfolio Analysis Inputs

Since the Portfolio Analysis was conducted in the January 2020 LC 73 Final Comments, PGE has updated information on several topics:

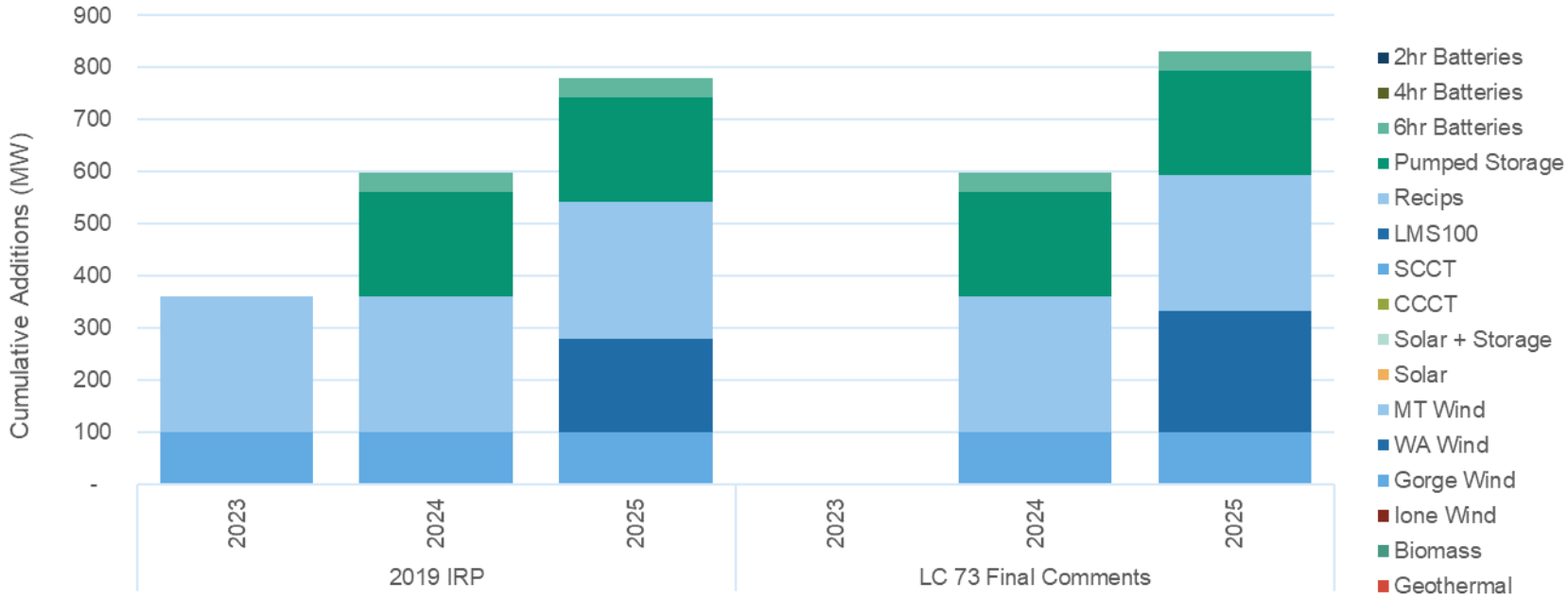
Category	Roundtable Discussion
Market price forecasts	August, October
Capacity Need	March, May, August, October
Load Forecast	October
Energy and RPS Position	October
New interconnection costs, PTC change	November

This new information has been incorporated into our IRP Update portfolio analysis

2019 IRP Update: Preferred Portfolio

The main finding from LC 73 Final Comments:

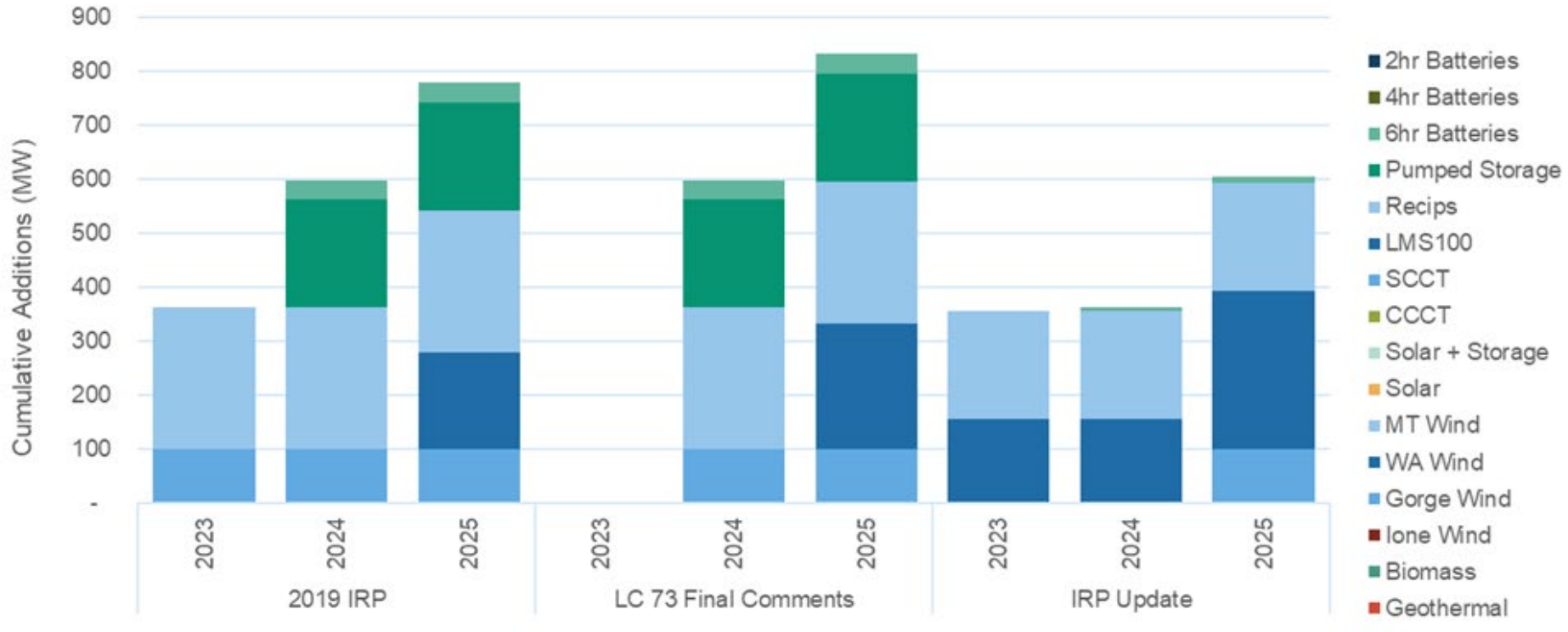
- A one-year delay in the first 150 MWa addition
- This reflects the change in PTCs, which extended PTC eligibility until 2025



2019 IRP Update: Preferred Portfolio

Two main findings from IRP Update:

1. Driven by PTC update, 2023 was again selected for the initial 150 MWa addition
2. Reduced new long-term capacity additions through 2025 due primarily to bilateral contracts



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2019 IRP Update: Preferred Portfolio Traditional Metrics

The cost of the preferred portfolio increased

- Multiple factors from updated information create this difference

However, the risk of the preferred portfolio has decreased

- Driven in large part by updated forecasted natural gas prices, which led to a reduction in electricity prices in corresponding market price futures

	2019 IRP	LC 73 Final Comments	IRP Update
Cost ($ millions)	25,740	25,617	25,836
Variability ($ millions)	3,614	3,623	2,904
Severity ($ millions)	31,004	30,851	29,838

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2019 IRP Update: Near-term Renewable Action

An area of investigation in LC 73 was the long-run system costs and benefits associated with a near-term renewable addition

As in LC 73, we evaluated the preferred portfolio with and without the ability to select a renewable addition in the near-term

- Results suggest long-term system costs remain lowered by the ability to add near-term PTC eligible energy resources

	Mixed Full Clean	Mixed Full Clean, No RA	Difference
Cost ($ millions)	25,836	26,249	413
Variability ($ millions)	2,904	2,977	74
Severity ($ millions)	29,838	30,342	503

Note: Rounding errors appear in the difference column

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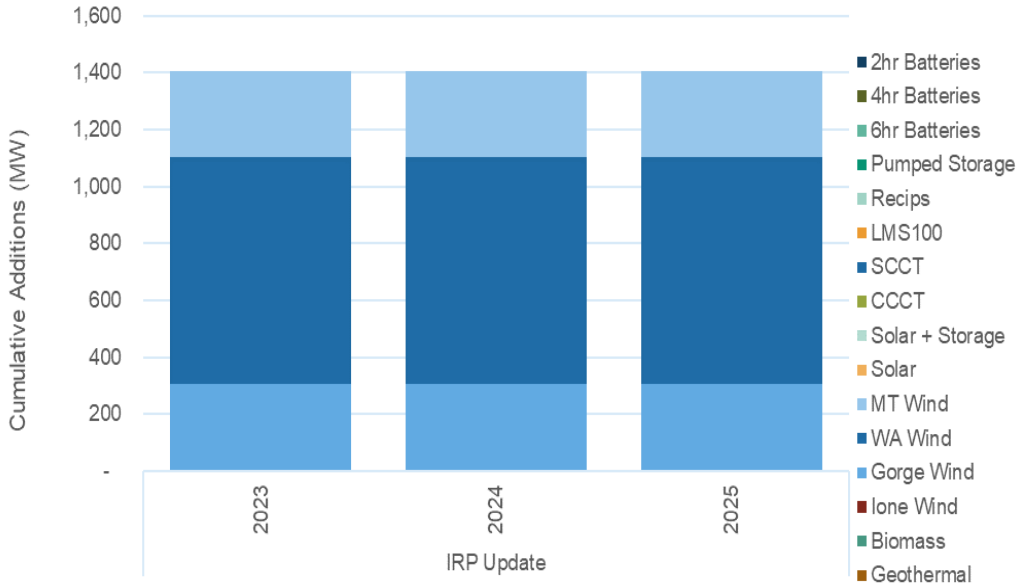
2019 IRP Update: Optimized Portfolios

IRP participants have been interested in fully optimized portfolios

- Optimized portfolios generally do not use portfolio constraints
- Rather, they test how ROSE-E (using various objective functions) would meet system needs if fully unconstrained

Portfolio analysis consistently shows ROSE-E minimizing system cost with a very large (~1400 MW) near-term renewable addition

The two main findings from preferred portfolio (the shifting of the first resource addition back to 2023, and a reduction of capacity additions) are seen in optimized portfolios



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2019 IRP Update: RPS Sensitivity

The question of RPS need has been an important topic throughout the LC 73 docket

In our Final Comments, we tested the preferred portfolio under two RPS sensitivities, which:

- Reduced our RPS obligation by 20% (reflecting the potential to retire up to 20% of our compliance obligation with unbundled RECs)
- Eliminated the RPS obligation altogether

We re-ran the latter to evaluate whether RPS need made any impact on resource additions

Results show a portfolio nearly identical in cost, risk, and resource additions

- This further supports the finding that RPS need is not driving near-term actions

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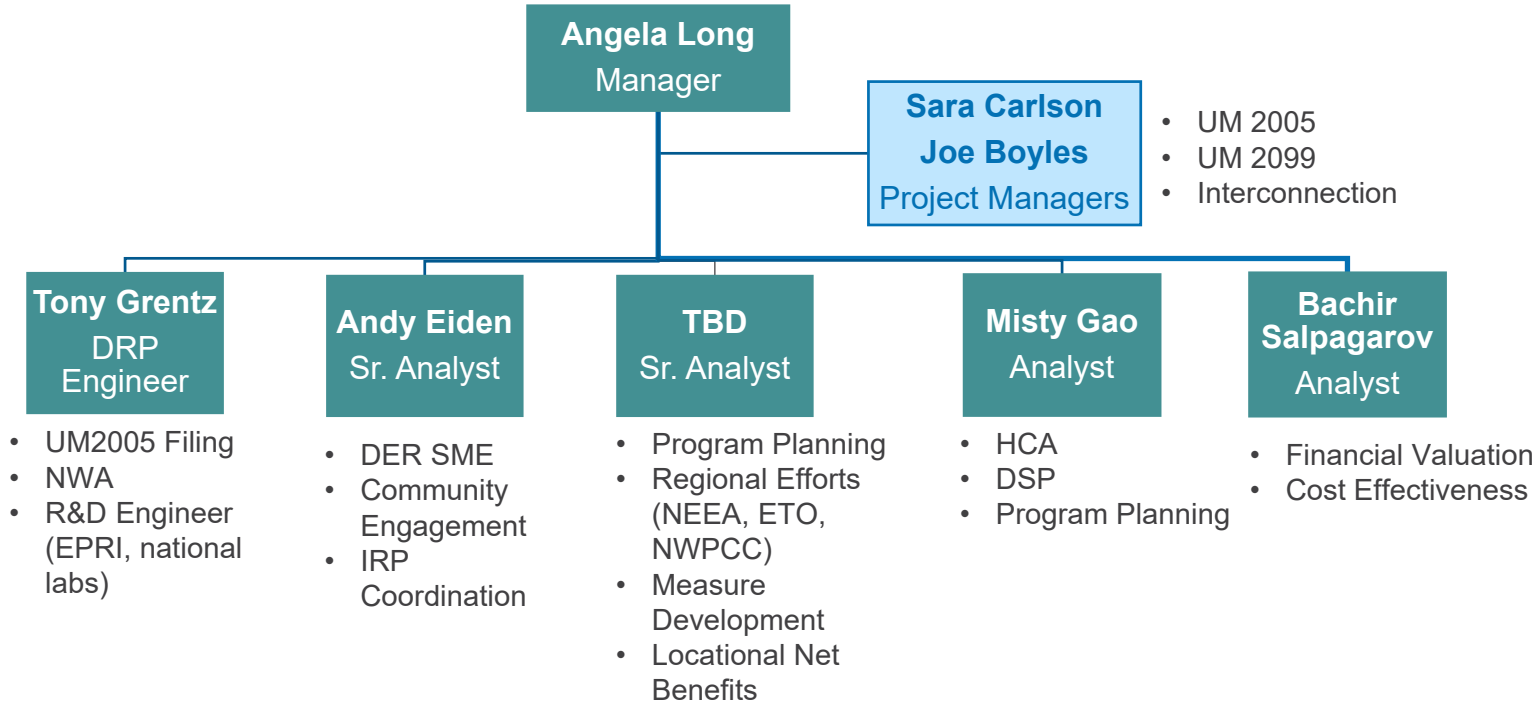
QUESTIONS/ DISCUSSION?

2022 Distributed Energy Resources (DER) and Flex Load Potential Study

Andy Eiden

Distributed Resource Planning Team Overview



DER Data and Analytics	DER Scenario Forecasts	Hosting Capacity Analysis	Community Engagement	Grid Needs Identifications	Near-Term and Long-Term Plan	Reporting and Regulatory Support

DER Forecasts and the IRP

Identifying customer resources that align with resource needs

- DERs treated as “customer actions” within IRP
- Energy efficiency forecast provided by Energy Trust
    - DRP team coordinating input into future IRP studies
- DER and Flex Load Potential Study focuses on:
    - Distributed flexibility
    - Customer renewables

Definitions

- Distributed energy resources (DERs) typically include:
    - Energy efficiency
    - Demand response
    - Electric vehicles
    - Customer-sited solar
    - Behind-the-meter energy storage
- Energy Trust of Oregon is a statewide non-profit implementer of energy efficiency programs
- Distributed Resource Planning (DRP) is a new function at PGE to help integrate DERs across the company

History of DR modeling at PGE

PGE has a long history of modeling DR for purposes of IRP modeling. First formal study in 2004.

Brattle conducted DR potential studies to inform the 2009, 2013, and 2016 IRPs

- 2016 IRP: Brattle Study on DR Potential
  - Brattle estimated the maximum achievable potential that represented approximate upper-bounds based on some of the highest enrollment levels observed in DR programs to-date
  - IRP adjusted Brattle results to account for participation rates and time to saturation
- 2019 IRP: Navigant DER and Flex Load Study
  - Introduced greater focus on accurately characterizing expected electric vehicle (EV) loads and residential light-duty vehicle DR potential
  - Incorporated more distributed resources (e.g., solar and storage), plus added interactive effects inherent to the modeling (e.g., price interactions)
- 2022 IRP: Cadeo DER and Flex Load Study **(Current study)**

Current Study Overview

- Hired Cadeo to lead the DER and Flex Load Potential study for 2022 IRP, with subcontractors Brattle and Lighthouse Energy Consulting

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 model on comparable basis within IRP analysis

DER and Flex Load Potential Study Aims

This project assesses DER and Flex Load potential to inform PGE's 2022 IRP, as well as delivers a model for generating feeder-level forecasts and conducting internal scenario analysis for incorporation into ongoing distribution system planning work.

- **Phase I**: System-level DER potential and adoption forecast for IRP
- **Phase II**: Bottom-up load forecasts and DER potential for distribution system planning

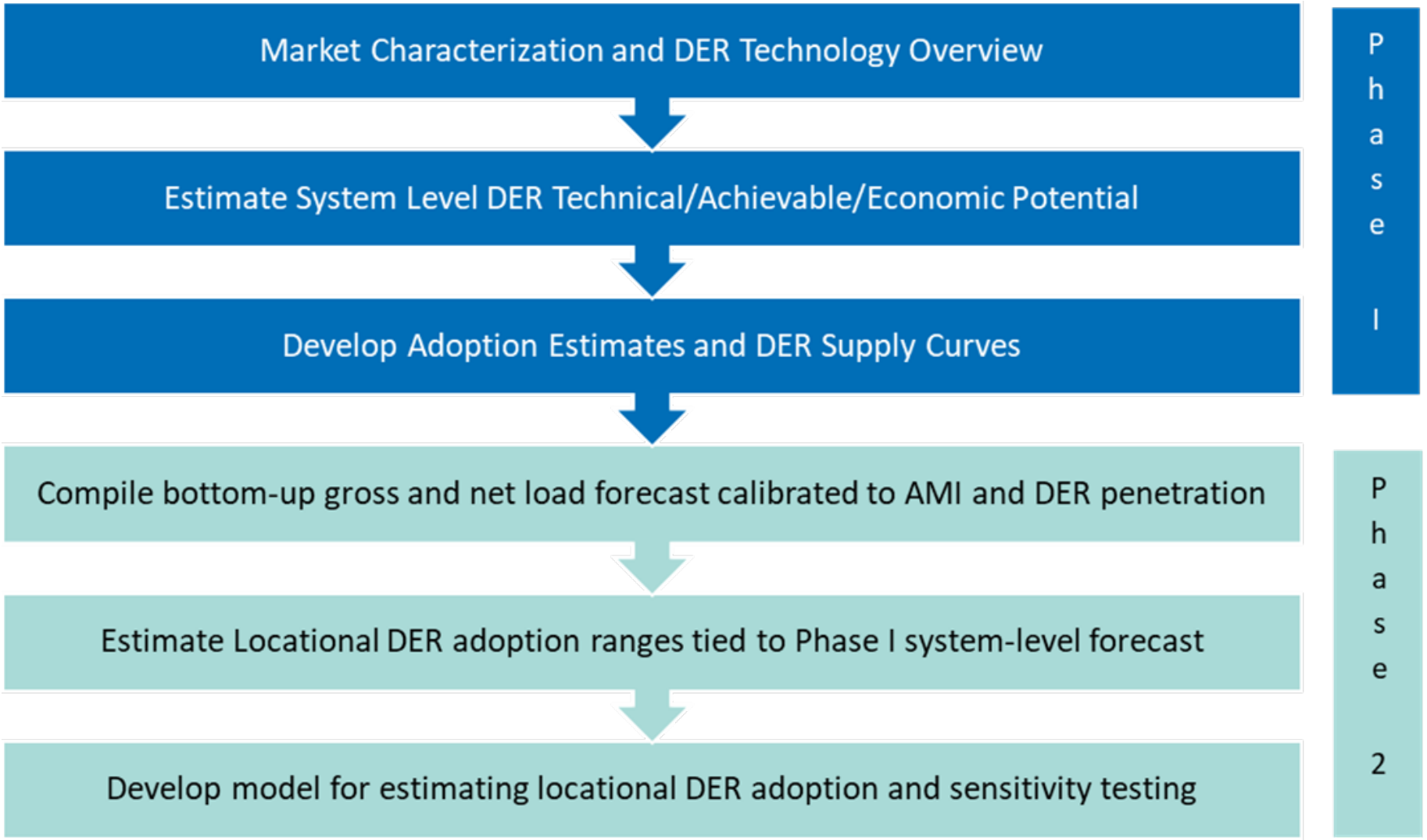
IRP requires reliable estimates of DER potential that are likely available to PGE over the IRP planning horizon. Key resource characteristics to model are:

- Quantity (e.g., kW and kWh)
- Shape (e.g., hourly, monthly)
- Controllability (e.g., customer-controlled versus utility-controlled)
- Costs (e.g., equipment costs, incentives)

Cross-functional Teams

- Product Strategy
- Product Development
- Product Management
- Grid Edge Solutions
- Smart Grid Test Bed
- IRP
- Transmission Planning
- Distribution Planning
- Corporate Planning
- Rates and Regulatory Affairs
- Key Account Managers

Methodology Overview



Data Sources

Leveraging open-source code and trusted third-party data sources wherever possible.

- CalTRACK methods for standardized baseline and net load profile calculations
- National Renewable Energy Lab (NREL) data sets and forecasts
  - PVWatts for solar output
  - Re-Opt Lite for energy storage
  - EVI-Pro Lite for EV charging infrastructure
- NEEA regional building stock surveys and
  - Residential Building Stock Assessment (RBSA)
  - Commercial Building Stock Assessment (CBSA)
  - End use load research (EULR) metering efforts
- Tie to Energy Trust forecast whenever possible

Methodology Overview – Stock Turnover Model

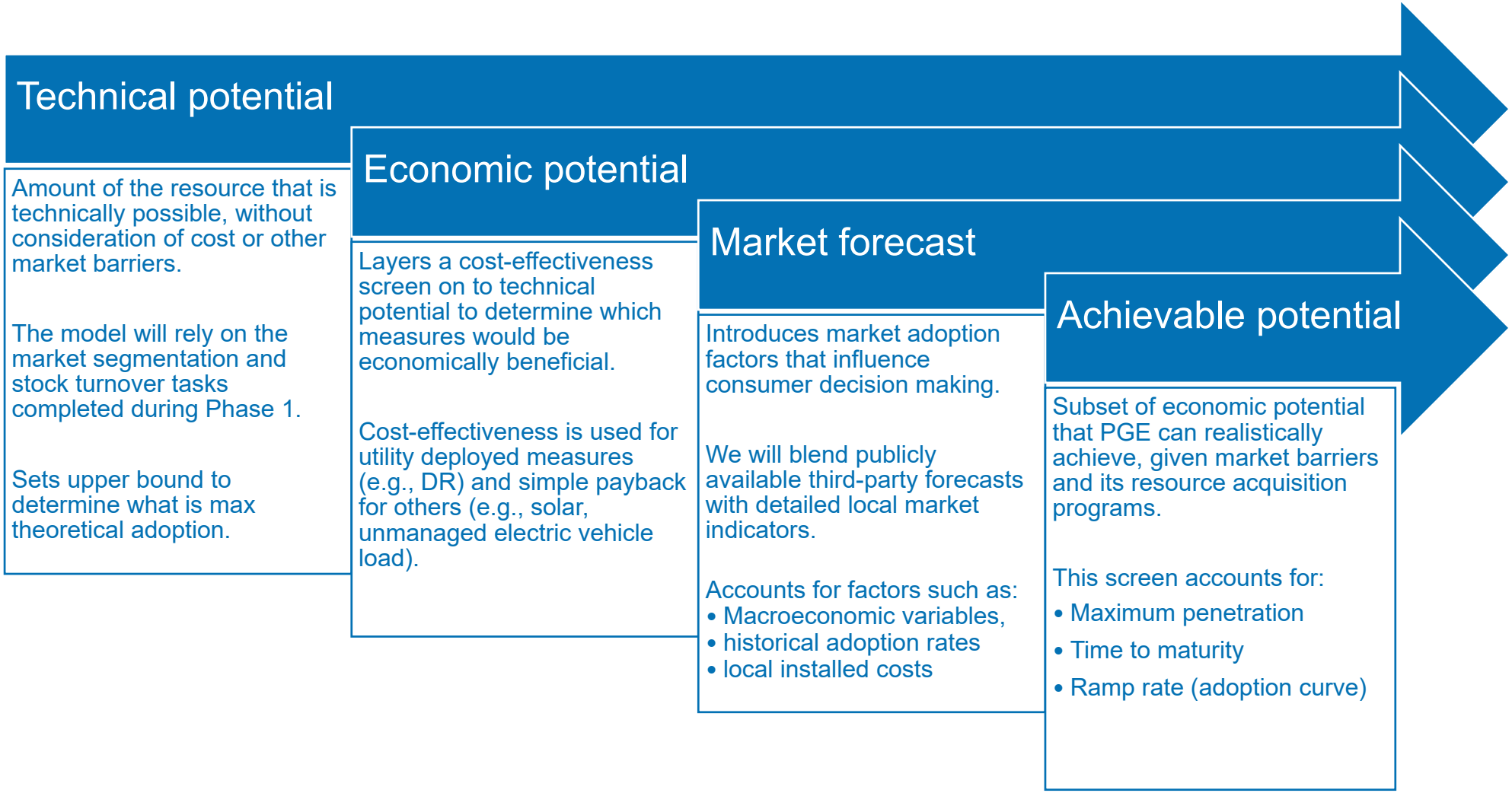
Foundational to the modeling of DER potential, the stock turnover model enables DER measure information to the available building and appliance stock in PGE service area.

- Calibrated to existing PGE customer base and forecasted customer growth
  - Residential (single family, multifamily, manufactured homes) and non-residential
- Models equipment profiles that change over time (e.g., replace equipment, new construction)
  - PGE enrollment data (heating/cooling, water heaters, net metering)
  - Third-party datasets (Energy Trust, Earth Advantage)
  - PGE customer survey data (Residential Appliance Saturation Survey)
  - Regional building stock surveys (NEEA residential and commercial stock assessments)
  - DMV registration data

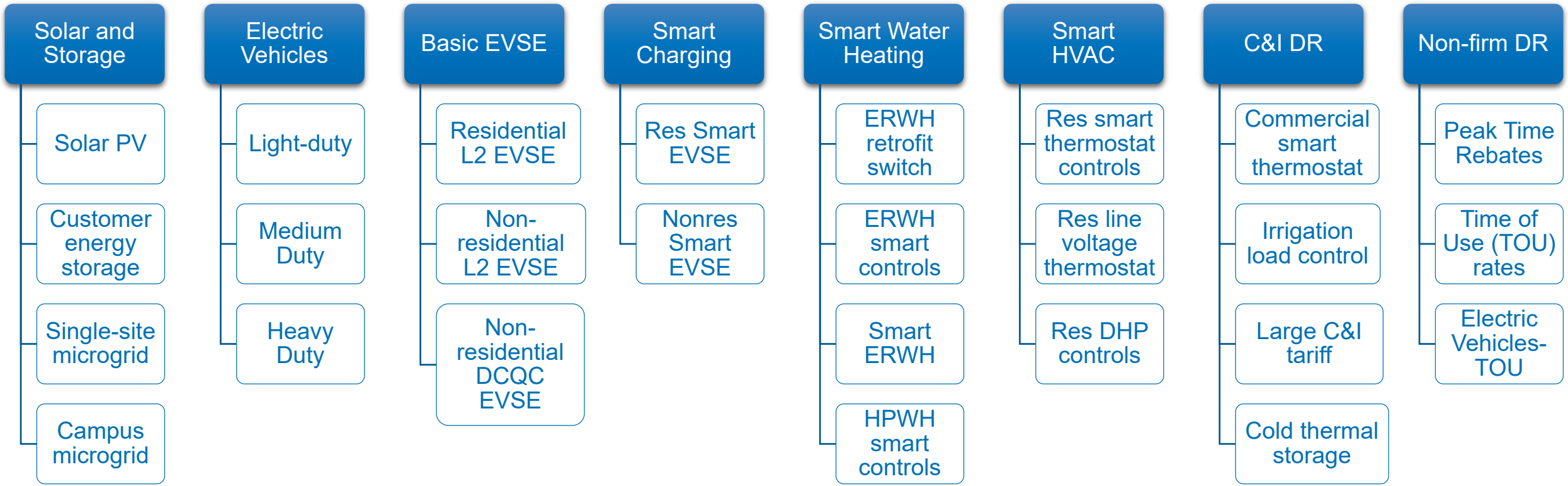
Methodology Overview – Market Characterization

- DER measure definition
  - Resource attributes (applicability, size, costs, etc.)
  - Operational parameters (shape, dispatch constraints, etc.)
  - Interactions with other measures (e.g., Thermostat + time of use rate, solar + storage)
- Market sizing
  - What technologies each site currently has (e.g., heat pump, gas furnace),
  - What measures it has already adopted (e.g., smart thermostat DR program), and
  - What measures (and how much of each) a site could feasibly adopt.
- Load research
  - Customer load shapes
    - Gross load shape and net of DER
  - DER measure resource shapes
    - Passive (e.g., standalone solar) and Dispatchable (e.g., demand response)

Methodology Overview – Potential Model



DER Measures included in the Current Study



DER Adoption Scenarios Modeled

- We will model a variety of adoption pathways from the load forecast and DER side of the equation
- Scenarios tied to inputs for key adoption drivers within the model, providing added visibility
- Useful for understanding “what ifs” in the context of key market or policy changes

DER Forecast Scenarios	Load Forecast Scenarios: Low	Load Forecast Scenarios: Reference	Load Forecast Scenarios: High
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

High DER Scenario Drivers

Looking deeper at what is within the “High DER” adoption scenario

Technology costs

- Solar, batteries, heat pumps

- **Codes and standards**
  - Building codes (e.g., Executive Order 20-04); appliance standards (e.g., CTA-2045)
  - Vehicles (e.g., Zero Emission Vehicle mandates)
- **Avoided costs**
  - Generation capacity costs
  - Locational value (Transmission & Distribution)
  - Carbon costs
- **Program incentives**
  - Benchmark from other utilities, greater incentive under higher avoided cost scenarios
- **Retail rates**
  - Electricity, Natural Gas, Gasoline/Diesel

DER Study Outputs for IRP

- Cost-effective forecast of DER and Flex Load adoption over 2022-2050 planning horizon
- Supply curves of non-cost effective resources in levelized $/kW

Output Area	Detailed Description
Annual participation forecasts (Low, Base, High)	Enrolled MW and MWh of curtailable and shift-able loads (including snapback)
Operational information	Characterization of customer response rate among participants
Operational information	Characterization of constraints on load flexibility relative to native load shape
Operational information	Hourly native load shape (month/day-type/hour granularity; day-type includes average weekday, peak day, holiday, and weekend day)
Cost information	Annual costs to the utility associated with each participation forecast
Cost information	Supply curves for additional non-cost effective DER potential beyond participation forecasts

Next Steps

- Continue model development and economic screening
- Present modeling overview and draft results to IRP participants, expected Q1 2021
- Final results presentation Q2 2021
- Determine cadence and venue for presenting DER forecasting information under UM 2005 Distribution System Planning docket

Milestone / Deliverable	Milestone End Date
DER Potential Results and Supply curves data input template ready	31-Dec-20
Draft Phase I DER potential results and supply curves	15-Feb-21
Final Phase I DER potential results and supply curves	31-Mar-21
Final Phase I report	30-Apr-21
Draft Phase II Feeder-level load forecast and DER potential	30-Jun-21
Final Phase II Feeder-level load forecast and DER potential	31-Jul-21

QUESTIONS/ DISCUSSION?

THANK YOU

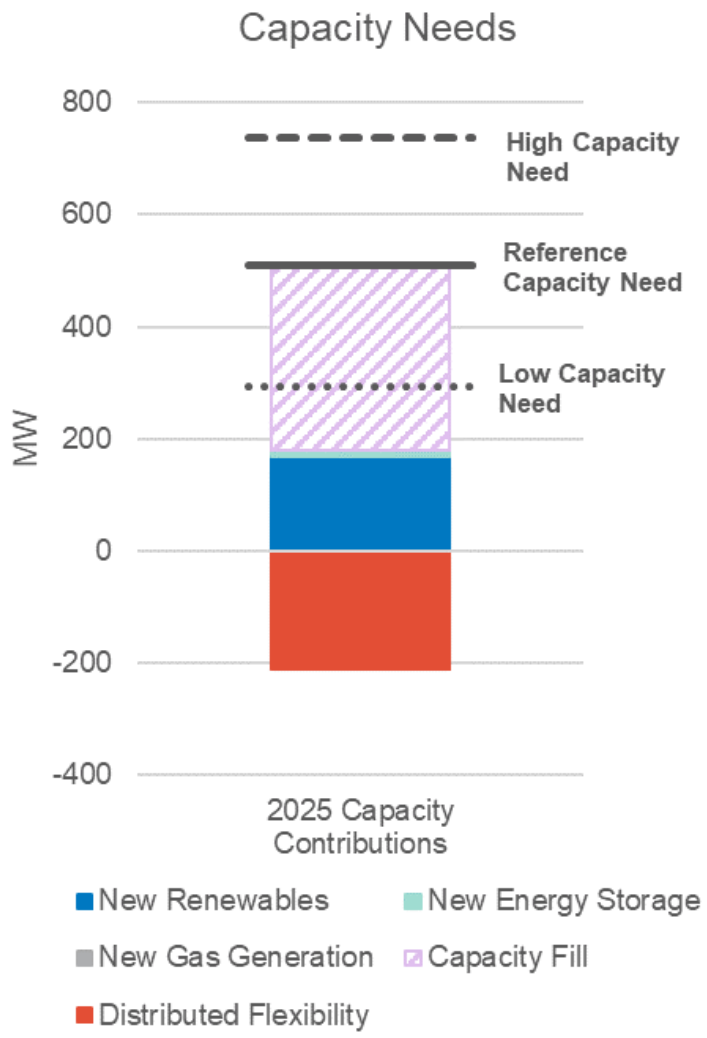
Contact us at:

IRP@pgn.com

Attachment A: Acronyms

- CBSA: commercial building stock assessment
- C&I: commercial and industrial
- DER: Distributed energy resource
- DR: Demand response
- DRP: distribution resource planning
- EE: Energy efficiency
- ERWH: electric resistance water heater
- ETO: Energy Trust of Oregon
- EULR: end use load research
- EV: electric vehicle
- EVSE: Electric vehicle supply equipment
- HPWH: Heat pump water heater
- MWa: megawatt average
- NEEA: Northwest Energy Efficiency Alliance
- NREL: Nation Renewable Energy Lab
- O&M: operation and maintenance
- PTC: production tax credit
- Q1/Q2: quarter 1/ quarter 2
- RA: resource adequacy
- RBSA: residential building stock assessment
- REC: renewable energy credit
- ROSE-E, RECAP, LUCAS, and Sequoia: models PGE uses or used for IRP analysis (see Appendix I: 2019 IRP Modeling Details from the 2019 IRP)
- RPS: renewable portfolio standard
- WECC-wide: Western Interconnection (Today - The generators, transmission lines, and other facilities that comprise the Western Interconnection electrical grid, which is a NERC region)

Appendix A: IRP Update Preferred Portfolio Capacity Need



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