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

Supplemental Rebuttal Testimony of Rick T. Link

April 2018

Q. Are you the same Rick T. Link who previously provided testimony in this case on behalf of Rocky Mountain Power, a division of PacifiCorp?

A. Yes.

PURPOSE AND SUMMARY OF TESTIMONY

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

A. I rebut challenges to PacifiCorp's economic analysis raised in the response testimonies of the Utah Division of Public Utilities ("DPU") witnesses Dr. Joni Zenger and Mr. Daniel Peaco; Office of Consumer Services ("OCS") witness Mr. Philip Hayet; and the Utah Association of Energy Users ("UAE") witness Mr. Kevin C. Higgins.

Q. Please summarize your supplemental rebuttal testimony.

A. My supplemental rebuttal testimony responds to concerns raised by parties in their response testimony, including criticisms of PacifiCorp's modeling assumptions and methodologies. My supplemental rebuttal demonstrates that:

- PacifiCorp's economic analysis summarized in my supplemental direct testimony was updated in accordance with its unopposed motion to amend the procedural schedule filed November 22, 2017.
- PacifiCorp filed a robust application and has provided extensive testimony, exhibits, and work papers with each filing to explain, demonstrate, and support its economic analysis.
- PacifiCorp improved its 20-year economic analysis by considering nominal production tax credit ("PTC") benefits and levelized capital revenue requirement costs, which conforms the treatment of PTCs to the treatment of other costs and benefits that are not actually spread over the life of the asset and appropriately weights the contribution of these elements in present value net-benefit calculations.
- Despite claims to the contrary, the independent analyses prepared by parties and summarized in their response testimony, while flawed, only validate and affirm the primary conclusions summarized in my supplemental direct testimony:

  1) 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;

2) 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.

3) these net and gross customer benefits are conservative, as they do not account for potential incremental benefits from renewable energy credits and understate the potential benefits from reduced carbon dioxide ("CO_2") emissions.

4) 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 PTCs, but does not account for the value of incremental energy output that will increase significantly beyond 2036.

ECONOMIC ANALYSIS ASSUMPTIONS

Q. In its supplemental direct filing, did PacifiCorp update its economic analysis supporting the wind repowering project?

A. Yes. My supplemental direct testimony summarized an updated economic analysis to reflect: (1) updated cost-and-performance assumptions for the wind repowering project; (2) more current price-policy scenario assumptions; and (3) recent changes in the federal tax rate for corporations.

Q. Dr. Zenger asserts that PacifiCorp "basically filed an entirely new case" when it should have only updated its economic analysis to reflect the recent change in federal tax legislation (Zenger Response, lines 124–128.) Do you agree?

A. No. In the unopposed motion to amend the procedural schedule filed by the company on November 22, 2017, parties authorized the company to represent that they supported the motion and agreed, among other things, that the company would file supplemental testimony that includes an updated economic analysis to reflect specific assumption

updates. Unopposed Motion to Amend Procedural Schedule, ¶¶ 2, 4 (Nov. 22, 2017).

Q. Was DPU among the parties that authorized the company to represent they had agreed, among other things, that the company would file an updated economic analysis?

A. Yes.

Q. What specific assumptions did DPU and other parties agree should be reflected in the supplemental filing?

A. The parties agreed that the supplemental economic analysis would be performed on a project-by-project basis and be updated to reflect: 1) any determinative actions by Congress on tax reform; 2) official forward price curves ("OFPCs") effective as of January 1, 2018; 3) scenario analysis for, at minimum, the low natural gas, zero CO_2 and medium natural gas, medium CO_2 price-policy scenarios; and 4) updates for known changes to cost in wind repowering costs and performance, and projected changes in CO_2 costs. Unopposed Motion to Amend Procedural Schedule, ¶ 4.

Q. Did PacifiCorp's updated economic analysis summarized in your supplemental direct testimony reflect the specific assumption updates listed in the unopposed motion?

A. Yes. In fact, had PacifiCorp updated its economic analysis to only reflect changes to federal tax legislation, as Dr. Zenger asserts should have been the case, the company would not have satisfied its agreement with DPU and other parties. PacifiCorp's supplemental direct filing simply met the commitments outlined in the company's unopposed motion.

Q. Do other parties find that it was reasonable for PacifiCorp to update certain assumptions in the economic analysis described in your supplemental direct testimony?

A. Yes. Mr. Hayet states in his response testimony that he found it reasonable that PacifiCorp lowered its natural gas forecast. (Hayet Response, lines 360–369.)

Q. Dr. Zenger claims that PacifiCorp filed very little upfront in its application, that DPU had to conduct its analysis through discovery, and that this was compounded by the company's "failure to include discussion of these project in the 2017 IRP workshops" (Zenger Response, lines 279–289.) Is this accurate?

A. No. PacifiCorp filed a robust application and has provided extensive testimony, exhibits, and work papers with each filing to explain, demonstrate, and support its economic analysis. PacifiCorp also participated in the wind repowering technical conference on August 30, 2017, to present and address questions from parties related to the company's wind repowering application. During the confidential session of this technical workshop, I personally walked the parties through the extensive set of work papers that supported the economic analysis summarized in my direct testimony.

Dr. Zenger's claim that the wind repowering project was not discussed in 2017 Integrated Resource Plan ("IRP") workshops is simply not accurate. In February 2017, PacifiCorp finalized its IRP analysis of the wind repowering project. The scope of the wind repowering project and the accompanying economic analysis was discussed at a public input meeting held in early March 2017, before filing the 2017 IRP in early April 2017. The wind repowering project was also discussed in the 2017 IRP. Moreover, after the 2017 IRP was filed and before the wind repowering application was filed,

PacifiCorp met with IRP stakeholders to discuss the wind repowering project; the meeting with DPU took place on May 10, 2017.

Q. Dr. Zenger states that "much of the early work in this case was wasted as analyses, assumptions and projections changed." (Zenger Response, lines 297–299.) How do you respond?

A. PacifiCorp updated its assumptions and projections to ensure that its economic analysis remains current. These updates are necessary to confirm that the wind repowering project will deliver customer benefits, despite changes to federal tax law and market forces that are beyond PacifiCorp's control. Moreover, all of the modeling updates that are described in my supplemental direct testimony conform to the updates that DPU and other parties agreed should be made. To facilitate the parties' review of PacifiCorp's filings, the company has been transparent, has thoroughly documented and explained its updated assumptions, and has provided extensive work papers that support all of the economic analyses presented in testimony and accompanying exhibits.

Q. Mr. Hayet testifies that updated medium CO_2 price assumptions reduce the CO_2 emission benefits from the wind repowering project and that it is possible that there will be no CO_2 benefits, particularly within the 20-year study period. (Hayet Response, lines 370–385.) How do you respond?

A. As described in my supplemental direct testimony, PacifiCorp updated its CO_2 price assumptions to align with the most current third-party projections. Relative to the CO_2 price assumptions applied in the economic analysis summarized in my direct and rebuttal testimony, the updated CO_2 price assumptions applied in the economic analysis

summarized in my supplemental direct testimony begins in 2030 (five years later) and are slightly lower. Mr. Hayet's observation that the benefits from CO_2 emission reductions have dropped is accurate. However, as noted in my supplemental direct testimony, PacifiCorp inadvertently applied these assumptions in 2012 real dollars instead of in nominal dollars. Consequently, the CO_2 emission reduction benefits in the six price-policy scenarios that use a CO_2 price assumption are conservative.

I also agree with Mr. Hayet that it is possible there may not be a direct cost associated with CO_2 emissions within the 20-year study period, and consequently, it is possible there may not be any direct CO_2 emission benefits from the wind repowering project. This is precisely why the company included a set of price-policy scenarios that do not assume a CO_2 price. However, I do not agree with Mr. Hayet's assertion that the five-year shift in the assumed start year for base case CO_2 price assumptions justifies an expectation that CO_2 price assumptions will continue to be pushed out in future studies. In fact, I believe it is more likely than not that there will be some form of state or federal CO_2 policy that imputes either a direct or indirect cost on CO_2 emissions.

LEVELIZED PTCs

Q. Is the total PTC benefit associated with the wind repowering project over 10 years substantial?

A. Yes. Over 10 years, the total PTC benefit sums to approximately $1.2 billion.

Q. Mr. Hayet states that the change in treatment of PTCs in PacifiCorp's analysis did not strictly comply with the Commission's amended scheduling order and implies that the company may be "doing everything it can to ensure the projects appear to be economic in every analysis performed." (Hayet Response, lines 87–103.) Mr. Higgins makes similar claims. (Higgins Response, lines 282–285.) Do you agree?

A. No. PacifiCorp updated its economic analysis consistent with the agreement set forth in its unopposed motion to amend the procedural schedule. As described in my testimony in Docket No. 17-035-40, PacifiCorp refined its treatment of PTCs when analyzing bids offered into the 2017R Request for Proposals to ensure that bid selections would appropriately account for nominal PTC benefits, which is how PTCs are treated in rates. For this same reason, and to maintain consistency, PacifiCorp applied this more accurate treatment of PTCs in its updated economic analysis of the proposed wind repowering project. This more accurate treatment of PTC benefits was *not* implemented to ensure that projects appear to be economic in every analysis. The updated economic analysis of the wind repowering project simply demonstrates that these investments are economic in all price-policy scenarios and will provide substantial customer benefits.

Q. Mr. Higgins explains that the present-value results from PacifiCorp's 20-year IRP economic analysis included with the company's supplemental direct filing are not directly comparable to the results included in the company's direct and rebuttal filings. (Higgins Response, lines 166–169.) Do you agree with this assessment?

A. Yes. In my supplemental direct testimony, I explained that the updated economic

analysis reflects a change in how the company applied federal PTC benefits in its 20-year analysis. (Link Supplemental Direct, lines 185–192.) When summarizing the results of the updated 20-year economic analysis, I explicitly noted that the reported present-value net benefits are higher than those summarized in my rebuttal testimony because the updated results were influenced by the use of nominal PTCs instead of levelized PTCs. (Link Supplemental Direct, lines 344–347.)

Q. Mr. Peaco claims that the nominal treatment of PTCs has the potential to bias model results and does not provide a reasonable estimate of the benefits of the repowering project. (Peaco Response, lines 204–209.) Mr. Higgins and Mr. Hayet similarly note that the treatment of capital costs continues to be measured on a real-levelized basis. (Higgins Response, lines 279–282; Hayet Response, lines 238–277.) How do you respond?

A. The rationale for applying PTC benefits on a nominal basis is reasonable and necessary to align the 20-year economic analysis with how PTC benefits will flow through to customers in rates. It is appropriate that the company continue to apply revenue requirement associated with capital costs on a levelized basis, because 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. In contrast, PTC benefits will flow to customers during the first 10 years after the new equipment is installed at the proposed wind facilities. Consequently, the timing of the PTC benefits should be appropriately weighted and accounted for in the present-value calculation of net benefits.

This is consistent with how PacifiCorp has historically conducted its economic

analysis of specific resource decisions, where it has treated costs that are not spread over the life of an asset on a nominal basis. Typically this means that capital costs are levelized, while other costs like run-rate operating costs, are nominal. The refined modeling used in the updated economic analysis is more accurate as it conforms the treatment of PTCs to the treatment of other costs and benefits that are not actually spread over the life of the asset.

Q. Mr. Higgins claims that to maintain any reasonable nexus with the IRP process, the benefits of the repowering project should be measured using the same valuation methods that were applied in the IRP and that the change to nominal treatment of PTC benefits causes the wind repowering proposal to depart from the IRP framework. (Higgins Response, lines 395–472.) Do you agree?

A. No. While it is true that PacifiCorp levelized PTC benefits in its 2017 IRP, the company has since improved its methodology to more accurately reflect how PTC benefits will flow into customer rates, which in turn, provides a more accurate representation of the net benefits associated with the wind repowering project. By accounting for PTC benefits on a nominal basis, present-value calculations of customer benefits appropriately weight the front-end loaded PTC benefits resulting in a more accurate representation of present-value net benefits. This means that the present-value economic benefits of the wind repowering project that are presented in the 2017 IRP are understated, and this is why PacifiCorp intends to adopt the more accurate nominal treatment of PTCs in future IRPs.

Mr. Higgins's position of maintaining consistency with the IRP might have merit if a modeling improvement were later adopted that demonstrates a resource

decision identified in the IRP should not have been an element of the least-cost, least-risk preferred portfolio. However, that is not the case in this instance. PacifiCorp's improved modeling approach simply demonstrates that, all else equal, the wind repowering project provides more present-value customer benefits than was originally estimated in the 2017 IRP, which only solidifies its inclusion as an element of the company's least-cost, least risk resource plan.

Q. Mr. Higgins calculates the 20-year wind repowering benefits using nominal capital costs with nominal PTCs and concludes that the benefits in each price-policy scenario drop by $39 million. (Higgins Response, lines 497–509.) How do you respond?

A. On its face, it is perfectly rational to consider nominal revenue requirement for capital investments over any time period. However, for the reasons described in my direct testimony (Link Direct, lines 412–431), it is not appropriate to include nominal revenue requirement from capital investments for assets having a depreciable life that extends beyond the 20-year IRP study period in *present-value* calculations. Mr. Higgins states that the 20-year analysis, with the application of levelized capital costs, understates revenue requirement and true rate impacts (Higgins Response, lines 478–480), and he inappropriately estimates the impact of this assumption in single present-value figure. Mr. Higgins fails to recognize that the present-value results from the IRP models are intended to assess the relative difference in system costs among different resource portfolios over a 20-year planning time frame. The present-value results from the IRP models are not configured to forecast annual rate impacts between different resource portfolios.

Throughout this proceeding, my testimony has presented an annual revenue requirement analysis of the wind repowering project to specifically address directional rate implications in nine different price-policy scenarios. In this analysis, it is appropriate to consider the nominal revenue requirement from capital costs in the present-value calculations because it spans the full 30-year life of the repowered wind facilities. Importantly, as summarized in my supplemental direct testimony, these present-value results demonstrate that the wind repowering project is expected to produce net customer benefits in all nine scenarios (Link Supplemental Direct, lines 381–398), that these results are conservative (Link Supplemental Direct, lines 399–314), and that under a base-case view, these benefits are expected to occur over both the near and long term. (Link Supplemental Direct, lines 414–435.)

Importantly, even if one were to assume that Mr. Higgins's present-value calculation showing a $39 million reduction in PacifiCorp's present-value net benefits is valid for the 20-year IRP analysis—and to be clear, the company is not saying this calculation is valid—the wind repowering project still generates net customer benefits in all nine price-policy scenarios. Mr. Higgins's own analysis shows that even in the lowest gross-benefit scenario that applies low natural gas and zero CO_2 price assumptions, the wind repowering project still generates between $103 million and $121 million in present-value net benefits for customers. (Higgins Response, Table KCH-7-RE.)

Q. Mr. Hayet concludes that while PacifiCorp's new modeling approach ensures that the entirety of PTC benefits will be captured in the 20-year economic evaluation, some of the repowering tax costs and other capital-related revenue requirements will be excluded from that 20-year analysis. (Hayet Response, lines 234–237.) Do you agree?

A. No. In the 20-year IRP analysis, application of nominal PTC benefits and levelized capital revenue requirement appropriately reflects the relative difference in the present-value benefits and costs from a resource portfolio that includes the wind repowering project with a resource portfolio that does not include the wind repowering project. Interestingly, in asserting that certain costs are not captured in PacifiCorp's 20-year IRP analysis, Mr. Hayet fails to mention that this analysis also does not capture any benefits that the wind repowering project will generate beyond the 20-year time frame.

Q. Mr. Hayet asserts that through the nominal treatment of PTCs and levelized treatment of capital costs, the company maximized the inclusion of PTC benefits but minimized the inclusion of capital revenue requirements in its economic analysis, thereby increasing the benefits of each project. (Hayet Response, lines 258–359.) Is this accurate?

A. No. As discussed above, PacifiCorp's approach to calculating the change in present-value system costs between resource portfolios with and without the wind repowering project in the 20-year IRP analysis is appropriate. It is only appropriate to include capital revenue requirement on a nominal basis in present-value calculations when those calculations cover the full life of the repowered wind facilities. That analysis is included in my supplemental direct testimony and demonstrates that the wind

repowering project is expected to generate net customer benefits in all nine price-policy scenarios.

PROJECT-BY-PROJECT ANALYSIS

Q. Mr. Hayet presents an alternative 20-year project-by-project analysis that treats both capital-related revenue requirement and PTCs on a nominal basis. (Hayet Response, lines 545–550.) Is Mr. Hayet's alternative analysis more accurate than the approach used in PacifiCorp's economic analysis?

A. No. Mr. Hayet justifies his alternative 20-year project-by-project analysis as superior because it relies on a representation of capital revenue requirement he claims is consistent with the representation of PTCs. He also states that this alternative is consistent with the way costs and benefits flow through to customer rates. (Hayet Response, lines 560–563.)

One of Mr. Hayet's fundamental assumptions—that revenue requirement from capital and PTCs should be calculated on the same basis when performing present-value calculations in the 20-year IRP analysis—is flawed. As I have already discussed, it is not appropriate to calculate present-value costs from nominal capital revenue requirement when the study period is shorter than the life of the asset. In contrast, it is appropriate to consider nominal PTC benefits in the 20-year IRP analysis because these benefits will be realized within the 20-year timeframe of the study. Consequently, PacifiCorp's 20-year IRP analysis appropriately weights these front-end loaded benefits without disproportionately weighting capital costs in the present-value calculations. For this reason, the company's approach provides the most accurate representation of overall customer net benefits when calculated over the 20-year

planning period used in the 2017 IRP.

Mr. Hayet also states that his alternative methodology is consistent with how costs and benefits flow through to customer rates. (Hayet Response, lines 560–563.) Mr. Hayet fails to recognize that the company's annual revenue requirement analysis is consistent with how costs and benefits flow through to customer rates, that it applies both capital revenue requirement and PTCs on a consistent (nominal) basis, and because the term of this annual revenue requirement analysis covers the full life of the repowered wind facilities, the present-value results of this analysis are valid. In short, Mr. Hayet fails to recognize that PacifiCorp has already performed an economic analysis that meets the stated goals of his proposed alternative methodology. This analysis demonstrates that each of the wind facilities show net benefits when using medium natural gas and medium CO_2 price-policy assumptions. And when the most conservative low natural gas and zero CO_2 price-policy assumptions are used, all repowered wind facilities show net benefits except for Leaning Juniper, where benefits equal costs. (Link Supplemental Direct, lines 252–263.)

Importantly, and as is the case with Mr. Higgins's alternative calculations, even if one were to accept that Mr. Hayet's methodology is valid for the 20-year IRP analysis—and to be clear, Mr. Hayet's approach is not valid or necessary—the conclusions drawn from this analysis are consistent with PacifiCorp's 20-year IRP analysis. Just like the economic analysis summarized in my supplemental direct testimony (Link Supplemental Direct, Table 2-SD), Mr. Hayet's own analysis shows that even in the lowest gross-benefit scenario that applies low natural gas and zero CO_2 price assumptions, the wind repowering project is expected to generate approximately

$110 million in present-value net benefits for customers. (Hayet Response, Table 5.)

Q. Based on his alternative methodology to use nominal costs for capital revenue requirement and PTCs in the 20-year analysis, Mr. Hayet concludes that six wind facilities should be excluded from the scope of the wind repowering project. (Hayet Response, lines 598–605.) Do you agree with Mr. Hayet's conclusion?

A. No. As discussed above, Mr. Hayet's alternative methodology is flawed and should not be used as the basis to determine whether specific wind facilities should be excluded from the scope of the wind repowering project. Based on this flawed analysis, Mr. Hayet appears to have arbitrarily drawn a line that suggests wind facilities expected to generate present-value net benefits at or below $5 million in the lowest gross-benefit scenario (assuming low natural gas and zero CO_2 price assumptions) should be eliminated from the project scope. The primary basis for Mr. Hayet's recommendation appears to be rooted in his assertion that certain wind facilities provide net benefits that are lower than others. But in making this recommendation, Mr. Hayet completely ignores the fact that his own analysis shows that the specific wind facilities he proposes be excluded are expected to generate net benefits even in the lowest gross-benefit scenario analyzed.

Q. Mr. Hayet presents an analysis that assumes a five-percent increase in total capital cost and a five-percent decrease in energy production.(Hayet Rebuttal, lines 650–714.) How do you respond?

A. First, Mr. Hayet's sensitivity analysis is applied to his alternative base case analysis, which for the reasons outlined above, is flawed. This alone renders any conclusions drawn from his sensitivity analysis irrelevant. Second, Mr. Hayet provides no basis to

support the assumptions used in his sensitivity analysis. He does not provide any assessment of the company's wind repowering cost assumptions or the company's expected energy output projections. In short, Mr. Hayet does not explain why he believes PacifiCorp's cost-and-performance assumptions are not valid. Mr. Hayet again appears to have arbitrarily selected assumptions, applied those assumptions to a flawed analysis with an unwarranted focus on worst-case outcome, and used the results to support faulty conclusions.

As described by Mr. Hemstreet, nearly all of the wind repowering costs included in PacifiCorp's economic analysis are now firm and therefore the risk of a five percent cost increase is unlikely.

Q. Mr. Peaco critiques how energy-not-served ("ENS"), which is an output reported from the Planning and Risk model ("PaR"), influences PacifiCorp's economic analysis in the low natural gas, zero CO_2 price-policy scenario. (Peaco Response, lines 327–373.) Have you reviewed Mr. Peaco's critiques?

A. Yes. Mr. Peaco raises two concerns. First, Mr. Peaco asserts that the benefit attributed to the lower amount of ENS in a portfolio that contains all wind repowering projects relative to a portfolio that removes one of the wind repowering projects is a modeling artifact and does not represent an economic benefit that will actually accrue to ratepayers. (Peaco Response, lines 352–355.) Second, Mr. Peaco believes that the percentage of total benefits that are attributable to ENS benefits in the low natural gas, zero CO_2 price-policy scenario are inconsistent. (Peaco Rebuttal, lines 356–361.)

Q. What do the ENS outputs from PaR represent?

A. As described in my direct testimony, PaR is configured to analyze volatility and

uncertainty in key system variables by using Monte Carlo sampling of load, wholesale electricity and natural gas prices, hydro generation, and thermal-unit outages. Consequently, PaR considers a distribution of system variable costs, including costs associated with energy or reserve deficiencies. (Link Direct, lines 207–218.) When PaR is configured to analyze these stochastic risks, there are certain combinations of variables that lead to low-probability outcomes where there are insufficient resources to meet load (*i.e.*, this is more likely to occur under high load, low hydro, and high thermal outage conditions).

PaR assigns a $1,000/megawatt-hour ("MWh") cost to ENS events, which serves two purposes. First, the ENS charge serves as a representative cost—tied to the historical cap established by the Federal Energy Regulatory Commission on supply offered into day-ahead and real-time markets—associated with having to make market purchases that could potentially be used avoid ENS events. Second, the ENS charge is sufficiently high to ensure that PaR does not "choose" ENS in its least-cost dispatch of system resources. For instance, if the ENS charge were set at $1/MWh, PaR would choose to reduce dispatch from system resources and market purchases to levels that would be insufficient to meet load because it would be lower cost.

Q. Are the ENS benefits that are included in PacifiCorp's economic analysis a benefit for customers?

A. Yes. PacifiCorp's project-by-project analysis compares system costs between two sets of resource portfolios—one portfolio with the full scope of repowered wind facilities and one portfolio where one of the wind facilities is assumed not to be repowered. The difference in system costs between these two cases represents the marginal system

value of the wind facility that was removed. When a wind facility is removed from scope, there is less zero-fuel-cost energy output available to the system. This makes the system less reliable, and consequently, the ENS cost increases. Contrary to Mr. Peaco's claims, avoidance of this incremental ENS cost when repowering any given wind facility is a real and quantifiable customer benefit that is appropriately accounted for in PacifiCorp's economic analysis.

Mr. Peaco's concerns are based entirely on his review of ENS benefits in the low natural gas, zero CO_2 price-policy scenario. In this price-policy scenario, the net-power cost benefits from wind repowering are proportionately smaller than the net-power cost benefits in other price-policy scenarios that use a higher market-price forecast. Consequently, when calculated on a percentage basis, the relative contribution of other benefits from wind repowering, such as ENS benefits, will be greater in the low natural gas, zero CO_2 price-policy scenario than in other price-policy scenarios that use a higher market-price forecast.

If one were to assess the proportionate contribution of ENS benefits to the net benefits under the medium natural gas, medium CO_2 price-policy scenario, one would expect the ENS benefits, expressed as a percentage of total benefits, would be smaller than in the low natural gas, zero CO_2 price-policy scenario. Table 1-SR shows the contribution of ENS benefits as a percentage of net benefits for each wind facility under the medium natural gas, medium CO_2 price-policy scenario. In this price-policy scenario, the average contribution of ENS benefits to the net benefits of each wind facility is about one percent. As expected, this is considerably smaller than the contribution of ENS benefits to the net benefits under the low natural gas, zero CO_2

price-policy scenario as calculated by Mr. Peaco.

Table 1-SR
Project-by-Project ENS Benefits in the Medium Natural Gas, Medium CO_2 Price-Policy Scenario (PaR Nominal Revenue Requirement Analysis)

Wind Facility	ENS Benefit ($ million)	Total Net Benefit ($ million)	ENS as % of Net Benefits
Glenrock 1	($1)	($33)	2%
Glenrock 3	($0)	($11)	0%
Seven Mile Hill 1	($1)	($41)	2%
Seven Mile Hill 2	($0)	($10)	0%
High Plains	($1)	($22)	5%
McFadden Ridge	($0)	($7)	0%
Dunlap Ranch	($1)	($39)	1%
Rolling Hills	($1)	($15)	4%
Leaning Juniper	($0)	($8)	0%
Marengo 1	$0	($50)	0%
Marengo 2	$0	($20)	0%
Goodnoe Hills	$0	($26)	0%

Q. Is it reasonable for the contribution of ENS benefits in the low natural gas, zero CO_2 price scenario to vary among specific wind facilities?

A. Yes. The range in benefits among wind facilities account for the unique characteristics of each project (*i.e.*, incremental energy output, hourly generation profiles, *etc.*), and these unique characteristics contribute to a unique package of benefits. For instance, Mr. Peaco claims that two wind facilities—Seven Mile Hill 1 and High Plains—should have similar ENS benefits because they are nearly identical in project size and are geographically close to each other. (Peaco Response, lines 356–360.) However, Mr. Peaco fails to acknowledge that the expected repowered energy output from Seven Mile Hill 1 is approximately nine percent higher than the repowered energy output expected from High Plains. Moreover, Seven Mile Hill 1 is expected to be repowered four months earlier than High Plains. Considering the unique characteristics of each wind facility, variation in the contribution of ENS benefits to total net benefits among

the wind facilities is expected and is not an indication that PacifiCorp's economic analysis is flawed.

Q. Mr. Hayet notes that PacifiCorp acknowledged there was an error in Table 3-SD of my supplemental direct testimony that affects the Marengo 1 project. (Hayet Response, lines 490–492.) Do you agree?

A. Yes. The net-present value benefits for Marengo 1 listed in Table 3-SD of my supplemental direct testimony were overstated by approximately $25 million. I agree that Mr. Hayet has made the appropriate corrections in Table 4 of his response testimony, which shows the Marengo 1 wind facility is expected to generate $50 million in net benefits under the medium natural gas, medium CO_2 price-policy scenario and $22 million in net benefits under the low gas, zero CO_2 price-policy scenario. The corrected result is also shown in Table-1SR above.

Q. Mr. Peaco claims that PacifiCorp has not explained differences in project-by-project results. (Peaco Response, lines 362–364.) Do you agree?

A. No. In support of his claim, Mr. Peaco references PacifiCorp's response to DPU data request 31.2(b), which refers to the company's response to DPU data request 29.5(b). Neither of these data requests ask PacifiCorp to explain differences in project-by-project results. These data requests question differences in the *total* project-by-project results relative to the aggregate results for the wind repowering project. PacifiCorp provided a responsive reply to each of these data requests.

Q. Did Mr. Peaco present alternative project-by-project results in his response testimony?

A. Yes. Mr. Peaco presents three alternative sets of project-by-project results using

benefit-cost ratios for individual wind facilities that are based on his own estimates of energy benefits for the low natural gas, zero CO_2 and medium natural gas, medium CO_2 price-policy scenarios. (Peaco Response, lines 374–402.) These alternative results are derived from costs and benefits that extend through 2050. Mr. Peaco draws three conclusions from his analysis: 1) there is a wide range of benefit-cost ratios and some wind facilities have higher margins than others; 2) the method used to determine benefits impacts the relative benefit-cost ratios among wind facilities, as well as the rank order of projects; and 3) even under a lower-energy-benefits scenario, several of the projects exhibit positive benefit-cost ratios with some margin. (Peaco Response, lines 404–410.)

Q. Do you agree with Mr. Peaco's analysis and conclusions?

A. No. By replacing PacifiCorp's model results *and* extrapolated results beyond 2036 with an alternative estimate of energy benefits, Mr. Peaco completely disregards the company's robust system modeling. This system modeling, which relies on the same models used to establish a least-cost, least-risk resource portfolio in PacifiCorp's IRP process, accounts for the specific characteristics of each repowered wind facility and how each interacts with other system resources over time. For instance, the incremental energy that will be generated by the repowered wind facilities is not the same across all seasons, months, days, and hours. Importantly, the market value of energy is not the same across all seasons, months, days, and hours.

Incremental energy benefits from repowered wind facilities will be affected by the volume of incremental energy and the market price of energy in any given time interval. Mr. Peaco's simplified cost-benefit analysis does not capture this dynamic.

Incremental energy benefits from repowered wind facilities will further be influenced by a complex web of system variables, including the availability and dispatch cost of both existing and future generating resources, load, and transmission, which can limit access liquid markets. Mr. Peaco's analysis does not capture these interactions either. Consequently, Mr. Peaco's analysis should be viewed as a high-level and simplified representation of PacifiCorp's more detailed and accurate analysis. When viewed in this light, Mr. Peaco's high-level analysis can be used as a means to validate whether PacifiCorp's more accurate analysis is reasonable.

Q. Does Mr. Peaco's cost-benefit analysis validate that PacifiCorp's economic analysis is reasonable?

A. Yes. Table 2-SR summarizes the simple average, low, and high cost-benefit ratios among the 12 wind facilities, as calculated by Mr. Peaco and summarized in his response testimony. (Peaco Response, Table 5.) A cost-benefit ratio greater than one indicates that benefits exceed costs, and a cost-benefit ratio less than one indicates that costs exceed benefits.

In the medium natural gas, medium CO_2 price-policy scenario, Mr. Peaco's high-level analysis shows higher cost-benefit ratios than those he calculated from PacifiCorp's more accurate economic analysis. In the low natural gas, zero CO_2 price-policy scenario, Mr. Peaco's high-level estimate produces a cost-benefit ratio that is, on average, slightly higher than those he calculated from PacifiCorp's more accurate economic analysis. Moreover, the range in cost-benefit ratios from Mr. Peaco's high-level analysis is similar to the range in cost-benefit ratios that he calculated from PacifiCorp's more accurate analysis.

Table 2-SR
Comparison of Mr. Peaco's Cost-Benefit Analysis

	Medium Natural Gas, Medium CO_2		Low Natural Gas, Zero CO_2	
	Mr. Peaco's Cost-Benefit Ratio from PacifiCorp's Economic Analysis	**Mr. Peaco's Cost-Benefit Ratio from his High-Level Estimate**	**Mr. Peaco's Cost-Benefit Ratio from PacifiCorp's Economic Analysis**	**Mr. Peaco's Cost-Benefit Ratio from his High-Level Estimate**
Simple Average	1.29	1.42	1.17	1.19
Low	1.07	1.11	1.00	0.92
High	1.47	1.62	1.37	1.36

Q. What conclusions do you draw from Mr. Peaco's cost-benefit analysis?

A. Mr. Peaco's cost-benefit analysis validates that PacifiCorp's economic analysis is reasonable. Consistent with my findings from the company's economic analysis, Mr. Peaco's independent and high-level cost-benefit analysis shows that all of the repowered wind facilities are expected to generate net customer benefits when applying medium natural gas, medium CO_2 price-policy assumptions. Even in the most extreme low natural gas, zero CO_2 price-policy scenario, 11 of 12 wind facilities are expected to generate net customer benefits.

Moreover, the single project that does not show customer net benefits in the low natural gas, zero CO_2 price-policy scenario, shows a net benefit when the results from the medium natural gas, medium CO_2 price-policy scenario and low natural gas, zero CO_2 price-policy scenario are averaged together. In a previous voluntary resource decision request filed by the Company, DPU used this approach to evaluate the economics of the resource decision because, according to DPU's expert witness in that case, using the simple average of the price-policy scenario results produced a reasonable "risk-weighted benefit" that assumes each of the price-policy results is "equally likely." *In the Matter of the Voluntary Resource Request of Rocky Mountain*

Power for Approval of a Resource Decision to Construct Selective Catalytic Reduction Systems on Jim Bridger Units 3 and 4, Docket No. 12-035-92, DPU Exhibit 2.0 SR, lines 52–58 (Feb. 28, 2013). DPU's expert explained that using a simple average to produce a risk-weighted benefit was a "pretty good way" to do it because it was "neutral" and "doesn't attempt to say that lower gas prices are more likely or less likely in the future, just that they are equally likely with the base and high gas price forecasts." *In the Matter of the Voluntary Resource Request of Rocky Mountain Power for Approval of a Resource Decision to Construct Selective Catalytic Reduction Systems on Jim Bridger Units 3 and 4*, Docket No. 12-035-92, Transcript, page 165, lines 1–10 (Mar. 7, 2013).

Q. Why did you not assess Mr. Peaco's high-level estimate of his cost-benefit ratios derived assuming energy benefits at 70 percent of Palo Verde market prices?

A. As discussed above, Mr. Peaco's cost-benefit analysis does not reflect the contemporaneous changes in energy output with changes in market prices, nor does it capture how these repowered wind facilities will interact with other system resources over time. For this reason, Mr. Peaco's cost-benefit analysis is best viewed as a simplified representation of PacifiCorp's more detailed and accurate analysis. In this capacity, Mr. Peaco's cost-benefit analysis derived by assuming a 30 percent reduction from Palo Verde market prices is not directly comparable to the company's results for these same price-policy scenarios. In fact, Mr. Peaco's cost-benefit analysis that assuming a 30 percent reduction in Palo Verde market prices from prices in the low natural gas, zero CO_2 price-policy scenario is effectively a high-level estimate of cost-benefit ratios assuming a significant and sustained reduction from the most extreme

and lowest gross-benefit scenario analyzed by the company.

Q. Does Mr. Peaco provide any support explaining why he chose to reduce Palo Verde prices by 30 percent?

A. Not really. Mr. Peaco states that he applied this discount consistent with analysis presented in my testimony. (Peaco Response, 393–395.) This is not accurate. In my rebuttal and supplemental direct testimony, recognizing that long-term benefits are more difficult to forecast, I did present an analysis that replaced extrapolated system-benefit results beyond 2036 with Palo Verde market prices. And in developing this analysis, I did assume a case where Palo Verde prices were reduced by 30 percent. However, I did not apply this assumption to assess its impact on energy benefits before 2036, as was done by Mr. Peaco. It is one thing to assume that prices might drop by 30 percent from base case projections of the long term. It is entirely different to assume that market prices will drop by 30 percent from a low-price scenario over the near-term. It is highly unlikely that market prices will fall by nearly a third from a *low* price forecast over the near term.

ANNUAL REVENUE REQUIREMENT MODELING THROUGH 2050

Q. Dr. Zenger asserts that a project in excess of one billion dollars represents a large investment for a project "that is not needed" and that customer benefits are "small relative to the investment's size." (Zenger Rebuttal, lines 158–161.) Do you agree?

A. No. Dr. Zenger's assertion is not supported by facts. The wind repowering project is a key element of PacifiCorp's least-cost, least-risk plan to deliver reasonably priced and reliable service for customers. All of PacifiCorp's economic analysis presented in this proceeding relies on the same modeling tools used to produce the company's IRP. Each

of the model runs for all price-policy scenarios used to calculate customer benefits-runs with and without the repowered wind facilities-achieve the same target planning reserve margin (13 percent) used in PacifiCorp's IRP in each year of the 20-year planning period. None of the model runs that include the repowered wind facilities achieves a planning reserve margin above 13 percent in any year of the 20-year forecast period. Contrary to Dr. Zenger's claims, the repowered wind facilities are needed, and resource portfolios that include the repowered wind facilities are lower cost and lower risk than resource portfolios that do not include the repowered wind facilities.

Dr. Zenger's claim that customer benefits are small relative to the size of the investment is also not supported by facts. The company's economic analysis shows *net* customer benefits based on the economic analysis over the remaining life ranging between $121 million and $466 million. The *gross* benefits are anything but small. The present-value *gross* benefits for the repowered wind facilities exceed project costs and conservatively range between $1.14 billion and $1.48 billion.

Q. Mr. Hayet argues that PacifiCorp's extrapolation of energy benefits during the 2037 to 2050 time frame overstates those benefits relative to what would have been derived using an expansion planning and production cost modeling approach. (Hayet Rebuttal, lines 386–428.) Do you agree?

A. No. It is perfectly reasonable to extrapolate system benefits during the 2037 to 2050 timeframe. 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. I also recognize that the value of this incremental energy can be assessed in different ways, and presented a long-term benefit sensitivity analysis that replaced extrapolated benefits with Palo Verde market prices. (Link Rebuttal, lines 421–447.) I updated this long-term benefit sensitivity in my supplemental direct testimony. (Link Supplemental Direct, lines 436–462.)

Mr. Hayet's criticism is based on calculating system benefits derived from approximately 739 gigawatt-hours ("GWh") of incremental annual energy before 2037 and then applying these benefits to approximately 3,478 GWh of incremental energy per year over the 2037 to 2050 time frame. Mr. Hayet argues that the replacement cost for a smaller amount of energy will generally lead to a higher per-unit value than it would for a larger amount of energy. All else equal, I agree with Mr. Hayet's observation. However, all else is not equal.

Beyond 2036, when the wind facilities would have otherwise hit the end of their lives, PacifiCorp will need to replace approximately 1,000 megawatts ("MW") of wind resource capacity with other resources if the wind facilities are not repowered. Consequently, in roughly the 2037 time frame, the repowered wind facilities will avoid the need to acquire new resources, which in turn, will further reduce system costs. Because the company is using modeled results over the 2028–2036 time frame, before resource deferral benefits are accounted for, to extrapolate system benefits in 2037 and beyond, PacifiCorp's extrapolated benefits are not overstated. If anything, the company's extrapolated benefits over the 2037–2050 timeframe are likely conservative because they do not capture customer savings associated with deferring resource-

replacement costs.

Q. Mr. Hayet also expresses a concern that benefits over the 2037–2050 time frame are overstated because the extrapolation does not reflect a long-term, optimal resource-expansion plan. (Hayet Response, lines 467–480.) Do you agree with his conclusion?

A. No. Mr. Hayet incorrectly states that the company assumes no other resources will be added to the system over this period. (Hayet Response, lines 468–470.) I agree with Mr. Hayet that such an assumption would be unrealistic. Clearly, it is likely that PacifiCorp will need new resources beyond the 2036 IRP planning period. PacifiCorp's extrapolation methodology used in the annual revenue requirement analysis simply assumes that system impacts over the 2028–2036 time frame, inclusive of impacts to the resource portfolio, are a reasonable, and as discussed above, conservative proxy for system benefits that can be expected over the 2037–2050 time frame.

I also agree with Mr. Hayet that absent wind repowering (referred to as the "status quo" case by Mr. Hayet), PacifiCorp would have to replace approximately 1,000 MW of wind resource capacity that would otherwise have reached the end of its life. (Hayet Response, lines 473–477.) I do not agree with Mr. Hayet that this overstates the wind repowering net benefits. (Hayet Response, lines 477–480.) To the contrary, and as noted above, benefits from the wind repowering project would only improve from the values reported in the company's economic analysis if they accounted for avoided resource-deferral costs over the 2037–2050 time frame.

Q. Does Mr. Hayet discuss the long-term benefit sensitivity summarized in your supplemental direct testimony?

A. Yes. As noted above, my supplemental direct testimony summarizes an updated long-term benefit sensitivity where the extrapolated benefits are replaced with flat Palo Verde market prices under three scenarios—130 percent of Palo Verde, 100 percent of Palo Verde, and 70 percent of Palo Verde. Mr. Hayet dismisses the 130 percent and 100 percent scenarios because they result in levelized per-unit benefits that are higher than the company's the extrapolated values. (Hayet Response, lines 452–459.) Mr. Hayet's assessment of the 70 percent Palo Verde scenario is that it "resulted in a wind repowering net benefit of $213 million, which was much lower than the $351 million net benefit that Mr. Link discussed, it was also lower than the net benefit from his original extrapolation methodology, which was $273." (Hayet Response, lines 459–462.) Based on this observation, Mr. Hayet concludes that "these highlight the fact, that without performing proper modeling analyses, it would be speculative to even consider the 70% of PV case result reasonable." (Hayet Response, lines 462–464.)

Q. Is Mr. Hayet's conclusion reasonable?

A. No. I agree with Mr. Hayet's assessment that the $213 million net benefit from the 70 percent Palo Verde sensitivity is lower than the $351 million net benefit from the 100 percent Palo Verde sensitivity and that it is also lower than the $273 million net benefit when using extrapolated benefits. However, I do not understand how these basic facts lead Mr. Hayet to conclude that it is speculative to consider the 70 percent case result reasonable. If anything, the basic facts support the exact opposite conclusion.

When energy benefits are assumed to be reduced by 30 percent, one would

expect that net benefits from the wind repowering project will be lower. This is precisely what the sensitivity results show—net benefits from the 100 percent Palo Verde sensitivity drop from $351 million to $213 million when net benefit assumptions are reduced in the 70 percent Palo Verde sensitivity. Similarly, when assumed energy benefits under the 70 percent Palo Verde sensitivity are lower than those assumed in the extrapolated results, one would expect the net benefits from the wind repower project to be directionally lower. Again, this is precisely what the sensitivity analysis shows—net benefits from the extrapolated results drop from $273 million to $213 million when net benefits are reduced in the 70 percent Palo Verde sensitivity. These results do not support Mr. Hayet's conclusion. Rather, they show that if one believes the extrapolated results are overstated, which they are not, then an even more conservative estimate of long-term benefits shows that the wind repowering project is *still* expected to generate significant net benefits for customers.

Q. Mr. Peaco questions PacifiCorp's use of Palo Verde prices in its long-term benefits sensitivity study and concludes that the implied market heat rate is unreasonable. (Peaco Response, lines 230–273.) How do you respond?

A. As described in my supplemental direct testimony, medium natural gas price assumptions are derived from PacifiCorp's OFPC. When producing the OFPC for natural gas and wholesale electricity prices, the first six years (through January 2024) reflect observed forward market prices as of December 29, 2017, which were validated against third-party broker quotes. In year seven (from February 2024 through January 2025), natural gas and wholesale electricity prices are a blend of the prior-year forward price and the fundamentals-based price in the subsequent year. Beyond year seven

(beginning February 2025), natural gas and wholesale electricity prices in the OFPC reflect a fundamentals-based forecast. (Link Supplemental Direct, lines 79–107.) Mr. Peaco calculates an implied heat rate of 11,455 million British thermal units "(MMBtu")/MWh for 2022, and states that it is highly unlikely that a natural-gas-fired unit at this heat rate would be the marginal unit in the market. (Peaco Response, lines 264–271.)

Considering that PacifiCorp's OFPC reflects observed market forwards for natural gas and wholesale electricity prices through January 2024, Mr. Peaco's criticism of the implied market heat rate is not so much a criticism of a company assumption, but a criticism of the market itself. Contrary to Mr. Peaco's assertion, PacifiCorp's Palo Verde prices are not too high and inconsistent with natural gas price forecasts. (Peaco Response, lines 268–271.) PacifiCorp's OFPC for natural gas and wholesale electricity prices in 2022, and consequently the implied market heat rate in 2022, is not only consistent with natural gas price forecasts, it is based entirely on market information. As prices in the OFPC transition to a fundamentals-based forecast, the implied market heat rate begins to drop. By 2037, when I started using Palo Verde prices in the long-term benefits sensitivity study, I calculate the implied market heat rate under the medium natural gas scenario to be 9,260 MMBtu/MWh (ranging between 7,653 MMBtu/MWh in March 2037 and 10,831 MMBtu/MWh in August 2037). Consequently, the implied market heat rate calculated off of Palo Verde prices in the time frame that these prices were used in the long-term benefits sensitivity is more closely aligned with Mr. Peaco's expectations.

Q. Did Mr. Peaco recommend that PacifiCorp's economic analysis should be adjusted based on his review of market implied heat rates?

A. No.

CONCLUSION

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

A. The updated economic analysis summarized in my supplemental direct testimony continues to support 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 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 rebuttal testimony?

A. Yes.