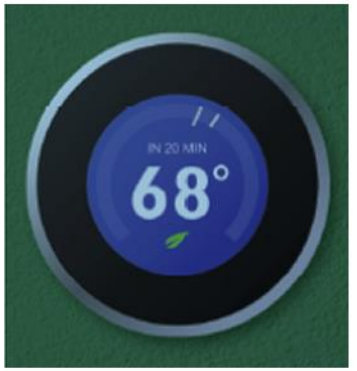
2019 Integrated Resource Plan (IRP) Public Input Meeting November 1, 2018



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Agenda

November 1

- 9:00am-10:00am pacific –Supply-Side Resource Table
- 10:00am-11:30am pacific – Modeling Improvements and Updates
- 11:30am-12:15pm pacific – Lunch Break
- 12:15pm-2:00pm pacific – Update on Coal Analysis
- 2:00pm-2:30pm pacific – Stakeholder Feedback Form Recap
- 2:30pm-3:00pm pacific – Wrap-Up / Next Steps

Supply-Side Resource Table




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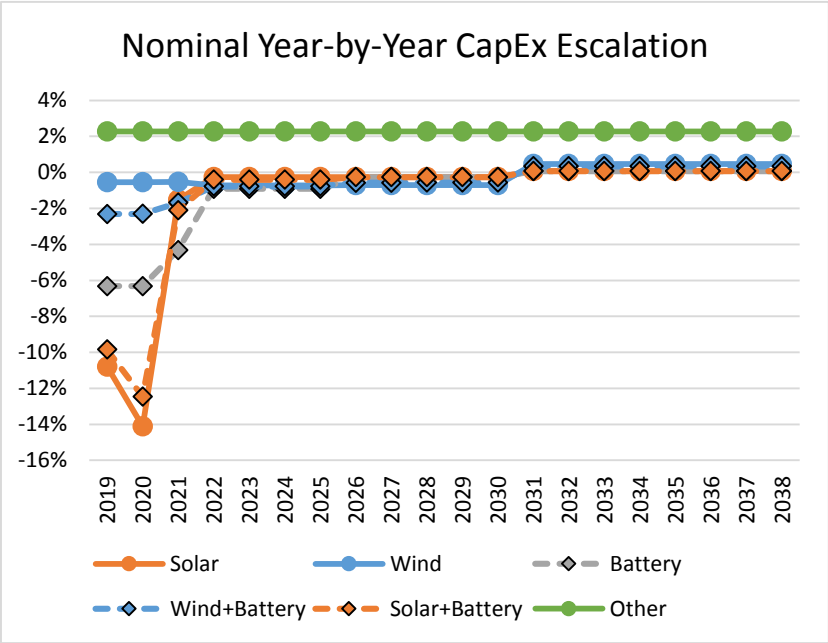
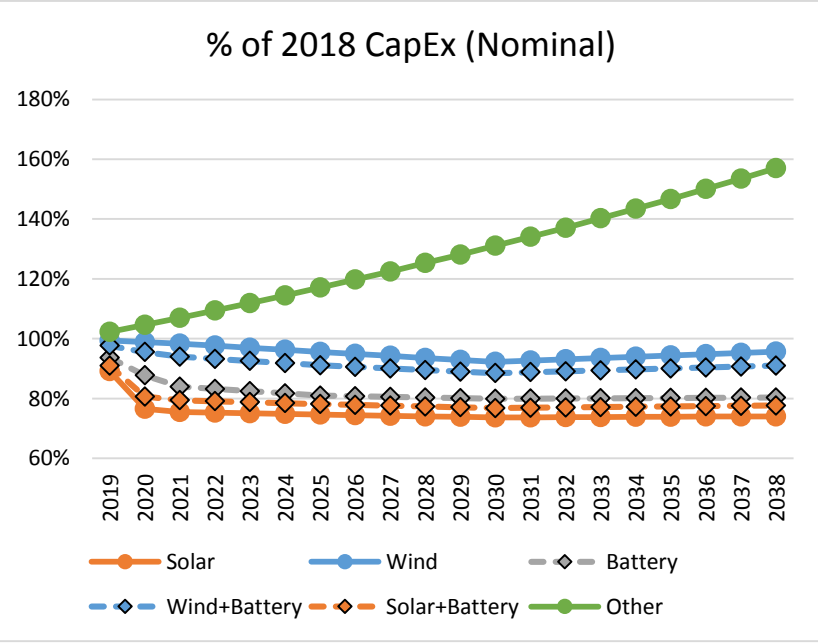
Supply-Side Resource Table Updates

- A number of updates based on stakeholder feedback lowering costs for renewable resources including reductions to:
  - Pumped storage capital investment costs
  - Wind and storage fixed costs
  - Solar and storage fixed costs
- For modeling purposes, a $10 MWh cost is added to west wind options to account for third-party wheeling costs (west side wind projects offered into the 2016R and 2017R RFPs interconnect with third-party transmission systems).
- Updated supply-side resource table posted on PacifiCorp's Integrated Resource Plan webpage—intra-hour flexible reserve credits have been removed.

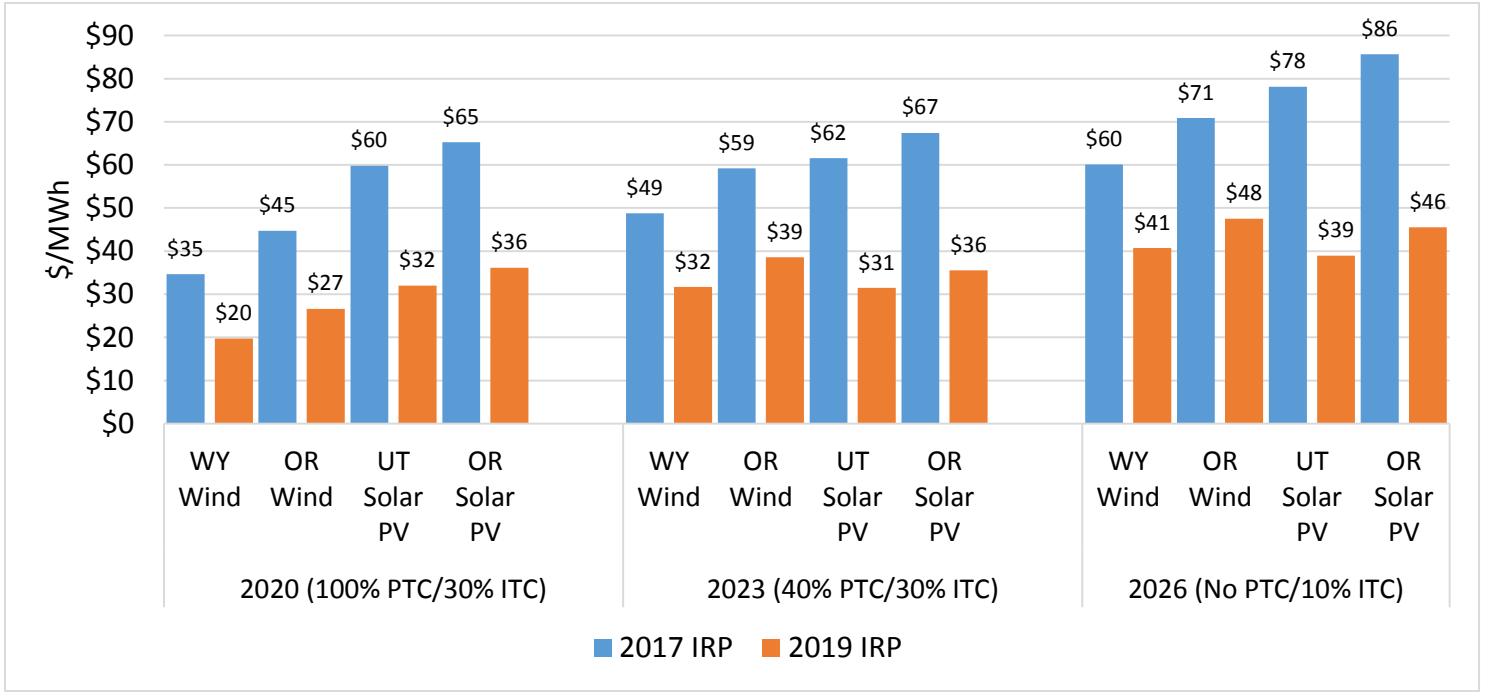
Updated Nominal Year-by-Year Escalation for Resource Capital Costs





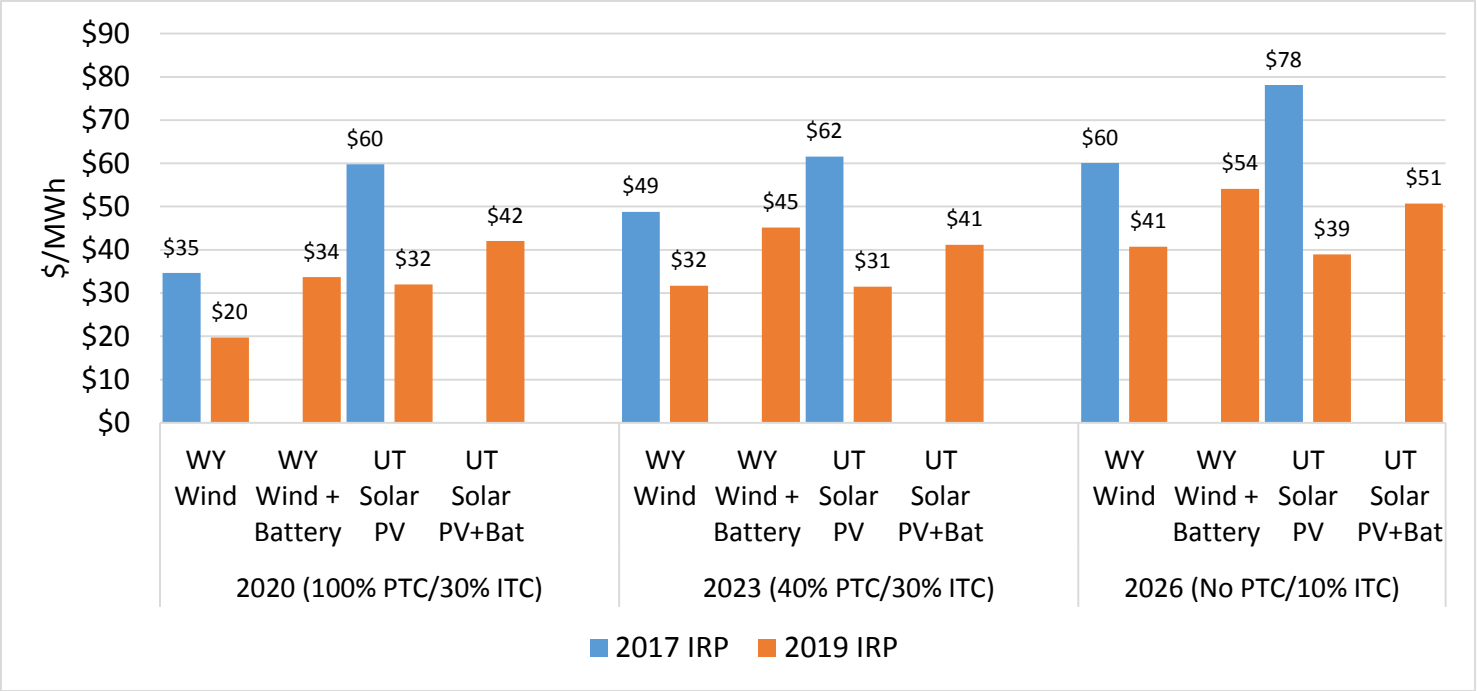
- Capital cost escalation/de-escalation rates are shown two ways—annual percentage rates and cumulatively relative to 2018 costs.
  - By 2038, nominal costs for solar, wind, and battery resources are 74%, 96%, and 80% of 2018 costs (note, when expressed as a percentage of 2018, the differentiation between solar and storage is driven by steep de-escalation assumed for solar in 2019 and 2020 to calibrate levelized costs to bid pricing from the 2017S RFP).
- Storage de-escalation rates presented at the October 9, 2018 conference call have been updated.
  - Includes data through 2021 provided in Lazard's levelized cost of storage analysis, which are averaged with Burns and MacDonald projections, which extend through 2028.
  - Annual de-escalation rates beginning 2026 are based on those assumed for solar to limit differentiation driven by the use of projections from different sources.

Nominal Levelized Costs for Wind and Solar



- Representative levelized cost information from the 2017 IRP and for the 2019 IRP both reflect the Tax Cut and Jobs Act.
- Wyoming wind costs from the 2017 IRP reflect updated assumptions applied in the final stages of the portfolio-development process (10.7 percent reduction in capital with a 41.3% capacity relative to the supply-side resource table from the 2017 IRP).
- Wind and solar costs reflect the proposed annual escalation/de-escalation rates summarized on the previous slide.
- As shown, Oregon wind does not include the $10/MWh wheeling charge.

Nominal Levelized Costs for Wind, Solar and Storage



- Representative levelized cost information from the 2017 IRP and for the 2019 IRP both reflect the Tax Cut and Jobs Act.
- Wyoming wind costs from the 2017 IRP reflect updated assumptions applied in the final stages of the portfolio-development process (10.7 percent reduction in capital with a 41.3% capacity relative to the supply-side resource table from the 2017 IRP).
- Wind, solar and battery costs reflect the proposed annual escalation/de-escalation rates summarized on the previous slide.
- Note, the 2017 IRP did not included combined wind and battery or combined solar and battery alternatives.

Performance and Cost Summary (2018$)

Description		Resource Characteristics			Costs		
Fuel	Resource	Elevation (AFSL)	Net Capacity (MW)	Design Life (yrs)	Base Capital ($/KW)	Var O&M ($/MWh)	Fixed O&M ($/KW-yr)
Solar	Idaho Falls, ID, 50 MW, CF: 28.1%	4,700	50	25	1,366	0.00	21.72
Solar	Idaho Falls, ID, 200 MW, CF: 28.1%	4,700	200	25	1,271	0.00	21.72
Solar	Lakeview, OR, 50 MW, CF: 29.7%	4,800	50	25	1,424	0.00	22.35
Solar	Lakeview, OR, 200 MW, CF: 29.7%	4,800	200	25	1,329	0.00	22.35
Solar	Milford, UT, 50 MW, CF: 32.5%	5,000	50	25	1,363	0.00	22.32
Solar	Milford, UT, 200 MW, CF: 32.5%	5,000	200	25	1,268	0.00	22.32
Solar	Rock Springs, WY, 50 MW, CF: 30.1%	6,400					
Solar	Rock Springs, WY, 200 MW, CF: 30.1%	6,400					
Solar	Yakima, WA, 50 MW, CF: 26.0%	1,000					
Solar	Yakima, WA, 200 MW, CF: 26.0%	1,000					
Solar + Storage	Idaho Falls, ID, 50 MW + 10 MW X 20 MWh, CF: 28.1%	4,700	50	25	1,628	0.00	23.48
Solar + Storage	Idaho Falls, ID, 200 MW + 50 MW X 100 MWh, CF: 28.1%	4,700	200	25	1,470	0.00	22.91
Solar + Storage	Idaho Falls, ID, 50 MW + 10 MW X 40 MWh, CF: 28.1%	4			1,756	0.00	25.03
Solar + Storage	Idaho Falls, ID, 200 MW + 50 MW X 200 MWh, CF: 28.1%	4			1,614	0.00	24.24
Solar + Storage	Idaho Falls, ID, 50 MW + 10 MW X 80 MWh, CF: 28.1%	4			1,992	0.00	26.46
Solar + Storage	Idaho Falls, ID, 200 MW + 50 MW X 400 MWh, CF: 28.1%	4,700	200	25	1,897	0.00	25.36
Solar + Storage	Lakeview, OR, 50 MW + 10 MW X 20 MWh, CF: 29.7%	4,800	50	25	1,706	0.00	23.48
Solar + Storage	Lakeview, OR, 200 MW + 50 MW X 100 MWh, CF: 29.7%	4,800	200	25	1,543	0.00	22.91
Solar + Storage	Lakeview, OR, 50 MW + 10 MW X 40 MWh, CF: 29.7%	4,800	50	25	1,844	0.00	25.03
Solar + Storage	Lakeview, OR, 200 MW + 50 MW X 200 MWh, CF: 29.7%	4,800	200	25	1,699	0.00	24.24
Solar + Storage	Lakeview, OR, 50 MW + 10 MW X 80 MWh, CF: 29.7%	4,800	50	25	2,098	0.00	26.46
Solar + Storage	Lakeview, OR, 200 MW + 50 MW X 400 MWh, CF: 29.7%	4,800	200	25	2,004	0.00	25.36

O&M Costs reduced (Storage Var O&M costs not listed here because they only apply to energy discharged by the battery)

Base Capital mapping error corrected

Performance and Cost Summary (2018$)

(Solar + Storage continued)

Description		Resource Characteristics			Costs		
Fuel	Resource	Elevation (AFSL)	Net Capacity (MW)	Design Life (yrs)	Base Capital ($/KW)	Var O&M ($/MWh)	Fixed O&M ($/KW-yr)
Solar + Storage	Milford, UT, 50 MW + 10 MW X 20 MWh, CF: 32.5%	5,000	50	25	1,626	0.00	23.48
Solar + Storage	Milford, UT, 200 MW + 50 MW X 100 MWh, CF: 32.5%	5,000	200	25	1,467	0.00	22.91
Solar + Storage	Milford, UT 50 MW + 10 MW X 40 MWh, CF: 32.5%	5			1,754	0.00	25.03
Solar + Storage	Milford, UT, 200 MW + 50 MW X 200 MWh, CF: 32.5%	5			1,612	0.00	24.24
Solar + Storage	Milford, UT, 50 MW + 10 MW X 80 MWh, CF: 32.5%	5			1,990	0.00	26.46
Solar + Storage	Milford, UT, 200 MW + 50 MW X 400 MWh, CF: 32.5%	5,000	200	25	1,895	0.00	25.36
Solar + Storage	Rock Springs, WY, 50 MW + 10 MW X 20 MWh, CF: 30.1%	6,400	50	25	1,623	0.00	23.48
Solar + Storage	Rock Springs, WY, 200 MW + 50 MW X 100 MWh, CF: 30.1%	6,400	200	25	1,464	0.00	22.91
Solar + Storage	Rock Springs, WY, 50 MW + 10 MW X 40 MWh, CF: 30.1%	6,400	50	25	1,751	0.00	25.03
Solar + Storage	Rock Springs, WY, 200 MW + 50 MW X 200 MWh, CF: 30.1%	6,400	200	25	1,609	0.00	24.24
Solar + Storage	Rock Springs, WY, 50 MW + 10 MW X 80 MWh, CF: 30.1%	6,400	50	25	1,987	0.00	26.46
Solar + Storage	Rock Springs, WY, 200 MW + 50 MW X 400 MWh, CF: 30.1%	6,400	200	25	1,892	0.00	25.36
Solar + Storage	Yakima, WA, 50 MW + 10 MW X 20 MWh, CF: 26.0%	1,000	50	25	1,704	0.00	23.48
Solar + Storage	Yakima, WA, 200 MW + 50 MW X 100 MWh, CF: 26.0%	1,000	200	25	1,541	0.00	22.91
Solar + Storage	Yakima, WA, 50 MW + 10 MW X 40 MWh, CF: 26.0%	1,000	50	25	1,842	0.00	25.03
Solar + Storage	Yakima, WA, 200 MW + 50 MW X 200 MWh, CF: 26.0%	1,000	200	25	1,697	0.00	24.24
Solar + Storage	Yakima, WA, 50 MW + 10 MW X 80 MWh, CF: 26.0%	1,000	50	25	2,097	0.00	26.46
Solar + Storage	Yakima, WA, 200 MW + 50 MW X 400 MWh, CF: 26.0%	1,000	200	25	2,002	0.00	25.36

Base Capital mapping error corrected

O&M Costs reduced

Performance and Cost Summary (2018$)

Description		Resource Characteristics			Costs		
Fuel	Resource	Elevation (AFSL)	Net Capacity (MW)	Design Life (yrs)	Base Capital ($/KW)	Var O&M ($/MWh)	Fixed O&M ($/KW-yr)
Wind	3.6 MW turbine 37.1% CF WA	1,500	200	30	1,354	0.00	27.99
Wind	3.6 MW turbine 37.1% CF OR	1,500	200	30	1,334	0.00	27.99
Wind	3.6 MW turbine 37.1% CF ID	4,500	200	30	1,358	0.00	27.99
Wind	3.6 MW turbine 29.5% CF UT	4,500	200	30	1,301	0.00	27.99
Wind	3.6 MW turbine 43.6% CF WY	6,500	200	30	1,301	0.65	27.99
Wind + Storage	Pocatello, ID, Storage: 50 MW | 100 MWh, CF: 37.1%	4,500	200	30			29.18
Wind + Storage	Arlington, OR, Storage: 50 MW | 100 MWh, CF: 37.1%	1,500	200	30			29.18
Wind + Storage	Monticello, UT, Storage: 50 MW | 100 MWh, CF: 29.5%	4,500	200	30	1,735	0.00	29.18
Wind + Storage	Medicine Bow, WY, Storage: 50 MW | 100 MWh, CF: 43.6%	6,500	200	30	1,730	0.65	29.18
Wind + Storage	Goldendale, WA, Storage: 50 MW | 100 MWh, CF: 37.1%	1,500	200	30	1,772	0.00	29.18
Wind + Storage	Pocatello, ID, Storage: 50 MW | 200 MWh, CF: 37.1%	4,500	200	30	1,880	0.00	29.88
Wind + Storage	Arlington, OR, Storage: 50 MW | 200 MWh, CF: 37.1%	1,500	200	30	1,917	0.00	29.88
Wind + Storage	Monticello, UT, Storage: 50 MW | 200 MWh, CF: 29.5%	4,500	200	30	1,877	0.00	29.88
Wind + Storage	Medicine Bow, WY, Storage: 50 MW | 200 MWh, CF: 43.6%	6,500	200	30	1,872	0.65	29.88
Wind + Storage	Goldendale, WA, Storage: 50 MW | 200 MWh, CF: 37.1%	1,500	200	30	1,924	0.00	29.88
Wind + Storage	Pocatello, ID, Storage: 50 MW | 400 MWh, CF: 37.1%	4,500	200	30	2,158	0.00	31.03
Wind + Storage	Arlington, OR, Storage: 50 MW | 400 MWh, CF: 37.1%	1,500	200	30	2,214	0.00	31.03
Wind + Storage	Monticello, UT, Storage: 50 MW | 400 MWh, CF: 29.5%	4,500	200	30	2,155	0.00	31.03
Wind + Storage	Medicine Bow, WY, Storage: 50 MW | 400 MWh, CF: 43.6%	6,500	200	30	2,150	0.65	31.03
Wind + Storage	Goldendale, WA, Storage: 50 MW | 400 MWh, CF: 37.1%	1,500	200	30	2,221	0.00	31.03

O&M Costs reduced

Performance and Cost Summary (2018$)

Description		Resource Characteristics			Costs		
Fuel	Added joint ownership option Resource	Elevation (AFSL)	Net Capacity (MW)	Design Life (yrs)	Base Capital ($/KW)	Var O&M ($/MWh)	Fixed O&M ($/KW-yr)
Storage	Oregon 3,800 MWh	4,457	400	60	3,095	0.00	16.76
Storage	Oregon joint ownership 950 MWh	4,457	100	60	3,099	0.00	16.76
Storage	Washington 16,800 MWh	500	1,200	60	2,719	0.00	12.50
Storage	Wyoming 7,000 MWh	580	700	60	3,255	0.00	17.00
Storage	Utah 1,800 MWh	6,359	300	60	2,991	0.00	17.00
Storage	Idaho 2,880 MWh	5,000	360	60	2,680	0.00	17.00
Storage	CAES 15,360 MWh	4,600	320	30	1,625	0.00	7.01
Storage	Li-Ion 1 MW X 250 kWh		1	15	1,473	11.42	8.29
Storage	Li-Ion 1 MW X 2 MWh		1	15	2,615	15.70	23.56
Storage	Li-Ion 1 MW X 4 MWh		1	15	3,412	14.98	35.23
Storage	Li-Ion 1 MW X 8 MWh		1	15	5,455	14.98	52.09
Storage	Li-Ion 15 MW X 60 MWh		15	15	1,766	15.07	11.50
Storage	Flow 1 MW X 6 MWh		1	15	3,996	0.00	32.00

- Base Capital mapping error corrected.
- O&M costs updated.

Modeling Improvements and Updates

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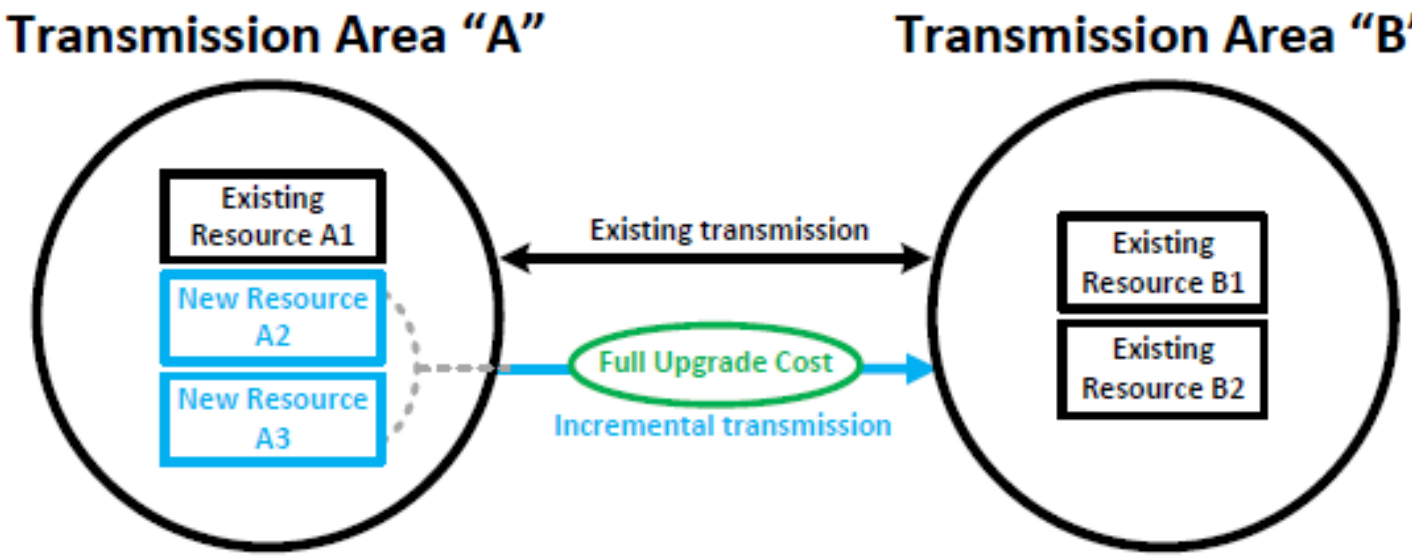
Modeling Improvements and Updates

- Expanded renewable resource options and locations including:
  - Roughly 250 more renewable resource options in the 2019 IRP vs. the 2017 IRP, inclusive of customer preference resources, additional locations, types (*i.e.*, combinations with storage), and capacity contribution levels.
- Transmission modeling improvements included:
  - Incremental transmission upgrades can be selected endogenously by the model.
  - Transmission upgrade costs are tied to total new resource capacity in a transmission area.
  - Out-of-model cost reconciliation related to transmission upgrades is no longer required and System Optimizer is able to identify potential benefits of added transmission capacity.
- With these improvements, model performance has suffered.

Additional Endogenous Transmission Enhancements



- Modeling has been expanded to allow replacement resources to use transmission rights following unit retirement.
- A prior modeling constraint (gray dashed lines in the graph, above) did not allow new transmission to contribute to the transmission area where new resources were selected. This constraint has been resolved.
- New resource additions can be selected in conjunction with incremental transmission options.

Integration Modeling Assumptions

Integration Resources:

- The System Optimizer includes integration costs for wind and solar (see Flexible Reserve Study), but does not account for benefits associated with resources that provide reserves to integrate the wind and solar.
- Specifically, certain resources in System Optimizer primarily provide operating reserves to help integrate wind and solar but that System Optimizer does not value.
- To help compensate, an adjustment has been applied to a limited set of resource types that are highly flexible and primarily provide operating reserves including: storage, gas peakers, and Class 1 DSM (interruptible load) – approximately $50/kW-yr.
- Storage combination resources (wind+storage and solar+storage) have a slightly lower adjustment to account for periods when available flexible dispatch is reduced by wind or solar.

Load Integration:

- Exploring load integration credit for Class 2 DSM (energy efficiency).
- Increases in load increase regulation reserve requirements and load integration costs. Class 2 DSM can avoid those load integration costs.

Update on Coal Analysis

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Update on Coal Analysis

- Modeling performance has delayed progress on completing model runs required to support the coal analysis.
- Updated unit-by-unit coal analysis results will be discussed at the December 3-4, 2018 public input meeting.
- While there has been a shift in timing, there is no change in methodology or approach.

Questions/Comments?

Stakeholder Feedback Form Recap




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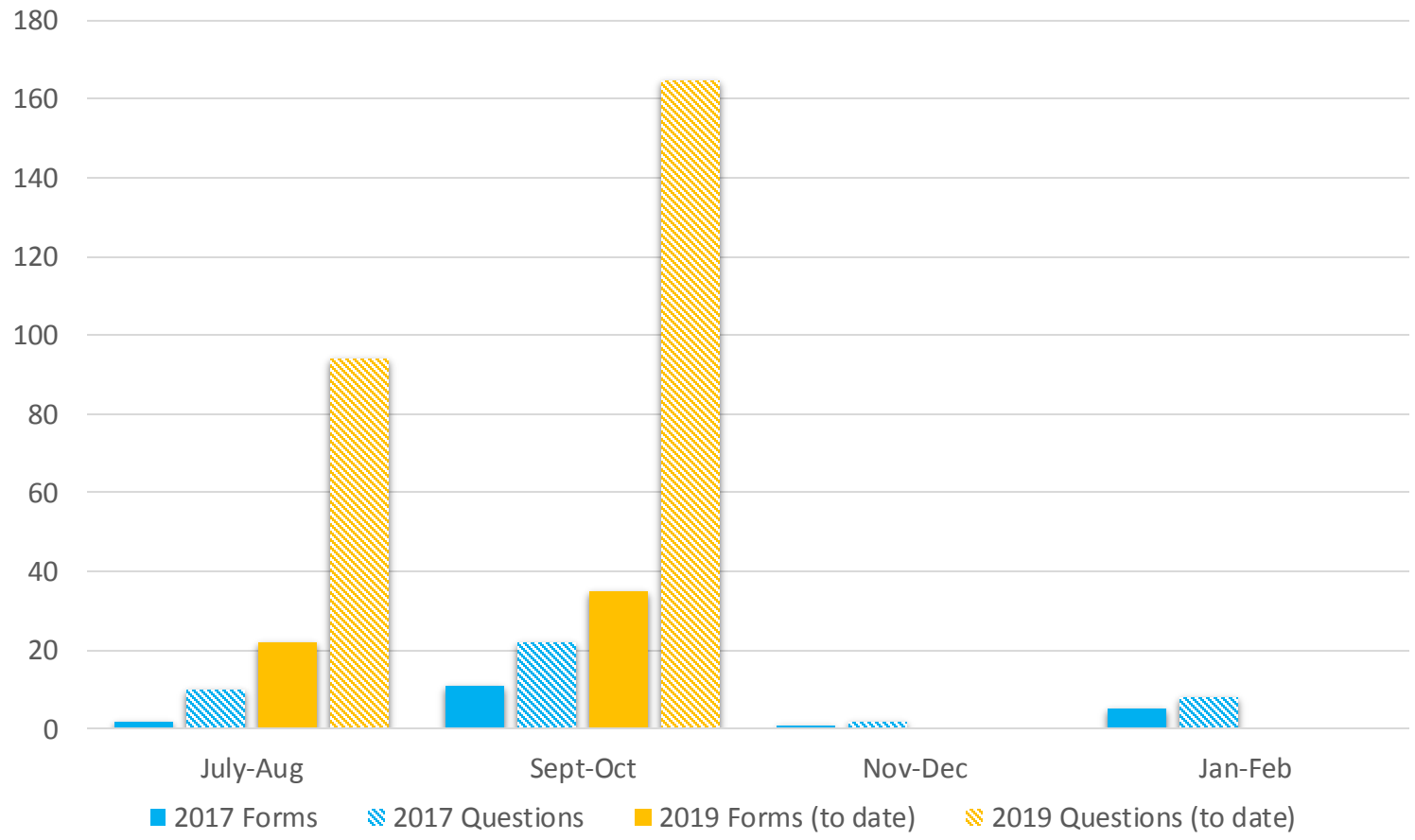
Stakeholder Feedback Form Update

- 57 stakeholder feedback forms submitted to date.
- Stakeholder feedback forms can be located at: www.pacificorp.com/es/irp/irpcomments.html
- A matrix to summarize feedback and the company's response was posted on October 31, 2018.
- Response to feedback captured in the matrix may be provided in different ways depending on the type and complexity of the feedback including but not limited to a written response in the matrix, a standalone response document, separate email, follow-up conversation, or incorporated in subsequent public input meeting material.
- Feedback received following the most recent public input meeting (September and October Conference Call) is summarized on the following slides for reference.

2019 IRP vs. 2017 IRP Stakeholder Feedback Form Activity to Date



Stakeholder Feedback Form Summary

Stakeholder	Date	Topic	Brief Summary (complete form available online)	Response
UCE	Sept 26	Coal Analysis	Coal unit retirement Study, Intra-Hour Dispatch Credit, Climate Change, Carbon Assumptions, and Sensitivities	Topics addressed at Sept 2018 PIM.
SWEEP	Oct 3	CPA	Recommends change to PacifiCorp's risk reduction credit calculation – adopt ACEEE study.	To be explored in future IRPs.
UCE, WRA, and UAE	Oct 4	Coal Analysis	Request for vendor studies underlying different carbon cost assumptions used in retirement analysis	Requested materials provided Oct 8, 2018.
UCE	Oct 8	Modeling	Request for consultants reports from Burns & MacDonnell and Black & Veatch.	Will be provided as available.
IPUC	Oct 9	Intra-Hour Credits	Please consider SO comparison between base case and second model run incorporating Intra-Hour Credits	See summary matrix.
Gridflex Energy, LLC	Oct 9	Portfolios	Identified inconsistencies in base cost assumptions for pumped storage projects.	See summary matrix.
Sierra Club	Oct 15	Portfolios	Full comments regarding coal analysis provided.	To discussed at Dec 3-4 PIM.
Gridflex Energy, LLC	Oct 15	Portfolios	Clarified previously identified inconsistencies behind base cost assumptions for pumped storage.	Modified costs. Discussed Nov. 1 PIM.
OPUC	Oct 16	Coal Analysis	Full comments regarding coal analysis provided.	To be discussed at Dec 3-4 PIM.
IEA	Oct 17	Intra-Hour Credits	Feedback and suggested changes to Intra-Hour Credits	Informational only, not being modeled.

Stakeholder Feedback Form Summary

Stakeholder	Date	Topic	Brief Summary (complete form available online)	Response
IEA	Oct 17	Coal Analysis	Requested earlier date for carbon price assumption and adoption of sensitivity for social cost of carbon.	Carbon price to begin 2025, social cost of carbon included.
UCE and WRA	Oct 17	Coal Analysis	Follow up to Oct 4 feedback form for vendor reports.	Data provided.
OPUC	Oct 17	Distribution Planning	Range of questions regarding Distribution System Planning and Area Planning Studies.	Target response week of Nov 5.
OPUC	Oct 17	Enviro Policy	CA RPS, interstate carbon regulation, methodology updates involving use of data from CAISO in 2019 IRP.	Target response week of Nov 5.
OPUC	Oct 17	Intra-Hour Credits	Methodology questions surrounding Intra-Hour Credits.	Informational only, not being modeled.
OPUC	Oct 17	Private Generation	Request clarification on Navigant assumptions and modeling of private generation.	Provided clarification.
OPUC	Oct 17	PRM	Requests that the 2019 IRP include further explanation of the selection of 13% planning reserve margin.	Further explanation will be included in IRP.
OPUC	Oct 17	Coal Analysis	Specific case questions regarding stacked coal unit retirement analysis.	To be addressed at Dec 3-4 PIM.
OPUC	Oct 17	Portfolio	Request to include generic 100MW resource in supply-side resource table.	Requested resource included.

Stakeholder Feedback Form Summary

Stakeholder	Date	Topic	Brief Summary (complete form available online)	Response
OPUC	Oct 17	Transmission	Broad ranging questions on Energy Gateway and transmission modeling enhancements.	Target response week of Nov 5.
National Grid	Oct 18	Storage	Request for clarification on variance in base capital costs as reported in supply-side resource table.	Costs include owner's cost, AFUDC, EPC, etc.
WUTC	Oct 19	General	Feedback and questions from Sept PIM.	Provided response.
UCE	Oct 22	Supply Side	Request to adjust solar pricing and to include PPA prices for all applicable resources.	See summary matrix.

Additional Information and Next Steps

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Draft Topics for Upcoming PIMs*

December 3-4, 2018 PIM*:

- Coal Studies
- Stakeholder Feedback Form Recap

January 24-25, 2018 PIM*:

- Load & Resource Balance
- Regional Haze Portfolios
- Portfolios / Sensitivity Cases
- Stakeholder Feedback Form Recap

** Topics and timing are tentative and subject to change*

Additional Information and Next Steps

- Public Input Meeting Presentation and Materials:
  - pacificorp.com/es/irp.html
- 2019 IRP Stakeholder Feedback Forms and Summary Matrix:
  - pacificorp.com/es/irp/irpcomments.html
- IRP Email / Distribution List Contact Information:
  - IRP@PacifiCorp.com
- Upcoming Public Input Meeting Dates:
  - December 3-4, 2018
  - January 24-25, 2019
  - February 21-22, 2019
  - March 2019 – *TBD /as needed*
  - *April 1, 2019 – 2019 IRP File Date*