



Integrated Resource Plan

2021 IRP Public Input Meeting

December 3, 2020



Agenda



- 9:00am-9:15am pacific – Introductions
- 9:15am-11:30am pacific – Portfolio Development
- 11:30am-12:00pm pacific – Lunch Break
- 12:00pm-1:30pm pacific – Carbon Capture Supply-Side Resource Table
- 1:30pm-2:30pm pacific – Price Curve and Customer Preference Updates
- 2:30pm-3:30pm pacific – Transmission Modeling Assumptions
- 3:30pm-3:45pm – Stakeholder Feedback Form Recap
- 3:45pm-4:00pm pacific – Wrap-Up/Next Steps



Portfolio Development



Modeling Approach for Coal Units



- Coal retirement dates specific to coal units will be selected in each Plexos run
- For owned/operated coal units, potential retirement dates are based upon avoiding major overhauls, assuming a unit would be able to operate five years after an overhaul
- For minority-owned coal units, assumed retirement dates are informed by ongoing discussions with joint owners
- Regional Haze assumptions and carbon capture retrofit options are being incorporated into the methodology

Jim Bridger Units 1 and 2

Operating Variants



Jim Bridger Unit 1	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Coal-Ret 2023		Op Limit 1	Retired																	
Coal-Ret 2028		Op Limit 1	Retired																	
Coal-Ret 2032		Op Limit 1	Op Limit 2 Retired																	
Coal-Ret 2037		Op Limit 1	Op Limit 2 Retired																	
Coal-CCUS Retrofit		Op Limit 1	CCUS Retrofit Operation																	

Jim Bridger Unit 2	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Coal-Ret 2023		Op Limit 1	Retired																	
Coal-Ret 2027		Op Limit 1	Retired																	
Coal-Ret 2031		Op Limit 1	Op Limit 2 Retired																	
Coal-Ret 2035		Op Limit 1	Op Limit 2 Retired																	
Coal-Ret 2037		Op Limit 1	Op Limit 2 Retired																	

- Proposed operating limits approved by the state of Wyoming are expected to comply with the Regional Haze second planning period and are effective beginning 2022--limits are discussed on a later slide
- For the third Regional Haze planning period, it is assumed that tighter operating limits will apply beginning 2029 (25% reduction from the limits applicable beginning 2022)—limits are discussed on a later slide
- A CCUS retrofit future will be applied to Jim Bridger Unit 1 beginning 2026—a discussion of why units were selected for CCUS retrofit options is provided in a later slide

Jim Bridger Units 3 and 4

Operating Variants



Jim Bridger Unit 3	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Coal-Ret 2025		Op Limit 1				Retired														
Coal-Ret 2029		Op Limit 1							OL2	Retired										
Coal-Ret 2033		Op Limit 1							Op Limit 2					Retired						
Coal-Ret 2037		Op Limit 1							Op Limit 2									Retired		
Coal-CCUS Retrofit		Op Limit 1				CCUS Retrofit Operation														

Jim Bridger Unit 4	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040		
Coal-Ret 2026		Op Limit 1					Retired															
Coal-Ret 2030		Op Limit 1								OL2		Retired										
Coal-Ret 2034		Op Limit 1								Op Limit 2					Retired							
Coal-Ret 2037		Op Limit 1								Op Limit 2										Retired		
Coal-CCUS Retrofit		Op Limit 1				CCUS Retrofit Operation																

- Proposed operating limits approved by the state of Wyoming are expected to comply with the Regional Haze second planning period and are effective beginning 2022--limits are discussed on the next slide
- For the third Regional Haze planning period, it is assumed that tighter operating limits will apply beginning 2029 (25% reduction from the limits applicable beginning 2022)—limits are discussed on the next slide
- A CCUS retrofit future will be applied to Jim Bridger Units 3 and 4 beginning 2026

Jim Bridger Regional Haze Operating Limits



Effective Beginning 2022	Plant NO _x Emission Limit (Monthly Average Basis)	Plant SO ₂ Emission Limit (Monthly Average Basis)
January	2,050 lb/hour	2,100 lb/hour
February	2,050 lb/hour	2,100 lb/hour
March	2,050 lb/hour	2,100 lb/hour
April	2,050 lb/hour	2,100 lb/hour
May	2,200 lb/hour	2,100 lb/hour
June	2,500 lb/hour	2,100 lb/hour
July	2,500 lb/hour	2,100 lb/hour
August	2,500 lb/hour	2,100 lb/hour
September	2,500 lb/hour	2,100 lb/hour
October	2,300 lb/hour	2,100 lb/hour
November	2,030 lb/hour	2,100 lb/hour
December	2,050 lb/hour	2,100 lb/hour

- In addition to the plant-wide monthly limits shown above, Jim Bridger will be subject to a plant-wide emission cap of 17,500 tons/year of combined NO_x and SO₂ emissions
- For modeling purposes, the annual/combined limit will be imposed for PacifiCorp's 66% share (11,550 tons/year) either through an emissions constraint or through another operating metric (i.e., maximum annual capacity factor) that will capture the effect of the emission limit on plant operations
- For the third Regional Haze planning period (beginning 2029), Units 1 and 2 will be constrained to half of PacifiCorp's 66% share of the 2022 plant-wide combined annual limit reduced by 25% (4,331 tons/year) and Units 3 and 4 will be constrained to half of PacifiCorp's 66% share of the 2022 plant-wide combined annual limit (5,775 tons/year)

Naughton Units 1 and 2 Operating Variants



Naughton Unit 1 and 2	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Coal-Ret 2025						Retired														
Coal-Ret 2028 (Oct)																				
Coal-CCUS Retrofit						CCUS Retrofit Operation														

- Coal boilers and coal combustion residual (CCR) ponds must achieve final closure by October 2028 for Naughton Units 1&2
- To achieve final closure of ponds by 2028, coal boilers will need to cease operation by the end of 2025
- Coal operations beyond 2025 will require new ponds
- With planned closure no later than October 2028, no Regional Haze operating limits will be imposed
- A CCUS retrofit option will be made available to both Naughton units beginning 2026 (EPA would need to approve continued operation of the coal boilers and new ponds would be required)

Dave Johnston Units 1-4 Operating Variants



Dave Johnston 1	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Coal-Ret 2022			Retired																	
Coal-Ret 2027								Retired												

Dave Johnston 2	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Coal-Ret 2024				Retired																
Coal-Ret 2027								Retired												
Coal-CCUS Retrofit								CCUS Retrofit Operation												

Dave Johnston 3	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Coal-Ret 2025					Retired															
Coal-Ret 2027								Retired												

Dave Johnston 4	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Coal-Ret 2023			Retired																	
Coal-Ret 2027								Retired												
Coal-CCUS Retrofit								CCUS Retrofit Operation												

- Dave Johnston units 1 and 2 have effluent limitation guidelines imposed in 2023 and 2028 (high-recycle rate system if not retired)
- PacifiCorp has a commitment to cease operating Dave Johnston 3 at the end of 2027 and without a planned operations beyond 2027, no Regional Haze operating limits will be imposed
- A CCUS retrofit option will be made available to Dave Johnston 2 and 4 beginning 2026—a discussion of why units were selected for CCUS retrofit options is provided in a later slide

Wyodak

Operating Variants



Wyodak	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	
Coal-Ret 2023				Retired																	
Coal-Ret 2027								Retired													
Coal-Ret 2031									Op Limit			Retired									
Coal-Ret 2035									Op Limit						Retired						
Coal-Ret 2039									Op Limit												Ret
Coal-CCUS Retrofit						CCUS Retrofit Operation															

- A Regional Haze planning period three operating limit is assumed beginning 2029 for PacifiCorp's 80% share of Wyodak (4,294 tons/year of NO_x and SO₂ emissions)
- A CCUS retrofit option will be made available on Wyodak beginning 2026

Hunter Operating Variants



Hunter 1	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040		
Coal-Ret 2023		Op Limit 1	Retired																			
Coal-Ret 2027		Op Limit 1						Retired														
Coal-Ret 2031		Op Limit 1						Op Limit 2					Retired									
Coal-Ret 2035		Op Limit 1						Op Limit 2										Retired				
Coal-Ret 2042		Op Limit 1						Op Limit 2														

Hunter 2	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	
Coal-Ret 2024		Op Limit 1			Retired																
Coal-Ret 2028		Op Limit 1							Retired												
Coal-Ret 2032		Op Limit 1							Op Limit 2			Retired									
Coal-Ret 2036		Op Limit 1							Op Limit 2									Retired			
Coal-Ret 2042		Op Limit 1							Op Limit 2												

Hunter 3	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	
Coal-Ret 2025		Op Limit 1				Retired															
Coal-Ret 2029		Op Limit 1							OP2	Retired											
Coal-Ret 2033		Op Limit 1							Op Limit 2					Retired							
Coal-Ret 2037		Op Limit 1							Op Limit 2											Retired	
Coal-Ret 2042		Op Limit 1							Op Limit 2												

- Operating limits proposed to comply with the Regional Haze second planning period would likely become effective beginning 2022—PacifiCorp's 85% share of plant-wide NO_x and SO₂ at 14,450 tons/year
- For the third Regional Haze planning period, it is assumed that tighter operating limits will apply beginning 2029 (25% reduction from the limits applicable beginning 2022)—PacifiCorp's 85% share of plant-wide NO_x and SO₂ at 12,283 tons/year

Huntington Operating Variants



Huntington 1	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Coal-Ret 2023		Op Limit 1	Retired																	
Coal-Ret 2027		Op Limit 1	Retired																	
Coal-Ret 2031		Op Limit 1							Op Limit 2	Retired										
Coal-Ret 2036		Op Limit 1							Op Limit 2								Retired			

Huntington 2	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Coal-Ret 2024		Op Li	Op Limit 1	Retired																
Coal-Ret 2028		Op Li	Op Limit 1	Retired																
Coal-Ret 2032		Op Li	Op Limit 1							Op Limit 2	Retired									
Coal-Ret 2036		Op Li	Op Limit 1							Op Limit 2								Retired		

- Operating limits proposed to comply with the Regional Haze second planning period would likely become effective beginning 2022—plant-wide NO_x and SO₂ at 10,000 tons/year
- For the third Regional Haze planning period, it is assumed that tighter operating limits will apply beginning 2029 (25% reduction from the limits applicable beginning 2022)—plant-wide NO_x and SO₂ at 7,500 tons/year

Other Jointly Owned Coal Units Operating Variants



	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Colstrip																				
Colstrip 3-Ret 2025						Retired														
Colstrip 4-Ret 2025						Retired														

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Craig																				
Craig 1-Ret 2025						Retired														
Craig 2-Ret 2028 (Sep)																				

	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Hayden																				
Hayden 1-Ret 2030											Retired									
Hayden 2-Ret 2030											Retired									

- For minority-owned coal units, assumed retirement dates are informed by ongoing discussions with joint owners

Business As Usual Case Requests



Four stakeholder feedback forms requested specific Business As Usual Case(s):

Requesting Party	Requested Case Summary
Wyoming Office of Consumer Advocate (Form 037)	Begin with current generation and transmission portfolio and reflect analysis on customer impacts of changes to portfolio to accommodate load growth and environmental compliance obligations. Exclude early coal retirement as that is analyzed elsewhere in the IRP.
Wyoming Public Service Commission (Form 045)	Carry forward the 2019 IRP preferred portfolio, with updates due to regulatory changes, no additional assumed early retirements, and exclude externalities that are not currently required by law to be evaluated.
Renewable Northwest (Form 046)	Include a BAU case that incorporates reliability issues in California, Front Office Transaction assumptions and state energy policy.
Joint Parties (Utah Association of Energy Users, Utah Division of Public Utilities, Wyoming Industrial Energy Consumers, and Wyoming Office of Consumer Advocate (Form 058)	Two BAU cases – one based on the 2019 IRP preferred portfolio and one based on the 2017 IRP Update preferred portfolio with all commitments since the 2019 IRP included in BAU case.

- Based on this feedback, PacifiCorp plans to develop to stakeholder-defined BAU cases
 - One based on existing assets that we will assume operate through the end of their life operating life (no early retirement); contracts expire at the end of their term
 - One that is reasonably aligned with the 2019 IRP preferred portfolio (resource types and size, but with updated cost and performance); new proxy resources can be added as needed to reliably meet load (ensuring sufficient resources are added to accommodate changes in load from the 2019 IRP)

Required Cases and Sensitivity Requests



Oregon

Requirement	Summary
Cost-effective Coal Retirements (Order 20-186)	Include in the 2021 development process an updated analysis – identifying the most cost-effective coal retirements individually and in combination.

Washington

Requirement	Summary
Alternative Lowest Reasonable Cost (CETA Draft Rules)	Analysis of lowest reasonable cost portfolio that the utility would have implemented if not for compliance with CETA requirements.
Future Climate Change (CETA Draft Rules)	Analysis should incorporate best available science on impacts of snowpack, streamflow, rainfall, heating/cooling degree days, and load changes from climate change.
Maximum Customer Benefit (CETA Draft Rules)	Scenario should model customer benefit (per RCW 19.405.040(8)) prior to balancing against other goals.

Preliminary Set of 2021 IRP Portfolio Development Cases



Case "Name"	Price-Policy	Existing Coal	Existing Gas	Other Existing Resources	Proxy Resources
BAU1-MM	MM	End of Life	End of Life	End of Life	Optimized
BAU1-MN	MN	End of Life	End of Life	End of Life	Optimized
BAU1-LN	LN	End of Life	End of Life	End of Life	Optimized
BAU1-HH	HH	End of Life	End of Life	End of Life	Optimized
BAU1-SC-GHG	SC-GHG	End of Life	End of Life	End of Life	Optimized
BAU2-MM	MM	2019 IRP	2019 IRP	2019 IRP	2019 IRP+
BAU2-MN	MN	2019 IRP	2019 IRP	2019 IRP	2019 IRP+
BAU2-LN	LN	2019 IRP	2019 IRP	2019 IRP	2019 IRP+
BAU2-HH	HH	2019 IRP	2019 IRP	2019 IRP	2019 IRP+
BAU2-SC-GHG	SC-GHG	2019 IRP	2019 IRP	2019 IRP	2019 IRP+
P01-MM	MM	Optimized	End of Life	End of Life	Optimized
P01-MN	MN	Optimized	End of Life	End of Life	Optimized
P01-LN	LN	Optimized	End of Life	End of Life	Optimized
P01-HH	HH	Optimized	End of Life	End of Life	Optimized
P01-SC-GHG	SC-GHG	Optimized	End of Life	End of Life	Optimized

Preliminary Set of 2021 IRP Portfolio Development Cases (Cont'd)



Case "Name"	Price-Policy	Existing Coal	Existing Gas	Other Existing Resources	Proxy Resources
P02-MM	MM	Optimized	End of Life	End of Life	No New Gas
P02-MN	MN	Optimized	End of Life	End of Life	No New Gas
P02-LN	LN	Optimized	End of Life	End of Life	No New Gas
P02-HH	HH	Optimized	End of Life	End of Life	No New Gas
P02-SC-GHG	SC-GHG	Optimized	End of Life	End of Life	No New Gas
P03-MM	MM	Retired by 2030	End of Life	End of Life	No New Gas
P03-MN	MN	Retired by 2030	End of Life	End of Life	No New Gas
P03-LN	LN	Retired by 2030	End of Life	End of Life	No New Gas
P03-HH	HH	Retired by 2030	End of Life	End of Life	No New Gas
P03-SC-GHG	SC-GHG	Retired by 2030	End of Life	End of Life	No New Gas

- This preliminary set of cases would produce 25 unique resource portfolios—each will be assessed using the MM, MN, LN, and HH price-policy assumptions
- Portfolios generated with SC-GHG price-policy assumptions are consistent with RCW19.280.030 in Washington
- Additional cases may be developed once preliminary results are available (i.e., as required to achieve RPS targets or Clean Energy Transformation Act requirements)



Other Studies

Sensitivities (top-performing cases and stakeholder-defined BAU cases)

- High/low load, 1-in-20 load
- High/low private generation
- High/no customer preference
- Market reliance
- Forced CCUS/WY HB200
- SC-GHG applied as a dispatch adder in operations¹
- Reliability (top-performing cases and stakeholder defined BAU cases)
 - Evaluation of portfolio performance under strained system/regional conditions (i.e., sustained weather events) based on actual events that have occurred in recent years
- Other?

¹These sensitivities are consistent with RCW19.280.030 in Washington



Carbon Capture Utilization & Sequestration (CCUS) Supply-Side Resource Table Update



Thermal Resources – Carbon Capture Utilization & Sequestration

Supply Side Resources Review



- Carbon Capture Utilization & Sequestration
- Background
- Supply Side Resource
 - Proxy Sites
 - Existing Generating Facilities
- Revenue
 - 45Q Tax Credit
 - Oil Price Forecast
 - CO₂ Price Forecast



Background

- Sources of information
 - Petra Nova adjusted by learning curve
 - Carbon capture developer
 - Longforecast.com
 - World Bank
 - U.S. Energy Information Administration
 - Dept. of Commerce, Bureau of Economic Analysis
 - Wyoming Carbon Capture, Utilization, and Storage (CCUS) Study



Background

- Costs are incremental – costs shown are for the technology only and do not include the cost of operating the generating unit
- Heat rate and emissions are for the entire generating unit
- Assumes that the operating life is 20 years for after the retrofit date
- Adding carbon capture requires meeting the Federal Implementation Plan (FIP) and State Implementation Plan (SIP) for air emissions
- Post-combustion carbon capture meets the FIP and SIP



Background

- PacifiCorp owns and operates the carbon capture facility
- Proxy generating facilities meet the NO_x and SO₂ flue gas requirements prior to installation of carbon capture
- Some existing unit scenarios require additional emission controls
- Costs are on a 100% share basis
- Costs are in 2020 dollars



Proxy Sites

Description		Resource Characteristics				Costs			
Fuel	Resource	Elevation (AFSL)	Net Capacity (MW)	Commercial Operation Year	Design Life (yrs)	Base Capital (\$/KW)	Var O&M (\$/MWh)	Fixed O&M (\$/kW-yr)	Demolition Cost (\$/kW)
Coal	SCPC with CCS	4,500	526	2028	40	6,488	7.00	72.22	127.00
Coal	IGCC with CCS	4,500	466	2028	40	6,282	11.77	58.20	60.00
Coal	PC CCS retrofit @ 500 MW pre-retrofit basis	4,500	-115	2026	20	2,971	3.29	28.18	37.00
Coal	SCPC with CCS	6,500	692	2028	40	7,348	7.58	67.09	127.00
Coal	IGCC with CCS	6,500	456	2028	40	7,113	14.11	63.40	60.00
Coal	PC CCS retrofit @ 500 MW pre-retrofit basis	6,500	-115	2026	20	2,971	3.29	28.18	37.00

Description		Operating Characteristics				Environmental			
Fuel	Resource	Avg. Full Load Heat Rate (HHV Btu/KWh)/Efficiency	EFOR (%)	POR (%)	Water Consumed (Gal/MWh)	SO2 (lbs/MMBtu)	NOx (lbs/MMBtu)	Hg (lbs/TBTu)	CO2 (lbs/MMBtu)
Coal	SCPC with CCS	13,087	5.0	5.0	1,004	0.0085	0.070	0.022	20.5
Coal	IGCC with CCS	10,823	8.0	7.0	394	0.0085	0.050	0.333	20.5
Coal	PC CCS retrofit @ 500 MW pre-retrofit basis	14,372	5.0	5.0	450	0.0050	0.070	1.200	20.5
Coal	SCPC with CCS	13,242	5.0	5.0	1,004	0.0085	0.070	0.022	20.5
Coal	IGCC with CCS	11,047	8.0	7.0	394	0.0085	0.050	0.333	20.5
Coal	PC CCS retrofit @ 500 MW pre-retrofit basis	14,372	5.0	5.0	450	0.0050	0.070	1.200	20.5

- Costs are incremental to the generating unit
- Heat rate and emissions are for the entire generating unit



Existing Generating Facilities

Plant / Unit	Net Dependable Capacity	Post CC Capacity	Carbon Capture Equipment			NOx Control Equipment			SO ₂ Control Equipment		
			Capital	Variable O&M	Fixed O&M	Capital	Variable O&M	Fixed O&M	Capital	Variable O&M	Fixed O&M
	MW	MW	\$/kW	\$/MWh	\$/kWyr	\$/kW	\$/MWh	\$/kWyr	\$/kW	\$/MWh	\$/kWyr
Dave Johnston 1	99	76	\$ 2,970.73	\$ 3.29	\$ 28.18	\$ 339.28	\$ 0.68	\$ 2.24	\$ 800.51	\$ 0.75	\$ 0.98
Dave Johnston 2	106	82	\$ 2,970.73	\$ 3.29	\$ 28.18	\$ 339.28	\$ 0.68	\$ 2.24	\$ 800.51	\$ 0.75	\$ 0.98
Dave Johnston 3	220	169	\$ 2,970.73	\$ 3.29	\$ 28.18	\$ 46.00	\$ 1.25	\$ 1.61	\$ 13.64	\$ 1.09	\$ 0.98
Dave Johnston 4	330	254	\$ 2,970.73	\$ 3.29	\$ 28.18				\$ 13.64	\$ 1.09	\$ 0.98
Jim Bridger 1	531	409	\$ 2,970.73	\$ 3.29	\$ 28.18				\$ 13.64	\$ 1.09	\$ 0.98
Jim Bridger 2	539	415	\$ 2,970.73	\$ 3.29	\$ 28.18				\$ 13.64	\$ 1.09	\$ 0.98
Jim Bridger 3	523	403	\$ 2,970.73	\$ 3.29	\$ 28.18				\$ 13.64	\$ 1.09	\$ 0.98
Jim Bridger 4	526	405	\$ 2,970.73	\$ 3.29	\$ 28.18				\$ 13.64	\$ 1.09	\$ 0.98
Naughton 1	156	120	\$ 2,970.73	\$ 3.29	\$ 28.18	\$ 46.00	\$ 1.25	\$ 1.61	\$ 13.64	\$ 1.09	\$ 0.98
Naughton 2	201	155	\$ 2,970.73	\$ 3.29	\$ 28.18	\$ 46.00	\$ 1.25	\$ 1.61	\$ 13.64	\$ 1.09	\$ 0.98
Wyodak	335	258	\$ 2,970.73	\$ 3.29	\$ 28.18				\$ 13.64	\$ 1.09	\$ 0.98

- Costs are incremental to the generating unit



Existing Generating Facilities

Plant / Unit	Net Dependable Capacity	Post CC Capacity	Total		
			Capital	Variable O&M	Fixed O&M
	MW	MW	\$/kW	\$/MWh	\$/kWyr
Dave Johnston 1	99	76	\$ 4,111	\$ 4.72	\$ 31.39
* Dave Johnston 2	106	82	\$ 4,111	\$ 4.72	\$ 31.39
Dave Johnston 3	220	169	\$ 3,030	\$ 5.63	\$ 30.76
* Dave Johnston 4	330	254	\$ 2,984	\$ 4.38	\$ 29.15
* Jim Bridger 1	531	409	\$ 2,984	\$ 4.38	\$ 29.15
Jim Bridger 2	539	415	\$ 2,984	\$ 4.38	\$ 29.15
* Jim Bridger 3	523	403	\$ 2,984	\$ 4.38	\$ 29.15
* Jim Bridger 4	526	405	\$ 2,984	\$ 4.38	\$ 29.15
* Naughton 1	156	120	\$ 3,030	\$ 5.63	\$ 30.76
Naughton 2	201	155	\$ 3,030	\$ 5.63	\$ 30.76
* Wyodak	335	258	\$ 2,984	\$ 4.38	\$ 29.15

- Costs are incremental to the generating unit



Existing Generating Facilities

- Units selected
 - A FEED study is in progress on Dave Johnston Unit 2
 - Feasibility studies have been carried out on Dave Johnston Unit 4 and this unit does not require additional emission controls
 - Jim Bridger Unit 1 is slated for the soonest closure
 - SCR is already installed on Jim Bridger Units 3 and 4
 - Naughton Units 1 and 2 are combined to meet the minimum capacity for economies of scale
 - Wyodak is a single unit facility and does not require additional emission controls
- Units not selected
 - Dave Johnston Unit 1 is the smaller of Units 1 and 2 and is not undergoing a FEED study
 - Dave Johnston Unit 3 has a federally enforceable closure commitment (in 2027)
 - Jim Bridger Units 1 and 2 are similar in size and Jim Bridger Unit 2 is slated to retire later than Unit 1

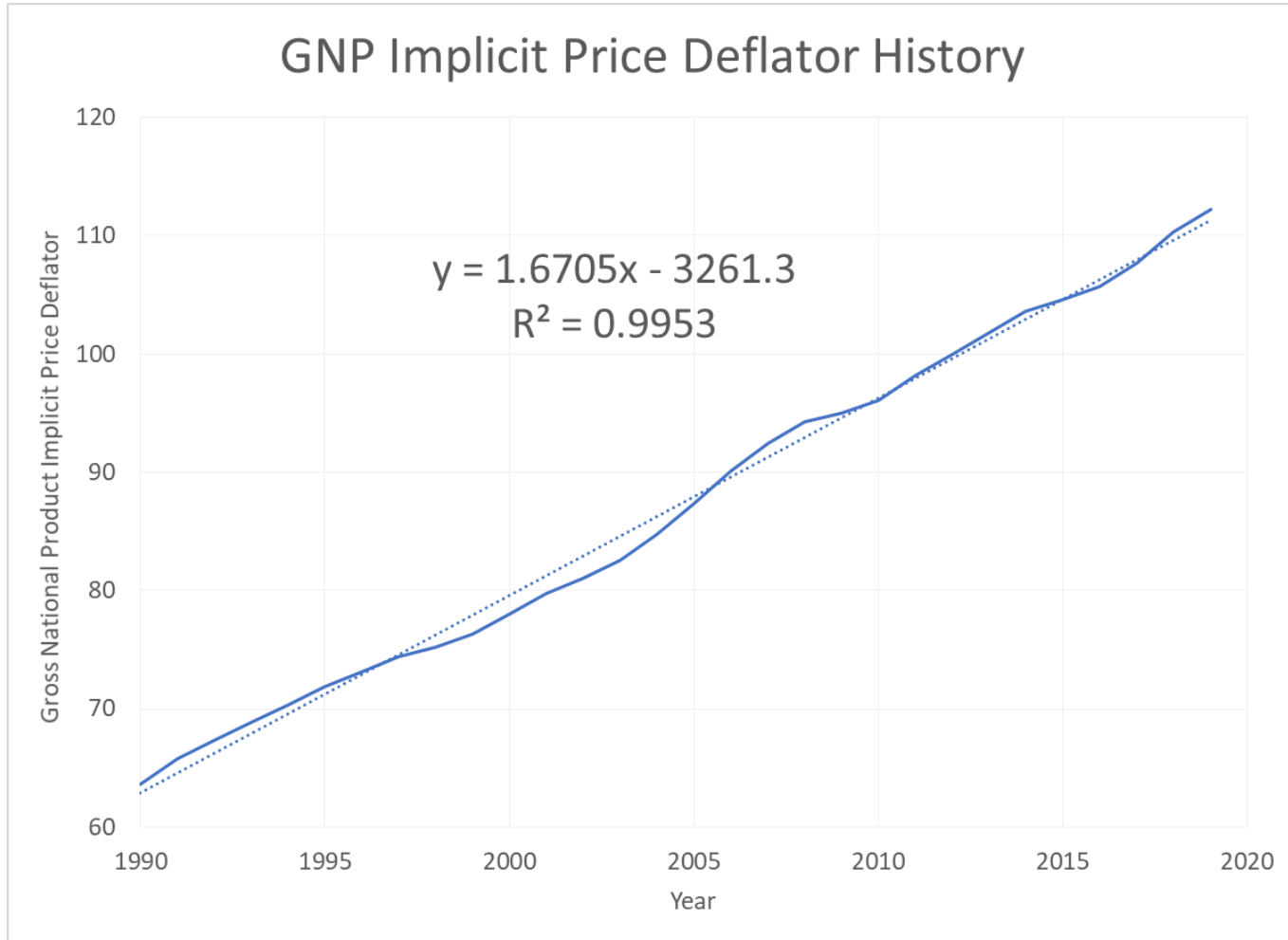


45Q Tax Credit

- Requirements
 - Credit Life: 12 Years
 - Construction must start by: January 1, 2024
 - Carbon dioxide minimum capture: 500,000 tonnes/year
- Two Options for 45Q Tax Credits
 - Enhanced Oil Recovery – \$35/tonne in 2026
 - Sequestration – \$50/tonne in 2026
- Adjusted by Gross National Product Implicit Price Deflator



45Q Tax Credit





45Q Tax Credit

- Linear Regression
- Source
 - Dept. of Commerce, Bureau of Economic Analysis
 - Table 1.1.9. Implicit Price Deflators for Gross Domestic Product
 - apps.bea.gov/iTable/iTable.cfm?reqid=19&step=3&isuri=1&1921=survey&1903=13#reqid=19&step=3&isuri=1&1921=survey&1903=13
 - October 29, 2020

Credit Life	Year	EOR	Sequestration
		\$/tonne	\$/tonne
1	2026	\$ 35.00	\$ 50.00
2	2027	\$ 35.68	\$ 50.97
3	2028	\$ 36.38	\$ 51.96
4	2029	\$ 37.10	\$ 53.00
5	2030	\$ 37.84	\$ 54.06
6	2031	\$ 38.61	\$ 55.16
7	2032	\$ 39.41	\$ 56.30
8	2033	\$ 40.24	\$ 57.48
9	2034	\$ 41.09	\$ 58.70
10	2035	\$ 41.97	\$ 59.95
11	2036	\$ 42.88	\$ 61.25
12	2037	\$ 43.82	\$ 62.60
	2038	\$ 44.79	\$ 63.99
	2039	\$ 45.80	\$ 65.43
	2040	\$ 46.84	\$ 66.92
	2041	\$ 47.92	\$ 68.45

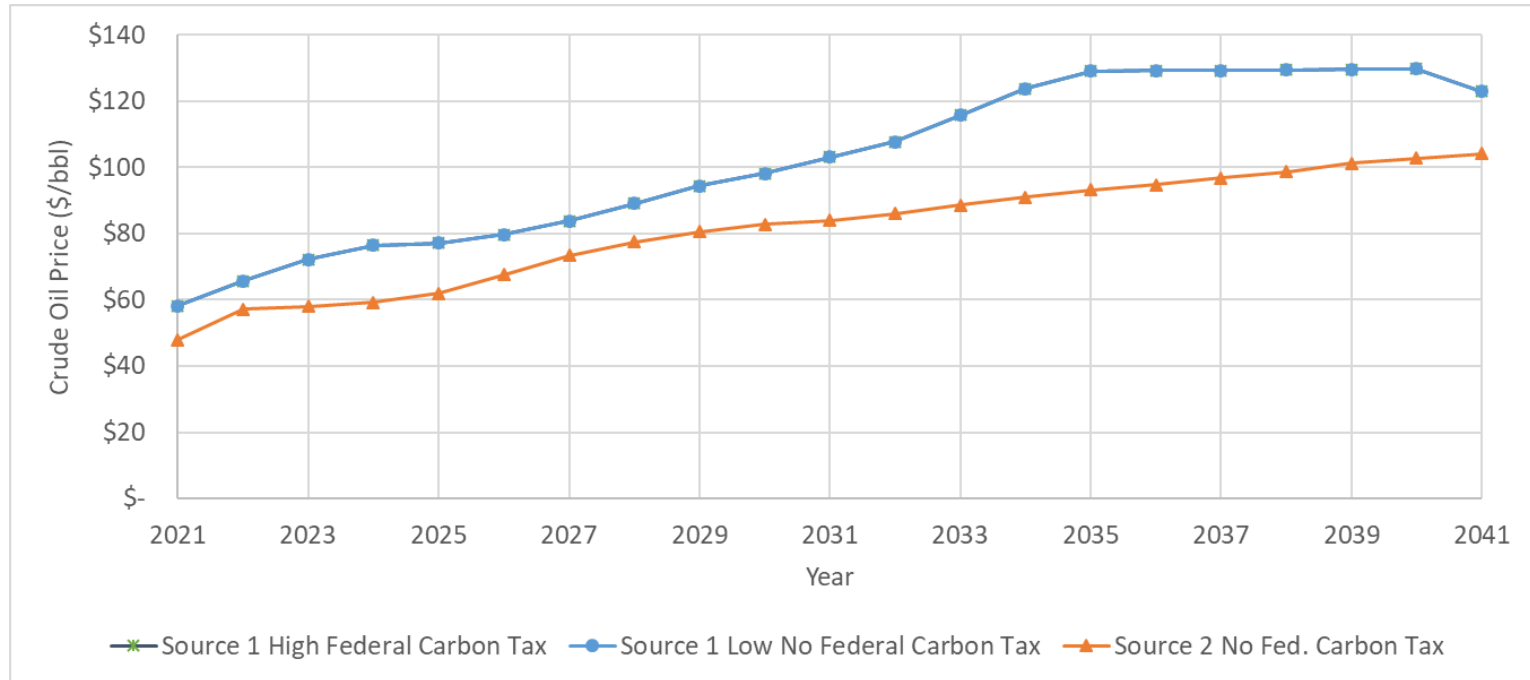


Oil Price Forecast

- Energy Information Administration (EIA) (Wyoming Crude Oil First Purchase Price)
 - January to August 2020 average – \$31.91/bbl
- Longforecast.com (West Texas Intermediate (WTI) Crude)
 - November 2020 – \$36.65/bbl
- World Bank Commodity Markets Outlook
 - 2021 – \$44.00/bbl
- EIA Short-term Energy Outlook
 - 2021 – \$44.24/bbl
- IRP natural gas information sources – 2020
 - Source A – \$35.98/bbl
 - Source B – \$38.87/bbl



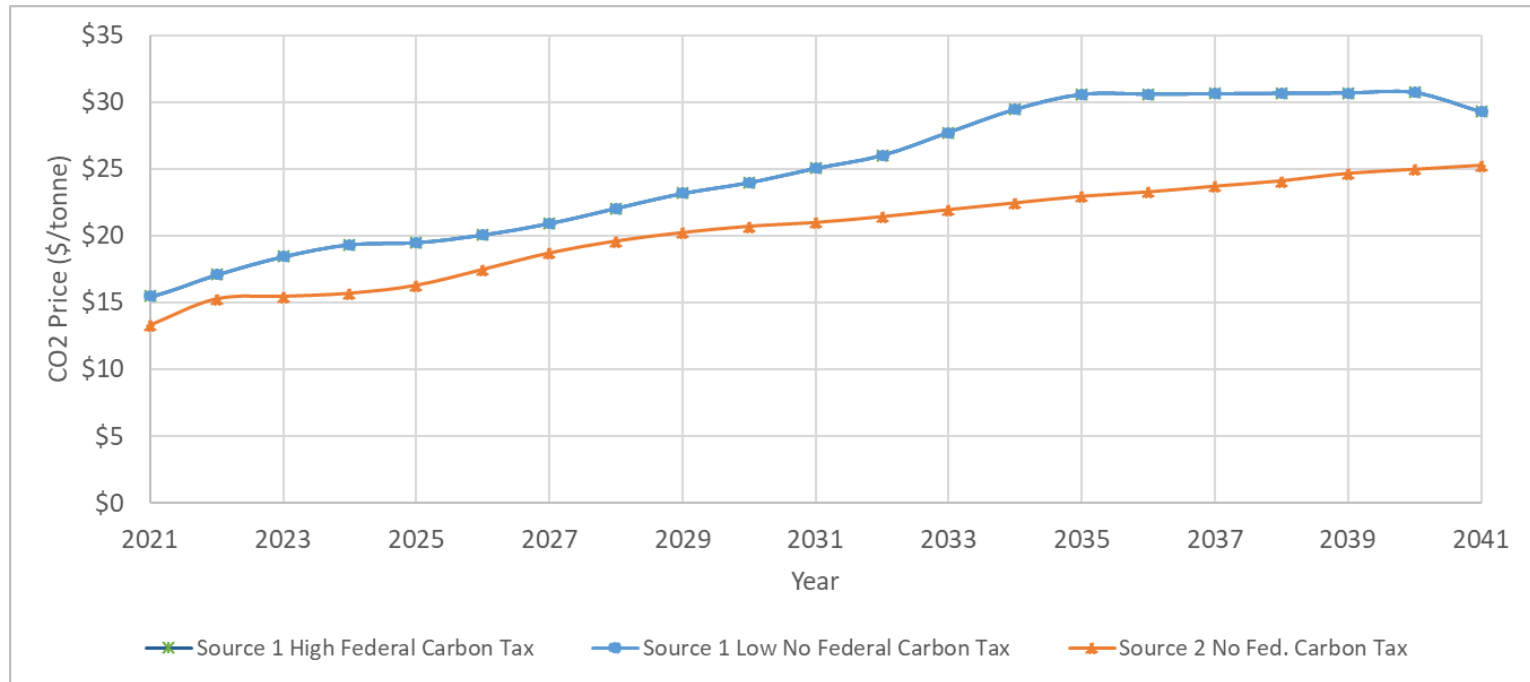
Oil Price Forecast



- Price Source
 - Same two sources used for natural gas prices for a total of three cases
 - Without federal carbon tax – Source 1 and Source 2
 - With federal carbon tax – Source 1
 - Source 1 prices for oil with and without federal carbon tax were the same



CO₂ Revenue Price Forecast For EOR



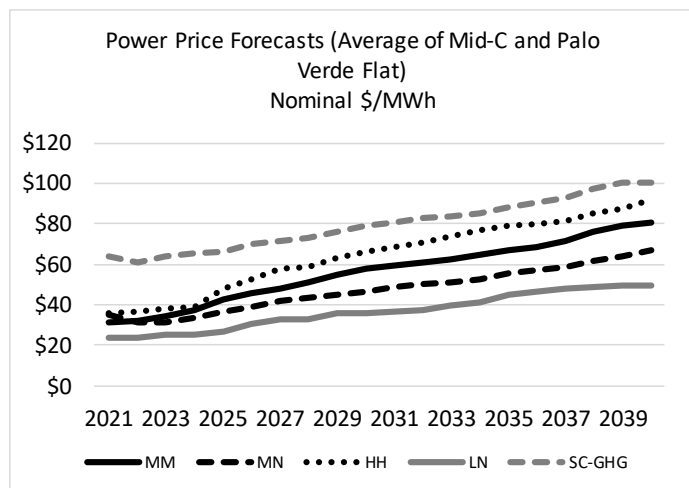
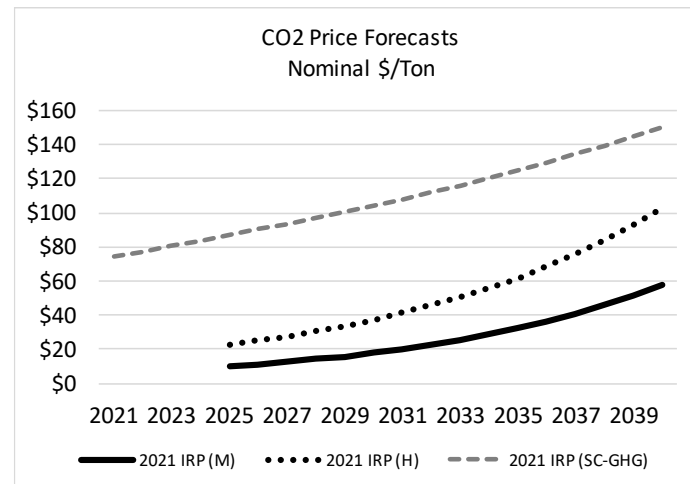
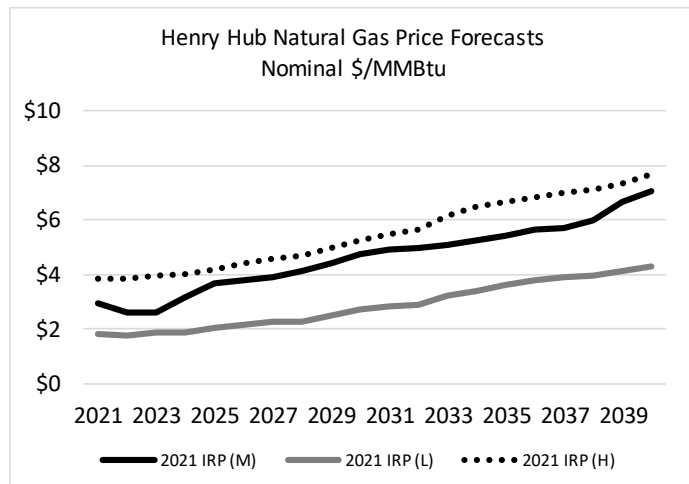
- CO₂ revenue price forecast assumptions are from Wyoming's Carbon Capture Utilization and Storage (CCUS) Study's linear regression from natural CO₂ prices and WTI crude oil prices.



Price Curve and Customer Preference Assumptions



Price-Policy Scenario Update

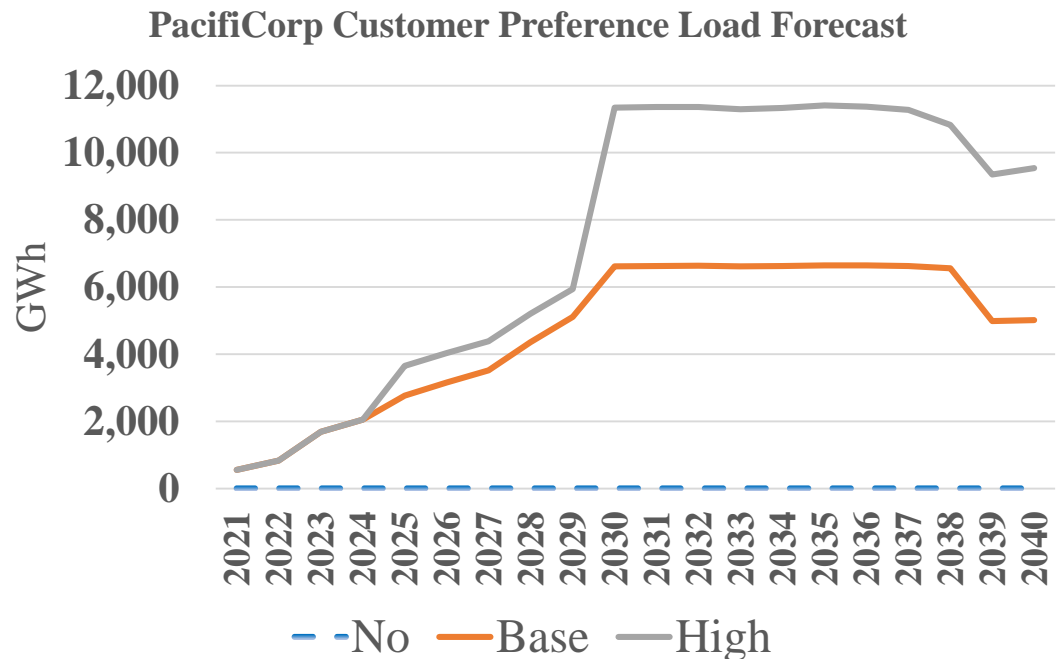


- The information here is consistent with the assumptions presented at the November 2020 public-input meeting
- The power price forecasts for the five price-policy scenarios being considered in the 2020 IRP have been completed (only the “MN” scenario was presented in the November 2020 materials)
- Note, the base assumption for the SC-GHG price-policy scenario is that it will drive portfolio outcomes, that once established will operate in an MM price-policy market environment

Accounting for Customer Preference



- Customer Preference load forecasts estimate load from customers and communities that seek to meet renewable energy targets with incremental renewable resources beyond the anticipated fuel mix for all customers
- The base case assumes a certain percentage of load attributable to preference customers is met with incremental renewables, depending on the customer/community and maturity of incremental renewable programming
- 2021 IRP runs will also include a “no customer preference” sensitivity (reflecting no incremental renewable adds addressing customer preference) and a high sensitivity (reflecting greater customer preference load met with renewables)



Accounting for Customer Preference, cont.



- The majority of customer preference load is attributed to communities and customers that have signaled specific target dates for reaching renewable energy goals and may participate in an incremental renewables offering
- In Pacific Power territory, OPUC has begun a regulatory process to explore programming to address community renewable goals
- In Rocky Mountain Power territory, Utah has three specific renewable tariffs in place to facilitate customer preference renewable resources; ID and WY do not currently have renewable tariffs, but large special contract customers may seek respective state commission approval for specific renewable solutions
- Customer preference forecasts are developed assuming customers account for system renewables



2021 IRP Transmission Option Assumptions



Endogenous Transmission Modeling



- Plexos modeling allows endogenous selection of incremental transmission construction to connect areas with resource surplus to areas where load needs to be served
- New to the 2021 IRP is the option for the Plexos model to endogenously select construction of the Boardman-Hemingway (B2H) 500 kV line to support the resource selection process
- The IRP group is currently testing endogenous inclusion of remaining Gateway options
- Existing generators, generators with executed LGIAs and transmission service requests are accounted for in the IRP modeling
- Scopes and costs for incremental transmission upgrade options are high level planning estimates.
- OATT Credit of 20% applied to costs based on PacifiCorp ESM share of monthly coincident peak network load of approximately 80%

Transmission Integration by Location and Capacity Increment (PACW)



IRP Bubble	Added Resource MW		IRP Year	Description of Integration	Affected Topology Path(s)		
	Min	Max			Incremental Capacity (if any)	From Bubble	To Bubble
Portland/N. Coast	1	130	2026	Portland area local reinforcement	-	-	-
	131	580	2030	Portland area (Troutdale) to Albany area 230 kV transmission	450	Portland	Willamette
Willamette	1	615	2026	Albany area local reinforcement	-	-	-
Yakima	1	405	2023	Yakima area local reinforcement	-	-	-
	406	585	2027	Yakima area 230 kV transmission	-	-	-
	586	685	2027	Yakima area 230 kV transmission	-	-	-
	686	835	2032	Yakima area to Bend area 230 kV transmission	1500	Yakima	Central Oregon
	836	1490	2037	Bend area to Willemette Valley 230 kV transmission	1500	Central Oregon	Willamette
Walla Walla	1	100	2026	Walla Walla area to Yakima 230 kV transmission	200	Walla Walla	Yakima
Southern Oregon	1	500	2023	Medford area 500-230 kV and 230 kV reinforcement	-	-	-
	501	960	2027	Medford area 500-230 kV and 230 kV reinforcement	-	-	-
Central Oregon	1	140	2023	Central Oregon area local reinforcement	-	-	-
	141	240	2027	Central Oregon area local reinforcement	-	-	-

Note: The scope and cost of transmission upgrades are planning estimates. Actual scope and costs will vary depending upon the interconnection queue, the transmission service queue, the specific location of any given project and the type of equipment proposed for any given project.

Transmission Integration by Location and Capacity Increment (PACE)



IRP Bubble	Added Resource MW		IRP Year	Description of Integration	Affected Topology Path(s)		
	Min	Max			Incremental Capacity (if any)	From Bubble	To Bubble
Goshen	1	152	2023	Southern Idaho reinforcement	-	-	-
Wyoming East	1	1930	2024	Energy Gateway segments D.1 (Windstar - Shirley Basin 230 kV line) and F (Aeolus-Clover 500 kV transmission line)	1200	Wyoming East	Clover
Utah North	1	245	2023	Northern Utah 345 kV reinforcement	-	-	-
	246	730	2024	Northern Utah 345 kV reinforcement	-	-	-
Utah South	1	256	2024	Utah Valley area 345-138 kV and 138 kV local reinforcement	-	-	-
	257	956	2031	Southern Utah 345 kV reinforcement	800	Utah South	Clover
B2H	1	tbd	2027	Segment H Boardman - Hemingway 500 kV	tbd		

Note: The scope and cost of transmission upgrades are planning estimates. Actual scope and costs will vary depending upon the interconnection queue, the transmission service queue, the specific location of any given project and the type of equipment proposed for any given project.

Energy Gateway

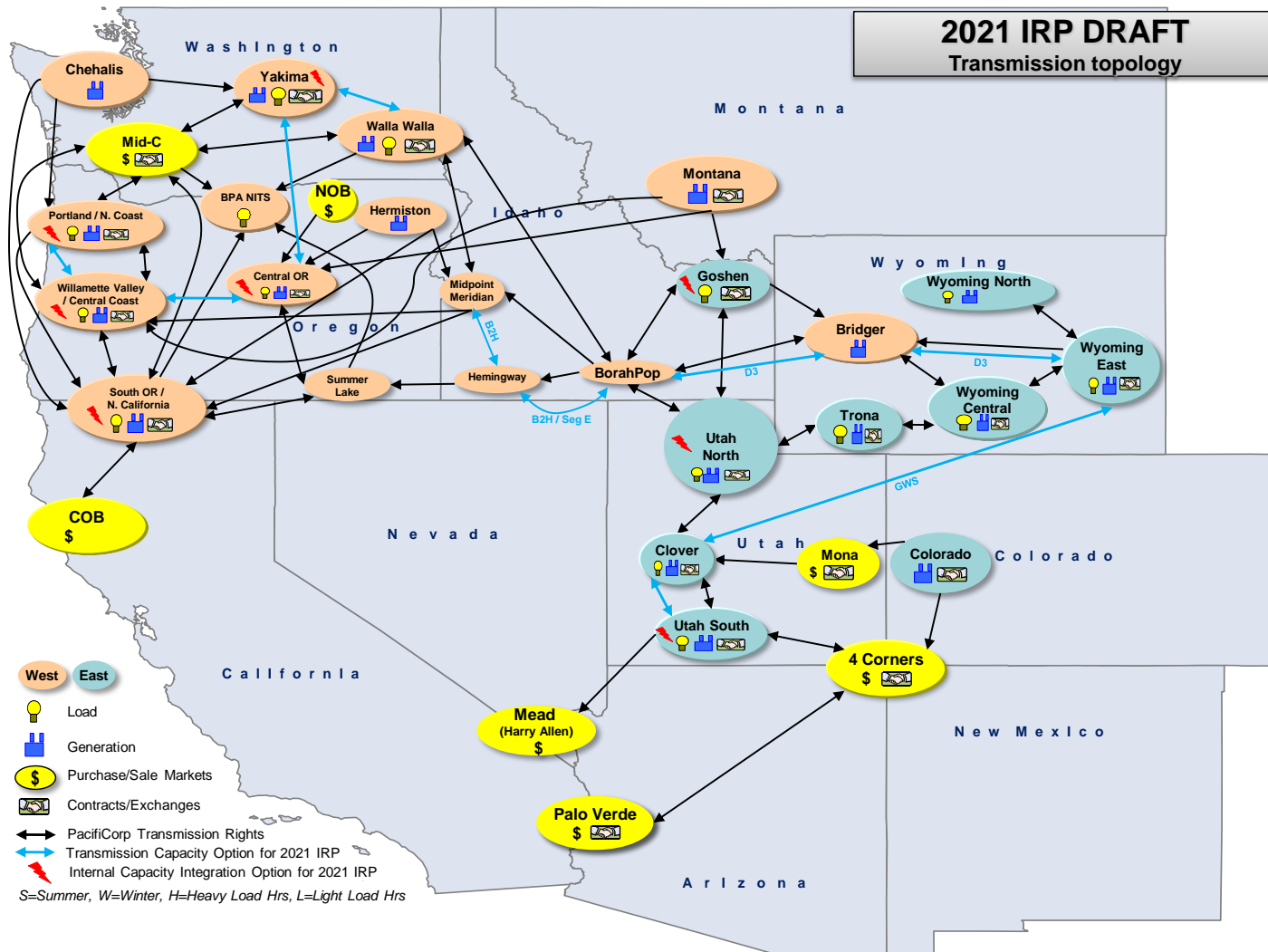


- Endogenous modeling of each of the Energy Gateway Projects in the Long Term Transmission Plan is being tested
- If successful, each option will include incremental transmission over multiple topology links and costs associated with the addition of the Energy Gateway segment(s)
- If the model does not endogenously select some options, they may be run as sensitivities to study cost implications
- Any options that are determined cannot be endogenously modeled due to performance or complexity considerations will be treated as sensitivities, similar to the 2019 IRP



This map is for general reference only and reflects current plans.
It may not reflect the final routes, construction sequence or exact line configuration.

2021 IRP Topology - DRAFT





Stakeholder Feedback Form Update



Stakeholder Feedback Form Update



- 66 stakeholder feedback forms submitted to date (seven since last public input meeting).
- 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 received 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.
- Stakeholder feedback following the previous public input meetings is summarized on the following slides for reference.
- During November 16, public input meeting, PacifiCorp received suggestions to clarify the stakeholder feedback form, that process is underway.

Summary - Recent Stakeholder Feedback Forms



Stakeholder	Date	Topic	Brief Summary (complete form available online)	Response (posted online when available)
Western Resource Advocates (060)	Nov 16, 2020	Transmission Topology	Request to provide incremental transmission topology.	Targeted response the week of November 30.
Oregon Public Utility Commission Staff (061)	Nov 17, 2020	recommended cases/scenarios	Recommendation to include a low market price, high volatility sensitivity in the IRP to determine PAC's optimal portfolio in a future where additional renewables mandates result in more renewables and less gas buildout WECC-wide	Targeted response the week of December 7.
Wyoming Public Service Commission (062)	Nov 18, 2020	Carbon Capture	Request regarding CCS/CCUS technologies	Targeted response the week of December 7.
Oregon Public Service Commission (063)	Nov 18, 2020	Efficiency Measure Bundling	Questions on decision process regarding energy efficiency measure bundling.	Targeted response the week of December 7.

Summary - Recent Stakeholder Feedback Forms



Stakeholder	Date	Topic	Brief Summary (complete form available online)	Response (posted online when available)
Interwest (064)	Nov 25, 2020	Brownfield Transmission, Modeling changes in response to WY proceedings	Questions regarding whether PacifiCorp has made any modeling changes in response to the 2019 Wyoming IRP proceeding or any ongoing proceedings, question regarding network service transmission capacity.	Targeted response the week of December 7.
Washington Utilities and Transportation Commission Staff (065)	Nov 25, 2020	11/16/2020 PIM and DERs	Questions regarding the November PIM; DERs and distribution system planning	Targeted response the week of December 7.
Renewable Northwest (066)	Nov 30, 2020	Supply side resource costs, PLEXOS benchmark updates and power price forecasts.	Recommendations for cost assumptions for supply side resources, recommendation for PLEXOS benchmark updates and results, and a recommendation for a power price forecast input.	Targeted response the week of December 14.



Additional Information/Next Steps



Additional Information



- Public Input Meeting and Workshop Presentation and Materials:
 - pacificorp.com/energy/integrated-resource-plan/public-input-process
- 2021 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

Next Steps



Upcoming Public Input Meeting Dates:

- January 14-15, 2021 – Public Input Meeting
- February 25-26, 2021 – Public Input Meeting
- April 1, 2021 – File the 2021 IRP

**meeting dates are subject to change*