2023 Integrated Resource Plan Public-Input Meeting

October 13, 2022




PACIFICORP
POWERING YOUR GREATNESS

Agenda

(approximate times shown in Pacific time zone)

- 9:00 - 9:15 a.m. – Introductions
- 9:15 - 9:30 a.m. – Updates from prior meeting
  - Supply-side Resource Escalation
  - Coal and Gas Modeling Options
- 9:30 - 9:45 a.m. – Regional Haze Update
- 9:45 - 10:15 a.m. – Load Forecast Update
- 10:15 - 10:30 a.m. – Transmission Upgrade Options
- 10:30 - 11:15 a.m. – Stochastics
- 11:15 - 12:15 p.m. – Lunch Break (45 min)
- 12:15 - 12:45 p.m. – Reliability assessment
- 1:45 - 2:45 p.m. – Portfolio Discussion
- 2:45 - 3:00 p.m. – Stakeholder Feedback Form Update
- 3:00 – 3:15 p.m. – Wrap-Up / Next Steps

Updates from September Public Input Meeting

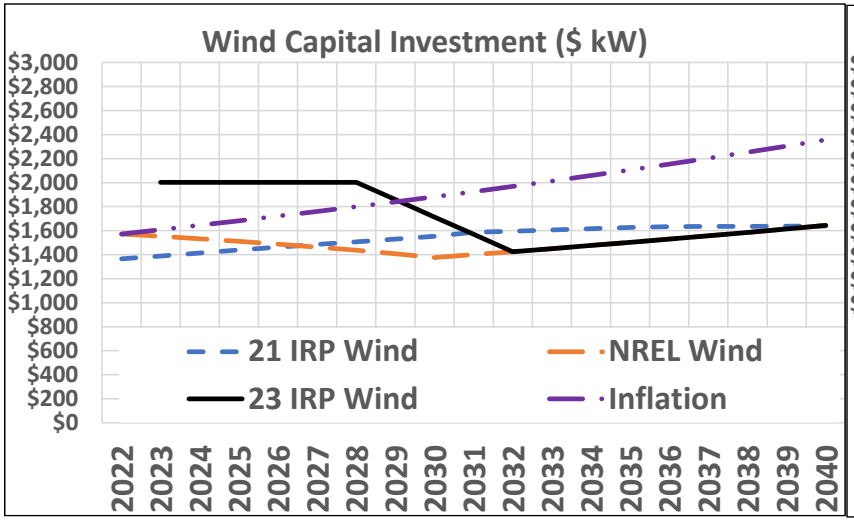


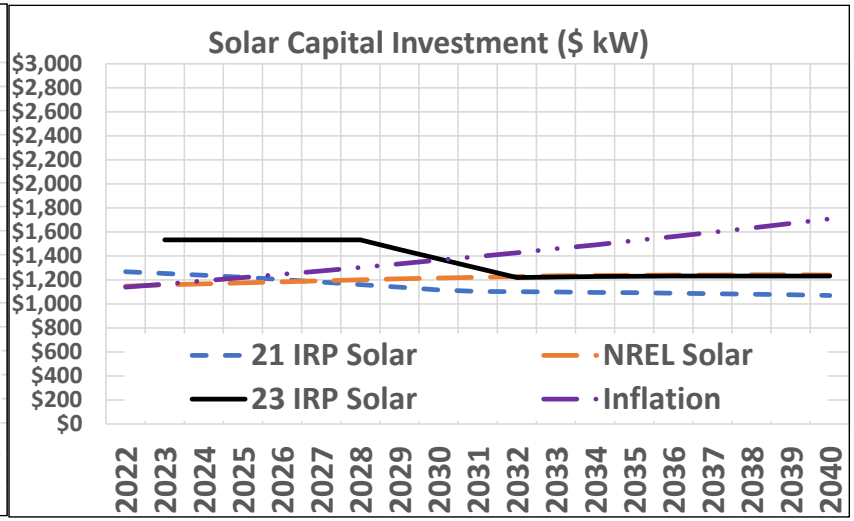

PACIFICORP
POWERING YOUR GREATNESS

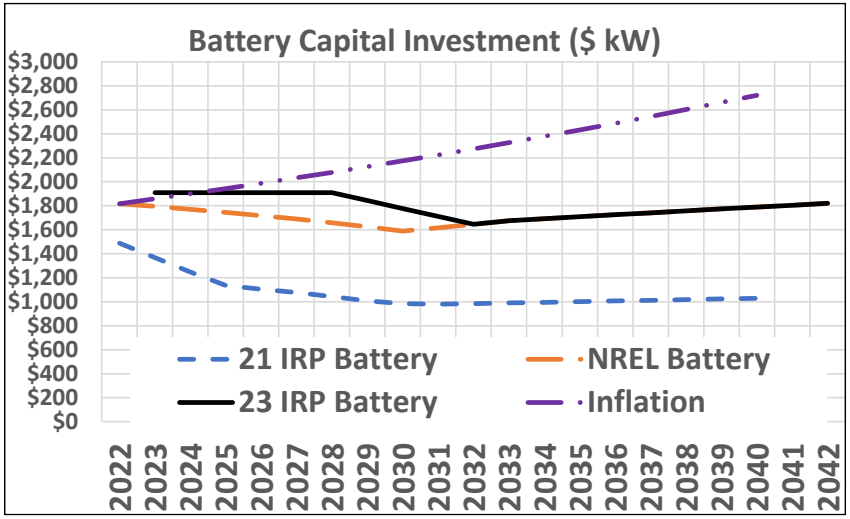
Supply Side Table Escalation

- 2023 IRP Supply Side Table cost assumptions are stated in 2022 dollars and reflect the results from a WSP report.
- WSP also provided future-year costs based on NREL's 2022 Annual Technology Baseline (ATB).
  https://atb.nrel.gov/electricity/2022/data
- Wind, solar, and battery storage equipment are impacted by supply chain issues and worldwide inflation, and tariffs on solar equipment. Demand for this equipment is also high.
- PacifiCorp modified the resource cost forecast for the next few years to be consistent with its recent pricing estimates.
- Pricing remains flat on a nominal basis through 2028 (year-end 2027) and returns to the ATB projection by 2032, as shown on the next slide.
- Resource escalations beyond ten years are from NREL's ATB, converted to nominal values.

Supply Side Table Escalation







Coal & Gas Modeling Options

- Full accounting of options was presented at the September 1-2, 2022 public input meeting:
  - Plexos will determine optimal retirements for existing coal and gas
  - Thermal options total 493 distinct options based on the configurations presented
  - The interactions of all options exceeds 5 trillion possibilities, which will be restricted by the need to meet all system requirements
- Ultimate model performance may require changes to these assumptions
- The Company remains open to feedback regarding the modeling of thermal options

Environmental Policy
Regional Haze Update




PACIFICORP
POWERING YOUR GREATNESS

Regional Haze Overview

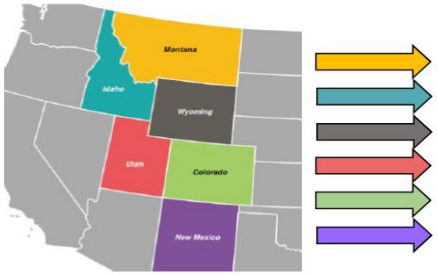
- The Regional Haze Rule was promulgated pursuant to the Clean Air Act; the Rule's focus is regulating the emission of 'haze-causing pollutants' (NOx, SO_2, PM) to achieve visibility improvements at Class I Areas.


- The Rule has decadal phases or 'planning periods', each designed to create gradual and consistent progress towards visibility improvements at Class I Areas, with a goal to achieve "natural" visibility by 2064.

State Implementation Plans

Coordination

Rules



SIP

STATE LAWS

- Rulemaking
- Permits
- Decrees / Orders
- Board Approval
- Governor Approval

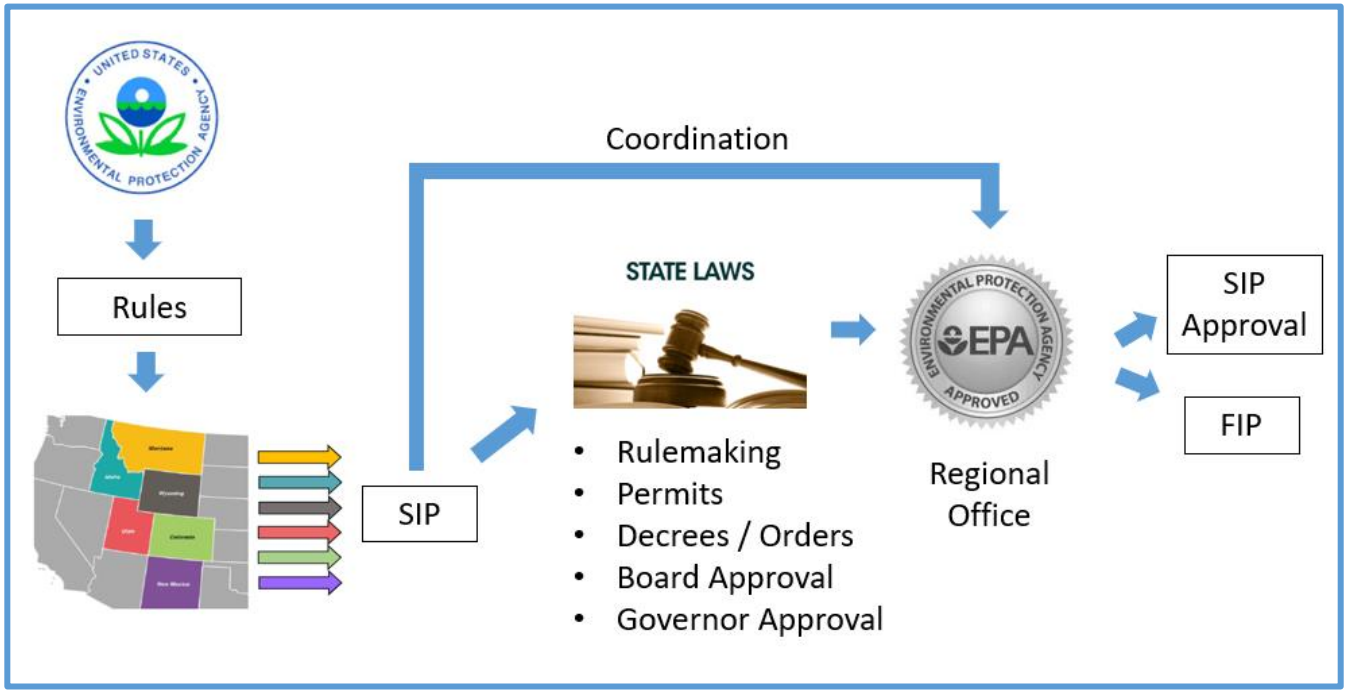
Regional Office

SIP Approval

FIP

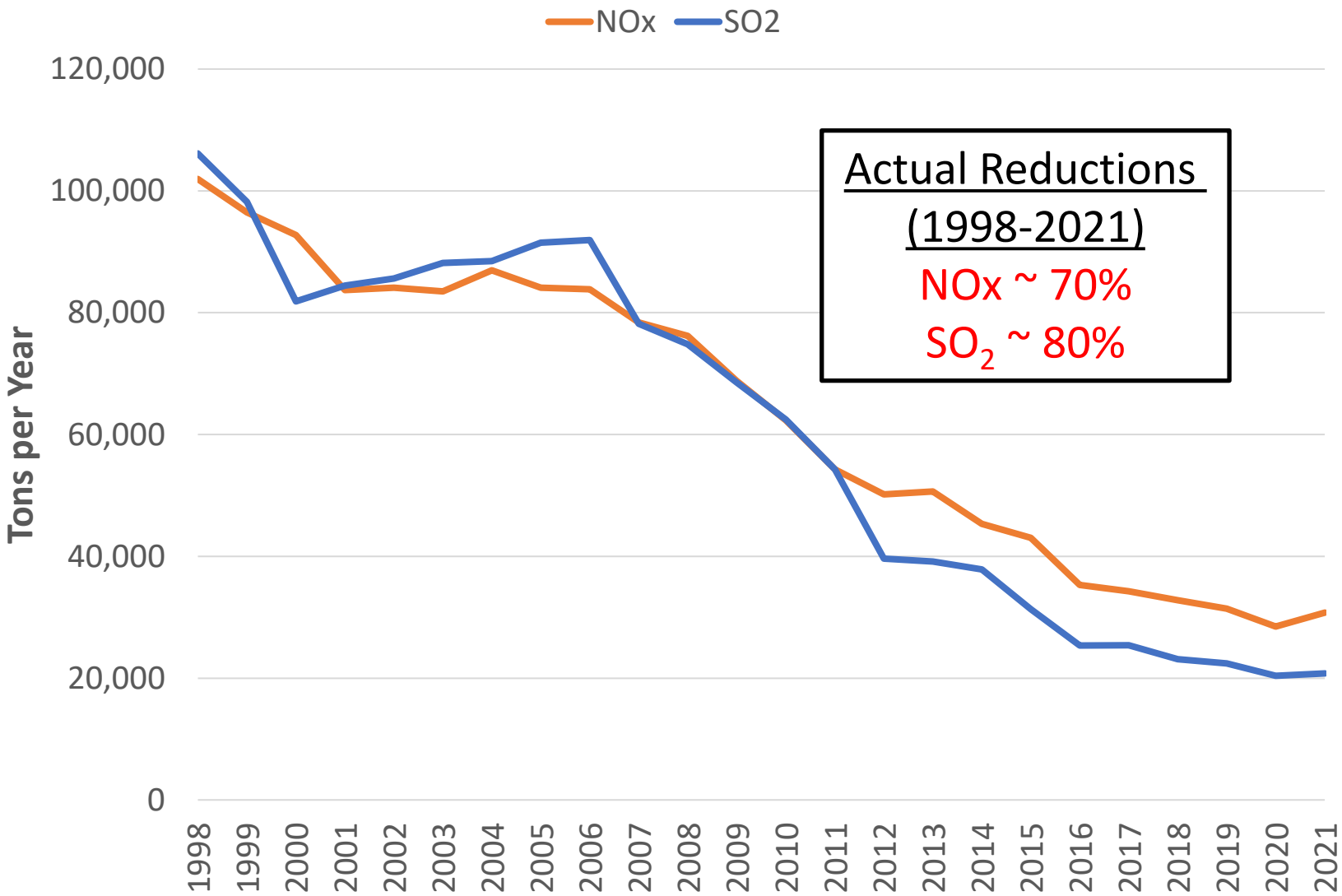
SIP – State Implementation Plan
FIP – Federal Implementation Plan

State Implementation Plans



- Public Comments
- Public Hearings
- Mandatory Consultations
- Stakeholder Outreach
- Agency Collaboration
- Industry Collaboration
- Advocacy Group Input
- Legal Challenges

PacifiCorp Emissions



Utah Regional Haze Compliance

First Planning Period

- EPA published approval of Utah's Regional Haze SIP for the first planning period on November 27, 2020, which made the shutdown of PacifiCorp's Carbon plant enforceable under the SIP and removed the requirement to install SCR on Hunter Units 1 and 2, and Huntington Units 1 and 2.
- HEAL Utah and other conservation groups challenged EPA's approval in the 10th Circuit Court of Appeals in January 2021. Utah and PacifiCorp intervened in the case in support of EPA's approval. The case has been fully briefed, and oral argument is expected to be scheduled fall of 2022 or winter of 2023.

Utah Regional Haze Compliance

Second Planning Period

- PacifiCorp submitted a Regional Haze Reasonable Progress Analysis to the Utah Department of Environmental Quality (UDAQ) in 2020 for PacifiCorp's Huntington and Hunter plants for the regional haze second planning period.
- UDAQ did not adopt PacifiCorp's proposed Reasonable Progress plan and instead presented a SIP to the Utah Air Quality Board in April 2022 that focused on a three-tier NOx emission reductions strategy at the Hunter and Huntington plants.
- On June 6, 2022, the Utah Air Quality Board voted to approve Utah's Regional Haze SIP for second planning period, which, ultimately includes updated 12-month rolling mass-based nitrogen oxide limits for the Hunter and Huntington plants as well as a sulfur dioxide rate-based limit.
- Utah submitted a corresponding state SIP to EPA for review in August 2022. The agency has 18 months to approve or disapprove all or part of the state's plan.

Wyoming Regional Haze Compliance

First Planning Period

- January 2014 – EPA issued a Regional Haze FIP partially approving certain parts of the state of Wyoming's SIP. EPA approved the following SIP requirements:
  - Jim Bridger Units 3&4: Install(ed) SCR in 2015, and 2016, respectively
  - Jim Bridger Units 1&2: Install SCR by 2022 and 2021, respectively
  - Naughton Unit 3: Remove from coal-fueled service in January 2019, with option to convert to gas (converted to gas in 2019)
  - Naughton Units 1&2: Install(ed) LNB and OFA (0.26 lb/MMBtu NOx rate)
  - Dave Johnston Unit 4: Install(ed) LNB and OFA (0.15 lb/MMBtu NOx rate)
  - Dave Johnston Unit 1&2: No new control requirements
  - Dave Johnston Unit 3: EPA offered two alternative compliance paths in the FIP – (1) install LNBs and OFA and shut-down by 2027 or (2) install LNB and OFA and SCR. (PacifiCorp elected option 1)
  - Wyodak Unit 1: Install SCR within five years of the final rule (challenged by PacifiCorp)

Wyoming Regional Haze Compliance

First Planning Period – Jim Bridger

- PacifiCorp submitted a "Reasonable Progress Reassessment" application with seasonally-variable plant-wide emission limits instead of the requirement to install SCR on Bridger Units 1 and 2 in February of 2019.
- On May 5, 2020, Wyoming issued permit P0025809, which approved PacifiCorp's proposed monthly and annual NOx and SO_2 emission limits included in the Reassessment application and removed the SCR requirements from Units 1 and 2 (limits effective January 1, 2022).
- Wyoming submitted a "Reassessment" SIP Revision to EPA on May 14, 2020, for review and approval. EPA notified Wyoming in November of 2020 that it had signed approval of the Reassessment SIP. However, EPA's approval was never finalized through publication in the Federal Register due to the change in presidential administrations.
- In December 2021, the Wyoming Governor issued a temporary emergency suspension of the SIP requirement to install SCR on Bridger Unit 2 based on EPA's failure to act on the Reassessment SIP. One month later, EPA proposed to disapprove the Reassessment SIP.
- With no final EPA action on the Reassessment SIP, Wyoming and PacifiCorp reached a settlement agreement, which was implemented through a consent decree (the "Consent Decree") in February 2022, requiring the units to cease coal operation by January 1, 2024, and subsequently be converted to natural gas operation with stringent NOx emission limits.
- In June 2022, EPA issued an administrative compliance order on consent with similar requirements to the Consent Decree.

Wyoming Regional Haze Compliance

First Planning Period – Wyodak

- EPA issued a regional haze FIP in 2014 that required Wyodak to install SCR within five years of the final rule. The FIP requirement was challenged by PacifiCorp in the 10th Circuit Court of Appeals and was consolidated with multiple appeals on EPA's 2014 Wyoming SIP decisions.
- PacifiCorp, Wyoming and Basin Electric submitted motions requesting the court to hold all the consolidated appeals of challenged portions of the Wyoming Regional Haze SIP/FIP in abeyance while settlement negotiations were pursued.
- In 2017, the 10th Circuit Court of Appeals granted the motion to hold the entire case in abeyance pending settlement.
- EPA, Wyoming, PacifiCorp and conservation groups were unable to reach a final settlement. In September 2022, the Court lifted the abatement, allowing litigation to move forward. Opening briefs are due October 28, 2022. The stay of EPA's FIP requirements for Wyodak remains in place.

Wyoming Regional Haze Compliance

Second Planning Period – Wyoming

- In 2020, PacifiCorp submitted a four-factor reasonable progress analysis to the Wyoming Department of Environmental Quality which analyzed second planning period requirements for PacifiCorp's Naughton, Jim Bridger, Dave Johnston, and Wyodak plants.
- Wyoming's Department of Environmental Quality submitted the state's regional haze second planning period SIP to EPA in August 2022, which meets requirements through existing control measures for PacifiCorp units in Wyoming and does not require additional emission controls. The agency has up to 18 months to approve or disapprove all or parts of the state's plan.

Load Forecast Update

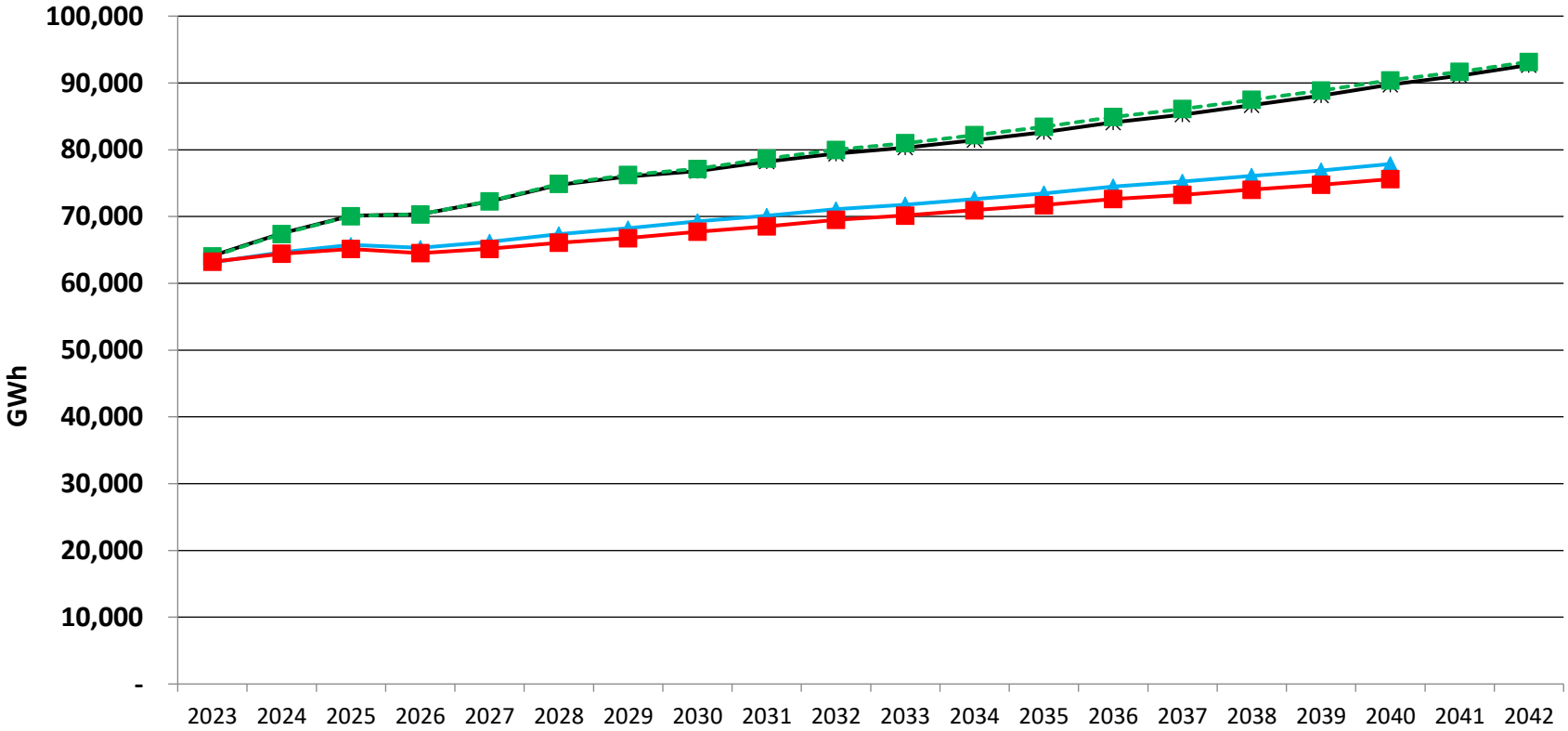



PACIFICORP
POWERING YOUR GREATNESS

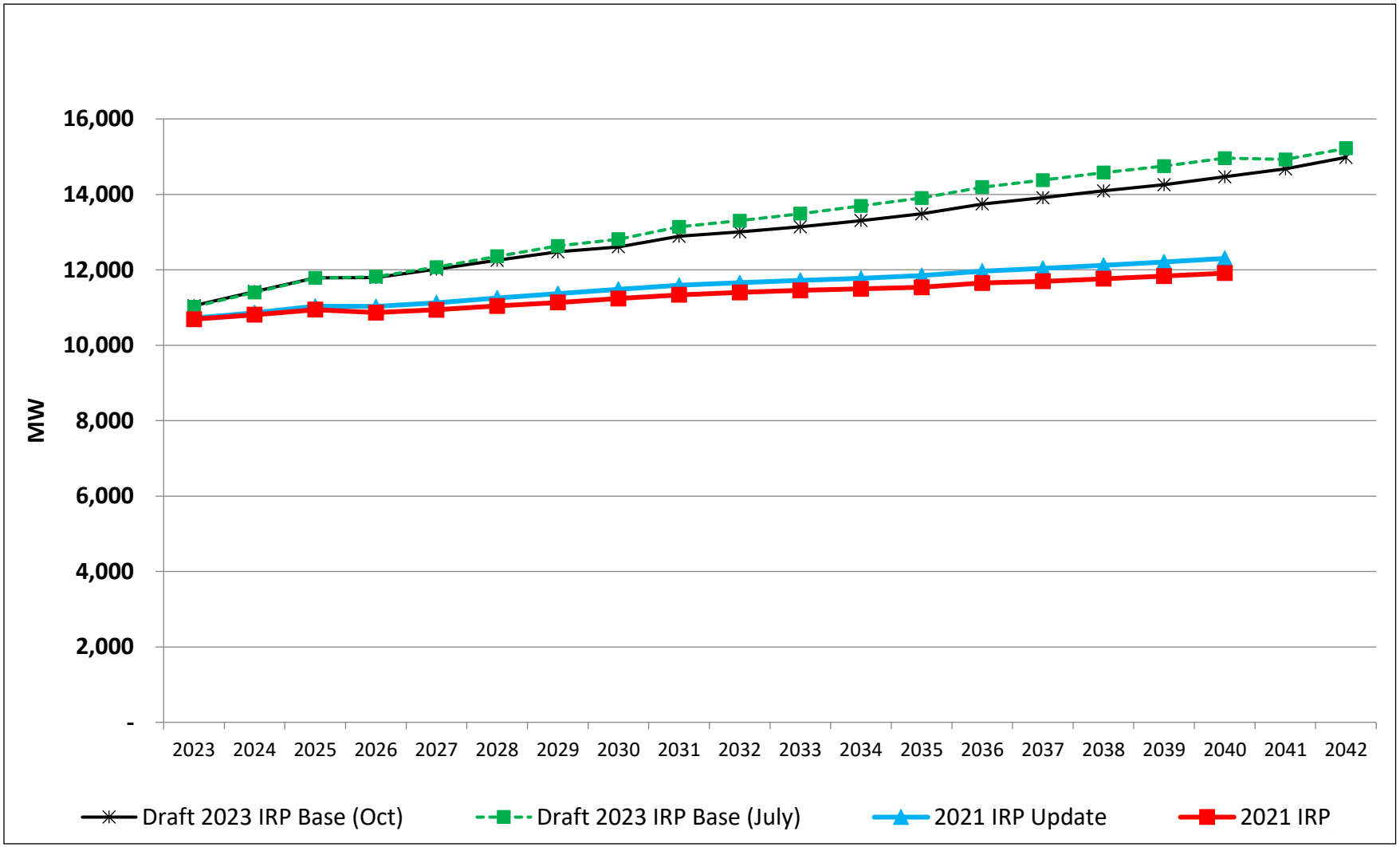
Load Forecast Progress since July PIM

- Incorporated impacts from the Inflation Reduction Act (IRA) within the base 2023 IRP forecast
  - Results in higher than previously contemplated electric vehicle adoption
  - Results in higher than previously contemplated private generation adoption
- Produced load forecast sensitivities
  - High Private Generation: Incorporates more optimistic private generation adoption assumptions than used in the base forecast
  - Low Private Generation: Incorporates less optimistic private generation adoption assumptions than used in the base forecast
  - 1-in-20: Incorporates the highest peak producing weather observed over the past 20-years into forecast
  - Optimistic: Accounts for four factors – 1) stronger than expected economic activity, 2) the upper bound of model error, 3) climate change temperatures that are higher than base forecast climate change assumptions and 4) low private generation adoption assumptions
  - Pessimistic: Accounts for four factors – 1) weaker than expected economic activity, 2) the lower bound of model error, 3) climate change temperatures that are lower than base forecast climate change assumptions and 4) high private generation adoption assumptions

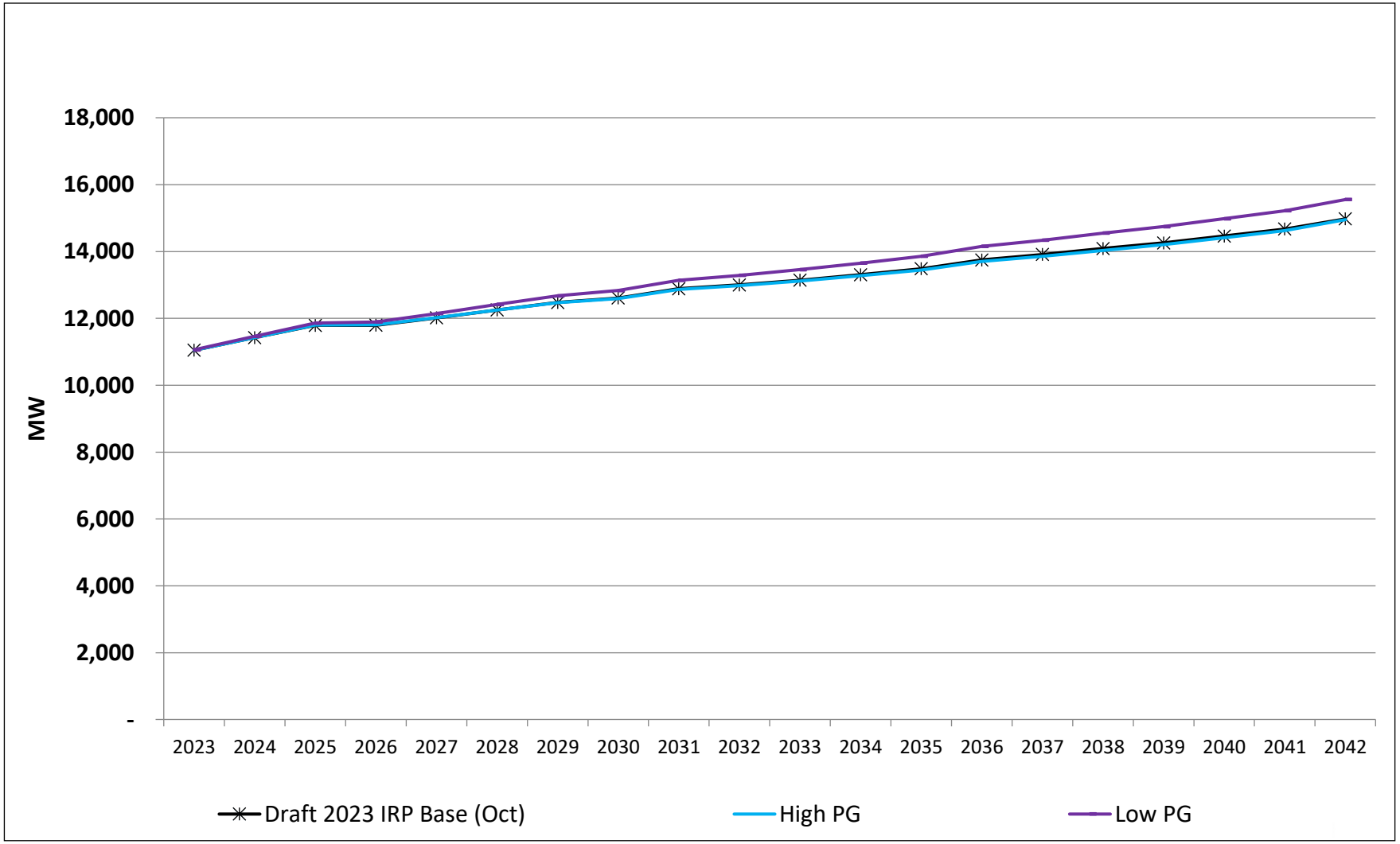
System Energy Load Forecast



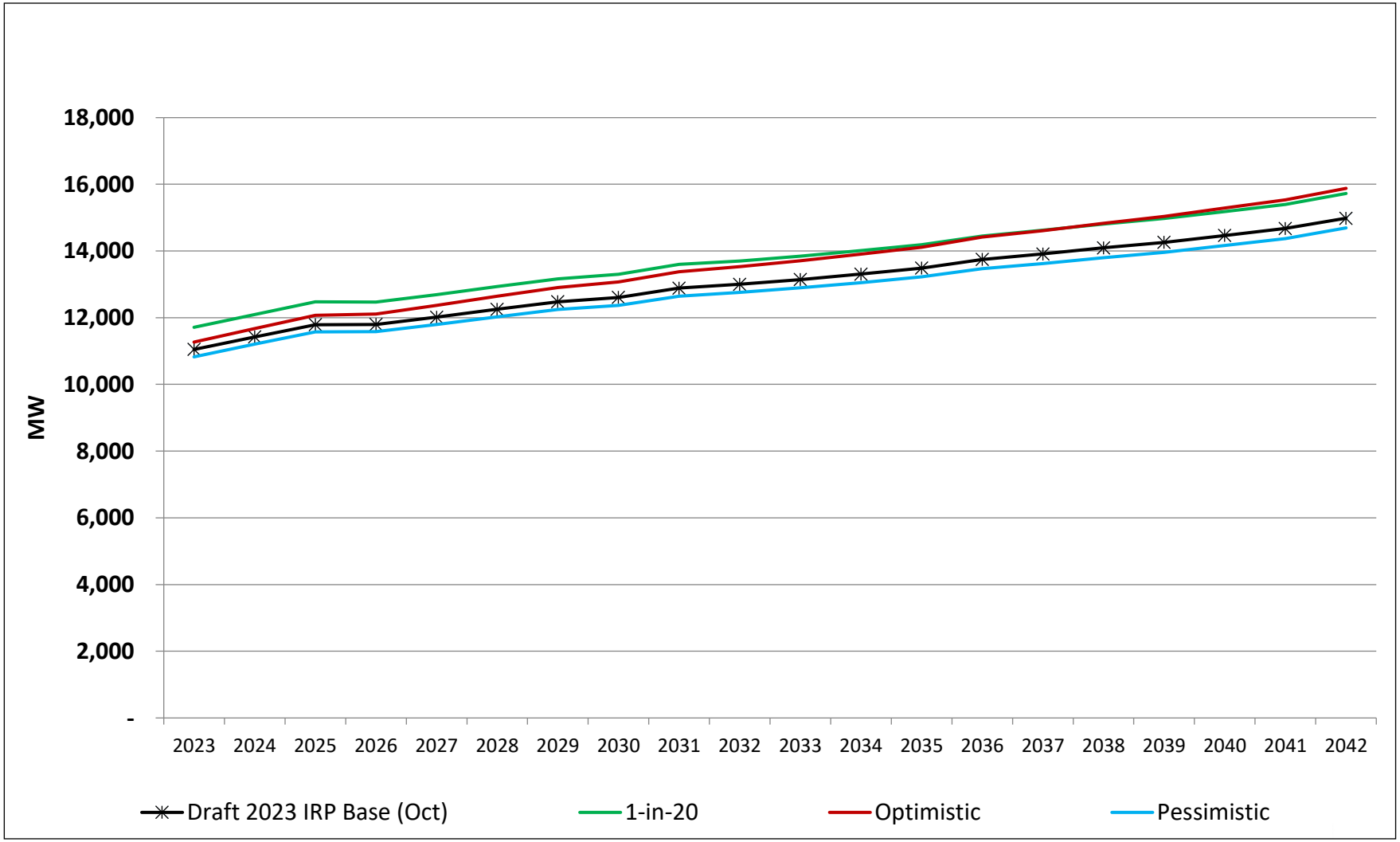
System Peak Load Forecast



Private Generation Load Forecast Sensitivities



Additional Load Forecast Sensitivities



Transmission Upgrade Options

PACIFICORP
POWERING YOUR GREATNESS

Transmission Upgrade Options

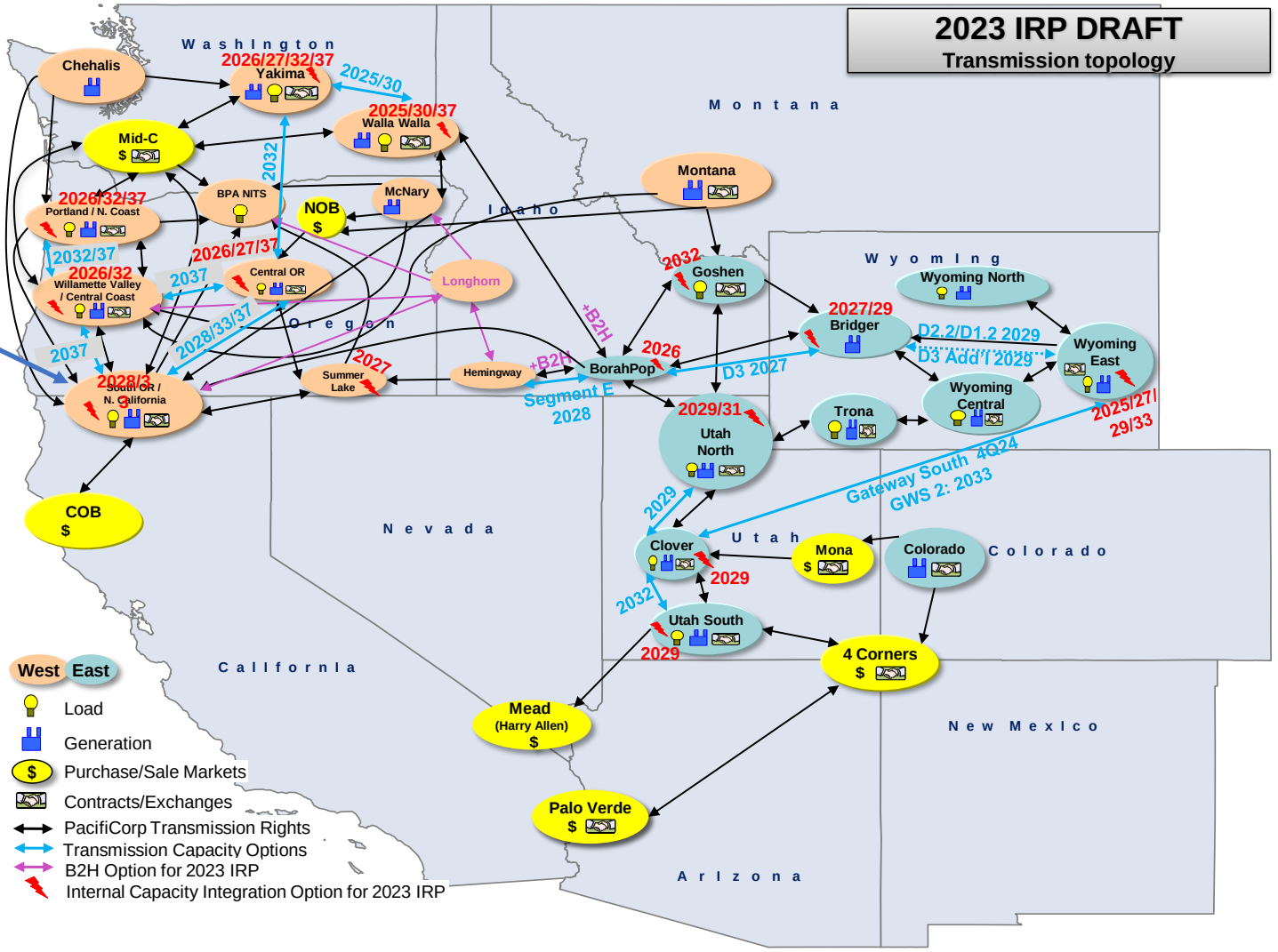
- IRP modeling reflects transmission associated with pending interconnection requests and future options.
- Both types can include transfer capability between bubbles (blue on next slide) and/or incremental interconnection capability within a bubble (shown in red).
- Pending requests:
  - Resources are restricted to sizing and technology in request. Includes serial queue, Transition Cluster, and Cluster 1.
  - Will be updated to include Cluster 2 when results are posted in November, which may capture some future options.
- Future options:
  - Additional transmission options through the end of the horizon.
  - Not associated with specific requests: no technology restrictions, and allows for hybrid (e.g. wind/solar/storage) resources, subject to hourly maximum generation constraint.

2023 IRP Transmission Options

Multiple dates indicate multiple upgrade options in an area.

The first available date for each upgrade or set of upgrades is shown.

Generally, upgrades must be completed in succession.



Stochastics




PACIFICORP
POWERING YOUR GREATNESS

Overview of Stochastic Parameters

- Stochastic parameters are used to generate stochastic processes on key long term planning variables such as load, fuels, etc., which evolve to create a spread of possible outcomes over a statistical distribution.

- Plexos modeling simulates mean reverting stochastic processes. It uses mean reversion, volatilities, and correlations across the key decision variables as input parameters. Under a mean reversion process, the distribution of possible outcomes would reach a steady state as time to delivery increases.

- Short term (ST) parameters were updated using historical PacifiCorp data:
  - Load: 1/1/2018 thru 12/31/2021 (4 years)
  - Hydro: 1/1/2017 thru 12/31/2021 (5 years)
  - Gas Prices: 1/1/2018 thru 12/31/2021 (4 years)
  - Power Prices: 1/1/2018 thru 12/31/2021 (4 years)

Short-Term Volatility Comparison
(2023 IRP vs 2021 IRP)

- Volatility is a measure of variation in time-series data that is observed over time.
- Positive change indicates increase in volatility vs 2021 IRP; negative change indicates decrease in volatility vs 2021 IRP.

2023 IRP S.T Volatility estimates

	CA	ID	Portland	OR Other	UT	WA	WY
Winter	4.58%	3.81%	4.06%	4.36%	2.41%	5.03%	2.08%
Spring	4.15%	6.44%	3.54%	3.63%	3.47%	4.20%	2.08%
Summer	4.19%	6.11%	5.95%	4.55%	5.41%	5.37%	2.12%
Fall	4.64%	4.68%	3.59%	4.20%	3.49%	4.42%	2.01%

	4C	COB	Mid-C	PV
Winter	19.42%	19.10%	22.31%	17.44%
Spring	19.26%	23.80%	56.40%	16.45%
Summer	31.11%	94.62%	39.16%	28.82%
Fall	21.46%	18.88%	18.97%	20.58%

	East Gas	West Gas
Winter	27.16%	23.66%
Spring	13.44%	22.44%
Summer	13.47%	14.77%
Fall	15.28%	74.31%

	Hydro
Winter	25.68%
Spring	20.11%
Summer	19.48%
Fall	27.59%

Change in S.T Volatility estimates from 2021 IRP to 2023 IRP

	CA	ID	Portland	OR Other	UT	WA	WY
Winter	-0.29%	-0.02%	-0.05%	-0.16%	0.11%	-0.21%	0.46%
Spring	-0.41%	-0.20%	-0.24%	-0.13%	0.45%	0.32%	0.25%
Summer	0.05%	0.40%	0.08%	0.27%	0.34%	0.06%	0.37%
Fall	-0.02%	0.13%	-0.11%	0.07%	0.16%	0.22%	0.24%

	4C	COB	Mid-C	PV
Winter	6.21%	2.79%	2.50%	5.33%
Spring	2.07%	-4.98%	-6.63%	2.64%
Summer	9.11%	60.68%	13.19%	8.65%
Fall	4.05%	1.56%	2.97%	5.56%

	East Gas	West Gas
Winter	15.68%	7.01%
Spring	4.39%	2.14%
Summer	3.56%	1.71%
Fall	5.21%	57.17%

	Hydro
Winter	-1.72%
Spring	1.20%
Summer	-1.48%
Fall	-2.22%

Short-Term Mean Reversion Comparison

(2023 IRP vs 2021 IRP)

- Mean reversion represents the speed at which a disrupted variable will return to its mean.
- Positive change indicates increase in speed vs 2021 IRP; negative change indicates decrease in speed vs 2021 IRP.

2023 IRP S.T Mean Reversion estimates

	CA	ID	Portland	OR Other	UT	WA	WY
Winter	0.2576	0.2634	0.2524	0.2614	0.3796	0.1713	0.2786
Spring	0.1534	0.1457	0.2287	0.2416	0.3321	0.1644	0.1094
Summer	0.1847	0.1432	0.1830	0.1678	0.2652	0.1735	0.1904
Fall	0.2223	0.1278	0.3654	0.2530	0.2338	0.2132	0.2243

	4C	COB	Mid-C	PV
Winter	0.1028	0.1012	0.1011	0.1021
Spring	0.2164	0.2132	0.4767	0.1994
Summer	0.2131	1.0139	0.3004	0.1491
Fall	0.2380	0.2972	0.2940	0.2301

	East Gas	West Gas
Winter	0.1292	0.0744
Spring	0.3039	0.1551
Summer	0.5245	0.4055
Fall	0.2441	0.5703

	Hydro
Winter	0.6774
Spring	0.7656
Summer	1.7956
Fall	0.3588

Change in S.T Mean Reversion estimates from 2021 IRP to 2023 IRP

	CA	ID	Portland	OR Other	UT	WA	WY
Winter	0.0411	0.0864	0.0878	0.1114	0.0989	0.0239	0.0529
Spring	-0.0426	-0.1127	-0.0128	0.0262	-0.1871	0.0078	-0.1626
Summer	-0.0620	-0.0050	-0.0817	-0.0266	-0.0419	-0.0388	-0.0432
Fall	-0.0172	-0.0700	0.0885	-0.0406	0.0317	-0.0212	-0.0167

	4C	COB	Mid-C	PV
Winter	0.0142	0.0310	0.0113	0.0161
Spring	0.0361	-0.0445	0.0153	0.0488
Summer	-0.0988	0.6187	0.1044	0.0029
Fall	0.0407	0.1189	0.1744	0.0675

	East Gas	West Gas
Winter	0.0679	0.0435
Spring	0.1434	0.0155
Summer	0.0213	0.1183
Fall	0.1980	0.5480

	Hydro
Winter	-0.0445
Spring	0.3330
Summer	0.6467
Fall	-0.0095

2023 IRP Short-Term Correlations

- Correlation represents a meaningful measure of strength and direction of a linear relationship between two variables.
- Plexos shocks (index mechanisms) are purely dedicated to deviations from the expected, i.e. the random portion of the key variables. Correlations are calculated from residual errors on the random portion (or deviations).
- Typically, variables may exhibit high correlations on deterministic or expected shapes of the variables. For example, hydro dispatch is shaped to load net renewables, or price formation is shaped by demand.
- However, the uncertainty portion of the key variables are lowly correlated. For example, deviations in hydro generation are dependent weather patterns (La Nina-El Nino) or deviations in renewable generation vs. deviations in the load being driven by different temperature abnormalities.

Short-Term Correlations – Winter

	K-O	SUMAS	4C	COB	Mid-C	PV	CA	ID	Portland	OR Other	UT	WA	WY	Hydro
K-O	100.00%	68.76%	39.91%	29.52%	33.70%	45.07%	0.87%	-5.40%	9.88%	1.41%	2.16%	4.61%	-1.46%	-11.63%
SUMAS	68.76%	100.00%	20.33%	26.23%	29.23%	24.42%	6.55%	5.53%	10.79%	6.28%	0.51%	12.86%	3.03%	-15.70%
4C	39.91%	20.33%	100.00%	57.70%	52.25%	88.61%	12.68%	2.06%	8.49%	14.69%	19.54%	17.32%	9.26%	1.50%
COB	29.52%	26.23%	57.70%	100.00%	72.47%	57.46%	17.85%	1.11%	9.02%	22.13%	12.22%	27.54%	8.09%	-1.93%
Mid-C	33.70%	29.23%	52.25%	72.47%	100.00%	55.85%	14.08%	-0.09%	19.43%	26.14%	12.08%	30.53%	4.54%	-3.41%
PV	45.07%	24.42%	88.61%	57.46%	55.85%	100.00%	7.99%	-1.08%	3.98%	8.76%	13.67%	13.40%	7.40%	-3.30%
CA	0.87%	6.55%	12.68%	17.85%	14.08%	7.99%	100.00%	16.36%	45.52%	78.03%	28.16%	44.99%	16.75%	10.23%
ID	-5.40%	5.53%	2.06%	1.11%	-0.09%	-1.08%	16.36%	100.00%	23.62%	26.23%	35.19%	28.05%	23.31%	9.15%
Portland	9.88%	10.79%	8.49%	9.02%	19.43%	3.98%	45.52%	23.62%	100.00%	68.91%	40.44%	64.23%	31.58%	9.99%
OR Other	1.41%	6.28%	14.69%	22.13%	26.14%	8.76%	78.03%	26.23%	68.91%	100.00%	39.54%	66.81%	24.66%	16.47%
UT	2.16%	0.51%	19.54%	12.22%	12.08%	13.67%	28.16%	35.19%	40.44%	39.54%	100.00%	33.40%	50.34%	4.29%
WA	4.61%	12.86%	17.32%	27.54%	30.53%	13.40%	44.99%	28.05%	64.23%	66.81%	33.40%	100.00%	28.07%	15.23%
WY	-1.46%	3.03%	9.26%	8.09%	4.54%	7.40%	16.75%	23.31%	31.58%	24.66%	50.34%	28.07%	100.00%	-0.11%
Hydro	-11.63%	-15.70%	1.50%	-1.93%	-3.41%	-3.30%	10.23%	9.15%	9.99%	16.47%	4.29%	15.23%	-0.11%	100.00%

Gas to Gas	Gas to Electric	Electric to Load
Electric to Electric	Gas to Load	Electric to Hydro
Load to Load	Gas to Hydro	Load to Hydro
Hydro to Hydro		

- Deviation events which impact one part of PacifiCorp's system do not necessarily affect other parts of the system, due to its geographic diversity and transmission constraints.
- The correlation between these different deviations can be low if the deviations are caused by different drivers.

Short-Term Correlations – Spring

	K-O	SUMAS	4C	COB	Mid-C	PV	CA	ID	Portland	OR Other	UT	WA	WY	Hydro
K-O	100.00%	61.76%	15.69%	13.43%	13.88%	13.27%	5.46%	19.13%	7.76%	13.51%	13.13%	10.28%	9.44%	2.94%
SUMAS	61.76%	100.00%	15.01%	18.88%	14.34%	8.40%	-3.14%	16.59%	10.15%	9.63%	16.74%	16.35%	9.62%	-5.18%
4C	15.69%	15.01%	100.00%	38.42%	40.60%	71.84%	18.33%	10.06%	26.25%	26.61%	20.27%	21.62%	4.77%	4.79%
COB	13.43%	18.88%	38.42%	100.00%	58.37%	28.23%	17.94%	1.03%	21.55%	25.56%	11.49%	28.48%	6.33%	12.39%
Mid-C	13.88%	14.34%	40.60%	58.37%	100.00%	27.50%	19.04%	0.10%	20.26%	20.94%	3.43%	28.75%	2.72%	7.11%
PV	13.27%	8.40%	71.84%	28.23%	27.50%	100.00%	15.74%	6.82%	22.44%	18.47%	15.43%	13.98%	9.17%	0.52%
CA	5.46%	-3.14%	18.33%	17.94%	19.04%	15.74%	100.00%	9.77%	43.32%	65.73%	16.96%	42.29%	13.66%	-3.69%
ID	19.13%	16.59%	10.06%	1.03%	0.10%	6.82%	9.77%	100.00%	-3.90%	6.17%	50.08%	10.54%	14.16%	3.17%
Portland	7.76%	10.15%	26.25%	21.55%	20.26%	22.44%	43.32%	-3.90%	100.00%	69.89%	13.00%	57.34%	24.03%	-10.65%
OR Other	13.51%	9.63%	26.61%	25.56%	20.94%	18.47%	65.73%	6.17%	69.89%	100.00%	19.35%	64.59%	28.71%	-3.15%
UT	13.13%	16.74%	20.27%	11.49%	3.43%	15.43%	16.96%	50.08%	13.00%	19.35%	100.00%	22.19%	26.51%	-14.11%
WA	10.28%	16.35%	21.62%	28.48%	28.75%	13.98%	42.29%	10.54%	57.34%	64.59%	22.19%	100.00%	14.58%	-1.58%
WY	9.44%	9.62%	4.77%	6.33%	2.72%	9.17%	13.66%	14.16%	24.03%	28.71%	26.51%	14.58%	100.00%	-16.61%
Hydro	2.94%	-5.18%	4.79%	12.39%	7.11%	0.52%	-3.69%	3.17%	-10.65%	-3.15%	-14.11%	-1.58%	-16.61%	100.00%

Gas to Gas	Gas to Electric	Electric to Load
Electric to Electric	Gas to Load	Electric to Hydro
Load to Load	Gas to Hydro	Load to Hydro
Hydro to Hydro		

- Deviation events which impact one part of PacifiCorp's system do not necessarily affect other parts of the system, due to its geographic diversity and transmission constraints.
- The correlation between these different deviations can be low if the deviations are caused by different drivers.

Short-Term Correlations – Summer

	K-O	SUMAS	4C	COB	Mid-C	PV	CA	ID	Portland	OR Other	UT	WA	WY	Hydro
K-O	100%	81%	13%	11%	23%	13%	1%	-4%	8%	4%	-2%	11%	-5%	-1%
SUMAS	81%	100%	11%	6%	21%	7%	1%	-1%	8%	3%	-1%	8%	-4%	1%
4C	13%	11%	100%	22%	40%	78%	19%	6%	26%	22%	26%	21%	10%	-3%
COB	11%	6%	22%	100%	61%	29%	14%	4%	20%	20%	20%	27%	5%	-4%
Mid-C	23%	21%	40%	61%	100%	47%	18%	-2%	39%	34%	5%	30%	0%	-3%
PV	13%	7%	78%	29%	47%	100%	21%	10%	28%	25%	26%	26%	13%	-1%
CA	1%	1%	19%	14%	18%	21%	100%	39%	44%	73%	30%	60%	9%	-9%
ID	-4%	-1%	6%	4%	-2%	10%	39%	100%	6%	19%	49%	17%	31%	0%
Portland	8%	8%	26%	20%	39%	28%	44%	6%	100%	77%	13%	62%	-4%	-1%
OR Other	4%	3%	22%	20%	34%	25%	73%	19%	77%	100%	18%	82%	3%	-2%
UT	-2%	-1%	26%	20%	5%	26%	30%	49%	13%	18%	100%	18%	43%	-5%
WA	11%	8%	21%	27%	30%	26%	60%	17%	62%	82%	18%	100%	5%	-6%
WY	-5%	-4%	10%	5%	0%	13%	9%	31%	-4%	3%	43%	5%	100%	-4%
Hydro	-1%	1%	-3%	-4%	-3%	-1%	-9%	0%	-1%	-2%	-5%	-6%	-4%	100%

Gas to Gas	Gas to Electric	Electric to Load
Electric to Electric	Gas to Load	Electric to Hydro
Load to Load	Gas to Hydro	Load to Hydro
Hydro to Hydro		

- Deviation events which impact one part of PacifiCorp's system do not necessarily affect other parts of the system, due to its geographic diversity and transmission constraints.
- The correlation between these different deviations can be low if the deviations are caused by different drivers.

Short-Term Correlations – Fall

	K-O	SUMAS	4C	COB	Mid-C	PV	CA	ID	Portland	OR Other	UT	WA	WY	Hydro
K-O	100%	20%	5%	13%	12%	3%	19%	-16%	9%	17%	-3%	9%	9%	1%
SUMAS	20%	100%	-1%	-9%	-3%	3%	5%	-3%	4%	5%	-3%	1%	6%	7%
4C	5%	-1%	100%	30%	26%	77%	13%	-3%	1%	8%	24%	10%	-7%	-15%
COB	13%	-9%	30%	100%	71%	37%	25%	-1%	28%	26%	13%	27%	11%	-19%
Mid-C	12%	-3%	26%	71%	100%	34%	23%	-3%	38%	34%	13%	32%	11%	-10%
PV	3%	3%	77%	37%	34%	100%	14%	-1%	2%	7%	17%	6%	-6%	-14%
CA	19%	5%	13%	25%	23%	14%	100%	27%	55%	80%	36%	60%	19%	8%
ID	-16%	-3%	-3%	-1%	-3%	-1%	27%	100%	26%	22%	43%	28%	22%	8%
Portland	9%	4%	1%	28%	38%	2%	55%	26%	100%	78%	37%	69%	33%	-1%
OR Other	17%	5%	8%	26%	34%	7%	80%	22%	78%	100%	41%	77%	32%	6%
UT	-3%	-3%	24%	13%	13%	17%	36%	43%	37%	41%	100%	43%	35%	1%
WA	9%	1%	10%	27%	32%	6%	60%	28%	69%	77%	43%	100%	34%	8%
WY	9%	6%	-7%	11%	11%	-6%	19%	22%	33%	32%	35%	34%	100%	3%
Hydro	1%	7%	-15%	-19%	-10%	-14%	8%	8%	-1%	6%	1%	8%	3%	100%

Gas to Gas	Gas to Electric	Electric to Load
Electric to Electric	Gas to Load	Electric to Hydro
Load to Load	Gas to Hydro	Load to Hydro
Hydro to Hydro		

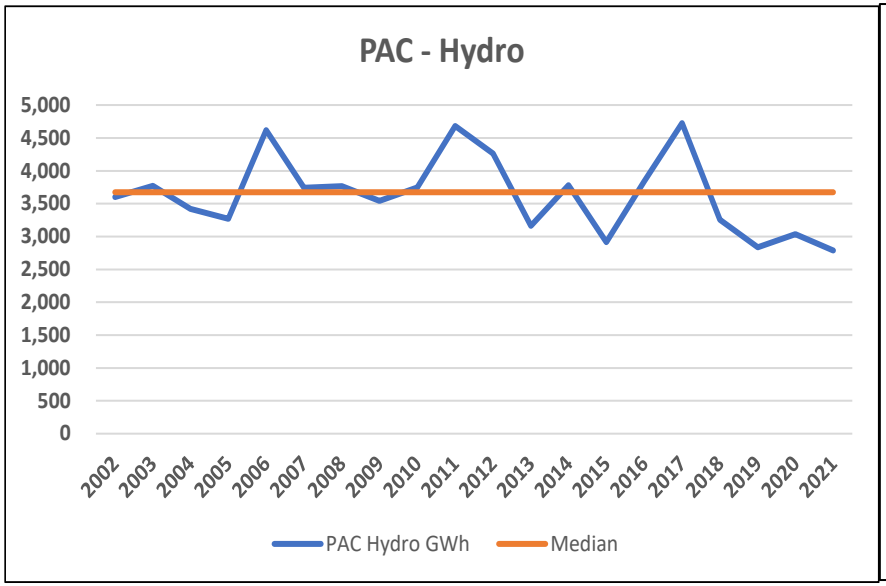
- Deviation events which impact one part of PacifiCorp's system do not necessarily affect other parts of the system, due to its geographic diversity and transmission constraints.
- The correlation between these different deviations can be low if the deviations are caused by different drivers.

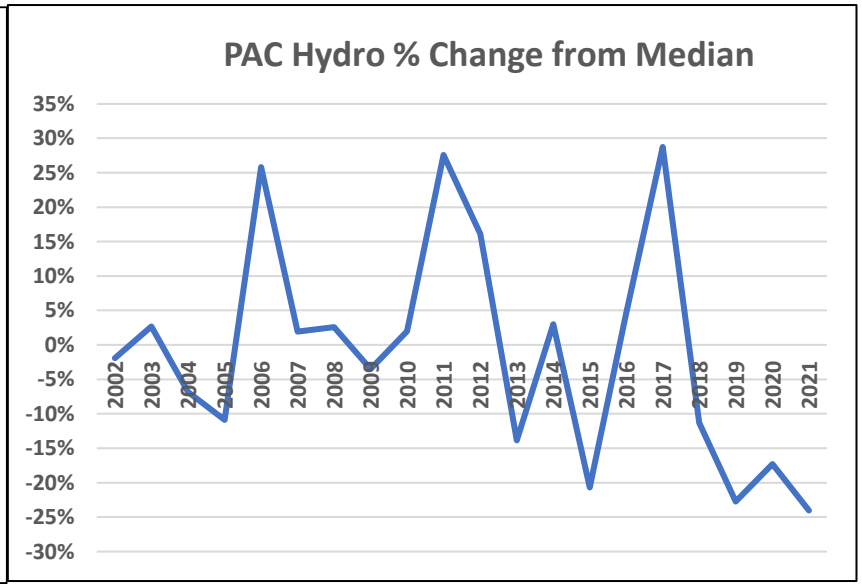
Annual Volatility and Correlation

- The short-term stochastic parameters previously discussed capture day-to-day changes for market prices and load, and week-to-week changes in hydro.
- The mean reversion parameter identifies how long a stochastic shock takes to get back to the expected level; however, it doesn't account for sustained changes.
  - For example, during dry hydro years output may be below normal for months at a time.
- As more long-duration dispatchable resources retire, sustained below-average energy conditions may significantly increase costs or impact reliability.
- Below-average energy conditions may also impact compliance with state requirements for clean energy resources or emissions reductions.

Historical Hydro

- PacifiCorp's owned hydro generation has varied by plus or minus 25% over the past 20 years, relative to the median.
  - Annual variation is larger for individual river systems.
  - Timing within the year (not shown here) is also important
  - Impacts on the Lewis River, which has significant storage, may have different cost implications.





Annual Volatility

- For those parameters that have annual volatility, PacifiCorp is considering modeling using relationships from historical calendar years.
  - A 20-year history is used: 2002-2021 (also used for load and hydro forecasting)
  - For each stochastic iteration of each year in the IRP study horizon, all inputs will reflect a single historical year.
  - To capture multi-year trends, three-year intervals are sampled.

Example Annual Volatility Modeling

Iteration	Study **2023**	2024	2025	**2026**	2027	2028	**2029**	2027	2028
	Year	Year+1	Year+2	Year	Year+1	Year+2	Year	Year+1	Year+2
1	**2005**	*2006*	*2007*	2002	*2003*	*2004*	2007	*2008*	*2009*
2	**2010**	*2011*	*2012*	2002	*2003*	*2004*	2002	*2003*	*2004*
3	**2004**	*2005*	*2006*	2017	*2018*	*2019*	2007	*2008*	*2009*
4	**2008**	*2009*	*2010*	2007	*2008*	*2009*	2011	*2012*	*2013*
5	**2006**	*2007*	*2008*	2009	*2010*	*2011*	2009	*2010*	*2011*
	Sample	*Calculation*							

After the last historical year (2021), results roll back to the beginning (2002)

Annual Volatility Modeling

- Hydro generation has a long historical record and relatively few changes in operations. This allows for relatively easy integration with hydro forecasts and climate impacts.
- Other data streams are more complicated:
  - It can be difficult to distinguish changes over time from volatility.
  - Changes between weather-normalized actual load and actual load may identify volatility, but don't readily translate to forecasted requirements.
  - Wind and solar generation are mostly recent additions, without a complete generation history.
  - Actual market prices reflect the generation mix, loads, and cost of inputs (coal, natural gas), which vary over time.
- PacifiCorp is continuing to evaluate annual volatility in load, wind, solar output, and relationships with market prices.

Reliability Assessment




PACIFICORP
POWERING YOUR GREATNESS

Reliability Background

- Reliable system operation requires sufficient resources to serve load and meet operating reserve requirements at all times and under all conditions.
- If insufficient resources are available, retail load customers may be curtailed, triggering a “loss of load event” that can be measured in duration (hours), frequency (count), or magnitude (MWh)
- Utility planning generally allows infrequent loss of load events because covering every theoretical system condition becomes extremely expensive. One day in ten years is commonly used, which PacifiCorp has translated as 2.4 hours per year.
- “Under all conditions” is key to evaluating reliability, as these stochastic variables can trigger loss of load events:
  - Higher Load
  - Higher Thermal Forced Outages
  - Lower Hydro Availability
  - Lower Wind and Solar Availability
- Climate change has the potential to make extreme weather conditions more frequent or more extreme

Reliability Assessment

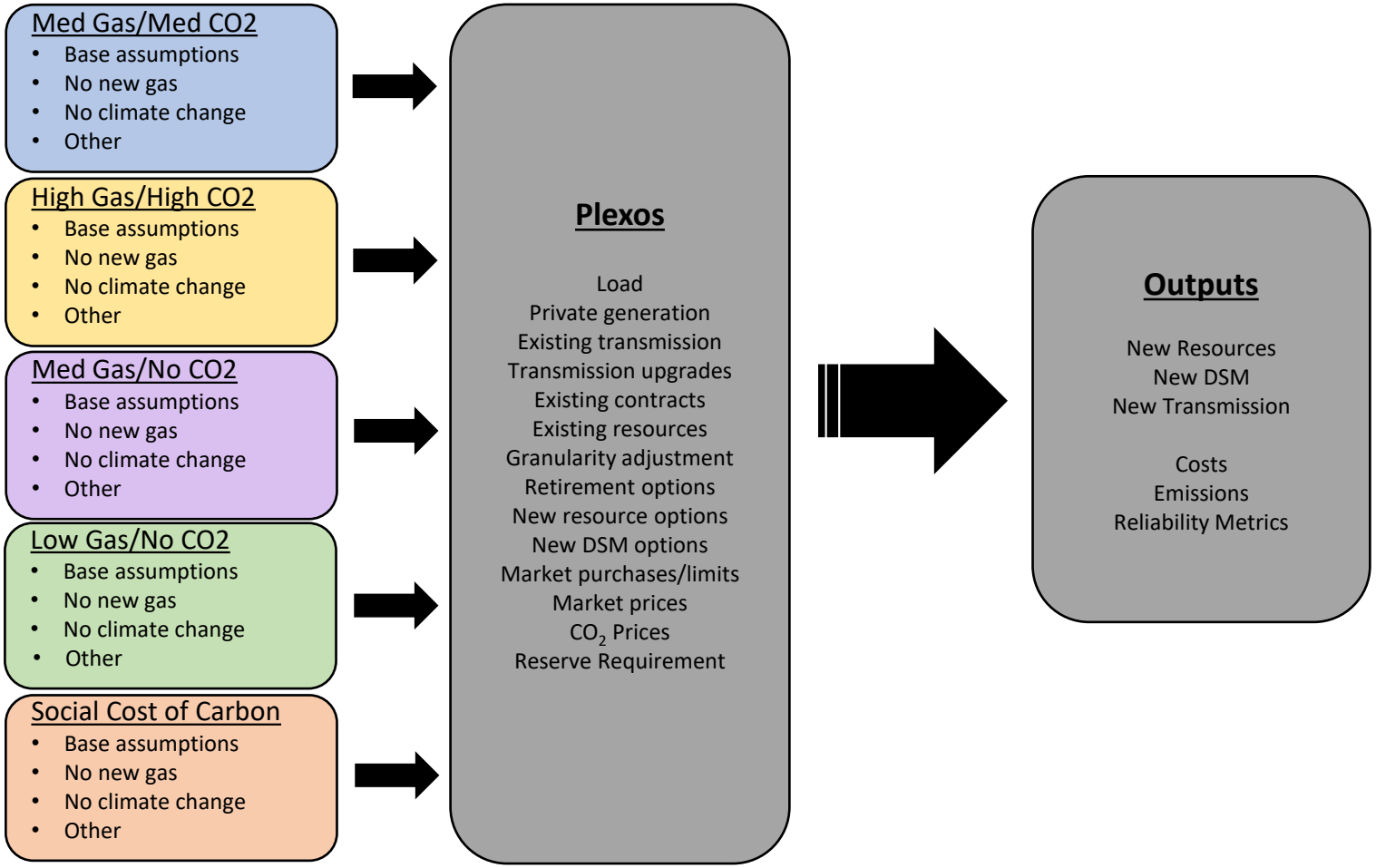
- Once 2023 IRP core inputs are complete, including resource options and stochastic parameters, PacifiCorp intends to run hourly ST stochastic studies.
  - This analysis will reflect a preliminary portfolio of expansion resources.
  - Because model runtime for many stochastic iterations is very long, the analysis will be conducted for a limited set of years (at least two).
- These studies will help identify:
  - Periods of high risk, including parameters such as frequency, duration, and magnitude.
    - Loss of Load Probability (LOLP) can be reported by month and hour to illustrate these patterns.
  - Comparing against results under "expected conditions" will help identify incremental resource requirements to manage risk and ensure adequate reliability.
  - The results can also inform granularity or capacity inputs to improve LT model portfolio optimization.
- PacifiCorp will develop a wide variety of portfolios (as discussed in the next section) using its LT model.
  - Each portfolio will be run through the ST model under "expected conditions" to identify unserved energy and unmet reserve requirements.
  - Each portfolio will also need to have sufficient incremental resources to meet the risk and reliability needs identified in the preliminary analysis.
  - Insufficiently reliable portfolios will be adjusted by moving proxy resource timing sooner and adding proxy resources as necessary – this may result in accelerated transmission selections.
  - Any portfolio changes will be identified, and the resulting portfolios will be run through ST model to confirm reliability.
- Cost and performance information will be reported for reliable portfolios only, including both expected case results and stochastic (risk-adjusted) results.

Portfolio Discussion




PACIFICORP
POWERING YOUR GREATNESS

Portfolio Development



Portfolio Development (continued)

- Model and run all portfolios
- Determine competitive least-cost, least-risk portfolios
- Assess state policy compliance
  - Oregon
    - Clean Energy Plan (CEP) compliance
    - RPS
    - Oregon small resource 20 MW
    - Oregon (HB 2021) emission compliance
  - Washington
    - Clean Energy Transformation Act (CETA) compliance
    - SCGHG portfolio analysis (Washington resources)
    - CETA Targets
- Preferred Portfolio Selection

Variants

- Variants – Studies to evaluate specific resources
  - No New Proxy Gas
  - Gateway South (GWS) *
  - B2H (Boardman to Hemingway Transmission) *
  - Nuclear (Natrium) *
  - CCUS *
    - CCUS with Oxide Air
  - Offshore Wind *
  - All Coal Retire beginning 2030
  - Jim Bridger Long Term Fuel Plan

* The nature of the variant analysis will depend on optimized outcomes; it is expected that each variant will be a counterfactual

Sensitivities

- Sensitivities
  - High Load
  - Low Load
  - 1 in 20 Load Growth
  - Business Plan
  - High Private Generation
  - Low Private Generation
  - No Climate Change
  - Incremental Renewable Additions
  - Oregon Increase Risk-reduction Credit - DSM Energy Efficiency

Stakeholder Feedback




PACIFICORP
POWERING YOUR GREATNESS

Stakeholder Feedback Form Update

- 22 stakeholder feedback forms submitted to date
- Stakeholder feedback forms and responses can be located at:
  pacificorp.com/energy/integrated-resource-plan/comments
- Depending on the type and complexity of the stakeholder feedback, responses may be provided in a variety of ways including, but not limited to, a written response, a follow-up conversation, or incorporation into subsequent public-input meeting material
  - Generally, written responses are provided with the form and posted online at the link mentioned above
- Stakeholder feedback following the previous public input meetings is summarized on the following slides for reference

Summary – Recent Stakeholder Feedback Forms

Stakeholder	Date	Topic	Brief Summary*	Response*
Utah Clean Energy	September 8, 2022	Methane emissions	Assess how methane leakage mitigation policies will affect natural gas portfolio outcomes	**Posted 10/5**
Renewable Northwest	September 14, 2022	Supply-side assumptions	Transmission capacity, offshore wind costs and modeling assumptions	**Posted 9/28**
Washington UTC	September 20, 2022	Social cost of GHG	Outlines statutory obligation to incorporate the social cost of greenhouse gas into Washington allocated resource carbon cost assumptions	**Pending Review**
Utah Division of Public Utilities	September 22, 2022	Supplemental study information and transmission topology	Request for Kiewit study on natural gas and hydrogen resources; request further explanation regarding Jim Bridger moving to PAC-East balancing authority.	**Posted 10/5**

*Full comments and PacifiCorp's responses can be found online at https://www.pacificorp.com/energy/integrated-resource-plan/comments.html

Summary – Recent Stakeholder Feedback Forms

Stakeholder	Date	Topic	Brief Summary*	Response*
Powder River Basin Resource Council	October 5, 2022	Natrium nuclear facility	Natrium project risk considerations, fuel availability and waste disposal	**Pending Review**

*Full comments and PacifiCorp's responses can be found online at https://www.pacificorp.com/energy/integrated-resource-plan/comments.html

Wrap-Up/Additional Information




PACIFICORP
POWERING YOUR GREATNESS

Additional Information

- 2023 IRP Upcoming Public Input Meetings:
  - December 1-2, 2022 (Thursday-Friday)
  - January 12-13, 2023 (Thursday-Friday)
- Public Input Meeting and Workshop Presentation and Materials:
  - pacificorp.com/energy/integrated-resource-plan/public-input-process
- 2023 IRP Stakeholder Feedback Forms:
  - pacificorp.com/energy/integrated-resource-plan/comments
- IRP Email / Distribution List Contact Information:
  - IRP@PacifiCorp.com
- IRP Support and Studies:
  - pacificorp.com/energy/integrated-resource-plan/support