REDACTED
Rocky Mountain Power
Docket No. 17-035-39
Witness: Rick T. Link

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF UTAH

ROCKY MOUNTAIN POWER

REDACTED
Supplemental Direct Testimony of Rick T. Link

February 2018

Q. Are you the same Rick T. Link who previously provided direct and rebuttal testimony in this case on behalf of Rocky Mountain Power ("Company"), a division of PacifiCorp?

A. Yes.

PURPOSE AND SUMMARY OF TESTIMONY

Q. What is the purpose of your supplemental direct testimony?

A. In my testimony, I provide updated economic analysis demonstrating that the wind repowering project remains beneficial to customers after taking into account new federal corporate income tax rates, and updated information on costs, performance, and market prices.

Q. Please summarize your supplemental direct testimony.

A. I summarize my updated and expanded economic analysis of the wind repowering project, developed in response to changes in federal income tax law. I demonstrate that:

- The updated economic analysis continues to show net customer benefits in all of the scenarios analyzed.
- The wind repowering project will produce present-value net customer benefits, based on updated economic analysis over the remaining life of the repowered wind facilities, ranging between $121 million to $466 million.
- Present-value gross customer benefits calculated over the remaining life of the repowered wind facilities range between $1.14 billion and $1.48 billion, which compares to present-value project costs totaling $1.02 billion.
- These net and gross customer benefits are conservative, as they do not account for potential incremental benefits from renewable energy credits ("RECs") and

understate the potential benefits from reduced carbon dioxide ("CO_2") emissions.

- When measured over a 20-year period, the present value of net customer benefits from wind repowering range between $139 million and $273 million, which accounts for the nominal value of federal production tax credits ("PTCs"), but does not account for the value of incremental energy output that will increase significantly beyond 2036.

UPDATED ECONOMIC ANALYSIS

Q. Did the Company update its economic analysis supporting the wind repowering project?

A. Yes. The economic analysis was updated to reflect more current assumptions, consistent with the agreement set forth in the Unopposed Motion to Amend the Procedural Schedule filed by the Company on December 14, 2017.

Q. What assumptions did the Company update before refreshing its economic analysis of the wind repowering project?

A. The models were updated to reflect: (1) updated cost-and-performance assumptions for the wind repowering project; (2) current price-policy scenario assumptions, including more current natural gas and CO_2 prices; and (3) recent changes in the federal tax rate for corporations.

Q. Please describe the updated cost-and-performance estimates for the wind repowering project.

A. Cost estimates for the wind repowering project have been updated consistent with findings from technical review studies. As described in the supplemental direct

testimony of Company witness Mr. Timothy J. Hemstreet, these technical review studies have led to a change in turbine specifications at the Leaning Juniper facility to ensure turbine loading remains within allowable limits. Mr. Hemstreet also explains that project costs have been updated to account for the need to strengthen foundations at the Leaning Juniper and Goodnoe Hills facilities. Mr. Hemstreet further explains that updated cost assumptions reflect information received through a competitive bidding process for installation, foundation retrofits, as applicable, and other construction services needed to complete the wind repowering project.

As discussed by Mr. Hemstreet, performance estimates for the wind repowering project have been updated to reflect: a) the change in turbine specifications at the Leaning Juniper facility; b) a longer historical period of data used to estimate increased energy production at the Glenrock I, Glenrock III, and Rolling Hills facilities; and c) increased incremental energy production at the Marengo I and II facilities to reflect expected modifications to the interconnection agreement.

In my rebuttal testimony, I explained that the Company did not receive verification that [redacted] equipment could be used on General Electric ("GE") sites (all sites except Marengo I, Marengo II, Leaning Juniper, and Goodnoe Hills) until after we had initiated the economic analysis summarized in that testimony. Consequently, the bulk of the economic analysis presented in my rebuttal testimony assumed the use of [redacted] equipment on all GE sites, and the [redacted] equipment was analyzed as a sensitivity. The updated economic analysis summarized here assumes the [redacted] equipment is used on all GE sites.

After accounting for all of these updates, the capital investment for the wind repowering project is $1.101 billion, which is approximately $18 million (1.6 percent) higher than the $1.083 billion cost assumed in the economic analysis summarized in my rebuttal testimony. The updated incremental energy output from the wind repowering project is 25.7 percent (738 gigawatt-hours ("GWh") per year)—up from the 24.9 percent (714 GWh per year) assumed in the economic analysis summarized in my rebuttal testimony.[1] The cost-and-performance assumptions for the wind facilities studied in the updated economic analysis are summarized in Confidential Exhibit RMP___(RTL-1SD).

Q. Please describe the new price-policy assumptions included in the updated economic analysis.

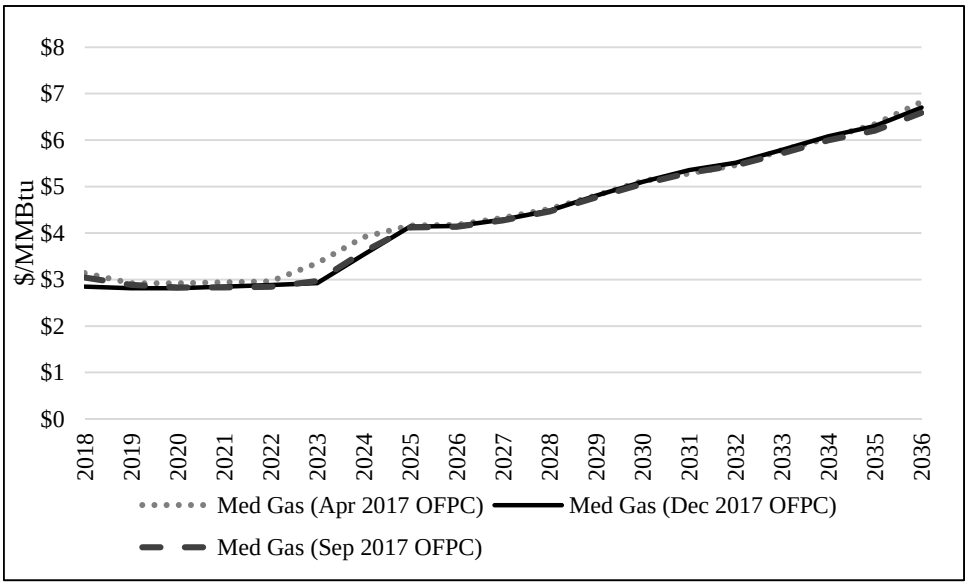
A. In my direct testimony, I described nine price-policy scenarios, developed by pairing three natural-gas price forecasts (low, medium, and high) with three CO_2 price forecasts (zero, medium, and high). The medium natural-gas price assumptions were derived from the Company's official forward price curve ("OFPC"). In the economic analysis summarized in my direct testimony, the Company used its April 26, 2017 OFPC. In the economic analysis summarized in my rebuttal testimony, the Company used its September 30, 2017 OFPC.

The Company's most recent OFPC is dated December 29, 2017, which reflects more current market forwards and an updated forecast from [redacted]. Figure 1-SD compares Henry Hub natural-gas prices from the April 26, 2017 OFPC and the

[1] In my rebuttal testimony, the economic analysis assumed a 24.9 percent incremental energy output. In addition, I provided a sensitivity analysis using the 25.9 percent incremental energy output discussed in Mr. Hemstreet's rebuttal testimony. As explained in the rebuttal testimony, the 25.9 percent increase was based on updated turbine specifications that were confirmed just before the rebuttal testimony was filed.

September 30, 2017 OFPC, which were used to support the economic analysis in my direct and rebuttal testimony, with Henry Hub natural-gas prices from the updated December 29, 2017 OFPC. Over the period 2018 through 2036 and using the most current discount rate, the nominal levelized price for Henry Hub natural-gas prices has decreased by less than one percent from $3.95 per million British thermal units ("MMBtu") as assumed in my rebuttal testimony to $3.94/MMBtu.

Figure 1-SD. Comparison of OFPC
Henry Hub Natural-Gas Price Forecasts



The updated OFPC reflects market forwards as of December 29, 2017, over the period January 2018 through January 2024. The decrease in levelized prices between the updated OFPC and the April OFPC used in the Company's original economic analysis is primarily driven by a reduction in market forwards. Prices in the updated market fundamentals forecast from [redacted], which are used exclusively in the OFPC beyond January 2025, track closely with those assumed in the April 2017 OFPC. The Company continues to blend market forwards from month 61 (February 2023) through month 72 (January 2024) with the fundamentals-based forecast from month 85

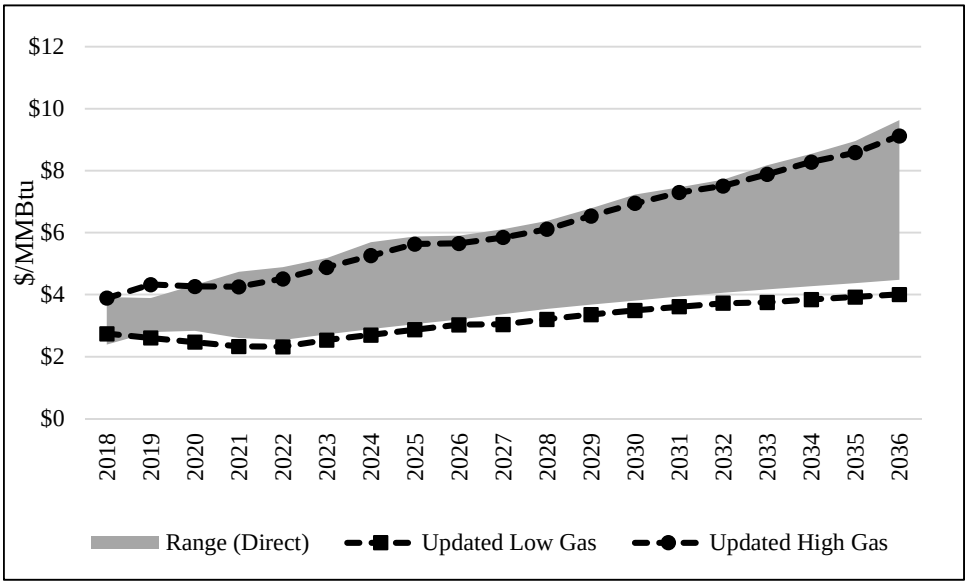
(February 2025) through month 96 (January 2026) to establish prices in month 73 (February 2024) through month 84 (January 2025).

Q. Did the Company update the low and high natural-gas price scenarios used in the updated economic analysis?

A. Yes. Consistent with the Company's approach to develop low and high natural-gas price scenarios used in the original economic analysis, low and high natural-gas price assumptions were updated after reviewing the range in more recent forecasts developed by [redacted], [redacted], and the U.S. Department of Energy's Energy Information Administration. Confidential Exhibit RMP___(RTL-2SD) shows the range in natural-gas price assumptions from these third-party forecasts relative to those adopted for the price-policy scenarios in the Company's updated economic analysis of the wind repowering project.

Figure 2-SD shows the range between the low and high natural-gas price scenarios used in the Company's original economic analysis alongside the updated low and high natural-gas price assumptions. Nominal levelized prices in the low and high scenarios are $2.95/MMBtu (down by approximately seven percent) and $5.60/MMBtu (down by approximately four percent), respectively.

Figure 2-SD. Updated Low and High Natural-Gas Price Assumptions



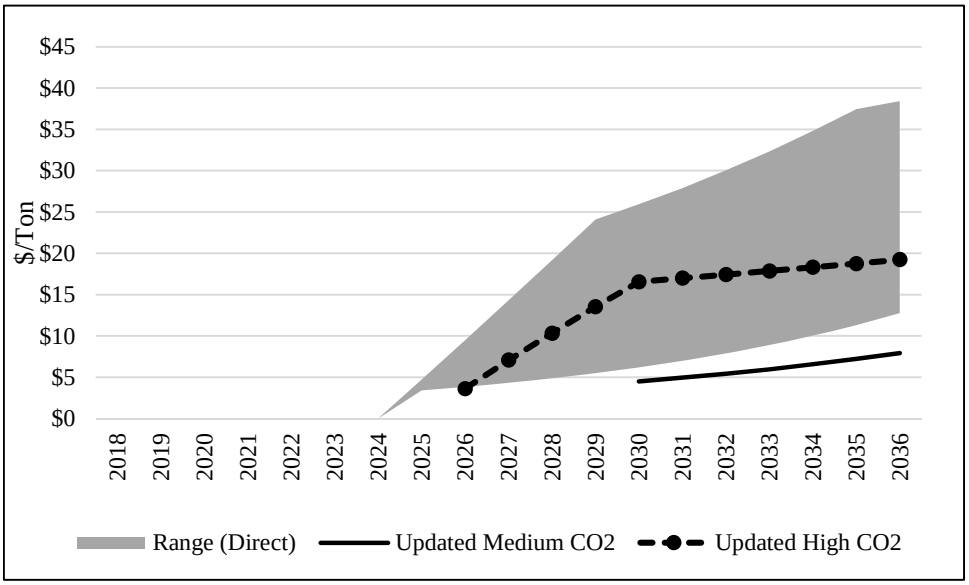
Q. Did the Company update its CO_2 price scenarios used in its updated economic analysis?

A. Yes. As with natural-gas price assumptions and consistent with the Company's approach to develop low and high CO_2 price scenarios used in the original economic analysis, low and high CO_2 price assumptions were updated after reviewing the range in more recent forecasts developed by [redacted] and [redacted]. To bracket the low end of potential-policy outcomes, the Company continues to assume there are no future policies adopted that would require incremental costs to achieve emission reductions in the electric sector. For this scenario, the assumed CO_2 price is zero.

Figure 3-SD shows the range between the medium and high CO_2 price scenarios used in the Company's original economic analysis alongside the updated medium and high CO_2 price assumptions. The updated medium and high CO_2 price assumptions are lower and start later relative to the assumptions summarized in my direct testimony. Updated CO_2 prices in the medium scenario begin in 2030 (five years later) at $4.49/ton

and rise to $7.95/ton by 2036. Updated prices in the high scenario begin in 2026 (one year later) at $3.62/ton, rise to $16.55/ton by 2030, and reach $19.23/ton by 2036.

Figure 3-SD. Updated Medium and High CO_2 Price Assumptions



Q. Please describe the updated federal tax rate for corporations that was included in the updated economic analysis of the wind repowering project.

A. The Company's updated analysis assumes a 21 percent federal income tax rate as provided in H.R. 1, which was passed by Congress on December 20, 2017, and became law on December 22, 2017. Based on an assumed net state income tax rate of 4.54 percent, the effective combined federal and state income tax rate used in the updated analysis is 24.587 percent.

Q. Please describe how the effective combined federal and state income tax rate assumption is applied in the System Optimizer ("SO") model and the Planning and Risk model ("PaR") in the updated economic analysis.

A. As described in my rebuttal testimony, the effective combined federal and state income tax rate affects the Company's post-tax weighted average cost of capital, which is used

as the discount rate in the SO model and PaR. With the changes in tax law, the Company's discount rate has been updated from 6.57 percent to 6.91 percent.

The modified income tax rate also affects the capital revenue requirement for all new resource options available for selection in the SO model. As described in my rebuttal testimony, capital revenue requirement is levelized in the SO and PaR models to avoid potential distortions in the economic analysis of capital-intensive assets that have different lives and in-service dates. This is achieved through annual capital recovery factors, which are expressed as a percentage of the initial capital investment for any given resource alternative in any given year. Capital recovery factors, which are based on the revenue requirement for specific types of assets, are differentiated by each asset's assumed life, book-depreciation rates, and tax-depreciation rates. Because capital revenue requirement accounts for the impact of income taxes on rate-based assets, the capital recovery factors applied to new resource costs in the SO model were updated for each of the Company's system simulations.

Finally, the updated income tax rate affects the tax gross-up of all PTC-eligible resources. As noted in my direct testimony, the current value of federal PTCs is $24/megawatt-hour ("MWh"), which equates to a $38.68/MWh reduction in revenue requirement assuming an effective combined federal and state income tax rate of 37.95 percent. The updated combined federal and state income tax rate reduces the revenue requirement associated with federal PTCs from $38.68/MWh to $31.82/MWh, adjusted for inflation over time. The impact of the updated income tax rate assumptions were applied to all PTC-eligible resource alternatives available in the SO model.

Q. How were these assumption updates captured in the updated economic analysis of the wind repowering project?

A. The Company updated the SO model and PaR to reflect these updated assumptions. As was done in the original analysis summarized in my direct and rebuttal testimony, these models were used to calculate the present value revenue requirement differential ("PVRR(d)") between a simulation with and without the wind repowering project after applying the modeling updates. These simulations continue to cover a forecast horizon out through 2036. The Company also updated its calculation of the PVRR(d) from the change in nominal revenue requirement due to the wind repowering project through 2050.

Q. In addition to the assumption updates described above, did the Company change how it applied federal PTC benefits in its system modeling using the SO model and PaR configured to forecast system costs through 2036?

A. Yes. The Company applied PTC benefits on a nominal basis rather than on a levelized basis. This approach better reflects how the federal PTC benefits for the repowered assets will flow through to customers and aligns the treatment of federal PTC benefits in the system modeling results extending out through 2036 with the nominal revenue requirement results extending out through 2050.

Q. Did the Company continue to apply revenue requirement associated with capital costs on a levelized basis in its system modeling using the SO model and PaR configured to forecast system costs through 2036?

A. Yes. When setting rates, revenue requirement from capital costs is depreciated over the book life of the asset, effectively spreading the cost of capital investments over

the life of the asset. Because revenue requirement from capital projects is spread over the life of the asset in rates, these costs continue to be treated as a levelized cost in the SO model and PaR simulations. As was done in the Company's original economic analysis to estimate the nominal revenue requirement impacts from the wind repowering project, revenue requirement from capital associated with the wind repowering project is treated as a nominal cost when the results are extrapolated out through 2050.

PROJECT-BY-PROJECT ANALYSIS

Q. Did the Company provide updated economic analysis for each individual wind repowering project?

A. Yes. The methodology used to develop the project-by-project analysis is similar to the methodology used to perform the economic analysis for the proposed wind repowering project. The Company ran one SO model simulation that included the full scope of the wind repowering project and then 12 separate SO model simulations where one of the repowered wind facilities is assumed to be excluded from the scope of the wind repowering project. The total system cost from the SO model simulation where all facilities are repowered and from the SO model simulation where one facility is removed from scope is used to calculate the marginal PVRR(d) for each wind facility.

Using the resource portfolios from the SO model simulations, this same approach was used to calculate PVRR(d) for each wind facility using projected system costs from PaR over a 20-year forecast period. Finally, the SO model and PaR results are used to estimate the change in nominal annual revenue requirement for each wind facility by extending the system modeling results to 2050. The methodology used to

estimate the change in nominal annual revenue requirement through 2050 is identical to the methodology used to analyze the full scope of the wind repowering project.

Q. What price-policy scenarios were used in the project-by-project analysis?

A. The Company used two price-policy scenarios—the low natural gas and zero CO_2 price-policy scenario and the medium natural gas and medium CO_2 price-policy scenario. Based on the results of these two price-policy scenarios, the Company determined which individual projects provided net customer benefits under the updated assumptions described above.

Q. Please summarize the project-by-project PVRR(d) results calculated from the SO model and PaR through 2036 when assuming medium natural gas and medium CO_2 price-policy assumptions.

A. Table 1-SD summarizes the PVRR(d) results for each wind facility within the scope of the wind repowering project. The PVRR(d) between cases with and without wind repowering are shown for each wind facility based on system modeling results from the SO model and for PaR, before accounting for the substantial increase in incremental energy beyond the 2036 time frame. When applying medium natural gas and medium CO_2 price-policy assumptions, benefits from repowering the Leaning Juniper wind facility are equal to costs. All other wind facilities are projected to deliver net benefits.

Table 1-SD. Project-by-Project SO Model and PaR PVRR(d) (Benefit)/Cost of Wind Repowering with Medium Natural Gas and Medium CO_2 Price-Policy Assumptions ($ million)

Wind Facility	SO Model PVRR(d)	PaR Stochastic-Mean PVRR(d)	PaR Risk-Adjusted PVRR(d)
Glenrock 1	($25)	($21)	($23)
Glenrock 3	($8)	($7)	($7)
Seven Mile Hill 1	($33)	($28)	($29)
Seven Mile Hill 2	($7)	($7)	($7)
High Plains	($17)	($13)	($13)
McFadden Ridge	($5)	($4)	($4)
Dunlap Ranch	($30)	($26)	($27)
Rolling Hills	($12)	($9)	($10)
Leaning Juniper	($0)	($0)	($0)
Marengo 1	($35)	($33)	($34)
Marengo 2	($15)	($14)	($15)
Goodnoe Hills	($18)	($18)	($19)
Total	($205)	($180)	($189)

Q. Please summarize the project-by-project PVRR(d) results calculated from the SO model and PaR through 2036 when assuming low natural gas and zero CO_2 price-policy assumptions.

A. Table 2-SD summarizes the PVRR(d) results for each wind facility within the scope of the wind repowering project. The PVRR(d) between cases with and without wind repowering are shown for each wind facility based on system modeling results from the SO model and for PaR, before accounting for the substantial increase in incremental energy beyond the 2036 time frame. When applying low natural gas and zero CO_2 price-policy assumptions, costs from repowering the Leaning Juniper wind facility are slightly higher than the benefits. All other wind facilities are projected to deliver net benefits.

Table 2-SD. Project-by-Project SO Model and PaR PVRR(d) (Benefit)/Cost of Wind Repowering with Low Natural Gas and Zero CO_2 Price-Policy Assumptions ($ million)

Wind Facility	SO Model PVRR(d)	PaR Stochastic-Mean PVRR(d)	PaR Risk-Adjusted PVRR(d)
Glenrock 1	($21)	($21)	($22)
Glenrock 3	($7)	($6)	($6)
Seven Mile Hill 1	($28)	($28)	($29)
Seven Mile Hill 2	($6)	($6)	($6)
High Plains	($12)	($9)	($10)
McFadden Ridge	($4)	($3)	($3)
Dunlap Ranch	($25)	($22)	($24)
Rolling Hills	($9)	($7)	($7)
Leaning Juniper	$6	$3	$4
Marengo 1	($27)	($25)	($26)
Marengo 2	($11)	($10)	($11)
Goodnoe Hills	($13)	($15)	($15)
Total	($157)	($149)	($156)

Q. Please summarize the project-by-project PVRR(d) results calculated from the change in annual revenue requirement through 2050.

A. Table 3-SD summarizes the PVRR(d) results for each wind facility calculated off of the change in annual nominal revenue requirement through 2050 for both price-policy scenarios. Unlike the results summarized in Table 4, these results account for the substantial increase in incremental energy beyond the 2036 time frame. Each of the wind facilities within the scope of the proposed repowering project show net benefits with repowering under the medium natural gas and medium CO_2 price-policy scenario and all facilities show net benefits under the low natural gas and zero CO_2 price-policy scenario, except for the Leaning Juniper wind facility, where the benefits are equal to the costs.

Table 3-SD. Project-by-Project Nominal Revenue Requirement PVRR(d) (Benefit)/Cost of Wind Repowering ($ million)

Wind Facility	Medium Natural Gas and Medium CO_2	Low Natural Gas and Zero CO_2
Glenrock 1	($33)	($33)
Glenrock 3	($11)	($6)
Seven Mile Hill 1	($41)	($40)
Seven Mile Hill 2	($10)	($6)
High Plains	($22)	($6)
McFadden Ridge	($7)	($2)
Dunlap Ranch	($39)	($23)
Rolling Hills	($15)	($5)
Leaning Juniper	($8)	($0)
Marengo 1	($75)	($46)
Marengo 2	($20)	($7)
Goodnoe Hills	($26)	($19)
Total	($306)	($194)

Q. The project-by-project results vary by wind facility, and some wind facilities appear to show relatively small PVRR(d) benefits. Have you calculated the net benefits of the wind repowering project taking into account the size of each wind facility?

A. Yes. As described in my rebuttal testimony, the magnitude of the PVRR(d) results must be considered in relation to the specific attributes of the repowered wind facility, including the size of the facility, the expected cost to repower the facility, and the level of annual energy output expected after the new equipment is installed. For example, the PVRR(d) for McFadden Ridge shows a $7 million benefit when repowered (using medium natural gas and medium CO_2 price-policy assumptions)—the lowest PVRR(d) among all of the project-by-project results. The PVRR(d) benefit for McFadden Ridge is approximately 9 percent of the $75 million benefit for Marengo I, which yields the

highest PVRR(d) among all of the project-by-project results. However, the current capacity of McFadden Ridge (28.5 MW) is approximately 20 percent of the current capacity of Marengo I (140.4 MW). Similarly, the expected energy output after repowering for McFadden Ridge (approximately 117 GWh per year) is approximately 24 percent of the expected energy output after repowering for Marengo I (approximately 488 GWh per year).

A reasonable metric to evaluate the relative benefits among the wind facilities that captures the specific attributes of each facility is the nominal levelized net benefit per incremental MWh expected after the facility is repowered. This metric captures the specific repowering cost for each facility net of the specific benefits of each facility per incremental MWh of energy expected after the facility is repowered. Table 4-SD shows the nominal levelized net benefit of repowering per MWh of expected incremental energy output after repowering for each wind facility. When using medium natural gas and medium CO_2 price-policy assumptions, the table shows the Seven Mile Hill II facility produces the largest net benefit per incremental MWh ($37/MWh), and Leaning Juniper produces the smallest net benefit per incremental MWh ($7/MWh).

Table 4-SD. Nominal Levelized Net Benefit per MWh of Incremental Energy Output after Repowering ($/MWh)

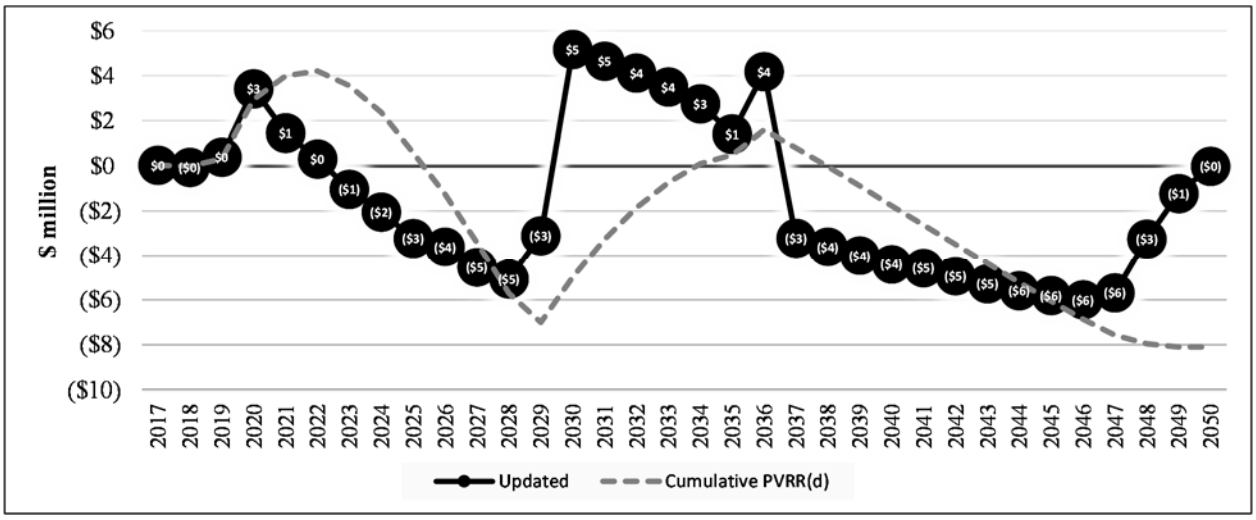
Wind Facility	Medium Natural Gas and Medium CO_2	Low Natural Gas and Zero CO_2
Glenrock 1	$29/MWh	$29/MWh
Glenrock 3	$28/MWh	$16/MWh
Seven Mile Hill 1	$30/MWh	$29/MWh
Seven Mile Hill 2	$36/MWh	$23/MWh
High Plains	$17/MWh	$5/MWh
McFadden Ridge	$17/MWh	$5/MWh
Dunlap Ranch	$28/MWh	$17/MWh
Rolling Hills	$19/MWh	$7/MWh
Leaning Juniper	$7/MWh	$0/MWh
Marengo 1	$37/MWh	$23/MWh
Marengo 2	$21/MWh	$8/MWh
Goodnoe Hills	$26/MWh	$18/MWh
Weighted Average	$25/MWh	$16/MWh

Q. Have you reviewed the change in annual nominal revenue requirement due to wind repowering from the Leaning Juniper facility, which yields the lowest net benefits per MWh of incremental energy output among all facilities within the proposed scope of repowering project?

A. Yes. Figure 4-SD shows the change in nominal revenue requirement due to wind repowering for the Leaning Juniper wind facility when using medium natural gas and medium CO_2 price assumptions. The figure also shows the cumulative PVRR(d) for Leaning Juniper through 2050. The cumulative PVRR(d) for any given year reflects the present value net benefits from prior years that are associated with repowering Leaning Juniper. For instance, the cumulative PVRR(d) shown for 2020 represents the present value of the net benefits for repowering in each year over the period 2017 through 2020. Consequently, the cumulative PVRR(d) in 2050 captures the net benefits

of repowering the Leaning Juniper wind facility through its expected useful life (*i.e.*, $8 million of net benefit as reported in Table 3-SD). This figure shows that repowering Leaning Juniper will produce customer benefits. Benefits are expected to exceed project costs in 20 years of the 30-year life of the repowered facility and federal PTCs contribute to customer benefits by 2023—three years after the new equipment is placed in service.

Figure 4-SD. Total-System Annual Revenue Requirement for Leaning Juniper with Wind Repowering ($ million)



Q. Is there an upside to the project-by-project PVRR(d) results?

A. Yes. Consistent with the economic analysis of the wind repowering project summarized in my direct and rebuttal testimony, the project-by-project results do not reflect the potential value of RECs that will be generated by the incremental energy output from each facility. For instance, as applied to the Leaning Juniper project discussed above, present-value net customer benefits would increase by approximately $1.1 million (approximately 14 percent of the PVRR(d) benefits under the medium natural gas and medium CO_2 price-policy scenario as shown in Table 3-SD) for every dollar assigned to the incremental RECs that will be generated from this facility. Importantly, there are

counterparties that might be interested in procuring incremental RECs from repowered wind facilities such as Leaning Juniper, allowing realization of this upside value.

Q. Based on these results, has the Company decided against repowering any of the 12 facilities that were originally included in the repowering project?

A. No. The project-by-project analysis demonstrates that the proposed scope of the wind repowering project, which includes repowering 12 wind facilities with a current capacity totaling just over 999 MW is appropriate and will maximize customer benefits.

UPDATED SYSTEM MODELING PRICE-POLICY RESULTS

Q. Please summarize the updated PVRR(d) results for the full scope of the wind repowering project as calculated from the SO model and PaR through 2036 among all nine price-policy scenarios.

A. Table 5-SD summarizes the updated PVRR(d) results for each price-policy scenario for the full scope of the wind repowering project. The PVRR(d) between cases with and without the repowering project, are shown for the SO model and for PaR, which was used to calculate both the stochastic-mean PVRR(d) and the risk-adjusted PVRR(d). The data used to calculate the PVRR(d) results shown in the table are provided as Exhibit RMP___(RTL-3SD).

Table 5-SD. Updated SO Model and PaR PVRR(d) (Benefit)/Cost of the Wind Repowering Projects ($ million)

Price-Policy Scenario	SO Model PVRR(d)	PaR Stochastic-Mean PVRR(d)	PaR Risk-Adjusted PVRR(d)
Low Gas, Zero CO_2	($159)	($141)	($148)
Low Gas, Medium CO_2	($158)	($139)	($146)
Low Gas, High CO_2	($183)	($165)	($173)
Medium Gas, Zero CO_2	($201)	($171)	($180)
Medium Gas, Medium CO_2	($204)	($180)	($189)
Medium Gas, High CO_2	($215)	($193)	($203)
High Gas, Zero CO_2	($257)	($234)	($246)
High Gas, Medium CO_2	($260)	($248)	($260)
High Gas, High CO_2	($273)	($240)	($252)

Over a 20-year period, the wind repowering project reduces customer costs in all nine price-policy scenarios. This outcome is consistent in both the SO model and PaR results. Under the central price-policy scenario, assuming medium natural-gas prices and medium CO_2 prices, the PVRR(d) net benefits range between $180 million, when derived from PaR stochastic-mean results, and $204 million, when derived from SO model results. These benefits are higher than those summarized in my rebuttal testimony (between $115 million to $138 million). This change is influenced by the fact that the updated analysis reflects nominal federal PTC benefits, whereas the analysis summarized in my rebuttal testimony reflects levelized federal PTC benefits.

Q. What trends do you observe in the modeling results across the different price-policy scenarios?

A. Projected system net benefits increase with higher natural-gas price assumptions, and similarly, generally increase with higher CO_2 price assumptions. Conversely, system net benefits generally decline when low natural-gas prices and low CO_2 prices are

assumed. This trend holds true when looking at the results from the two simulations used to calculate the PVRR(d) for all nine of the price-policy scenarios. Importantly, both models continue to show that the net benefits from the wind repowering project are robust across a range of price-policy assumptions.

Q. Did you update the potential upside to these PVRR(d) results associated with REC revenues?

A. Yes. Consistent with my direct and rebuttal testimony, the PVRR(d) results presented in Table 5-SD do not reflect the potential value of RECs generated by the incremental energy output from the repowered facilities. Accounting for the updated performance estimates discussed above, customer benefits for all price-policy scenarios would improve by approximately $6 million for every dollar assigned to the incremental RECs that will be generated from the repowered facilities through 2036 (the same figure as estimated in my rebuttal analysis). Quantifying the potential upside associated with incremental REC revenues is intended to simply communicate that the net benefits from the repowering project could improve if the incremental RECs can be monetized in the market.

Q. Is there additional upside to the net benefits shown in Table 5-SD?

A. Yes. The CO_2 price assumptions used in the updated economic analysis were inadvertently modeled in 2012 real dollars instead of nominal dollars. Consequently, the PVRR(d) net benefits in the six price-policy scenarios that use medium and high CO_2 price assumptions are conservative.

UPDATED REVENUE REQUIREMENT MODELING PRICE-POLICY RESULTS

Q. Did the Company update its revenue requirement modeling among different price-policy scenarios to reflect the modeling updates described above?

A. Yes. Using the same annual revenue requirement modeling methodology described in my direct and rebuttal testimony, the Company updated its forecast of the change in nominal annual revenue requirement due to the wind repowering project, incorporating the modeling updates described earlier in my testimony.

Q. Please summarize the updated PVRR(d) results calculated from the change in annual revenue requirement through 2050.

A. Table 6-SD summarizes the updated PVRR(d) results for each price-policy scenario calculated off of the change in annual nominal revenue requirement through 2050. The annual data over the period 2017 through 2050 that was used to calculate the PVRR(d) results shown in the table are provided as Exhibit RMP___(RTL-4SD).

Table 6-SD. Updated Nominal Revenue Requirement PVRR(d) (Benefit)/Cost of the Wind Repowering Project ($ million)

Price-Policy Scenario	Updated Annual Revenue Requirement PVRR(d)	Rebuttal Annual Revenue Requirement PVRR(d)
Low Gas, Zero CO_2	($127)	($360)
Low Gas, Medium CO_2	($121)	($480)
Low Gas, High CO_2	($223)	($473)
Medium Gas, Zero CO_2	($224)	($483)
Medium Gas, Medium CO_2	($273)	($471)
Medium Gas, High CO_2	($321)	($534)
High Gas, Zero CO_2	($389)	($555)
High Gas, Medium CO_2	($386)	($635)
High Gas, High CO_2	($466)	($619)

When system costs and benefits from the wind repowering project are extended

through 2050, covering the full depreciable life of the repowered wind facilities, the wind repowering project reduces customer costs in all nine price-policy scenarios. Customer benefits range from $121 million in the low natural gas and medium CO_2 price-policy scenario to $466 million in the high natural gas and high CO_2 price-policy scenario. Under the central price-policy scenario, assuming medium natural-gas prices and medium CO_2 prices, the PVRR(d) benefits of the wind repowering project are $273 million. While changes in federal tax law have reduced net benefits relative to the economic analysis summarized in my rebuttal testimony, the wind repowering project continues to provide significant customer benefits in all price-policy scenarios, and the updated economic analysis reconfirms that upside benefits outweigh downside risks.

Q. Is there additional potential upside to these PVRR(d) results associated with REC revenues?

A. Yes. Consistent with my direct and rebuttal testimony, the PVRR(d) results presented in Table 6-SD do not reflect the potential value of RECs generated by the incremental energy output from the repowered facilities. Accounting for the updated performance, customer benefits for all price-policy scenarios would improve by approximately $12 million for every dollar assigned to the incremental RECs that will be generated from the Wind Projects through 2050 (down slightly from $13 million in my rebuttal analysis).

Q. Is there additional potential upside to these PVRR(d) results shown in Table 6-SD?

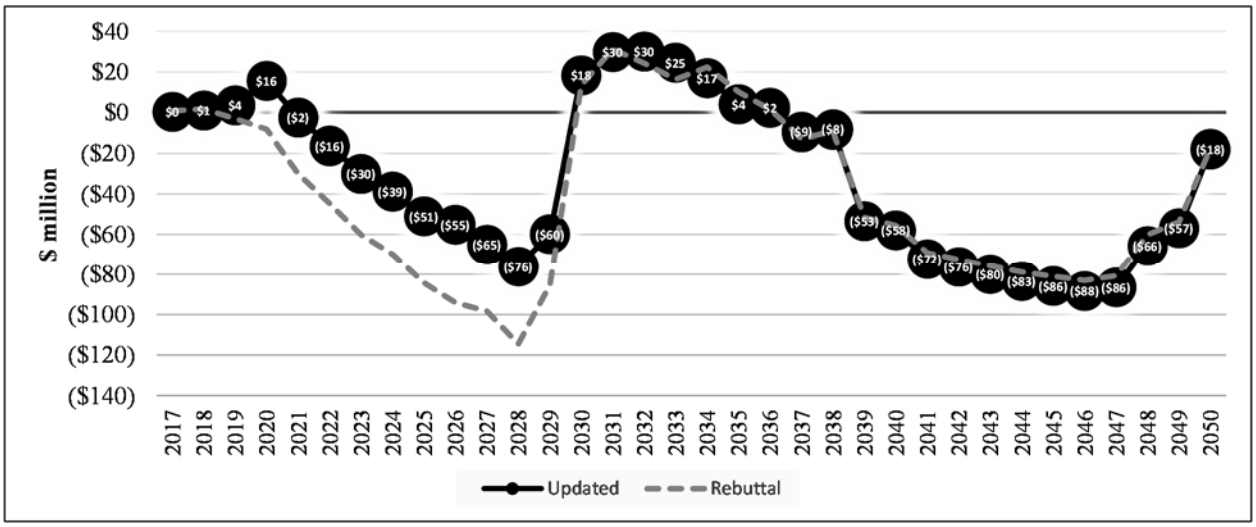
A. Yes. As noted earlier, the updated CO_2 price assumptions used in the updated economic analysis were inadvertently modeled in 2012 real dollars instead of nominal dollars.

Consequently, the PVRR(d) net benefits in the six price-policy scenarios that use medium and high CO_2 price assumptions are conservative.

Q. Please describe the change in annual nominal revenue requirement from the wind repowering project.

A. Figure 5-SD shows the updated change in nominal revenue requirement due to the wind repowering project for the medium natural gas, medium CO_2 price-policy scenario on a total-system basis. These results are shown alongside the same results from the economic analysis summarized in my rebuttal testimony. The change in nominal revenue requirement shown in the figure reflects updated costs, including capital revenue requirement (*i.e.*, depreciation, return, income taxes, and property taxes), O&M expenses, the Wyoming wind-production tax, and PTCs. The project costs are netted against updated system impacts from the wind repowering project, reflecting the change in net power costs ("NPC"), emissions, non-NPC variable costs, and system fixed costs that are affected by, but not directly associated with, the wind repowering project.

Figure 5-SD. Updated Total-System Annual Revenue Requirement With the Wind Repowering Project (Benefit)/Cost ($ million)



The data shown in this figure for the updated economic analysis have the same basic profile as the data from the economic analysis summarized in my rebuttal testimony. This profile also shows that the change in tax law has reduced net benefits through the first 10 years of operation, but that after the PTCs expire, net benefits track very closely with those presented in my rebuttal testimony. Despite a reduction in PTC benefits associated with changes in federal tax law, the wind repowering project continues to generate substantial near-term customer benefits and continues to contribute to customer benefits over the long-term.

Q. Did you evaluate how wind repowering benefits assumed beyond 2036 affect the PVRR(d) results calculated from the change in annual nominal revenue requirement through 2050?

A. Yes. As stated in my rebuttal testimony, the point of extrapolating results beyond 2036 is to capture the benefits from the significant increase in the expected annual energy output from the repowered wind facilities beyond the period in which the existing wind

facilities would have otherwise reached the end of their lives. While the methodology used in my analysis is valid, the value of this incremental energy can be evaluated in different ways.

Table 7-SD summarizes how the PVRR(d) results through 2050 would change if flat market prices at the Palo Verde ("PV") market from the December 29, 2017 OFPC were used as the basis to evaluate the value of incremental energy from wind repowering over the 2037 to 2050 time frame. Recognizing there is both upside and downside price risk to the value of this energy, I assume different levels of PV prices—70 percent of the PV forward curve, 100 percent of the PV forward curve, and 130 percent of the PV forward curve. PacifiCorp's December 29, 2017 OFPC includes forward prices through 2042. Conservatively, I assume no escalation in PV prices beyond 2042 for each of these scenarios. Each of these scenarios is shown alongside the $273 million PVRR(d) net benefit when incremental energy from repowering beyond 2036 is calculated from system modeling results over the 2028 through 2036 time frame.

Table 7-SD. Updated Long-Term Benefit Sensitivity

Source of 2037-2050 Benefits	Nominal Levelized Benefit from 2037-2050 ($/MWh)	Annual Revenue Requirement PVRR(d) (Benefit)/Cost ($ million)
2027-2036 System Modeling	$59.08	($273)
70% of PV	$49.49	($213)
100% of PV	$70.70	($351)
130% of PV	$91.92	($489)

This analysis demonstrates that regardless of the methodology used to extend wind repowering benefits to 2050, the PVRR(d) result shows significant customer savings. If the incremental energy is valued at the PV forward curve, the PVRR(d)

benefits of the wind repowering project are $351 million, which is $78 million higher than the methodology used in my analysis.

NEW WIND SENSITIVITY

Q. Has the Company updated its sensitivity analysis related to the new wind and transmission resources ("Combined Projects") that are the subject of Docket No. 17-035-40?

A. Yes. Based on the updates discussed above, coupled with the updated cost-and performance-estimates for the new wind resources and transmission proposed and described as the "Combined Projects" in Docket No. 17-035-40, the Company performed a sensitivity that includes the wind repowering project with the Combined Projects.

Q. What are the results of the Combined Projects sensitivity?

A. Table 8-SD summarizes PVRR(d) results for the Combined Projects sensitivity. This sensitivity was developed using SO model and PaR simulations through 2036 for the medium natural gas, medium CO_2 and the low natural gas, zero CO_2 price-policy scenarios. The results are shown alongside the base repowering study presented above in which wind repowering was evaluated without the Combined Projects.

Table 8-SD Combined Projects Sensitivity (Benefit)/Cost ($ million)

	Sensitivity (Repowering + Combined Projects) PVRR(d)	Base Study (Repowering) PVRR(d)	Change in PVRR(d)
Medium Gas, Medium CO_2			
SO Model	($532)	($204)	($328)
PaR Stochastic Mean	($466)	($180)	($286)
PaR Risk Adjusted	($489)	($189)	($300)
Low Gas, Zero CO_2			
SO Model	($301)	($159)	($142)
PaR Stochastic Mean	($300)	($141)	($159)
PaR Risk Adjusted	($315)	($148)	($167)

Customer benefits increase significantly when the wind repowering project is implemented with the Combined Projects in both the medium natural gas, medium CO_2 and the low natural gas, zero CO_2 price-policy scenarios. These results demonstrate that customer benefits not only persist, but increase, if both the wind repowering project and the Combined Projects are completed.

Q. Did you update the sensitivity that evaluates the potential incremental benefits of the wind repowering project if existing interconnection agreements, beyond what has already been assumed for the Marengo I and II facilities, can be modified to accommodate additional energy production?

A. No. The Company will continue to evaluate the feasibility and incremental benefits associated with modifications to existing interconnection agreements. If this ongoing review indicates that modifications to these interconnection agreements are feasible and provide net customer benefits, the Company will pursue those opportunities outside of this proceeding.

Q. Please summarize the conclusion of your supplemental direct testimony.

A. The updated economic analysis summarized in my supplemental direct testimony supports repowering just over 999 MW of existing wind resource capacity located in Wyoming, Oregon, and Washington. The updated economic analysis shows significant net customer benefits in all of the scenarios analyzed. The wind repowering project will replace equipment at existing wind facilities with modern technology to improve efficiency, increase energy production, extend the operational life, reduce run-rate operating costs, reduce net power costs, and deliver substantial federal PTC benefits that will be passed on to customers. The proposed wind repowering project is in the public interest.

Q. Does this conclude your supplemental direct testimony?

A. Yes.