



2015

Integrated Resource Plan

Public Input Meeting 7

February 26, 2015

Agenda

- 2015 IRP Draft Action Plan
 - Separate Handout
- High CO₂ PaR Results
- Sensitivity Studies
- *Lunch Break (1/2 hour) | 1:30 PT/12:30 MT*
- Sensitivity Studies (continued)
- Wrap-up Discussion



2015

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2015 IRP Draft Action Plan

(Please Refer to Separate Handout)

DSM Class 2 State Implementation Plan

	California	Idaho	Utah	Washington	Wyoming
Expand manufactured home delivery	√	√	√	√	√
Expand multi-family home delivery	√	√	√	√	√
Expand residential behavioral programs	√				
Expand residential new construction services		√	√		
Low Income program enhancements	√	√			
Rebid key residential contracts	√	√	√	√	√
Energy management delivery improvements	√	√	√	√	√
Expand business incentive payment options		√			
Expand commercial LED lighting channels	√	√	√	√	√
Incorporate CHP/waste heat efficiency measures in business program			√	√	
Rebid key business sector contracts	√	√	√	√	√
Small to medium business behavioral pilot program			√		
Targeted business sector initiatives i.e. oil/gas			√		√
Expand and refresh communication & customer outreach programs	√	√	√	√	√

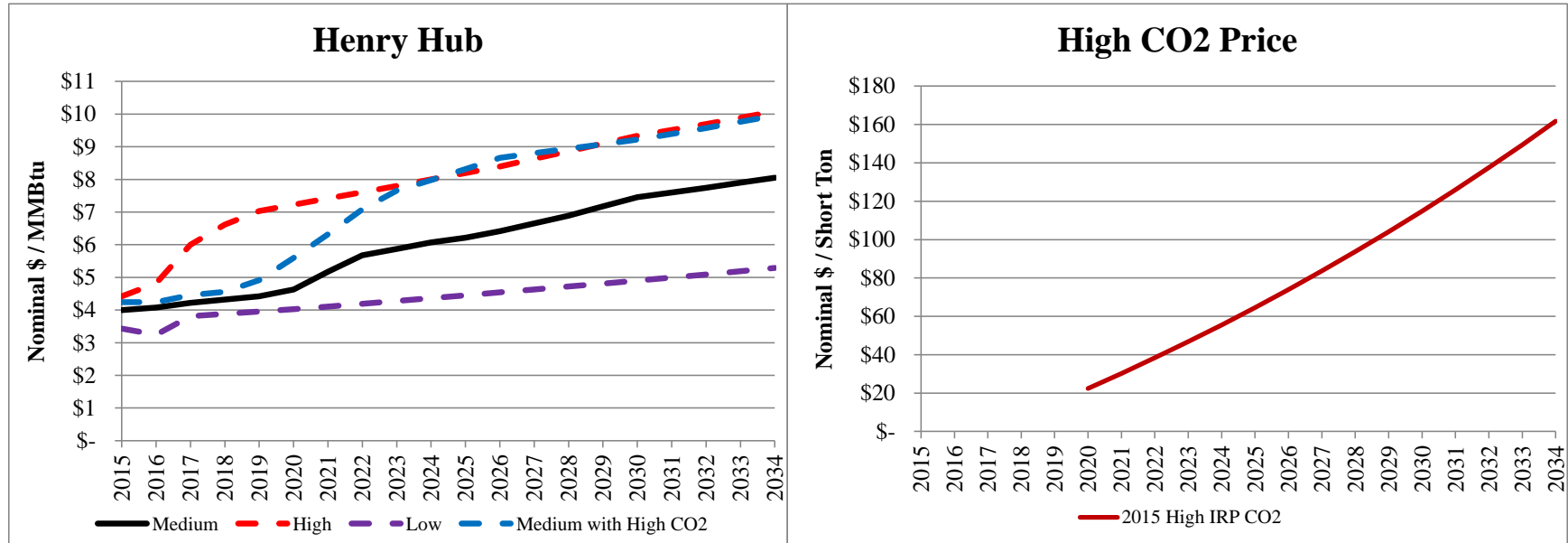


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High CO₂ Par Results

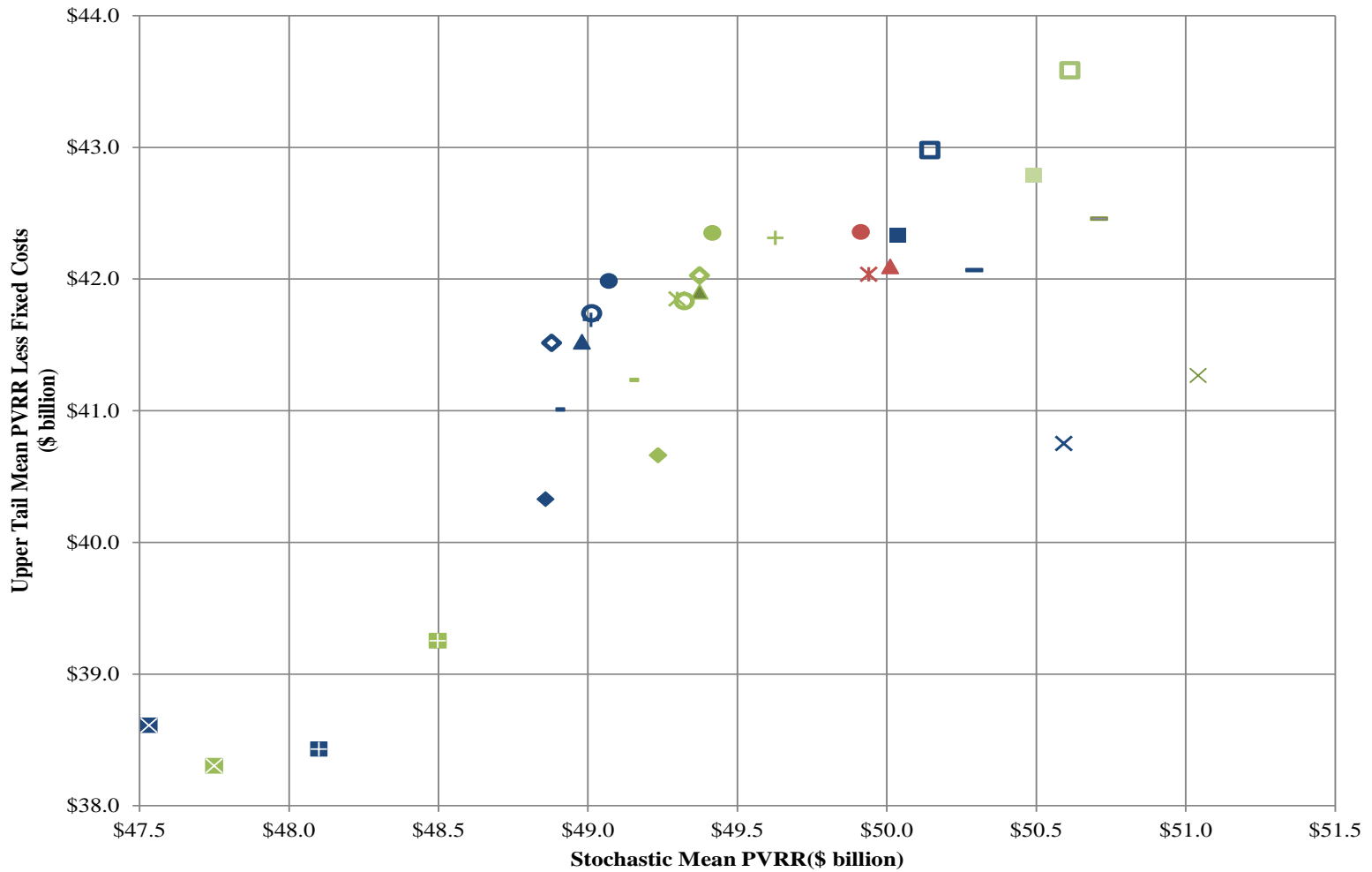
PaR Price Scenarios



- PaR runs were completed for four different scenarios:
 - Low natural gas
 - Medium natural gas
 - High natural gas
 - Medium natural gas with high CO₂ prices
- PaR results used in the selection of the preferred portfolio were reviewed at the January 30, 2015 public input meeting; stakeholders requested a summary of high CO₂ price scenario PaR results among all core cases.

Core Case PaR Cost/Risk Scatter Plot - High CO₂ Price Scenario

Medium Gas High CO2



High CO₂ Price Scenario PaR Results

- Portfolios developed both III(d) and CO₂ price assumptions (C14 and C14a Cases) are lower cost and lower risk relative to portfolios that were developed with III(d) considerations but without incremental CO₂ price assumptions.
- When allowing endogenous coal unit retirements beyond those assumed for Regional Haze compliance (C14a Cases), costs are lower than the C14 portfolios that locked in assumed coal unit retirements.
- The stochastic mean PVRR differential between C05a-3 and C14a-2 is \$2.26 billion favorable to C05a-3 under medium natural gas price assumptions without an assumed CO₂ price.
- The stochastic mean PVRR differential between C05a-3 and C14a-2 is \$2.38 billion favorable to C14a-2 under the high CO₂ price scenario.
- Neither of the above PVRR differentials account for the reality that resource plans change with changes in the planning environment (i.e., with the introduction of a high CO₂ price).

Front Ten Year Portfolio Comparison Among C14 Cases and C05a-3

Portfolio Comparison (2015 - 2024)





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Sensitivity Analysis Results

Sensitivity Case Definitions

Case #	Benchmark Case #	Description	Natural Gas	Load	DG	PTC/ITC	111(d)
S-01	C05-1	Low Load Forecast	Medium	Low	Base	Expired	Flexible System Allocation
S-02	C05-1	High Load Forecast	Medium	High	Base	Expired	Flexible System Allocation
S-03	C05-1	1 in 20 Load	Medium	1 in 20	Base	Expired	Flexible System Allocation
S-04	C05-1	Low Distributed Generation	Medium	Base	Low	Expired	Flexible System Allocation
S-05	C05-1	High Distributed Generation	Medium	Base	High	Expired	Flexible System Allocation
S-06	C05-1	Pumped Storage	Medium	Base	Base	Expired	Flexible System Allocation
S-07	C07-1	Energy Gateway 2	Medium	Base	Base	Expired	Flexible System Allocation
S-08	C07-1	Energy Gateway 5	Medium	Base	Base	Expired	Flexible System Allocation
S-09	C05-1	PTC Extension	Medium	Base	Base	Through Study Period	Flexible System Allocation
S-10	C05-3a	East/West BAAs	Medium	Base	Base	Expired	Flexible System Allocation
S-11	C14-1	111(d) and High CO2 Price	Medium/High CO2	Base	Base	Expired	Flexible System Allocation
S-12	C05-1	Stakeholder Solar Cost Proposal	Medium	Base	High	Expired	Flexible System Allocation
S-13	C05-1	Compressed Air Storage	Medium	Base	Base	Expired	Flexible System Allocation
S-14	C05-1	Class 3 DSM	Medium	Base	Base	Expired	Flexible System Allocation
S-15	C05-1	Restricted 111(d) Attributes	Medium	Base	Base	Expired	111(d) and REC Attributes Must be Used Simultaneously

Sensitivity Study Update

- January 30, 2015 Public Input Meeting
 - Sensitivities S-01 through S-05 (load & DG)
- Today's meeting
 - Sensitivity S-10 (Balancing Authority Area)
 - Separate East and West BAAs
 - Benchmarked to a Regional Haze 3 and unbundled REC strategy portfolio, consistent with the draft preferred portfolio
 - Draft results from all remaining sensitivities have been prepared

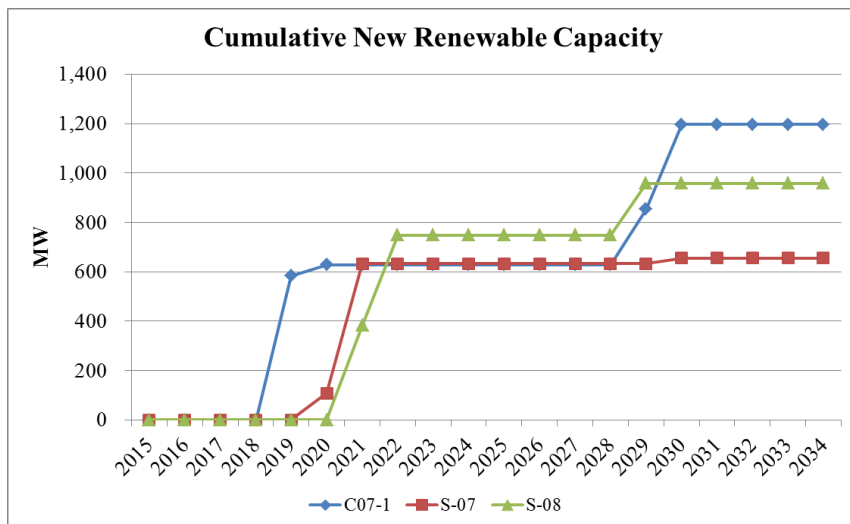
Energy Gateway Sensitivities: S-07 and S-08



Sensitivity	Energy Gateway Scenario	Segments (In-service Date)
S-07	EG-2	Segment C (2013) Segment D (2022) Segment G (2015)
S-08	EG-5	Segment C (2013) Segment D (2022) Segment E (2024) Segment G (2015) Segment F (2023)

- Two Energy Gateway sensitivities are patterned after scenarios initially defined in the 2013 IRP (EG-2 and EG-5), and compared to Case C07-I, a portfolio that contains higher penetration of renewable resources.
- Potential impacts to in-service dates remain associated with permitting delays and implementation of III(d) rules.
- Future Energy Gateway analysis will be determined based on the type, timing and location of resource needs.

Energy Gateway Sensitivities: System Optimizer Results



Increase/(Decrease) relative to C07-1	S-07 (EG-2)	S-08 (EG-5)
System Optimizer PVRR without Energy Gateway Transmission Costs (\$m)	(\$234)	(\$583)
PVRR of Energy Gateway Transmission Costs (\$m)	\$945	\$2,044
Total PVRR (\$m)	\$711	\$1,461

- System Optimizer benefits are approximately 25% and 29% of Energy Gateway costs for Sensitivities S-07 and S-08, respectively.
- Energy Gateway transmission provides access to high capacity factor, low cost wind resources in Wyoming, and with the addition of Gateway South (Segment F), access to Wyoming wind is higher in S-08 as compared to S-07:
 - C07-1 Wyoming wind totals 25 MW
 - S-07 Wyoming wind totals 525 MW
 - S-08 Wyoming wind totals 959MW
- Access to this low cost renewable resource reduces the cost of meeting PacifiCorp’s share of III(d) state emission rate targets (states with retail load) under a compliance strategy that targets increased energy efficiency and renewable resources.
 - Benefits would increase with higher renewable resource penetration (i.e., a renewable compliance strategy applied to a III(d) emission rate obligation that includes PacifiCorp’s share of fossil emissions in Arizona, Colorado, and Montana).
 - Benefits would decrease if fewer renewables were required (i.e., a III(d) compliance strategy prioritizing re-dispatch of fossil generation).

Energy Gateway Sensitivities: PaR Results

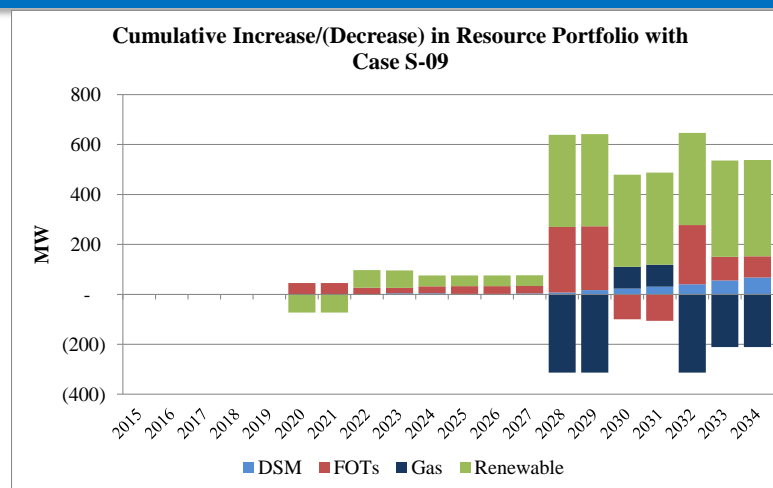
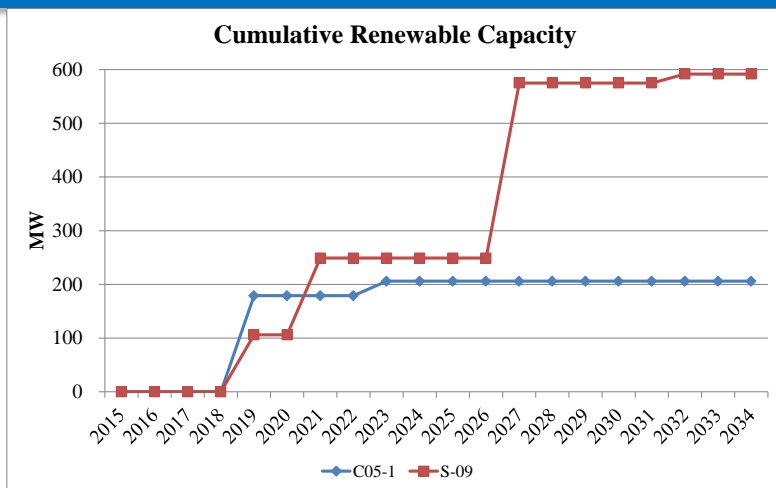
Increase/ (Decrease) from C07-1 (Stochastic Mean)		Low Gas	Medium Gas	High Gas
S-07 (EG-2)	PaR PVRR(d) without Energy Gateway Transmission Costs (\$m)	(\$247)	(\$264)	(\$265)
	PVRR(d) of Energy Gateway Transmission Costs (\$m)	\$945	\$945	\$945
	Total PVRR(d) (\$m)	\$698	\$681	\$680
S-08 (EG-5)	PaR PVRR(d) without Energy Gateway Transmission Costs (\$m)	(\$560)	(\$624)	(\$665)
	PVRR(d) of Energy Gateway Transmission Costs (\$m)	\$2,044	\$2,044	\$2,044
	Total PVRR(d) (\$m)	\$1,484	\$1,421	\$1,379

- Under stochastic conditions, net benefits from PaR increase as compared to System Optimizer, but do not offset the full cost Energy Gateway transmission projects as modeled.
- Benefits remain relatively stable among natural gas price scenarios.

Energy Gateway Sensitivity Conclusions

- The Energy Gateway project originated under different conditions than exist today.
- The type, timing, and location of future resource needs will drive future analysis of Energy Gateway projects.
- Based on PaR results, benefits are approximately 30% of levelized Energy Gateway on a PVRR basis through the 2034 planning horizon.
- Finding one or more partners to share in Energy Gateway project costs can be a means to “size” PacifiCorp customer costs with benefits and provide regional benefits.
- Permitting efforts continue for Segment D, E, F, and H to achieve final federal permits and be in a position to respond to future load and resource needs.

PTC Extension Sensitivity: S-09



	System Optimizer	PaR Stochastic Mean		
	Medium Gas	Low Gas	Medium Gas	High Gas
Increase/(Decrease) from Case C05-1 (PVRR(d), \$m)	(\$203)	\$9	(\$29)	(\$53)

- S-09 assumes the production tax credit (PTC) of 23 ¢ per kWh (2015) escalates at 1.9% per year and is available through the planning period.
- With an assumed indefinite extension of the PTC 449 MW of economic Wyoming wind is selected (106 MW in 2020, 326 MW in 2028, and , 17 MW in 2030). Accounting for the addition of this system wind, 143 MW of wind in Utah is added in 2021 to meet Oregon’s RPS requirements through 2034.
- Additional renewables, incremental FOTs, and DSM offset CCCT capacity(down 211 MW by 2034).
- System Optimizer results reflect the incremental III(d) compliance benefits of the additional renewable resources, added at lower cost with assumed PTC benefits, that are included in the S-09 portfolio.
- PaR results reflect portfolio cost and stochastic risk impacts of S-09, but do not reflect III(d) re-dispatch benefits. With medium to high natural gas prices, S-09 shows stochastic risk benefits. The PVRR(d) is marginally higher cost under case S-09 when low natural gas prices are assumed (a scenario that favors natural gas resources).

Balancing Authority Area Sensitivity: S-10

- The Washington Utilities and Transportation Commission requested the Company model the East and West control areas separately:
 - “The Company must model the two areas separately in the next IRP as a prerequisite for acknowledgement.”
- S-10 assesses the impact of independently planning for a sub-system as compared to planning for PacifiCorp’s system as a whole.
- Sub-systems are defined by PacifiCorp’s east and west balancing authority areas (BAAs), also referred to as east and west control areas (ECA and WCA).
- Comparison of ECA and WCA standalone resource portfolios to benchmark system portfolio.
 - Benchmark system portfolios is derived under Regional Haze Scenario 3 and assumes unbundled REC strategy for state RPS, consistent with draft preferred portfolio.
 - Portfolio and system cost impacts are reported.
 - With and without III(d).

SIO Sensitivity: Overview of Assumptions

- WCA standalone portfolio developed with System Optimizer.
 - Winter peak, maintain 13% planning reserve margin.
 - Allow January on-peak FOTs, maintaining limits at Mid C (775 MW), COB (300 MW), and NOB (100 MW)
 - Class 2 DSM capacity contribution updated to align with a winter peak.
 - With III(d), assumes Chehalis is retired at the end of 2019, new CCCT resources are not allowed, and Oregon can use a WCA allocation of renewables to meet PacifiCorp's share of its III(d) targets.
 - Without III(d), new CCCT resources are allowed.
- ECA standalone portfolio developed with System Optimizer.
 - Summer peak, maintain 13% planning reserve margin.
 - Summer on-peak FOTs, no access to west-side FOTs, but inclusion of Mona (300 MW).
 - Class 2 DSM capacity contribution updated to align with a summer peak.
 - With III(d), assume flexible allocation of ECA renewable resources can be used to meet PacifiCorp's share of Utah and Wyoming emission rate targets.

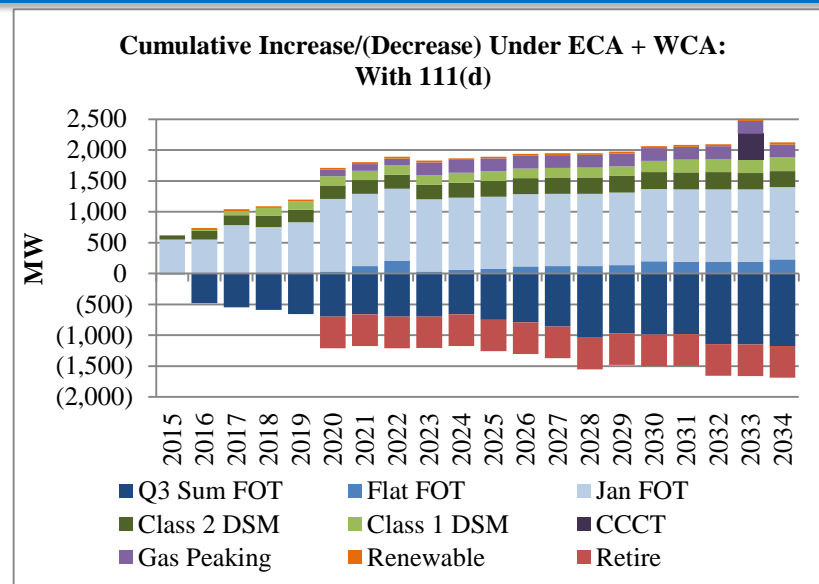
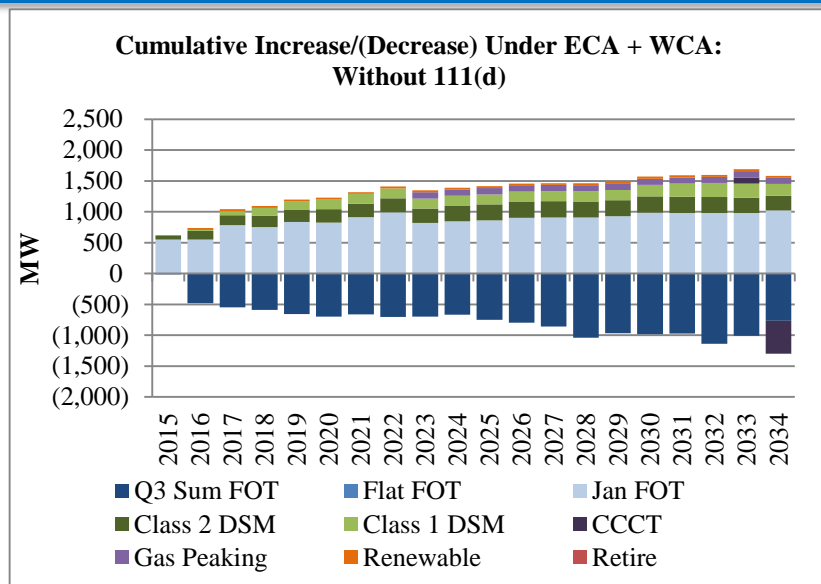
S-10 Sensitivities: Summary of System Costs

Increase/(Decrease) Relative to the System Benchmark (\$m)	System Optimizer	PaR Stochastic Mean		
	Medium Gas	Low Gas	Medium Gas	High Gas
Without 111(d)	\$1,149	n/a	n/a	n/a
With 111(d)*	\$1,326	\$2,031	\$2,109	\$2,158

- System Optimizer results show that planning the system on a WCA standalone and ECA standalone basis leads to higher costs.
- The incremental cost of planning for two standalone system increases under 111(d).

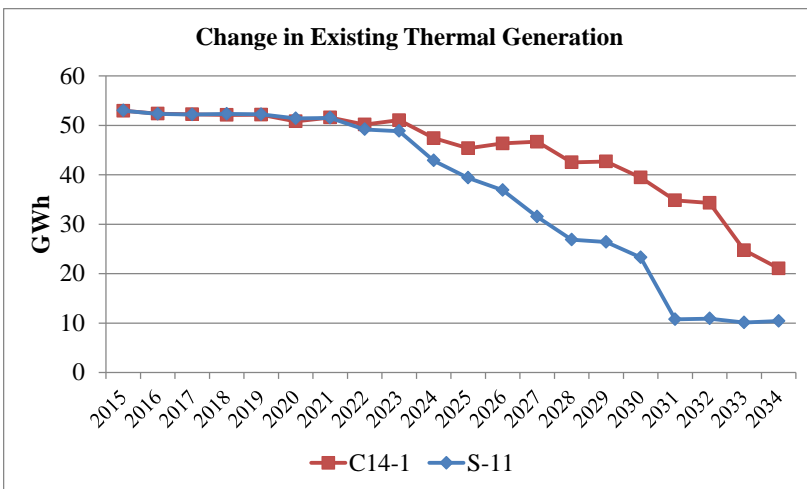
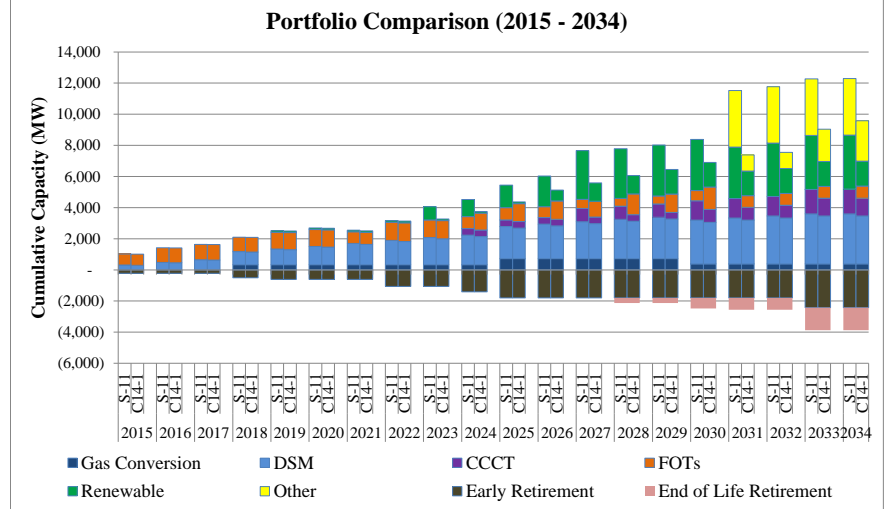
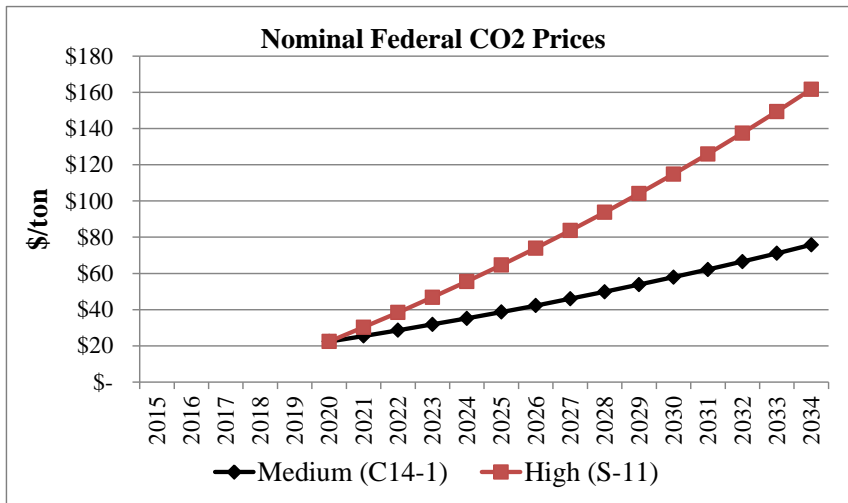
*Note, PaR results reflect resource portfolios developed under 111(d) but do not capture re-dispatch costs under 111(d).

S-10 Sensitivity : ECA+WCA Portfolio Results



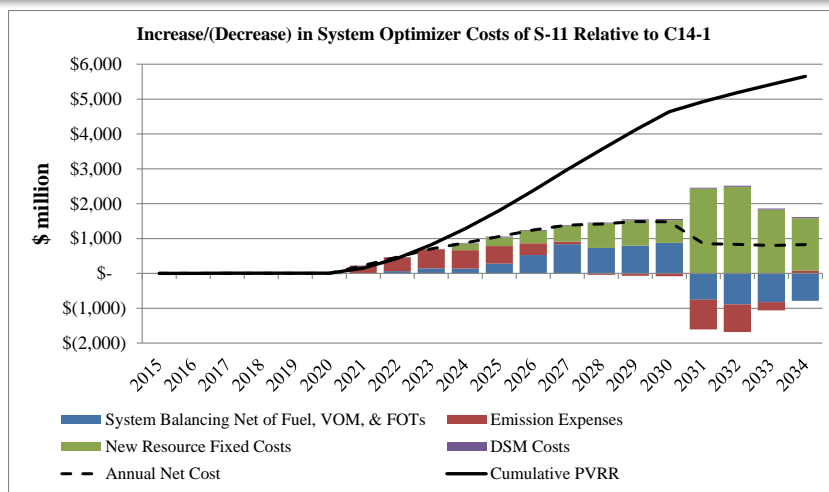
- As compared system benchmark portfolio, combined standalone ECA and WCA portfolios cannot rely on resource selections in the other BAA to meet their respective planning reserve margin targets.
- January FOTs are needed for the WCA; and incremental DSM is needed for the ECA.
- Without the ECA, the WCA includes a gas peaking resource in 2023 without 111(d) and in 2020 with 111(d) (coinciding with the retirement at Chehalis) and needs January FOTs
- Without the WCA, the ECA no longer has access to west side FOTs and needs incremental Class 1 and Class 2 DSM resources; Mona FOT limit had to be increased to allow the ECA to achieve its target 13% planning reserve margin in 2015 – 2017 (711 MW, 459 MW, and 359 MW, respectively)
- Total increase in System Optimizer PVRR = \$1,149m without 111(d) and \$1,326m with 111(d)

High CO₂ Price Sensitivity: S-II Portfolio Results



- As compared to Case C14-I (medium CO₂ prices), nuclear resources are accelerated, and 1,036 MW of additional nuclear capacity is added (518 MW in the east and 518 MW in the west).
- Additional CCCT capacity is added beginning 2027; by 2034 total CCCT capacity is up by 423 MW.
- An additional 750 MW of renewable capacity is added in 2023; by 2034 total renewable capacity is up 1,867 MW.
- Partially offsetting incremental new resources, FOTs are reduced in S-II as compared to C14-I.
- Similar to the impact of imposing medium CO₂ prices, generation from the existing thermal fleet is reduced significantly.

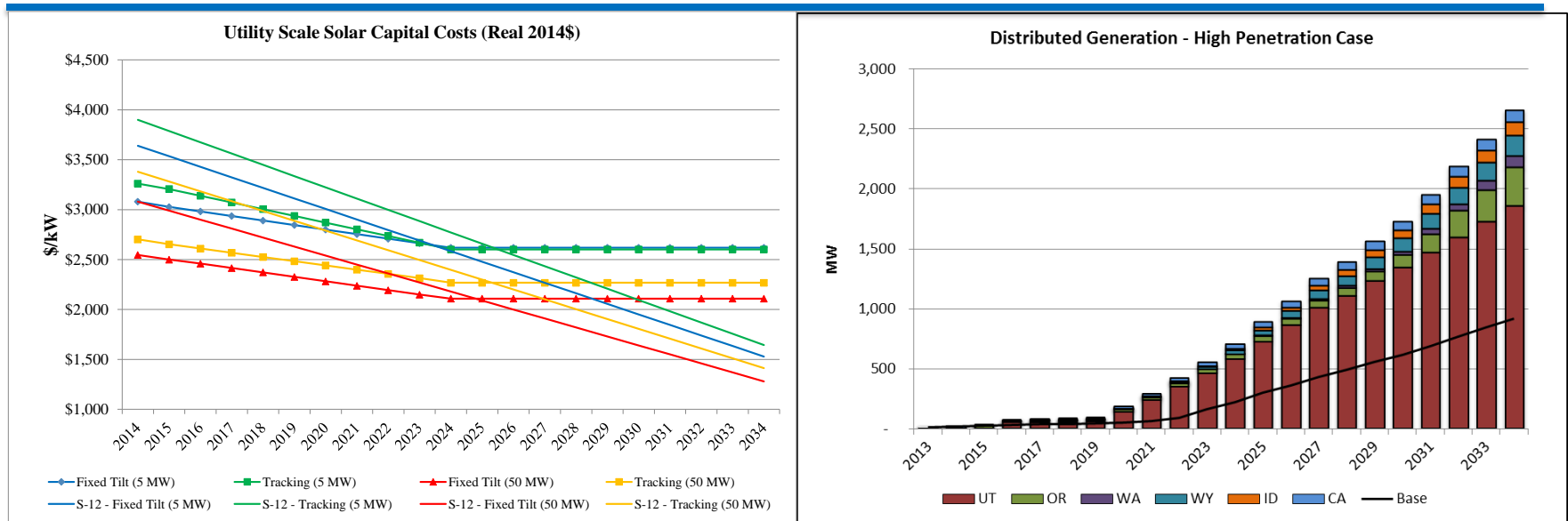
High CO₂ Price Sensitivity: S-11 PVRR Results



Increase/ (Decrease) from C14-1	System Optimizer	PaR Stochastic Mean		
	Medium Gas	Low Gas	Medium Gas	High Gas
PVRR(d) (\$m)	\$5,650	\$3,027	\$2,640	\$2,310

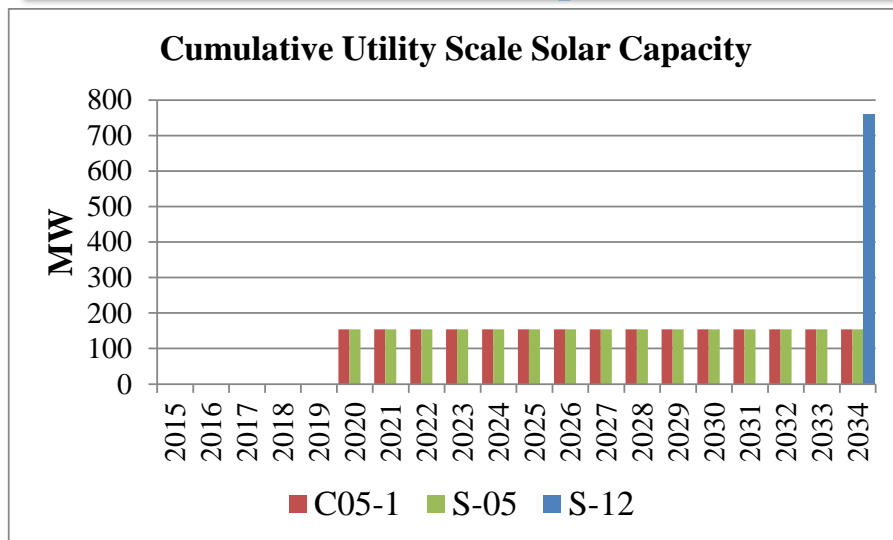
- With high CO₂ price assumptions, the present value revenue requirement (PVRR) increased by \$5,650 million as reported from the SO model when compared to Case C14-1, which includes III(d) re-dispatch costs.
- The cost increases are lower in PaR, which reflects stochastic risk impacts, but does not reflect III(d) re-dispatch costs; the increase in cost is reduced with higher natural gas price assumptions, reflecting the gross margin benefits of a portfolio with significant nuclear and renewable resources.

Solar Cost Sensitivity: S-12



- The Company assumes real de-escalation of utility scale solar resource costs in the first ten years of the planning period due to such factors as technology and manufacturing improvements, government subsidization, over supply compared to demand and improvement in implementation process.
- As the technology matures, PacifiCorp assumes solar resource costs remain flat on a real basis, as is assumed for other supply side resource alternatives (nominal costs are derived by applying an assumed 1.9% annual inflation rate).
- Sensitivity S-12 is based on recommendations from stakeholders and assumes alternative solar resource costs and real de-escalation rates that achieves a targeted cost by the end of the 20-year period planning period.
- Sensitivity S-12 also assumes high penetration of distributed solar generation, which reflects reduced solar costs, along with assumed improved performance and higher electricity rates.

S-12 Sensitivity: Portfolio and PVRR Results

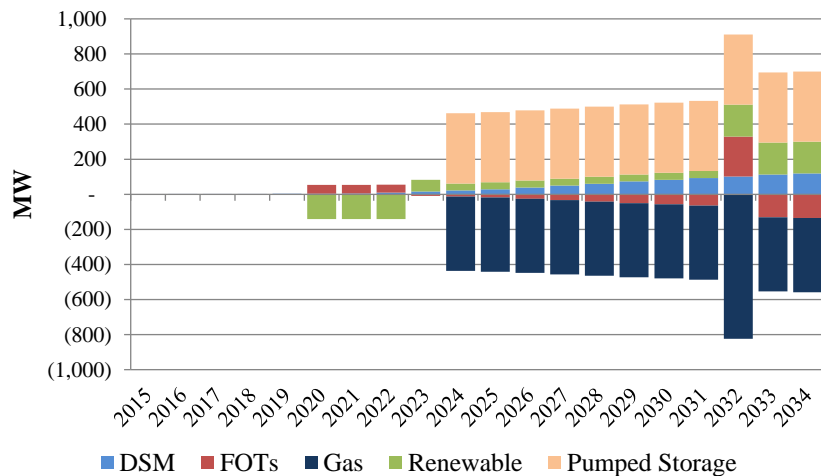


	System Optimizer	PaR Stochastic Mean		
	Medium Gas	Low Gas	Medium Gas	High Gas
PVRR(d) Increase/ (Decrease) from C05-1 (\$m)	(\$617)	(\$515)	(\$649)	(\$761)
PVRR(d) Increase/ (Decrease) from S-05 (\$m)	\$14	\$77	\$58	\$37

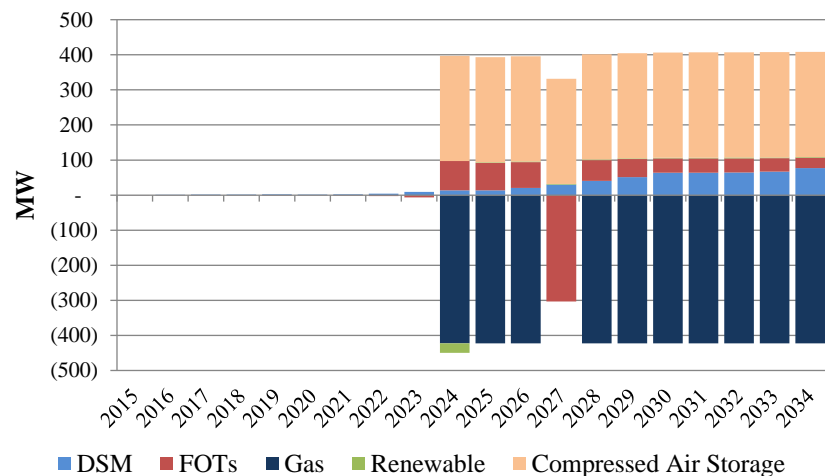
- 154 MW of solar resource added in C05-1 and S-05 for Oregon RPS is displaced, as System Optimizer selects economic solar resources in 2034, using available transmission capacity. Moreover, under S-12, solar costs in 2020 are higher.
- With declining solar costs and rising wholesale power prices, 759 MW of economic system solar resources are added in 2034 (154 MW in the east, 605 MW in the west) under Sensitivity S-12.
- With assumed high DG penetration levels, by the end of 2034, over 1,000 MW of new CCCT capacity is eliminated from the portfolio when compared to Case C05-1; reduced resource needs from the assumed high DG penetration levels lowers the cost under S-12 relative to C05-1.
- When compared to S-05 (high DG penetration scenario), costs increase with the use of higher cost renewables assumed for Oregon RPS needs (259 MW of west side wind in 2023).
- PaR model results reflect stochastic risk impacts of portfolios, but do not capture the I I I(d) re-dispatch costs reflected in System Optimizer results.

Storage Sensitivities: S-06 and S-13 System Optimizer Results

Cumulative Increase/(Decrease) Under S-06 as Compared with C05-1



Cumulative Increase/(Decrease) Under S-13 as Compared with C05-1



- Two storage technologies were considered: pumped storage (PS) and compressed air energy storage (CAES). Each was assumed to be in service in 2024, which coincide with the first CCCT added in C05-1.
- In S-06, 300 MW of pumped storage on the west side of the Company's system, supplemented with DSM and renewables, replaced the need for a 423 MW CCCT in 2024.
- In S-13, 400 MW of CAES on the east side of the Company's system, supplemented with DSM and FOTs, deferred a 423 MW CCCT in 2024 by 3 years and displaced a 2028 423 MW CCCT plant.
- In System Optimizer, storage resources provide firm capacity applied toward meeting a 13% planning reserve margin. To supply energy, these resources increase load on the system when storage is being filled.

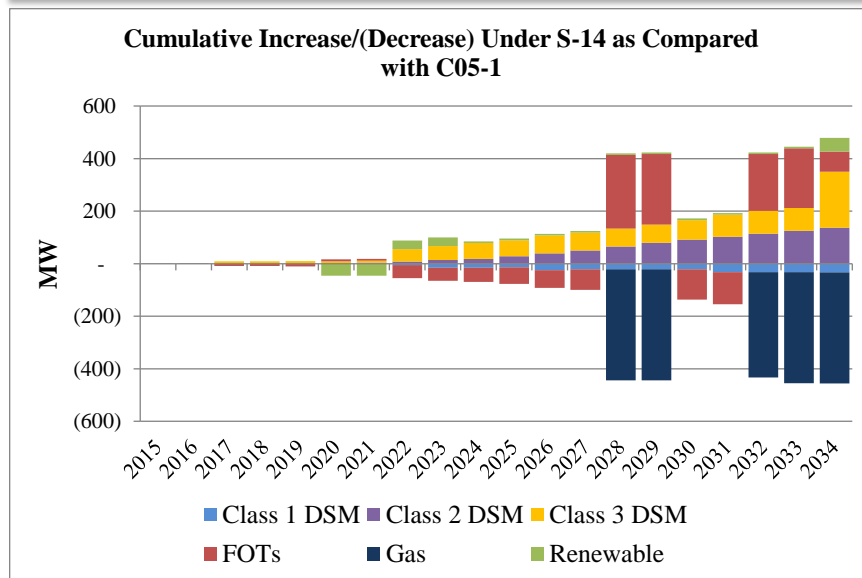
PVRR(d) Figures Reported as Increase/(Decrease) from C05-1	Pumped Storage S-06	Compressed Air Energy Storage S-13
Nominal Capital Cost (\$/kW)	\$3,455	\$3,270
Nominal FOM (\$/kW-yr)	\$23.37	\$22.67
Nominal First Year VOM (\$/MWh)	\$4.21	\$2.75
SO PVRR(d) without Fixed Costs of the Storage Resource (\$m)	(\$63)	(\$53)
PVRR(d) of Storage Resource Fixed Costs (\$m)	\$511	\$453
Total PVRR(d) (\$m)	\$448	\$400

Storage Sensitivities: S-06 and S-13 PaR Results

Increase/ (Decrease) from C05-1 (Stochastic Mean)		Low Gas	Medium Gas	High Gas
S-06 (West Pumped Storage)	PaR PVRR(d) without Fixed Costs of the Storage (\$m)	(\$76)	(\$74)	(\$72)
	PVRR(d) of Fixed Costs of the Storage Resource (\$m)	\$511	\$511	\$511
	Total PaR PVRR(d) (\$m)	\$435	\$437	\$439
S-13 (East Compressed Air)	PaR PVRR(d) without Fixed Costs of the Storage (\$m)	(\$87)	(\$80)	(\$76)
	PVRR(d) of Fixed Costs of the Storage Resource (\$m)	\$453	\$453	\$453
	Total PaR PVRR(d) (\$m)	\$366	\$373	\$378

- Under stochastic conditions, the benefits from PaR increase as compared to System Optimizer, but do not offset the full cost of the storage resources.
- PaR captures incremental benefits of storage, including the ability for storage to meet operating reserves. Other grid benefits, such as frequency regulation are not captured in System Optimizer or PaR.
- Variable cost benefits remain relatively stable among natural gas price scenarios.

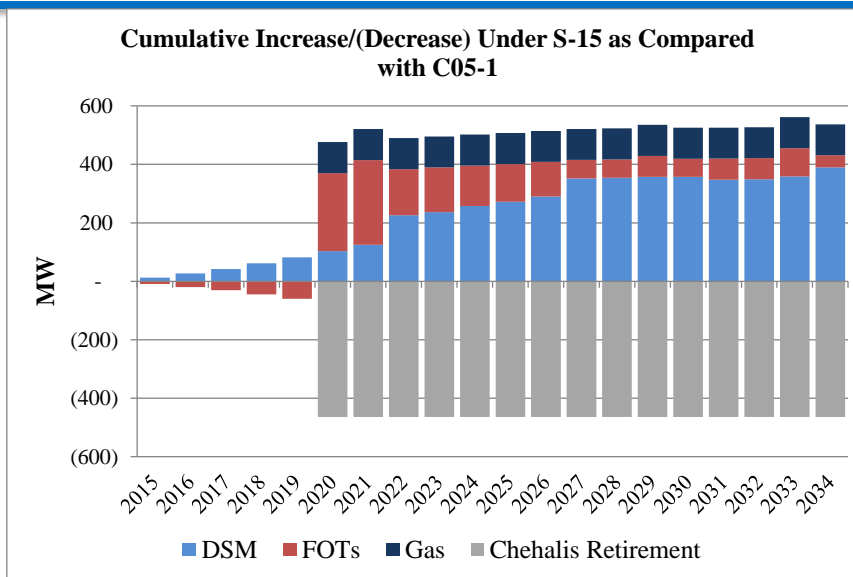
Class 3 Demand Side Management Sensitivity: S-14



Increase/ (Decrease) from C05-1	System Optimizer	PaR Stochastic Mean		
	Medium Gas	Low Gas	Medium Gas	High Gas
PVRR(d) (\$m)	(\$44)	(\$48)	(\$57)	(\$63)

- Class 3 DSM resources are capacity-based resources like Class 1 DSM resources; with savings assumed to be achieved with rate design.
- S-14 adds approximately 47 MW of Class 3 DSM by 2022, increasing to 87 MW by 2033 and 213 MW by 2034; additional Class 2 DSM resources total 8 MW in 2022, increasing to 137 MW by 2034.
- The Class 3 and Class 2 DSM resources displace 5 MW of Class 1 DSM resources in 2022 and 33 MW by 2034; the Class 3 and Class 2 resources also displace FOTs in 2022 – 2027 and 2030 – 2031.
- Changes in DSM resources defer a 423 MW CCCT in 2028 by two years and displace CCCT capacity from 2032-2034.

Restricted III(d) Attribute Sensitivity: S-15



Increase/ (Decrease) from C05-1	System Optimizer	PaR Stochastic Mean		
	Medium Gas	Low Gas	Medium Gas	High Gas
PVRR(d) (\$m)	\$411	\$434	\$406	\$360

- Sensitivity S-15 assumes that state RPS-eligible RECs and III(d) attributes must be surrendered at the same time.
- In Oregon, with its allocated share of system renewable energy, PacifiCorp more than meets its share of the state's III(d) emission rate target; however, the excess renewable energy, which must be used for Oregon RPS compliance, is not available to be re-allocated to other states.
 - The draft III(d) rule does not allow banking of III(d) attributes, while the Oregon RPS allows unlimited banking of RECs.
 - It is assumed that banked RPS RECs can continue to be carried forward, which means that "first in, first out" REC banking principals would not be required.
 - If "first in, first out" REC banking principals are required, this would devalue PacifiCorp's existing REC bank and increase the costs from those shown above.
- In Washington, linking the state RPS program to III(d) would force PacifiCorp to meet its share of the state's emission rate target with situs assigned renewable resources, or alternatively, eliminate PacifiCorp's Washington III(d) compliance obligation by retiring Chehalis at the end of 2019.
- It is assumed that retirement of Chehalis at the end of 2019 is lower cost than meeting PacifiCorp's share of the Washington III(d) emission rate target with incremental renewable resources.
- Incremental FOTs and DSM, along with a 2020 west side gas peaking resource, replace the capacity lost with Chehalis.
- With no re-dispatch required (driven by the removal of Washington III(d) requirements), the System Optimizer cost increase (\$411 million) is similar to the medium gas price cost increase from PaR (\$406 million).



2015

Integrated Resource Plan

Wrap-up Discussion

2015 IRP Wrap-up Discussion

- 7 Public Input Meetings
 - Initiated June 5, 2014
 - 4 of the 7 meetings scheduled as two-day sessions
- 5 State-specific Meetings
 - Held over the course of June 2014
- 2 Technical Workshops
 - Portland/Salt Lake City to review the III(d) Scenario Maker
- Portfolio Modeling
 - 33 core case portfolios
 - 15+ sensitivity studies
- Updated/New Studies
 - Conservation Potential Study
 - Distributed Generation Study
 - Wind Integration Study
 - Planning Reserve Margin Study
 - Wind & Solar Capacity Contribution Study
 - Stochastic Parameter Study
 - Anaerobic Digester Resource Assessment
 - Energy Storage Screening Study
 - Confidential Volume III
- Expected Filing Date = March 31, 2015
- Comments, questions, closing remarks