



2015
Integrated
Resource
Plan
Update
REDACTED
Appendix B
*Let's turn the answers **on.***

March 31, 2016



Pacific Power
Rocky Mountain Power

This 2015 Integrated Resource Plan Update Report is based upon the best available information at the time of preparation. The IRP action plan will be implemented as described herein, but is subject to change as new information becomes available or as circumstances change. It is PacifiCorp’s intention to revisit and refresh the IRP action plan no less frequently than annually. Any refreshed IRP action plan will be submitted to the State Commissions for their information.

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Solar: Residential Solar Install

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Demand-Side Management: Wattsmart Flower

Thermal-Gas: Lake Side 1

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CONFIDENTIAL APPENDIX B – NAUGHTON UNIT 3 ANALYSIS

Executive Summary

Consistent with action item 4a in the 2015 IRP action plan PacifiCorp has updated its analysis of regional haze compliance alternatives for the Naughton Unit 3 coal-fueled generating facility. This updated analysis also satisfies the request by the Public Utility Commission of Oregon (OPUC) in its 2015 IRP acknowledgement order.¹ The analysis incorporates updates to forecasted loads, resources, market prices, and other modeling inputs. The studies also reflect updated costs that are specific to gas conversion of Naughton Unit 3, including the cost to procure gas transportation and the most recent cost estimates for engineering, procurement, and construction (EPC) to convert the unit to operate as a gas-fired facility.

The Naughton plant is located near Kemmerer, Wyoming. Unit 3 of the three-unit plant is owned and operated by PacifiCorp and was commissioned in 1971. Naughton Unit 3 has a capacity of 330 MW. In its final action, EPA indicated support for the conversion of Naughton Unit 3 to natural gas and that it would expedite action relative to consideration of the gas conversion once the state of Wyoming submitted the requisite state implementation plan (SIP) amendment. PacifiCorp has obtained a construction permit and revised regional haze BART permit from the state of Wyoming to convert Naughton Unit 3 to natural gas in 2018. Wyoming has not yet submitted a revised regional haze SIP incorporating this alternative compliance approach to EPA.

PacifiCorp's updated analysis compares early retirement at the end of 2017 to the natural gas conversion of Naughton Unit 3 by mid-2018 across a range of scenarios. This analysis shows that the early retirement alternative is lower cost than the assessed natural gas conversion alternative. However, recognizing that Naughton Unit 3 is an important generation resource to the state of Wyoming and PacifiCorp's customers, PacifiCorp will continue to review emerging technologies, re-assess traditional gas conversion technologies and costs, and consider other potential alternatives that could be applied to Naughton Unit 3 to allow continued operation beyond year-end 2017.

Naughton Unit 3 Compliance Alternatives

Compliance Timeline

PacifiCorp has considered an early retirement compliance alternative to the planned 2018 natural gas conversion of Naughton Unit 3. Timelines for the natural gas conversion and early retirement alternative are discussed below.

¹ Order No. 16-071 in PacifiCorp's 2015 Integrated Resource Plan, Docket LC 62, dated February 29, 2016.

Natural Gas Conversion

A schedule to convert Naughton Unit 3 to 100 percent natural gas fueling is presented in Attachment B-I, Figure B-I.1. The implementation schedule assumes the unit would be converted to natural gas fueling in 2018 after coal fueling is discontinued December 31, 2017. Thereafter, a five-month tie-in outage is planned. The following scope of work is anticipated to be required:

- Installing new low oxides of nitrogen natural gas burner system;
- Main windbox modifications;
- Modifying the boiler flame scanner system;
- Installing new boiler burner front natural gas piping;
- Installing an induced flue gas recirculation system, provided to reduce oxides of nitrogen and carbon monoxide emissions;
- Potential air preheater basket modifications;
- Flue gas ductwork and equipment modifications;
- Potential boiler and flue gas path equipment structural reinforcement;
- Electrical and control system modifications; and
- Installing a natural gas delivery system.

Early Retirement

A schedule for an early retirement scenario of Naughton Unit 3 by an assumed date of January 1, 2018 is presented in Attachment B-I, Figure B-I.2. Unit retirement work would include:

- Unit 3 will be decommissioned and cleaned of all fluids;
- All hazardous materials will be removed and properly disposed of;
- Demolition, removal and disposal of electric generating equipment and ancillary systems will occur after 2029 when Units 1 and 2 are retired; and
- Reclamation and final closure of the site.

Naughton Unit 3 Analysis

Methodology

Present value revenue requirement differential (PVRR(d)) analyses are used to quantify the benefit or cost of regional haze environmental compliance alternatives relative to a benchmark. In the case of Naughton Unit 3, a natural gas conversion is compared to an early retirement alternative benchmark. The PVRR(d) for a given environmental compliance alternative is calculated as the difference in system costs between two System Optimizer model simulations—a benchmark simulation and a simulation for an alternative compliance scenario.

This confidential appendix presents the updated studies on the compliance alternatives of Naughton Unit 3 that were provided in PacifiCorp's 2015 IRP. The updated studies reflect the changes in load forecast, market prices, existing resources, as well as the costs to convert the unit. The studies are performed under different emission compliance scenarios: without Clean Power Plan (CPP) emission control constraints and with CPP emission control constraints that

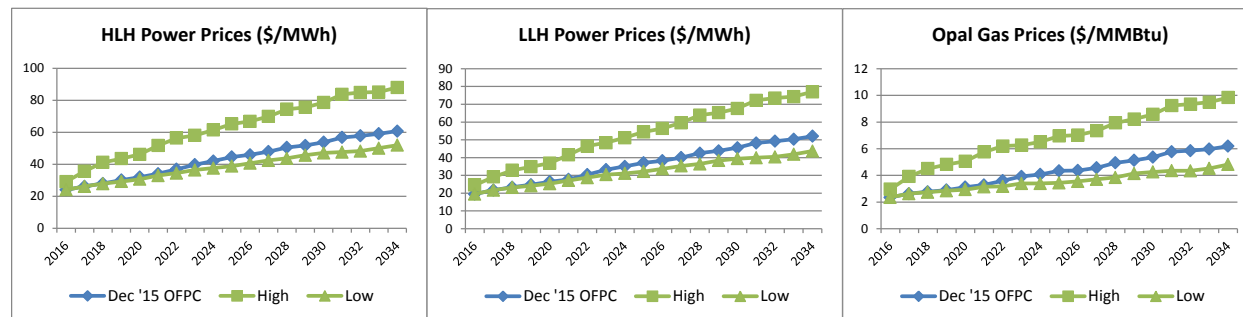
are consistent with EPA’s mass-based federal implementation plan proposed for the CPP. Two book-end CPP assumptions are implemented in the studies: one assumes that PacifiCorp would not be able to receive set-aside incentives that encourage early development of renewable resources (“FIP” mass-cap), while the other assumes PacifiCorp would be able to receive these allowance set-asides, which would result in less stringent emission mass-cap constraints (“Set-aside” mass-cap). Table B.1 shows PacifiCorp’s share of emission mass-cap goals that would be applicable to PacifiCorp’s affected units.² The mass-cap constraints are implemented by applying a company-wide cap on emissions of the affected units.

Table B.1 – CPP Emission Mass-Cap Assumptions (thousand short tons)

	2022	2023	2024	2025	2026	2027	2028	2029	2030
“FIP”	42,441	40,779	38,626	41,063	40,095	38,930	38,184	37,376	36,482
“Set-aside”	47,905	46,155	43,889	42,948	41,929	40,702	39,917	39,066	38,126

The Naughton Unit 3 compliance analysis was performed using medium, high and low price curve scenarios. The medium price scenario is based on PacifiCorp’s December 2015 official forward price curve (OFPC), consistent with medium price assumptions used to develop the portfolio for the 2015 IRP Update. Figure B.1 summarizes heavy load hour (HLH) and light load hour (LLH) wholesale power prices and natural gas prices assumed for this analysis.³

Figure B.1 – Naughton Unit 3 Forward Price Curve Assumptions



*Note, for presentation purposes, power prices reflect the average of Mid-Columbia and Palo Verde prices. Opal is the natural gas market hub most applicable to natural gas conversion alternatives studied in the Naughton Unit 3 analysis.

Annual Non-fuel Expenditure Assumptions

Annual non-fuel planned expenditures include environmental capital costs, run-rate capital costs, run-rate operation and maintenance (O&M) costs, fixed firm natural gas transportation costs, and natural gas [REDACTED] costs, as applicable. In addition, liquidated damage (LD) costs associated with the existing coal supply agreement (CSA), which extends through 2021, are included in PacifiCorp’s analysis. Detailed annual non-fuel planned expenditures for the Naughton Unit 3 natural gas conversion and early retirement compliance alternatives are provided in Attachment B-II.

² Cholla Unit 4 is excluded based on the assumption that PacifiCorp’s share of mass-cap in the state of Arizona is sufficient to cover the emission from the unit during limited time period.

³ HLH prices cover to hours ending 7 through 22 PPT, Monday through Saturday, excluding NERC holidays. LLH prices cover all other hours.

The 2018 Naughton Unit 3 natural gas conversion case includes [REDACTED] in 2018 run-rate capital expenditures to complete the conversion and further includes annual fixed costs for natural gas transportation, including levelized costs for a new pipeline lateral, which would be required to transport natural gas from [REDACTED] to the Naughton plant.⁴

Under either the 2018 natural gas conversion or the 2018 early retirement case, PacifiCorp would be subject to LD payments under an existing CSA between PacifiCorp and Westmoreland Kemmerer, Inc. that provides for coal deliveries to the Naughton plant from January 1, 2017 through December 31, 2021. LD payments applicable to either alternative total [REDACTED] over the period 2018 through 2021.

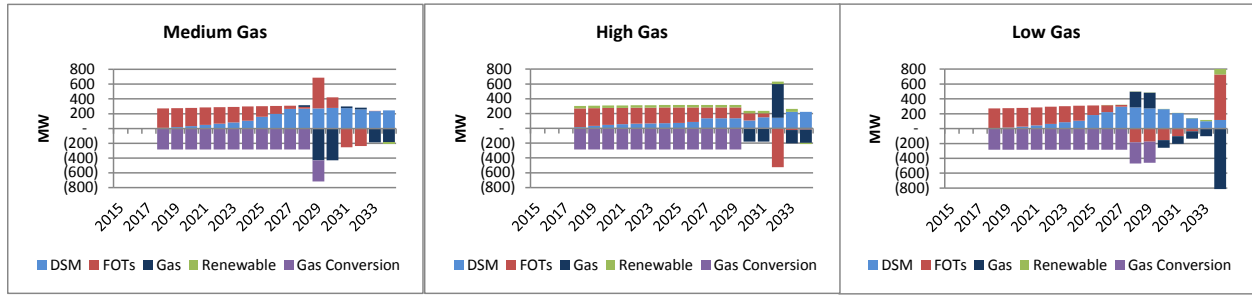
Resource Portfolio Results

In the 2018 early retirement case, the loss of Naughton Unit 3 creates an incremental capacity need beginning in the summer of 2018, which drives the need for replacement resources over the 2018 to 2034 timeframe. Figure B.2 summarizes the cumulative change in resource portfolio capacity when Naughton Unit 3 is retired at the end of 2017 as compared to the unit being converted to natural gas by June 2018, and under the “FIP” mass-cap constraint. Positive values show cumulative resource portfolio additions and negative values show the cumulative capacity of resources that are removed from the portfolio when Naughton Unit 3 retires at end of 2017. Notable resource portfolio changes resulting from an early retirement relative to conversion include:

- In the medium natural gas price scenario:
 - Prior to 2028 and after Naughton Unit 3 is assumed to retire at the end of 2017 as opposed to being converted to gas fueled unit, front office transactions (FOTs) and demand side management resources (DSM) fill the capacity resource needs.
 - 2028 onwards, given that significant amount of DSM has been added to the system, combined cycle combustion turbines (CCCTs) are reduced and delayed.
- In the high natural gas price scenario:
 - Prior to 2028 and after Naughton Unit 3 is assumed to retire at the end of 2017 as opposed to being converted to gas fueled unit, FOTs and DSM fill the capacity resource needs.
 - In 2028, when Naughton Unit 3 retires early, a 635 MW CCCT is replaced with a 477 MW CCCT, which, in turn, accelerates a 635 MW CCCT from 2033 to 2032.
 - In 2018, 33 MW of wind resources are added when Naughton Unit 3 retires. With 52 MW of solar resources added in 2033 and 2034, a 100 MW of wind resource on the west side of the system is displaced.
- In the low natural gas price scenario:
 - Prior to 2028 and after Naughton Unit 3 is assumed to retire at the end of 2017 as opposed to being converted to a gas-fueled unit, FOTs and DSM fill the capacity resource needs.
 - In 2028, under the Naughton Unit 3 early retirement scenario, a 423 MW CCCT is replaced with a 635 MW CCCT, which, together with the addition of FOTs and DSM, displaces 1,025 MW of CCCTs on the east and west sides of the system.

⁴ It is assumed that [REDACTED] would complete [REDACTED] and charge PacifiCorp for its estimated [REDACTED] cost. The [REDACTED] costs are treated as a lease with an assumed [REDACTED] interest rate, which effectively converts the up-front payment to a [REDACTED] annual expense.

Figure B.2 – Cumulative Increase/(Decrease) in Portfolio Resources Under the Naughton Unit 3 Early Retirement Case



PVRR(d) Results

Table B.2 summarizes PVRR system cost detail for the 2018 early retirement case and the 2018 natural gas conversion case along with the PVRR(d) benefit/(cost) of early retirement for the medium, high and low natural gas price scenarios, with and without CPP mass-cap constraints.

Table B.2 – Line Item Detail of 2018 Early Retirement of Naughton Unit 3 as Compared to 2018 Gas Conversion (\$ million)

Scenario	SO Model Results for Gas Price Scenarios without CPP Constraints by Cost Category								
	Naughton Unit 3 Retire Early (PVRR \$ million)			Naughton Unit 3 Conversion (PVRR \$ million)			PVRR(d) (Benefit/Cost of Early Retirement)		
	High Gas	Base Case (Dec' 2015 OFPC)	Low Gas	High Gas	Base Case (Dec' 2015 OFPC)	Low Gas	High Gas	Base Case (Dec' 2015 OFPC)	Low Gas
SO Model Simulation	Early Retirement	Early Retirement	Early Retirement	Gas-Fired	Gas-Fired	Gas-Fired	n/a	n/a	n/a
System Variable Costs									
Fuel/FOTs									
Variable O&M/Wind&Solar PPA									
Emissions									
Net System Balancing									
Total Variable									
System Fixed Costs									
New Resource Capital/Run-rate									
Existing Resource Capital/Run-rate									
Decommissioning/Stranded Cost									
Contracts									
Incremental DSM									
Transmission									
Total Fixed									
Total Costs									

1/ Includes adjustments for changes in Naughton coal supply contracts when Naughton Unit 3 ceases coal-fired operation.
 2/ Fixed costs include levelized costs for incremental environmental upgrade investments, total O&M for coal resources, and fixed O&M and run-rate capital for all resources.

Table B.2 – Line Item Detail of 2018 Early Retirement of Naughton Unit 3 as Compared to 2018 Gas Conversion (\$ million), Continued

SO Model Results for Gas Price Scenarios with Assumed FIP Mass-Cap by Cost Category									
Scenario	Naughton Unit 3 Retire Early (PVRR \$ million)			Naughton Unit 3 Conversion (PVRR \$ million)			PVRR(d) (Benefit)/Cost of Early Retirement		
	High Gas	Base Case (Dec' 2015 OFPC)	Low Gas	High Gas	Base Case (Dec' 2015 OFPC)	Low Gas	High Gas	Base Case (Dec' 2015 OFPC)	Low Gas
	Early Retirement	Early Retirement	Early Retirement	Gas-Fired	Gas-Fired	Gas-Fired	n/a	n/a	n/a
SO Model Simulation									
System Variable Costs									
Fuel/FOTs									
Variable O&M/Wind&Solar PPA									
Emissions									
Net System Balancing									
<i>Total Variable</i>									
System Fixed Costs									
New Resource Capital/Run-rate									
Existing Resource Capital/Run-rate									
Decommissioning/Stranded Cost									
Contracts									
Incremental DSM									
Transmission									
<i>Total Fixed</i>									
Total Costs									

1/ Includes adjustments for changes in Naughton coal supply contracts when Naughton Unit 3 ceases coal-fired operation.
 2/ Fixed costs include levelized costs for incremental environmental upgrade investments, total O&M for coal resources, and fixed O&M and run-rate capital for all resources.

SO Model Results for Gas Price Scenarios with Assumed Set-Aside Mass-Cap by Cost Category									
Scenario	Naughton Unit 3 Retire Early (PVRR \$ million)			Naughton Unit 3 Conversion (PVRR \$ million)			PVRR(d) (Benefit)/Cost of Early Retirement		
	High Gas	Base Case (Dec' 2015 OFPC)	Low Gas	High Gas	Base Case (Dec' 2015 OFPC)	Low Gas	High Gas	Base Case (Dec' 2015 OFPC)	Low Gas
	Early Retirement	Early Retirement	Early Retirement	Gas-Fired	Gas-Fired	Gas-Fired	n/a	n/a	n/a
SO Model Simulation									
System Variable Costs									
Fuel/FOTs									
Variable O&M/Wind&Solar PPA									
Emissions									
Net System Balancing									
<i>Total Variable</i>									
System Fixed Costs									
New Resource Capital/Run-rate									
Existing Resource Capital/Run-rate									
Decommissioning/Stranded Cost									
Contracts									
Incremental DSM									
Transmission									
<i>Total Fixed</i>									
Total Costs									

1/ Includes adjustments for changes in Naughton coal supply contracts when Naughton Unit 3 ceases coal-fired operation.
 2/ Fixed costs include levelized costs for incremental environmental upgrade investments, total O&M for coal resources, and fixed O&M and run-rate capital for all resources.

The following summarizes line-item PVRR(d) results for the early retirement case as compared to the gas conversion case under medium natural gas price assumptions and under the “FIP” mass-cap constraint. The values below are quoted on a present value revenue requirement basis calculated through the 20-year planning horizon:

- Fuel cost at Naughton Unit 3 decrease by [REDACTED], which is offset by increased system fuel and FOT costs totaling [REDACTED]—driven by the need to replace lost generation.
- Net system balancing benefits increase by approximately [REDACTED], offsetting the increase in system fuel and FOT costs.
- Early retirement of Naughton Unit 3 results in approximately [REDACTED] of savings in run-rate capital and operating cost of the unit and capital cost to convert the unit.
- With more Class 2 DSM resources under the early retirement case, system DSM costs are increased by [REDACTED].

- In aggregate, variable and fixed cost expenditures for Naughton Unit 3 decrease by [REDACTED], which is partially offset by increased fixed and variable costs of rest of the system totaling [REDACTED]. The net benefit under the 2018 Naughton Unit 3 early retirement case relative to the 2018 natural gas conversion case is [REDACTED].

The following summarizes line-item PVRR(d) results for the early retirement case as compared to the gas conversion case under high natural gas price assumptions and under the “FIP” mass-cap constraint. The values below are quoted on a present value revenue requirement basis calculated through the 20-year planning horizon:

- Fuel cost at Naughton Unit 3 decrease by [REDACTED], which is offset by increased system fuel and FOT costs totaling [REDACTED]—driven by the need to replace the lost generation.
- Net system balancing benefits increase by approximately [REDACTED], offsetting the increase in system fuel and FOT costs.
- Early retirement of Naughton Unit 3 results in approximately [REDACTED] of savings in run-rate capital and operating cost of the unit and capital cost to convert the unit.
- With more Class 2 DSM resources under the early retirement case, system DSM costs are increased by [REDACTED].
- In aggregate, variable and fixed cost expenditures for Naughton Unit 3 decrease by [REDACTED], which is partially offset by increased fixed and variable costs of rest of the system totaling [REDACTED]. The net benefit under the 2018 Naughton Unit 3 early retirement case relative to the 2018 natural gas conversion case is [REDACTED].

The following summarizes line-item PVRR(d) results for the early retirement case as compared to the gas conversion case under low natural gas price assumptions and under the “FIP” mass-cap constraint. The values below are quoted on a present value revenue requirement basis calculated through the 20-year planning horizon:

- Fuel cost at Naughton Unit 3 decrease by [REDACTED], which is offset by increased system fuel and FOT costs totaling [REDACTED]—driven by the need to replace the lost generation.
- Net system balancing benefits increase by approximately [REDACTED], offsetting the increase in system fuel and FOT costs.
- Early retirement of Naughton Unit 3 results in approximately [REDACTED] of savings in run-rate capital and operating cost of the unit and capital cost to convert the unit.
- With more Class 2 DSM resources under the early retirement case, system DSM costs are increased by [REDACTED].
- In aggregate, variable and fixed cost expenditures for Naughton Unit 3 decrease by [REDACTED], which is partially offset by increased fixed and variable costs of rest of the system totaling [REDACTED]. The net benefit under the 2018 Naughton Unit 3 early retirement case relative to the 2018 natural gas conversion case is [REDACTED].

Conclusion

In July 2015 the competitive bid event was reopened using an Addendum 6. The “short-listed” bidders from the previous request for proposals were asked to refresh all pricing and commercial

terms to current market conditions. Refreshed proposals were received from the short-listed bidders on November 2, 2015. With updated forecasted loads, resources, market prices, and capital costs to convert the unit, PacifiCorp's financial analysis shows that the 2018 early retirement of Naughton Unit 3 is lower cost than a 2018 gas conversion alternative. Recognizing that Naughton Unit 3 is an important generation resource to the state of Wyoming and PacifiCorp's customers, PacifiCorp will continue to review emerging technologies, re-assess traditional gas conversion technologies and costs, and consider other potential alternatives that could be applied to Naughton Unit 3 to allow continued operation beyond year-end 2017.

Attachment B-I: Naughton Unit 3 Timelines

Figure B-I.1 – Naughton Unit 3 Natural Gas Conversion Schedule for a June 1, 2018 On-line Date

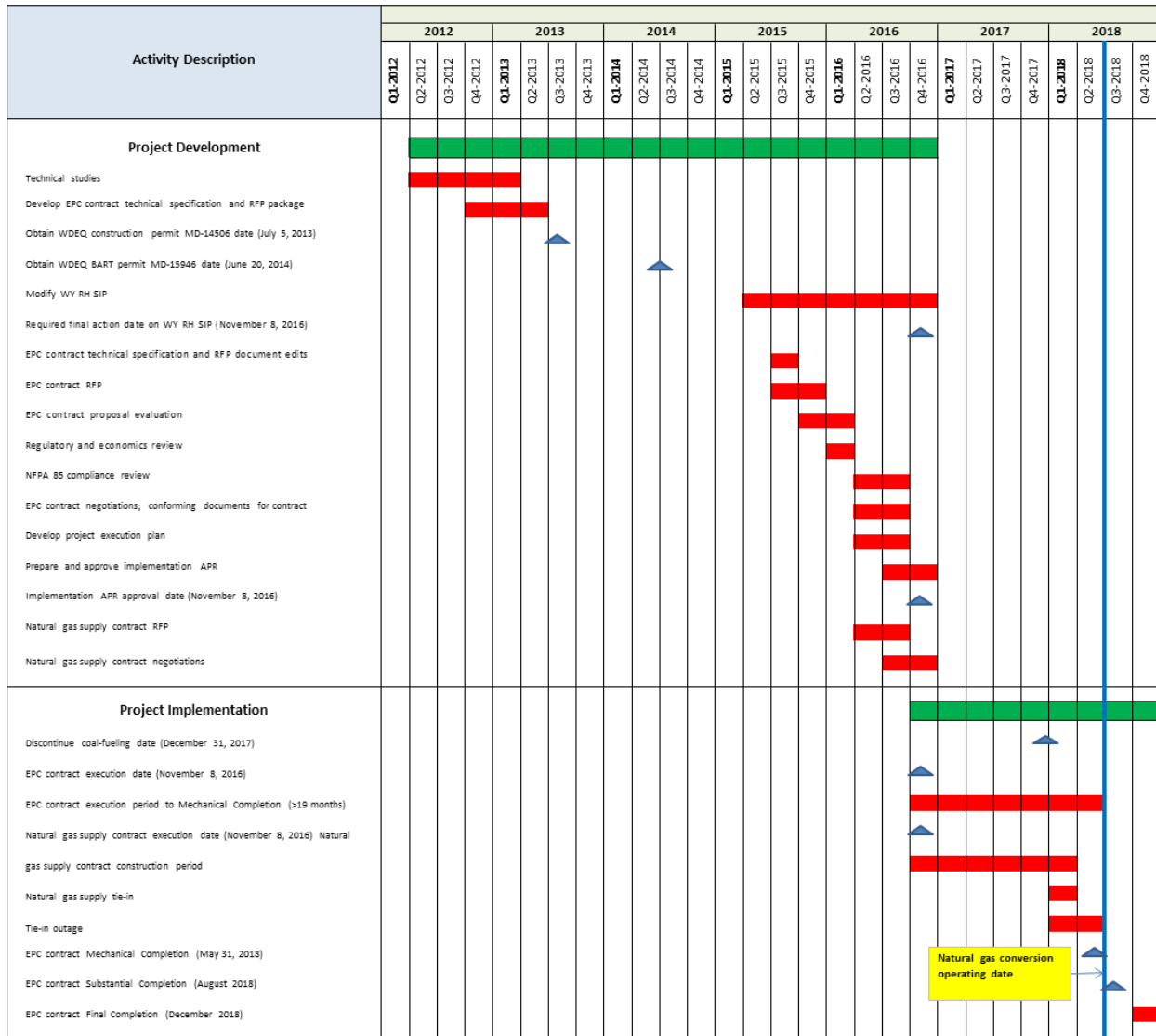


Figure B-I.2 – Naughton Unit 3 Early Retirement Decommissioning Schedule for a December 31, 2017 Retirement Date

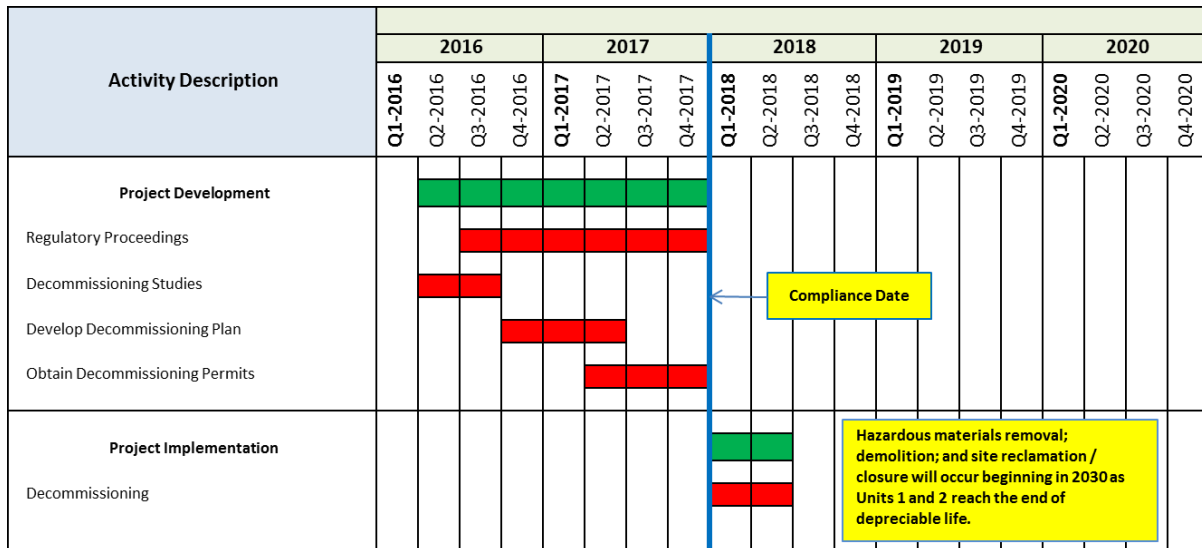
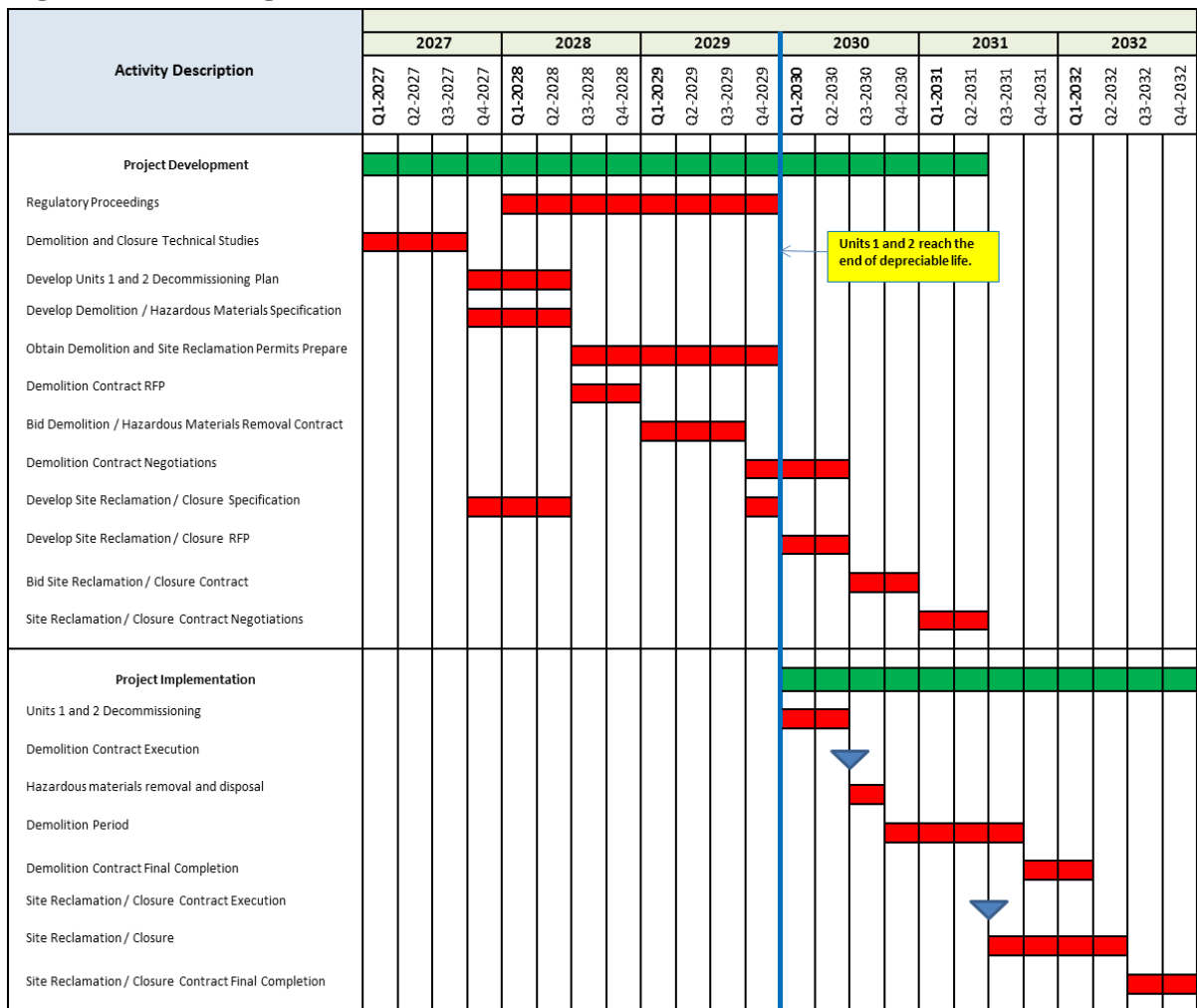


Figure B-I.3 – Naughton Unit 3 Demolition and Closure Schedule



Attachment B-II: Naughton Unit 3 Compliance Alternative Annual Expenditures

Table B-II.1 – Naughton Unit 3 Annual Expenditures for a 2018 Gas Conversion Case

Naughton Unit 3 Environmental Capital (Nominal \$m, with AFUDC)			
Description	2015	2017	Total
Mercury	█	█	█
CWA	█	█	█
Effluent	█	█	█
Total	█	█	█

Naughton Unit 3 Run-rate Operating Cost (Nominal \$m, Capital with AFUDC)										
Description	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
O&M	█	█	█	█	█	█	█	█	█	█
Capital	█	█	█	█	█	█	█	█	█	█
CSA LDs	█	█	█	█	█	█	█	█	█	█
Fixed Gas Trans.	█	█	█	█	█	█	█	█	█	█
Total	█	█	█	█	█	█	█	█	█	█

Description	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
O&M	█	█	█	█	█	█	█	█	█	█
Capital	█	█	█	█	█	█	█	█	█	█
CSA LDs	█	█	█	█	█	█	█	█	█	█
Fixed Gas Trans.	█	█	█	█	█	█	█	█	█	█
Total	█	█	█	█	█	█	█	█	█	█

Table B-II.2 – Naughton Unit 3 Annual Expenditures for a 2018 Early Retirement Case

Naughton Unit 3 Environmental Capital (Nominal \$m, with AFUDC)			
Description	2015	2017	Total
Mercury	█	█	█
CWA	█	█	█
Effluent	█	█	█
Total	█	█	█

Naughton Unit 3 Run-rate Operating Cost (Nominal \$m, Capital with AFUDC)										
Description	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
O&M	█	█	█	█	█	█	█	█	█	█
Capital	█	█	█	█	█	█	█	█	█	█
CSA LDs	█	█	█	█	█	█	█	█	█	█
Total	█	█	█	█	█	█	█	█	█	█

Description	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
O&M	█	█	█	█	█	█	█	█	█	█
Capital	█	█	█	█	█	█	█	█	█	█
CSA LDs	█	█	█	█	█	█	█	█	█	█
Total	█	█	█	█	█	█	█	█	█	█

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