Integrated Resource Planning

ROUNDTABLE 21-4

JUNE 2021





MEETING LOGISTICS

Electronic version of presentation:

https://www.portlandgeneral.com/our-company/energy-strategy/resource-planning/integrated-resource-planning/irp-public-meetings

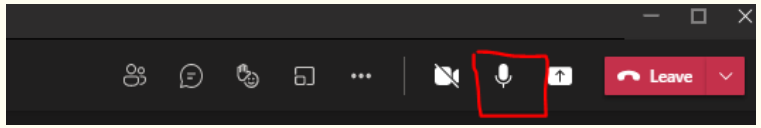
Teams Meeting

Please click the meeting link sent to your email or here:

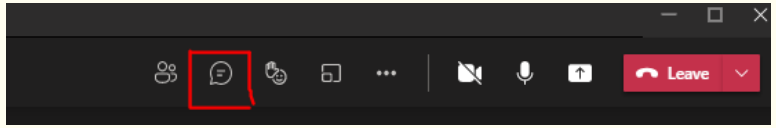
Join Microsoft Teams Meeting
+1 971-277-2317 (dial this number into your phone for best results)
PW: 498 970 501#
*Please use Microsoft Edge or Google Chrome with Teams as it will give you the best experience

PARTICIPATION

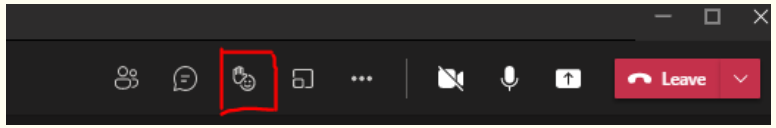
- Mute your mic while others are speaking; to unmute via phone press *6



- 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’d 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
Technology cost	45 minutes
Energy position	60 minutes
Portfolio requests from participants	5 minutes

SAFETY MOMENT

Protect your feet

You foot has 26 bones, 38 joints, blood vessels, ligaments, muscles, and nerves.

At home, work, and recreating wear protective footwear appropriate for the task you are doing.

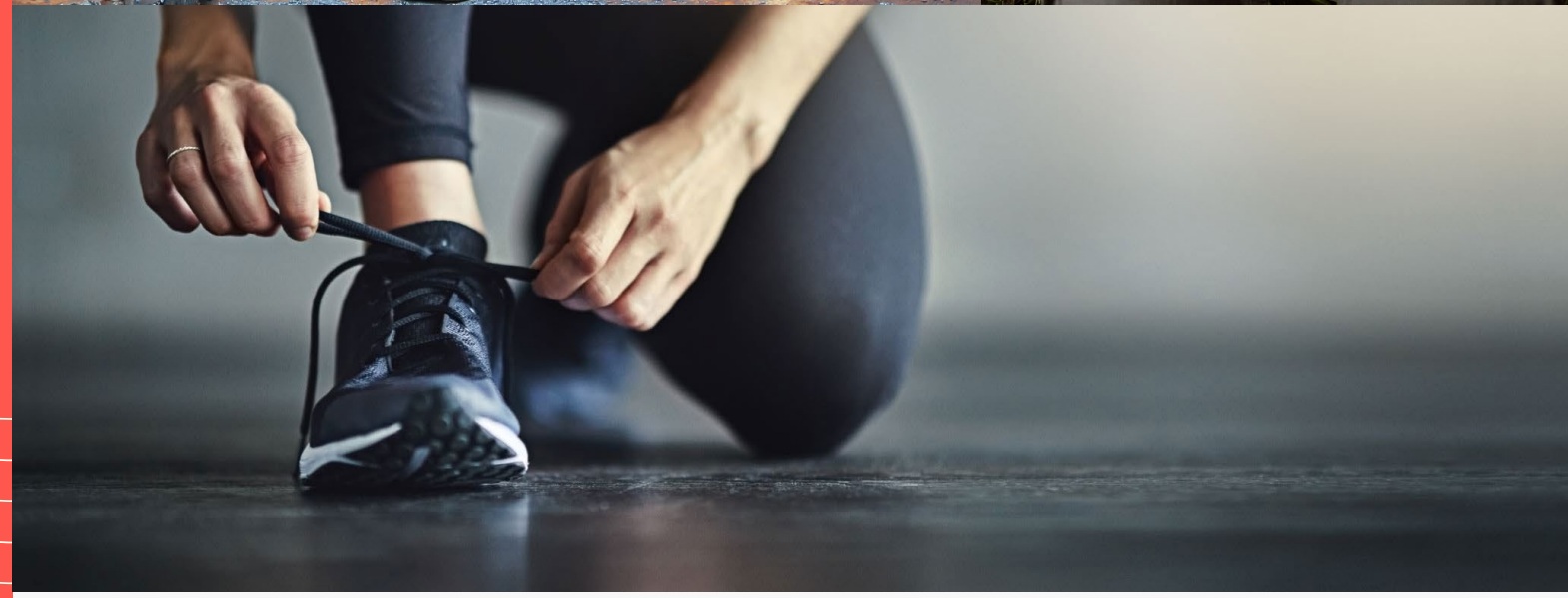
Major injuries are caused by punctures, sprains, and lacerations.

Other causes are slips, trips, and falls.

The best protection is footwear designed for your activity.

If you cannot afford specialized footwear, choose close-toed, rubber-soled shoes in the correct size.

(For free shoe resources see: Souls4soles, The Shoe Project, or The Shoe That Grows)



TECHNOLOGY COSTS

Yash Gokhale

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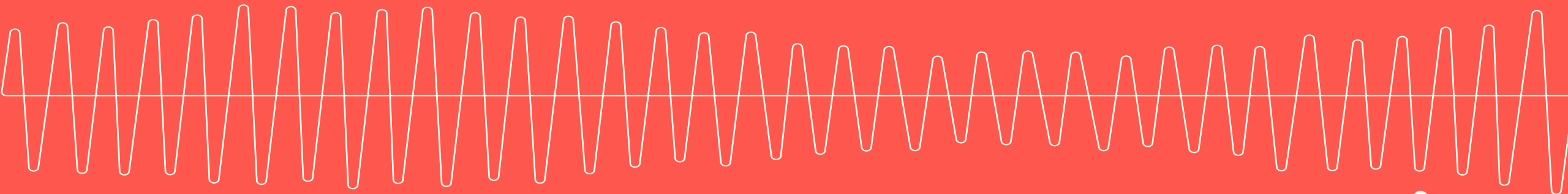
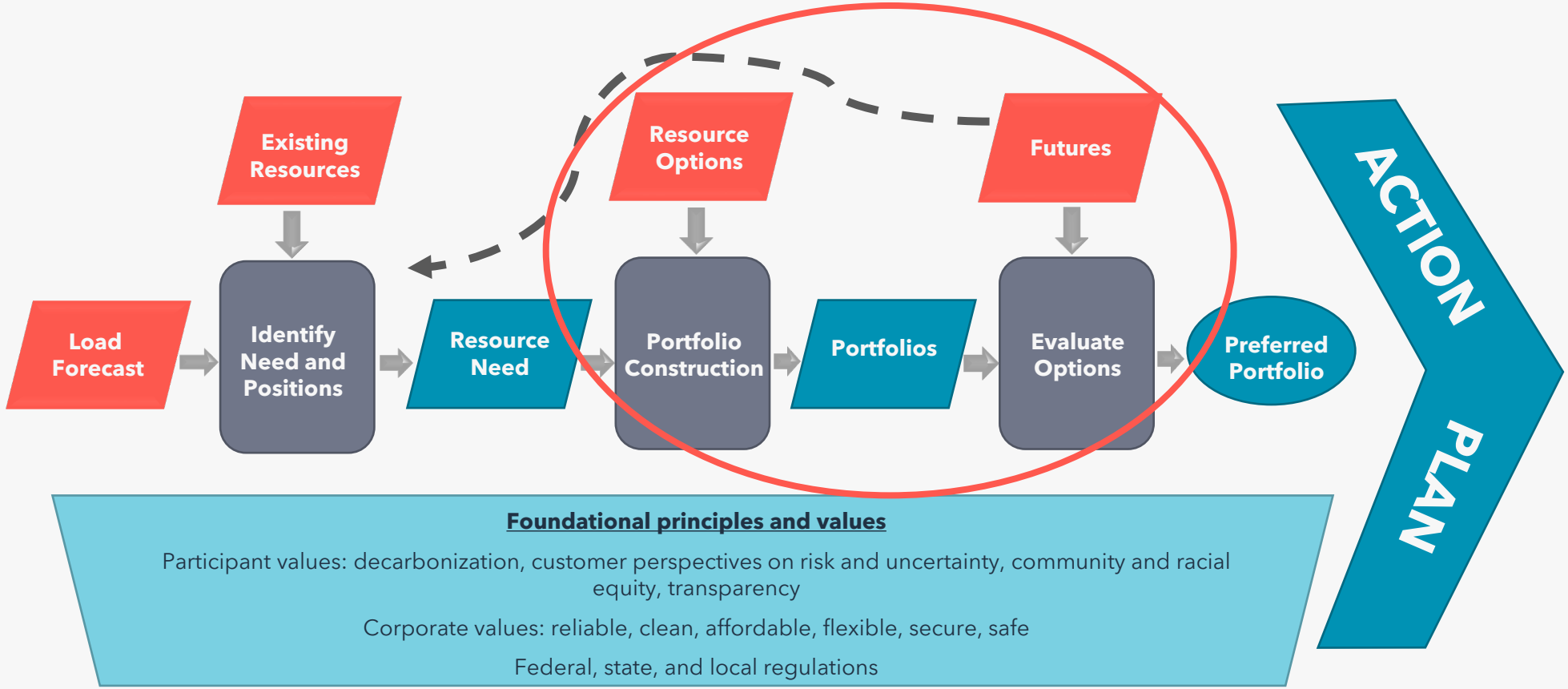


IRP Analysis Process

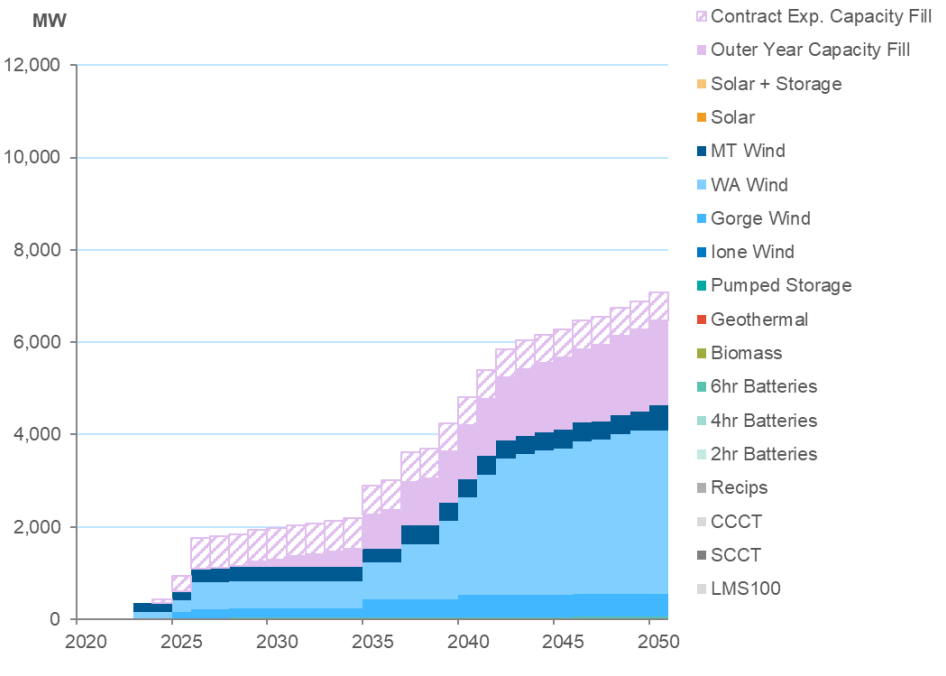


Technology Costs

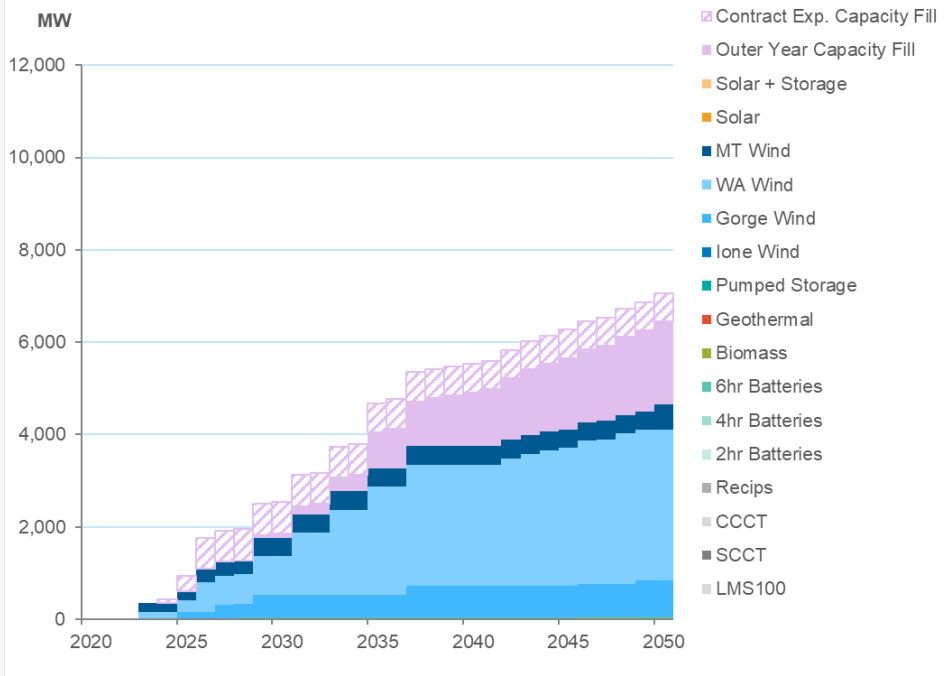
Estimates of technology costs flow into portfolio futures

- ROSE-E creates different resource buildouts for each technology-cost future

Reference Case

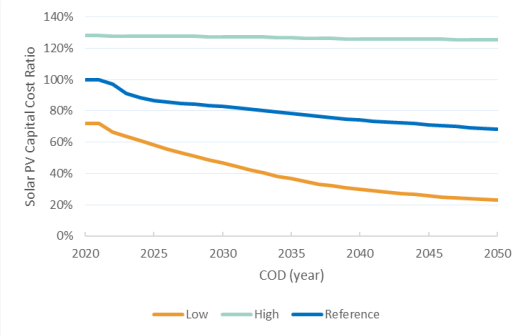


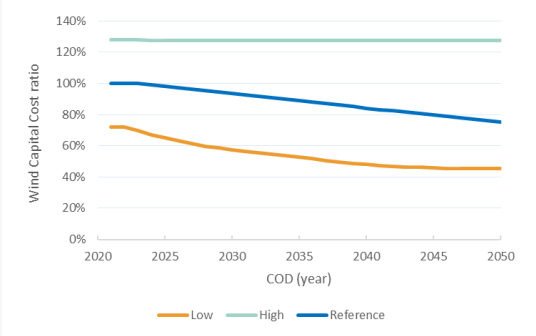
Low-cost Wind Future

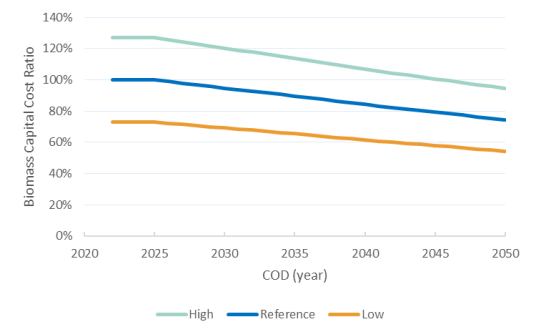


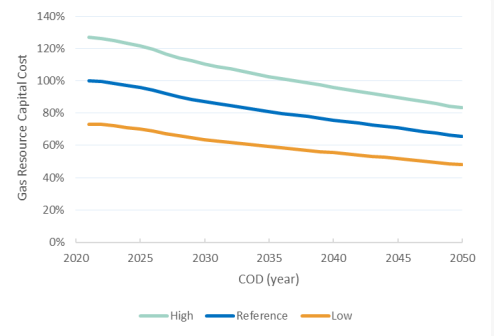
Capital Cost Uncertainty

- Multiple factors contribute to the uncertainty in capital costs in the near term
- Costs and advances in technology were estimated through study of technology maturity and potential for reduction in future capital cost
- Learning curve analysis was conducted to estimate upper and lower bounds on future technology cost trajectories
- Key factors in the analysis were cumulative capacity – which was estimated through forecasting techniques and learning rate – which was estimated using historical data





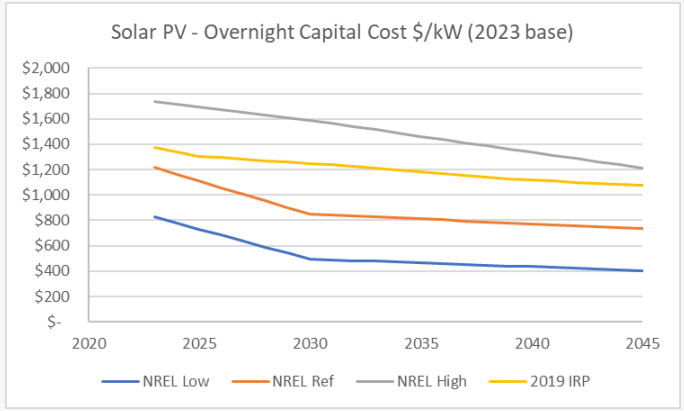


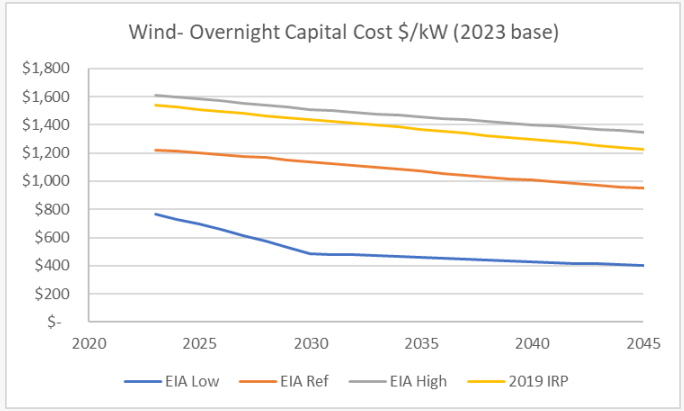


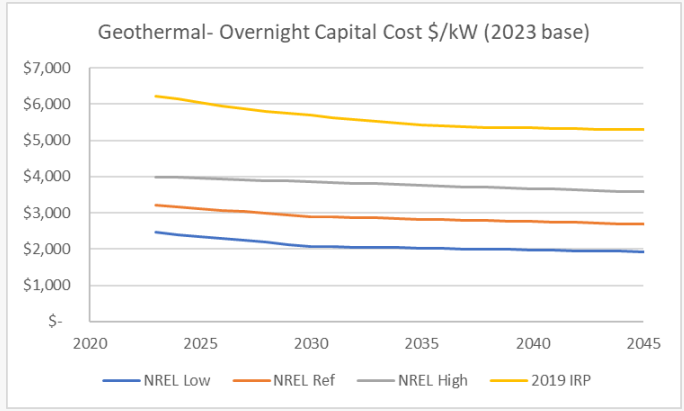
Capital Cost Ratio curves for selected resources

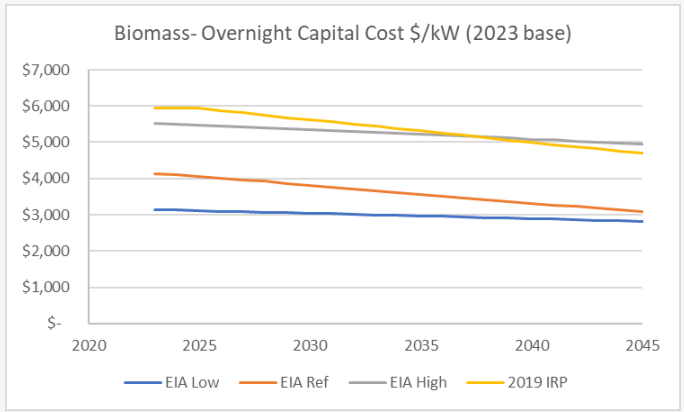
Technology Costs

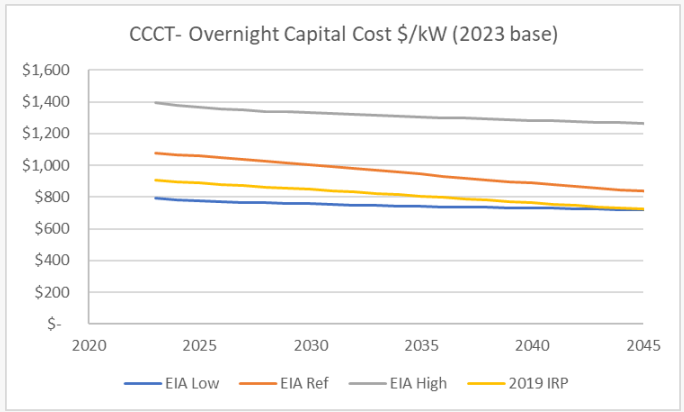
- Comparison of resource capital cost trajectories for multiple resources
- Trend in cost considered in IRP 2019 are compared to the three scenarios put forth

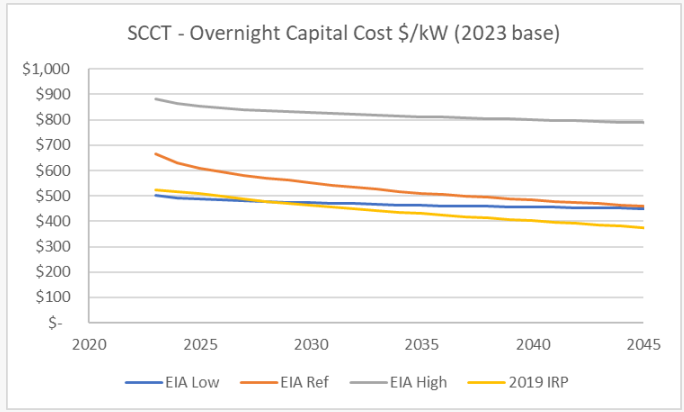








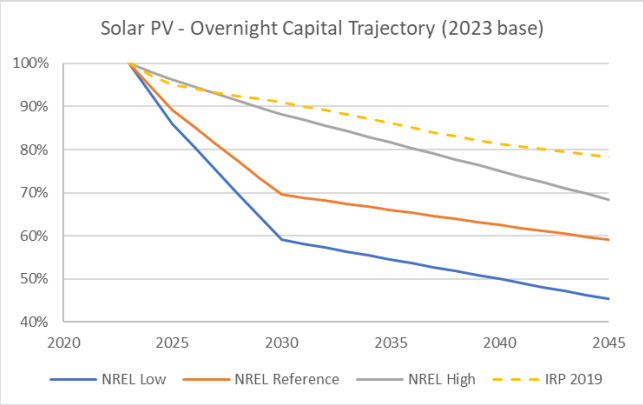


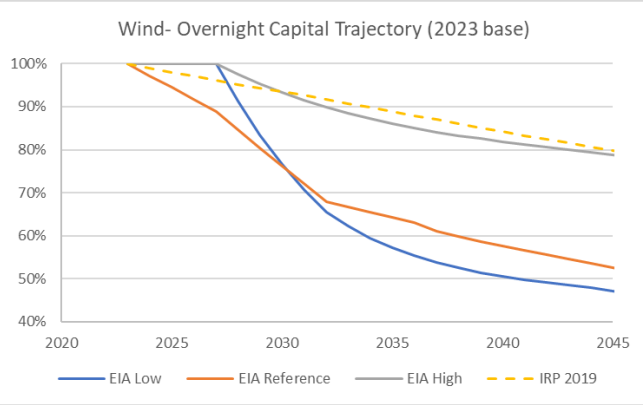


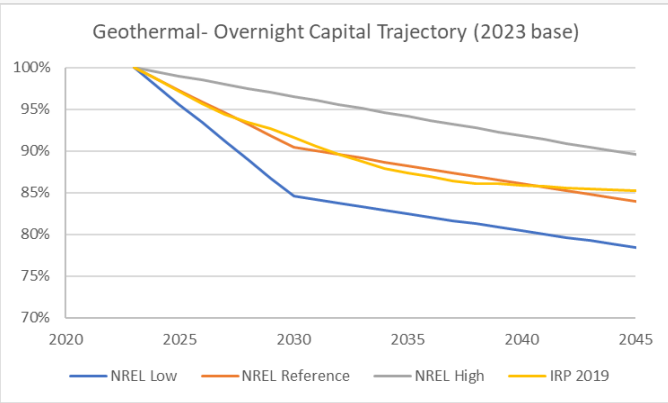
Draft Results

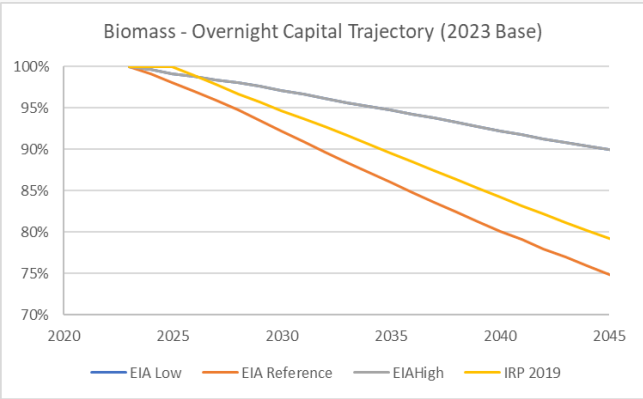
Technology Costs

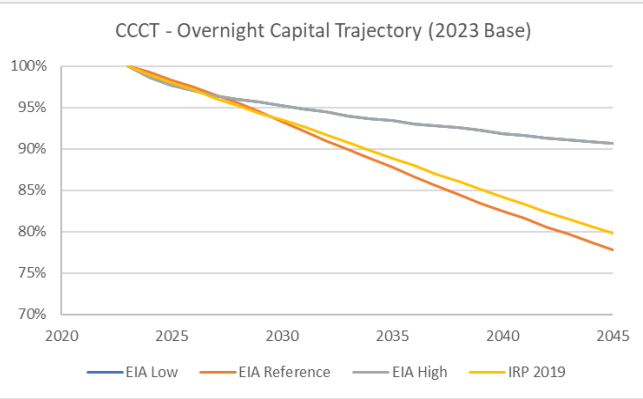
- Comparison of overnight capital cost behavior of resources relative to 2023 base year
- All capital cost curves follow a decreasing trendline over the years

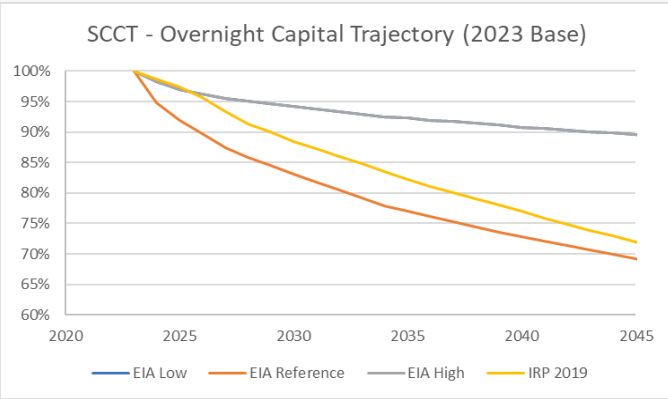












Draft Results

Technology Cost Futures

- Capital Cost Trajectories are used to create definite technology futures to examine the impact of cost uncertainties in portfolio performance.
- Guidance from each of the technology trends inform the Technology Futures to be considered in the future IRP portfolio analysis.

Technology Cost Future	Solar Costs	Battery Costs	Wind Costs	Biomass & Geothermal Costs	Pumped Storage Costs	Gas Resource Cost
Low Cost	Low	Low	Low	Reference	Reference	Reference
Reference	Reference	Reference	Reference	Reference	Reference	Reference
High Cost	High	High	High	Reference	Reference	Reference

Proposed Cost Futures for the next IRP cycle

QUESTIONS/DISCUSSION?

Energy Position

Seth Wiggins

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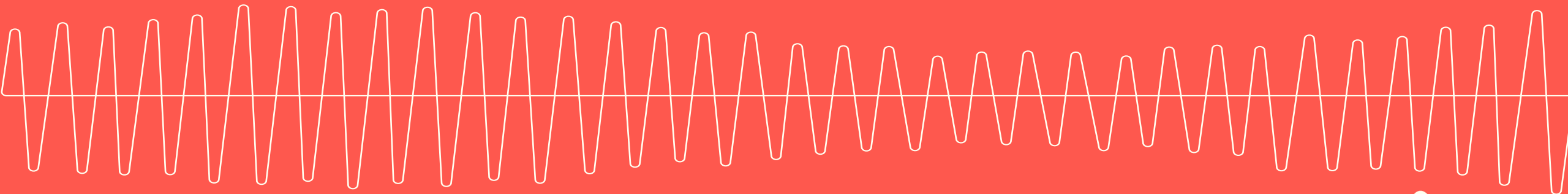
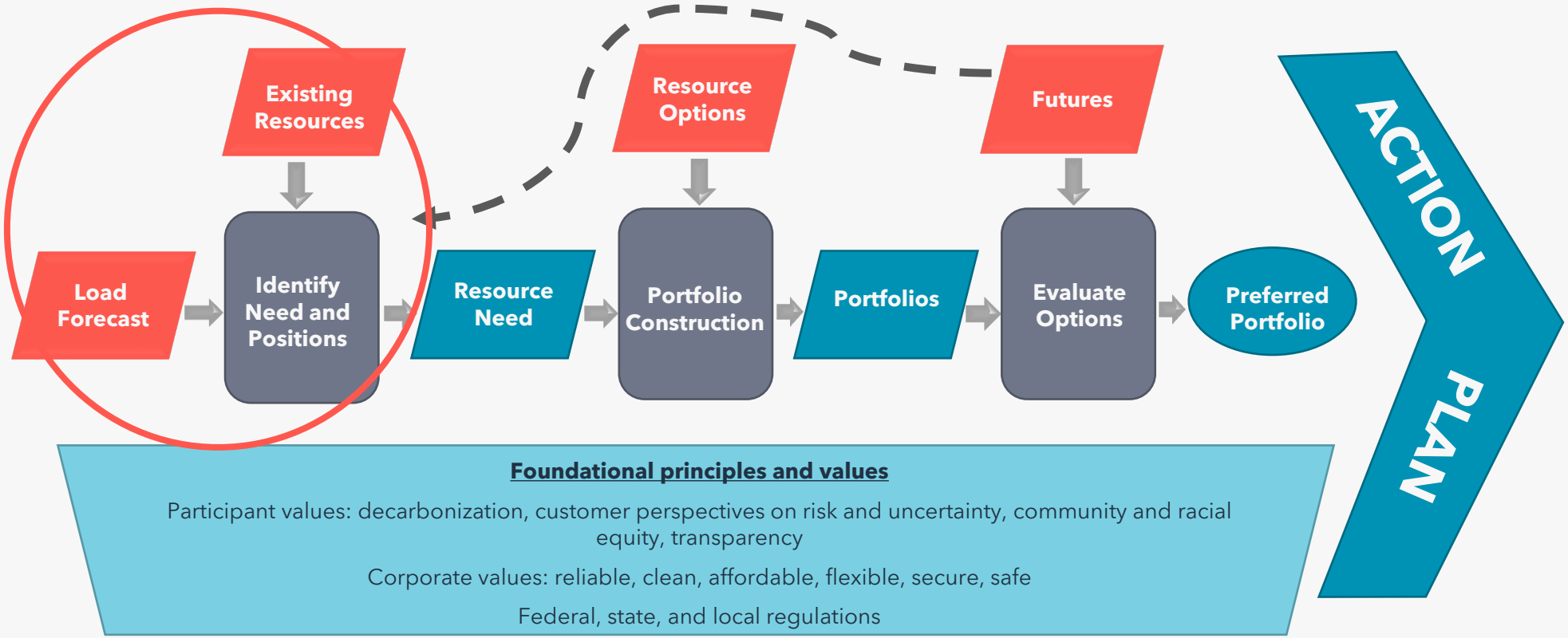


IRP ANALYSIS PROCESS



What is an Energy Position?

We use the term 'position' to describe the forecasted surplus/deficit a given timeframe. Three positions are calculated yearly in the IRP:

Position:	Calculated as the Difference Between:	
Capacity	*Peak* forecasted load *plus contingency reserves*	The total *capacity contribution* from each existing and contracted resource
Energy	*Average* forecasted load	The *energy available* from each existing and contracted resource
RPS	RPS obligation	The expected REC generation from all existing and applicable contracted resources

Energy positions are useful in long-term planning to evaluate our system's ability to economically meet average forecasted loads.

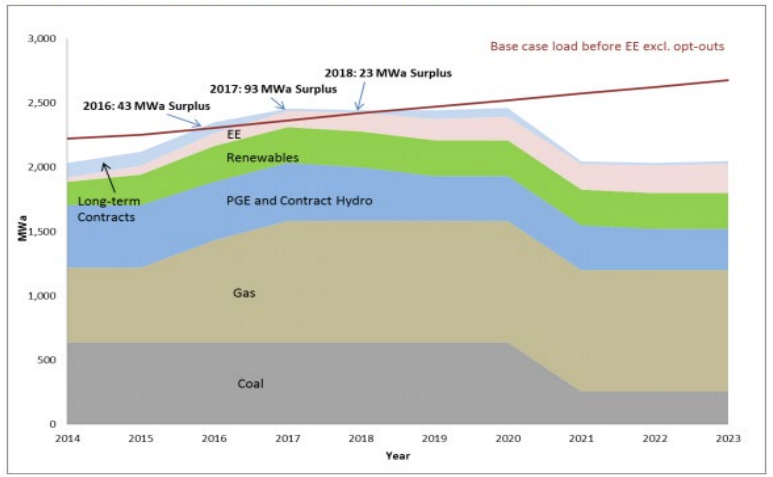
Energy Load-Resource Balance (ELRB)

The ELRB is a method of displaying our energy position

- PGE has included an updated ELRB in each IRP/IRP Update

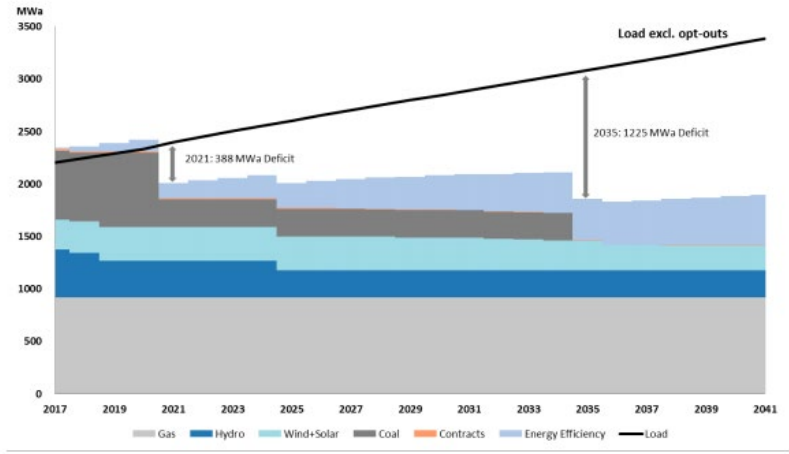
2013 IRP

Figure 1: PGE's projected annual average energy load-resource balance



2016 IRP

FIGURE 5-23: PGE's projected annual average energy load-resource balance



2019 IRP

TABLE G-3: PGE's projected annual average energy load-resource balance, MWa

	2021	2022	2023	2024	2025	2030	2035	2040	2045	2050
Gas	945	945	945	945	945	945	945	945	945	945
Coal	262	262	262	262	262	262	0	0	0	0
Hydro	417	416	416	413	321	271	259	259	259	259
Wind+Solar	465	500	500	500	500	492	413	338	334	333
Other Contracts	50	50	50	50	50	44	25	0	0	0
Energy Efficiency	41	70	97	124	150	280	400	515	629	742
Total Resources	**2179**	**2244**	**2271**	**2294**	**2228**	**2294**	**2043**	**2059**	**2167**	**2280**
Load	**2153**	**2198**	**2248**	**2292**	**2337**	**2574**	**2810**	**3051**	**3300**	**3545**
Energy Deficit / (Surplus)	**(26)**	**(45)**	**(23)**	**(2)**	**109**	**279**	**767**	**993**	**1133**	**1265**

Energy Availability Calculation

PGE's ELRB has defined energy availability differently, depending on resource type:

Resource Type	Contribution
Traditional Baseload	Nameplate * (1–Forced Outage) * (1–Maintenance)
Traditional Peaking	No contribution
Renewables	Assumed Annual Average Generation
Hydro	Assumed Annual Average Generation

However, the treatment of **dispatchable resources** requires strong assumptions about future dispatch that may not hold under changing market conditions.

(Simplified) Utility Dispatch

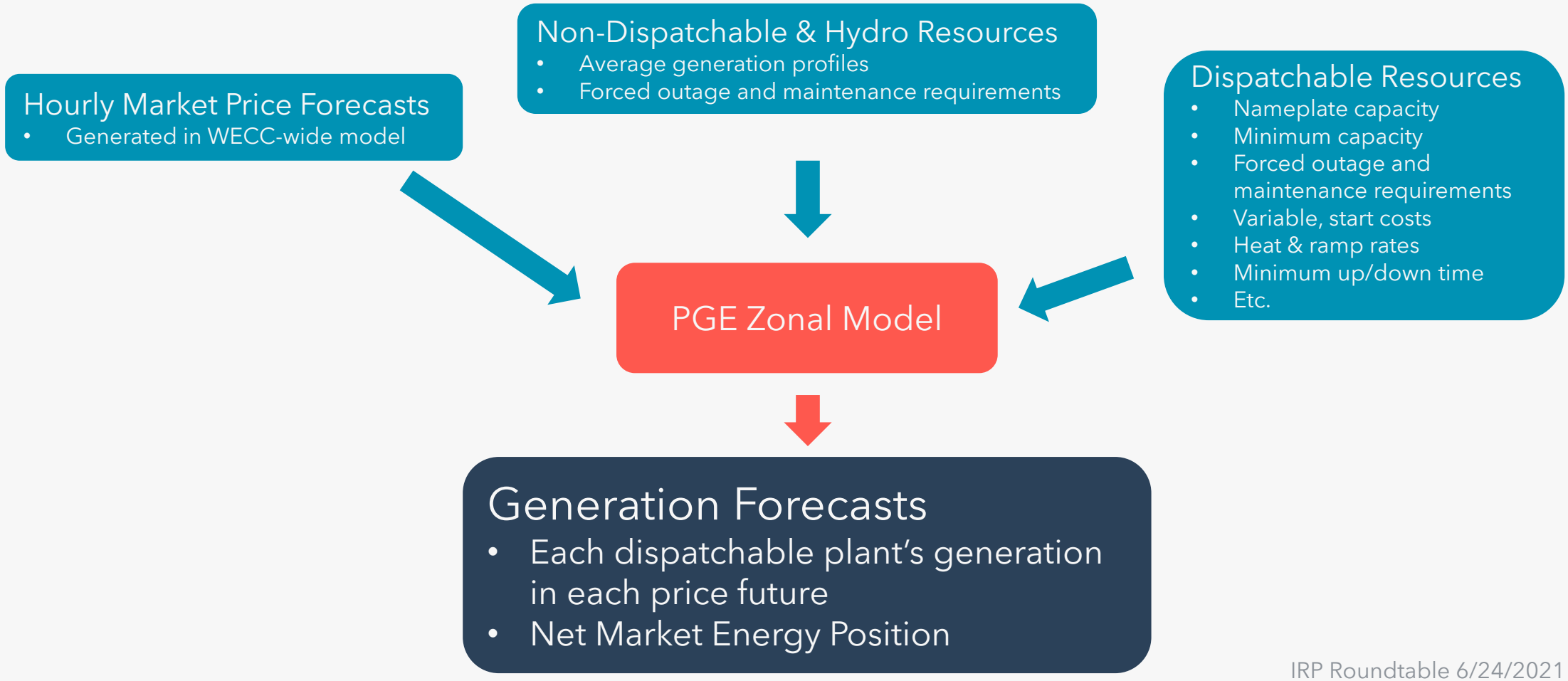
During constrained periods, utilities use dispatchable resources to maintain system reliability.

During non-constrained periods, utilities use **market prices** and **variables costs** to minimize costs:

When…	…that plant will
Market prices **are greater than** a plant's variable costs	generate
Market prices **are less than** a plant's variable costs	not generate

Additionally, there are other operational and contractual obligations that affect dispatch.

Simulating Economic Dispatch in Aurora



Net Market Energy Position (MEP)

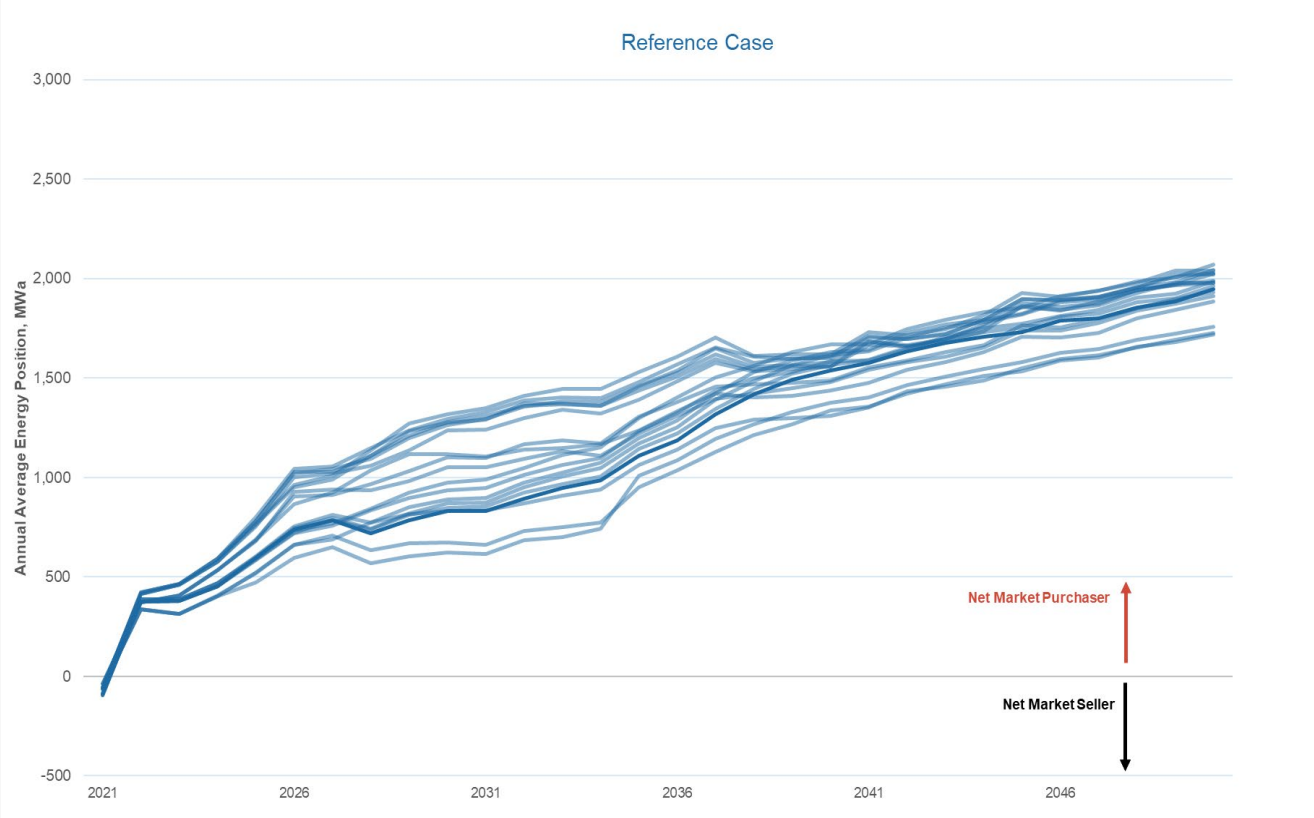
2019 IRP: PGE introduced the MEP, which defined 'energy available' from dispatchable resources using simulated economic dispatch

- Calculated on an annual average basis

The MEP **was** used to limit renewable additions in ROSE-E

- Renewables could not push company to be a net market seller in Reference Case, or in any future after 2040

The MEP **was not** used to characterize resource need



Energy Position in the Next IRP

Are there system characteristics this approach to energy position misses?

- Seasonal position? Different views of average?

How should we use our energy position?

- We have ability to constrain ROSE-E differently

Should we be considering anything else?

Questions & Comments

We’re seeking your feedback!

PORTFOLIO REQUESTS FROM PARTICIPANTS

SETH WIGGINS

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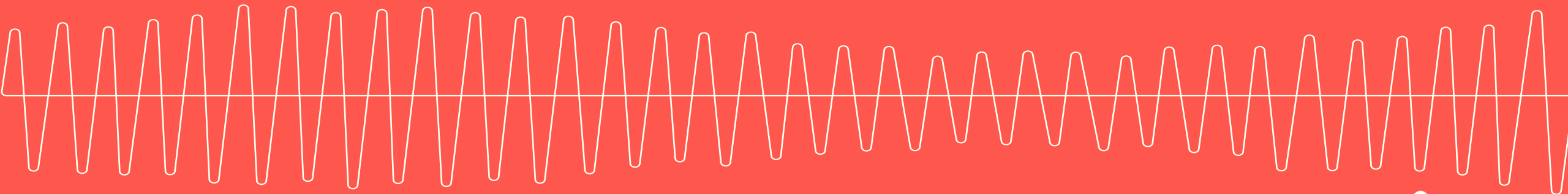

Portfolio Requests

Our portfolio optimization model ROSE-E has flexibility to evaluate any specific resource/size/year combination

- For example, we could estimate the portfolio effects of adding 235 MW of SE Washington wind in 2036 and/or 150 MW of 6-hr batteries in 2026
- We can also model yearly emissions targets
- In the 2019 IRP, we used this capability to evaluate the size and timing of 16 different renewable additions MW/year combinations

We are open to any suggestions for portfolio questions to be evaluated

- Please contact us (email: IRP@PGN.com)

NEXT STEPS

Submit feedback by August 31 on technology costs
General comments on our approach

Submit feedback by August 31 on energy position

Are there system characteristics this approach to energy position misses?

- Seasonal position? Different views of average?

How should we use our energy position?

- We have ability to constrain ROSE-E differently

Should we be considering anything else?

A recording from today's webinar will be available online within a week

THANK YOU

CONTACT US AT:
IRP@PGN.COM

ATTACHMENT A: ACRONYMS

ELRB: energy load-resource balance

IRP: integrated resource plan

High, low, reference: different need futures in IRP analysis

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

MEP: net market energy position

MW: megawatt

REC: renewable energy credit

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)

WM: Wood Mackenzie