



2017

Integrated Resource Plan

Portfolio Development Detail

September 8, 2016

2017 Portfolio Development Process



- Volume III modeling will inform Regional Haze compliance assumptions used to produce core resource portfolios for existing coal units.
 - PacifiCorp will study five Regional Haze scenarios among a range of market price and future greenhouse gas policy assumptions.
 - PacifiCorp will not allow endogenous coal unit retirements as this functionality cannot be implemented with accurate cost and performance assumptions.
- Core resource portfolios will include an optimized portfolio and supplemental portfolios targeting specific types of resources.
 - Promotes portfolio diversity and eliminates the need for deterministic risk analysis.
 - Allows resources having operating characteristics not valued in System Optimizer to be analyzed in Planning and Risk during the cost and risk analysis phase of the portfolio development process.
- Cost and risk analysis performed using the Planning and Risk model will include market price and future greenhouse gas policy assumptions.
- Sensitivity analysis will be informed by modeling results from core cases.
 - PacifiCorp has preliminarily identified a number of sensitivities, but will consider additional sensitivities and identify the sensitivity “benchmark” case once core case modeling is completed.
 - As appropriate, sensitivity cases can be used to select a preferred portfolio, inform the action plan, and inform acquisition path analysis.

Vol. III: Assumptions Affected by Early Coal Unit Retirements

- Stakeholders requested that PacifiCorp identify the types of assumptions that are affected by early coal unit retirement dates, and therefore, inaccurately represented in the model if endogenous coal unit retirements are allowed.
- Assumptions affected by early retirement include:
 - Coal fuel costs (early closure can affect tonnage requirements that trigger certain coal supply contract provisions that introduce incremental costs, as applicable)
 - Run-rate mine costs (changes to tonnage requirements can affect mining costs, as applicable)
 - Plant run-rate capital costs (timing can influence maintenance outages and scope and allocation of plant common costs among remaining units of a multi-unit facility)
 - Plant run-rate O&M (timing can influence maintenance outages and general operations & maintenance plans along with allocation of common costs among remaining units of a multi-unit facility)
 - Endogenous coal unit retirements would also be expected to result in changes to environmental compliance obligations, associated costs, and performance inputs of remaining units that would not be reflected in underlying data sets absent PacifiCorp's approach to identifying potential inter-temporal trade-off compliance alternatives
- PacifiCorp's approach, which analyzes a range of Regional Haze scenarios defined by specific unit closure dates and alternative emission control technologies, ensures operating cost and performance inputs used for modeling accurately reflect the assumptions of the scenario being analyzed.

Vol. III: Regional Haze Cases

Plant	2015 IRP Update (Pref. Port.)	2017 IRP (Ref. Case)	2017 IRP (Alt. Case RH-1)	2017 IRP (Alt. Case RH-2)	2017 IRP (Alt. Case RH-3)	2017 IRP (Alt. Case RH-4)	2017 IRP (Alt. Case RH-5)
Hunter 1	SCR 2021 Ret. 2042	SCR 2021 Ret. 2042	No SCR;NO _x + 2021 Ret. 2042	No SCR Ret. 2031	No SCR;NO _x + 2026 Ret. 2042	SCR 2021 ⁽¹⁾ Ret. 2042	RH-1
Hunter 2	No SCR Ret. 2032	SCR 2021 Ret. 2042	No SCR;NO _x + 2021 Ret. 2042	No SCR Ret. 2031	No SCR;NO _x + 2027 Ret. 2042	No SCR;NO _x + 2027 ⁽¹⁾ Ret. 2042	RH-1
Huntington 1	SCR 2022 Ret. 2036	SCR 2021 Ret. 2036	No SCR Ret. 2036	No SCR Ret. 2036	No SCR;NO _x + 2026 Ret. 2036	SCR 2021 ⁽²⁾ Ret. 2036	RH-1
Huntington 2	No SCR Ret. 2029	SCR 2021 Ret. 2036	No SCR Ret. 2036	No SCR Ret. 2036	No SCR;NO _x + 2027 Ret. 2036	No SCR;NO _x + 2027 ⁽²⁾ Ret. 2036	RH-1
Jim Bridger 1	SCR 2022 Ret. 2037	SCR 2022 Ret. 2037	No SCR Ret. 2032	No SCR Ret. 2024	No SCR Ret. 2028	No SCR;NO _x + 2022 ⁽¹⁾ Ret. 2032	RH-3
Jim Bridger 2	SCR 2021 Ret. 2037	SCR 2021 Ret. 2037	No SCR Ret. 2035	No SCR Ret. 2028	No SCR Ret. 2032	SCR 2021 ⁽¹⁾ Ret. 2037	RH-3
Naughton 3	No Gas Conv. Ret. 2017	Gas Conv. 2019 ⁽³⁾ Ret. 2029	No Gas Conv. Ret. 2017	Gas Conv. 2019 ⁽³⁾ Ret. 2029	No Gas Conv. Ret. 2017	Gas Conv. 2019 ⁽³⁾ Ret. 2029	RH-2
Cholla 4	Gas Conv. 2025 Ret. 2042	Gas Conv. 2025 Ret. 2042	No Gas Conv. Ret. Apr-2025	No Gas Conv. Ret. 2020	No Gas Conv. Ret. Apr-2025	No Gas Conv. Ret. Apr-2025	RH-2
Craig 1	SCR 2021 Ret. 2034	SCR 2021 Ret. 2034	No SCR Ret. 2025	Gas Conv. 2023 ⁽⁴⁾ Ret. 2034	No SCR Ret. 2025	No SCR Ret. 2025	RH-1

- 1) The Alternative Regional Haze Cases for Hunter Units 1 and 2 and Jim Bridger Units 1 and 2 have been developed for analysis purposes only with consideration given to the fact that the emissions profiles for the units are effectively identical in the Regional Haze context. The compliance actions for the units in this scenario could effectively be swapped and provide the same Regional Haze compliance outcome. The matrix presentation of different compliance actions between the units is necessary for analysis data preparation, but does not dictate or represent pre-determined individual partner plant owner strategies or preferences or individual unit strategies or preferences.
- 2) The Alternative Regional Haze Cases for Huntington Units 1 and 2 have been developed for analysis purposes only with consideration given to the fact that the emissions profiles for the units are effectively identical in the Regional Haze context. The compliance actions for the units in this scenario could effectively be swapped and provide the same Regional Haze compliance outcome. The matrix presentation of different compliance actions between the units is necessary for analysis data preparation, but does not dictate or represent pre-determined individual unit strategies or preferences.
- 3) Naughton 3 will cease coal fueled operation by year-end 2017, under this scenario.
- 4) Craig 1 will cease coal fueled operation by end of August 2021, under this scenario.

Vol. III: Market Price and GHG Policy Scenarios

Natural Gas Prices	GHG Policy
Low	CPP Mass Cap A
Sep 2016 OFPC	CPP Mass Cap A
High	CPP Mass Cap A
Low	CPP Mass Cap B + CO ₂ Price
Sep 2016 OFPC	CPP Mass Cap B + CO ₂ Price
High	CPP Mass Cap B + CO ₂ Price

- Each Regional Haze case will be analyzed among six different market price and GHG policy scenarios.
 - Three natural gas price scenarios with corresponding wholesale electricity price forecasts.
 - Two GHG policy scenarios:
 - CPP Mass Cap A = EPA’s mass-based FIP with pro-rata allocation of set-asides to PacifiCorp
 - CPP Mass Cap B + CO₂ Price = EPA’s mass-based FIP, no set-asides allocated to PacifiCorp, new source complement paired with CO₂ price assumption as used in the 2015 IRP (~\$22/ton in 2020 and reaching ~\$86/ton by 2036)
- Resource portfolios will be optimized among each Regional Haze case and each market price/GHG policy scenario.

Core Cases: Overview

- Volume III studies will be used to establish Regional Haze assumptions for existing coal units.
 - Addresses stakeholder feedback (ODOE) from the 2015 IRP recommending that core cases be compared among common Regional Haze assumptions.
 - Emission control equipment installations and costs, early retirement assumptions, and associated run-rate operating costs.
 - Once Volume III studies and initial core case studies are completed, additional Regional Haze sensitivities may be studied.
- Limited number of core case portfolios (6) that achieve resource diversity by targeting specific types of resources among different cases.
 - Allows resources having operating characteristics not valued in System Optimizer to be analyzed in Planning and Risk during the cost and risk analysis phase of the portfolio development process.
 - Simplified set of planning assumptions for portfolio development purposes.
 - Broader set of planning assumptions for cost and risk analysis.
 - Eliminates the need for deterministic risk analysis.

Core Cases: Summary

Resource Class	Case 1 (OP-1)	Case 2 (FR-1)	Case 3 (FR-2)	Case 4 (RE-1)	Case 5 (RE-2)	Case 6 (DLC-1)
Flexible Resources	Optimized	10% of Incremental L&R Balance	20% of Incremental L&R Balance	10% -20% of Incremental L&R Balance	10%-20% of Incremental L&R Balance	Optimized
Renewable Resources	Optimized	Optimized	Optimized	Just-in-Time Physical RPS Compliance	Early Physical RPS Compliance	Just-in-Time Physical RPS Compliance
Class 1 DSM Resources	Optimized	Optimized	Optimized	Optimized	Optimized	5% of Incremental L&R Balance
All Other Resources	Optimized	Optimized	Optimized	Optimized	Optimized	Optimized

- Base planning assumptions for each case:
 - September 2016 official forward price curve.
 - Clean Power Plan using EPA's mass-based FIP with pro-rata allocation of set-asides to PacifiCorp
- Additional market price and GHG policy assumptions will be analyzed in the cost and risk analysis phase of the process.
- Additional Clean Power Plan assumptions will be analyzed as sensitivities.

Core Cases: Descriptions

- **Case 1: Optimized Portfolio (OP-1)**
 - All resources optimized (selected endogenously by System Optimizer)
 - Same approach used in prior IRPs
- **Case 2: Flexible Resources (FR-1)**
 - Beginning the first year a new thermal resource is added from Case 1 (OP-1), at least 10% of the system L&R need will be met with fast ramp resource capacity.
 - Fast-ramp resources available for selection include: SCCT Aero (i.e., LM6000); Intercooled SCCT Aero (i.e., LMS100); IC Reciprocating Engines; pumped storage, compressed air energy storage, and battery storage.
- **Case 3: Flexible Resources (FR-2)**
 - Beginning the first year a new thermal resource is added from Case 1 (OP-1), at least 20% of the system L&R need will be met with fast ramp resource capacity.
 - Fast-ramp resources available for selection include: SCCT Aero (i.e., LM6000); Intercooled SCCT Aero (i.e., LMS100); IC Reciprocating Engines; pumped storage, compressed air energy storage, and battery storage.

Core Cases: Descriptions (Cont'd)

- **Case 4: Renewable Energy (RE-1)**
 - Renewable resources added to physically comply with projected Oregon and Washington RPS requirements, after accounting for endogenous selection of any new renewable resources, beginning the first year in which there is a projected compliance shortfall.
 - Renewable resources available for selection include wind and solar resource options.
 - Flexible resource targets as in Case 2 (FR-1).
- **Case 5: Renewable Energy (RE-2)**
 - Renewable resources added beginning 2020 to comply with projected Oregon and Washington RPS requirements through the planning period, after accounting for any endogenous selection of new renewable resources.
 - Renewable resources available for selection include wind and solar resource options.
 - Flexible resource targets as in Case 2 (FR-1).
- **Case 6: Direct Load Control (DR-1)**
 - Beginning the first year a new thermal resource is added from Case 1 (OP-1), at least 5% of the system L&R need, but no more than market potential, will be met with Class I DSM resources.
 - Renewable resource assumptions as in Case 4 (RE-1).

Cost & Risk: Market Price and GHG Policy Scenarios

Natural Gas Prices	GHG Policy
Low	CPP Mass Cap A
Sep 2016 OFPC	CPP Mass Cap A
High	CPP Mass Cap A
Low	CPP Mass Cap B + CO ₂ Price
Sep 2016 OFPC	CPP Mass Cap B + CO ₂ Price
High	CPP Mass Cap B + CO ₂ Price

- Each core case portfolio will be analyzed among six different market price and GHG policy scenarios in Planning & Risk (PaR).
 - Three natural gas price scenarios with corresponding wholesale electricity price forecasts
 - Two GHG policy scenarios
 - CPP Mass Cap A = EPA's mass-based FIP with pro-rata allocation of set-asides to PacifiCorp
 - CPP Mass Cap B + CO₂ Price = EPA's mass-based FIP, no set-asides allocated to PacifiCorp, new source complement paired with CO₂ price assumption as used in the 2015 IRP (~\$22/ton in 2020 and reaching ~\$86/ton by 2036)
- Results will be assessed with initial portfolio rankings before initiating sensitivity case runs.

Sensitivity Analysis: Preliminary List of Cases

- PacifiCorp has preliminarily identified a number of sensitivities, but will consider additional sensitivities and identify the sensitivity “benchmark” case once core case modeling is completed.
- As appropriate, sensitivity cases can be used to select a preferred portfolio, inform the action plan, and inform acquisition path analysis.
- The preliminary list of sensitivity cases is outlined below:
 - Delayed Clean Power Plan (CPP)
 - CPP with set-asides but no allocation to PacifiCorp
 - CPP with new source complement but no allocation to PacifiCorp
 - Storage (if not selected in core case portfolios)
 - Constrained Market (limits on FOTs)
 - Energy Gateway Transmission
 - East/West Split
 - Washington Clean Air Rule
 - Washington PM2.5 Externality (Applies to Chehalis)
 - Load Growth (Low / High / I in 20)
 - Private Generation (Low / High)
 - Business Plan (Pending UT Commission Order)

Next Steps

- Continued stakeholder discussion regarding portfolio development will occur at the September 22-23, 2016 public input meeting.
- For feedback or comments submitted prior to the next public input meeting, please submit a stakeholder feedback form by September 15, 2016 to the IRP email address:
 - Link to 2017 IRP stakeholder feedback form:
<http://www.pacificorp.com/es/irp/irpcomments.html>
 - Email stakeholder feedback forms to:
 - IRP@PacifiCorp.com