Integrated Resource Planning

Roundtable Meeting #20-7

November 18, 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: 949 307 508#
  - 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

- COVID-19 spreads easily from person to person
- Wearing a mask is the most effective way to reduce transmission of COVID-19, even if you don't feel sick
- Everyone should: wash hands often, avoid close contact, cover your mouth and nose with a mask, cover coughs and sneezes, clean and disinfect used objects, monitor your health
- www.cdc.gov/coronavirus

AGENDA

- Welcome & Introduction
- Change to Production Tax Credits for 2019 IRP update
  - 15 minutes
  - Informational
- Interconnection costs (updated for 2019 IRP update)
  - 15 minutes
  - Informational
- Capacity Contributions
  - 15 minutes
  - Informational
- LUCAS 101
  - 15 minutes
  - Informational
- ROSE-E 101
  - 15 minutes
  - Informational

Change to PTCs for 2019 IRP Update

Seth Wiggins

Production Tax Credit

- The federal government provides a payment for every MWh generated by large-scale wind operations, called the Production Tax Credit (PTC)
  - This value declines with the commercial operation date (COD)

- The level of PTC eligibility has changed twice since PGE filed the 2019 IRP
  - The first (12/2019) extended the 60% eligibility to projects with a COD before 2025
  - The second (5/2020) provided an additional year to projects that began work in 2016 and 2017 (changes in red)

Construction Began	COD on or Before	IRP Start	2019 Filed IRP	12/2019 PTC Extension
2016	12/31/2020	2021	100%	100%
2017	12/31/2021	2022	80%	80%
2018	12/31/2022	2023	60%	60%
2019	12/31/2023	2024	40%	60%
2020	12/31/2024	2025	0	60%

Construction Began	COD on or Before	IRP Start	5/2020 PTC Extension
2016	12/31/2021	2022	100%
2017	12/31/2022	2023	80%
2018	12/31/2022	2023	60%
2019	12/31/2023	2024	60%
2020	12/31/2024	2025	60%

QUESTIONS/ DISCUSSION?

Interconnection Costs (Updated for 2019 IRP Update)

Seth Wiggins

Interconnection Costs

- The estimated costs associated with interconnection are added to each off-system candidate new resource in the 2019 IRP Update portfolio analysis
  - These are comprised of two parts:

Interconnection Facilities
Customer side (Gen-ties)
Transmission Provider side

Network Upgrades
Paid by transmission customer
Repaid through a reduction in transmission credits

- The total costs associated with interconnection represent a small portion (< 3%) of total project costs among each off-system candidate new resource

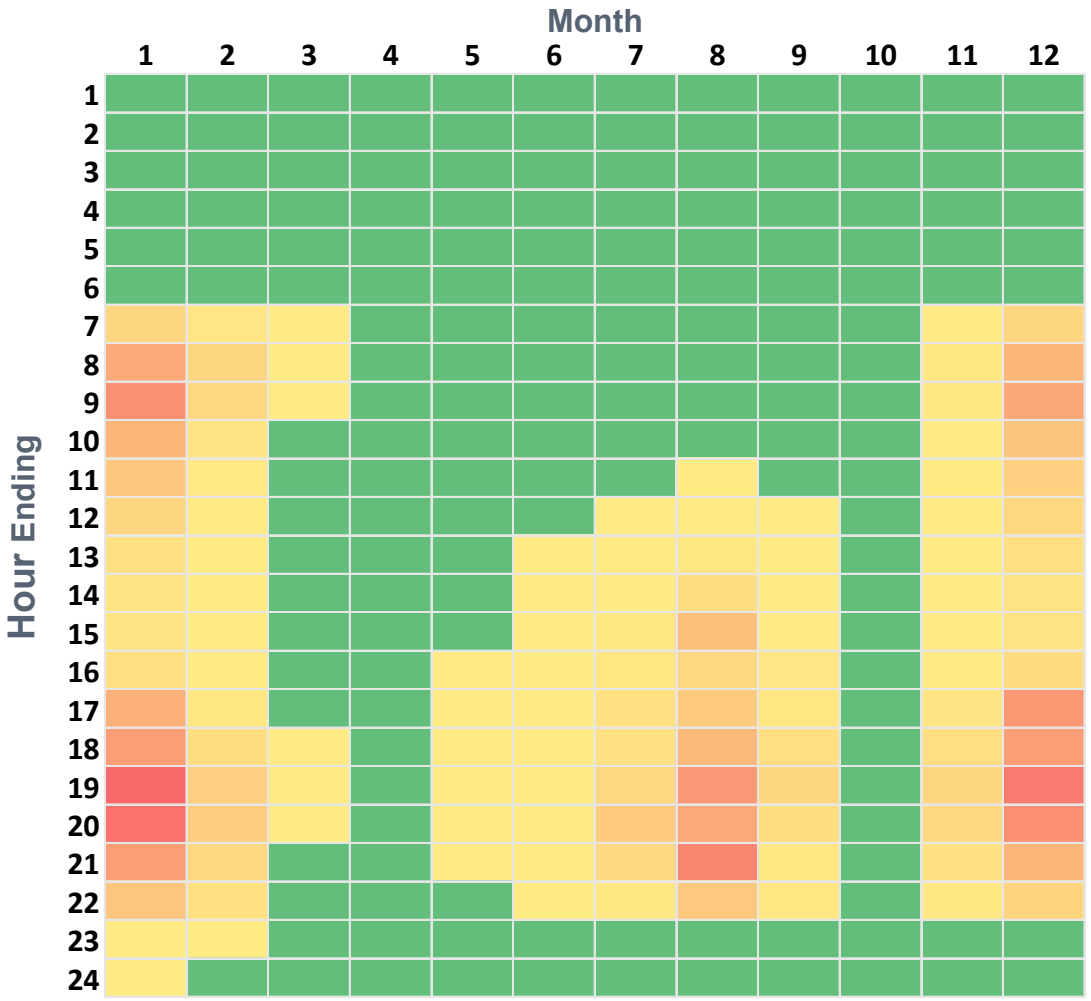
QUESTIONS/ DISCUSSION?

Capacity Contribution Update for 2019 IRP Update

Kate von Reis Baron

Capacity Contribution – ELCC - DRAFT

Loss-of-Load Expectation 2025

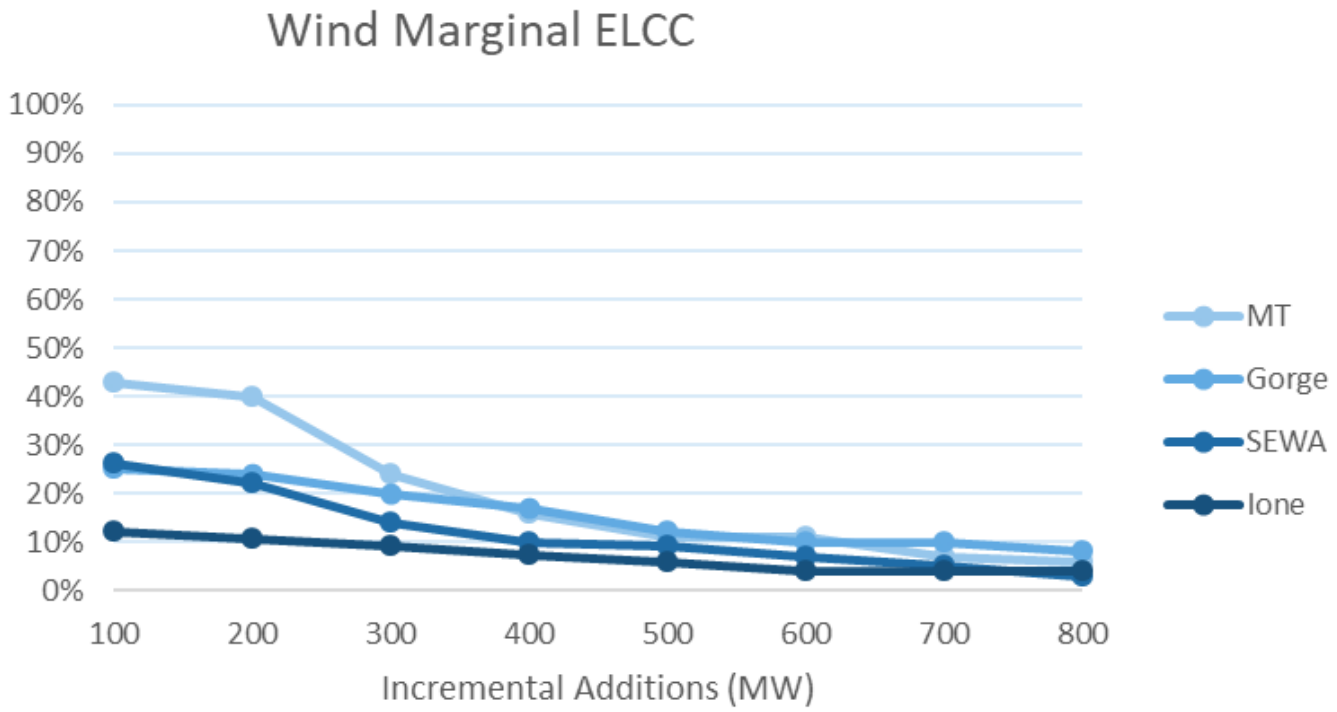


- **Capacity contribution** is the reduction to capacity need from adding an incremental resource. It is dependent both on the new resource characteristics and the characteristics of the system.
- **Effective Load Carrying Capability (ELCC)** values express the capacity contribution as a percentage of the resource capacity. For example, if a 100 MW wind resource has a capacity contribution of 25 MW, its ELCC value is 25%.

Note: Capacity contribution is discussed in Section 6.2.3 of the 2019 IRP.

All data is draft until filed.

2019 IRP - Update Wind ELCC Values – DRAFT

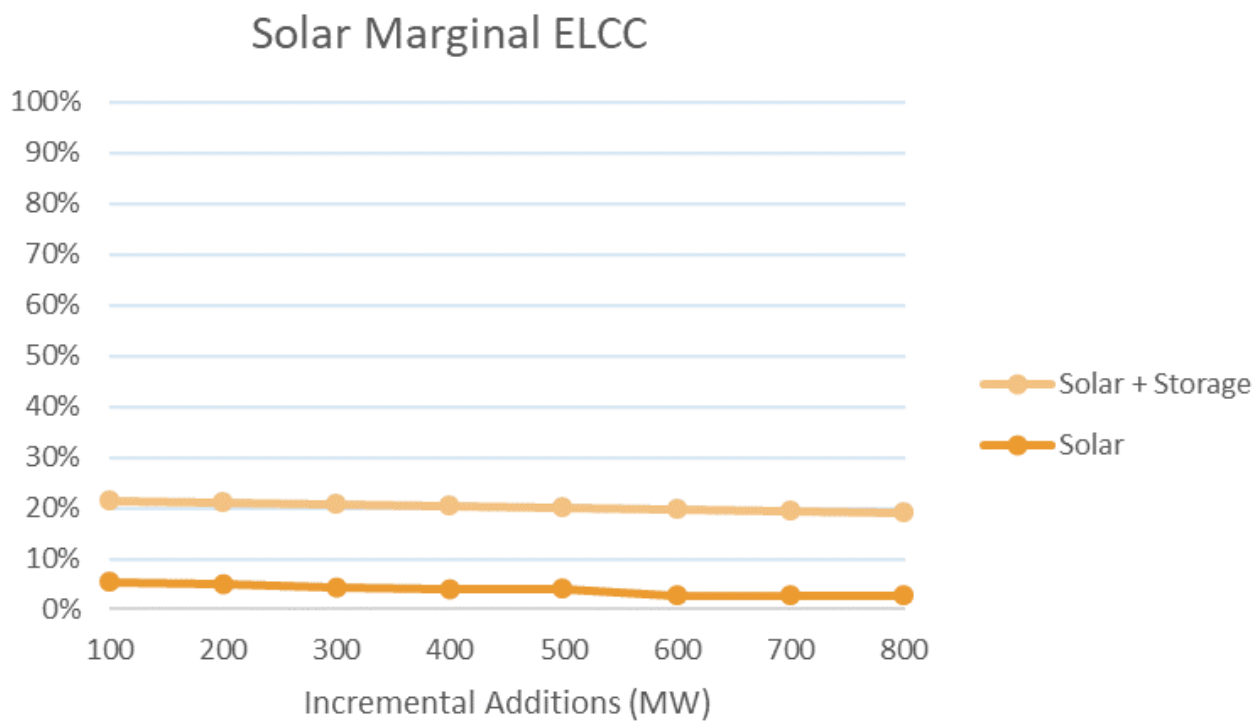


Draft Marginal ELCC Values

MW	Gorge	Ione	SEWA	MT
100	25%	12%	26%	43%
200	24%	11%	22%	40%
300	20%	9%	14%	24%
400	17%	8%	10%	16%
500	12%	6%	9%	11%
600	10%	4%	7%	11%
700	10%	4%	5%	7%
800	8%	4%	3%	6%

All data is draft until filed.

2019 IRP Update - Solar ELCC Values - DRAFT

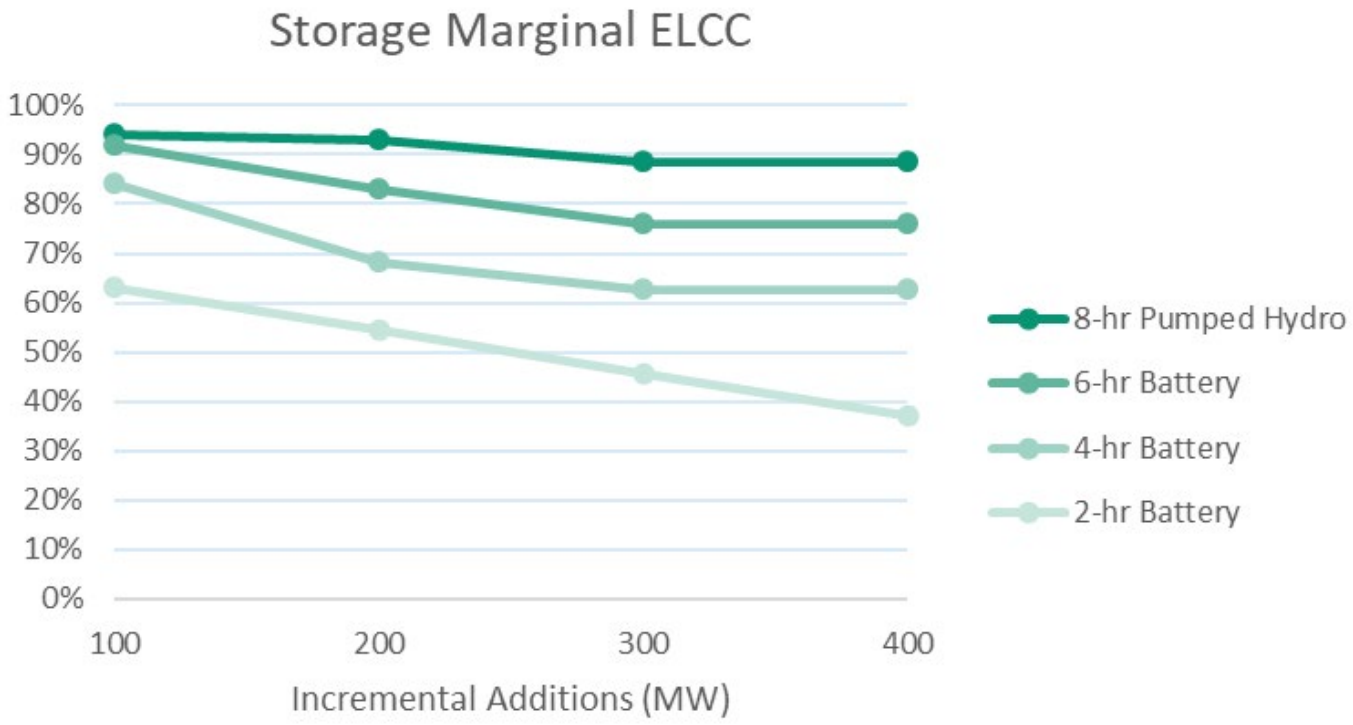


Draft Marginal ELCC Values

MW	Solar	Solar + Storage
100	6%	21%
200	5%	21%
300	5%	21%
400	4%	20%
500	4%	20%
600	3%	20%
700	3%	19%
800	3%	19%

All data is draft until filed.

2019 IRP Update - Storage ELCC Values - DRAFT

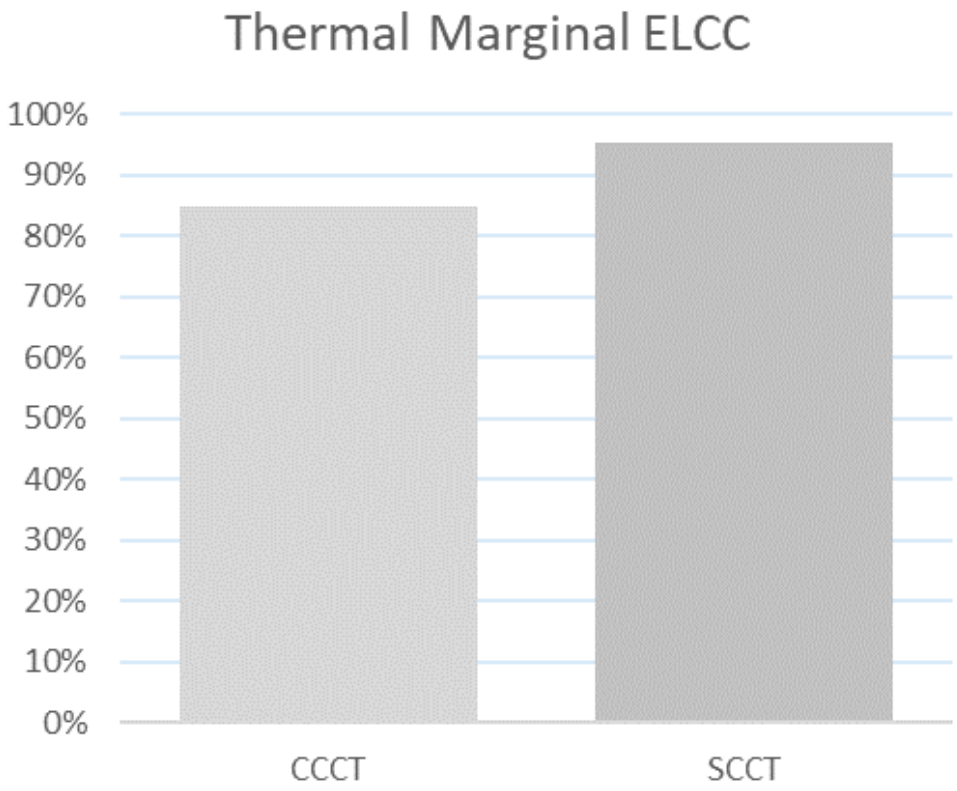


Draft Marginal ELCC Values

MW	2-hr Battery	4-hr Battery	6-hr Battery	8-hr Pumped Hydro
100	63%	84%	92%	94%
200	54%	68%	83%	93%
300	46%	63%	76%	89%
400	37%	63%	76%	89%

All data is draft until filed.

2019 IRP Update - Thermal ELCC Values - DRAFT



Draft Marginal ELCC Values

Type	Unit Size at 55F	ELCC
CCCT	503 MW	85%
SCCT	347 MW	96%

All data is draft until filed.

QUESTIONS/ DISCUSSION?

LUCAS 101

Seth Wiggins

LUCAS

- Levelized Fixed Cost Revenue Requirement Tool (LUCAS) is PGE's IRP model to calculate fixed costs of both new and existing resources.

- The main inputs to LUCAS are:
  - **PGE's financial assumptions:** Cost of capital, required return, long-term inflation, tax rates, tax credits, and the Modified Accelerated Cost Recovery System (MACRS) schedule
  - **PGE-owned Resources:** Book and tax depreciation, economic life, deferred tax, fixed O&M, scheduled capital additions, and fixed gas transportation costs
  - **Candidate new resources:** Overnight capital costs, fixed O&M, project life, decommissioning costs, plant operating parameters, and gas transportation and wheeling, integration costs, royalty payments, and federal tax credits

LUCAS: Financial Parameters

PGE Financial Parameters from 2019 IRP:

Component	Percent
Composite Income Tax Rate	27.35%
Incremental Cost of Long-term Debt	4.94%
Long-term Debt Share of Capital Structure	50.00%
Common Equity Return	9.50%
Common Equity Share of Capital Structure	50.00%
Weighted Cost of Capital	7.22%
Weighted After-Tax Cost of Capital	6.54%
Long-term General Inflation	2.05%

LUCAS: New Resource Technology Cost Trajectories

- LUCAS evaluates the fixed costs of candidate new resources for the entire planning horizon
  - Necessary is an estimation of potential cost declines going forward

- The 2019 IRP used a third-party consultant (HDR) to estimate the cost trajectories of each resource

- As described in the August 2020 roundtable, PGE plans to use publicly available data to estimate new resource cost trajectories for the next IRP
  - These findings will be presented to IRP participants in future roundtables

QUESTIONS/ DISCUSSION?

ROSE-E 101

Seth Wiggins

ROSE-E

PGE uses our capacity expansion model ROSE-E to determine the size and timing of our resource additions

There are near infinite ways PGE could meet its energy, capacity, and RPS needs between 2020-2050

ROSE-E helps us determine the long-run least-cost resource expansion path that satisfies our system needs given considered constraints

- These paths preserve optionality by adjusting to changing market conditions, resource needs, and technology costs in each future scenarios

Alongside the size and timing of resource additions, ROSE-E tells us for each portfolio the costs, emissions, and REC bank implications

ROSE-E: 2019 IRP objective functions considered

Minimize Net Present Value of Revenue Requirement (NPVRR)

- This most used objective function minimizes the net present value of total system costs over all futures

Minimize Variability

- Resource additions are identified that minimize the semi-variance of NPVRR

Minimize Near-term Costs

- This objective function determines the optimal way to keep near-term costs low

Minimize GHG + Costs

- Resource additions are identified that minimize both expected emissions and costs, while maintain economic dispatch of existing and future resources

ROSE-E: Constraints

After selecting the desired objective function, constraints are used to ensure that the selected portfolios meet system requirements and answer specific planning questions

There are two types of constraints: **System** and **Portfolio**

System Constraints	
Resource Adequacy	All portfolio solutions must be resource adequate
RPS	All portfolio solutions must be RPS-compliant
Energy	In the reference case, energy from incremental resources must be at or below the forecasted net market shortage. This constraint is applied to all futures after 2040.
Optionality	Action-plan window additions are fixed across all futures, but progress independently after for each future

ROSE-E: Portfolio Constraints

Portfolio constraints are applied to test the implications of individual choices

- Resource procurements of any size in can be ensured or limited in any year

Individual actions

Examples: 100 MW of Geothermal in 2026, 330 MW SCCT in 2033

Technology group actions

Example: 150 MW of RPS resource(s) in 2028

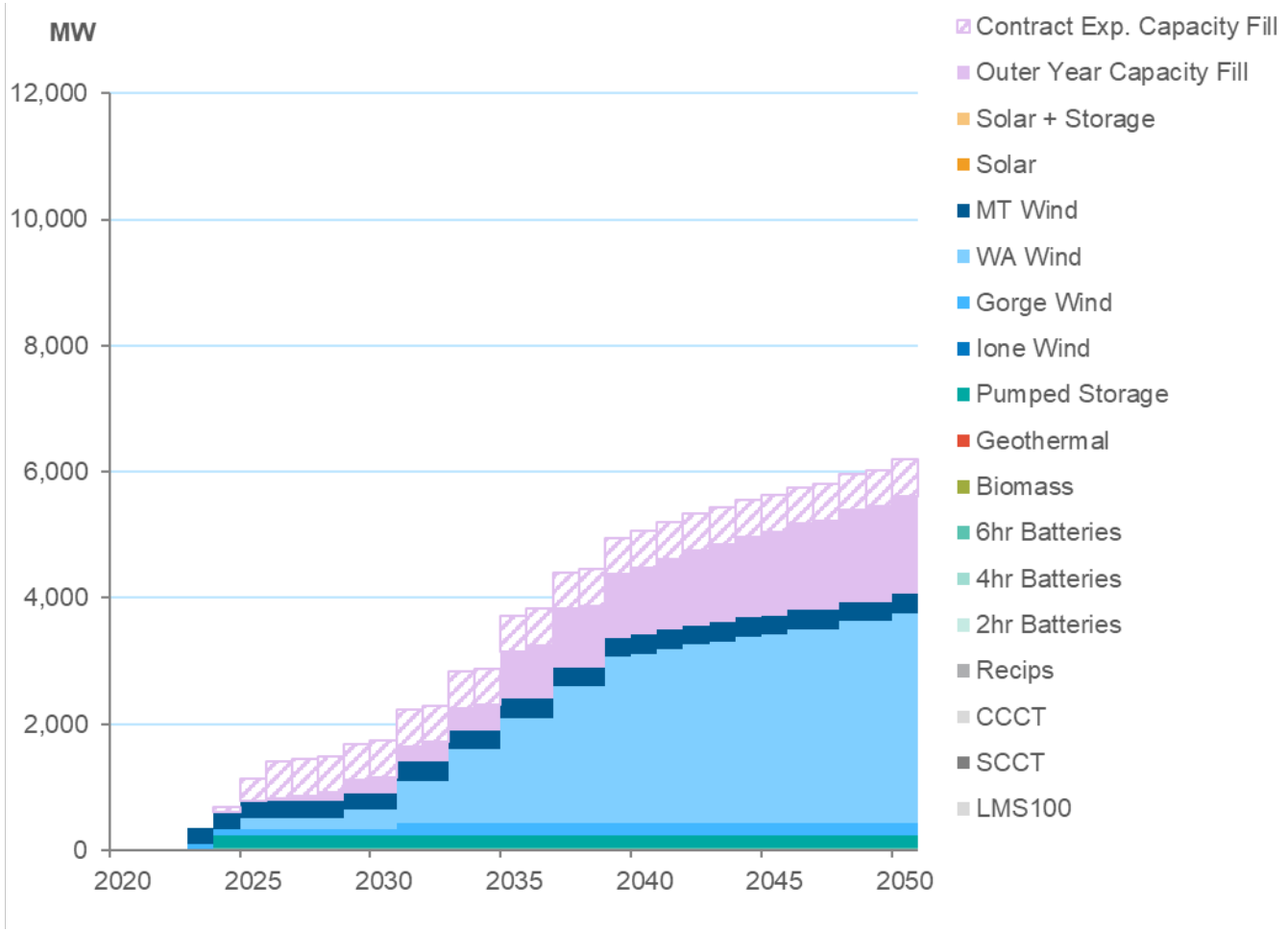
Additional limits

Example: 0 MW of any resources in 2023-2027

ROSE-E's flexibility allows PGE to test many individual portfolios

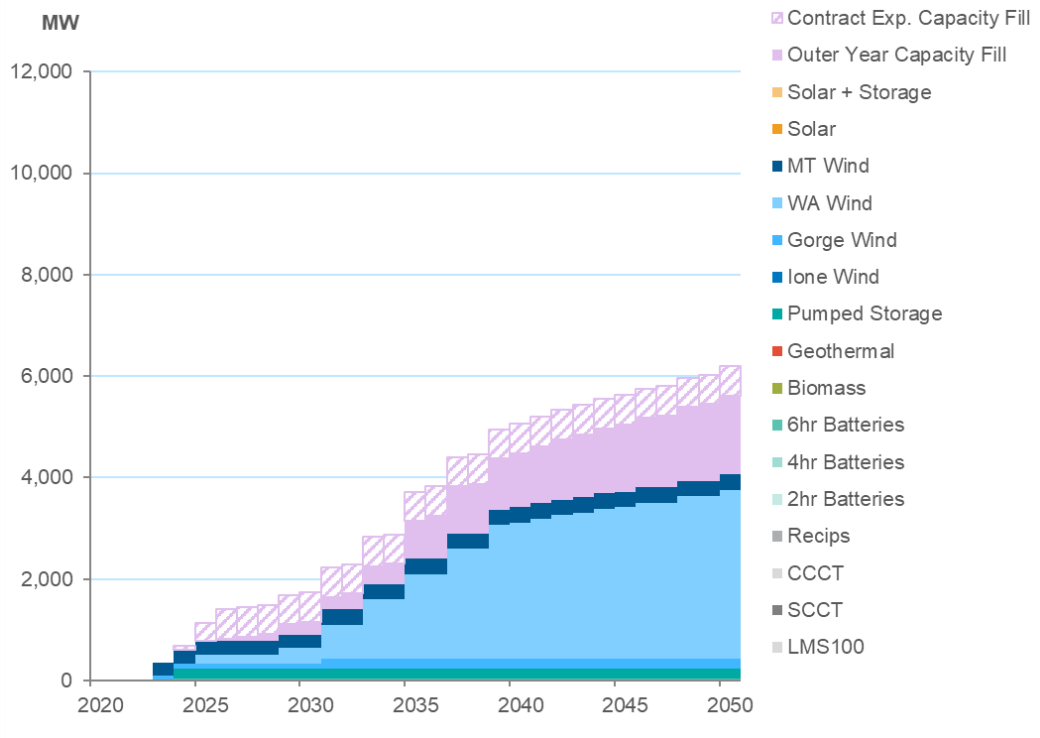
- We are open to participant input to model specific choices

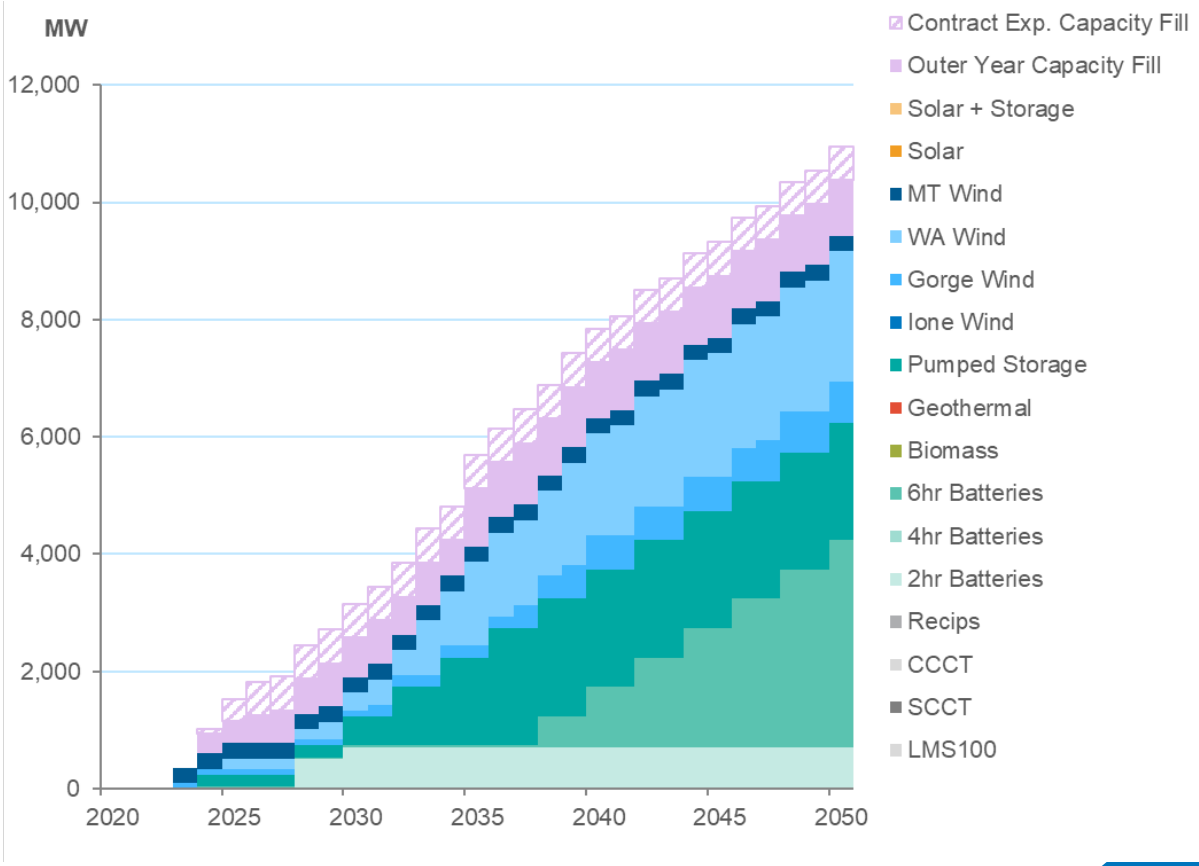
ROSE-E: Outputs from 2019 IRP



Preferred portfolio

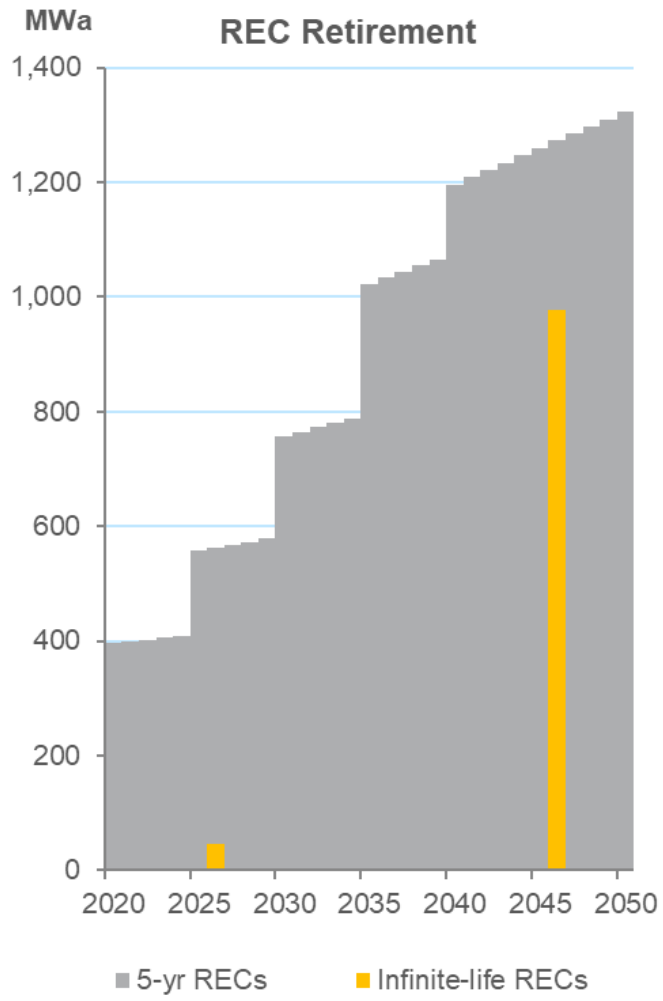
ROSE-E: Outputs from 2019 IRP

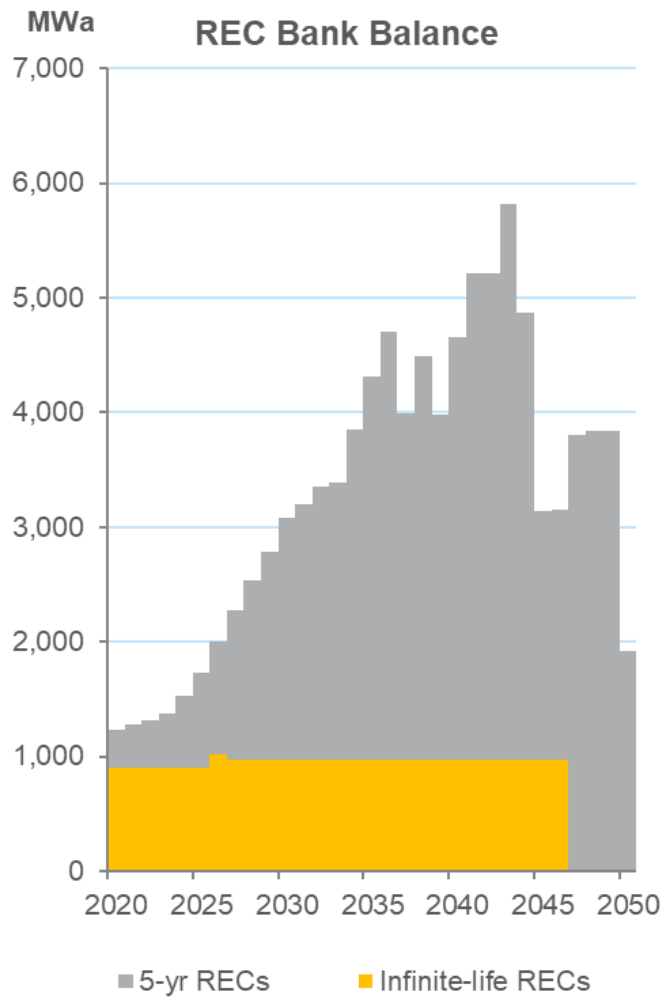




Preferred portfolio: Reference Case vs High need, High WECC Buildout, Low Carbon Price, Reference Gas and Hydro, High cost solar and storage

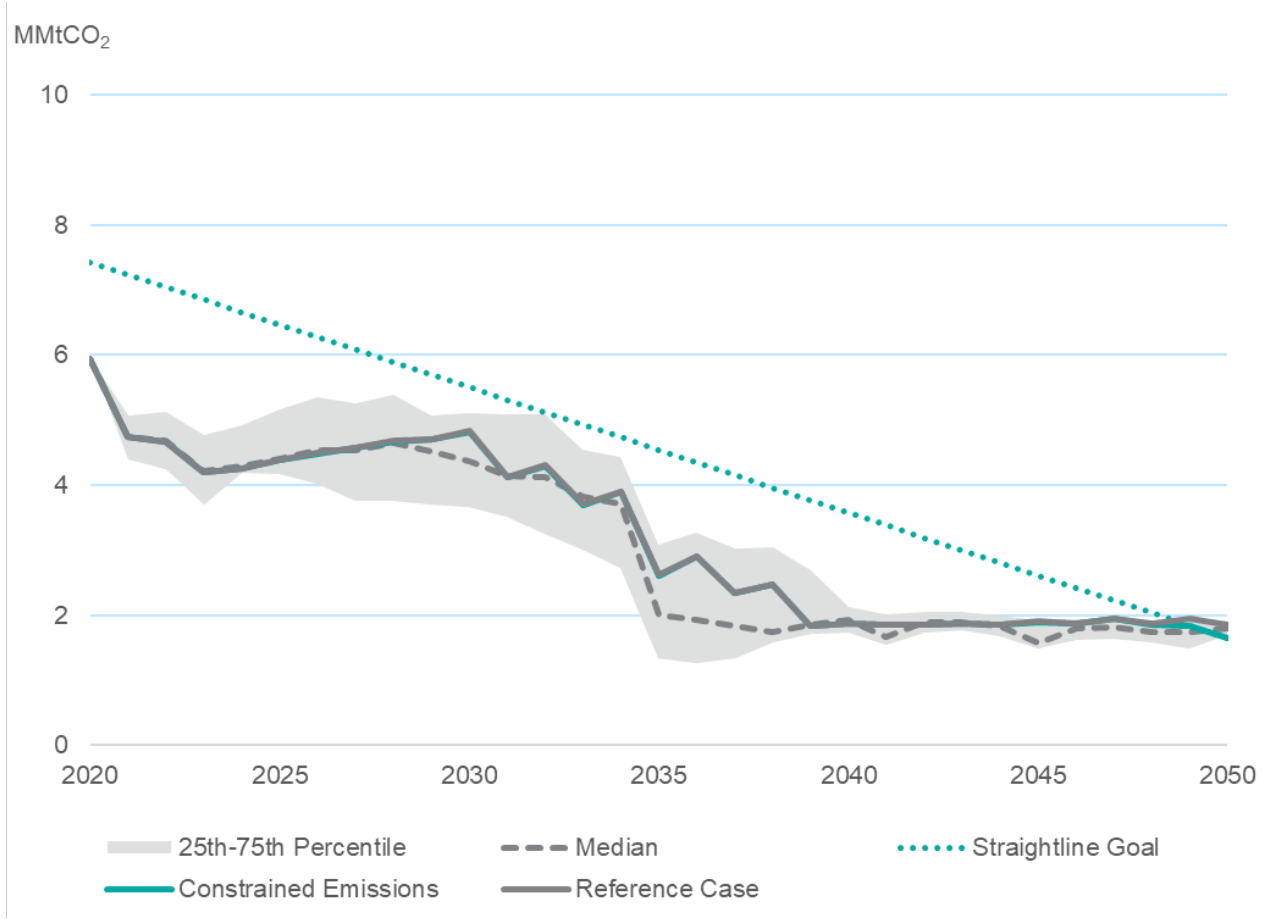
ROSE-E: Outputs from 2019 IRP





Preferred Portfolio: REC Bank

ROSE-E: Outputs from 2019 IRP



Preferred Portfolio: GHG Emissions

QUESTIONS/ DISCUSSION?

Additional Information

Kate von Reis Baron

Questions Received on Future IRP and RFP Process

Timing of IRP Update?	IRP Update expected between December 2020 and January 2021
Bilateral negotiations complete?	PGE continues to pursue bilateral negotiations for capacity with existing operators to partially meet PGE's forecasted 2025 capacity needs
Expected timing of RFP for new resources?	Regulatory process associated with an RFP for new resources expected in Q1 & Q2 of 2021
Can long-lead time resources participate in the RFP?	Accommodations expected to allow long-lead time resources to participate in upcoming solicitation

THANK YOU

Contact us at:

IRP@pgn.com

Attachment A: Acronyms

- CCCT: combined cycle combustion turbine
- COD: commercial operation date
- ELCC: effective load carrying capability
- GHG: greenhouse gas
- LCOE: levelized cost of energy
- LUCAS: Levelized Fixed Cost Revenue Requirement Tool PGE uses or used for IRP analysis (see Appendix I: 2019 IRP Modeling Details from the 2019 IRP)
- MACRS: Modified Accelerated Cost Recovery System
- MW: megawatt
- NPVRR: net present value of revenue requirement
- O&M: operation and maintenance
- PTC: production tax credit
- Q1/Q2: quarter 1/ quarter 2
- REC: renewable energy credit
- RFP: request for proposal
- ROSE-E, RECAP, 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
- SCCT: simple cycle combustion turbine
- WECC-wide: Western Interconnection (Today - The generators, transmission lines, and other facilities that comprise the Western Interconnection electrical grid, which is a NERC region)