

2017 INTEGRATED RESOURCE PLAN

Volume II - Appendices

April 4, 2017



Regional Haze Case: Ref.

Regional Haze Case Fact Sheets

CASE ASSUMPTIONS

Description

Refer to Volume I, Chapter 7 (Regional Haze Case Definitions).

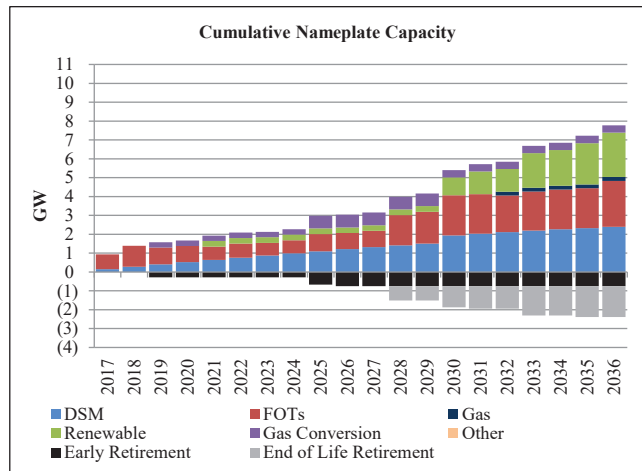
PORTFOLIO SUMMARY

System Optimizer PVRR (\$m)

System Cost without Transmission Upgrades	\$24,156
Transmission Integration	\$51
Transmission Reinforcement	\$12
Total Cost	\$24,219

Resource Portfolio

Cumulative changes to the resource portfolio (new resource additions and resource retirements), represented as nameplate capacity, are summarized in the figure below.



Regional Haze

Regional Haze assumptions are summarized in the following table.

Coal Unit	Description
Cholla 4	Gas Conversion by Dec 2025, Retire Dec 2042
Colstrip 3	Retire Dec 2046
Colstrip 4	Retire Dec 2046
Craig 1	Retire Dec 2025
Craig 2	SCR by Dec 2017, Retire Dec 2034
Dave Johnston 1	Retire Dec 2027
Dave Johnston 2	Retire Dec 2027
Dave Johnston 3	Retire Dec 2027
Dave Johnston 4	Retire Dec 2027
Hayden 1	Retire Dec 2030
Hayden 2	SCR by Dec 2016, Retire Dec 2030
Hunter 1	SCR by 2021, Retire Dec 2042
Hunter 2	SCR by 2021, Retire Dec 2042
Hunter 3	Retire Dec 2042
Huntington 1	SCR by 2021, Retire Dec 2036
Huntington 2	SCR by 2021, Retire Dec 2036
Jim Bridger 1	SCR by 2022, Retire Dec 2037
Jim Bridger 2	SCR by 2021, Retire Dec 2037
Jim Bridger 3	Retire Dec 2037
Jim Bridger 4	SCR by Dec 2016, Retire Dec 2037
Naughton 1	Retire Dec 2029
Naughton 2	Retire Dec 2029
Naughton 3	Gas Conversion by Dec 2019, Retire Dec 2029
Wyodak	Retire Dec 2039

SCR = selective catalytic reduction

Regional Haze Case: RH-1

Regional Haze Case Fact Sheets

CASE ASSUMPTIONS

Description

Refer to Volume I, Chapter 7 (Regional Haze Case Definitions).

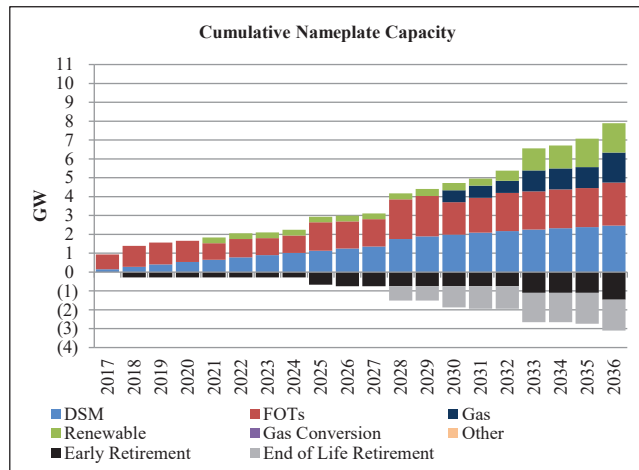
PORTFOLIO SUMMARY

System Optimizer PVRR (\$m)

System Cost without Transmission Upgrades	\$23,066
Transmission Integration	\$81
Transmission Reinforcement	\$12
Total Cost	\$23,159

Resource Portfolio

Cumulative changes to the resource portfolio (new resource additions and resource retirements), represented as nameplate capacity, are summarized in the figure below.



Regional Haze

Regional Haze assumptions are summarized in the following table.

Coal Unit	Description
Cholla 4	Retire Apr 2025
Colstrip 3	Retire Dec 2046
Colstrip 4	Retire Dec 2046
Craig 1	Retire Dec 2025
Craig 2	SCR by Dec 2017, Retire Dec 2034
Dave Johnston 1	Retire Dec 2027
Dave Johnston 2	Retire Dec 2027
Dave Johnston 3	Retire Dec 2027
Dave Johnston 4	Retire Dec 2027
Hayden 1	Retire Dec 2030
Hayden 2	SCR by Dec 2016, Retire Dec 2030
Hunter 1	NOx by 2021, Retire Dec 2042
Hunter 2	NOx by 2021, Retire Dec 2042
Hunter 3	Retire Dec 2042
Huntington 1	Retire Dec 2036
Huntington 2	Retire Dec 2036
Jim Bridger 1	Retire Dec 2032
Jim Bridger 2	Retire Dec 2035
Jim Bridger 3	Retire Dec 2037
Jim Bridger 4	SCR by Dec 2016, Retire Dec 2037
Naughton 1	Retire Dec 2029
Naughton 2	Retire Dec 2029
Naughton 3	Retire Dec 2017
Wyodak	Retire Dec 2039

SCR = selective catalytic reduction
 NOx = Low NOx burner

Regional Haze Case: RH-2

Regional Haze Case Fact Sheets

CASE ASSUMPTIONS

Description

Refer to Volume I, Chapter 7 (Regional Haze Case Definitions).

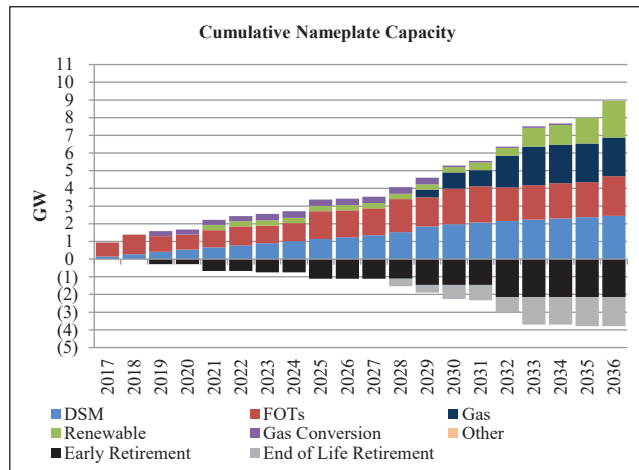
PORTFOLIO SUMMARY

System Optimizer PVRR (\$m)

System Cost without Transmission Upgrades	\$23,313
Transmission Integration	\$157
Transmission Reinforcement	\$12
Total Cost	\$23,482

Resource Portfolio

Cumulative changes to the resource portfolio (new resource additions and resource retirements), represented as nameplate capacity, are summarized in the figure below.



Regional Haze

Regional Haze assumptions are summarized in the following table.

Coal Unit	Description
Cholla 4	Retire Dec 2020
Colstrip 3	Retire Dec 2046
Colstrip 4	Retire Dec 2046
Craig 1	Gas Conversion by Dec 2023, Retire Dec 2034
Craig 2	SCR by Dec 2017, Retire Dec 2034
Dave Johnston 1	Retire Dec 2027
Dave Johnston 2	Retire Dec 2027
Dave Johnston 3	Retire Dec 2027
Dave Johnston 4	Retire Dec 2032
Hayden 1	Retire Dec 2030
Hayden 2	SCR by Dec 2016, Retire Dec 2030
Hunter 1	Retire Dec 2031
Hunter 2	Retire Dec 2031
Hunter 3	Retire Dec 2042
Huntington 1	Retire Dec 2036
Huntington 2	Retire Dec 2036
Jim Bridger 1	Retire Dec 2024
Jim Bridger 2	Retire Dec 2028
Jim Bridger 3	Retire Dec 2037
Jim Bridger 4	SCR by Dec 2016, Retire Dec 2037
Naughton 1	Retire Dec 2029
Naughton 2	Retire Dec 2029
Naughton 3	Gas Conversion by Dec 2019, Retire Dec 2029
Wyodak	Retire Dec 2039

SCR = selective catalytic reduction

Regional Haze Case: RH-3

Regional Haze Case Fact Sheets

CASE ASSUMPTIONS

Description

Refer to Volume I, Chapter 7 (Regional Haze Case Definitions).

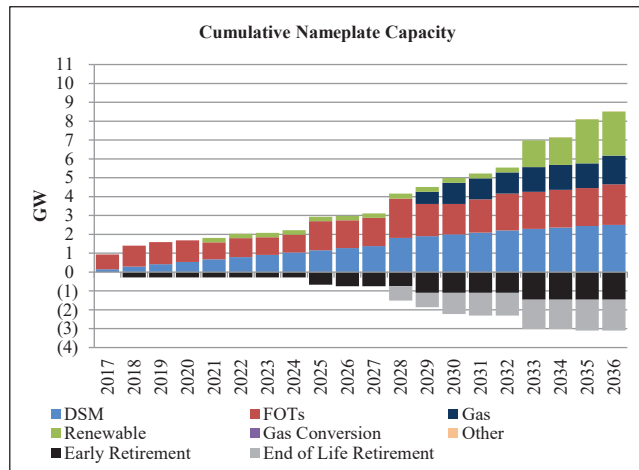
PORTFOLIO SUMMARY

System Optimizer PVRR (\$m)

System Cost without Transmission Upgrades	\$23,315
Transmission Integration	\$70
Transmission Reinforcement	\$12
Total Cost	\$23,398

Resource Portfolio

Cumulative changes to the resource portfolio (new resource additions and resource retirements), represented as nameplate capacity, are summarized in the figure below.



Regional Haze

Regional Haze assumptions are summarized in the following table.

Coal Unit	Description
Cholla 4	Retire Apr 2025
Colstrip 3	Retire Dec 2046
Colstrip 4	Retire Dec 2046
Craig 1	Retire Dec 2025
Craig 2	SCR by Dec 2017, Retire Dec 2034
Dave Johnston 1	Retire Dec 2027
Dave Johnston 2	Retire Dec 2027
Dave Johnston 3	Retire Dec 2027
Dave Johnston 4	Retire Dec 2027
Hayden 1	Retire Dec 2030
Hayden 2	SCR by Dec 2016, Retire Dec 2030
Hunter 1	NOx by Dec 2026, Retire Dec 2042
Hunter 2	NOx by Dec 2027, Retire Dec 2042
Hunter 3	Retire Dec 2042
Huntington 1	NOx by Dec 2026, Retire Dec 2036
Huntington 2	NOx by Dec 2027, Retire Dec 2036
Jim Bridger 1	Retire Dec 2028
Jim Bridger 2	Retire Dec 2032
Jim Bridger 3	Retire Dec 2037
Jim Bridger 4	SCR by Dec 2016, Retire Dec 2037
Naughton 1	Retire Dec 2029
Naughton 2	Retire Dec 2029
Naughton 3	Retire Dec 2017
Wyodak	Retire Dec 2039

SCR = selective catalytic reduction
 NOx = Low NOx burner

Regional Haze Case: RH-4

Regional Haze Case Fact Sheets

CASE ASSUMPTIONS

Description

Refer to Volume I, Chapter 7 (Regional Haze Case Definitions).

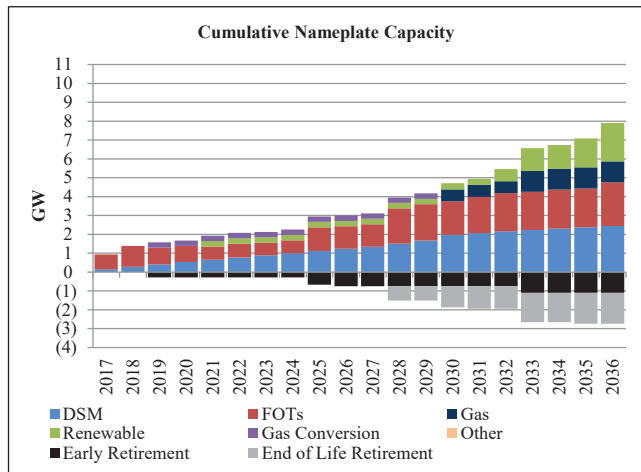
PORTFOLIO SUMMARY

System Optimizer PVRR (\$m)

System Cost without Transmission Upgrades	\$23,582
Transmission Integration	\$69
Transmission Reinforcement	\$12
Total Cost	\$23,663

Resource Portfolio

Cumulative changes to the resource portfolio (new resource additions and resource retirements), represented as nameplate capacity, are summarized in the figure below.



Regional Haze

Regional Haze assumptions are summarized in the following table.

Coal Unit	Description
Cholla 4	Retire Apr 2025
Colstrip 3	Retire Dec 2046
Colstrip 4	Retire Dec 2046
Craig 1	Retire Dec 2025
Craig 2	SCR by Dec 2017, Retire Dec 2034
Dave Johnston 1	Retire Dec 2027
Dave Johnston 2	Retire Dec 2027
Dave Johnston 3	Retire Dec 2027
Dave Johnston 4	Retire Dec 2027
Hayden 1	Retire Dec 2030
Hayden 2	SCR by Dec 2016, Retire Dec 2030
Hunter 1	SCR by Dec 2021, Retire Dec 2042
Hunter 2	NOx by Dec 2027, Retire Dec 2042
Hunter 3	Retire Dec 2042
Huntington 1	SCR by Dec 2021, Retire Dec 2036
Huntington 2	NOx by Dec 2027, Retire Dec 2036
Jim Bridger 1	NOx by Dec 2022, Retire Dec 2032
Jim Bridger 2	SCR by Dec 2021, Retire Dec 2037
Jim Bridger 3	Retire Dec 2037
Jim Bridger 4	SCR by Dec 2016, Retire Dec 2037
Naughton 1	Retire Dec 2029
Naughton 2	Retire Dec 2029
Naughton 3	Gas Conversion by Dec 2019, Retire Dec 2029
Wyodak	Retire Dec 2039

SCR = selective catalytic reduction

NOx = Low NOx burner

Regional Haze Case: RH-5

Regional Haze Case Fact Sheets

CASE ASSUMPTIONS

Description

Refer to Volume I, Chapter 7 (Regional Haze Case Definitions). This Regional Haze case became core case OP-1.

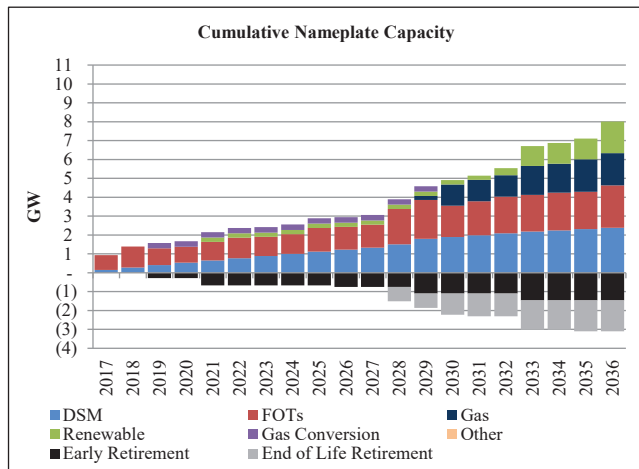
PORTFOLIO SUMMARY

System Optimizer PVRR (\$m)

System Cost without Transmission Upgrades	\$23,081
Transmission Integration	\$84
Transmission Reinforcement	\$12
Total Cost	\$23,177

Resource Portfolio

Cumulative changes to the resource portfolio (new resource additions and resource retirements), represented as nameplate capacity, are summarized in the figure below.



Regional Haze

Core case OP-1 Regional Haze assumptions are summarized in the following table.

Coal Unit	Description
Cholla 4	Retire Dec 2020
Colstrip 3	Retire Dec 2046
Colstrip 4	Retire Dec 2046
Craig 1	Retire Dec 2025
Craig 2	SCR by Dec 2017, Retire Dec 2034
Dave Johnston 1	Retire Dec 2027
Dave Johnston 2	Retire Dec 2027
Dave Johnston 3	Retire Dec 2027
Dave Johnston 4	Retire Dec 2027
Hayden 1	Retire Dec 2030
Hayden 2	SCR by Dec 2016, Retire Dec 2030
Hunter 1	NOx by Dec 2021, Retire Dec 2042
Hunter 2	NOx by Dec 2021, Retire Dec 2042
Hunter 3	Retire Dec 2042
Huntington 1	Retire Dec 2036
Huntington 2	Retire Dec 2036
Jim Bridger 1	Retire Dec 2028
Jim Bridger 2	Retire Dec 2032
Jim Bridger 3	Retire Dec 2037
Jim Bridger 4	SCR by Dec 2016, Retire Dec 2037
Naughton 1	Retire Dec 2029
Naughton 2	Retire Dec 2029
Naughton 3	Gas Conversion by Dec 2019, Retire Dec 2029
Wyodak	Retire Dec 2039

SCR = selective catalytic reduction

NOx = Low NOx burner

Regional Haze Case: RH-6

Regional Haze Case Fact Sheets

CASE ASSUMPTIONS

Description

Refer to Volume I, Chapter 7 (Regional Haze Case Definitions).

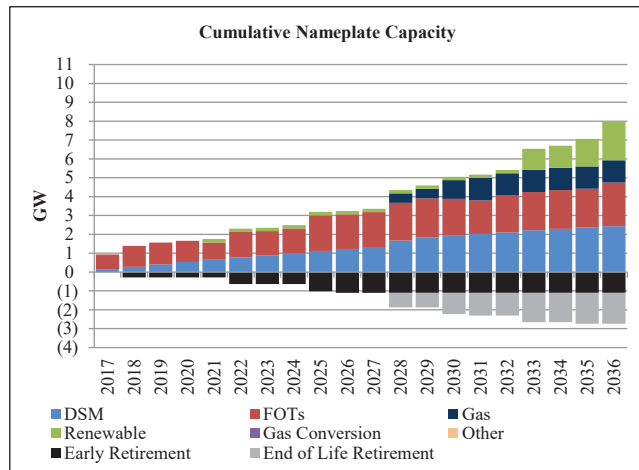
PORTFOLIO SUMMARY

System Optimizer PVRR (\$m)

System Cost without Transmission Upgrades	\$23,891
Transmission Integration	\$83
Transmission Reinforcement	\$12
Total Cost	\$23,986

Resource Portfolio

Cumulative changes to the resource portfolio (new resource additions and resource retirements), represented as nameplate capacity, are summarized in the figure below.



Regional Haze

Regional Haze assumptions are summarized in the following table.

Coal Unit	Description
Cholla 4	Retire Apr 2025
Colstrip 3	Retire Dec 2046
Colstrip 4	Retire Dec 2046
Craig 1	Retire Dec 2025
Craig 2	SCR by Dec 2017, Retire Dec 2034
Dave Johnston 1	Retire Dec 2027
Dave Johnston 2	Retire Dec 2027
Dave Johnston 3	Retire Dec 2027
Dave Johnston 4	Retire Dec 2027
Hayden 1	Retire Dec 2030
Hayden 2	SCR by Dec 2016, Retire Dec 2030
Hunter 1	SCR by 8/4/2021 or Retire by 7/31/2021
Hunter 2	SCR by 8/4/2021 or Retire by 7/31/2021
Hunter 3	Retire Dec 2042
Huntington 1	SCR by 8/4/2021 or Retire by 7/31/2021
Huntington 2	SCR by 8/4/2021 or Retire by 7/31/2021
Jim Bridger 1	SCR by 12/31/2022 or Retire by 12/30/2022
Jim Bridger 2	SCR by 12/31/2022 or Retire by 12/30/2022
Jim Bridger 3	Retire Dec 2037
Jim Bridger 4	SCR by Dec 2016, Retire Dec 2037
Naughton 1	Retire Dec 2029
Naughton 2	Retire Dec 2029
Naughton 3	Retire Dec 2017
Wyodak	Retire Dec 2039

SCR = selective catalytic reduction

Case: OP-1

Core Case Fact Sheets

CASE ASSUMPTIONS

Description

This case is the least-cost-least-risk Regional Haze case emerging from screening stage 1 (RH-5). The Regional Haze case with the best cost-risk metrics is promoted to become core case 1, and serves as the basis for further studies, including the remaining core cases and sensitivities. Therefore, as with the underlying Regional Haze case, all resources have been optimized (selected endogenously by System Optimizer), and valued in the Planning and Risk model.

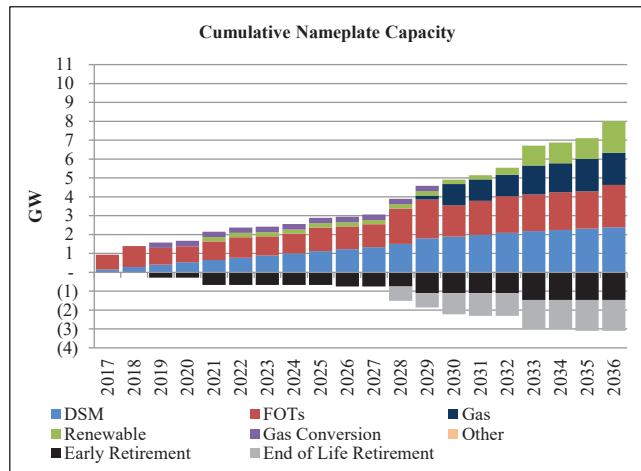
PORTFOLIO SUMMARY

System Optimizer PVRR (\$m)

System Cost without Transmission Upgrades	\$23,081
Transmission Integration	\$84
Transmission Reinforcement	\$12
Total Cost	\$23,177

Resource Portfolio

Cumulative changes to the resource portfolio (new resource additions and resource retirements), represented as nameplate capacity, are summarized in the figure below.



Regional Haze

Core case OP-1 Regional Haze assumptions are summarized in the following table.

Coal Unit	Description
Cholla 4	Retire Dec 2020
Colstrip 3	Retire Dec 2046
Colstrip 4	Retire Dec 2046
Craig 1	Retire Dec 2025
Craig 2	SCR by Dec 2017, Retire Dec 2034
Dave Johnston 1	Retire Dec 2027
Dave Johnston 2	Retire Dec 2027
Dave Johnston 3	Retire Dec 2027
Dave Johnston 4	Retire Dec 2027
Hayden 1	Retire Dec 2030
Hayden 2	SCR by Dec 2016, Retire Dec 2030
Hunter 1	NOx by Dec 2021, Retire Dec 2042
Hunter 2	NOx by Dec 2021, Retire Dec 2042
Hunter 3	Retire Dec 2042
Huntington 1	Retire Dec 2036
Huntington 2	Retire Dec 2036
Jim Bridger 1	Retire Dec 2028
Jim Bridger 2	Retire Dec 2032
Jim Bridger 3	Retire Dec 2037
Jim Bridger 4	SCR by Dec 2016, Retire Dec 2037
Naughton 1	Retire Dec 2029
Naughton 2	Retire Dec 2029
Naughton 3	Gas Conversion by Dec 2019, Retire Dec 2029
Wyodak	Retire Dec 2039

SCR = selective catalytic reduction

NOx = Low NOx burner

Case: Optimized Naughton 3 (OP-NT3)

Core Case Fact Sheets

CASE ASSUMPTIONS

Description

Case OP-NT3 is the optimal Regional Haze case selected as core case 1 and includes enhancements of full PTC value and Naughton 3 retirement by December 31, 2018. All resources optimized (selected endogenously by System Optimizer), and valued in the Planning and Risk model. This case is a variant of core case OP-1.

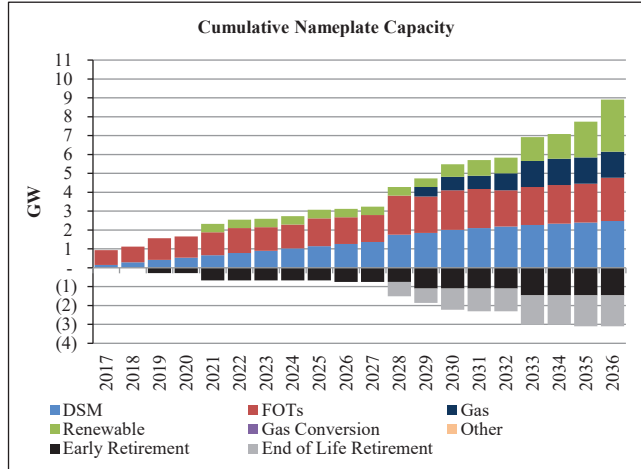
PORTFOLIO SUMMARY

System Optimizer PVRR (\$m)

System Cost without Transmission Upgrades	\$22,913
Transmission Integration	\$127
Transmission Reinforcement	\$12
Total Cost	\$23,052

Resource Portfolio

Cumulative changes to the resource portfolio (new resource additions and resource retirements), represented as nameplate capacity, are summarized in the figure below.



Regional Haze

Core case OP-NT3 Regional Haze assumptions are summarized in the following table.

Coal Unit	Description
Cholla 4	Retire Dec 2020
Colstrip 3	Retire Dec 2046
Colstrip 4	Retire Dec 2046
Craig 1	Retire Dec 2025
Craig 2	SCR by Dec 2017, Retire Dec 2034
Dave Johnston 1	Retire Dec 2027
Dave Johnston 2	Retire Dec 2027
Dave Johnston 3	Retire Dec 2027
Dave Johnston 4	Retire Dec 2027
Hayden 1	Retire Dec 2030
Hayden 2	SCR by Dec 2016, Retire Dec 2030
Hunter 1	NOx by Dec 2021, Shut Down Dec 2042
Hunter 2	NOx by Dec 2021, Shut Down Dec 2042
Hunter 3	Retire Dec 2042
Huntington 1	Retire Dec 2036
Huntington 2	Retire Dec 2036
Jim Bridger 1	Retire Dec 2028
Jim Bridger 2	Retire Dec 2032
Jim Bridger 3	Retire Dec 2037
Jim Bridger 4	SCR by Dec 2016, Retire Dec 2037
Naughton 1	Retire Dec 2029
Naughton 2	Retire Dec 2029
Naughton 3	Retire Dec 2018
Wyodak	Retire Dec 2039

SCR = selective catalytic reduction

NOx = Low NOx burner