Integrated Resource Planning

ROUNDTABLE 22-5

JUNE 2022





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

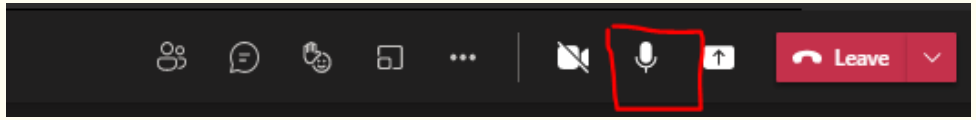
*Please use Microsoft Edge or Google Chrome with Teams as it will give you the best experience

+1 971-277-2317 (dial this number from your phone for best results)

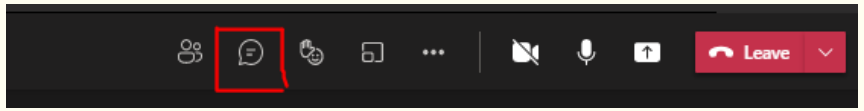
PW: 310 455 708#

PARTICIPATION

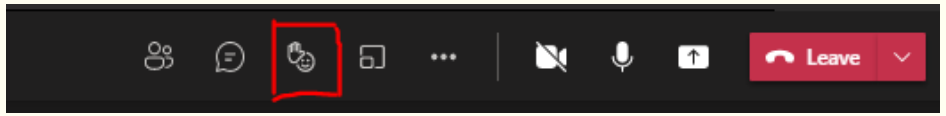
- Mute your mic while others are speaking; to unmute via phone press *6



- We will ask for comments and questions along the way
- Participate using the chat box or ask questions verbally



- Use the “raise hand” feature to signal you would like to ask your question verbally



- Wait to be called on
- Please be polite and respect all participants on the webinar
- Please stay on topic; we may interrupt or shorten questions to meet the time commitment of the meeting

AGENDA

Welcome and introductions	15 minutes
Safety moment	5 minutes
House Bill 2021 and IRP Modeling	60 minutes
2023 IRP Portfolio Analysis	60 minutes
Resource Adequacy Market Access	30 minutes

Introductions

SAFETY MOMENT

Ladder safety

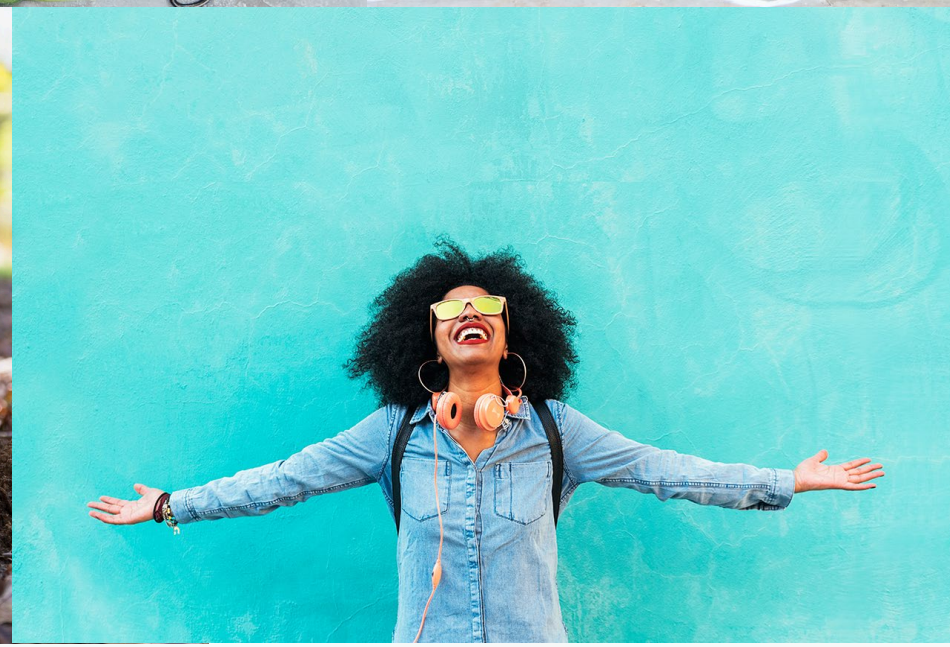
- Make sure to set up your ladder safely on level and solid ground
- Remember to use a spotter and/or communicate to a housemate or neighbor about when and where you will be using a ladder

Gardening safety

- Use gloves to protect your hands and skin from sun, irritants, cuts, and contaminants
- Use sunscreen and a hat to protect yourself and any children or elders in your care

Vision safety

- Be aware of sun damage to your eyes, try to invest in protective eyewear if you can afford it or use a hat with a bill
  - Lions Eyeglasses Assistance Program
  - VSP no-cost vision care
  - AAO Resource list



HOUSE BILL 2021 AND IRP MODELING

SETH WIGGINS AND TOMÁS MORRISSEY

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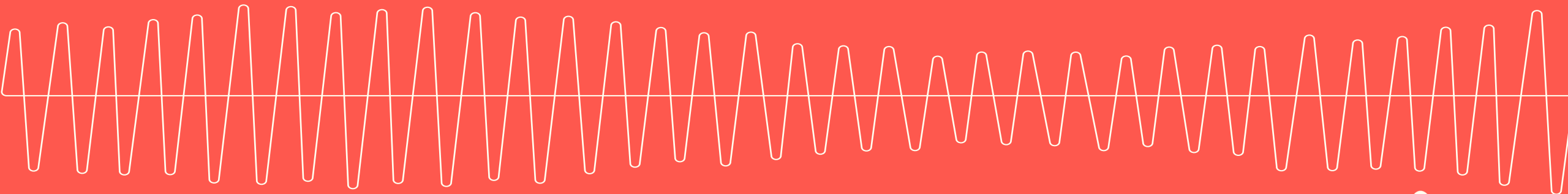


Presentation Goals

Today we want to highlight the planning considerations we are seeing with HB 2021's emission reduction targets

We have not made final decisions on our planning approach

Rather, this informational presentation is aimed at evaluating how to integrate HB2021 compliance into our long-term planning models

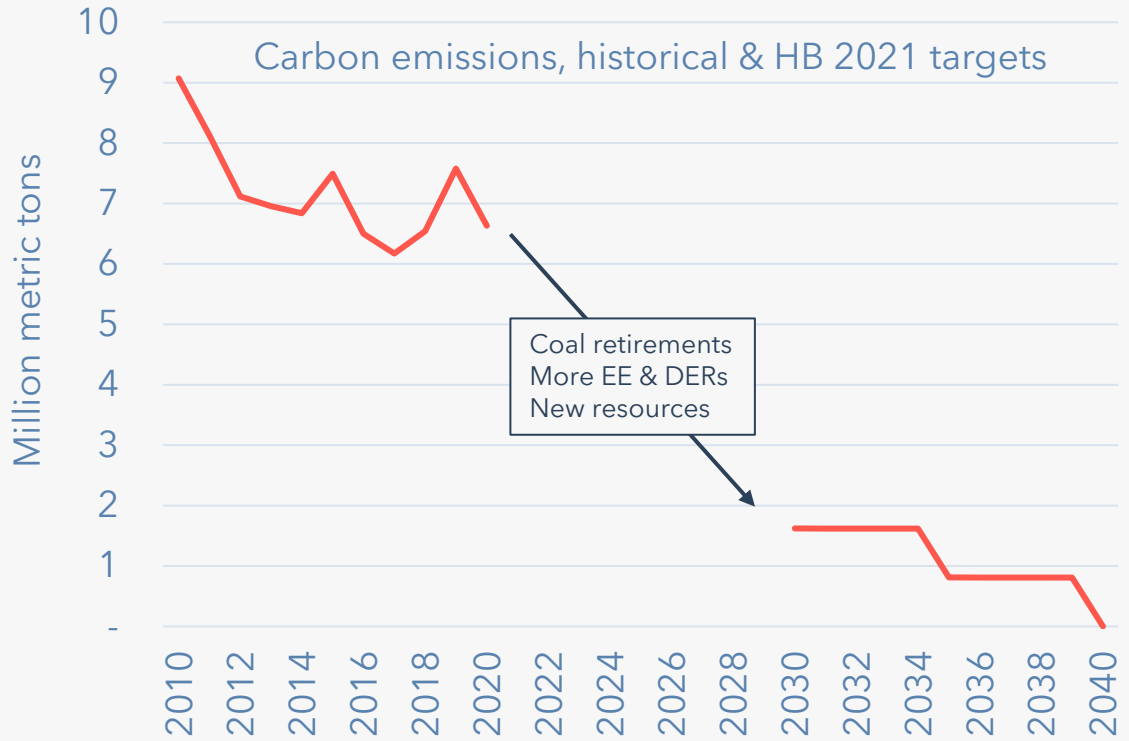
- We welcome any feedback as we determine how to best incorporate these requirements

HB 2021 Carbon Reduction Targets

SECTION 3. Clean energy targets

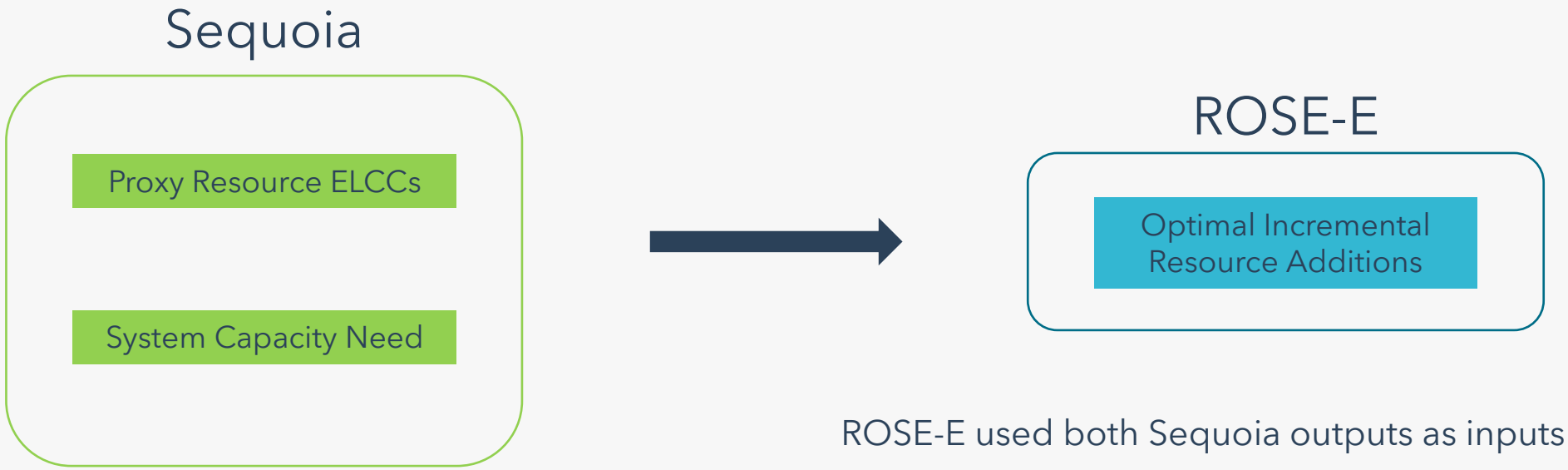
A retail electricity provider shall reduce greenhouse gas emissions, measured for an electric company as greenhouse gas emissions reported under ORS 468A.280… by the following targets:

- (a) By 2030, 80 percent below baseline emissions level (1.62 MMT for PGE)
- (b) By 2035, 90 percent below baseline emissions level (0.81 MMT for PGE)
- (c) By 2040, and for every subsequent year, 100 percent below baseline emissions level



Historical data from Oregon DEQ
Department of Environmental Quality : Greenhouse Gas Emissions Reported to DEQ : Air Quality Programs : State of Oregon

2019 IRP Update Model Configuration



ROSE-E used both Sequoia outputs as inputs

- System capacity need is a constraint to be met
- ELCCs inform how resources can meet that need

Sequoia's Weekly Construction

Model starts by randomly picking one week in the load history (1980 – 2020).

A hydro week is picked from the same month. It sets generation min, max, and total MWh parameters by project.

Some resources and load change daily & match the month, load bin, and weekday variables (if appropriate).

Other resources enter model through monthly or weekly inputs and FOR.

Start date	Month	Load bin	Weekday	Hydro year	Biglow	Tucannon	Bakeoven	Load	Colstrip 3	Carty
8/5/1997	8	5	1	2003	8/6/2005	8/28/2017	8/11/2014	8/30/2007		
8/6/1997	8	5	1	2003	8/25/2016	8/12/2004	8/3/2014	8/7/1981		
8/7/1997	8	5	1	2003	8/5/2010	8/3/2017	8/10/2014	8/13/1992	Resource generation varies hourly by month and by forced outage rate	
8/8/1997	8	3	1	2003	8/22/2005	8/21/2006	8/24/2014	8/30/1991		
8/9/1997	8	4	0	2003	8/1/2005	8/27/2005	8/9/2012	8/24/2019		
8/10/1997	8	5	0	2003	8/21/2011	8/11/2017	8/26/2011	8/8/1987		
8/11/1997	8	5	1	2003	8/31/2004	8/7/2006	8/19/2014	8/18/1981		

Carbon Accounting in 2023 IRP

Two important models in estimating system emissions are:

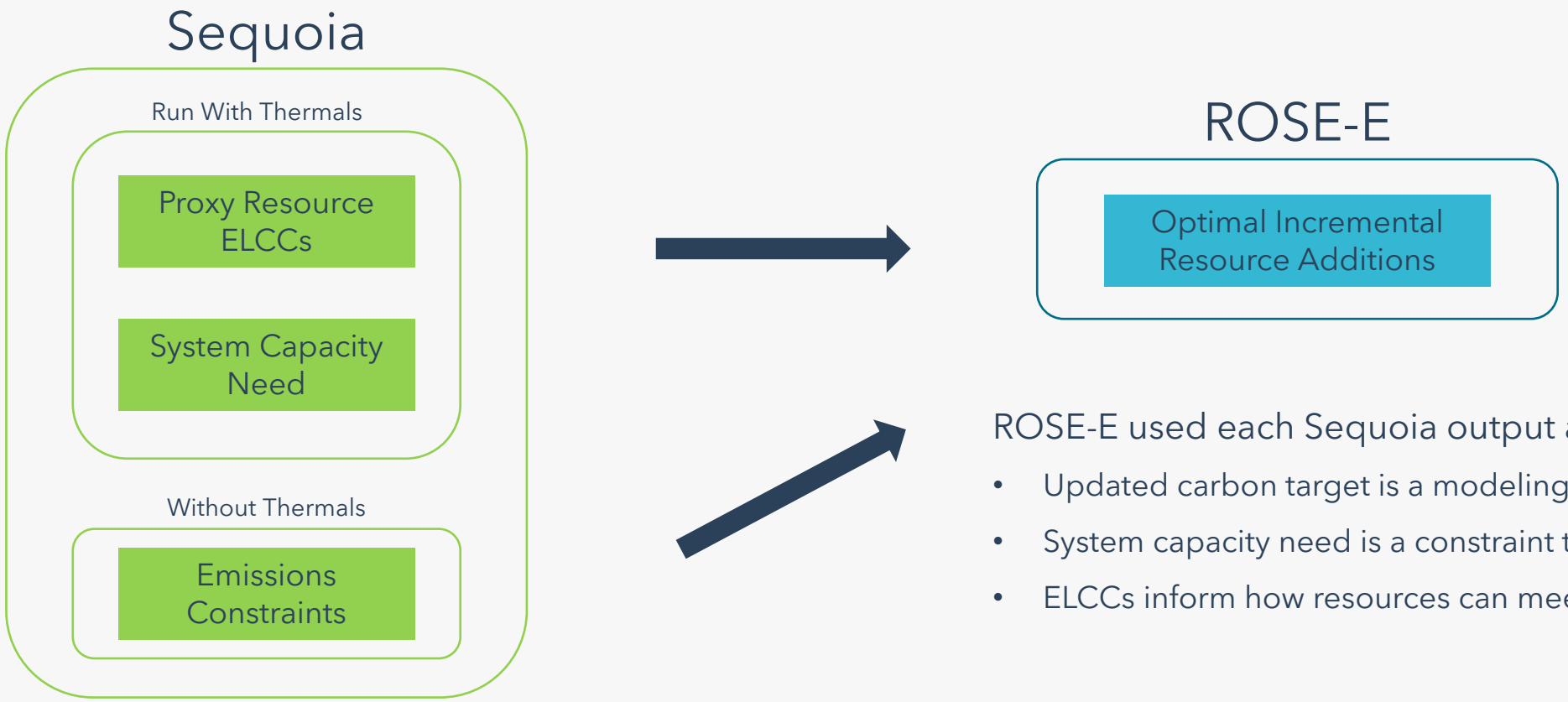
- **Sequoia** (resource adequacy): Hourly, running in 168-hour (weekly) segments
- **ROSE-E** (capacity expansion): Yearly, losing some detail

PGE contracted with E3 to help setup Sequoia to study yearly carbon emissions

- They suggested grouping weeks together by similar characteristics (hydro year, temperature year, and so on)
- Allows us use Sequoia outputs to study annual carbon targets

E3 also suggested a modeling approach using Sequoia and ROSE-E for the 2023 IRP to plan for HB 2021 carbon targets (detailed in upcoming slides)

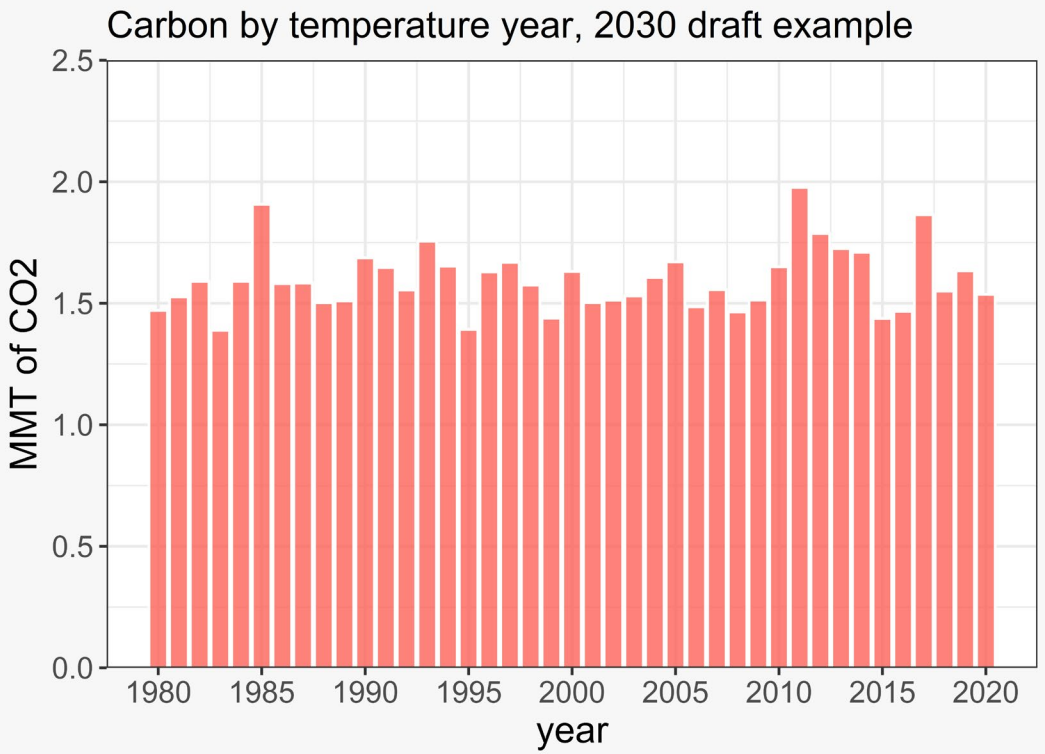
2023 IRP Model Configuration



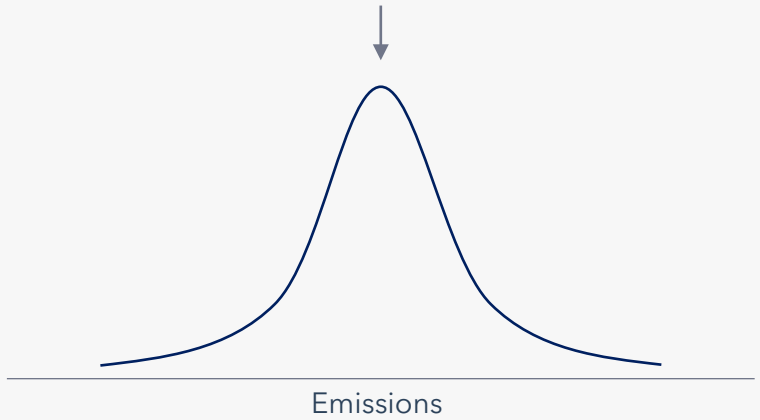
ROSE-E used each Sequoia output as inputs

- Updated carbon target is a modeling constraint
- System capacity need is a constraint to be met
- ELCCs inform how resources can meet that need

Estimated Annual Emission Variability



Changing axes to show the distribution of emission outcomes*

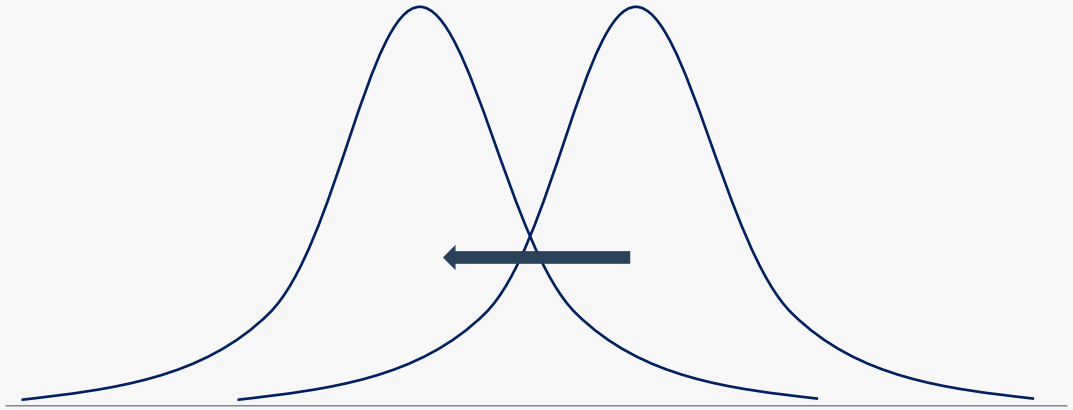


* Assumes a symmetric distribution of emissions for illustrative purposes only

Shifting Emissions Distribution

By adding new energy and capacity resources, we can reduce the forecasted distribution of emissions

- Both allow us to rely on existing natural gas plants and the market in fewer hours
- This shifts the potential carbon emission distribution left, as it becomes less likely in every hour that we will need to emit to maintain adequacy

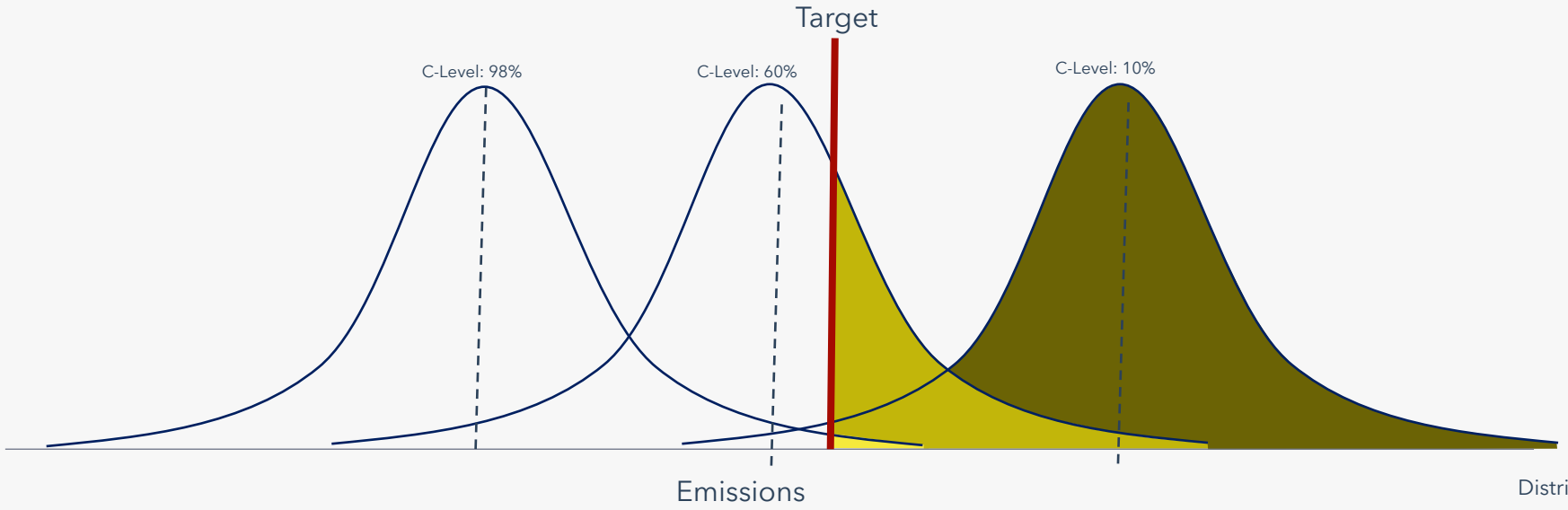


Emissions

For each weather year, emissions are forecasted to be lower

Determining Desired ‘C-Level’

A set of resource additions creates a ‘C-Level’ that describes the emission distribution’s area above the specific carbon target



Distributions and C-Levels purely illustrative

For example: A C-Level of 60% signifies a forecasted 60% likelihood that actual emissions are at or below the relevant HB2021 carbon reduction target at that point of time

New Carbon Constraint

Using the distribution of emissions (caused by variability in temperature, load, and generation) and the chosen C-Level a new carbon constraint can be created

As a hypothetical example, to achieve a C-Level of 60% in 2030 Sequoia will instruct ROSE-E to use 1.48 MMT in 2030 as a constraint

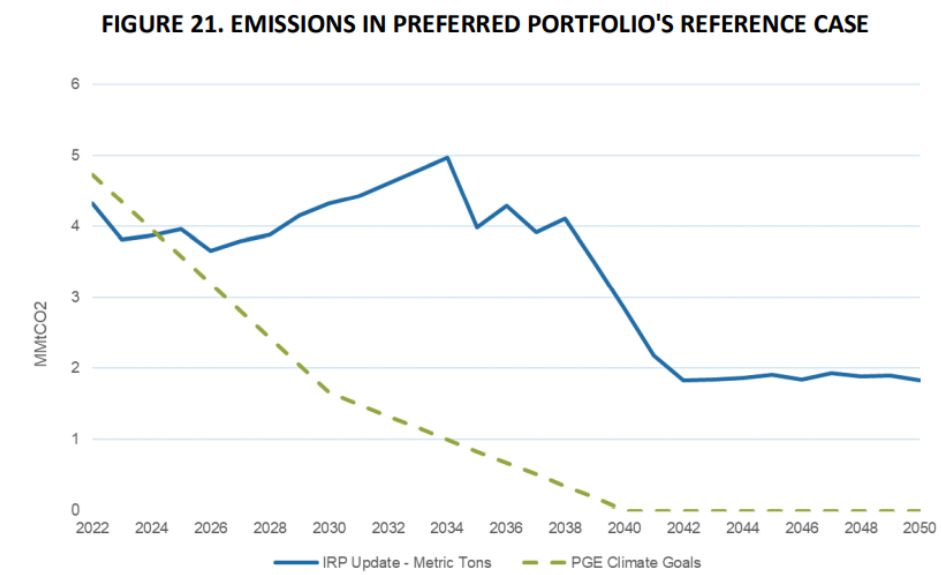
- ROSE-E would then search for the least-cost set of resource additions that ensure sufficient resources to meet this carbon constraint

The required resource additions **increase** as the carbon constraint **decreases**

Past Planning Has Used C-50

- Carbon constraints in past PGE planning have been based on C-50 (meeting the carbon target under expected weather conditions)

- Moving to a higher C-Level would increase the probability of meeting HB 2021 targets in any given year, but also increase the need for carbon free resources (and the associated cost)



The 2019 IRP Update and other work forecast emissions under expected weather conditions (C-50)

Determining Appropriate 'C-Level'

While we will eventually choose one reference case C-level for the IRP, we are also modeling a range of C-levels as a sensitivity

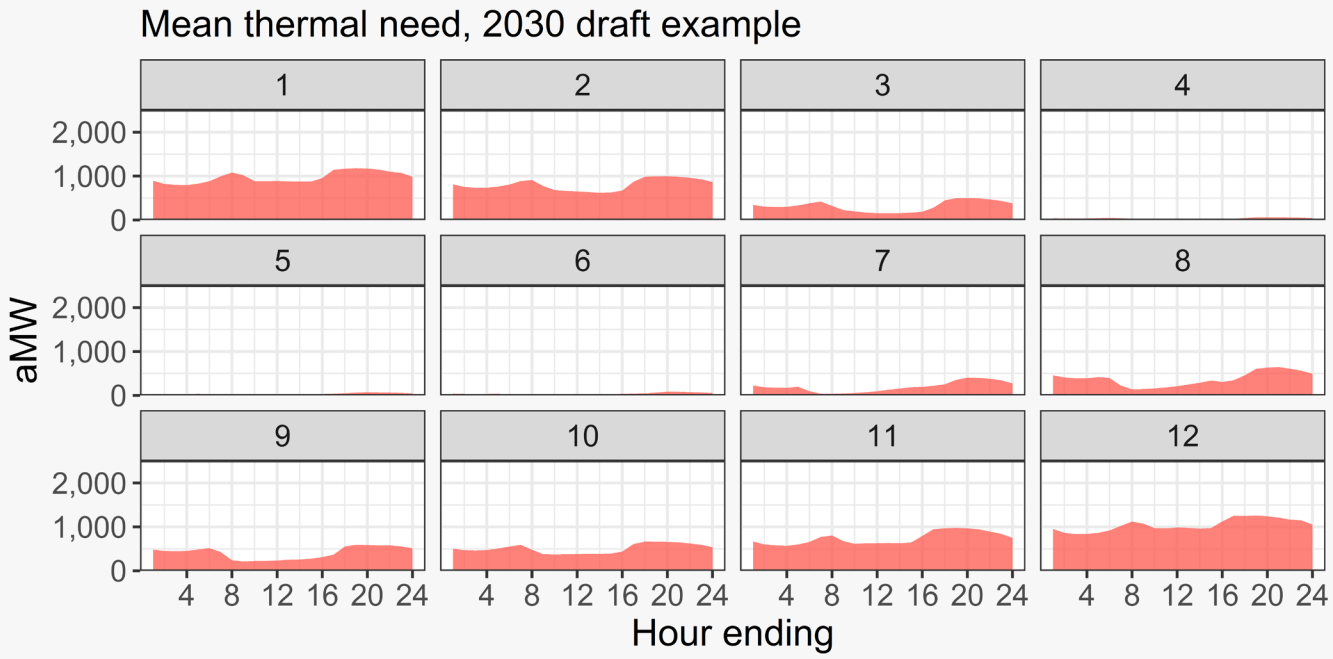
- Results will show the trade-off between addressing variables we do not control versus the cost associated with additional incremental resources

Additionally, we are currently refining our carbon accounting methodology to best incorporate our DEQ carbon reporting processes

- As emission constraints drive resource additions, any updating will affect the quantity of resources required across all sensitivities

Thermal Generation in 2030

In some hours thermals units are running 100% for adequacy. In other hours thermals are off. Initial estimates suggest the gas fleet could run at a ~25% capacity factor while meeting the 2030 carbon targets at a C-level of 50%



High thermal usage in the winter is offset by low usage in spring

QUESTIONS/ DISCUSSION?

2023 IRP PORTFOLIO ANALYSIS

SETH WIGGINS AND TOMÁS MORRISSEY

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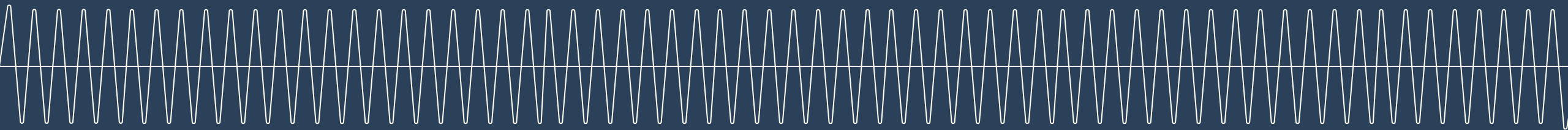


PGE

IRP Portfolio Analysis

The IRP has two main objectives:

1. **Estimate system need**
   - Difference between forecasted demand and supply (existing and contracted resources)
   - Expressed in yearly MW capacity need, MWa renewable need, etc.

2. **Create a strategy to fill that need**
   - Identifying best combinations of specific incremental resource additions
   - Culminates in an 'action plan' of near-term resource additions

This second step has been performed in the IRP's 'Portfolio Analysis', which:

- Tests a variety of portfolios in changing market conditions
- Leads to a 'Preferred Portfolio' of resource additions
- Employs our capacity expansion model ROSE-E

Proxy Resources Available

To meet system needs, ROSE-E selects from a list of *proxy resources*:

- Reasonable estimates of resources that we could plausibly add to our system

2019 IRP	2023 IRP
Solar	Solar (CV, Wasco, McMinnville)
Solar plus Storage	Solar plus Storage (two ILRs)
Wind (Ione, Gorge, SE WA, MT)	Wind (Gorge, SE WA, MT)
Batteries (various durations)	Offshore Wind
Pumped Hydro	Battery Storage (various durations)
Geothermal	Pumped Hydro
Biomass	

See PGE's February and November 2021 Roundtables for more information on the development of the 2023 IRP's supply-side options

Low Precision in Outer-Year Additions

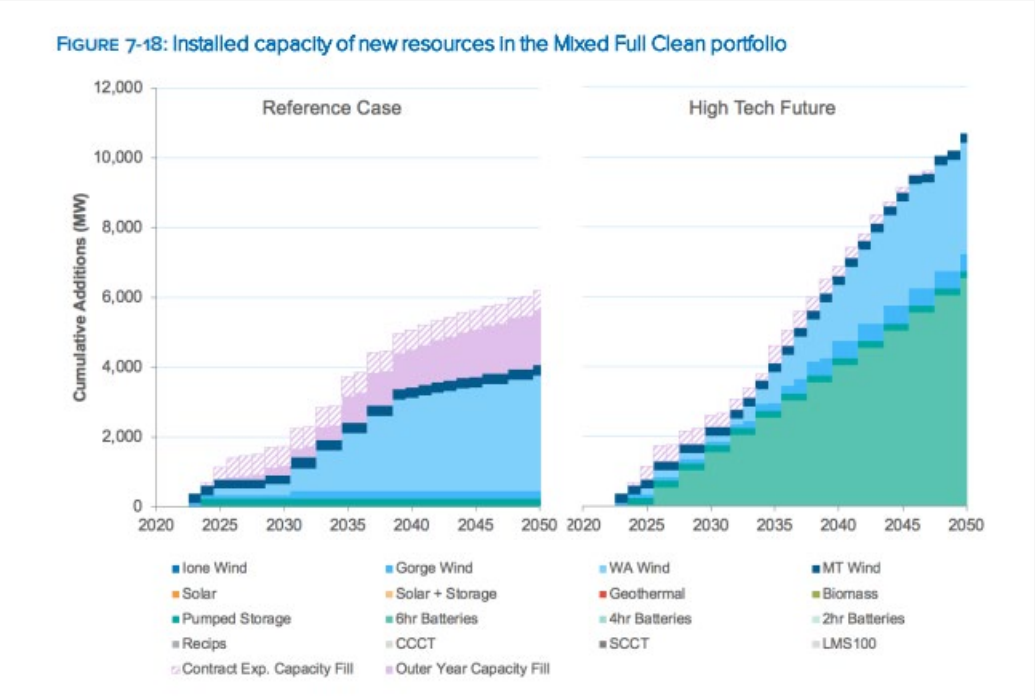
The 2019 IRP preferred portfolio included:

- > 3,800 MW of SE WA Wind in the Reference Case
- > 6,000 MW of 6-hour batteries in the high-tech future

There is low precision in these values

The models used the information available to create a set of resources based on their applicable costs, benefits, and constraints

- This analysis provided sufficient detail to the Commission to be with our near-term resource decisions (outlined in our action plan)



Challenges of Meeting 2040

The IRP estimates the difference between expected demand (i.e., load growth) and forecasted supply (of existing and contracted resources)

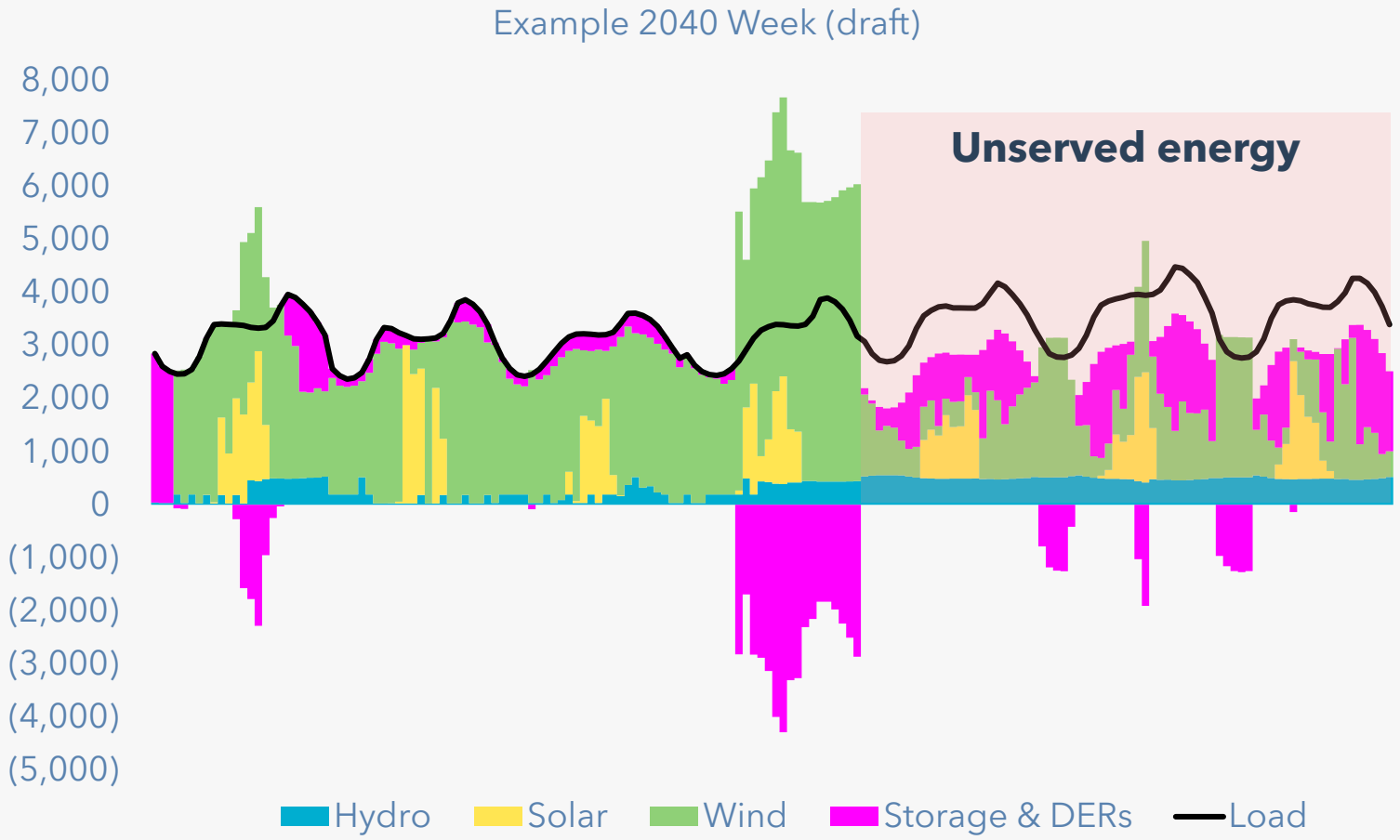
- With constant growth but no emitting (coal and natural gas) generation available, our system has periods of significant deficit in 2040

To meet this long-term need, the IRP would generally select the best set of resources available today

- However, the resources available today at reasonable cost and reliability are not able to fill the deficits

Both the correlations of energy resources and the current capabilities of energy-limited storage options would lead to a *significant* overbuild of our system

Challenges of Meeting 2040

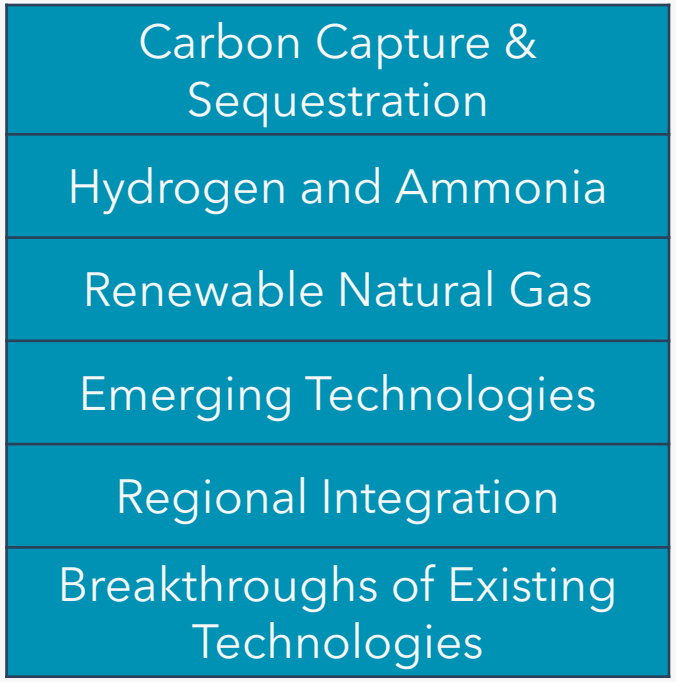


Here, to our system, we've added:

- 6,000 incremental MW wind;
- 6,000 incremental MW solar; &
- 6,000 incremental MW of storage

We still see a capacity deficit of over 1500 MW in 2040

Different Resources are Needed for 2040



We are evaluating the feasibility of possible resources that could potentially meet our 2040 needs

Many of these options have uncertainty in performance, long lead times, regulatory hurdles, and high costs

- Accordingly, these *should not* be considered as potential near-term resource additions
- Will not be evaluated in ROSE-E

However, we are currently investigating whether they could be important pathways to enable a non-emitting system

Portfolio Analysis in the 2023 IRP

In the coming IRP, portfolio analysis will be conducted like earlier iterations:

- Model will choose optimal combination of proxy supply-side resources
- Cost and Risk metrics be used to determine a Preferred Portfolio and Action Plan

However, quantitative results after 2030 will be deemphasized

In its place will be a larger focus on:

- System requirements (more granularity on energy and capacity needs)
- A qualitative assessment of the possible pathways to 2040

This will provide to us (both PGE and our public participants) the opportunity to evaluate viable emission-free options that traditional analysis with current supply-side options would not provide

QUESTIONS/ DISCUSSION?

RESOURCE ADEQUACY MARKET ACCESS

TOMÁS MORRISSEY

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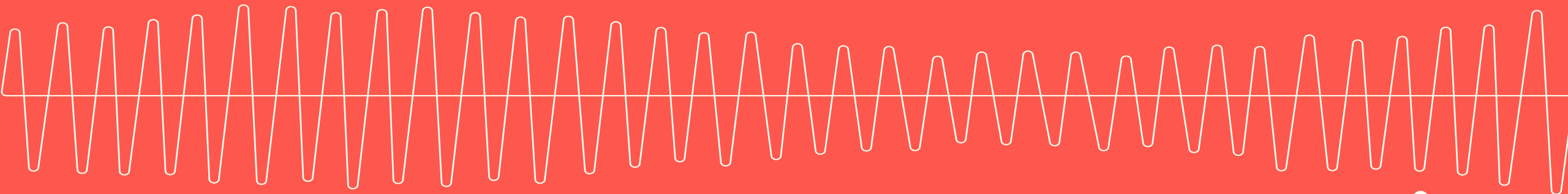
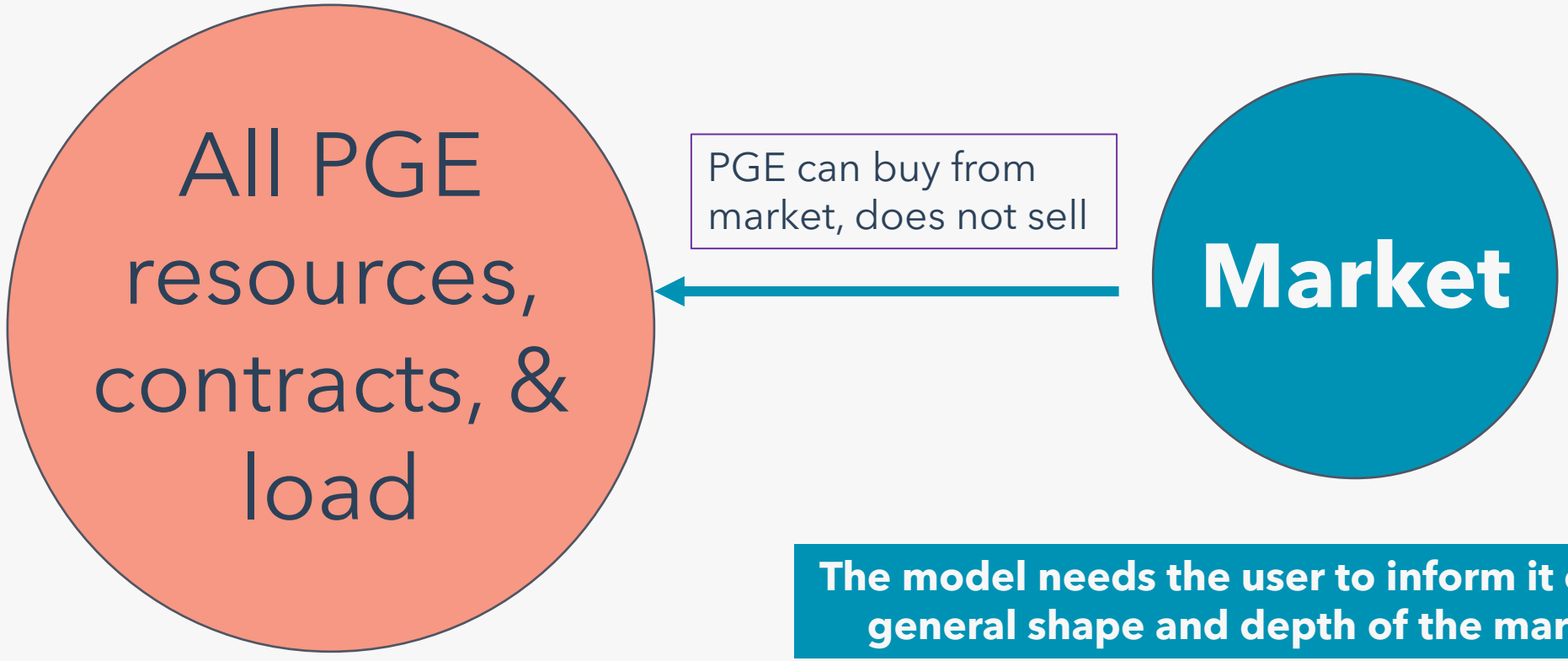


PGE

Sequoia Market Interaction



The model needs the user to inform it of the general shape and depth of the market

2019 IRP Update Ref. Assumptions

- For summer/winter HLH:
  - Zero MW in summer after 2023 (some market available prior in 2023 and earlier)
  - Zero MW in winter

- For spring/fall HLH:
  - 200 MW

- For year round LLH:
  - 999 MW

Heavy-load-hours (**HLH**): 6:00 AM to 10:00 PM Monday through Saturday

Light-load-hours (**LLH**): 10:00 PM to 6:00 AM Monday through Saturday, all day Sunday, all day on holidays

What Informs the Market Assumptions

E3 setup a workbook for the 2019 IRP that provides a high-level summer/winter load resource balance for the Northwest. The workbook is fed data from various sources:

- Northwest Power & Conservation Council data ("Council")
- BPA White Book
- WECC Western Assessment of Resource Adequacy

2023 IRP Market Availability Updates

- Using updated Council data, we see more resource and less load in the winter, and less resource and more load in the summer
  - This is mostly due to climate change impacting loads and hydro

- We are tuning the summer/winter month definition
  - Old: July 1 – September 30 / December 1 – February 28
  - New: June 15 – September 30 / November 16 – March 15

- Also adjusting the light-load-hour assumptions
  - Old: 999 MW of market available
  - New: 200 to 999 MW of market available depending on load

2023 IRP Market Assumption Proposal

- For summer/winter HLH:
  - Zero MW in summer
  - 200 MW in winter through 2025, 50 MW after (reduction due to coal retirements)

- For spring/fall HLH:
  - 200 MW

- For year round LLH:
  - 200 to 999 MW available depending on load

QUESTIONS/ DISCUSSION?

NEXT STEPS

Please provide feedback on the information presented during House Bill 2021 and IRP modeling by **October 1** using the IRP feedback form

A recording from today's webinar will be available in one week

Upcoming Roundtables:
July 21
August 18
September 15
October 20
November 16
December 15

THANK YOU

CONTACT US AT:
IRP@PGN.COM

ACRONYMS

BPA: Bonneville Power Administration

C-level: forecasted likelihood that actual emissions are at or below the HB 2021 carbon reduction target

DER: distributed energy resource

EE: energy efficiency

ELCC: effective load carrying capability

FOR: forced outage rate

HB 2021: House Bill 2021

HLH: high load hours

ILR: inverter loading ratio

IRP: integrated resource plan

LLH: light load hours

MMT: million metric tons

MW: megawatt

MWa: megawatt average

MWh: megawatt hour

ORS 468.280: Oregon revised statutes chapter 468 (Air Quality)

ROSE-E, LUCAS, ROM, PGE-zone, Sequoia, and AURORA: models PGE uses for IRP analysis (see Appendix I: 2019 IRP Modeling Details from the 2019 IRP)

VER: variable energy resource

WECC: Western Energy Coordinating Council