Integrated Resource Planning

Roundtable Meeting #20-6

October 28, 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: 448 662 887#
  - 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

Pinch points at home

A pinch point is defined as any point where it is possible for a body part to be caught between moving and stationary portions of equipment. Pinch points are found in many places throughout a workplace or home. Things like doors, drawers, windows, vents, and cabinets are all common areas for pinch point injuries.

Safeguards to avoid pinch points

•Eliminate the hazard by ensuring proper guarding is in place.
•Pay attention to where your hands are around any moving parts or any objects that have the potential to move.
•When working with others make sure to communicate to let each other know if you are out of the line of fire before moving objects or starting up equipment

AGENDA

- Welcome & Introduction
- Load forecast for IRP update
  - 30 minutes
  - Informational
- Capacity Need, RPS Position, Energy Position
  - 45 minutes
  - Informational
- Market prices for IRP update
  - 20 minutes
  - Informational and participants' feedback

Load Forecast for the IRP Update

Amber Riter

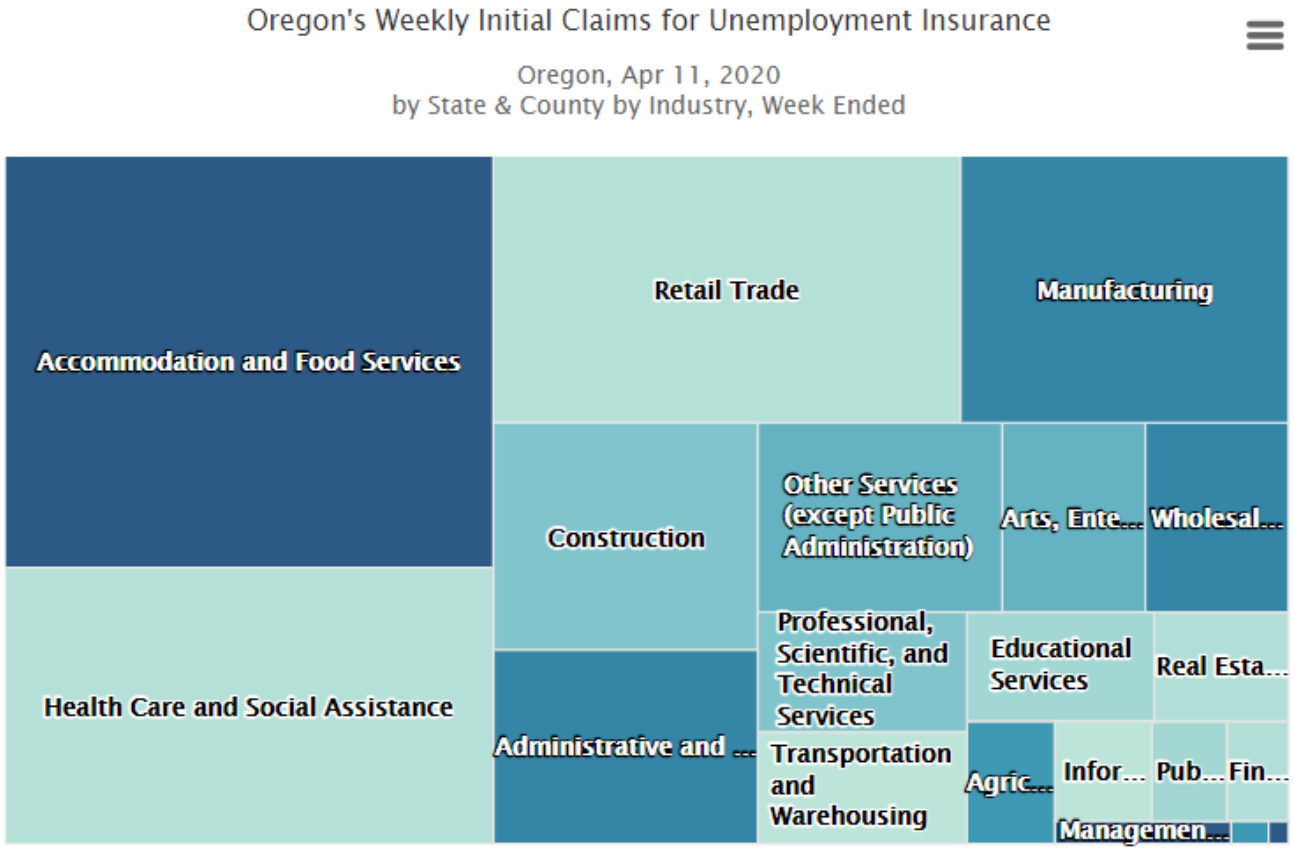
Load Forecast Update

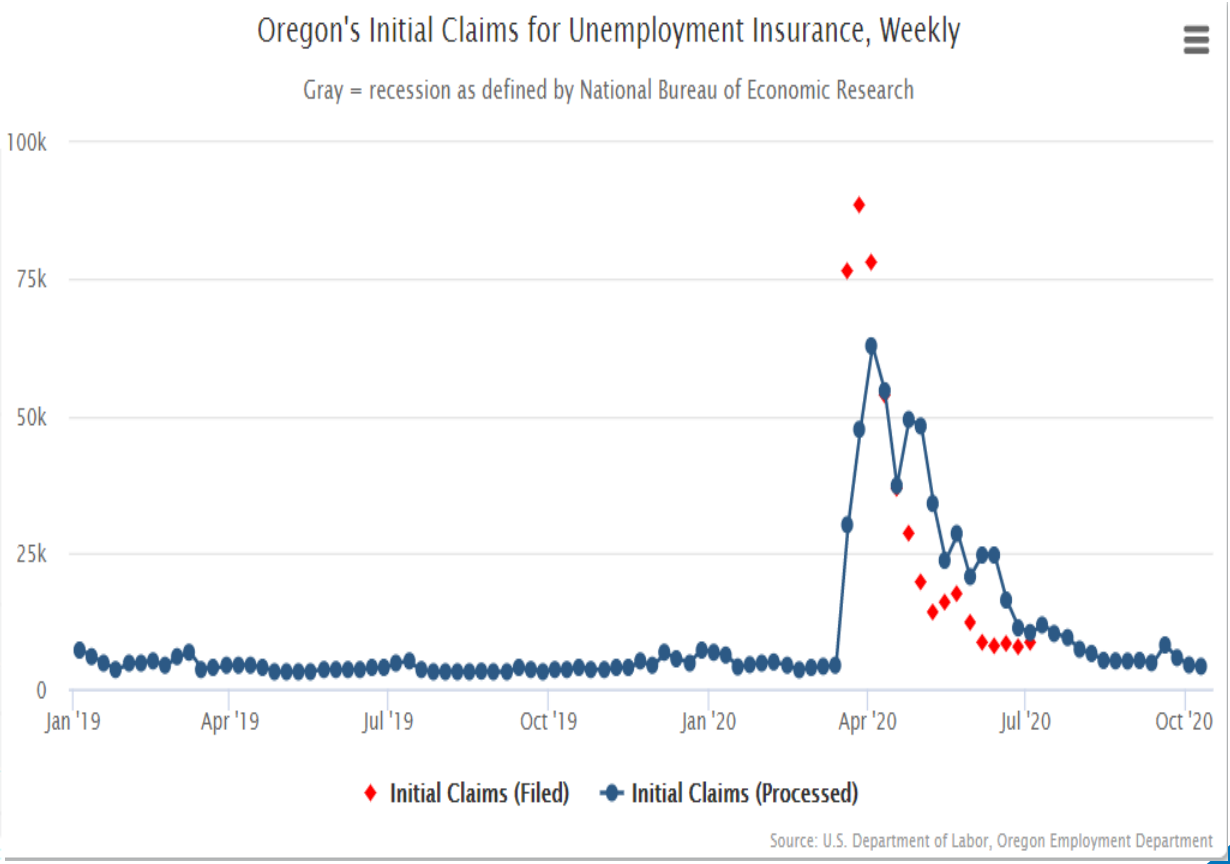
- Impact of COVID-19 on PGE's Energy Deliveries
- Updated Load Forecast

Context, COVID-19 response in PGE's Service Area

- March 8th – Declaration of Emergency in Oregon
- March 12-16th – School closures begin, many employers initiate work from home
- March 23rd –Oregon Executive Order 20-12 (Stay Home, Save Lives)
- June 19th – Multnomah county joins Clackamas and Washington counties in Phase 1 of reopening, Marion county enters Phase 2
- Multnomah, Clackamas and Washington counites remain in Phase 1 as of mid-October

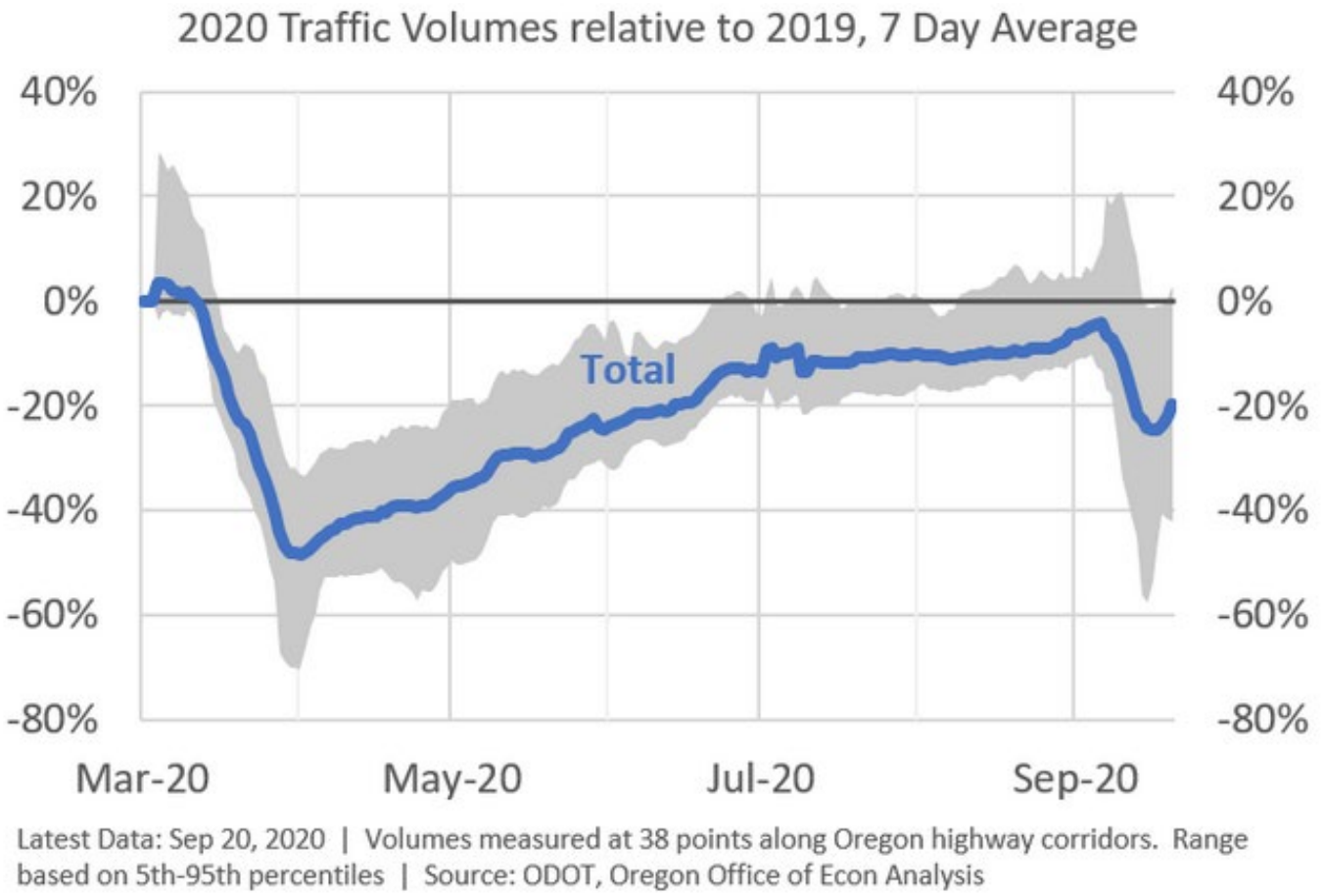
High Frequency Indicators: Unemployment Claims





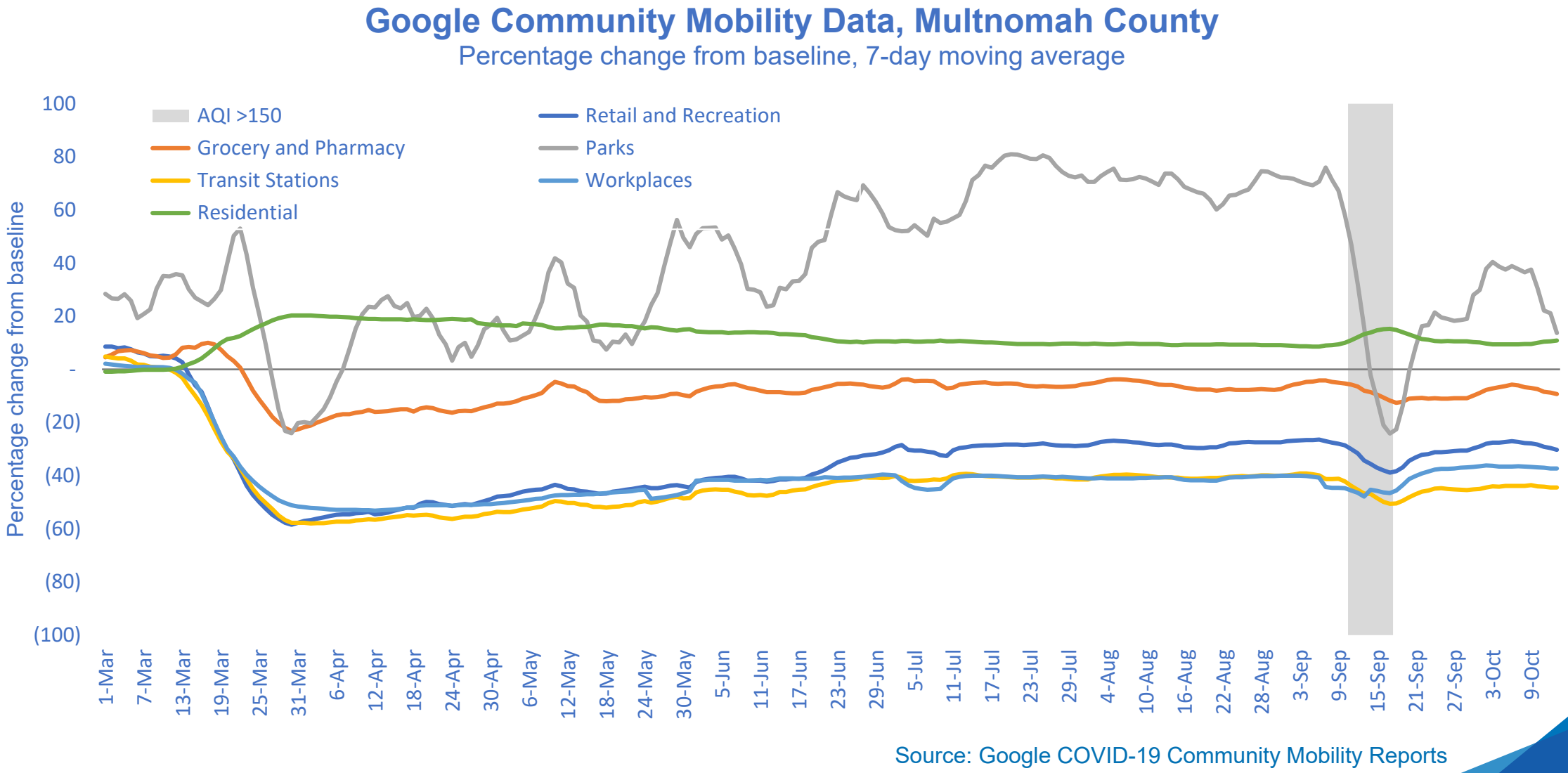
Source: Oregon Employment Department

High Frequency Indicators: Traffic Volumes



Source: Oregon Department of Transportation and Oregon Office of Economic Analysis

High Frequency Indicators: Mobility Data



Source: Google COVID-19 Community Mobility Reports

High Frequency Indicators: Electricity Use

BLOG POST

Covid-19 crisis: electricity demand as a real-time indicator

BUSINESS

U.S. Power Use Weakening After Plunging in Italy Amid Coronavirus

Power demand in Italy has fallen 18% so far. Experts say such data can be a real-time indicator of coming economic damage.

UTILITYDIVE Deep Dive Opinion Podcasts Library Events

Generation T&D Solar Storage Demand Response Distribute

Utilities beginning to see the load impacts of COVID-19 as economic shutdown widens

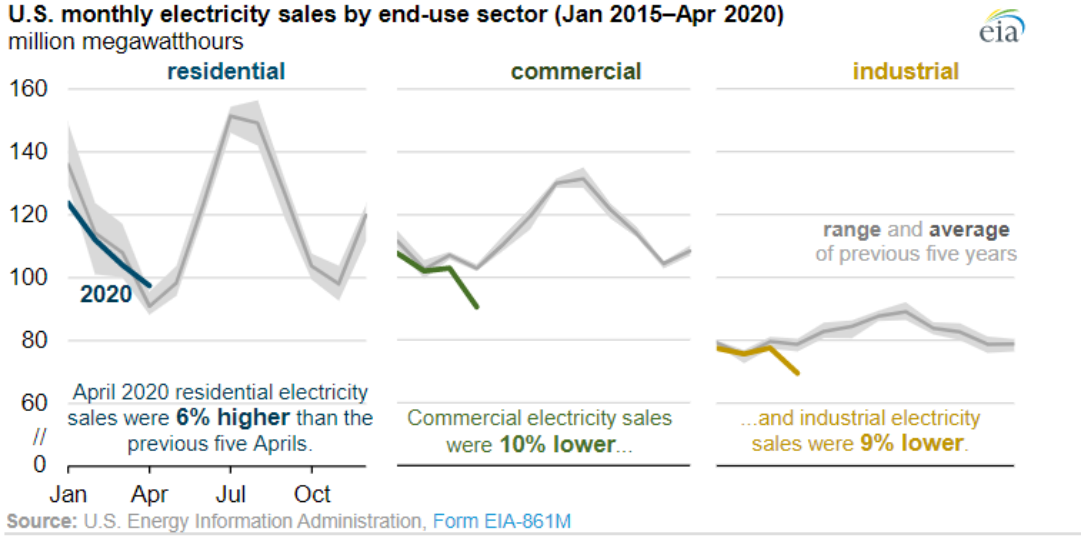
ELECTRIC POWER — 23 Mar 2020 | 21:51 UTC — New York

COVID-19-related load impacts are being reported by several US grid operators

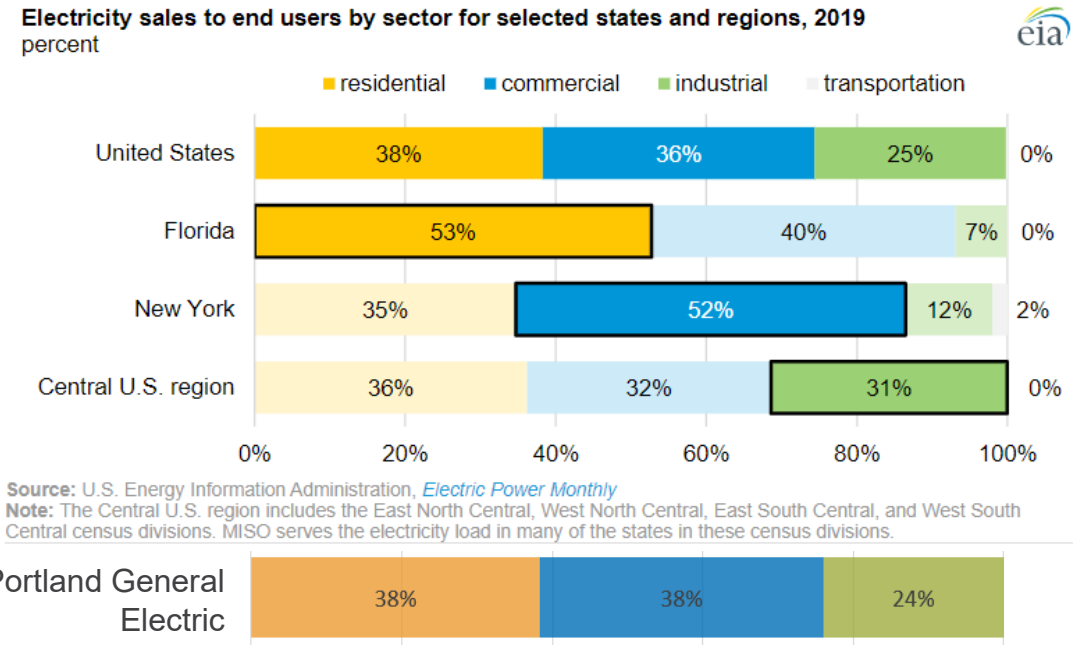
Impact by region and utility varies widely driven by customer mix, appliance stock and climate

JUNE 30, 2020

Stay-at-home orders led to less commercial and industrial electricity use in April

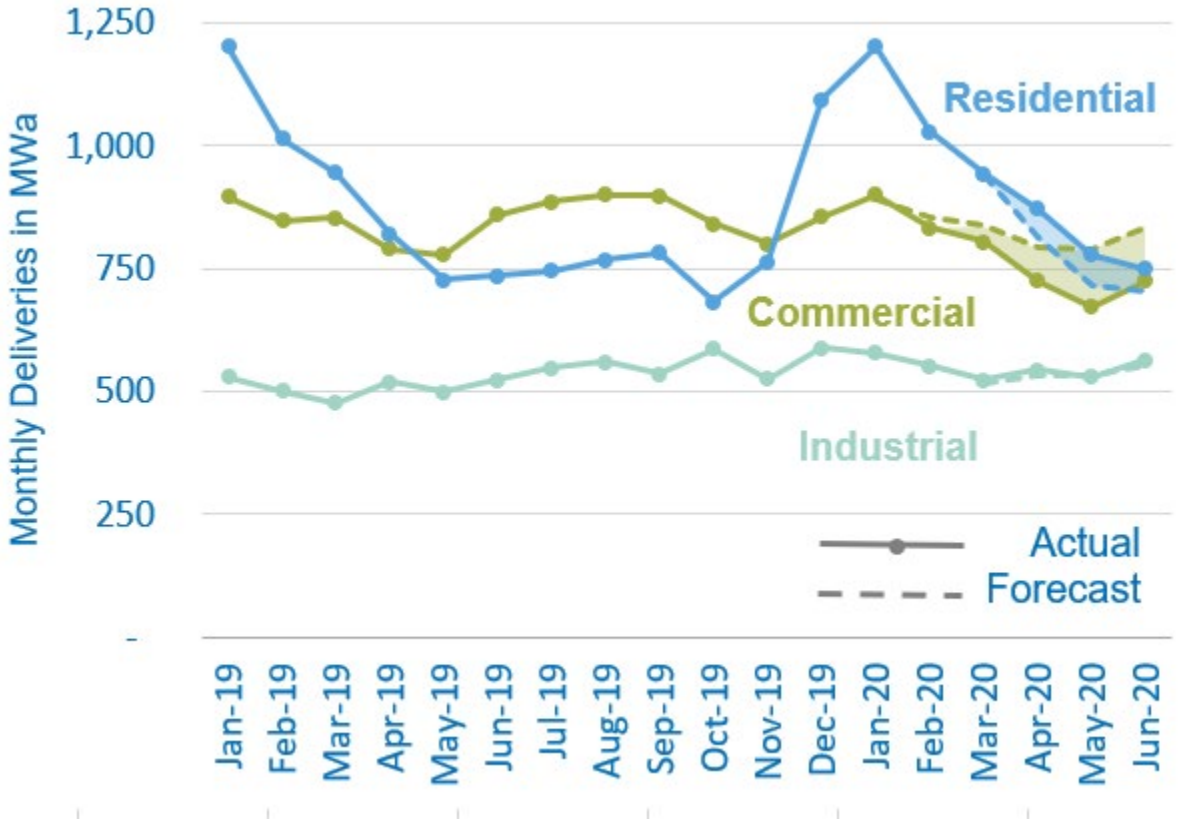


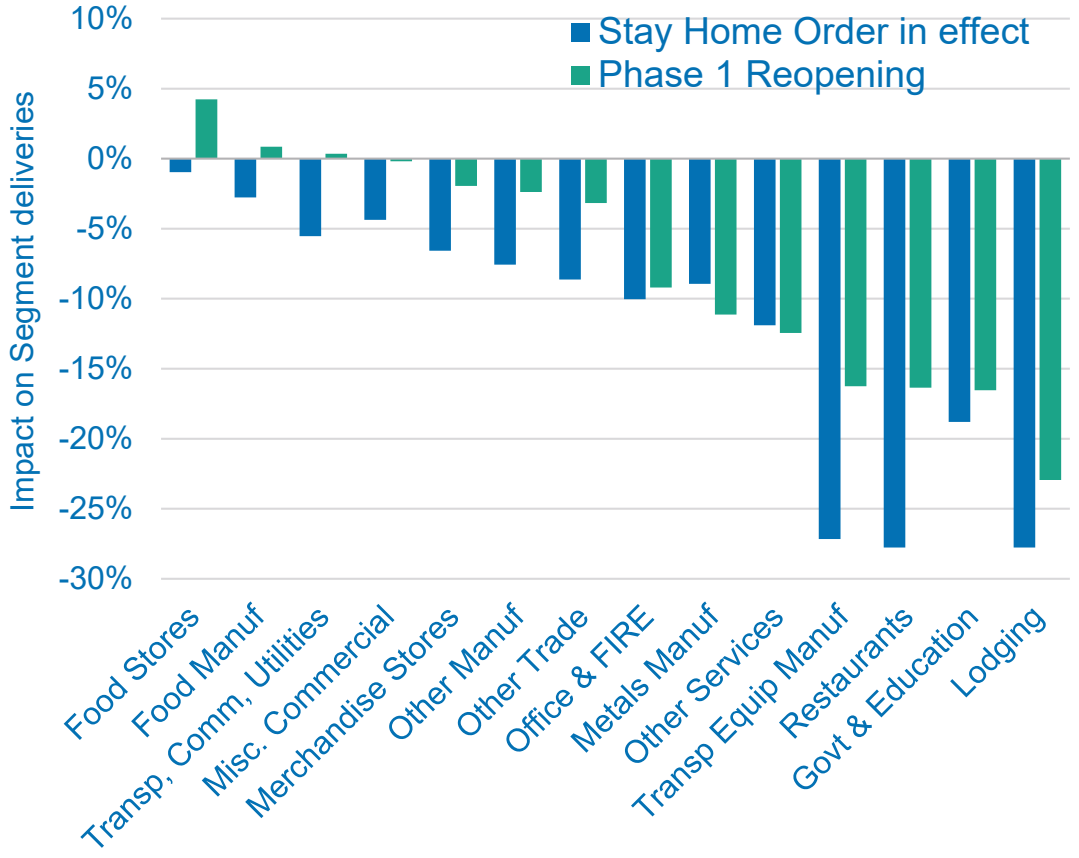
Source: U.S. Energy Information Administration, Form EIA-861M



Source: U.S. Energy Information Administration, *Electric Power Monthly*
Note: The Central U.S. region includes the East North Central, West North Central, East South Central, and West South Central census divisions. MISO serves the electricity load in many of the states in these census divisions.

Estimated Impact of COVID-19 on PGE Energy Deliveries

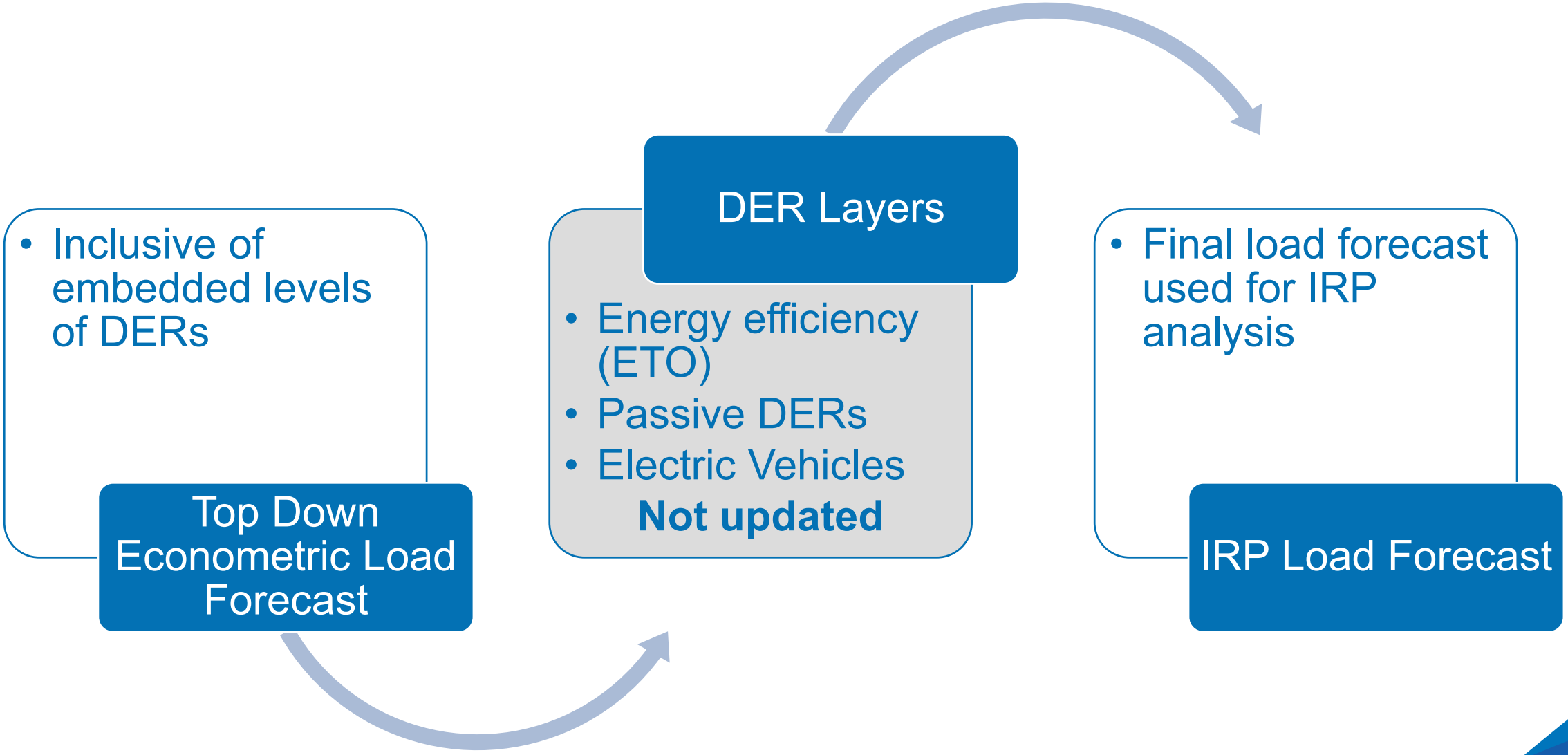




Accounting for the Impact of COVID-19 in the Load Forecast

- Modeling approach
  - Current use of out-of-model adjustments reflecting expectations by segment
  - The next step is to integrate recent historical data into the time series models
  - Ongoing analysis to understand long term changes to usage

Components of IRP Load Forecast



Forecast Components and Update Schedule

Near Term (1-5 Years)

- 25 regression-based monthly energy deliveries models
- Business cycle influences energy deliveries
- Individually forecasts ~25 large customer
- Explicitly removes incremental energy efficiency
- Updated as frequently as every quarter

Long Term (5+ Years)

- Convergence to long term growth rates, agnostic to business cycle and specific customer growth
- Three aggregated customer class models
- Assumes energy efficiency is embedded in growth rates
- Growth rates are appended to near term model output
- Updated for IRP Cycle

Peak Demand

- Model spans full time horizon, near term and long term
- Average energy is a model input
- Updated annually

Forecast Time Horizon

Update of Near-Term Model

- Several forecast vintages since initial IRP filing which was based on PGE's Sept 2018 load forecast
  - Residential average usage fell more dramatically than anticipated in 2019, however in 2020, usage has increased significantly associated with more time spent in the home due to COVID-19
  - Commercial forecast reflects impacts of current COVID-19 induced economic conditions for several years
  - Industrial energy deliveries have grown rapidly, high tech manufacturing has performed well as compared to other segments

Long Term Model

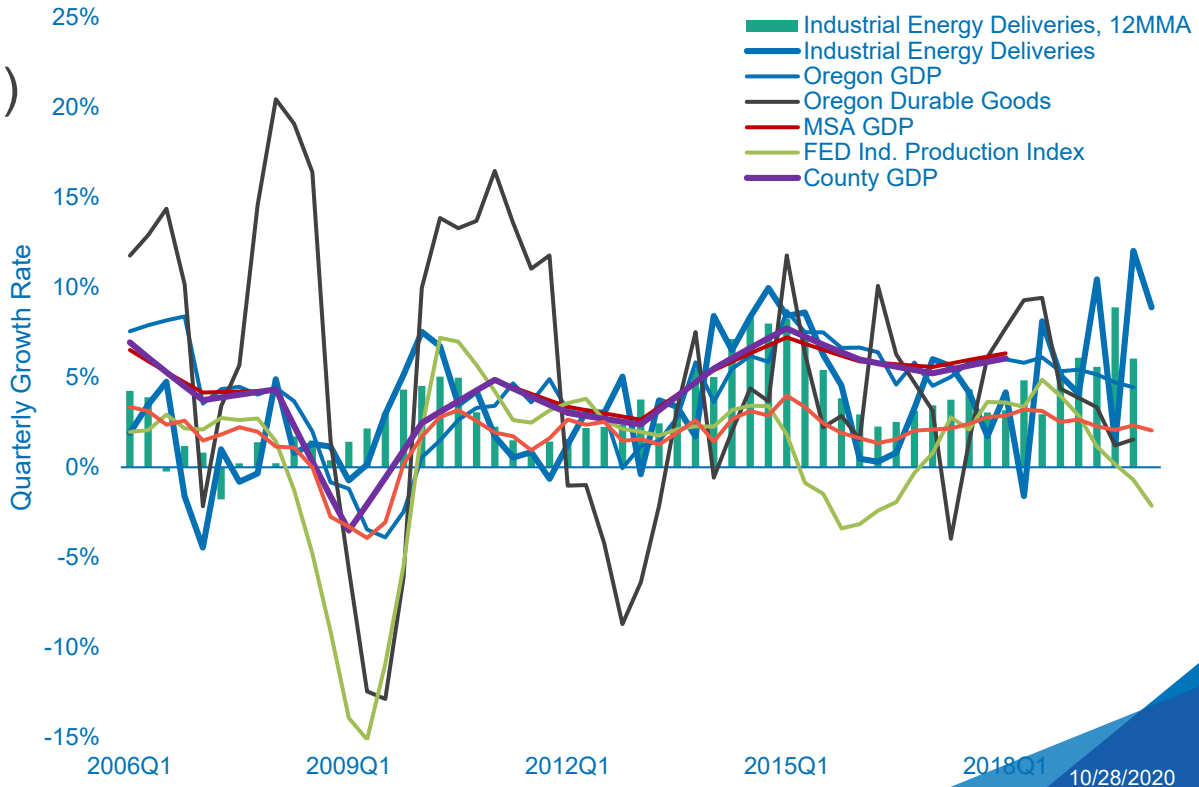
- Long term growth rate models were updated in June of 2020, prior model from summer of 2018
- Historical data through Q1 2020, and May economic forecast

	2019 IRP (2018)	2019 IRP Update (2020)
Residential Count	0.8%	0.7%
Residential Energy	0.1%	0.2%
Commercial Energy	0.5%	0.9%
Industrial Energy	1.9%	1.9%

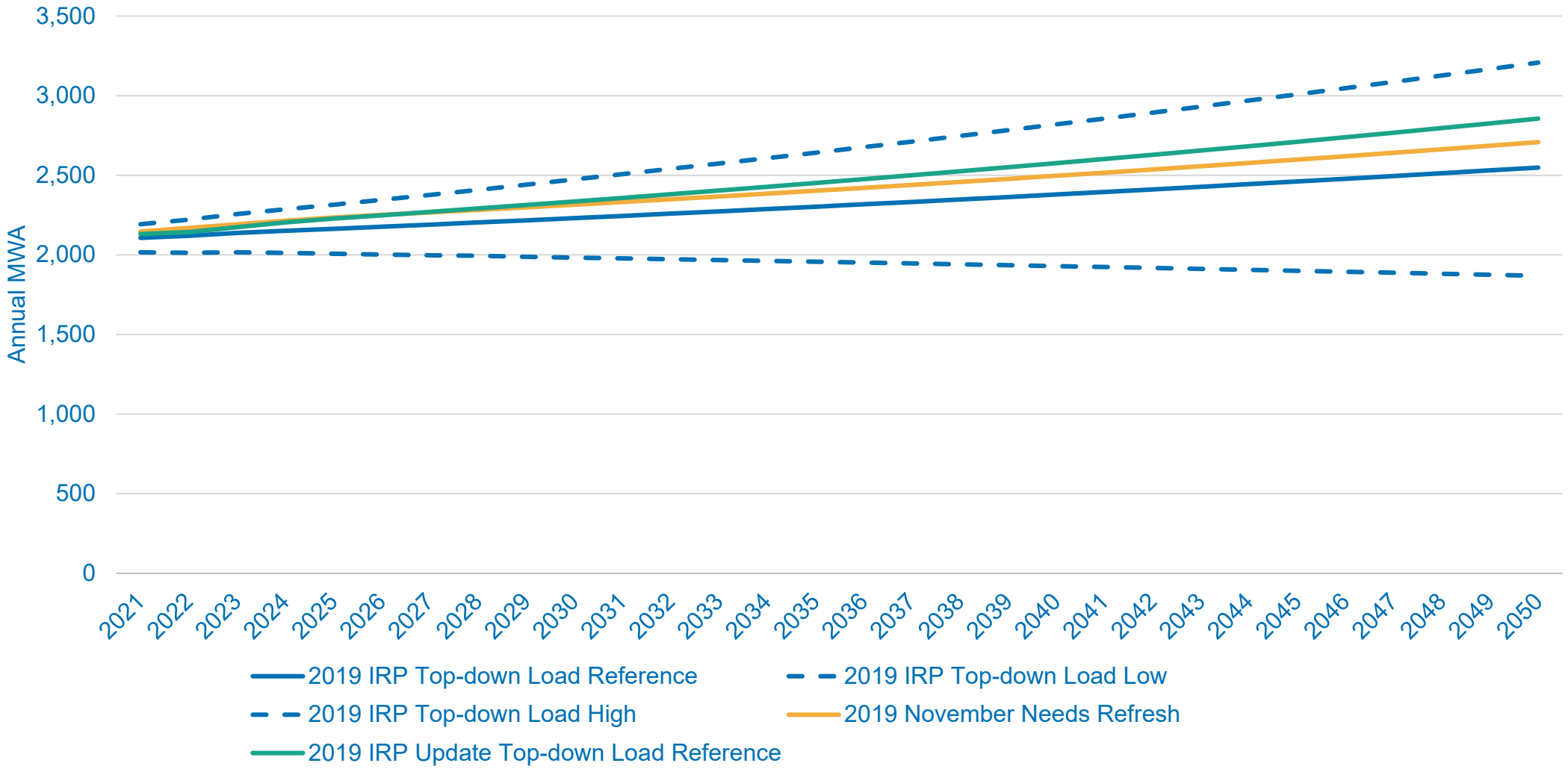
Industrial Drivers

- In LC 73, CUB recommended testing alternate drivers in the industrial model
- Variables Tested
  - GDP (US, State, County, Metro)
  - Oregon Durable Goods Manuf.
  - Industrial Production Indices (Fed, IHS)
- Conclusions:
  - Several indicators show strong correlations
  - GDP outperforms with respect to volatility
  - US GDP also has the benefit of a readily available forecast

Growth Rate Correlations	Industrial Energy Deliveries	Industrial Energy Deliveries, 12MMA
Oregon GDP	17%	24%
Oregon Durable Goods	1%	-7%
Portland MSA GDP	18%	14%
3-County GDP	22%	13%
US GDP Growth	18%	20%
US Industrial Production Index (Fed)	23%	30%
US Industrial Production Index (IHS)	21%	24%



Results: Energy Comparison

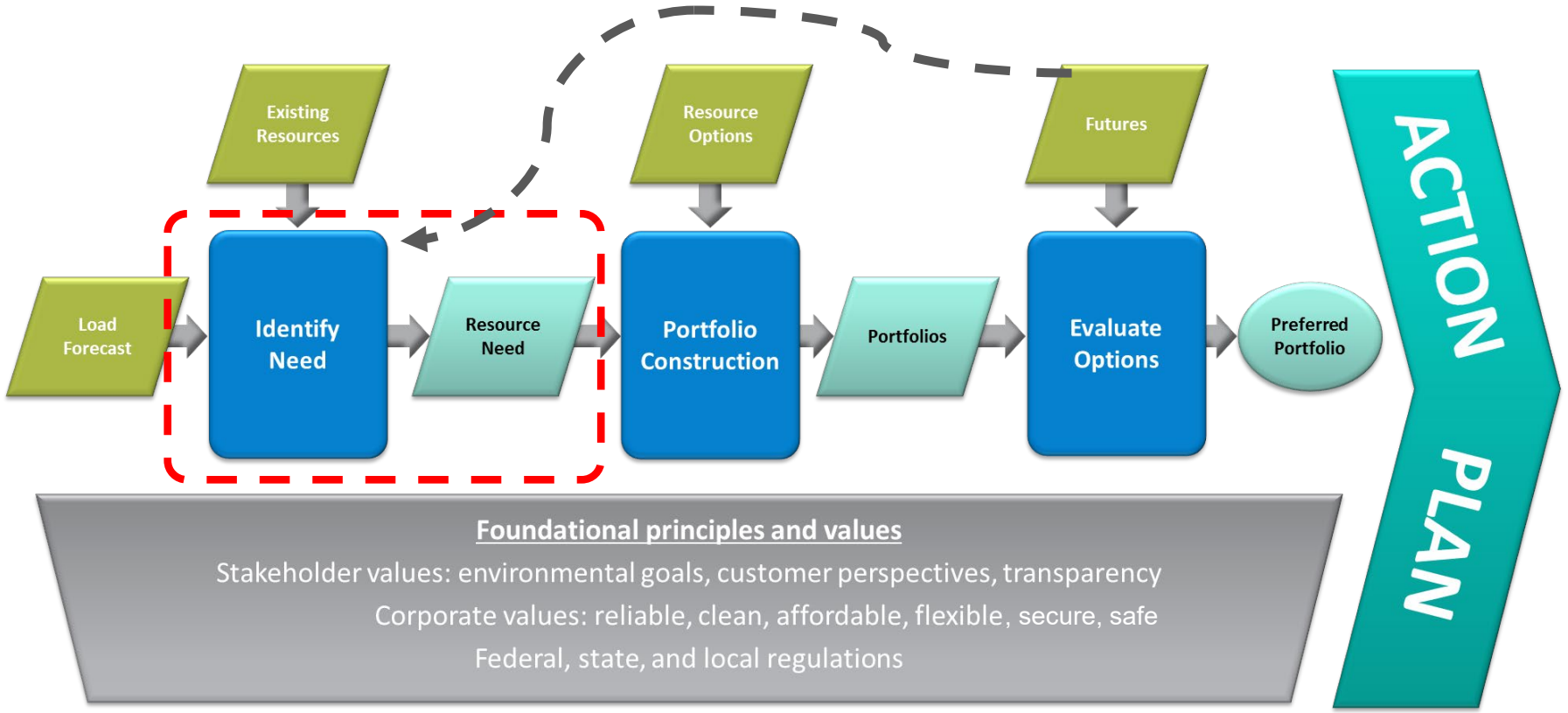


QUESTIONS/ DISCUSSION?

Capacity Need, RPS Position, Energy Position

Kate von Reis Baron and Seth Wiggins

Need Assessment and Position Analysis



Need and Position DRAFT Update

- In this section, we will provide draft updates for:
  - Capacity Need
  - RPS Position
  - Energy Position
- The previous update was the November 2019 Needs Assessment (Docket No. LC 73)
- All values are considered DRAFT until filed

Input Updates since November 2019

The following summarizes the major input updates to the capacity, RPS, and energy assessments:

- Econometric Load Forecast updated to June 2020 (as discussed in earlier section in this roundtable [RT])
- Contracts:
  - PURPA Qualifying Facility updated to June 2020 snapshot, including impacts of Community Solar Settlement
  - Added Douglas County PUD Power Purchase Agreement
- Added Community Solar resource
- Wholesale Market Prices (as discussed in later section in this RT)
- Updated Regional Capacity estimate

Capacity Need – Roundtable Review

- RT 20-1 included a high-level introduction to capacity assessments and the Sequoia model
- RT 20-3 provided additional details about Sequoia's structure and dispatch logic
- RT 20-5 provided information from a preliminary baselining exercise for Sequoia
- The slides from earlier Roundtables are available at:

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

Capacity adequacy means that a system has sufficient resources to meet a reliability standard (e.g. a loss of load probability of one day in ten years)

Capacity need is the amount of additional resources needed to achieve the adequacy standard

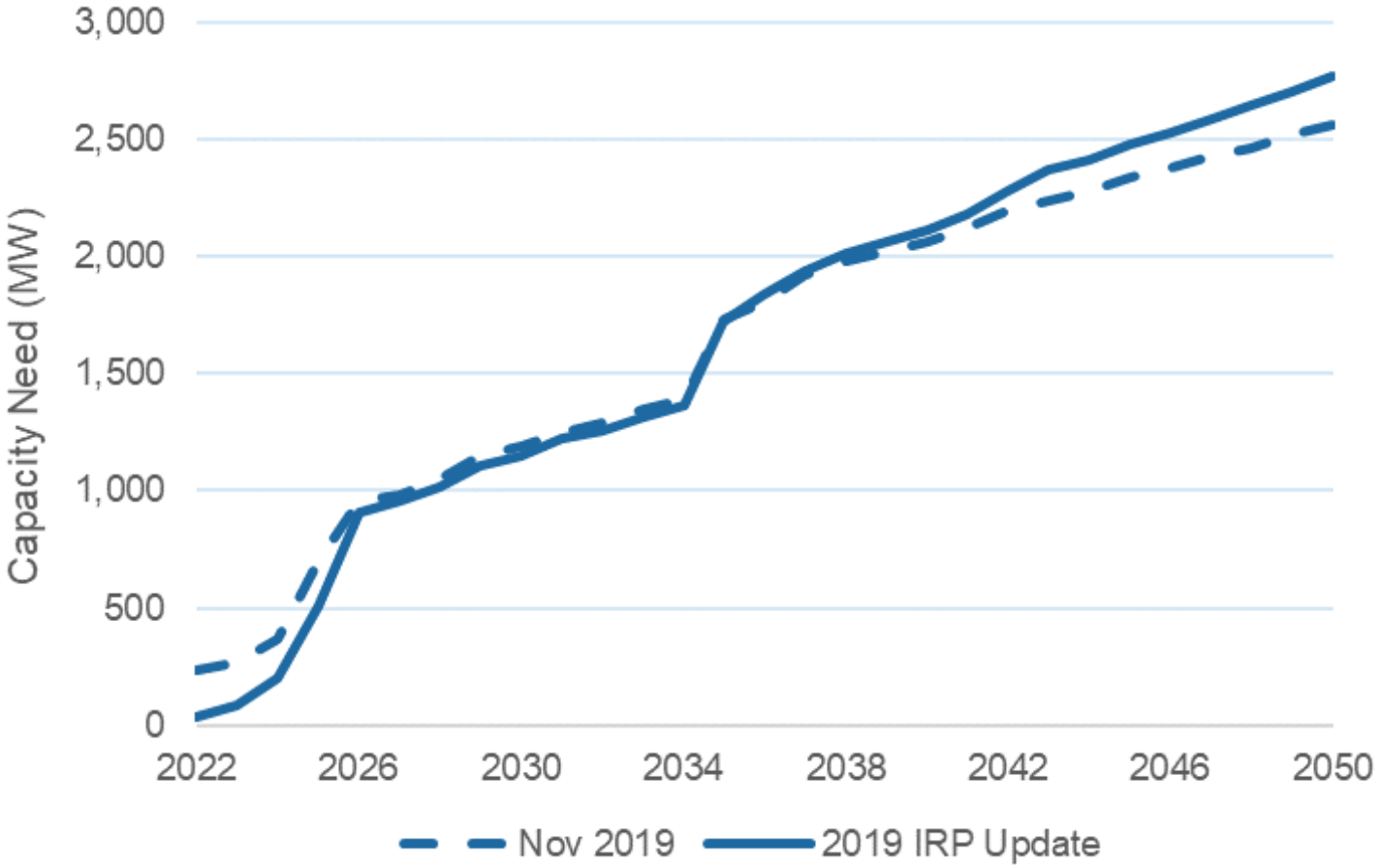
Sequoia

A Monte Carlo time-sequential capacity assessment model that calculates capacity need and capacity contribution of incremental resources

Capacity need is expressed in terms of perfect capacity (available 24x7, 0% forced outage rate)

Reference Capacity Need - DRAFT

- Major updates since the November 2019 Needs Assessment include: contracts, load forecast, and the capacity model (including change to perfect capacity)



Capacity Need

	2025 MW
Nov 2019	697
IRP Update	511

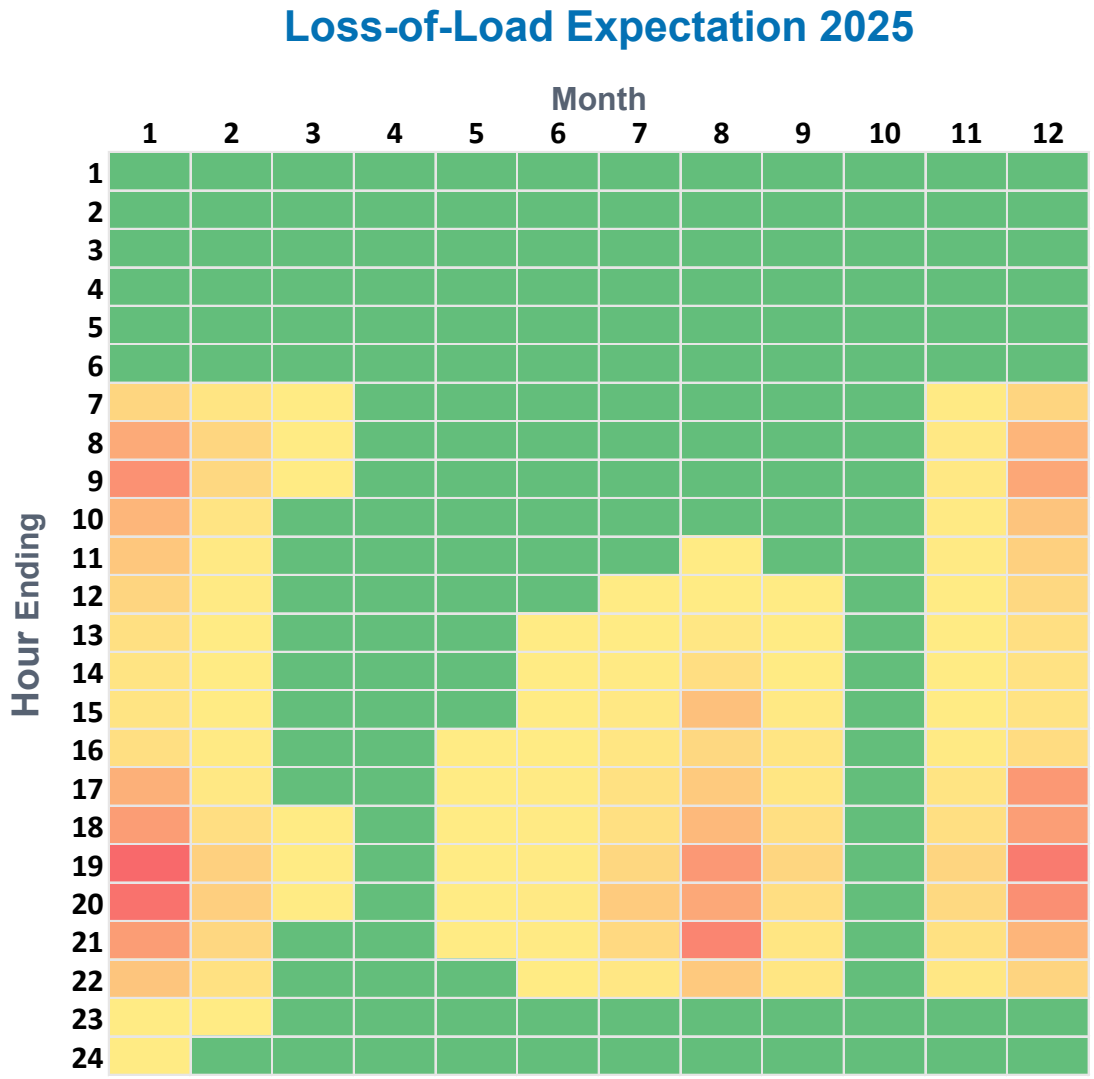
The November 2019 capacity need is expressed in terms of conventional units (100 MW, 5% forced outage rate). The IRP Update values are expressed in terms of perfect capacity (24x7, no forced outages).

All data is draft until filed.

Capacity Need Heatmap - DRAFT

Most challenging hours continue to be winter evenings

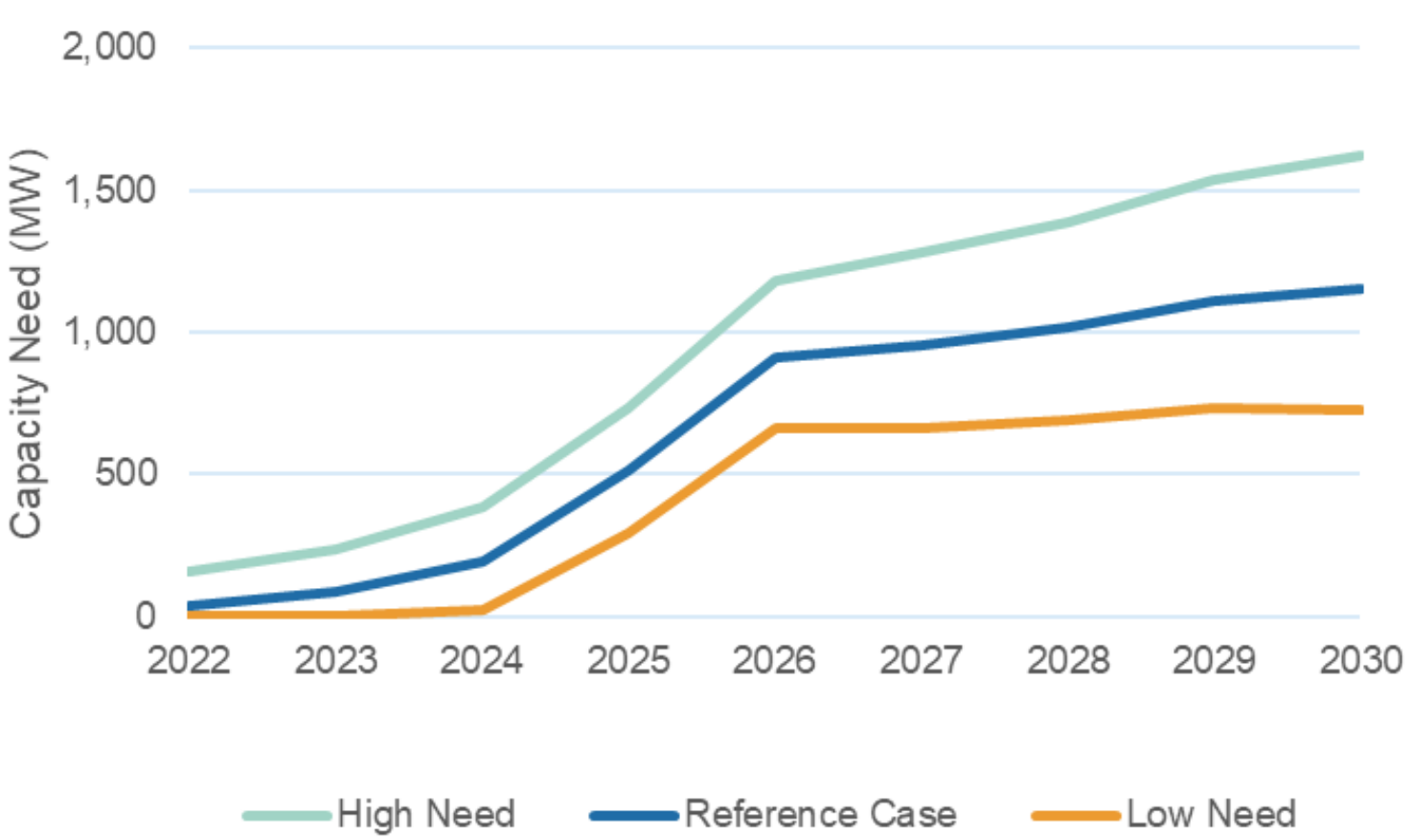
Other high need times are winter mornings and summer evenings



All data is draft until filed.

Capacity Need by Need Future - DRAFT

- The Need Futures continue to capture a wide range of uncertainty in the amount of capacity needed.
- The drivers are the econometric load forecast, DER adoption, EE acquisitions, and regional capacity



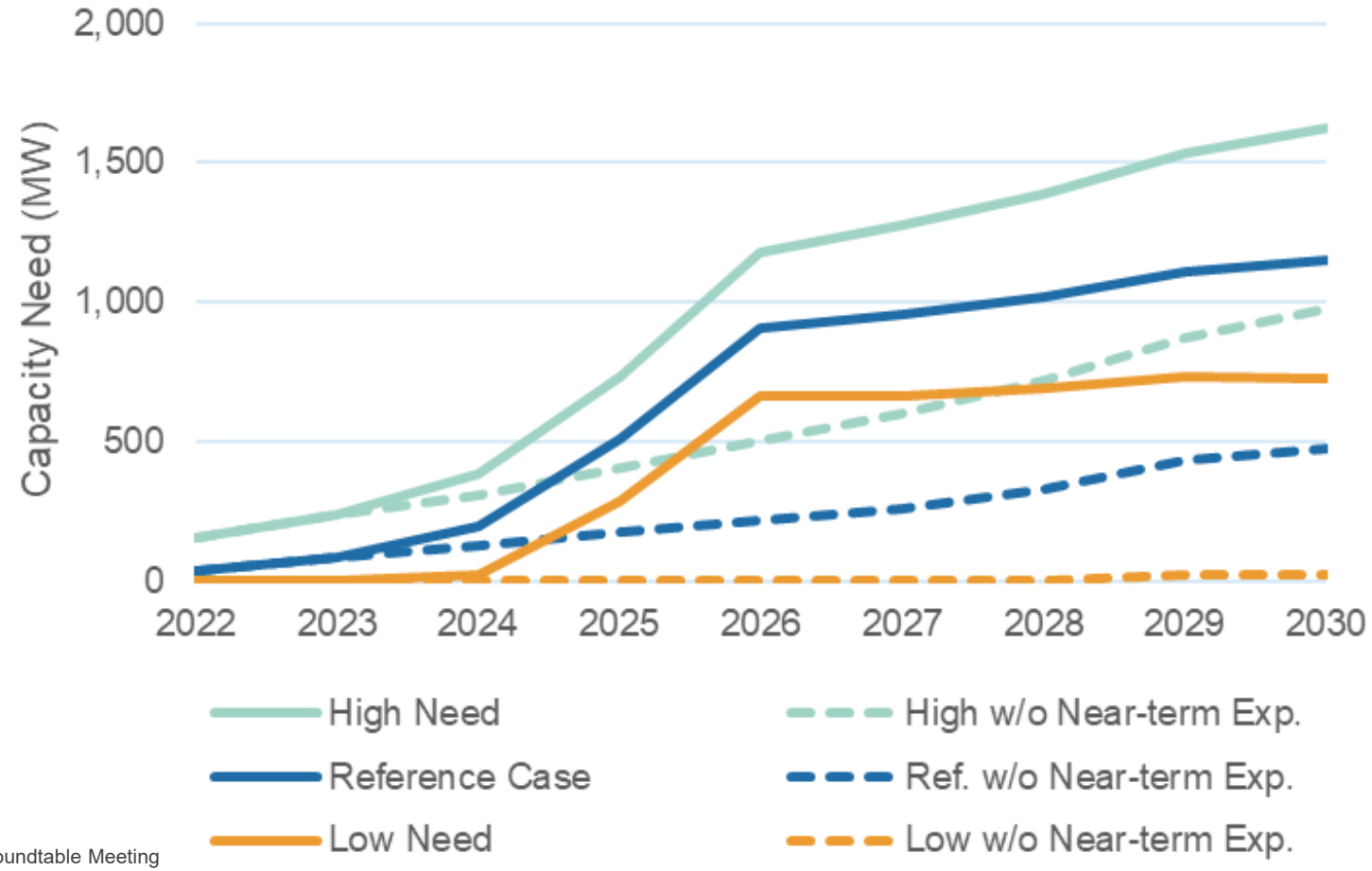
Capacity Need Futures

Need Future	2024 MW	2025 MW	2026 MW
High	388	737	1182
Ref.	198	511	909
Low	22	292	664

All data is draft until filed.

Capacity need excluding near-term expirations DRAFT

- Existing regional resources have the potential to meet some of the identified capacity need; however, their availability is uncertain. The dashed lines in the figure below show the impact of excluding near-term contract expirations from the capacity assessment.



Capacity Need in 2025

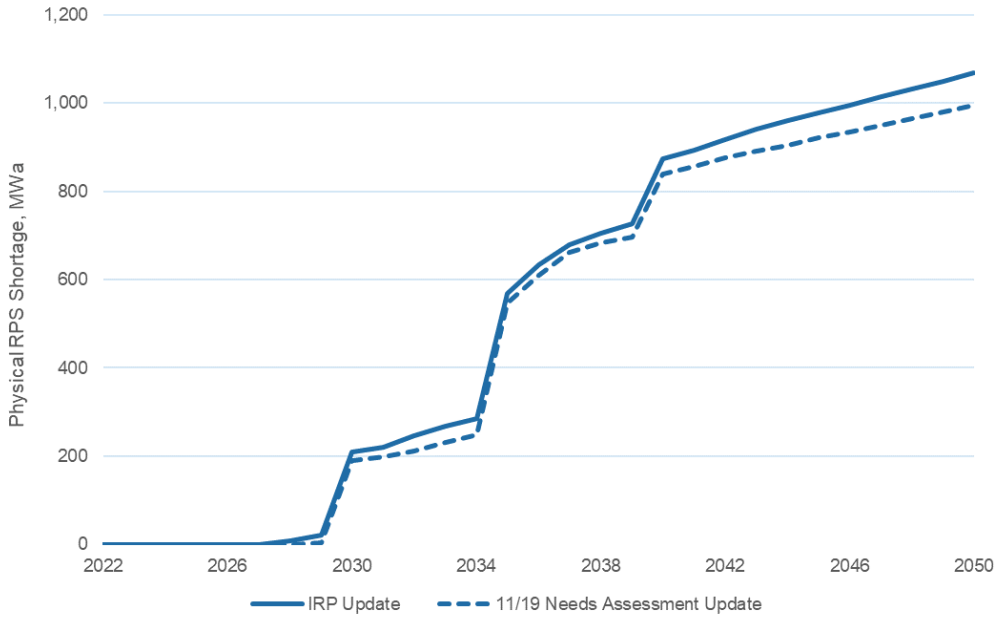
Need Future	Need MW	w/o Exp. MW
High	737	410
Ref.	511	181
Low	292	2

All data is draft until filed.

RPS Position

- The Oregon Renewable Portfolio Standard (RPS) has played a major role in the development of renewable resources to serve PGE customers
  - The percent required increases every five years until 2040
- Since the November 2019 needs assessment update, we've seen:
  - An increased long-term forecast demand
  - A reduction in REC generation from QF contracts
- These two lead to a slightly higher physical RPS shortage*

Years	RPS Requirement (% of Retail Sales)
2020-2024	20%
2025-2029	27%
2030-2034	35%
2035-2039	45%
2040+	50%

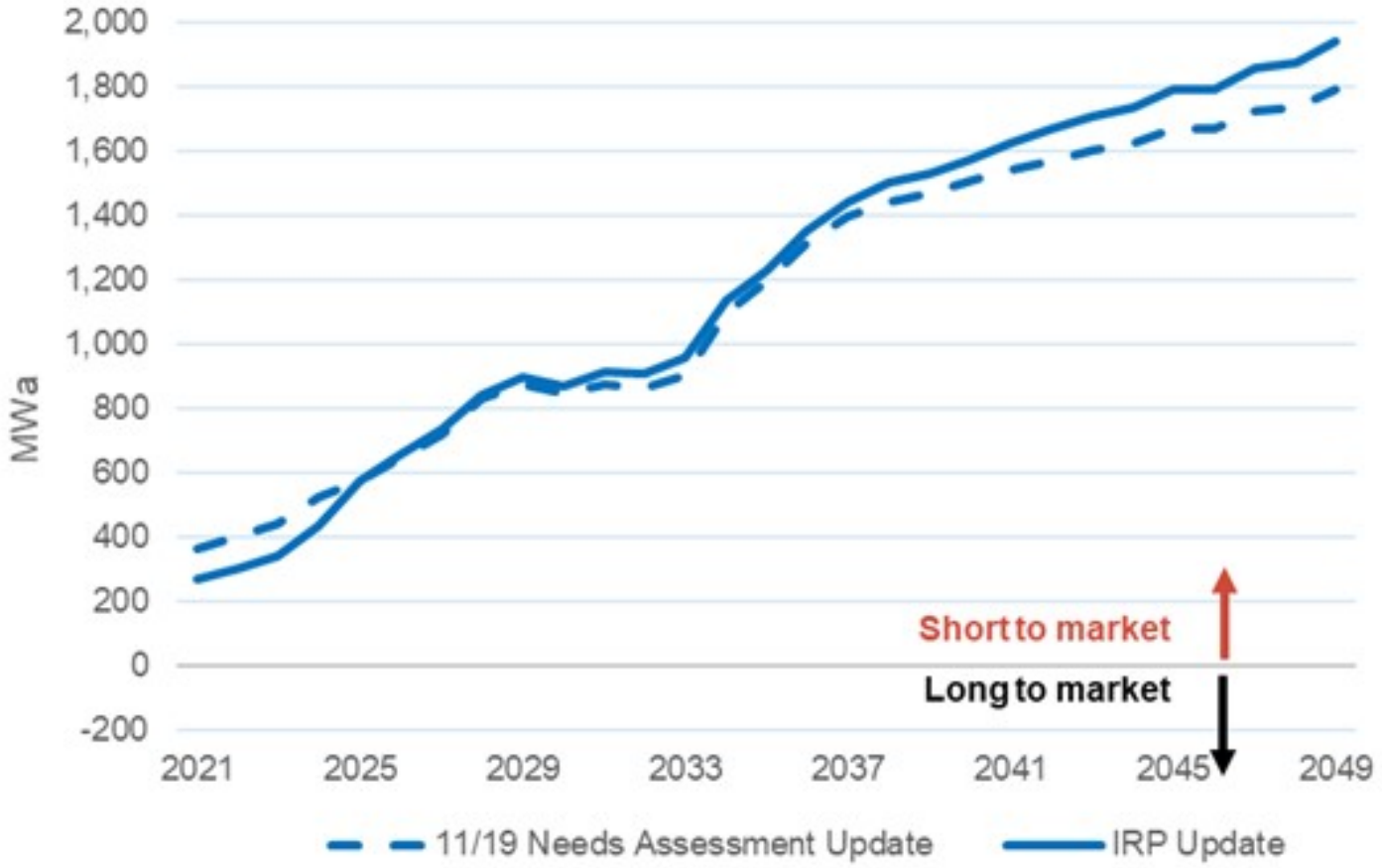


* We measure our 'physical' RPS position, the difference between our yearly REC generation and compliance obligation

All data is draft until filed.

Energy Position - DRAFT

- 2019 IRP Update Reference Case net energy market position compared to the Nov 2019 Needs Assessment. Positive values indicate a net-short position.



Net Energy Market Position in 2025 across Futures

	Filed IRP MWa	Nov 2019 MWa	IRP Update MWa
Reference Case	580	527	435
10th Percentile	446	285	301
90th Percentile	915	848	771

All data is draft until filed.

QUESTIONS/ DISCUSSION?

Market Prices for the IRP Update

Nora Xu

IRP Update Wholesale Market Electricity Prices

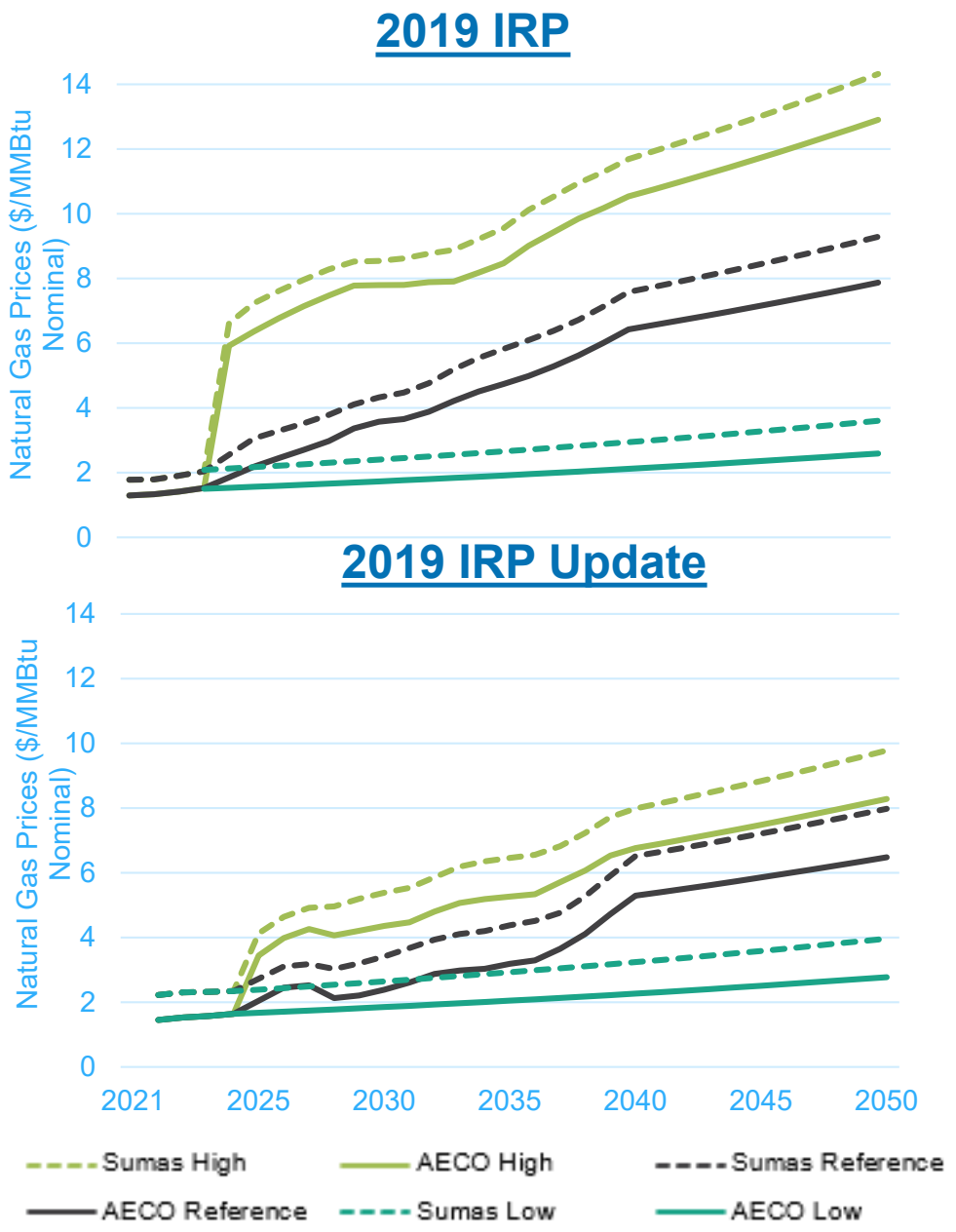
- Consideration of different trajectories for renewable build out, natural gas prices, carbon prices, and Pacific Northwest (PNW) hydro conditions resulted in 54 distinct Market Price Futures in the 2019 IRP.
- 54 (2*3*3*3) Market Price Futures

R/H	L/R/H	L/R/H	L/R/H
Renewable buildout	*Carbon Price*	*Natural Gas Price*	*PNW Hydro*

- We updated the following inputs for the IRP Update
  - Carbon price forecasts
  - Natural gas price forecasts
- The above updated inputs result in updated electricity price trajectories for the 54 Market Price Futures

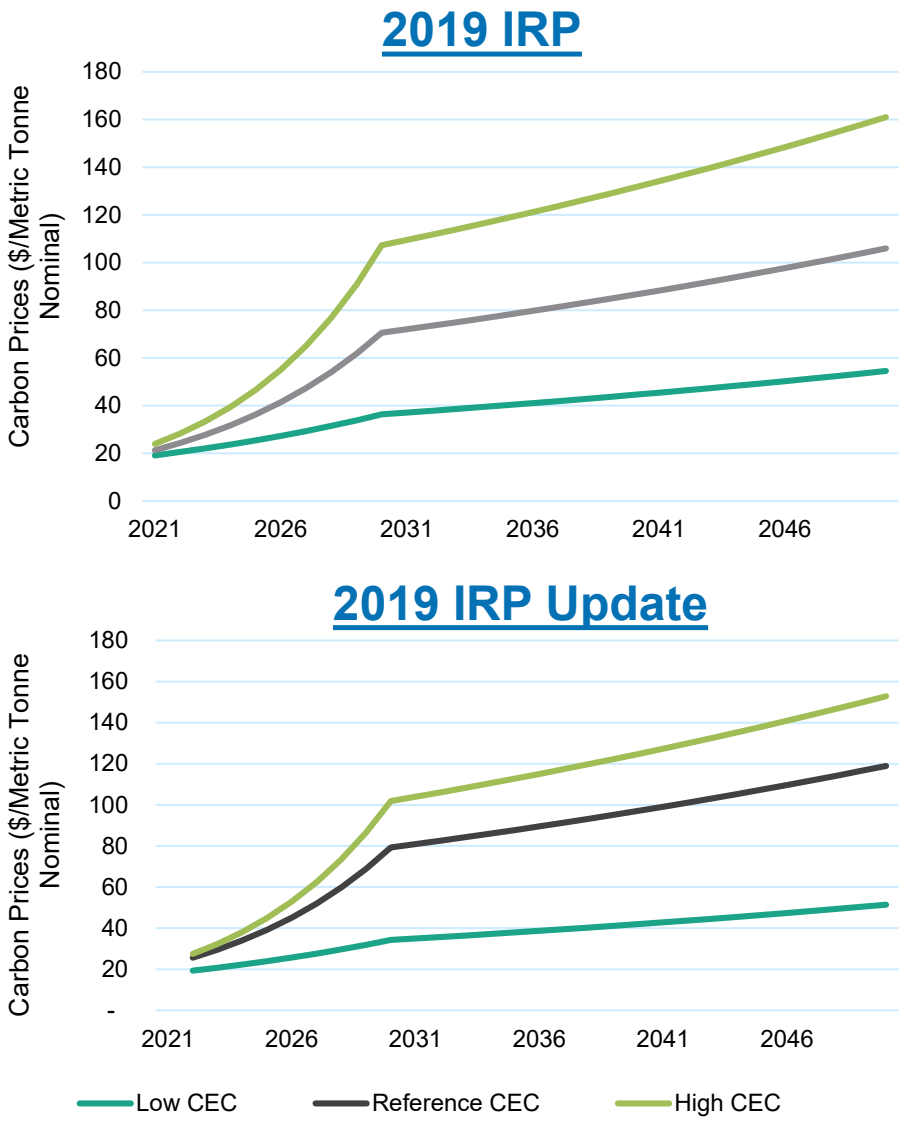
Natural Gas Price Forecast

- Near term, we use PGE's forward gas trading curve
- Long term, we use a Low, Reference and High natural gas price forecast
- 2019 IRP: 2020-23 PGE forward gas trading curve, 2024 as the interpolation year, 2025-40 L/R/H gas price forecasts
- 2019 IRP Update updates
  1. Forward trading curve updated to 2020 Q1 for 2021-24
  2. Reference Case updated to the 2019 H2 vintage of Wood Mackenzie gas forecast for 2026-40
  3. High Case updated to U.S. Energy Information Agency's (EIA) 2020 Annual Energy Outlook Low Oil and Gas Supply Case for 2026-40

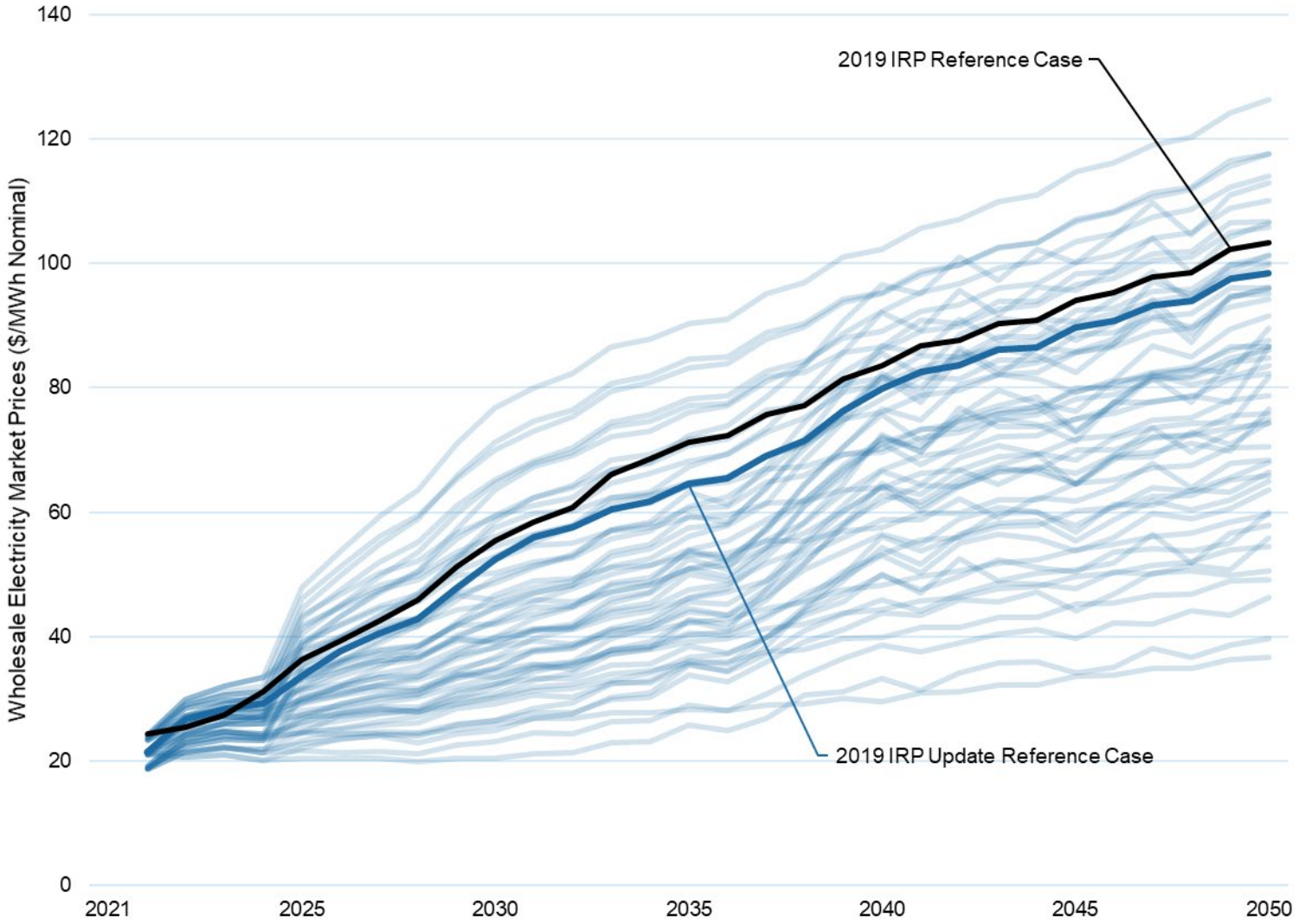


Carbon Price Forecast

- In the 2019 IRP:
  - We assumed OR and WA began with a carbon price in 2021
  - We used three carbon price scenarios: Low, Reference and High from the California Energy Commission (CEC)'s Low, Mid and High forecasts in the 2017 Integrated Energy Policy Report (IEPR)
- In the 2019 IRP Update, two updates were made:
  1. Values were updated to those released in the 2019 IEPR
  2. The start date of assumed carbon pricing in OR and WA is updated from 2021 to 2022



Updated Wholesale Market Electricity Prices



- A wide range of forecasted wholesale electricity prices across the range of price scenarios continue to be observed
- Generally, electricity price forecasts have lowered, driven by the drop in natural gas price forecasts
- Reference Case forecast is lower than 2019 IRP

QUESTIONS/ DISCUSSION?

IRP Upcoming Dates

- Roundtable 20-7: November 18, 2020 9 a.m. – 12 p.m.

- End point for input to the supply side options technology list: November 1, 2020
  - IRP feedback form
  - irp@pgn.com
  - See August 19 roundtable for the supply side option presentation and request for feedback

THANK YOU

Contact us at:

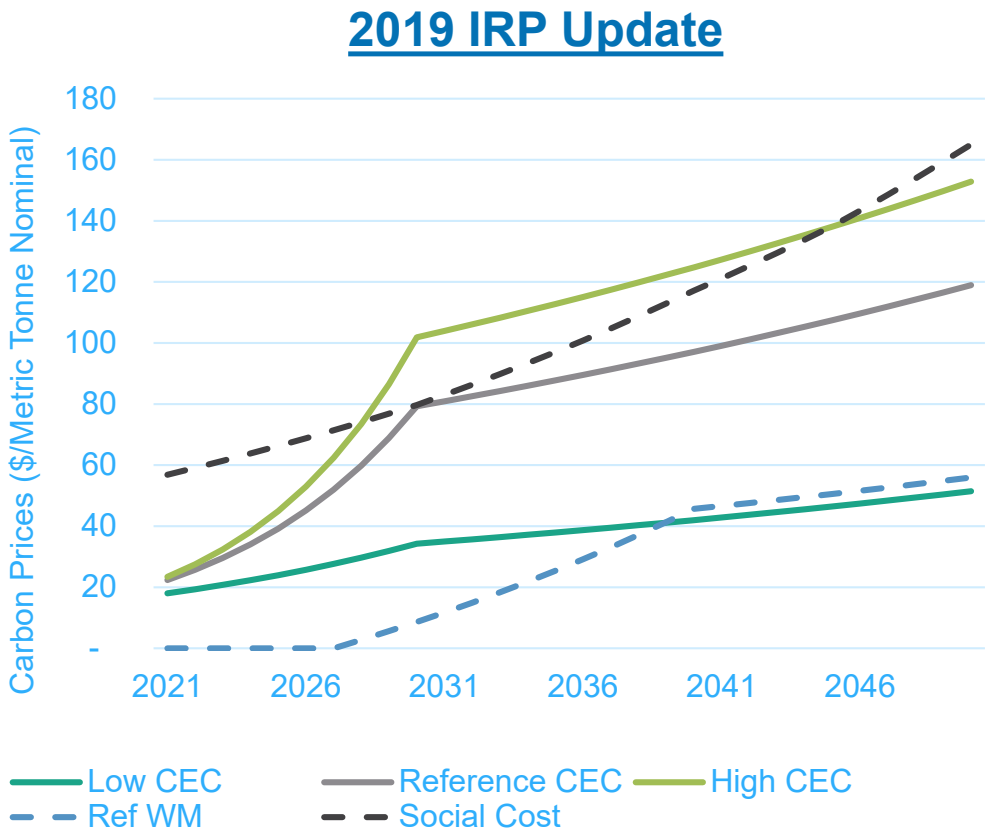
IRP@pgn.com

Attachment A: Acronyms

- CEC: California Energy Commission
- CUB: Citizens' Utility Board
- DER: distributed energy resources
- EE: energy efficiency
- EIA: Energy Information Administration
- ELCC: effective load carrying capability
- EPA: Environmental Protection Agency
- ETO: Energy Trust of Oregon
- GDP: Gross Domestic Product
- IEPR: Integrated Energy Policy Report
- LOLP: loss-of-load probability
- LRB: load resource balance
- MW: megawatt
- MWa: megawatt average
- PNW: Pacific Northwest
- PUD: Public Utility District
- PURPA: Public Utility Regulatory Policies Act 1978
- Q1: first quarter
- QF: qualifying facility
- REC: Renewable Energy Credit
- 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
- RT: Roundtable
- SCC: social cost of carbon
- WM: Wood Mackenzie

Appendix A: 2019 IRP Carbon Price Analysis

- In the 2019 IRP Public Process, we also discussed and looked at the social cost of carbon (SCC) using the Environmental Protection Agency (EPA)'s 3% average long-term discount rate SCC
  - A market price future using Reference renewable build out, Social Cost of Carbon, Reference gas prices, Reference hydro (RSRR) was used as an informational sensitivity for comparison and discussion
  - It was not included in the 54 Market Price Futures



SCC Source: https://www.epa.gov/sites/production/files/2016-12/documents/social_cost_of_carbon_fact_sheet.pdf

Appendix B: LRB Energy Position - DRAFT

- The traditional energy load-resource balance (LRB) provides another view of the energy position. This view excludes resources that were traditionally considered to be peak serving resources and includes energy from resources that were traditionally considered to be base-load resources based on energy availability (adjusted for maintenance and forced outage rates).

									Reference	
	2021	2022	2023	2024	2025	2030	2035	2040	2045	2050
Gas	954	954	954	956	954	954	954	956	954	954
Coal	263	263	263	264	263	263	0	0	0	0
Hydro	529	528	521	528	427	275	261	260	259	259
Wind+Solar	438	537	559	559	558	547	494	360	334	334
Other Contracts	31	31	31	31	31	26	8	0	0	0
EE	41	70	97	124	150	280	400	515	629	742
Total Resources	**2256**	**2383**	**2425**	**2462**	**2383**	**2345**	**2117**	**2092**	**2175**	**2289**
Load	**2177**	**2222**	**2284**	**2346**	**2402**	**2678**	**2958**	**3248**	**3549**	**3853**
Energy deficit/(surplus)	**(79)**	**(161)**	**(141)**	**(116)**	**19**	**334**	**841**	**1157**	**1374**	**1564**