

Integrated Resource Planning

ROUNDTABLE 21-1

FEBRUARY 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: 863 207 757#
- *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

Do one thing: February

Make a plan for where to meet your family or group in the event of an emergency

One at your home and one outside your neighborhood

Decide where you would go and what route you would take to get there (hotel, friend/family home, shelter)

Practice your evacuation drill and route

Make notes on pet friendly hotels and animal shelters

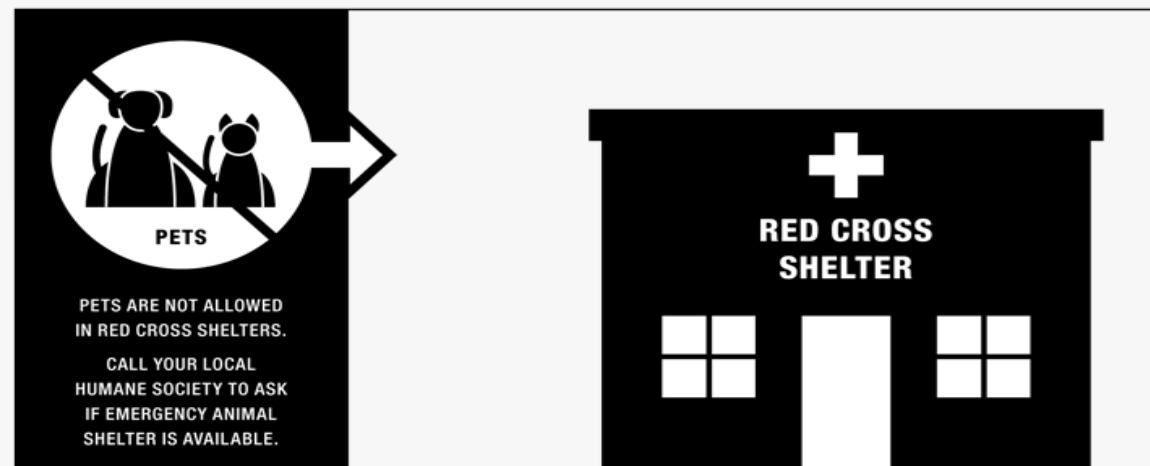
1

CHOOSE TWO EMERGENCY MEETING PLACES



2

PLAN AHEAD FOR PETS



AGENDA

Welcome and introductions	15 minutes
Community values and the 2022 IRP	15 minutes
Price forecasts: part one	30 minutes
Supply side options	30 minutes
Portfolio requests from participants	10 minutes

COMMUNITY VALUES AND THE 2022 IRP

JESSICA GRAEBER
ROUNDTABLE 21-1



COMMUNITY VALUES

ROUNDTABLE 20-4 July 29, 2020

28 participants

What we heard:

Participant values

Key topics of interest

COMMUNITY VALUES

Prompts we discussed in July 2020

- What is important to you as a consumer of energy and/or a representative of your organization?
- Are there values from the 2019 IRP process that resonate with you or that do not resonate with you?
- What additional values would you like to bring to this process that have not been mentioned?
- What would you like to see from PGE in how we approach this process? How will you know that you have been heard?
- What else would you like to share?

COMMUNITY VALUES

transmission deliverability
Least risk, least cost
moving forward state policy objectives

Executive Order 20-04

climate/GHG is a threshold consideration for cost/risks balancing

Forward-looking approach

Climate Change impacts & risks

Community Engagement

Cleaner grid
small renewables

Front-loading of emissions reductions

SB978 Community group recommendations

connect to on-the-ground impacts

Flexibility

Where will values be discussed, if not in the IRP

Everybody should get the benefits of the system

Technological change risk

participation of small businesses

Broad perspective

Include more voices

Decarbonization

social, economic, and environmental justice

Reliability and affordability while decarbonizing

100% clean energy goals

Risk fair

just and reasonable costs

responsive to more frequent & rapid change

Equity Urgency of climate change

resource adequacy

Electrification

capacity management efforts

Limits to traditional regulation

Reliability

benefits to community

economic development opportunities

Political stability risk

metrics/impacts to small businesses

help customers save energy

localized value

exit Colstrip

incorporate values that were shared

Fair service to customers

opportunity to influence energy supply

customer understanding

customer outreach

resiliency

energy burden

COMMUNITY VALUES

What we heard about most from the attendees in July was a focus on...

- How to achieve reliability and affordability in a decarbonized system
- How to think about risk and uncertainty
- How to promote community involvement in PGE processes and how to clearly communicate what the IRP action plan means to the public
- How to address and prioritize the climate crisis in IRP analysis

COMMUNITY VALUES

How we integrate the values conversation

- Used to guide framing questions that direct analysis
- Inform studies, model inputs, considerations of risk, and other influences on decision points
- Adjust engagement to fit participant needs
- Adapt how and when we share information, draft results, and parts of the written report to support participant engagement

COMMUNITY VALUES

As we move forward with the 2022 IRP, we will continue to listen and respond to the values, questions, and concerns that come up in our process

- We will continue to partner with PGE's Diversity, Equity, and Inclusion team to evolve our public process
- We will revisit the values and priorities shared in July 2020 as well as additional input shared during the process
- We will continue to welcome feedback and suggestions for analytical processes

We welcome feedback at irp@pgn.com

QUESTIONS/DISCUSSION?



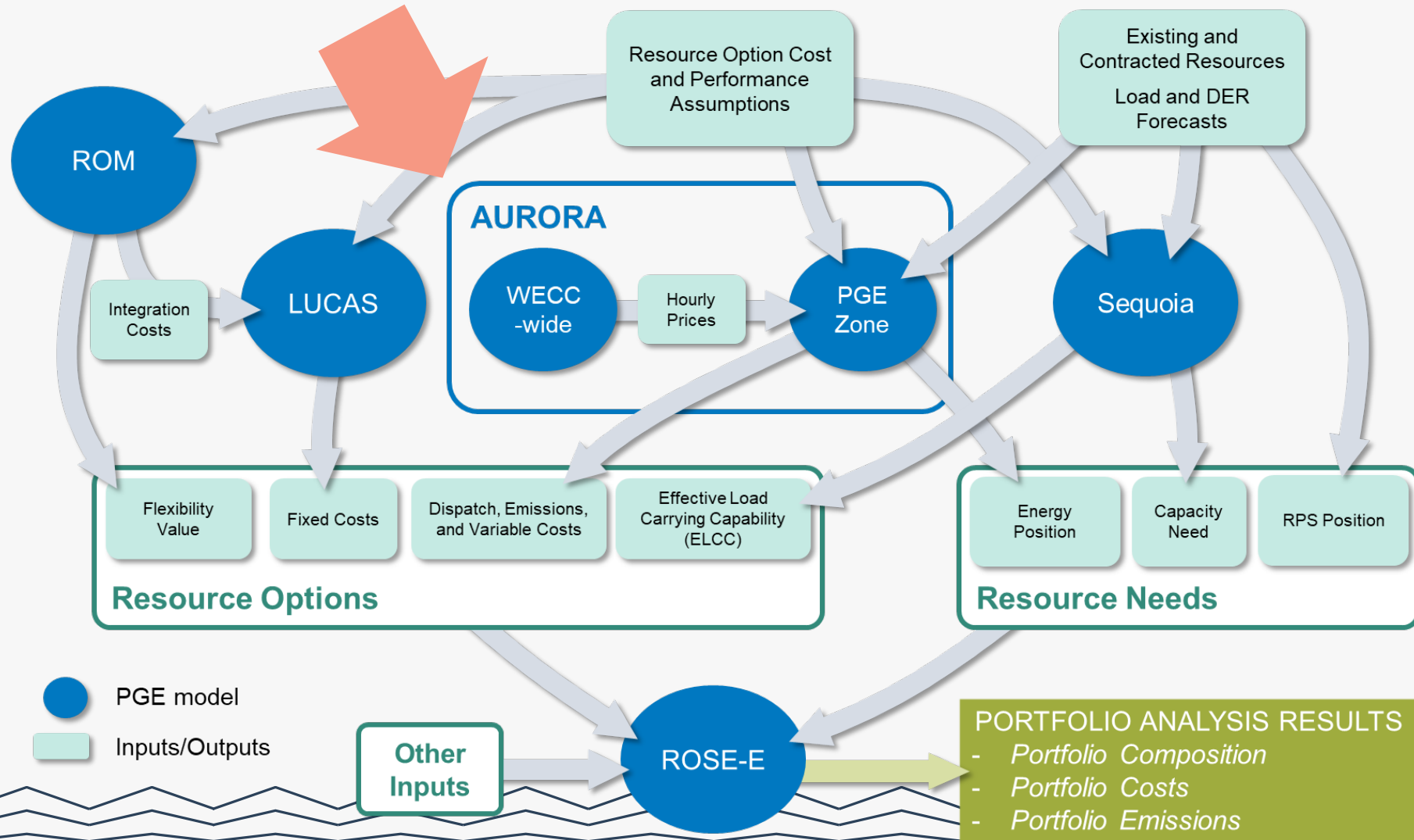
PRICE FORECASTS: PART ONE

NORA XU

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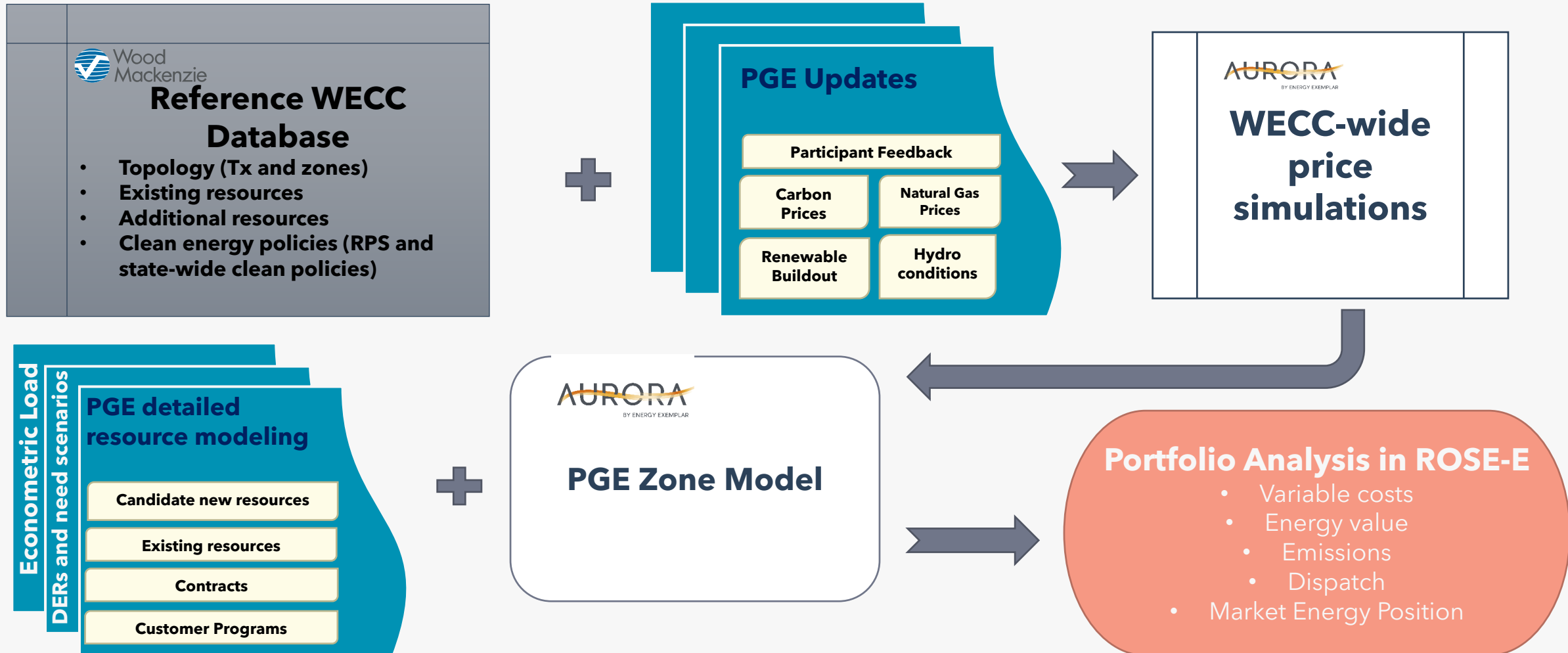
WECC-wide market price forecasting



WECC-wide market price forecasting

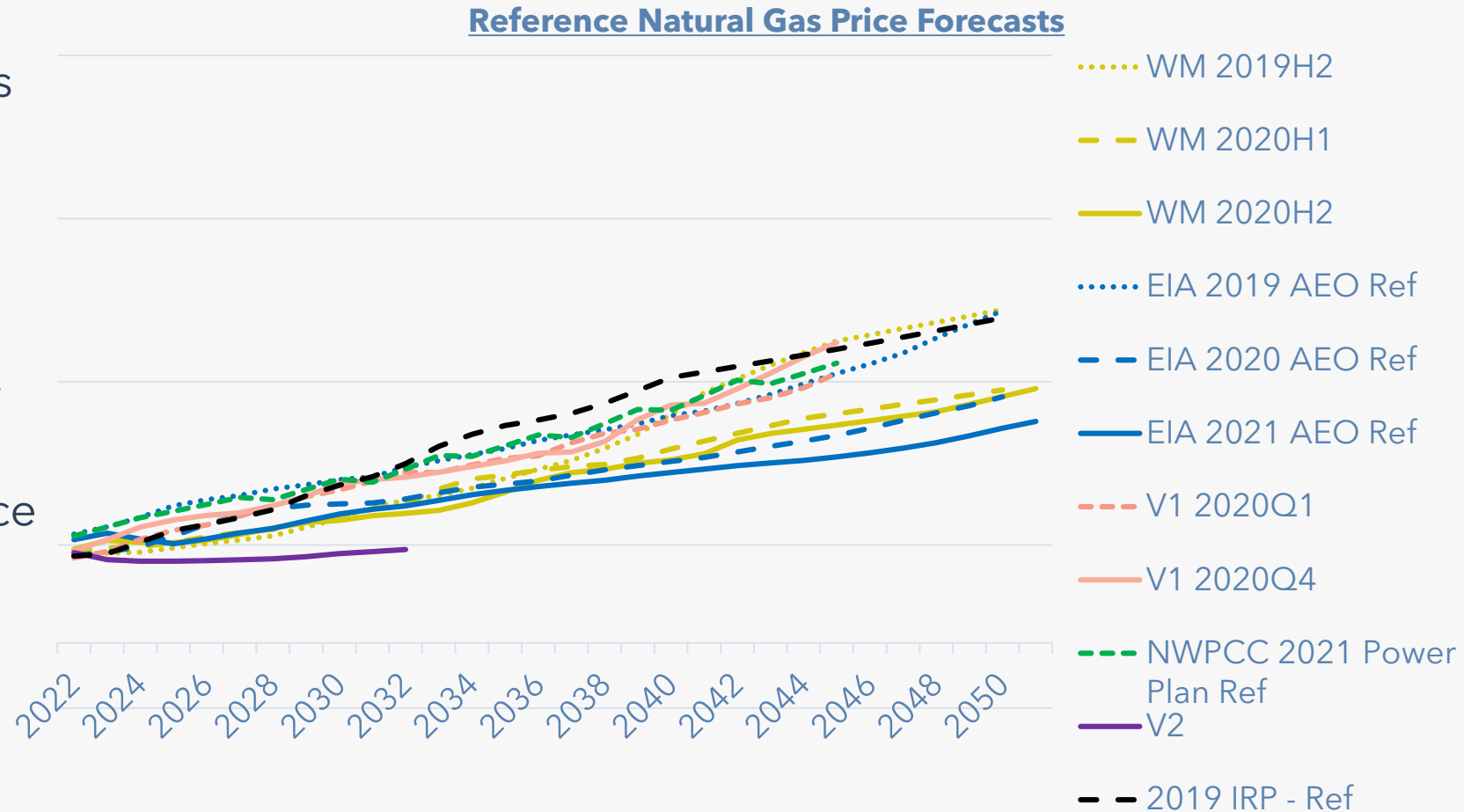
- Wholesale electricity prices forecasts are developed through WECC-wide dispatch of Aurora under different Market Price Futures
- In the 2019 IRP, PGE examined the impact on wholesale electricity price forecasts resulting from variation in gas prices, carbon prices, the WECC-wide resource buildout, and hydro conditions
- We started from a base database developed by a third-party research and consultancy company, Wood Mackenzie (WM)
 - WM's 2020H1 database released in July 2020, 2020H2 to be released in February 2021
 - Database contains WECC-wide resources build-out, load, fuel prices, and constraints over time in a zonal topology
- We use the database with scenarios for inputs such as carbon pricing and natural gas to simulate the WECC on an hourly basis through least-cost commitment and dispatch

WECC-wide market price forecasting



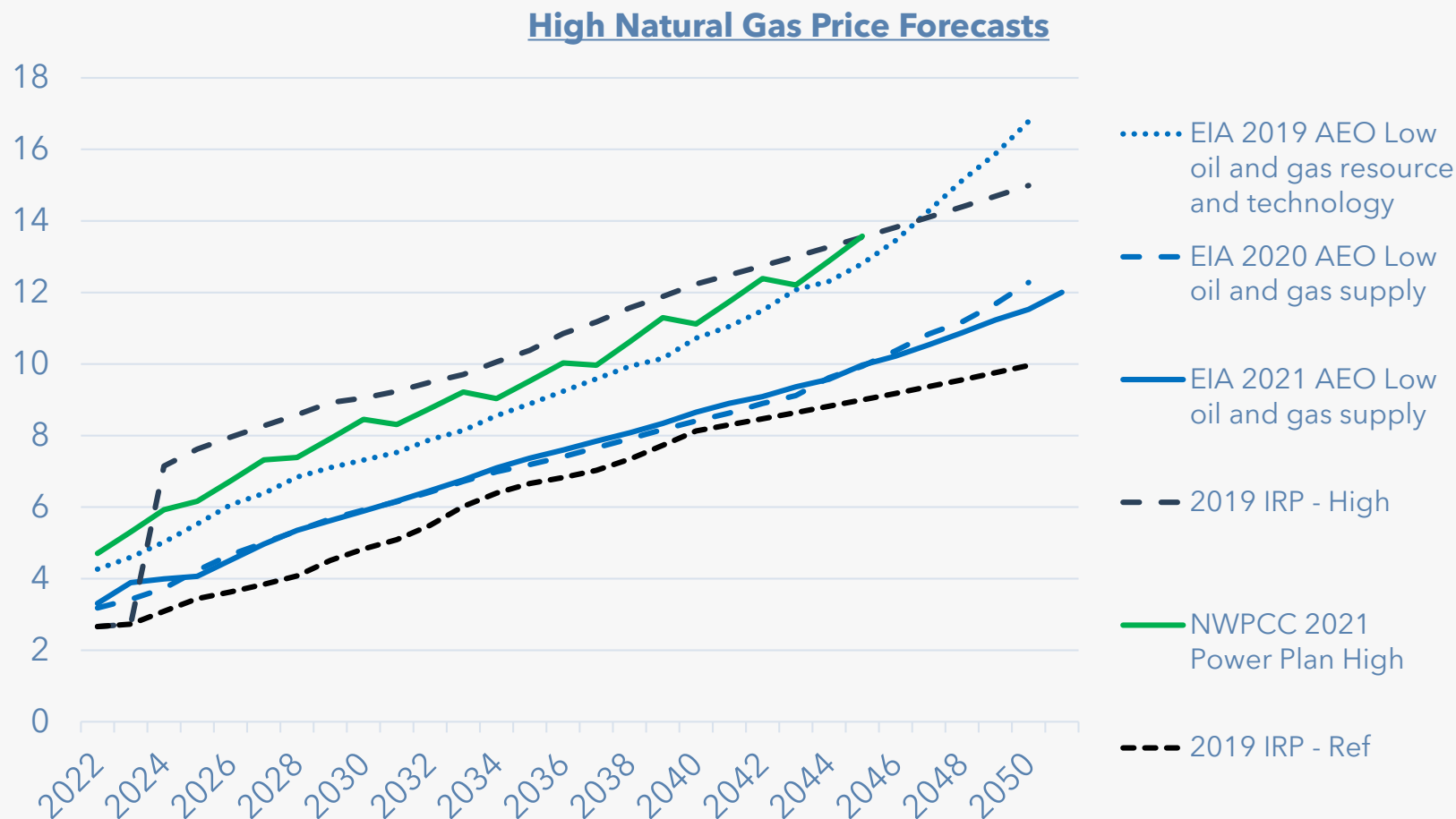
Natural gas price forecasts: Reference

- Natural gas price forecasts have generally been decreasing over the last two years across multiple vendors and forecast sources
- This slide shows the set of forecasts we would categorize as the Reference gas price scenario



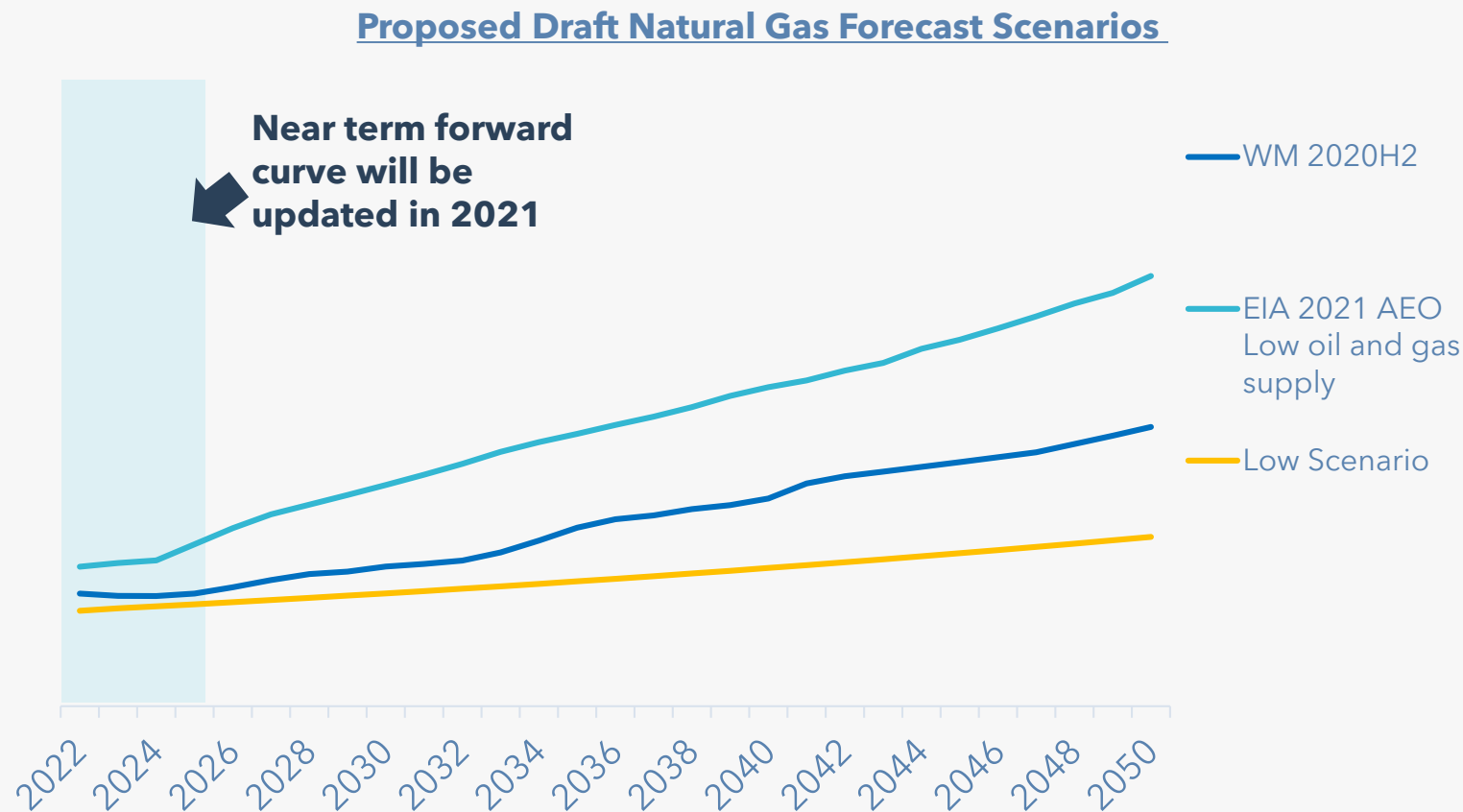
Natural gas price forecasts: High

- This set of forecasts is in the High gas price scenario
- Recent High gas price scenario forecasts are also lower relative to previous forecasts



Draft natural gas price scenarios

- We continue to propose three gas price forecast scenarios: Low, Reference and High
- Near-term: PGE forward curve. This will likely be updated this quarter
- Proposed draft long-term sources:
 - Low: Continue end of forward curve price flat in real dollars
 - Reference: likely WM 2020H2
 - High: likely EIA AEO 2021



Carbon prices in the 2019 IRP

- PGE has included carbon pricing in IRP analysis since 2008, consistent with Order No. 08-339
- In the 2019 IRP, we used three carbon price futures: Low, Reference and High
- California Energy Commission (CEC)'s low, mid and high forecasts used for the three scenarios
- Additionally, we discussed and presented the Social Cost of Carbon (3% discount rate) informationally

2019 IRP Carbon Price Futures

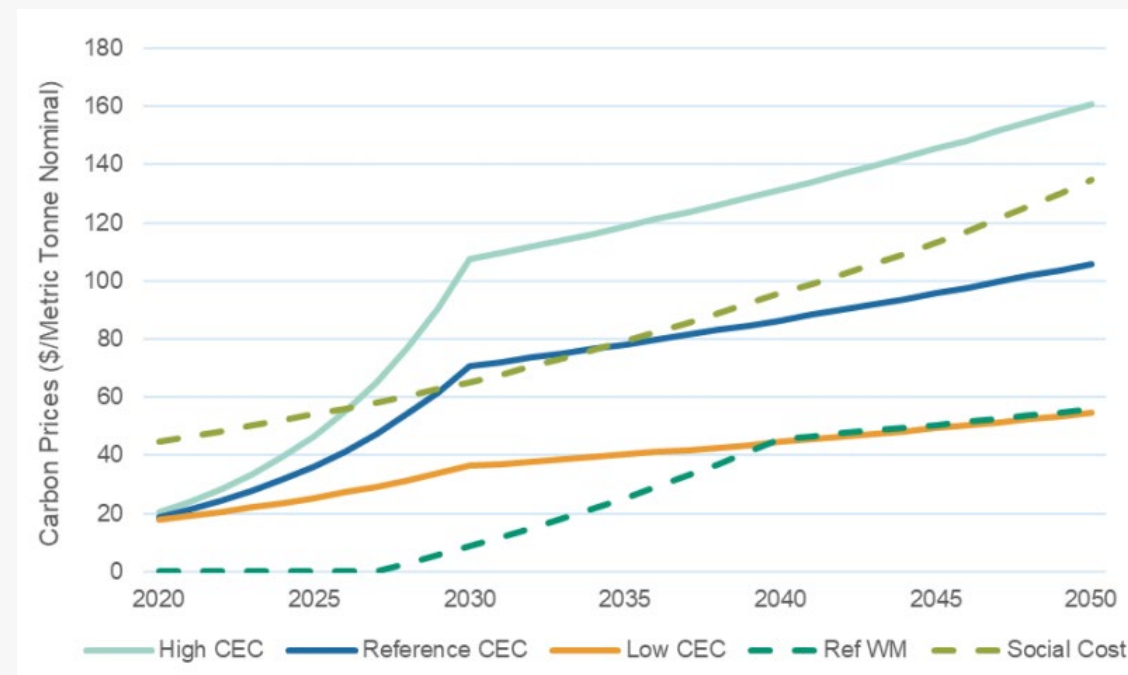
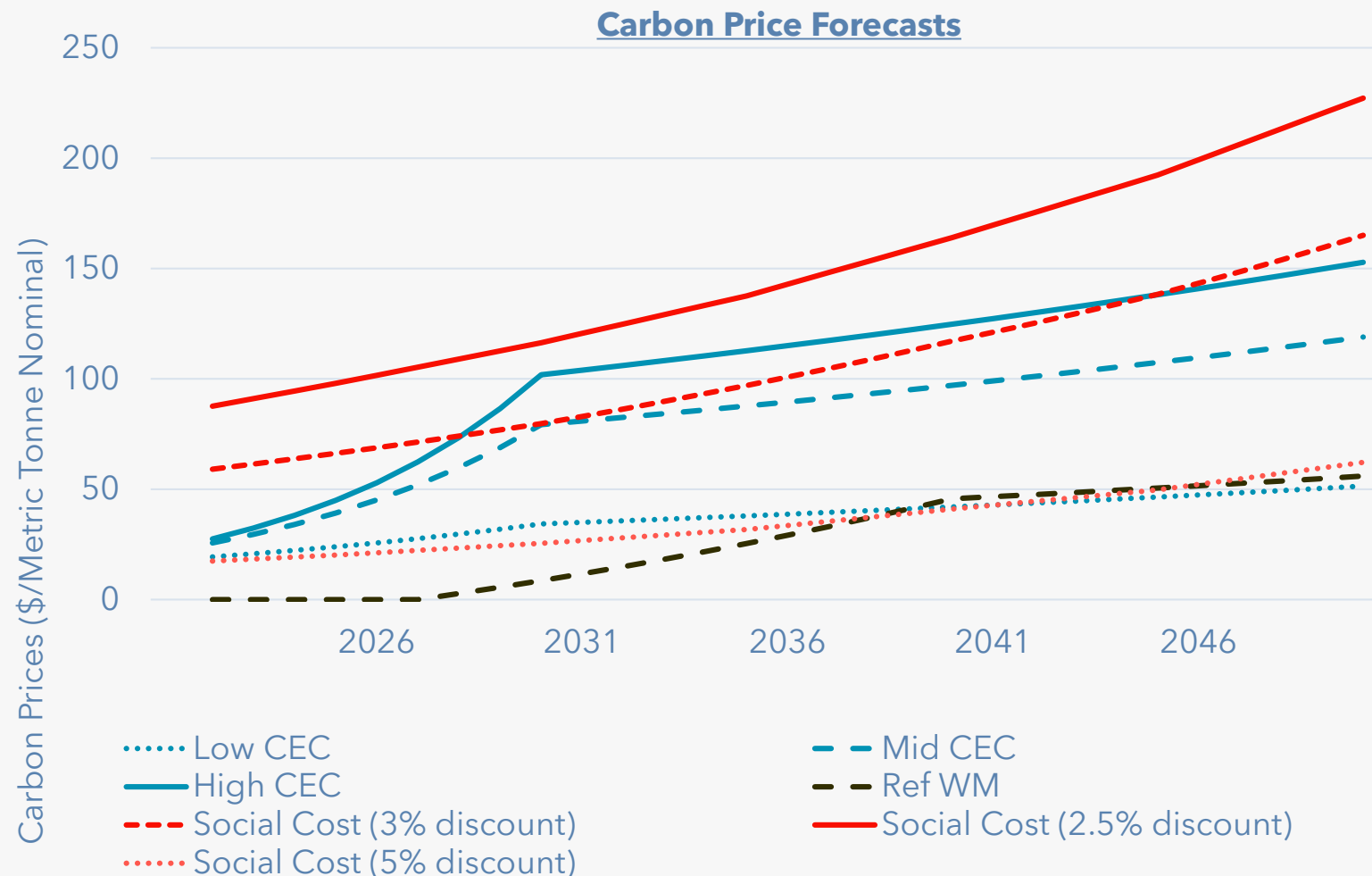


TABLE 3-2: Carbon Price Future assumptions

Region	Low Carbon Price Future	Reference Case	High Carbon Price Future
CA+OR+WA	Low CEC	Reference CEC	High CEC
Rest of WECC	None	Reference WM	Reference WM

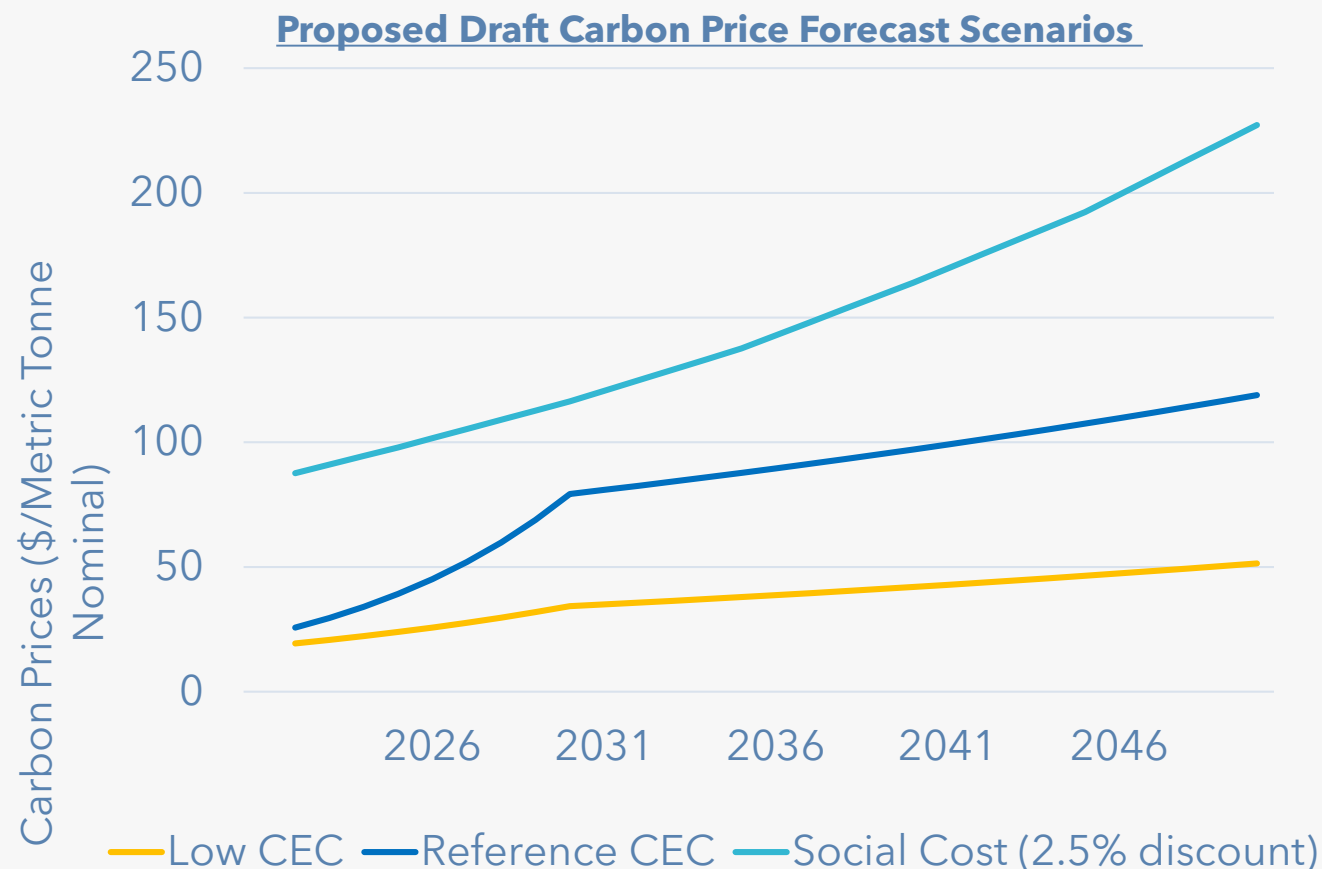
Carbon price forecasts

- Two carbon pricing sources are depicted to the right
- The CEC's Low, Mid and High forecasts from the 2019 Integrated Energy Policy Report (IEPR)
- The EPA's 5%, 3% and 2.5% discount rate Social Cost of Carbon Dioxide (SC-CO₂) values from 2013



Draft carbon price scenarios

- We continue to propose three carbon pricing forecast scenarios: Low, Reference and High
- Low: CEC Low 2019 IEPR
- Reference: CEC Mid 2019 IEPR
- High: EPA SC-CO₂ 2.5% discount rate

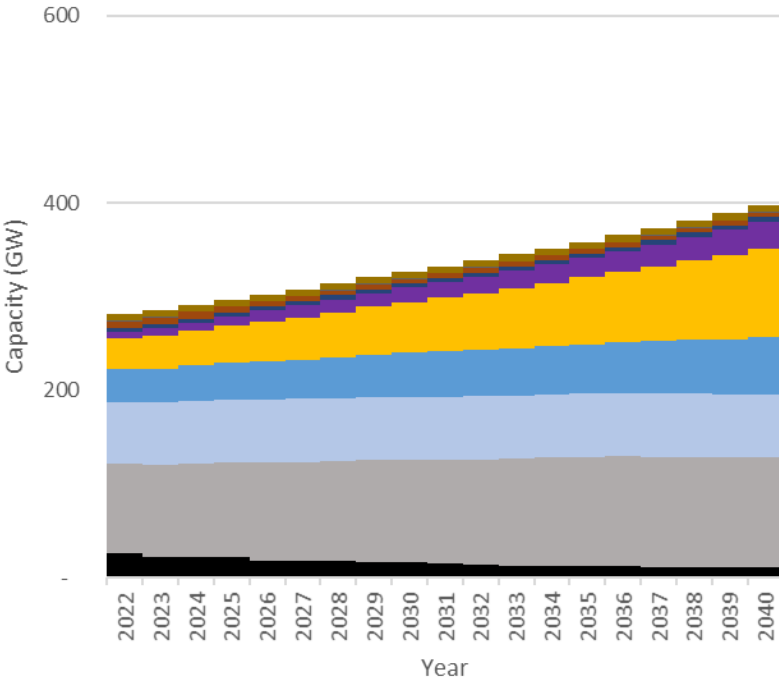


WECC-wide Resource Buildout

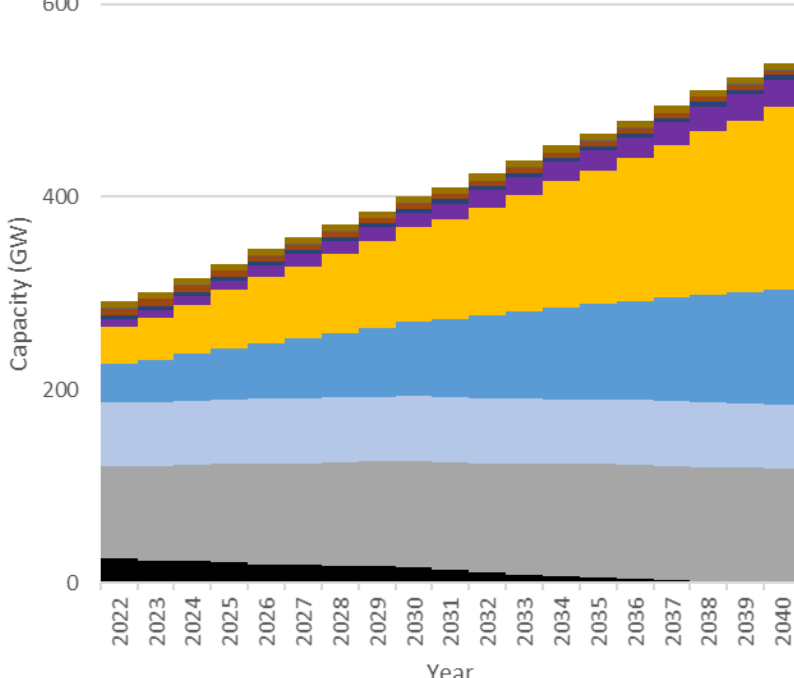
- Renewables: increase in renewables driven by clean energy policy goals and improving renewable economics
- Storage: increase in storage driven by forecasted cost declines and clean energy policy goals
- Coal: WECC-wide coal is steadily reduced over time
- Gas: Less new gas is built compared to the previous databases

Draft WECC-wide Buildout

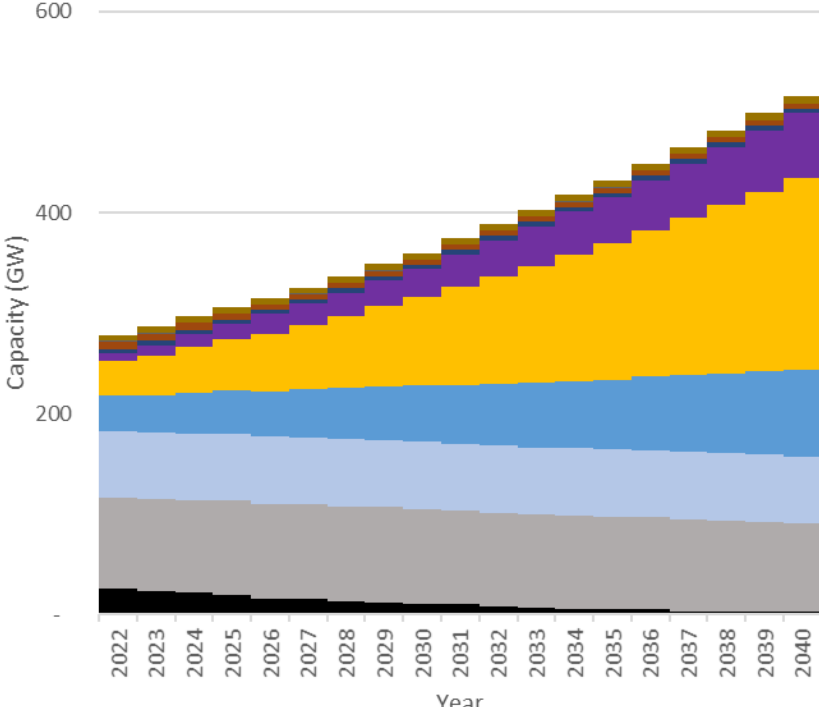
2019 IRP Reference Buildout



2019 IRP High Renewable Buildout



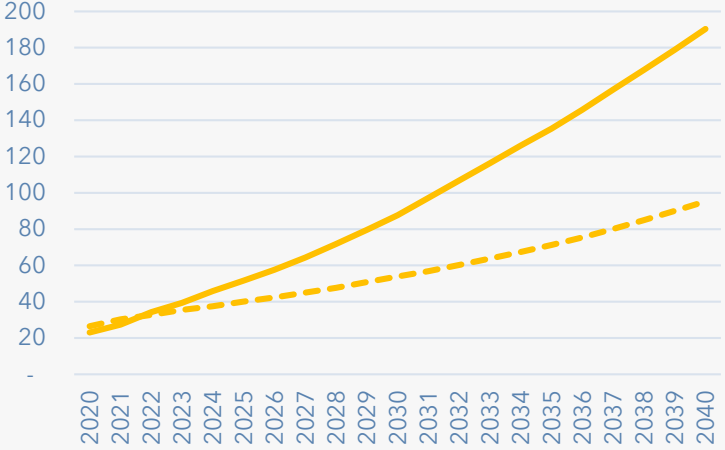
WM 2020H1 Buildout



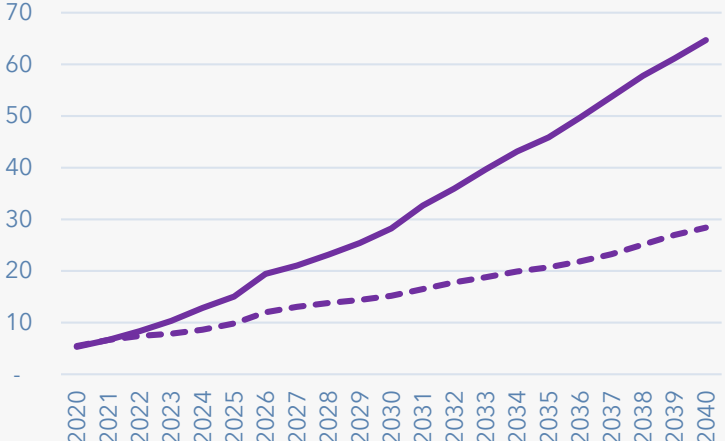
Coal
 Natural Gas
 Hydro
 Wind
 Solar
 Energy Storage
 Demand Response
 Nuclear
 Oil
 Other

Draft WECC-wide Buildout by Fuel

Solar



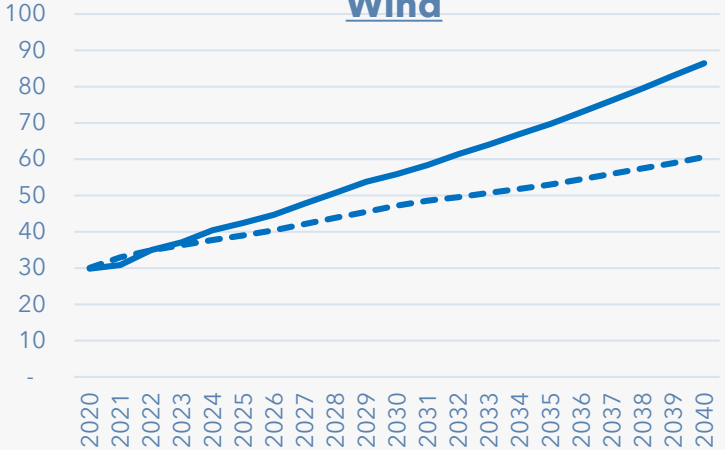
Storage



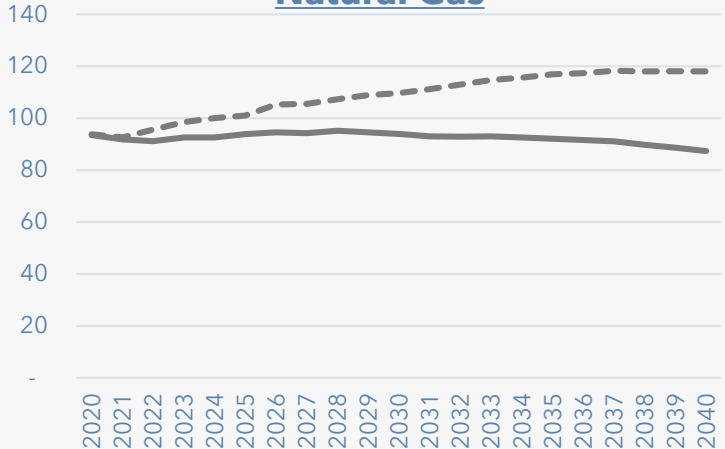
Legend



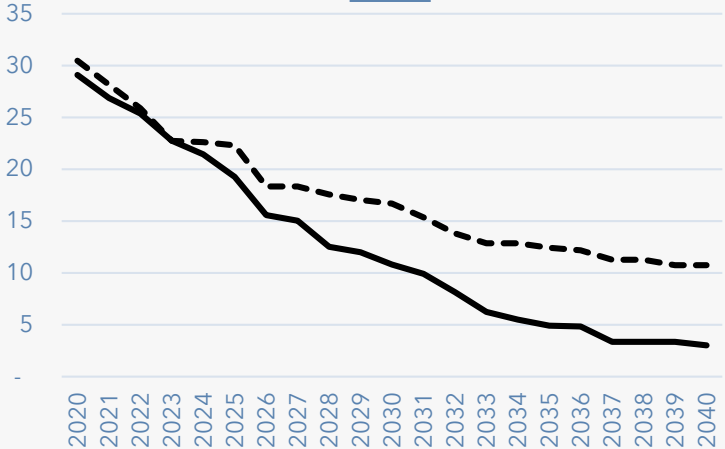
Wind



Natural Gas



Coal



PNW Hydro Conditions

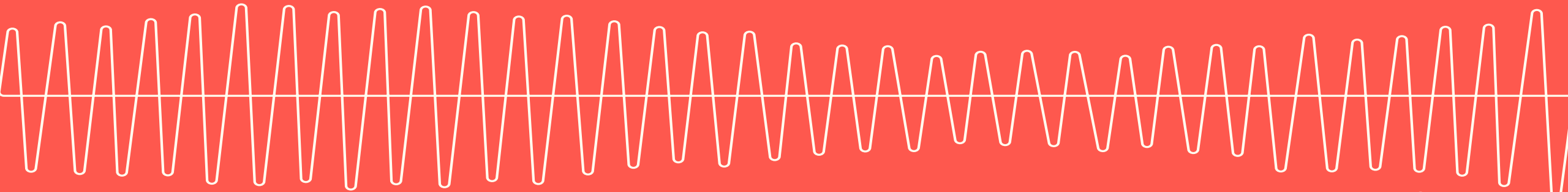
- PNW hydro generation can strongly influence electricity prices
- In the 2016 IRP, we considered a Reference hydro condition and examined critical hydro conditions under reference gas and carbon prices
- In the 2019 IRP, we expanded to consider three PNW hydro conditions: Low, Reference and High
 - Low and High are modeled as +/- 10 percent (approximately one standard deviation) of annual PNW hydro energy
- We plan to continue to consider Low, Reference and High PNW hydro conditions

Questions & Comments

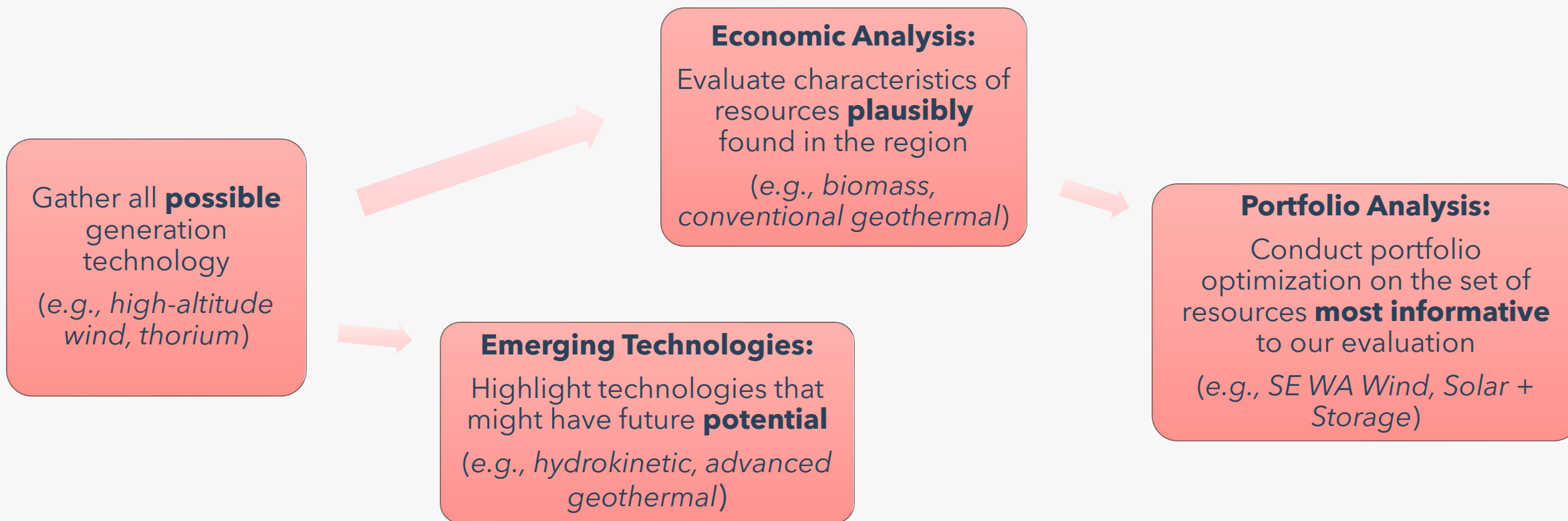
We're seeking your feedback!

SUPPLY-SIDE OPTIONS

SETH WIGGINS, ROBERT BROWN
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Supply-side Options



Note: examples are illustrative; PGE has not yet determined the resources in each category

Supply-side Options

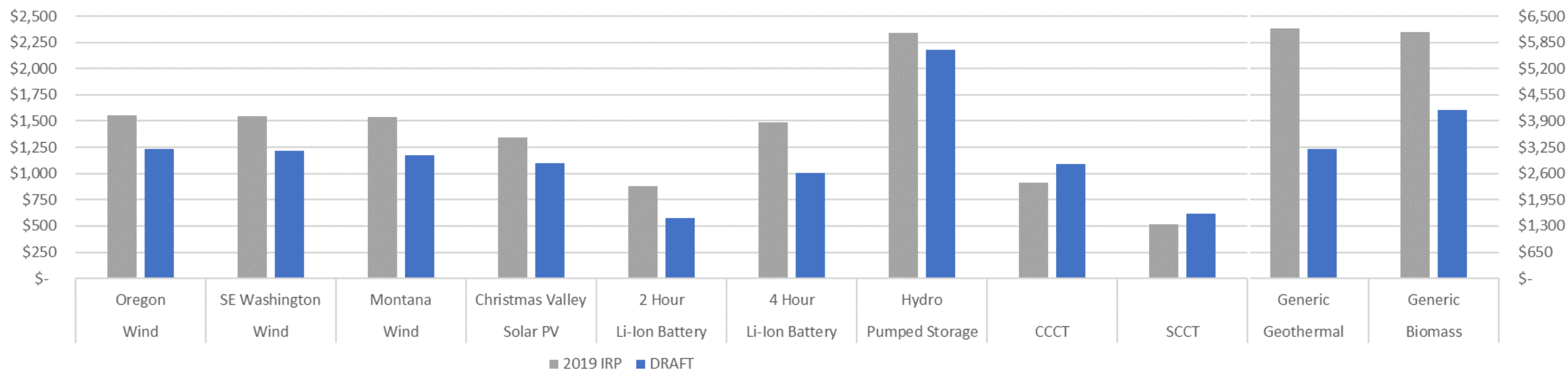
As discussed at the August 2020 roundtable meeting, we decided to utilize publicly available sources of supply-side costs and operating characteristics

Fuel Type	Resource	Data Source
Wind	Oregon Gorge, SE Washington, Montana, Offshore	EIA: AEO 2020
Solar	Central Oregon, Oregon George, Willamette Valley	NREL: 2020 ATB
Hybrid	Solar + Storage	NREL: 2020 ATB
	Wind + Storage	Combined
Geothermal	Geothermal	NREL: 2020 ATB
Biomass	Biomass	EIA: AEO 2020
Pumped Storage	Pumped Storage	Other: PNNL, NWPCC
Battery Storage	Li-Ion 2-24 Hours	NREL: 2020 ATB
	Vanadium Flow Batteries	Other: PNNL, NWPCC
Hydrogen	Production, storage, generation	Other: PNNL, NWPCC
Natural Gas	Combined-cycle CT	EIA: AEO 2020
	Simple-cycle CT	EIA: AEO 2020
Renewables	Hydrokinetic (wave or tidal)	Emerging Resource
	Waste-to-energy (municipal solid waste)	Emerging Resource
Additional	Small modular reactor	Emerging Resource
	Hydrogen co-fire (at new natural gas facilities)	Other: PNNL, NWPCC

Supply-side Options

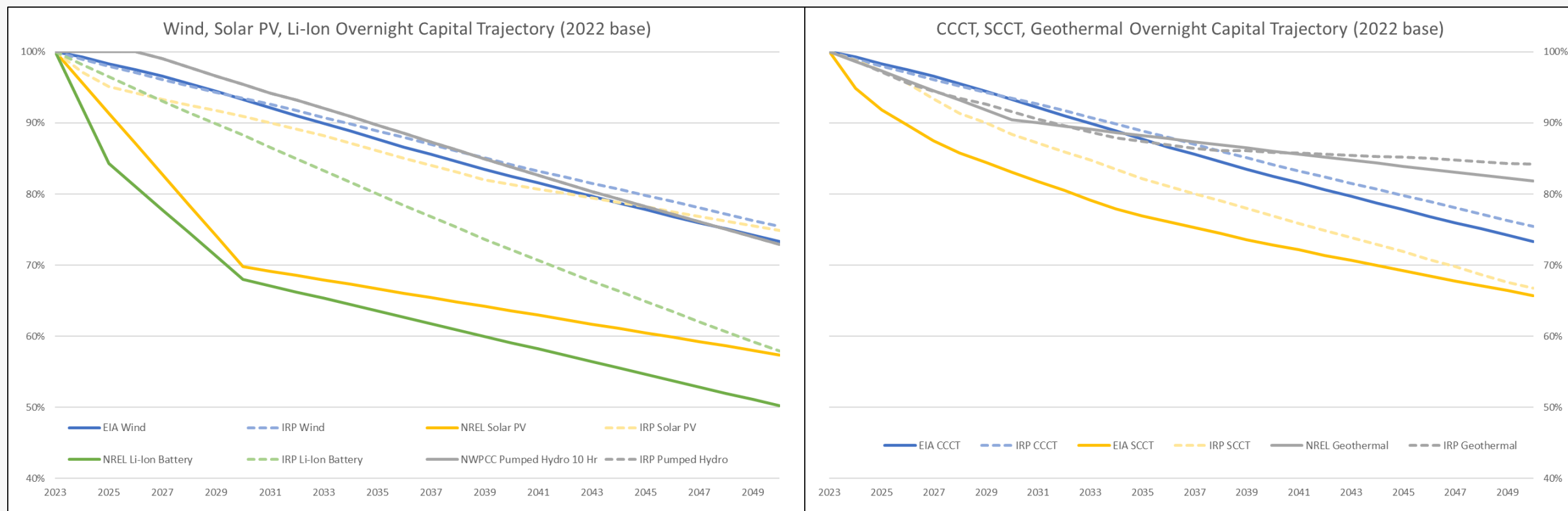
- Comparison of select draft overnight capital costs to 2019 IRP (2026 COD)

Draft Overnight \$/kW - COD 2026 (2020\$)



Supply-side Options

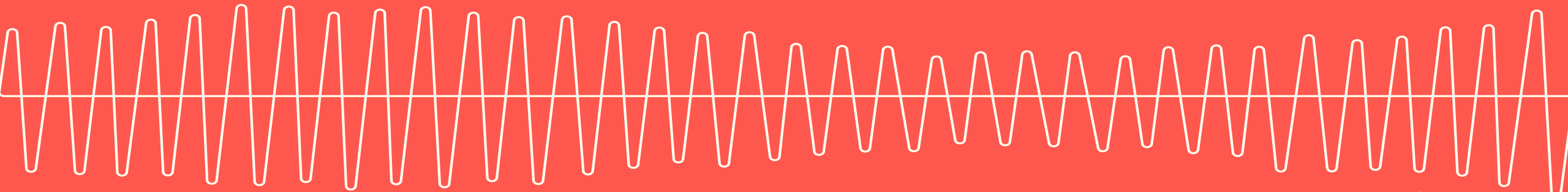
- Comparison of select draft overnight capital costs trajectories to 2019 IRP (% of base year)
- Relatively larger near-term declines for projected Solar, Li-ion, and CT costs



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
 - ⑩ 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
 - ⑩ 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)

QUESTIONS/DISCUSSION?





THANK YOU

CONTACT US AT:
IRP@PGN.COM

ATTACHMENT A: ACRONYMS

CEC: California energy commission

COD: commercial operation date

DER: distributed energy resources

EIA AOE: energy information
administration annual energy
outlook

ELCC: effective load carrying
capacity

IRP: integrated resource plan

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)

NREL: national renewable energy
laboratory

NWPCC: northwest power and
conservation council

PNNL: pacific northwest national
laboratory

QF: qualifying facility

RPS: renewable portfolio standard

SB 978: Senate Bill 978

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