PACIFIC POWER
A DIVISION OF PACIFICORP

825 NE Multnomah, Suite 2000
Portland, Oregon 97232

September 29, 2014

***VIA ELECTRONIC FILING***
***AND OVERNIGHT DELIVERY***

Public Utility Commission of Oregon
3930 Fairview Industrial Dr. S.E.
Salem, OR 97302-1166

Attn: Filing Center

**RE: Docket LC 57—PacifiCorp's Confidential Cholla 4 Special IRP Update**

PacifiCorp d/b/a Pacific Power (PacifiCorp or Company) encloses for filing an original and five copies of its Confidential Cholla 4 Special IRP Update. Confidential information is provided in accordance with the protective order in this docket, Order No. 13-095.

PacifiCorp submits this Confidential Cholla 4 Special IRP Update in compliance with Order No. 14-252, which instructed PacifiCorp to provide an analysis of the Cholla Unit 4 compliance alternatives in a special designated IRP update within six months of the final order in this docket.

If you have questions about this filing, please contact Natasha Siores, Director, Regulatory Affairs & Revenue Requirement, at (503) 813-6583.

Sincerely,

R. Bryce Dalley
Vice President, Regulation

Enclosure

cc: Service List—LC 57

**CERTIFICATE OF SERVICE**

I certify that I served a true and correct copy of PacifiCorp's Response on the parties listed below via electronic mail and/or Overnight Delivery in compliance with OAR 860-001-0180.

## Oregon Docket LC 57

Kacia Brockman (W)(C)
Oregon Department of Energy
625 Marion St. NE
Salem, OR 97301
kacia.brockman@state.or.us

Philip H. Carver (W)
Oregon Department of Energy
625 Marion St. NE Ste 1
Salem, OR 97301
phil.carver@state.or.us

Renee M France (W)(C)
Oregon Department of Justice
1162 Court St NE
Salem, OR 97301-4096
Renee.m.france@doj.state.or.us

OPUC Dockets (W)
Citizens' Utility Board of Oregon
610 SW Broadway – Ste 400
Portland, OR 97205
dockets@oregoncub.org

Robert Jenks (W)(C)
Citizens' Utility Board of Oregon
610 SW Broadway – Ste 400
Portland, OR 97205
bob@oregoncub.org

G. Catriona McCracken (W)(C)
Citizens' Utility Board of Oregon
610 SW Broadway – Ste 400
Portland, OR 97205
catriona@oregoncub.org

Regulatory Dockets (W)
Idaho Power Company
PO Box 70
Boise, ID, 83707-0070
dockets@idahopower.com

Lisa D. Nordstrom (W)(C)
Idaho Power Company
PO Box 70
Boise, ID, 83707-0070
lnordstrom@idahopower.com

Wendy Gerlitz (W)(C)
NW Energy Coalition
1205 SE Flavel
Portland, OR 97202
wendy@nwenergy.org

Fred Heutte (W)(C)
NW Energy Coalition
1205 SE Flavel
Portland, OR 97202
fred@nwenergy.org

Ralph Cavanagh (W)
Natural Resources Defense Council
111 Sutter St. Floor 20
San Francisco, CA 94104
rcavanagh@nrdc.org

Angus Duncan (W)(C)
Natural Resources Defense Council
2373 NW Johnson St
Portland, OR 97210
angusduncan@b-e-f.org

Sarah Wallace (W) (C)
Pacific Power
825 NE Multnomah St, Suite 1800
Portland, OR 97232-2149
sarah.wallace@pacificorp.com

Patrick G Hager (W)
121 SW Salmon Street 1WTC0702
Portland, OR 97204
Pge.opuc.filings@pgn.com;
Patrick.hager@pgn.com

Brian Kuehne (W)
Portland General Electric
121 SW Salmon Street 3WTCBR06
Portland, OR 97204
Brian.kuehne@pgn.com

V. Denise Saunders (W)
Portland General Electric
121 SW Salmon Street 1WTC1301
Portland, OR 97204
Denise.Saunders@pgn.com

Juliet Johnson (W)(C)
Public Utility Commission of Oregon
PO Box 1088
Salem, OR 97308-1088
Juliet.johnson@state.or.us

Jason W. Jones (W)(C)
Department of Justice
1162 Court St NE
Salem OR, 97301-4096
Jason.w.jones@state.or.us

Melinda J. Davison (W)(C)
Davison Van Cleve
333 SW Taylor, Suite 400
Portland, OR 97204
mjd@dvclaw.com

Jesse E. Cowell (W) (C)
Davison Van Cleve
333 SW Taylor St, Suite 400
Portland, OR 97204
jec@dvclaw.com

Oregon Dockets (W)
PacifiCorp, dba Pacific Power
825 NE Multnomah St. Suite 2000
Portland, OR 97232
oergondockets@pacificorp.com

RNP Dockets (W)
Renewable Northwest Project
421 SW 6th Avenue, #1125
Portland, OR 97204-1629
dockets@rnp.org

Derek Nelson (W)
Sierra Club Environmental Law
85 Second Street, 2nd Floor
San Francisco, CA 94105
derek.nelson@sierraclub.org

Megan Walseth Decker (W)(C)
Renewable Northwest Project
421 SW 6th Avenue, #1125
Portland, OR 97204-1629
megan@rnp.org

Lisa F. Rackner (W)(C)
McDowell Rackner & Gibson PC
419 SW 11th Ave., Suite 400
Portland, OR 97205
dockets@mcd-law.com

Tyler C. Pepple (W)
Davison Van Cleve
333 SW Taylor, Suite 400
Portland, OR 97204
tcp@dvclaw.com

Dustin T. Till (W)
Pacific Power
825 NE Multnomah St, Suite 1800
Portland, OR 97232
Dustin.Till@pacificorp.com

Travis Ritchie (W)
Sierra Club Environmental Law
85 Second Street, 2nd Floor
San Francisco, CA 94105
Travis.ritchie@sierraclub.org

Gloria Smith (W)
Sierra Club Environmental Law
85 Second Street, 2nd Floor
San Francisco, CA 94105
gloria.smith@sierraclub.org

Dated this 29th of September, 2014.

Amy Eissler
Coordinator, Regulatory Operations

**Redacted – Confidential**
**Subject to General Protective Order**

# 2013

# Integrated Resource Plan Special Update

# REDACTED

PACIFICORP

Rocky Mountain Power
Pacific Power
PacifiCorp Energy

September 29, 2014

*Let's turn the answers on.*

For more information, contact:
PacifiCorp
IRP Resource Planning
825 N.E. Multnomah, Suite 600
Portland, Oregon 97232
(503) 813-5245
irp@pacificorp.com
http://www.pacificorp.com

**Cover Photos (Top to Bottom):**
***Transmission:*** *Sigurd to Red Butte Transmission Segment G*
***Hydroelectric:*** *Lemolo 1 on North Umpqua River*
***Wind Turbine:*** *Leaning Juniper I Wind Project*
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# CONFIDENTIAL SPECIAL 2013 IRP UPDATE: CHOLLA UNIT 4

## Executive Summary

The coal-fired Cholla power plant located in Joseph City, Arizona, includes four units. PacifiCorp owns Cholla Unit 4, which contributes 387 MW of capacity to the PacifiCorp system. Arizona Public Service (APS), the operator of the plant, owns Units 1, 2, and 3.[1] PacifiCorp acquired Cholla Unit 4, which was commissioned in 1981, from APS in 1991. Under the Regional Haze program, a visibility improvement program that was enacted in 1999 and revised in 2005, installation of select catalytic reduction (SCR) emission control equipment is required at Cholla Unit 4 by January 4, 2018.[2]

PacifiCorp has analyzed compliance alternatives to installation of SCR including early retirement of Cholla Unit 4 by the end of 2017 and conversion of the unit to natural gas with an online date in the second quarter of 2018. PacifiCorp has also analyzed technology and inter-temporal trade-off compliance alternatives in which it is assumed the installation or SCR required by January 4, 2018, can be avoided in exchange for a firm commitment to cease coal-fired operation at a later date.[3] The inter-temporal trade-off scenarios analyzed include a case in which coal fired operations cease by the end of 2024, with either an early retirement or with a natural gas conversion coming online in the second quarter of 2025. The technology trade-off analysis applies the cost of selective non-catalytic reduction (SNCR) technology in 2017 (to achieve an assumed January 4, 2018 compliance deadline) to the inter-temporal tradeoff cases. Table 1 summarizes the present value revenue requirement differential (PVRR(d)) of each compliance alternative as compared to installation of SCR by January 4, 2018.

**Table 1. Summary of Cholla Unit 4 PVRR(d) Results**

| Compliance Alternative to SCR | $NO_X$ Control | 2018 – 2032 Nominal Levelized Henry Hub Natural Gas Price ($/MMBtu) | PVRR(d) Benefit/(Cost) of SCR as Compared to Each Compliance Alternative ($m) |
|---|---|---|---|
| 2017 Early Retirement | None | $6.65 | [redacted] |
| 2018 Gas Conversion | Gas Conversion | $6.65 | [redacted] |
| 2017 Early Retirement | None | $6.07 | [redacted] |
| 2018 Gas Conversion | Gas Conversion | $6.07 | [redacted] |
| 2024 Early Retirement | SNCR | $6.07 | [redacted] |
| 2025 Gas Conversion | SNCR/Gas Conversion | $6.07 | [redacted] |
| 2024 Early Retirement | None | $6.07 | [redacted] |
| 2025 Gas Conversion | Gas Conversion | $6.07 | [redacted] |

[1] PacifiCorp owns 37 percent of the common facilities at the Cholla plant.
[2] The requirement for SCR is being litigated; however, with denial of requests for administrative stay and judicial stay as discussed further below, the January 4, 2018 compliance deadline for installing SCR at Cholla Unit 4 remains in place.
[3] The technology and inter-temporal alternate compliance scenarios would require review and approval of the EPA, the state of Arizona, APS as operator of the unit, and potentially other parties to the on-going Regional Haze litigation in Arizona.

Based upon PacifiCorp's assessment of Cholla Unit 4 Regional Haze compliance alternatives, the least-cost alternative for customers is to pursue a compliance alternative that eliminates the compliance obligation to install SCR and maximizes customer benefits. This decision is supported by PacifiCorp's financial analysis of Cholla Unit 4 compliance alternatives, as well as the U.S. Environmental Protection Agency's (EPA) recent history of being willing to consider such approaches when they also provide significant environmental benefits. Furthermore, eliminating the SCR installation requirement is expected to help maintain compliance flexibility, as well as mitigating the risk of incremental stranded investment associated with EPA's proposed rule under §111(d) of the Clean Air Act (the "111(d)" rule). Consistent with its inter-temporal tradeoff analysis, PacifiCorp will pursue a compliance strategy that avoids installation of SCR with a firm commitment to cease operating Cholla Unit 4 as a coal-fired unit in early 2025.[4] In parallel, PacifiCorp will continue to evaluate least cost compliance alternatives at Cholla Unit 4 as EPA's proposed 111(d) rule is finalized and the state of Arizona begins to formulate its 111(d) compliance plan.

# Regional Haze Program

## Overview

The Regional Haze program is a visibility improvement program that was enacted in 1999 and revised in 2005. Although its long-term goal is to return Class I areas in the U.S. to natural visibility conditions by 2064, the Regional Haze program also contains stringent requirements at the front end. The states, through development of state implementation plans (SIPs), and EPA are tasked with administering the Regional Haze program under two primary compliance timeframes:

(1) The initial Best Available Retrofit Technology (BART) planning and compliance period originally required BART controls to be in place by 2013[5]; and
(2) Long-term planning periods that require resubmittal of updated SIPs, including long-term strategy controls on BART and other units to meet reasonable progress goals, every ten years beginning in 2018.

Because the Regional Haze program affects all emissions sources within a region and is implemented over many years, there will continue to be emerging compliance obligations established by state and federal agencies responsible for administering the rules for several decades to come. Projects and visibility improvements deployed and achieved in the initial BART phase of the program are intended to be operated over time to support continued compliance with the program's visibility goals.

[4] It is important to note that PacifiCorp's assessment of alternate compliance options for Cholla Unit 4 all assume that remaining book value for the asset at the end of the various operating schedules is recovered from customers.

[5] The Final Amendments to the Regional Haze Rule and Guidelines for Best Available Retrofit Technology (BART) Determinations (70 Fed. Reg. 128; July 6, 2005) contemplated that states would complete SIPs and the EPA would issue final approval during 2008, which in turn would require BART controls to be installed at eligible units within five years (2013). Because EPA has not yet finalized its approval of the states' SIPs, the five-year clock continues to get pushed out in time from a federal compliance perspective.

### Regional Haze Compliance Requirements at Cholla Unit 4

In March 2011, the state of Arizona submitted its Regional Haze SIP to EPA for review. The SIP requires currently installed low $NO_X$ burners (LNB) as BART for $NO_X$ emissions at Cholla Unit 4. By final rule dated December 5, 2012, EPA disapproved portions of the Arizona Regional Haze SIP and issued a federal implementation plan (FIP). The FIP requires, among other things, installation of SCR on Cholla Unit 4 by January 4, 2018. The FIP also institutes an averaged $NO_X$ emission rate of 0.055 lb/MMBtu for Cholla Units 2, 3, and 4. In January and February 2013, PacifiCorp, the state of Arizona, and other Arizona utilities filed separate appeals of EPA's FIP with the Ninth Circuit Court of Appeals. In February 2013, PacifiCorp and other Arizona utilities filed petitions for reconsideration at the EPA and filed requests for administrative stay of the FIP until judicial appeals are completed. In March 2013, PacifiCorp and other Arizona utilities filed motions for judicial stay of the FIP with the Ninth Circuit Court of Appeals until the appeals are complete.

On April 3, 2013, the court consolidated the various appeals into a single docket before a single judicial panel. On April 9, 2013, EPA granted various petitions for reconsideration for the $NO_X$ rate only, but has taken no further action to date. Although EPA may propose a new $NO_X$ rate at some time in the future, which will undergo public comment, it is not under any timing requirement to do so. EPA did not address the various requests for administrative stay in its April 9, 2013 action.

On April 23, 2013, the court set the following case schedule:

- June 2013—Briefing on motions for judicial stay (completed)
- January 2014—Briefing on the merits of appeals (completed)

On September 9, 2013, the court denied the motions for stay. The court is now expected to issue a final decision on the appeals in 2015. However, there are no mandatory dates by which the court must issue decisions.

With the denial of requests for administrative stay and judicial stay, the January 4, 2018 compliance deadline for installing SCR at Cholla Unit 4 remains in place. PacifiCorp continues to coordinate with the state of Arizona and other Arizona utilities in connection with the now consolidated appeals. Various environmental groups have intervened in the appeals in support of EPA's FIP.

## Compliance Timeline

PacifiCorp has considered compliance alternatives to the Cholla Unit 4 SCR requirement in EPA's FIP for Arizona, which include: (1) early retirement; (2) cease coal-fueled operations by converting the unit to operate on natural gas; and (3) technology and inter-temporal tradeoffs. An acceptable alternate compliance solution would require that the state of Arizona incorporate the alternative as a recommended amendment to its SIP for EPA review and approval. The SIP amendment and EPA review and approvals would include the appropriate public notice and comment processes.

The timeline for installing SCR by January 4, 2018, is outlined in Appendix A. To evaluate key decision points associated with the natural gas conversion and early retirement alternatives in relation to SCR installation, the timelines for those alternatives are also provided. In evaluating a technology tradeoff alternative, PacifiCorp considered a case that might require installation of SNCR by January 4, 2018. The timeline for installing SNCR equipment is also provided in Appendix A. To facilitate direct comparison, each timeline is built around the current January 4, 2018 compliance deadline. The timeline for compliance alternatives other than installing SCR could shift out in time under an alternate compliance outcome that allows for implementation of natural gas conversion, early retirement, or installing SNCR beyond the January 4, 2018 deadline for SCR installation.

## Installation of SCR

A schedule to install SCR on Cholla Unit 4 by an assumed January 4, 2018 compliance date is presented in Appendix A, Figure A.1. The SCR project entails installing the reactor module(s) on the unit in the boiler flue gas exit path between the economizer exit and the air preheater inlet. Other work that may be required includes:

- Installing an ammonia receiving and delivery system.
- Installing a SCR reactor cleaning system.
- An economizer modification to limit SCR reactor inlet temperatures to avoid catalyst damage.
- Adding an economizer exit gas temperature control system to extend the operating load range of the unit, if economically justified.
- To provide NFPA 85 Code compliance, structurally reinforcing the boiler; forced draft equipment and ductwork; and flue gas path equipment and ductwork. Alternatively and/or in addition, control system mitigations may be implemented.
- Potential modifications to the boiler induced draft equipment.
- Potential modifications to the unit auxiliary power system.

## Installation of SNCR

A schedule to install SNCR on Cholla Unit 4 by an assumed compliance date January 4, 2018, is presented in Appendix A, Figure A.2. If an SNCR is needed, the project would entail installation of several levels of urea solution injection equipment in the boiler at critical temperature zones. Other work that may be required includes:

- Installing a urea solution receiving and transport system.
- Boiler modifications to accommodate urea solution injection locations.

## Natural Gas Conversion

A schedule to convert Cholla Unit 4 to 100 percent natural gas fueling is presented in Appendix A, Figure A.3. The implementation schedule assumes the unit would be converted to natural gas fueling in 2018 after coal fueling is discontinued on December 31, 2017. Thereafter, a six-month tie-in outage is planned. The schedule would shift out in time under potential compliance scenarios that allow for continued coal operation beyond December 31, 2017. 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 a 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 structural reinforcement;
- Electrical and control system modifications; and
- Installing a natural gas delivery system.

### Early Retirement

A schedule for an early retirement scenario of Cholla Unit 4 is presented in Appendix A, Figure A.4. The implementation schedule assumes the unit would cease coal-fired operation by December 31, 2017. The schedule would shift out in time under potential compliance scenarios that allow for continued coal operation beyond December 31, 2017.

## Initial Analysis: August 2013

### Overview: Initial Analysis

PVRR(d) analyses are used to quantify the benefit or cost of installing emission control equipment in relation to other compliance alternatives. The PVRR(d) for any given emission control installation is calculated as the difference in system costs between two System Optimizer model simulations. The base System Optimizer simulation includes costs for near-term and prospective future environmental compliance costs required for the unit to continue operating as a coal-fueled unit. In the case of Cholla Unit 4, this simulation includes the cost of SCR and other environmental compliance costs related to the Mercury and Air Toxics Standard (MATS), coal combustion by-products (CCB), and effluent limit guidelines (ELG). In the alternative Regional Haze compliance cases, SCR costs are removed and other environmental compliance costs and run-rate operating costs are adjusted consistent with the scenario being analyzed. In each System Optimizer simulation, resource portfolio impacts, including up-front capital and run-rate operating costs for new generating units, and system dispatch impacts of the specific compliance alternative being studied are captured.[6]

An initial PVRR(d) analysis of the 2017 early retirement and 2018 natural gas conversion alternatives to installation of SCR was performed in August 2013. In this analysis, it was assumed that the compliance schedule for Cholla Unit 4 as outlined in EPA's FIP for Arizona is met, requiring coal-fueled operations to cease by January 4, 2018, under either a natural gas conversion or early retirement scenario.[7] The PVRR(d) analysis reflects the difference in the

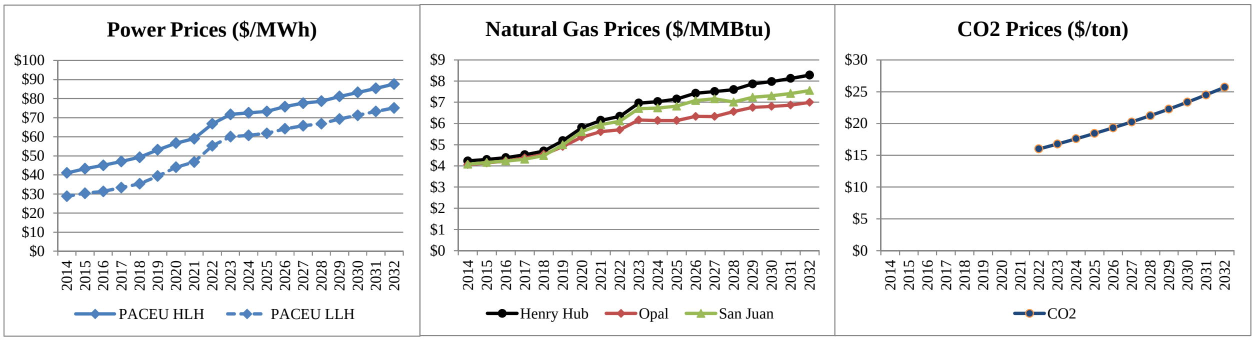
[6] The study period used to analyze Cholla Unit 4 Regional Haze compliance alternatives is aligned with the 2013 IRP planning horizon and covers the period 2013–2032.
[7] For modeling purposes, coal-fueled operations were assumed to cease by December 31, 2017. The currently approved depreciable life for Cholla 4 is 2042 for all states but Oregon. For Oregon, the currently approved depreciable life of Cholla 4 is 2028.

present value revenue requirement (PVRR) between a case where Cholla Unit 4 continues operating as a coal-fueled facility, requiring SCR installation during a spring 2017 outage, and the PVRR among the 2017 early retirement and 2018 natural gas conversion alternatives.[8]

## Forward Price Curve Assumptions: Initial Analysis

PacifiCorp's initial analysis of Cholla Unit 4 compliance alternatives was performed using its March 2013 official forward price curve (OFPC), which included a $CO_2$ price beginning 2022 at $16/ton and escalating to over $25/ton by 2032.[9] Figure 1 summarizes wholesale power prices, natural gas prices, and $CO_2$ prices assumed for the initial analysis.

**Figure 1. Forward Price Curve Assumptions (March 2013 OFPC)***




* San Juan is the natural gas market hub assumed to supply Cholla Unit 4 in the gas conversion case.

## Annual Non-fuel Expenditure Assumptions: Initial Analysis

Annual non-fuel planned expenditures include environmental capital costs, run-rate capital costs, run-rate operations and maintenance (O&M) costs, fixed firm natural gas transportation costs, and natural gas pipeline lateral costs as applicable.[10] In addition, costs associated with termination of existing agreements, as applicable, are included in PacifiCorp's economic analysis. Contract termination-related costs include:

- Under the Asset Purchase and Power Exchange Agreement (APPEA) between PacifiCorp and APS, PacifiCorp paid APS a prepaid availability and transmission charge of [redacted] in April 1994 and [redacted] in April 1996.[11] These charges are related to the construction of transmission facilities that enable an additional 150 MW of northbound firm transmission capability on the Phoenix–Mead transmission line. The pre-paid transmission service costs began being amortized over a 50-year life in May 1997 as PacifiCorp began receiving transmission credits on its bill from APS. The unamortized prepaid balance as of December 2017 would be [redacted] Under the early retirement scenario, the APPEA would terminate and it is assumed the unamortized balance would be written-off.

[8] For each alternative, it is assumed coal-fueled operations cease year-end 2017. For the natural gas conversion, it is assumed that the Cholla 4 would be available for natural gas-fueled operation by June 1, 2018.
[9] PacifiCorp's analysis of Cholla Unit 4 Regional Haze compliance alternatives was performed before issuance of EPA's draft 111(d) rule. Implications of 111(d) regulations are discussed later in this report.
[10] Environmental capital costs are included for planned stack modifications (SM), SCR, mercury, and coal combustion by-product/effluent guideline limit (CCB/ELG) projects.
[11] PacifiCorp acquired Cholla 4 under the APPEA, dated September 21, 1990, at a purchase price of [redacted].

- PacifiCorp's acquisition of Cholla Unit 4 under the APPEA was subject to a pre-existing safe harbor lease, for federal income tax purposes, between APS, as property owner, and General Electric Company (GE) as tax lessor (Safe Harbor Lease). PacifiCorp assumed certain rights and obligations of APS under the Safe Harbor Lease with respect to Cholla Unit 4. When APS completed construction of Cholla Unit 4 in 1981, APS sold the plant to GE (for tax purposes only) for [redacted] in cash and a 42-year note receivable in the amount of [redacted]. The [redacted] cash payment represented the value to GE of the investment tax credit and accelerated MACRS depreciation on the plant. Concurrently, for tax purposes, APS entered into a 42-year lease with GE for the plant.[12] The note receivable payments equal the lease payments and no actual cash is exchanged. Under the early retirement scenario, a casualty payment totaling [redacted] to GE is assumed for GE's loss of tax benefits associated with Cholla Unit 4.

- PacifiCorp and Peabody are parties to a long-term coal-supply agreement (CSA) for the El Segundo/Lee Ranch mine complex through December 2024. In both the 2017 early retirement case and the 2018 natural gas conversion case, termination of the CSA under the "Early Termination and Buy-Out" provision of the contract requires an estimated liquidated damage (LD) payment of [redacted], payable in 2018.

Detailed annual non-fuel planned expenditures, including contract termination-related costs, for the continued coal operation case, the 2017 early retirement case, and the 2018 natural gas conversion case, respectively, are provided in Appendix B. In the early retirement case, annual expenditures include pre-paid transmission write-off costs and the Safe Harbor Lease casualty payment. In both the 2017 early retirement case and the 2018 natural gas conversion case, annual expenditures include LDs under the CSA. The 2018 natural gas conversion case includes [redacted] in 2018 run-rate capital expenditures to complete the conversion of the unit 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 El Paso Natural Gas Company's North Mainline to the Cholla plant.[13]

## Resource Portfolio Results: Initial Analysis

In both the 2017 early retirement and 2018 natural gas conversion cases, PacifiCorp's resource portfolio is impacted when Cholla Unit 4 ceases operating as a coal-fired resource at the end of 2017. In the case of a 2017 early retirement, the loss of Cholla Unit 4 creates an incremental capacity need beginning in the summer of 2018, which drives the need for replacement resource(s) throughout the 20-year planning horizon.[14] In the case of a 2018 natural gas conversion, system capacity is maintained; however, with the loss of energy from a baseload plant that is replaced by an inefficient gas-fired peaking resource, system dispatch is impacted, which in turn influences the economic selection of future resources in the portfolio. In either case, changes in the resource portfolio fundamentally influence the economic analysis of each compliance alternative.

[12] The Safe Harbor Lease expires November 2023.
[13] It is assumed that El Paso Natural Gas Company would build and operate the lateral and charge PacifiCorp for its estimated [redacted] cost. The pipeline lateral capital cost is [redacted].
[14] PacifiCorp's coincident system peak load occurs in the summer.

Figure 2 summarizes the cumulative change in the resource portfolio when Cholla Unit 4 retires at the end of 2017 as compared to the continued coal operation case. Positive values show cumulative resource portfolio additions and negative values show the cumulative capacity of resources that are removed from the portfolio when Cholla Unit 4 retires at the end of 2017. Notable resource portfolio changes resulting from an early retirement of Cholla Unit 4 at the end of 2017 include:

- Front office transactions (FOTs) replace 387 MW of retired Cholla Unit 4 coal capacity in 2018.[15]
- An incremental 423 MW combined cycle combustion turbine (CCCT) plant is needed in 2019, and with changes in the system resource mix, FOTs displace a natural gas peaking resource in 2024, which is deferred to 2028.
- A 423 MW CCCT plant is accelerated from 2027 to 2025, offsetting the need for natural gas peaking capacity through 2027 and displacing FOTs and Class 1 DSM resources through 2026.
- An incremental 368 MW CCCT plant is added in 2031, displacing natural gas peaking capacity and FOTs.

**Figure 2. Cumulative Change in Portfolio Resources for the 2017 Early Retirement Case**

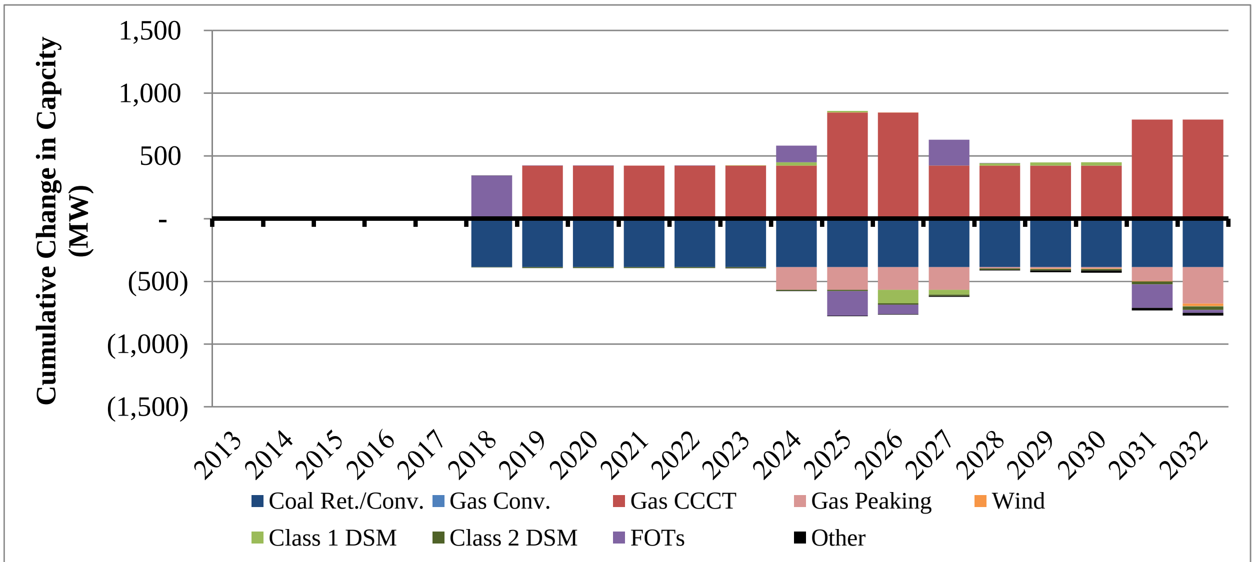


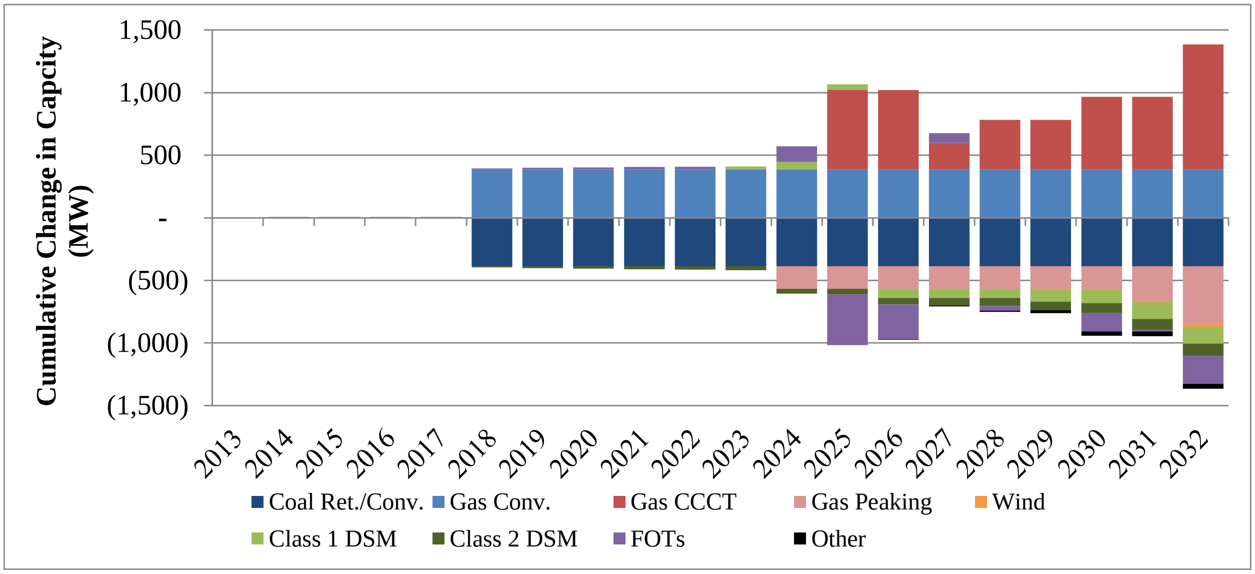

Figure 3 summarizes the cumulative change in the resource portfolio when Cholla Unit 4 is converted to natural gas in 2018 as compared to the continued coal operation case. Positive values show cumulative resource portfolio additions and negative values show the cumulative capacity of resources that are removed from the portfolio when Cholla Unit 4 ceases operating as a coal-fired unit at the end of 2017 and begins operating as a gas-fired plant in the summer of 2018. Notable resource portfolio changes resulting from a natural gas conversion of Cholla Unit 4 include:

- With no change in capacity associated with a Cholla Unit 4 natural gas conversion, resource portfolio impacts are relatively minor over the 2018 through 2023 timeframe.

[15] FOTs represent firm short-term market purchases.

- The timing of a CCCT plant is accelerated from 2027 to 2025 and the size of this CCCT plant is increased from 423 MW to 634 MW.
- The acceleration of the 634 MW CCCT plant in 2025 displaces natural gas peaking capacity, FOTs, Class 1 DSM, and Class 2 DSM resources.
- Two CCCT plants added in 2028 totaling 846 MW are larger than the 661 MW CCCT plant added when Cholla continues operating as a coal-fired unit.
- Similarly, CCCT plants added in 2030 and 2032 total 1,449 MW, exceeding CCCT plant additions over this timeframe in the continued coal-fired operation case by 603 MW.
- The additional CCCT resources added in the out years of the planning horizon help replace baseload generation from Cholla Unit 4 and displace natural gas peaking capacity, FOTs, Class 1 DSM, and Class 2 DSM.

**Figure 3. Cumulative Change in Portfolio Resources for the 2018 Gas Conversion Case**




## PVRR(d) Results: Initial Analysis

Table 2 summarizes the PVRR of system costs for the continued coal operation case, the 2017 retirement case, and the 2018 natural gas conversion case along with the PVRR(d) benefit/(cost) of each compliance alternative relative to installation of SCR. The results show that on a present value revenue requirement basis:

- Installation of SCR is [redacted] to early retirement;
- A 2018 natural gas conversion is [redacted] to installation of SCR; and
- A 2018 natural gas conversion is [redacted] to early retirement.

**Table 2. 2017 Retirement/2018 Conversion PVRR(d) Results: Initial Analysis ($ million)**

| | System PVRR | | | PVRR(d) | |
|---|---|---|---|---|---|
| | Coal Operation with SCR | 2017 Retirement | 2018 Gas Conversion | PVRR(d) Benefit/(Cost) of SCR vs. 2017 Retirement | PVRR(d) Benefit/(Cost) of SCR vs. 2018 Gas Conversion |
| System Variable Costs | | | | | |
| Fuel, FOTs | [redacted] | | | [redacted] | |
| Variable O&M | | | | | |
| Emissions | | | | | |
| Net System Balancing | | | | | |
| *Total Variable* | [redacted] | | | [redacted] | |
| System Fixed Costs | | | | | |
| New Resource Capital/Run-rate | [redacted] | | | [redacted] | |
| Existing Resource Capital/Run-rate | | | | | |
| Decommissioning/Stranded Cost | | | | | |
| Contracts | | | | | |
| Incremental DSM | | | | | |
| Transmission | | | | | |
| *Total Fixed* | [redacted] | | | [redacted] | |
| Total Costs | | | | | |
| *Total* | [redacted] | | | [redacted] | |

The following summarizes line-item PVRR(d) results for the 2017 retirement case (quoted figures are on a present value revenue requirement basis calculated through the 20-year planning horizon):

- Reduced fuel costs from Cholla Unit 4 total [redacted], partially offset by increased system fuel costs from replacement generation and FOTs totaling [redacted].
- Reduced non-fuel variable O&M costs from Cholla Unit 4 total [redacted], which is nearly offset by increased system variable O&M costs totaling [redacted].
- With an assumed $CO_2$ price beginning 2022, emissions costs are reduced by [redacted], with [redacted] of this cost savings attributed to reduced emissions from Cholla Unit 4.
- With the removal of baseload generation from Cholla Unit 4 beginning 2018, system balancing benefits are reduced, increasing the cost of the early retirement alternative by [redacted].
- Driven by the addition of a CCCT plant in 2019 and 2031, and an acceleration of a CCCT plant from 2027 to 2025, new resource capital costs and run-rate operating costs contribute [redacted] of incremental cost to the early retirement case.
- Reduced capital and run-rate operating costs at Cholla Unit 4 total [redacted] under the early retirement case, which is partially offset by accelerated decommissioning costs and recovery of stranded costs for incremental capital expenditures made between 2013 and 2017, which combined total [redacted].
- Contract-related costs for coal contract LDs, the pre-paid transmission write-off, and the casualty payment under the Safe Harbor Lease increase the cost of the 2017 early retirement case by [redacted].
- Additional CCCT plants in the resource portfolio partially displace Class 2 DSM resources and changes the timing of Class 1 DSM resources, reducing system costs by [redacted].
- In aggregate, reduced variable and fixed cost expenditures at Cholla Unit 4 reduce costs by [redacted], which is more than offset by an increase in system fixed and variable

costs, including the cost of replacement generation and reduced net system balancing benefits, totaling [redacted]. The net cost under the 2017 early retirement case as compared to installation of SCR is [redacted].

The following summarizes line-item PVRR(d) results for the 2018 gas conversion case (quoted figures are on a present value revenue requirement basis calculated through the 20-year planning horizon):

- Reduced fuel costs from Cholla Unit 4 total [redacted], which is a lower cost reduction than in the 2017 early retirement case due to inclusion of natural gas fuel expenditures beginning 2018. Cholla Unit 4 fuel cost savings are partially offset by increased system fuel costs from replacement generation and FOTs totaling [redacted].
- Reduced non-fuel variable O&M costs from Cholla Unit 4 total [redacted], equal to savings in the 2017 early retirement case because reagent expenses are avoided when coal-fired operations cease in both cases. These savings are nearly offset by increased system variable O&M costs totaling [redacted].
- With an assumed $CO_2$ price beginning 2022, emissions costs are reduced by [redacted], which is lower than in the 2017 early retirement case given continued, albeit greatly reduced, $CO_2$ emissions when Cholla Unit 4 operates as a natural-gas fired unit beginning in the summer of 2018.
- With reduced generation from Cholla Unit 4 beginning 2018, system balancing benefits are lower, which increases the cost of the natural gas conversion alternative by [redacted]
- Driven by the acceleration of a CCCT plant from 2027 to 2025 and overall increase in total CCCT capacity beginning 2025, new resource capital costs and run-rate operating costs contribute [redacted] of incremental cost to the gas conversion case. As compared to the early retirement case, the present value impact of new resource costs is less because there is no incremental need for a 423 MW CCCT plant in 2019 and resource portfolio impacts occur later in the planning horizon.
- Reduced capital and run-rate operating costs at Cholla Unit 4 total [redacted] under the gas conversion case. Cost savings are less as compared to the early retirement case due continued operation of the unit, including fixed costs for natural gas transportation.
- Coal contract LDs increase the cost of the 2018 gas conversion case by [redacted]. The pre-paid transmission write-off and the casualty payment under the Safe Harbor Lease applied to the 2017 early retirement case are not applicable to the gas conversion case.
- Additional CCCT plants in the resource portfolio partially displace Class 1 and Class 2 DSM resources, reducing system costs by [redacted]
- In aggregate, reduced variable and fixed cost expenditures at Cholla Unit 4 reduce costs by [redacted], which is more than offset by an increase in system fixed and variable costs, including the cost of replacement generation and reduced net system balancing benefits, totaling [redacted]. The net savings under the 2017 early retirement case as compared to installation of SCR total [redacted]

# Updated/Expanded Analysis: January 2014

## Overview: Updated/Expanded Analysis

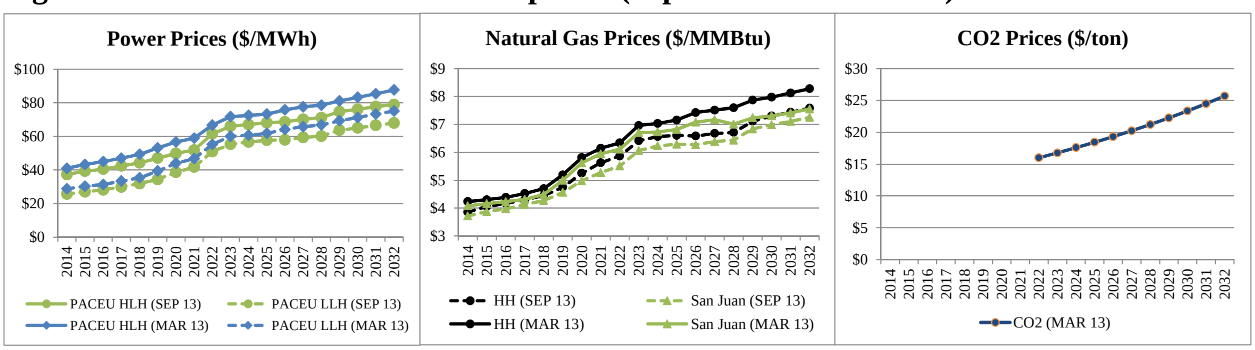
PacifiCorp refreshed and expanded its initial analysis of the early retirement and natural gas conversion alternatives for Cholla Unit 4 in January 2014 with updated forward price curve assumptions and updated capital cost assumptions for CCB/ELG compliance obligations based on updated data supplied to PacifiCorp by APS, the operator of the Cholla plant. PacifiCorp expanded its analysis by studying technology and inter-temporal trade off cases. In its updated and expanded analysis, PacifiCorp evaluated the following compliance alternatives:

- 2017 early retirement (updated);
- 2018 gas conversion (updated);
- SNCR by end of 2017, early retirement by end of 2024 (new);
- SNCR by end of 2017, gas conversion effective 2025 (new);
- No additional emission control equipment, early retirement by end of 2024 (new); and
- No additional emission control equipment, gas conversion effective 2025 (new)

## Updated Forward Price Curve Assumptions: Updated/Expanded Analysis

PacifiCorp's updated analysis of Cholla Unit 4 compliance alternatives was performed using its September 2013 OFPC, which, as in the March 2013 OFPC, includes a $CO_2$ price beginning 2022 at $16/ton and escalating to over $25/ton by 2032. On a nominal levelized basis, power prices and natural gas prices fell by approximately nine percent over the 2018 to 2032 timeframe. Figure 4 summarizes wholesale power prices, natural gas prices, and $CO_2$ prices assumed for the updated analysis.

**Figure 4. Forward Price Curve Assumptions (September 2013 OFPC)***




* San Juan is the natural gas market hub assumed to supply Cholla Unit 4 in the gas conversion cases.

## Annual Non-fuel Expenditure Assumptions: Updated/Expanded Analysis

PacifiCorp's updated analysis included updated capital costs for CCB/ELG compliance obligations. Contract-termination-related costs remain unchanged for 2017 early retirement and 2018 gas conversion cases. Pre-paid transmission write-off costs applicable to the 2024 early retirement cases total [redacted] Safe Harbor Lease costs do not apply to the 2024 early retirement cases because the contract expires November 2023. Similarly, LD costs under the CSA do not apply in the 2024 early retirement and 2025 gas conversion cases because the agreement expires at the end of 2024. Appendix C contains tables detailing annual non-fuel planned expenditures, including contract termination related costs, for each case studied in PacifiCorp's updated and expanded analysis.

## Resource Portfolio Results: Updated/Expanded Analysis

Figure 5 summarizes the cumulative change in the resource portfolio for the updated 2017 early retirement case as compared to the updated continued coal operation case. Positive values show cumulative resource portfolio additions and negative values show the cumulative capacity of resources that are removed from the portfolio when Cholla Unit 4 retires at the end of 2017. Notable resource portfolio changes resulting from an early retirement of Cholla Unit 4 at the end of 2017 include:

- Front office transactions (FOTs) replace 387 MW of retired Cholla Unit 4 coal capacity in 2018 and partially replace Cholla Unit 4 coal capacity in 2019.
- Natural gas peaking resources are accelerated from the 2025/2026 timeframe to the 2019/2020 timeframe, and more Class 1 DSM resources are added sooner, beginning 2020. These resource changes partially offset the need for FOTs and Class 2 DSM resources through 2024.
- An incremental 423 MW CCCT plant is added in 2025 and a second 423 MW CCCT plant is added in 2028. The incremental 2028 CCCT plant defers the need for gas peaking capacity, FOTs, Class 1 DSM, and Class 2 DSM resources.

**Figure 5. Cumulative Change in Portfolio Resources for the Updated 2017 Early Retirement Case**

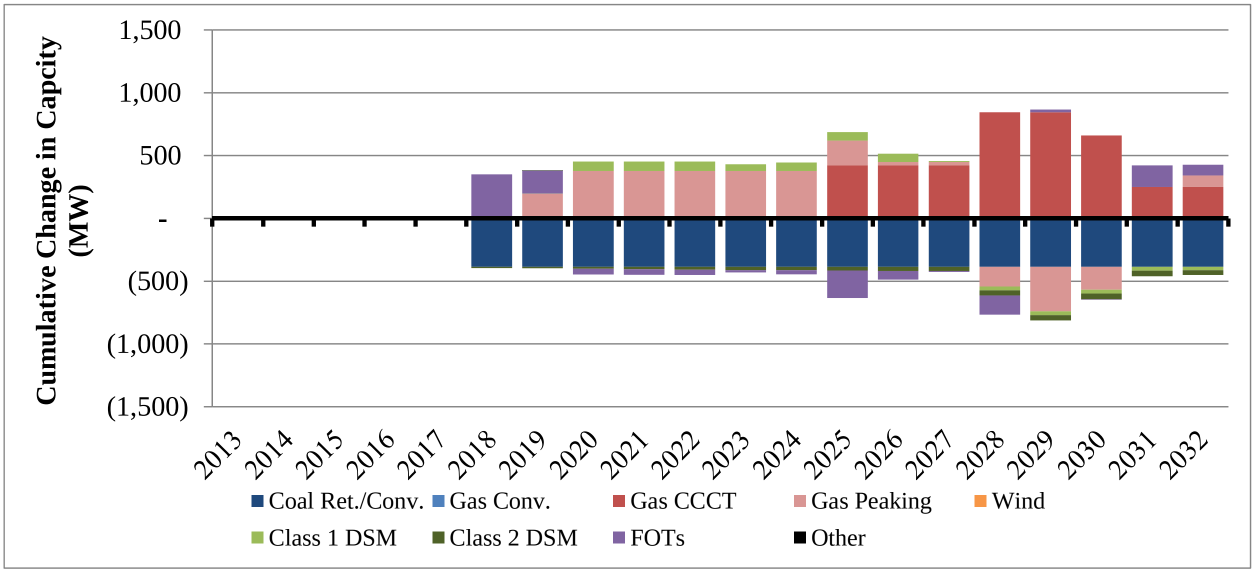



Figure 6 summarizes the cumulative change in the resource portfolio for the updated 2018 gas conversion case as compared to the updated continued coal operation case. Positive values show cumulative resource portfolio additions and negative values show the cumulative capacity of resources that are removed from the portfolio when Cholla Unit 4 ceases operating as a coal-fired unit at the end of 2017 and begins operating as a gas-fired plant in the summer of 2018. Notable resource portfolio changes resulting from a 2018 natural gas conversion of Cholla Unit 4 include:

- With no change in capacity associated with a Cholla Unit 4 natural gas conversion, resource portfolio impacts are relatively minor over the 2018 through 2022 timeframe.
- A 181 MW gas peaking plant is accelerated from 2025 to 2023, partially displacing FOTs, Class 1 DSM and Class 2 DSM resources in 2023 and 2024.
- An incremental 661 MW CCCT plant is added in 2026, partially displacing gas peaking resources, FOTs, Class 1 DSM, and Class 2 DSM resources through 2029.
- By the end of the study period, an incremental 461 MW of CCCT capacity is added, and with incremental FOT purchases, this additional capacity displaces gas peaking resources, Class 1 DSM and Class 2 DSM resources.

**Figure 6. Cumulative Change in Portfolio Resources for the Updated 2018 Gas Conversion Case**

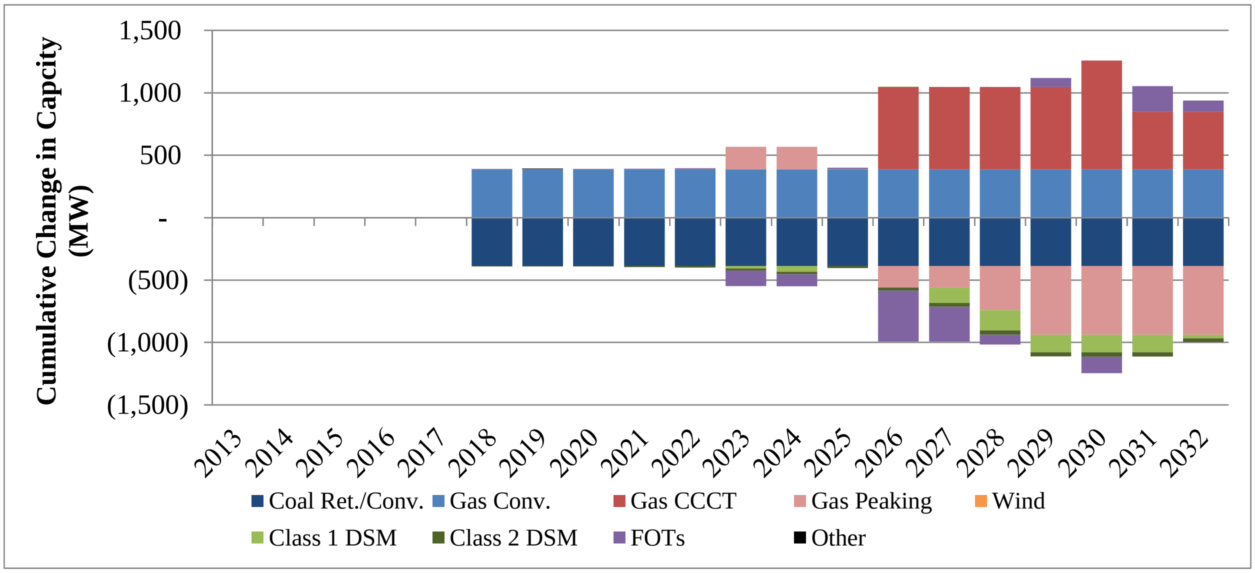



Figure 7 summarizes the cumulative change in the resource portfolio for cases in which Cholla 4 retires at the end of 2024 (with or without installation of SNCR in 2017) as compared to the updated continued coal operation case. Positive values show cumulative resource portfolio additions and negative values show the cumulative capacity of resources that are removed from the portfolio when Cholla Unit 4 is retired at the end of 2024. Notable resource portfolio changes resulting from a 2024 early retirement include:

- When Cholla Unit 4 retires at the end of 2024, a 423 MW CCCT plant is accelerated from 2031 to 2025 and additional Class 1 DSM and Class 2 DSM resources are added to the system, which in aggregate partially displaces gas peaking resource additions through 2031.
- By the end of the study period, an incremental gas peaking resource, FOTs, Class 1 DSM and Class 2 DSM resources combine to replace the 387 MW of retired Cholla Unit 4 capacity.

**Figure 7. Cumulative Change in Portfolio Resources for the 2024 Early Retirement Cases**

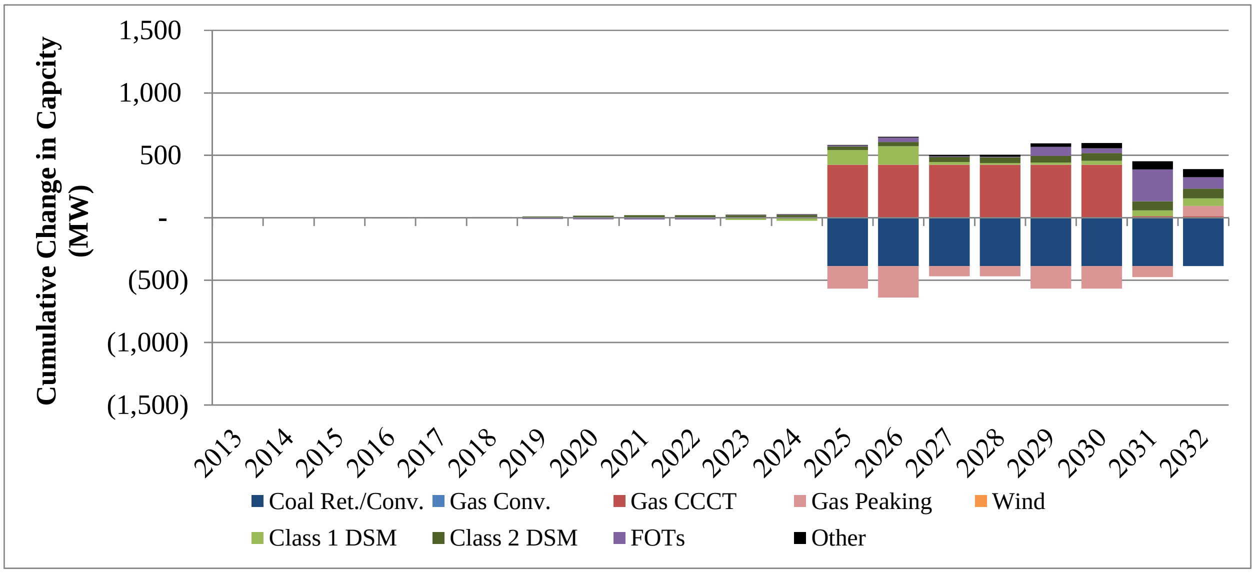
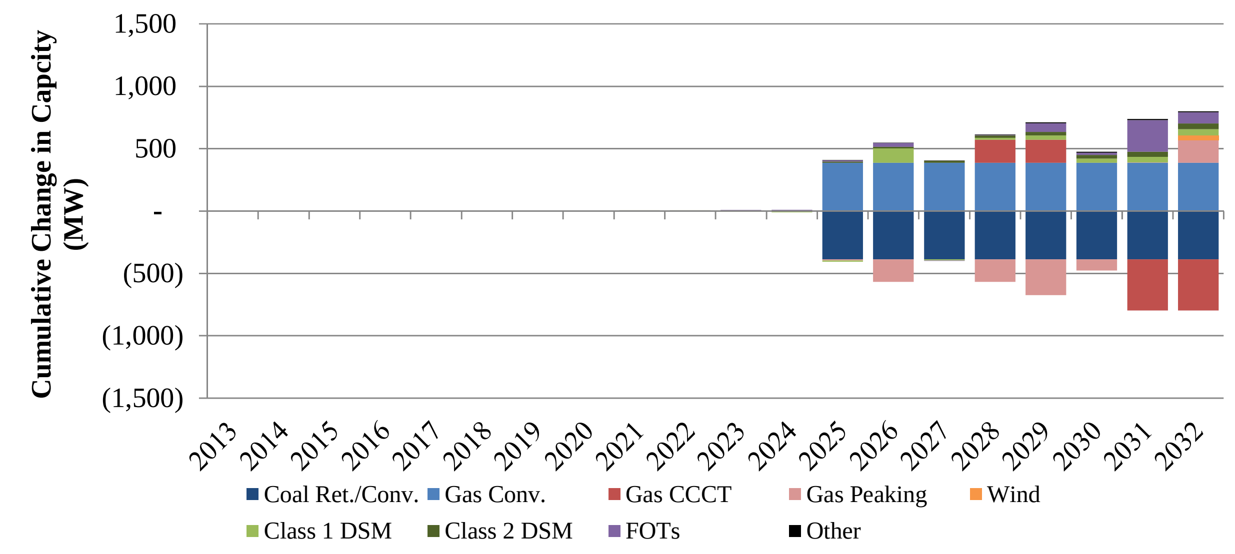



Figure 8 summarizes the cumulative change in the resource portfolio for cases in which Cholla Unit 4 is converted to natural gas in 2025 (with or without installation of SNCR) as compared to the updated continued coal operation case. Positive values show cumulative resource portfolio additions and negative values show the cumulative capacity of resources that are removed from the portfolio when Cholla Unit 4 ceases operating as a coal-fired unit at the end of 2024 and begins operating as a gas-fired plant in the summer of 2025. Notable resource portfolio changes resulting from a 2025 natural gas conversion of Cholla Unit 4 include:

- With no change in capacity associated with a Cholla Unit 4 natural gas conversion, resource portfolio impacts are relatively minor through 2025.
- Class 1 DSM resources and FOTs added in 2026 defer the need for a gas peaking plant by one year.
- In 2028, a 661 MW CCCT plant is replaced with two 423 MW CCCT plants, and the additional CCCT capacity, supplemented with additional Class 1 DSM, Class 2 DSM, and FOTs partially displaces the need for gas peaking resources through 2029.
- By 2030, FOTs and Class 1 DSM resources partially offset gas peaking resource capacity.
- By the end of the study period, additional gas peaking capacity, FOTs, Class 1 DSM, and Class 2 DSM resources offset the need for 411 MW of CCCT capacity.

**Figure 8. Cumulative Change in Portfolio Resources for the 2025 Gas Conversion Cases**




## PVRR(d) Results: Updated/Expanded Analysis

Table 3 summarizes the PVRR of system costs for the updated continued coal operation case, the 2017 retirement case, and the 2018 natural gas conversion case along with the PVRR(d) benefit/(cost) of each compliance alternative relative to installation of SCR. Table 4 summarizes results for the 2024 early retirement and 2025 gas conversion cases. The PVRR(d) results for the equivalent inter-temporal trade-off cases that include SNCR equipment are estimated by adding SNCR capital and operating costs, totaling [redacted] on a PVRR basis, to these two cases. The results show that on a present value revenue requirement basis:

- All cases are more favorable than installation of SCR in 2017.
- Inter-temporal cases that avoid installation of SCR with continued coal-fired operations through 2024 are lower cost relative to installation of SCR in 2017 and lower cost than a 2018 natural gas conversion.
- The 2025 natural gas conversion inter-temporal case where emission control costs are entirely avoided is the least cost alternative, with a PVRR(d) that is [redacted] favorable to installation of SCR in 2017.

**Table 3. 2017 Retirement/2018 Conversion PVRR(d) Results: Updated Analysis ($ million)**

| | System PVRR | | | PVRR(d) | |
|---|---|---|---|---|---|
| | Coal Operation with SCR | 2017 Retirement | 2018 Gas Conversion | PVRR(d) Benefit/(Cost) of SCR vs. 2017 Retirement | PVRR(d) Benefit/(Cost) of SCR vs. 2018 Gas Conversion |
| System Variable Costs | | | | | |
| Fuel, FOTs | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Variable O&M | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Emissions | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Net System Balancing | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| *Total Variable* | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| System Fixed Costs | | | | | |
| New Resource Capital/Run-rate | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Existing Resource Capital/Run-rate | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Decommissioning/Stranded Cost | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Contracts | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Incremental DSM | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Transmission | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| *Total Fixed* | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Total Costs | | | | | |
| *Total* | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |

The following summarizes line-item PVRR(d) results for the 2017 retirement case (quoted figures are on a present value revenue requirement basis calculated through the 20-year planning horizon):

- Reduced fuel costs from Cholla Unit 4 total [redacted], and system fuel costs including the cost for FOTs are reduced by over [redacted].
- Reduced non-fuel variable O&M costs from Cholla Unit 4 total [redacted] which is partially offset by increased system variable O&M costs totaling [redacted].
- With an assumed $CO_2$ price beginning 2022, emissions costs are reduced by [redacted], with [redacted] of emission cost savings attributed to reduced emissions from Cholla Unit 4 offset by [redacted] of higher $CO_2$ emission costs from the rest of the system.
- Beginning 2018, system balancing benefits are reduced, increasing the cost of the early retirement alternative by [redacted].
- Driven by the acceleration of natural gas peaking resources to the 2019/2020 timeframe and the addition of a 423 MW CCCT plant in 2025, new resource capital costs and run-rate operating costs contribute [redacted] of incremental cost to the updated early retirement case.
- Reduced capital and run-rate operating costs at Cholla Unit 4 total [redacted] under the early retirement case, which is partially offset by accelerated decommissioning costs and recovery of stranded costs for incremental capital expenditures made between 2013 and 2017, which combined, total [redacted].
- Contract-related costs for coal contract LDs, the pre-paid transmission write-off, and the casualty payment under the Safe Harbor Lease increase the cost of the updated 2017 early retirement case by [redacted].
- With changes in the timing of Class 1 DSM resources and partial displacement of Class 2 DSM resources, system costs are lowered by [redacted].

- In aggregate, reduced variable and fixed cost expenditures at Cholla Unit 4 reduce costs by [redacted] , which is partially offset by an increase in system fixed and variable costs, including the cost of replacement generation and reduced net system balancing benefits, totaling [redacted]. With reduced natural gas prices, the updated 2017 early retirement case is lower cost than installing SCR. The net savings under the updated 2017 early retirement case relative to installation of SCR total [redacted].

The following summarizes line-item PVRR(d) results for the updated 2018 gas conversion case (quoted figures are on a present value revenue requirement basis calculated through the 20-year planning horizon):

- Reduced fuel costs from Cholla Unit 4 total [redacted], lower savings than in the updated 2017 early retirement case due to inclusion of natural gas fuel expenditures beginning 2018. Cholla Unit 4 fuel cost savings are partially offset by increased system fuel costs from replacement generation and FOTs totaling [redacted]
- Reduced non-fuel variable O&M costs from Cholla Unit 4 total [redacted], equal to savings in the updated 2017 early retirement case because reagent expenses are avoided when coal-fired operations cease in both cases. These savings are offset by increased system variable O&M costs totaling [redacted]
- With an assumed $CO_2$ price beginning 2022, emissions costs are reduced by [redacted], which is lower than in the updated 2017 early retirement case given continued, albeit greatly reduced, $CO_2$ emissions when Cholla Unit 4 operates as a natural-gas fired unit beginning 2018.
- Without baseload generation from Cholla Unit 4 beginning 2018, system balancing benefits are reduced, increasing the cost of the natural gas conversion alternative by [redacted]
- Driven by the acceleration of a of a gas peaking plant from 2025 to 2023 and incremental CCCT resource additions net of offsetting costs from reduced gas peaking resources, new resource capital costs and run-rate operating costs contribute [redacted] of incremental cost to the updated 2018 gas conversion case.
- Reduced capital and run-rate operating costs at Cholla Unit 4 total [redacted] under the updated 2018 gas conversion case. Cost savings are less as compared to the updated early retirement case due continued operation of the unit, inclusive of fixed costs for natural gas transportation.
- Coal contract LDs increase the cost of the 2018 gas conversion case by [redacted]. The pre-paid transmission write-off and the casualty-related payment under the Safe Harbor Lease applied to the updated 2017 early retirement case are not applicable to the gas conversion case.
- Class 1 and Class 2 DSM resources are partially displaced with changes in the resource mix, reducing system costs by [redacted]
- In aggregate, reduced variable and fixed cost expenditures at Cholla Unit 4 reduce costs by [redacted], which is partially offset by an increase in system fixed and variable costs, including the cost of replacement generation and reduced net system balancing benefits, totaling [redacted]. With reduced natural gas prices, the PVRR(d) in favor of a 2018 natural gas conversion improves. The net savings under the updated 2018 gas conversion case relative to installation of SCR total [redacted]

**Table 4. 2024 Early Retirement/2025 Gas Conversion PVRR(d) Results: Expanded Analysis ($ million)***

| | System PVRR | | | PVRR(d) | |
|---|---|---|---|---|---|
| | Coal Operation with SCR | 2024 Retirement | 2025 Gas Conversion | PVRR(d) Benefit/(Cost) of SCR vs. 2024 Retirement | PVRR(d) Benefit/(Cost) of SCR vs. 2025 Conversion |
| System Variable Costs | | | | | |
| Fuel, FOTs | [redacted] | | | [redacted] | |
| Variable O&M | | | | | |
| Emissions | | | | | |
| Net System Balancing | | | | | |
| *Total Variable* | | | | | |
| System Fixed Costs | | | | | |
| New Resource Capital/Run-rate | [redacted] | | | [redacted] | |
| Existing Resource Capital/Run-rate | | | | | |
| Decommissioning/Stranded Cost | | | | | |
| Contracts | | | | | |
| Incremental DSM | | | | | |
| Transmission | | | | | |
| *Total Fixed* | | | | | |
| Total Costs | | | | | |
| *Total* | [redacted] | | | [redacted] | |

* Adding 2017 SNCR costs increases the PVRR of the 2024 early retirement and the 2025 natural gas conversion cases by [redacted]

The following summarizes line-item PVRR(d) results for the 2024 early retirement case (quoted figures are on a present value revenue requirement basis calculated through the 20-year planning horizon):

- Reduced fuel costs from Cholla Unit 4 total [redacted], partially offset by increased system fuel costs inclusive of the cost for FOTs totaling [redacted]
- Reduced non-fuel variable O&M costs from Cholla Unit 4 total [redacted], which is partially offset by increased system variable O&M costs totaling [redacted]
- With an assumed $CO_2$ price beginning 2022, emissions costs are reduced by [redacted] with [redacted] of emission cost savings attributed to reduced emissions from Cholla Unit 4 offset by [redacted] of higher $CO_2$ emission costs from the rest of the system.
- System balancing benefits are reduced, increasing the cost of the early retirement alternative by [redacted]
- Driven by the acceleration of a 423 MW CCCT plant from 2031 to 2025, new resource capital costs and run-rate operating costs contribute [redacted] of incremental cost to the 2024 early retirement case.
- Reduced capital and run-rate operating costs at Cholla Unit 4 total [redacted] under the 2024 early retirement case, which is partially offset by accelerated decommissioning costs and recovery of stranded costs for incremental capital expenditures made between 2013 and 2024, which combined, total [redacted].
- Contract related costs for the pre-paid transmission write-off increase the cost of the 2024 early retirement case by [redacted]
- With additional Class 1 and Class 2 DSM resources, DSM system costs increase by [redacted].

- In aggregate, reduced variable and fixed cost expenditures at Cholla Unit 4 reduce costs by [redacted], which is partially offset by an increase in system fixed and variable costs, including the cost of replacement generation and reduced net system balancing benefits, totaling [redacted]. The net savings under the 2024 early retirement case as compared to installation of SCR are [redacted]. With 2017 SNCR costs, the net savings decrease to [redacted].
- As compared to the 2017 early retirement case, the net savings of the 2024 early retirement case are [redacted]. With 2017 SNCR costs, the net savings decrease to [redacted].
- As compared to the 2018 natural gas conversion case, the net savings of the 2024 early retirement case are [redacted]. With 2017 SNCR, costs the net savings decrease to [redacted].

The following summarizes line-item PVRR(d) results for the 2025 gas conversion case (quoted figures are on a present value revenue requirement basis calculated through the 20-year planning horizon):

- Reduced fuel costs from Cholla Unit 4 total [redacted], lower than the savings in the 2024 early retirement case due to inclusion of natural gas fuel expenditures beginning 2025. Cholla Unit 4 fuel cost savings are partially offset by increased system fuel costs from replacement generation and FOTs totaling [redacted].
- Reduced non-fuel variable O&M costs from Cholla Unit 4 total [redacted], equal to savings in the 2024 early retirement case because reagent expenses are avoided when coal-fired operations cease in both cases. System variable O&M costs are reduced by [redacted].
- With an assumed $CO_2$ price beginning 2022, emissions costs are reduced by [redacted], with [redacted] of these cost savings attributable to reduced emissions from Cholla Unit 4.
- System balancing benefits are reduced, increasing the cost of the 2025 natural gas conversion alternative by [redacted]
- With Class 1 DSM and FOTs deferring 2026 natural gas peaking capacity by one year and partially deferring CCCT capacity beginning 2030, new resource capital costs and run-rate operating costs are reduced by [redacted]
- Reduced capital and run-rate operating costs at Cholla Unit 4 total [redacted] under the 2025 gas conversion case. Cost savings are less as compared to the 2024 early retirement case due to continued operation of the unit, inclusive of fixed costs for natural gas transportation.
- Under the 2025 gas conversion case, there are no coal contract LDs, no pre-paid transmission write-off costs, and no casualty payments under the Safe Harbor Lease.
- With additional Class 1 and Class 2 DSM resources, DSM system costs increase by [redacted]
- In aggregate, reduced variable and fixed cost expenditures at Cholla Unit 4 reduce costs by [redacted], which is partially offset by an increase in system fixed and variable costs, including the cost of replacement generation and reduced net system balancing benefits, totaling $280 million. The net savings under the 2025 gas conversion case as compared to installation of SCR are [redacted]. With 2017 SNCR costs, the net savings decrease to [redacted]

- As compared to the 2017 early retirement case, the net savings of the 2025 gas conversion case are [redacted]. With SNCR costs, the net savings decrease to [redacted].
- As compared to the 2018 natural gas conversion case, the net savings of the 2025 gas conversion case are [redacted]. With SNCR, costs the net savings decrease to [redacted]

## Discussion

### Cholla Unit 4 Preferred Compliance Alternatives

PacifiCorp's financial analysis shows that installation of SCR by an assumed compliance date of January 4, 2018, is not a cost effective solution for customers when evaluated against a range of compliance alternatives. Customer benefits are maximized under an assumed alternate compliance scenario in which Cholla Unit 4 continues operating through early 2025 without the installation of SCR, followed by conversion of the unit to natural gas fueling, thereby avoiding coal contract LDs, avoiding casualty payments under the Safe Harbor Lease, and avoiding or mitigating pre-paid transmission write-off expenses. This preferred compliance alternative also effectively manages utilization and depreciation of the resource over an appropriate period of time for the benefit of customers. If an alternate compliance solution that maximizes benefits for PacifiCorp customers consistent with these results cannot be reached, converting Cholla Unit 4 to a natural gas-fired unit in 2018 or later is currently assessed as the next best alternative to a 2017 early retirement outcome.

### Implications of 111(d)

On June 2, 2014, EPA issued a proposed rule under Clean Air Act § 111(d) to regulate $CO_2$ emissions from existing fossil-fueled electric generators. EPA is requesting comments on the proposed rule by December 1, 2014, and the final rule is expected in June 2015. Under the proposed rule, state plans implementing the final rule will be due June 2016. States submitting individual plans can request an extension to submit plans to EPA by June 2017, and states submitting multi-state plans can request an extension to submit plans to EPA by June 2018. Under EPA's proposed rule, state plans will need to achieve state-specific emission rate goals based on fossil emissions adjusted for creditable renewable energy, nuclear energy, and energy savings from end-use energy efficiency by 2030 via a 2020-2029 glidepath with biennial plans beginning 2022 showing reasonable progress.[16]

EPA's emission rate standards under its proposed rule for the state of Arizona targets an interim emission rate goal of 735 lb/MWh over the period 2020–2029 and a final emission rate goal of 702 lb/MWh in 2030. Based on EPA's data used to calculate the Arizona emission rate standards, the Cholla plant emission rate in 2012 was 2,425 lb/MWh. If converted to natural gas, mass-based $CO_2$ emissions from the unit would fall dramatically due to reduced dispatch and the lower $CO_2$ content of natural gas as compared to coal.[17] However, the emission rate of Cholla Unit 4 operating as a gas-fired unit is expected to be within the 1,300 lb/MWh to 1,350 lb/MWh

[16] States can convert emission rate targets to a mass-based cap (tons $CO_2$); however, EPA has provided little guidance or indication of how to convert emission rate targets to mass-based caps.
[17] When converted to natural gas, the annual average capacity factor for Cholla 4 is expected to range between 3 percent and 7 percent (between 14 percent and 29 percent in July and August).

range. Whether operating as a coal-fired unit or as a gas-fired unit, the Cholla Unit 4 emission rate exceeds the final emission rate goal established for the state of Arizona by EPA in its proposed rule.

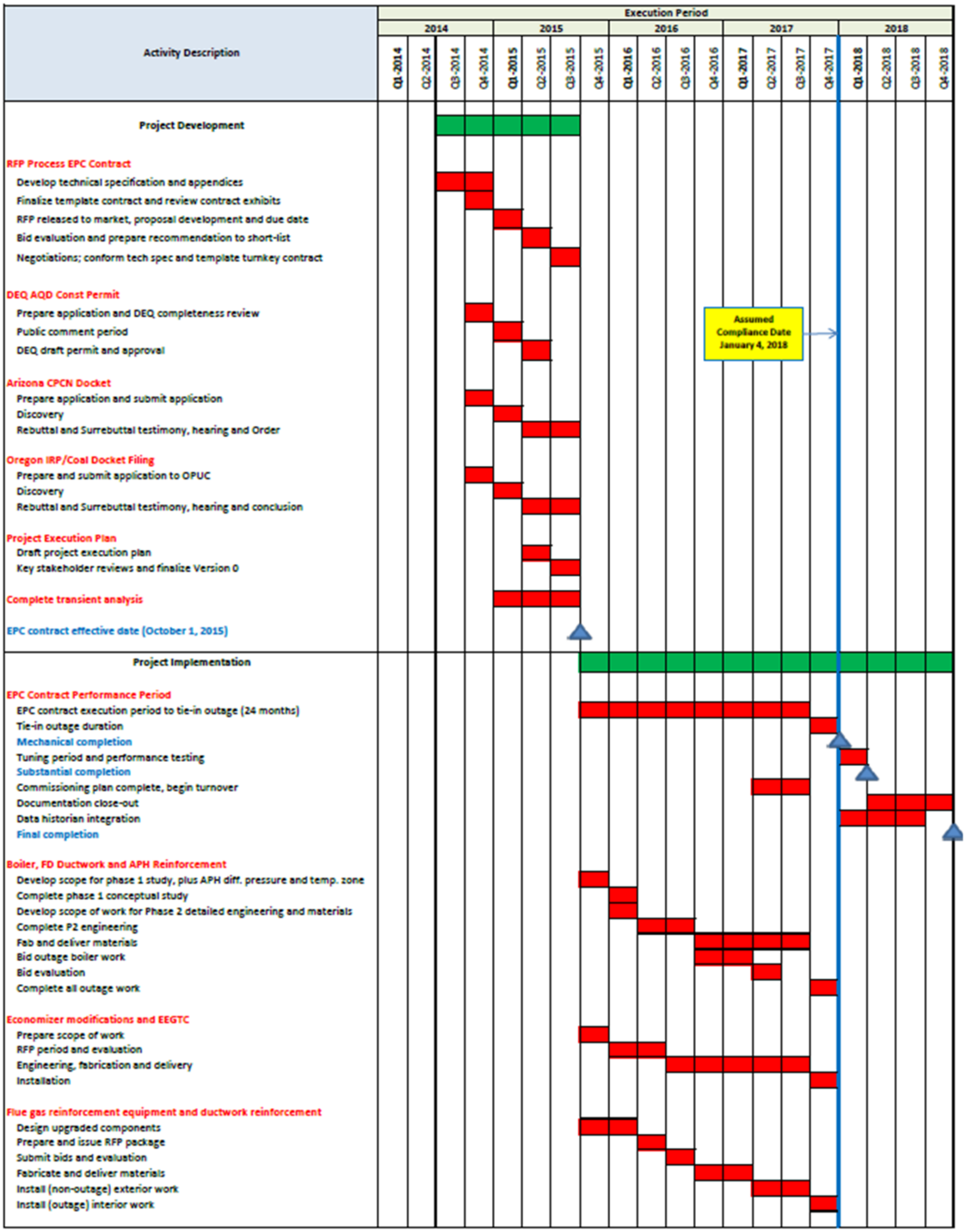
PacifiCorp does not have retail customers in Arizona and does not own any generating resources in the state other than Cholla Unit 4. With the ability to optimize its system resources for 111(d) compliance purposes, PacifiCorp could utilize system fossil emissions, fossil energy, and renewable energy, or end-use energy efficiency to achieve compliance with Arizona 111(d) targets. Without the ability to optimize the allocation of fossil emissions, fossil energy, renewable energy, or end-use energy efficiency savings from across its system for 111(d) compliance purposes, PacifiCorp would be unable to credit the Cholla Unit 4 emission rate to align with the Arizona state emission rate goal. Consequently, the state's decision on how it will treat non-load serving entities in its 111(d) plan will ultimately determine 111(d) compliance impacts associated with long-term operations of Cholla Unit 4. Consideration of 111(d) compliance risks aligns with the financial analysis showing that installation of SCR is not a cost effective Regional Haze compliance solution for customers. PacifiCorp will continue to evaluate least cost compliance alternatives for Cholla Unit 4 as EPA's proposed 111(d) rule is finalized and the state of Arizona begins to formulate its 111(d) compliance plan for submittal to EPA.

## Conclusion

PacifiCorp will pursue a Regional Haze compliance alternative for Cholla Unit 4 that eliminates the obligation to install SCR and maximizes customer benefits. The decision is supported by financial analysis of compliance alternatives, including technology and inter-temporal trade-off analysis. Furthermore, eliminating the SCR installation requirement is expected to help maintain compliance flexibility, as well as mitigate the risk of incremental stranded investment, associated with 111(d) compliance. PacifiCorp will pursue an alternate compliance solution that avoids installation of SCR in exchange for a firm commitment to cease operating Cholla Unit 4 as a coal-fired unit by early 2025, with an option to convert to natural gas fueling thereafter, thereby mitigating coal contract LD costs, Safe Harbor Lease casualty payments, pre-paid transmission write-off costs, and effectively managing utilization and depreciation of the resource over an appropriate period of time for the benefit of customers. In parallel, PacifiCorp will continue to evaluate least cost compliance alternatives at Cholla Unit 4 as EPA's proposed 111(d) rule is finalized and the state of Arizona begins to formulate its 111(d) compliance plan.

# Appendix A

## Figure A.1. SCR Installation Schedule for Assumed January 4, 2018 Compliance Date



## Figure A.2. SNCR Installation Schedule for Assumed January 4, 2018 Compliance Date

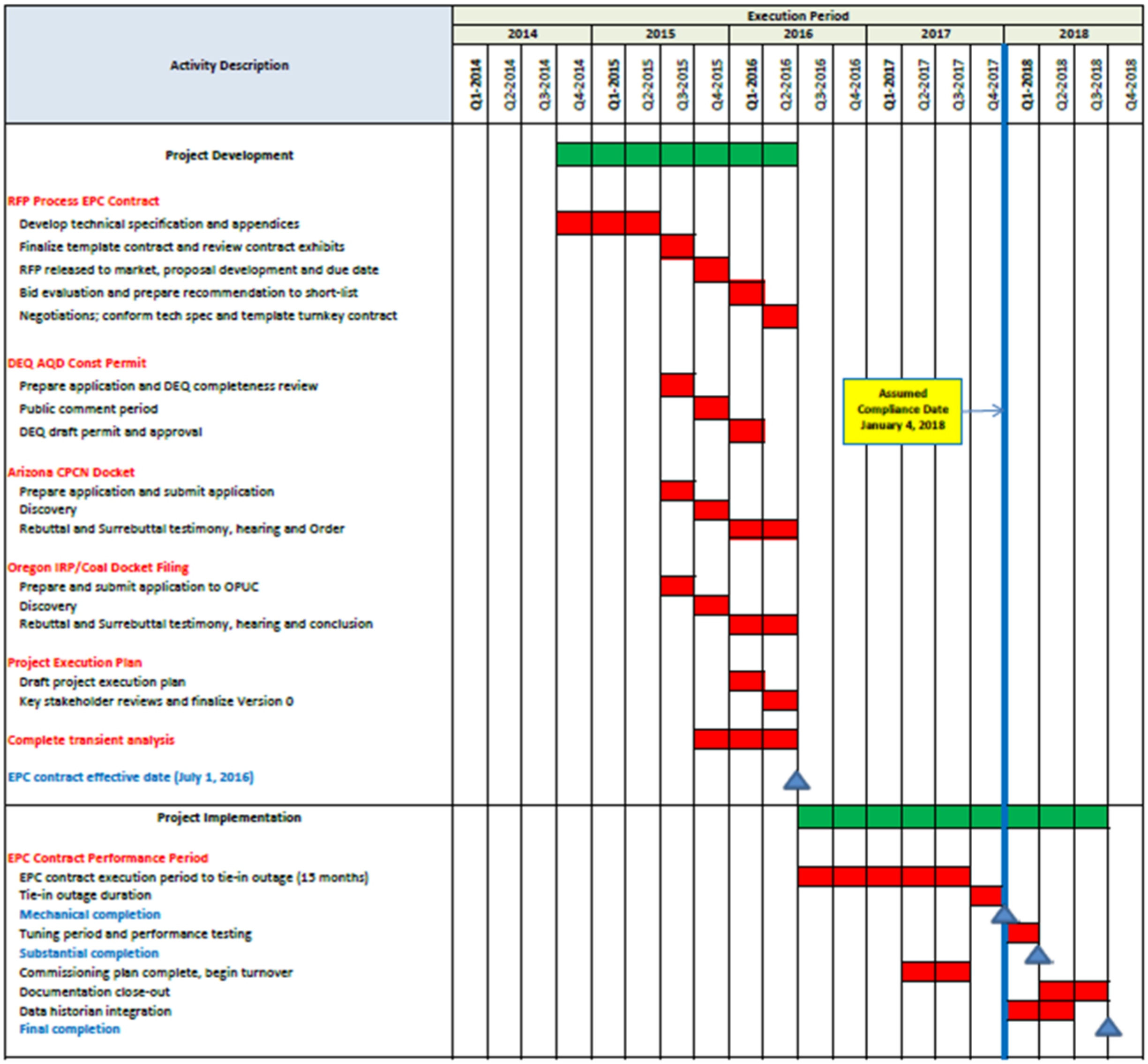


**Figure A.3. Natural Gas Conversion Installation Schedule for a 2018 On-line Date**

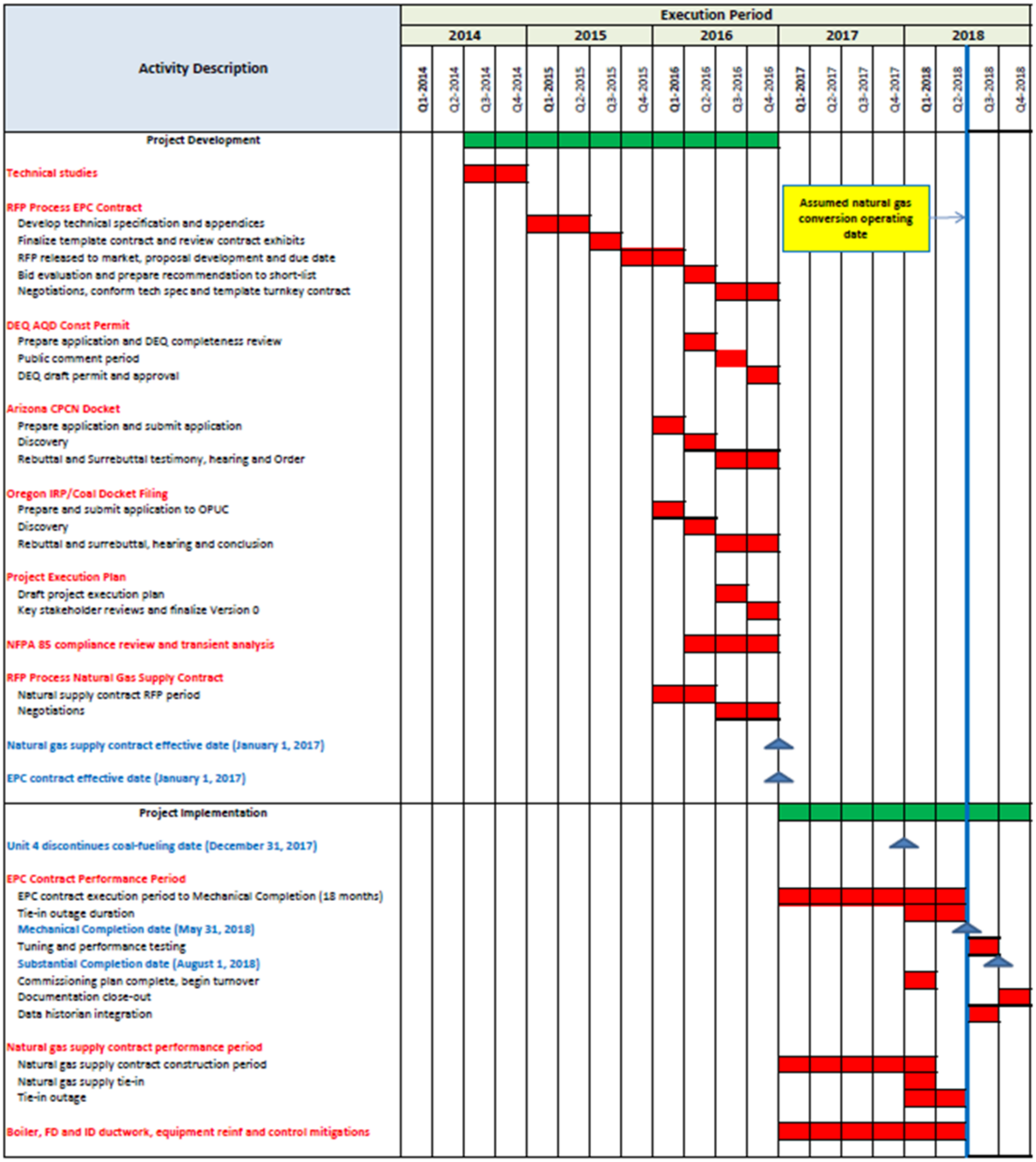
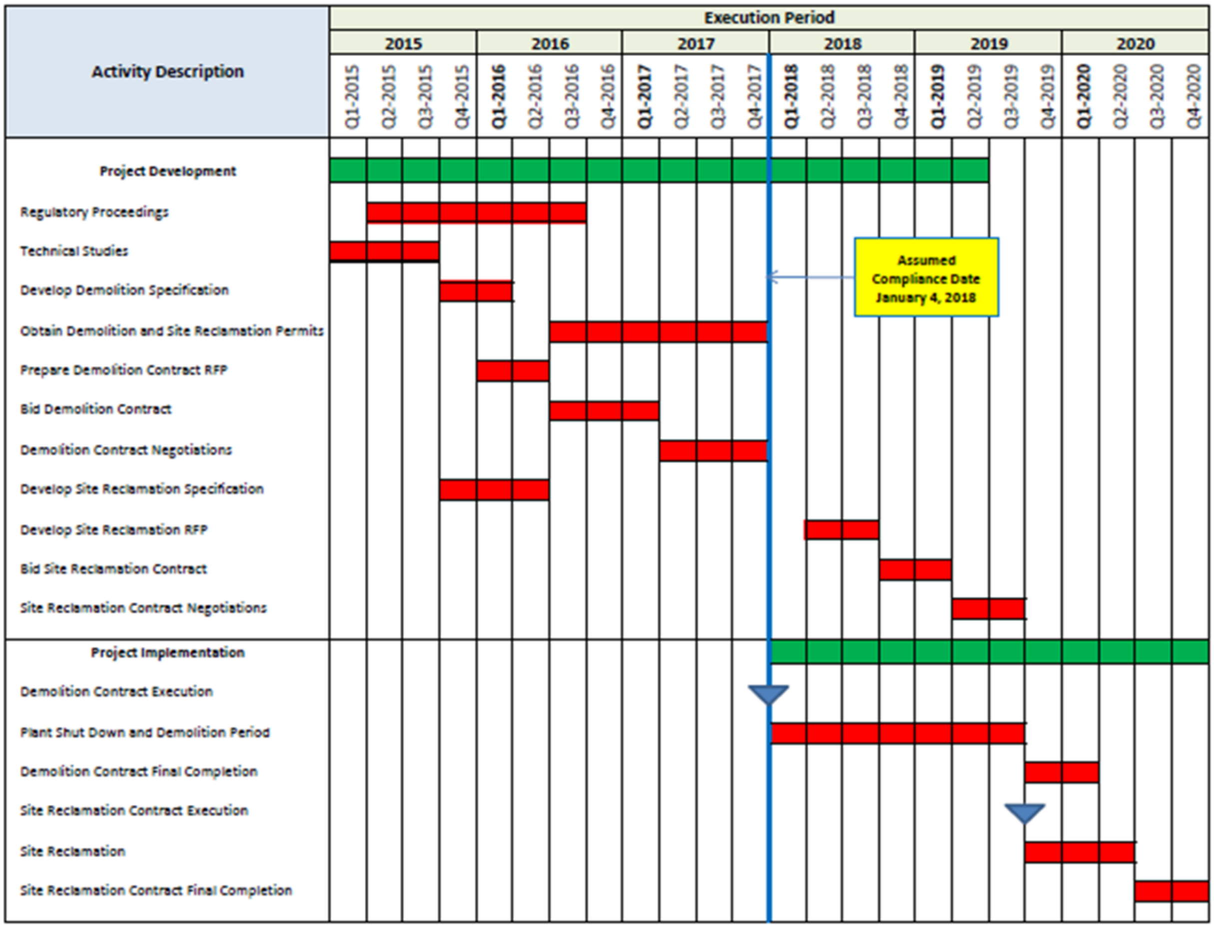


**Figure A.4. Early Retirement Schedule for a Year-end 2017 Retirement Date**



# Appendix B: Initial Analysis Annual Expenditures by Case

### Table B.1. Cholla Unit 4 Annual Expenditures for the Continued Coal Operation Case

| Environmental Capital (Nominal $m, with AFUDC) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Description | 2013 | 2015 | 2017 | 2020 | 2025 | 2030 | Total |
| SM | [redacted] | | | | | | |
| SCR | | | | | | | |
| Mercury | | | | | | | |
| CCB/ELG | | | | | | | |
| Total | | | | | | | |

| Run-rate Operating Cost (Nominal $m, Capital with AFUDC) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Description | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
| O&M | [redacted] | | | | | | | | | |
| Capital | | | | | | | | | | |
| Total | | | | | | | | | | |
| | | | | | | | | | | |
| Description | [redacted] | | | | | | | | | |
| O&M | | | | | | | | | | |
| Capital | | | | | | | | | | |
| Total | | | | | | | | | | |

### Table B.2. Cholla Unit 4 Annual Expenditures for the 2017 Early Retirement Case

| Environmental Capital (Nominal $m, with AFUDC) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Description | 2013 | 2015 | 2017 | 2020 | 2025 | 2030 | Total |
| SM | [redacted] | | | | | | |
| SCR | | | | | | | |
| Mercury | | | | | | | |
| CCB/ELG | | | | | | | |
| Total | | | | | | | |

| Run-rate Operating Cost (Nominal $m, Capital with AFUDC) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Description | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
| O&M | [redacted] | | | | | | | | | |
| Capital | | | | | | | | | | |
| Pre-paid Trans. | | | | | | | | | | |
| Safe Harbor | | | | | | | | | | |
| CSA LDs | | | | | | | | | | |
| Total | | | | | | | | | | |
| | | | | | | | | | | |
| Description | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 |
| O&M | [redacted] | | | | | | | | | |
| Capital | | | | | | | | | | |
| Pre-paid Trans. | | | | | | | | | | |
| Safe Harbor | | | | | | | | | | |
| CSA LDs | | | | | | | | | | |
| Total | | | | | | | | | | |

**Table B.3. Cholla Unit 4 Annual Expenditures for the 2018 Gas Conversion Case**

| **Environmental Capital (Nominal $m, with AFUDC)** | | | | | | | |
|---|---|---|---|---|---|---|---|
| Description | 2013 | 2015 | 2017 | 2020 | 2025 | 2030 | Total |
| SM | [redacted] | | | | | | |
| SCR | | | | | | | |
| Mercury | | | | | | | |
| CCB/ELG | | | | | | | |
| Total | | | | | | | |

| **Run-rate Operating Cost (Nominal $m, Capital with AFUDC)** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Description | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
| O&M | [redacted] | | | | | | | | | |
| Capital | | | | | | | | | | |
| CSA LDs | | | | | | | | | | |
| Fixed Gas Trans. | | | | | | | | | | |
| Total | | | | | | | | | | |
| | | | | | | | | | | |
| Description | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 |
| O&M | [redacted] | | | | | | | | | |
| Capital | | | | | | | | | | |
| CSA LDs | | | | | | | | | | |
| Fixed Gas Trans. | | | | | | | | | | |
| Total | | | | | | | | | | |

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# Appendix C: Updated/Expanded Analysis Annual Expenditures by Case

**Table C.1. Cholla Unit 4 Updated Annual Expenditures for the Continued Coal Operation Case**

| Environmental Capital (Nominal $m, with AFUDC) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Description | 2013 | 2015 | 2017 | 2020 | 2025 | 2030 | Total |
| SM | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| SCR | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Mercury | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| CCB/ELG | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Total | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |

| Run-rate Operating Cost (Nominal $m, Capital with AFUDC) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Description | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| O&M | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Capital | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Total | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| | | | | | | | | | | |
| Description | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 |
| O&M | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Capital | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Total | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |

**Table C.2. Cholla Unit 4 Updated Annual Expenditures for the 2017 Early Retirement Case**

| Environmental Capital (Nominal $m, with AFUDC) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Description | 2013 | 2015 | 2017 | 2020 | 2025 | 2030 | Total |
| SM | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| SCR | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Mercury | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| CCB/ELG | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Total | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |

| Run-rate Operating Cost (Nominal $m, Capital with AFUDC) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Description | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
| O&M | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Capital | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Pre-paid Trans. | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Safe Harbor | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| CSA LDs | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Total | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| | | | | | | | | | | |
| Description | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 |
| O&M | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Capital | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Pre-paid Trans. | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Safe Harbor | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| CSA LDs | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Total | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |

**Table C.3. Cholla Unit 4 Updated Annual Expenditures for the 2018 Gas Conversion Case**

| **Environmental Capital (Nominal $m, with AFUDC)** | | | | | | | |
|---|---|---|---|---|---|---|---|
| Description | 2013 | 2015 | 2017 | 2020 | 2025 | 2030 | Total |
| SM | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| SCR | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Mercury | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| CCB/ELG | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Total | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |

| **Run-rate Operating Cost (Nominal $m, Capital with AFUDC)** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Description | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
| O&M | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Capital | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| CSA LDs | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Fixed Gas Trans. | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Total | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| | | | | | | | | | | |
| Description | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 |
| O&M | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Capital | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| CSA LDs | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Fixed Gas Trans. | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Total | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |

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**Table C.4. Cholla Unit 4 Annual Expenditures for the SNCR, 2024 Retirement Case***

| Environmental Capital (Nominal $m, with AFUDC) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Description | 2013 | 2015 | 2017 | 2020 | 2025 | 2030 | Total |
| SM | [redacted] | | | | | | |
| SNCR | | | | | | | |
| Mercury | | | | | | | |
| CCB/ELG | | | | | | | |
| Total | [redacted] | | | | | | |

| Run-rate Operating Cost (Nominal $m, Capital with AFUDC) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Description | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
| O&M | [redacted] | | | | | | | | | |
| Capital | | | | | | | | | | |
| Pre-paid Trans. | | | | | | | | | | |
| Safe Harbor | | | | | | | | | | |
| CSA LDs | | | | | | | | | | |
| Total | [redacted] | | | | | | | | | |
| | | | | | | | | | | |
| Description | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 |
| O&M | [redacted] | | | | | | | | | |
| Capital | | | | | | | | | | |
| Pre-paid Trans. | | | | | | | | | | |
| Safe Harbor | | | | | | | | | | |
| CSA LDs | | | | | | | | | | |
| Total | [redacted] | | | | | | | | | |

*In the 2024 retirement case (without SNCR expenditures), 2017 SNCR capital costs are avoided, and SNCR-related O&M expenses are reduced by [redacted] from 2018 through 2024. No other expenditures change.

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**Table C.5. Cholla Unit 4 Annual Expenditures for the SNCR, 2025 Gas Conversion Case***

| **Environmental Capital (Nominal $m, with AFUDC)** | | | | | | | |
|---|---|---|---|---|---|---|---|
| Description | 2013 | 2015 | 2017 | 2020 | 2025 | 2030 | Total |
| SM | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| SNCR | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Mercury | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| CCB/ELG | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Total | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |

| **Run-rate Operating Cost (Nominal $m, Capital with AFUDC)** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Description | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
| O&M | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Capital | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Fixed Gas Trans. | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Total | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| | | | | | | | | | | |
| Description | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 |
| O&M | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Capital | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Fixed Gas Trans. | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |
| Total | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] | [redacted] |

*In the 2025 gas conversion case (without SNCR expenditures), 2017 SNCR capital costs are avoided, and SNCR-related O&M expenses are reduced by [redacted] from 2018 through 2024. No other expenditures change.

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