BEFORE THE PUBLIC SERVICE COMMISSION OF UTAH

IN THE MATTER OF THE VOLUNTARY REQUEST OF ROCKY MOUNTAIN POWER FOR THE APPROVAL OF RESOURCE DECISION TO REPOWER WIND FACILITIES	))))))))	**DOCKET NO. 17-035-39** **DPU Exhibit 2.0 Confidential RESP** **Response Testimony and Exhibits** **Daniel Peaco**

FOR THE DIVISION OF PUBLIC UTILITIES
DEPARTMENT OF COMMERCE
STATE OF UTAH

CONFIDENTIAL

Response Testimony of

Daniel Peaco

On Behalf of the Division of Public Utilities

April 2, 2018

CONFIDENTIAL-SUBJECT TO UTAH PUBLIC SERVICE COMMISSION RULES R746-1-602 and 603

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I. Introduction

Q. Are you the same Daniel Peaco who previously provided direct and surrebuttal testimony in this case on behalf of the Utah Division of Public Utilities?

A. Yes, I submitted direct testimony on September 20, 2017 as DPU Confidential Exhibit 2.0 DIR and surrebuttal testimony on November 15, 2017 as DPU Exhibit 2.0 SR. Both pieces of testimony were offered on behalf of the Division of Public Utilities (Division).

Q. What is the purpose of your response testimony?

A. My response testimony examines the new and updated information contained in the Company's February 1, 2018 Supplemental Direct Testimonies and associated discovery responses regarding the economics, reliability, and risks of the 12 repowering projects proposed by the Company. The assessments included in my responsive testimony focus on (a) whether any or all of the repowering projects, as represented in the Company's Supplemental Testimonies, are likely to be lowest reasonable cost resources, (b) the short-term and long-term impacts on Utah ratepayers, and (c) the resulting economic risks to Utah ratepayers. This response testimony follows the structure of my direct and surrebuttal testimony.

The Company's supplemental direct testimony contains updated economic analysis reflecting the new federal tax law and other updated information, as well as updated project information. This responsive testimony provides my evaluation of the Company's updated project proposal.

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In particular, my response testimony addresses the following issues:

- For each of the projects, does the Company's analysis demonstrate that repowering will deliver cost-effective energy to Utah ratepayers?
- Is the Company's modeling analysis sound, and does it provide an accurate representation of the economic benefits of each of the 12 projects to Utah ratepayers?
- Does the Company's analysis of the repowering projects reasonably consider all of the uncertainties that have bearing on the risk to Utah ratepayers that the projects may not deliver cost-effective energy?

II. Summary of Conclusions

Q. Please summarize your conclusions and recommendations regarding the issues addressed in your testimony.

A. Based upon my review, I offer the following conclusions:

- The Company has proposed several additional changes to the repowering projects, including changes in turbines, project costs, and energy production estimates.
- The Company's economic analysis has a number of problems that make the results unreliable and leave considerable uncertainty on the actual value that the repowering projects could provide to ratepayers. As a result, the Company has not demonstrated that its repowering proposal provides a high likelihood of net benefits to customers.

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- The economics vary considerably between the twelve sites and by subsets of wind turbine generators (WTGs) within each site.
- The Company has taken a number of steps to mitigate risks of project development; however, the Company continues to require that ratepayers bear a number of significant economic risks and uncertainties.
- With the uncertainty in the reliability of the Company's economic analysis and the nature of the risks that the ratepayers are being asked to bear, the Company's repowering proposal should be rejected.
- Based on my review of the project-by-project costs and economics, there is potential that a downsized repowering program focused on the best sites and on the turbines within those sites that require new gearbox equipment may offer a higher likelihood of significant ratepayer benefits. The avoided capital costs associated with the gearbox replacements make the economics of those turbines materially better.

Based upon these conclusions, I find that:

- At least six of the twelve repowering project sites should be eliminated from further consideration. The Goodnoe Hills, Marengo 2, Rolling Hills, McFadden Ridge, High Plains, and Leaning Juniper are the most economically challenged sites. The projects represent nearly half of the total cost of the repowering program proposed by the Company.

- The Seven Mile Hill I and II, Glenrock I and III, Dunlop Ranch, and Marengo I demonstrate better economics and may merit further consideration by the Company.
- The Company should consider developing a revised evaluation of the best sites, specifically evaluating the economics of the turbines that require new gearbox equipment and eliminating turbines that do not have that issue. The Company may wish to consider proceeding with a smaller subset of the projects, though the Commission should not approve any alternative configuration based on the record before it. The Company could decide to proceed with a modified proposal in another preapproval application.

III. The Company's Supplemental Filing Has Not Demonstrated Lowest Reasonable Cost Energy Benefits

A. Changes in the Repowering Projects

Q. Please briefly describe the changes in RMP's proposal for the wind repowering projects contained in its February 1, 2018 Supplemental Testimony, as compared to its October 19, 2017 Rebuttal Testimony.

A. The Company has described a number of changes affecting some of the twelve projects relative to the projects presented in the October 19, 2017 Rebuttal Filing. The changes include:

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1) The WTG to be used at the Leaning Juniper project had to be changed, resulting in a reduction in the estimated incremental energy production and lower turbine costs;[1]
2) The costs of Leaning Juniper and Goodnoe Hills have increased to allow for retrofits to strengthen the foundations at those sites;[2]
3) The incremental energy production estimates for Glenrock I and III and Rolling Hills have been revised, resulting in a reduction in the energy output;[3]
4) The incremental energy production estimates for Marengo I and II have increased based on the Company's expectations that the interconnection agreement can be revised to deliver full output;[4]
5) The costs for Marengo I and II are higher to include the cost of the transmission upgrades necessary to deliver full output;[5] and
6) The projects with changed energy production include adjustments in land lease costs associated with the portion of those costs that are tied to production.[6]

The Seven Mile Hill I and II, High Plains, McFadden Ridge, and Dunlap I projects are unchanged from the October 2017 Rebuttal Testimony.

1 Supplemental Direct Testimony of Timothy J. Hemstreet, lines 52 and 68-71.
2 Id., lines 122-132.
3 Id., lines 72-87.
4 Id., lines 90-96.
5 Id., lines 105-108.
6 Id., lines 46-49.

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Q. How do these changes affect the power output increases from repowering these facilities?

A. In the aggregate, the Company's estimated increase in energy production from all twelve sites when repowered is slightly less than reported in October 2017. The average energy production increase is now estimated to be 25.7 percent rather than the 25.9 percent previously reported.[7] However, the changes are not uniform. Marengo I and II production estimates have increased, and there are offsetting reductions at Leaning Juniper, Glenrock I and III, and Rolling Hills. The remainder of the sites are unchanged.[8]

Q. How do these changes affect the Company's estimates of the costs to repower these facilities?

A. The Company has increased its estimate of the cost to repower these facilities by $17.6 million or 1.6 percent.[9] However, as with the production changes, the costs are not uniform across the twelve sites. The cost increases are specific to the Marengo I and II transmission costs and the Leaning Juniper and Goodnoe Hills foundation retrofits. The costs for the other eight sites are essentially unchanged.[10]

[7] Id., lines 100-102.
[8] Id., lines 88-96 and Confidential Exhibit RMP (TJH-1SD).
[9] Id., lines 147-149.
[10] Id., lines 140-144 and Confidential Exhibit RMP (TJH-1SD).

B. The Company's Updated Economic Analysis Shows Benefits Have Declined

Q. Has the Company provided new economic analysis of the benefits of the repowering projects?

A. Yes, it has. The Company's updated analysis estimates that the net customer benefits of the combined projects for the nine price-policy scenarios in the Company's 30-year analysis[11] range from $127 million to $446 million.[12] These values are lower than the $360 million to $635 million range offered in the Company's rebuttal testimony. As was the case in the rebuttal analysis, these updated, lower values contain considerable uncertainties that pose risks that ratepayers may or may not realize these estimated benefits.

Q. What is the Company's position on the economic value of these projects to ratepayers?

A. Mr. Link concludes that his analysis of the bundled projects shows significant net benefits in all of the scenarios that he analyzed.[13] Ms. Crane concludes that the overall economics of the repowering projects are favorable in all price-policy scenarios and that analysis demonstrates a high likelihood that the repowering projects will provide significant benefits to ratepayers.[14]

[11] Note that the analysis extends to 2050 in order to capture the full 30-year depreciable life of all of the repowered projects. Therefore, the analysis extends from 2017-2050, a period of 34 years. In this testimony I will refer to this as the "30-year" analysis.
[12] Supplemental Direct Testimony of Rick T. Link, lines 16-18, line 387 and Table 6-SD.
[13] Id., lines 494-502.
[14] Supplemental Direct Testimony of Cindy A. Crane, lines 37-39.

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Q. Do you agree with the Company's position?

A. No, particularly as it pertains to the entirety of the repowering projects included in the Company's proposal.

First, due to the fact that the Company's estimate of the benefits of the entire package of repowering projects has declined from the analysis it presented in the Rebuttal Testimony, the cost/benefit margins are not sufficient to assure a high likelihood of benefits to ratepayers, even if you assume the Company's estimates are reasonable. In the Low Gas, Zero CO_2 scenario, the Company's analysis shows the $1.1 billion investment offers ratepayers (all jurisdictions) $127 million in net benefits. This value is much less than the return on investment that the Company is seeking, with ratepayers receiving lower estimated benefits while continuing to bear many important risks.

Second, the Company's analyses of the benefits continues to have issues that call their results into question and tend to overstate the benefits to ratepayers.

Third, the Company's project-by-project analysis shows a wide range of benefits among the twelve projects, and even among subsets of WTGs within some projects. The aggregate benefits of the entire set of repowering projects, and specifically the ratio of benefits to costs, would be improved if the scale of the repowering program were reduced to target the most cost-effective repowering investments.

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C. The Company's Economic Benefits Approach Remains Flawed

Q. Has the Company provided new economic analysis of the benefits of the repowering projects?

A. Yes, it has. Mr. Link has provided an updated analysis of the economics of the repowering projects, in the aggregate, using the nine price and policy case approach presented in his direct and rebuttal testimony, including both the 20-year results from the SO and PaR models[15] and the 30-year life-of-projects revenue requirements results derived by extrapolating the 20-year model results.[16] Mr. Link indicates that he has updated these analyses to include more current information on the cost and performance of the repowering projects, as well as updated price-policy scenario assumptions, and updated assumptions reflecting the new federal tax law.[17]

Mr. Link also provided updated project-by-project analysis for each of the twelve wind farms included in the Company's repowering proposal. In these analyses, Mr. Link used the same updated information for two price-policy scenarios (Low Gas, Zero CO_2 and the Medium Gas, Medium CO_2)[18] to conduct the 20-year[19] and the extrapolated 30-year[20] economic analysis.

[15] Supplemental Direct Testimony of Rick T. Link, line 338 and Table 5-SD.
[16] Id., line 387 and Table 6-SD.
[17] Id., lines 39-42.
[18] Id., lines 224-226.
[19] Id., lines 239 and Table 1-SD; line 251 and Table 2-SD.
[20] Id., lines 263 and Table 3-SD.

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In addition, he provides additional sensitivity tests, including:

- An alternative 30-year extrapolation method for one price-policy case (Medium Gas, Medium CO_2) applied to the combined set of repowering projects;[21]
- A sensitivity combining the Company's proposed Wind and Transmission Projects for two price-policy scenarios (Low Gas, Zero CO_2 and the Medium Gas, Medium CO_2), presenting results from the 20-year model for the combined set of repowering projects.[22]

Q. Do you have any concerns with the Company's methodology of evaluating the economic benefits of the repowering projects?

A. Yes, I have several concerns with the Company's methodology. The methodologies used in the Supplemental Testimony for the economic analysis are the same methodologies used in the Company's Direct and Rebuttal filings.

The Company relies primarily on its modeling with the Planning and Risk (PaR) and System Optimizer (SO) software to evaluate the benefits of the repowering projects. I described several issues with this method in both my direct[23] and surrebuttal[24] testimonies. These issues have not been resolved, and I have identified additional concerns with the modeling methodology, which I will discuss later in this testimony.

[21] Id., lines 445-457 and Table 7-SD.
[22] Id., lines 472-478 and Table 8-SD.
[23] Direct Testimony of Daniel Peaco, lines 468-486 and 515-534.
[24] Surrebuttal Testimony of Daniel Peaco, lines 305-351.

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Q. Do you have any additional concerns specific to the Company's 20-year economic analysis methodology for the combined set of repowering projects?

A. Yes, I do. In addition to the PaR/SO modeling issues, which all apply to the 20-year analysis, I have a concern with the Company's treatment of PTC benefits.

The Company had originally incorporated the benefit of the PTCs on a levelized basis in the 20-year analyses. In the supplemental analysis, the Company applied the PTCs on a nominal basis. According to the Company, this approach "better reflects how the federal PTC benefits for the repowered assets will flow through to customers…"[25]

The effect of this change was a large increase in the 20-year benefits estimates. Table 1 compares the project-by-project 20-year benefits (PaR Stochastic Mean) using the nominal PTC treatment used in the Company's Supplemental Direct filing with the benefits if the Company had used the levelized PTC treatment from the original analysis. Given that the proposed assets are long-term investments, and the fact that the costs of the project are incorporated on a levelized basis, I believe it is more appropriate to use a levelized PTC benefit. The method used by the Company results in substantially higher benefits levels in the 20-year analysis than in the long-term analysis. This provides a distorted estimate of the project benefits.

[25] Supplemental Direct Testimony of Rick T. Link, lines 185-192.

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Table 1. Comparison of PTC nominal and levelized treatment, 20-year PaR PVRR(d)[26]

Wind Facility	Medium Gas, Medium CO_2		Low Gas, Zero CO_2	
	Nominal PTC benefit	Levelized PTC benefit	Nominal PTC benefit	Levelized PTC benefit
Glenrock 1	($21)	[redacted]	($21)	[redacted]
Glenrock 3	($7)	[redacted]	($6)	[redacted]
Seven Mile Hill 1	($28)	[redacted]	($28)	[redacted]
Seven Mile Hill 2	($7)	[redacted]	($6)	[redacted]
High Plains	($13)	[redacted]	($9)	[redacted]
McFadden Ridge	($4)	[redacted]	($3)	[redacted]
Dunlap Ranch	($26)	[redacted]	($22)	[redacted]
Rolling Hills	($9)	[redacted]	($7)	[redacted]
Leaning Juniper	$0	[redacted]	$3	[redacted]
Marengo 1	($33)	[redacted]	($25)	[redacted]
Marengo 2	($14)	[redacted]	($10)	[redacted]
Goodnoe Hills	($18)	[redacted]	($15)	[redacted]
Total	($180)	[redacted]	($149)	[redacted]

The increase in 20-year benefits cited by the Company in the new analysis does not provide a reasonable estimate of the benefits of the repowering projects.

In addition to the distortion of the 20-year results, the change in treatment of PTCs in the SO model has the potential to bias the SO results. All other options are included on a levelized cost basis, a technique used to compare options with different timing and asset lives.

[26] Confidential Attachment to RMP's Response to Data Request UAE 9.2.

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Q. Do you have any additional concerns specific to the Company's 30-year economic analysis for the combined set of repowering projects?

A. Yes, I do. In my prior testimony in this docket, I have described several issues with the extrapolation method used by the Company for the period from 2037-2050, after the end of the modeling analysis conducted with the PaR and SO models.[27] Since filing its supplemental direct testimony, the Company has clarified that it cannot use its PaR and SO models to evaluate the entire study period, in part, because simulation times were "excessive and prohibitive."[28]

The Company has continued to use the same extrapolation methods in its supplemental analysis, and therefore my initial concerns still stand. These concerns pertain to the fact that the repowering projects have a very unique characteristic, offering small incremental energy in the first twenty years of project life and then 10 years of added production in years 21 to 30. The SO model runs only through year 17 of the repowering project life, meaning the extrapolation period is very different from the first 17 years. Further, SO does not model these very small changes well, a feature that is evident in the differing results for similar projects in the Company's project-by-project analysis (e.g., see Table 2).

The Company did provide an alternative extrapolation methodology for assessing the benefits of the repowering projects between 2037 and 2050, but that method has flaws as well.

[27] See Surrebuttal Testimony of Daniel Peaco, lines 305-351.
[28] RMP's Response to Data Request DPU 32.2.

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Q. What are the flaws you have identified with the alternative 30-year extrapolation methodology offered by the Company?

A. The alternative methodology is presented in the Supplemental Direct Testimony of Rick T. Link.[29] In this method, instead of extrapolating the benefits of the bundle of 12 repowering projects as they were determined by the PaR and SO models, the Company instead used a market price for energy to value the incremental wind generation. The Company used the Palo Verde (PV) pricing location, and used the Medium Gas, Medium CO_2 price forecast. Acknowledging the uncertainty of market prices that far in the future, the Company evaluated three scenarios, with the incremental wind energy priced at 100% of the PV forecast, as well as 70% and 130% of the PV forecast.

This approach does have one benefit over the primary method used by the Company to extrapolate the benefits as calculated in the PaR and SO models, which is that it assigns a consistent value to all megawatt-hours of wind generated by the projects, and there are no large project-by-project discrepancies. This provides a better method for comparing the benefits of projects in that period from 2037-2050.

However, there are some issues with the method as presented by the Company. First, as noted above, the Company used only the Palo Verde price for the bundle of all repowering projects. While Palo Verde is a major trading hub, it is located in Arizona.

[29] Supplemental Direct Testimony of Rick T. Link, lines 436-462.

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This pricing location may not be appropriate for all repowering projects, particularly those in Oregon and Washington.

More importantly, this method relies on the Company using a reasonable market price forecast, and I have concerns with the price forecasts provided by the Company.

Q. Please explain your concerns with the Company's market price forecasts.

A. To evaluate the reasonableness of the Company's market price forecasts, I used the forecasts of energy prices at Palo Verde and the associated forecasts for natural gas prices at the Henry Hub to calculate the implied market heat rate (MHR).[30] The MHR provides a way to compare the Palo Verde prices to the Company's natural gas price forecasts. I calculated the MHR using both the Medium Gas, Medium CO_2 price forecast (which the Company used for the alternative extrapolation method) and the Low Gas, Zero CO_2 forecast. The results are provided in the figure below.

[30] Market Heat Rate is a commonly-used metric to determine system efficiency. It is calculated as energy price ($/MWh) divided by gas price ($/MMBtu) to yield MHR in MMBtu/MWh.

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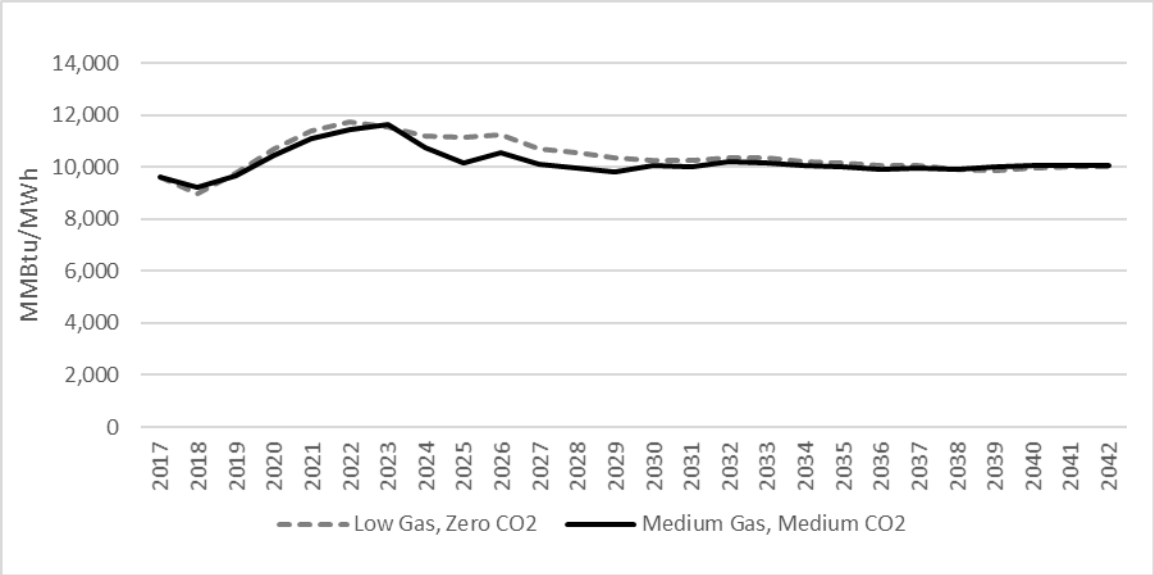

Figure 1. Implied Market Heat Rate

These results show that the Company's market price assumptions yield an unreasonably high MHR. For example, in 2022, the MHR in the Medium Gas, Medium CO_2 scenario is 11,445 MMBtu/MWh. This result means that, on an annual average, a natural gas fired unit with an 11,445 heat rate would be the marginal unit in the market. This is highly unlikely, as an average new combined cycle unit should have a heat rate of less than 7,500 and an average peaking plant should have a heat rate near 10,000. Therefore, a MHR of 11,455 MMBtu/MWh is significantly higher than the cost to produce power from natural gas-fired plants, demonstrating that the Company's Palo Verde prices are too high and not consistent with its natural gas price forecasts. A more typical benchmark annual MHR would be between 8,000 and 9,000, not the much higher value contained in the forecast that the Company has used.

Q. What is your conclusion regarding the Company's economic analysis methodology?

A. The Company's primary and alternative methodologies each are challenged to provide reasonable economic analysis of the unique characteristics of the incremental production offered by the repowered projects. Neither method provides a sufficiently sound and transparent evaluation of the projects to give confidence in the results. As a result, I cannot conclude that either method is a proper basis to make judgments as to whether any or all of the projects have a high likelihood of customer benefits. There remains significant risk that the actual economic value to ratepayers will be significantly different than the results in the Company's analyses.

D. The Company's Project-by-Project Economic Benefits Results

Q. Is a project-by-project analysis important to the evaluation of the Company's wind repowering proposal?

A. Yes. The importance of this analysis has been established in my testimony in this proceeding and by others due to the distinct variations in project characteristics among the twelve sites in the proposal. It is also important to consider the variation in project characteristics for individual WTGs at each site in many of the twelve sites.

Q. Does the Company's analysis of the project-by-project benefits of the repowering projects show material variation of value?

A. Yes. As I noted earlier, the Company provided an analysis of the benefits of each of the twelve projects using two price-policy scenarios, the Medium Gas, Medium CO_2 and the Low Gas, Zero CO_2 scenarios. I have reproduced the Company's project-by-project

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benefits resulting from that analysis under the Low Gas, Zero CO_2 scenario and calculated the ratio of the gross benefits to costs in the Table 2. The metric is calculated as the ratio of each project's gross benefits (benefits determined by the Company's PaR/SO modeling plus the PTC benefits) divided by the NPV of the nominal annual costs for each project (including [redacted]). The results show significant variation in the relative value of the projects.

On the high end, the Seven Mile Hill I and II and the Glenrock I projects have benefit/cost ratios of [redacted] or higher in the Company's results. These projects contribute [redacted] of the total estimated benefits under this scenario, and represent [redacted] of total capital costs. On the low end, Marengo II, McFadden Ridge, High Plains, Rolling Hills, and Leaning Juniper have benefit/cost ratios of [redacted] or less. These five projects on the low end of the benefit/cost spectrum represent nearly [redacted] of the total repowering project cost and only [redacted] of the Company's estimated benefits in the Low Gas, Zero CO_2 scenario. Leaning Juniper is the lowest ranking project, representing over [redacted] of the project cost and contributing no net value to the Company's estimated benefits in the Low Gas/No CO_2 scenario.

These values show the potential to increase the likelihood of ratepayer benefits by reducing the number of projects, prioritizing those projects with the highest value.

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Project	Net Cost/(Benefit)	B/C Ratio
Seven Mile Hill 1	($40)	[redacted]
Glenrock 1	($33)	[redacted]
Seven Mile Hill 2	($6)	[redacted]
Goodnoe Hills	($19)	[redacted]
Glenrock 3	($6)	[redacted]
Dunlap Ranch	($23)	[redacted]
Marengo 1	($22)	[redacted]
Marengo 2	($7)	[redacted]
Rolling Hills	($5)	[redacted]
McFadden Ridge	($2)	[redacted]
High Plains	($6)	[redacted]
Leaning Juniper	$0	[redacted]

Table 2. Project-by-Project Net Benefits and Benefit Cost Ratios: Low Gas, Zero CO_2 Scenario

Q. Do you have any concerns with the Company's estimates of benefits summarized in the table above?

A. Yes, I have several concerns and will describe two in particular.

First, as noted above, the PaR/SO methodology used by the Company is not appropriate for assessing the impact of projects of this size, and the models can provide some unreasonable results. I will describe this concern by evaluating one specific component of the PaR/SO benefits methodology, Energy Not Served.

Second, while the Company has provided project-by-project estimates, this analysis does not recognize that within projects, repowering some turbines may provide more benefits

than others. This is particularly true of projects with known issues, such as defective gearboxes or higher-than-usual blade replacement rates.

Q. Please describe your concerns with the PaR/SO methodology related to Energy Not Served.

A. I have evaluated the individual components of the benefits determined by the Company using the PaR/SO methodology on a project-by-project basis. In this evaluation, I have determined that the modeling methodology produces some anomalous results for certain components of repowering project benefits. A particularly stark example of this is the "PaR Mean Deficiency" benefits component.

Q. Please describe the "PaR Mean Deficiency" component.

A. The PaR Mean Deficiency component is comprised of two sub-components: Energy Not Served (ENS) and Reserve Deficiency.[31] The repowering project benefits are calculated as the reduction in costs associated with these elements after the repowering of the project.

ENS reflects the cost of unserved load resulting from the model run. If the resource optimization model is not able to serve all load with the available resources, it may choose to leave some load unserved at a large penalty ($1,000/MWh) rather than choose to make a large investment to build a new resource. This cost is not passed on to customers, but rather represents a reliability metric used for assessing the performance of the system as modeled.[32]

[31] RMP's Response to Data Request DPU 29.2(c).
[32] RMP's Response to Data Request DPU 31.2.

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Q. What is the effect of Company's inclusion of the ENS component?

A. In the Low Gas, Zero CO2 price-policy scenario, the impact of including the ENS component is [redacted] for certain projects. The table below summarizes the value of this component in the long-term nominal revenue requirement analysis for each project.

Table 3. Project-by-project ENS benefit

Wind Facility	Energy-Not-Served Benefit	Total Net Benefits	ENS % of Net Benefits
Glenrock 1	[redacted]	($33)	[redacted]
Glenrock 3	[redacted]	($6)	[redacted]
Seven Mile Hill 1	[redacted]	($40)	[redacted]
Seven Mile Hill 2	[redacted]	($6)	[redacted]
High Plains	[redacted]	($6)	[redacted]
McFadden Ridge	[redacted]	($2)	[redacted]
Dunlap Ranch	[redacted]	($23)	[redacted]
Rolling Hills	[redacted]	($5)	[redacted]
Leaning Juniper	[redacted]	$0	[redacted]
Marengo 1	[redacted]	($22)	[redacted]
Marengo 2	[redacted]	($7)	[redacted]
Goodnoe Hills	[redacted]	($19)	[redacted]

Q. Please explain your concerns regarding these results.

A. I have two primary concerns after reviewing these results. First, this benefit, which is essentially an artifact of the model methodology and not an economic benefit that will actually accrue to ratepayers, represents [redacted] of several of the repowering projects in the Low Gas, Zero CO_2 price-policy scenario.

Second, I note that the model results do not appear to be consistent. For example, [redacted]

[redacted]

[redacted]

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[redacted]. These projects should impact ENS in a similar way, [redacted].

Q. Has the Company provided evidence explaining the differences in impact across different repowering projects?

A. No, it has not.[33]

Q. What do you conclude from your evaluation of this issue?

A. This example shows that the PaR/SO modeling methodology used by the Company to calculate the benefits of the repowering projects does not produce consistent and reliable results. In the case of the ENS value, [redacted]

This evaluation has further decreased my confidence in the Company's use of the PaR and SO models to calculate project benefits.

Q. Have you done any analysis to test the economics of the repowering projects in light of the problems with the Company's analyses?

A. Yes, I have. I have calculated a set of benefit-cost metrics for each of the repowering projects using different estimates of energy benefits. The benefit-cost metrics are summarized in Table 4.

[33] RMP's Response to Data Request DPU 31.2(b). See also RMP's Response to Data Request DPU 29.5(b).

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The first pair of benefit-cost metrics columns use the project-by-project benefits as calculated by the Company using the PaR and SO model results, and the standard extrapolation method. For these calculations, the benefits numerator equals the NPV of the system benefits plus the NPV of the PTC benefits. The cost denominator equals the NPV of the three cost components included in the Company's workpapers ([redacted]). I have calculated this ratio using the Medium Gas, Medium CO_2 (MM) and the Low Gas, Zero CO_2 (LN) scenarios.

The second pair of benefit-cost ratio columns does not use the benefits calculated with the Company's PaR and SO model, but rather calculates the benefits of the projects using the Palo Verde price strips. Instead of only using these price strips for the end of the study period (2037-2050), I used this market price approach for the entire study period in order to avoid the issues related to the PaR/SO modeling I previously critiqued. Thus, the benefits are calculated as the annual incremental wind energy in the repowering case, multiplied by the annual flat PV price forecast. The denominator is the same as above.

The last pair of benefit-cost ratio columns uses the methodology just described, but applies a 30% discount to the PV price forecast, following the "70% PV" analysis conducted by Mr. Link. I included these ratios based on my prior analysis indicating that the PV price forecasts are likely overstated.

Within each column, the colors indicate the highest ratios (green) to lowest ratios (red). The table is sorted by the "B/C Ratio LN Benefits - PaR/SO" column.

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Table 4. Project-by-project benefit/cost comparison

Project	Capital Cost ($M)	Benefits from PaR/SO		Benefits valuing energy on Palo Verde prices 2018-2050			
		B/C Ratio MM Benefits - PaR/SO	B/C Ratio LN Benefits - PaR/SO	B/C Ratio MM Benefits - 100% PV	B/C Ratio LN Benefits - 100% PV	B/C Ratio MM Benefits - 70% PV	B/C Ratio LN Benefits - 70% PV
Seven Mile Hill 1	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Glenrock 1	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Seven Mile Hill 2	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Goodnoe Hills	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Glenrock 3	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Dunlap Ranch	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Marengo 1	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Marengo 2	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Rolling Hills	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
McFadden Ridge	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
High Plains	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Leaning Juniper	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Table 5 includes the same data, resorted by the "B/C Ratio LN Benefits - 70% PV" column.

Table 5. Project-by-project benefit/cost comparison (sorted)

Project	Capital Cost ($M)	Benefits from PaR/SO		Benefits valuing energy on Palo Verde prices 2018-2050			
		B/C Ratio MM Benefits - PaR/SO	B/C Ratio LN Benefits - PaR/SO	B/C Ratio MM Benefits - 100% PV	B/C Ratio LN Benefits - 100% PV	B/C Ratio MM Benefits - 70% PV	B/C Ratio LN Benefits - 70% PV
Seven Mile Hill 2	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Seven Mile Hill 1	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Glenrock 1	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Glenrock 3	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Dunlap Ranch	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Marengo 1	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Marengo 2	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Rolling Hills	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Goodnoe Hills	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
McFadden Ridge	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
High Plains	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Leaning Juniper	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

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The results presented in these tables demonstrate several major points.

First, they show that there is a wide range of benefit-cost ratios for each project, and that some projects have a much higher margin than others.

Second, it demonstrates that the method used to determine benefits has an impact on the relative benefit-cost ratios, as well as the rank ordering of the projects. This illustrates the problems with SO that I discussed earlier.

Finally, it shows that even under one lower energy benefits scenario, several of the projects exhibit positive benefits-cost ratios with some margin. Of course, actual conditions encountered by the projects, if constructed, will differ from any forecast so uncertainty will remain even with regard to those projects.

Q. Please explain your second concern, regarding the potential differentiation of the benefits of repowering turbines within an individual project.

A. In my surrebuttal testimony, I raised a related concern that the Company's economic analysis incorporated a large amount of speculative avoided capital expenditures.[34] These avoided capital expenditures act as an offset to the project costs and have a significant impact on the overall economics of the projects. The concern I expressed in my surrebuttal testimony is that these avoided capital expenditures are based on assumptions of failure rates. If, in the status quo case, the facilities do not fail at the rate assumed by the Company, these avoided capital expenditures would be overstated, and therefore the repowering economics would not be as favorable.

[34] Surrebuttal Testimony of Daniel Peaco, lines 547-564.

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Q. Did the Company provide a response to your concerns in its supplemental direct testimony?

A. No, it did not.

Q. Do you have any additional concerns regarding these avoided capital expenditures?

A. Yes, I do. Since filing my surrebuttal testimony in November, I have conducted additional investigation and analysis into this issue.

The Direct Testimony of Mr. Timothy Hemstreet discussed known issues with higher than expected failure rates for gearboxes and turbine blades at certain wind projects.[35] Mr. Hemstreet explains that certain models of gearboxes have experienced high failure rates and are requiring a higher rate of capital expenditure to replace the faulty turbines. As those gearboxes have failed, they have been replaced with alternative models that do not have the same known defect. In addition, the Goodnoe Hills project has required much more frequent blade replacements than most projects. His testimony notes that the repowering will resolve these known issues and lead to a reduction in ongoing capital expenditures. He notes that "[g]iven these ongoing gearbox and blade failure costs, repowering is particularly attractive because repowering avoids significant forecast capital expenditures to maintain turbine production."[36]

Based on this testimony, I suspect that within each project, there is likely to be a substantial difference in the benefits derived from avoided capital cost for the defective turbines that are assumed to require replacement, as compared to the turbines that have

[35] Direct Testimony of Timothy J. Hemstreet, lines 326-387.
[36] Id. at 368-370.

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already been repaired. This difference could have a meaningful impact in the benefit/cost ratio of repowering each WTG depending on the status of its repairs.

Q. Has the Company provided any information or analysis separately evaluating the economic benefits of repowering only the turbines that are likely to require replacement?

A. No, it has not.

Q. Please describe the analysis you conducted to evaluate this issue.

A. In the Company's long-term nominal revenue requirements analysis, project costs are summarized as three components: [redacted].[37] The [redacted] component in the work papers includes several other sub-components:[38]

[redacted]

[37] See confidential workpapers [redacted] provided in support of the Supplemental Direct Testimony of Rick T. Link.

[38] See, e.g., confidential workpapers [redacted].

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The [redacted] sub-component is further comprised of several components, including the [redacted] on individual cost components identified in the Company's workpapers as:[39]

[redacted]

The [redacted] item is the primary focus of my analysis. This component includes [redacted]

Using the Company's work papers, I was able to isolate the costs and avoided costs of the defective and non-defective turbines separately, in order to develop an approximation of the net benefits of the repowering of these subsets of turbines.

Q. Which projects did you evaluate in your analysis?

A. I selected two projects for this analysis: Seven Mile Hill 1 and Leaning Juniper. Both projects [redacted]. The Seven Mile Hill 1 project has [redacted] in my project-by-

[39] See, e.g., confidential workpapers [redacted].

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project analysis and the Leaning Juniper project [redacted].

As I previously discussed, the [redacted] item in the economic analysis is comprised of several components. First, I isolated the separate components of the [redacted] total for each project. Using the Company's workpaper supporting the capital expenditure estimates, I isolated these components for the repowering projects as a whole, and then separately for the impacted and non-impacted turbines. In most cases, the components of the [redacted] total were simply scaled based on the number of turbines in each category (impacted and non-impacted). However, certain categories were not allocated simply on number of turbines. The primary example is the [redacted] item, of which 100% was assigned to the impacted turbines.

The allocation of the components of the [redacted] component are summarized in the tables below.

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494 **Table 6. Seven Mile Hill 1 comparison of impacted and non-impacted gearbox WTGs**

	Project Total	Impacted Gearboxes	Non-Impacted Gearboxes
[redacted]			

495

496 **Table 7. Leaning Juniper comparison of impacted and non-impacted gearbox WTGs**

	Project Total	Impacted Gearboxes	Non-Impacted Gearboxes
[redacted]			

497

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As I previously mentioned, in addition to [redacted], the repowering project costs consist of [redacted] components. I have allocated those to the impacted and non-impacted groups based on turbine share.

Q. How did you calculate the benefits for the groups of impacted and non-impacted turbines?

A. I allocated the benefits of the repowering projects to the impacted and non-impacted categories based on the number of turbines in each group. For this analysis, I used the benefits estimate described above, utilizing the Low Gas, Zero CO_2 Palo Verde market price strip for the entire evaluation period. I also allocated PTC revenue based on the number of turbines.

Q. How do these modified costs and benefits impact the B/C ratios for the projects?

A. The results of my analysis for the Seven Mile Hill 1 and Leaning Juniper projects are presented in Table 8.

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Table 8. Benefit/Cost comparison of impacted and non-impacted gearboxes

	Seven Mile Hill 1			Leaning Juniper		
Project Costs	Project Total	Impacted Gearboxes	Non-Impacted Gearboxes	Project Total	Impacted Gearboxes	Non-Impacted Gearboxes
[redacted]						
[redacted]						
[redacted]						
[redacted]						
Total Project Cost						
Net Project Costs						
Project Gross Benefits **Based on Low Gas, Zero CO_2 Palo Verde Market Price*						
Project Net Cost/(Benefit)						
B/C Ratio **PTC value is included as benefit*						

These results show that [redacted]

[redacted].

Q. What do you conclude from this analysis?

A. This analysis demonstrates that [redacted] depending on whether the gearboxes associated with those turbines are expected to require replacement due to a known defect.

Given that the benefits of the repowering projects, as calculated by the Company, are subject to significant uncertainty, the Company should only consider repowering those turbines with the highest likelihood of delivering benefits to customers, if at all. The

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Company could evaluate the economics of turbines that include gearboxes with known defects to identify projects with the highest likely benefit/cost ratios.

Q. Given the concerns you have expressed here, do you agree with the Company that its project-by-project analysis demonstrates a high likelihood of customer net benefits from each of the repowering projects?

A. No, I do not. While the Company's results as presented in its testimony show positive results in all nine price-policy scenarios for the projects in aggregate and for each individual project for one scenario, there are a number of problems with this analysis, including:

- Methodology issues with these new results, including issues that I discussed in my direct and rebuttal testimony that persist in this analysis;
- The Company's results verify that there are distinct differences in the economics by project and by turbine. Many of projects and turbines included in the repowering proposal do not have potential to deliver high likelihood of benefits.
- The methodological issues leave the actual economic value of the repowering projects as a significant risk to ratepayers.

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IV. The Company's Analysis Does Not Reasonably Address Risk

Q. Please describe your remaining concerns regarding the treatment of risk in the Company's analysis.

A. In my direct and surrebuttal testimonies in this proceeding I raised a number of issues pertaining to the uncertainties and risks in the repowering projects that the Company is asking ratepayers to bear. The primary issues are:

- Economic Benefits Risk
- PTC Qualification Risk
- Project Cost Risk
- Avoided Cost Risk
- Energy Production Risk
- Project Life Risk
- Federal Tax Law Risk

In rebuttal testimony, Company witness Ms. Crane made clear there are limits on the Company's willingness to assume risk in these projects. Despite her assertion that the Company has demonstrated "that it has recognized and reasonably managed all of the potential risks and concerns"[40] (emphasis added), she makes clear that the Company will not absorb risks beyond its control and is prepared to only accept risks associated with the Company's performance.[41] In her Supplemental Direct Testimony, Ms. Crane states

[40] Rebuttal Testimony of Cindy A. Crane, lines 15-16, emphasis added.
[41] Id. at lines 103-106.

that additional risks have been mitigated, but she does not offer any mechanisms for the Company to assume any risks previously left to ratepayers.

Q. How has the Company addressed your concerns regarding ratepayer risks in its Supplemental Direct Testimony?

A. The Federal Tax Law Risk has changed materially, the new tax law has been enacted and the Company has incorporated that in the economic analysis. The risk of federal legislation changing the economics remains, but the significant issue surrounding the change in Federal Tax law that existed last fall is now resolved and incorporated in the analysis.

Beyond that change, Ms. Crane indicates that the expected costs and benefits are more certain and the risks have decreased.[42] However, a number of important risks to customers remain in the proposal, even as amended in the Company's supplemental testimony.

Q. How has the Company responded to your concerns with respect to the risks associated with Economic Benefits?

A. The critique of the Company's economic benefits analysis that I presented earlier in my testimony shows that there remains considerable uncertainty about the real value of the repowering projects to ratepayers and, with the changes, the overall economic margins in the Company's analysis have decreased. The economic opportunity that the Company proposes for ratepayers remains uncertain and at risk of not materializing.

[42] Supplemental Direct Testimony of Cindy A. Crane, lines 41-47.

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Q. Has the Company provided any additional information with respect to the risks associated with PTC Qualification?

A. Mr. Hemstreet offers some supplemental information regarding the changes made to position each WTG to meet the safe harbor provisions considering the changes in project costs that are presented in his testimony.[43]

However, the PTC qualification risks that remain are largely within the Company's control to manage, but, as in the prior testimony, the Company is not agreeing to assume any of the remaining risk.

Q. Please summarize the aspect of uncertainties in Project Costs that the Company addressed in its supplemental testimony.

A. Mr. Hemstreet offered updated cost estimates for the projects and provided information on the procurement process for the Vestas projects.[44] The costs did change somewhat and he indicates that the procurement process leading to construction contracts for the Vestas projects should be completed in March, so further information on that issue should be available soon.

The questions I raised in earlier testimony regarding the foundations has proven to be a factor in the updates now being presented. As engineering, design and procurement proceeds, some potential remains for further changes to the project costs.

[43] Supplemental Direct Testimony of Timothy J. Hemstreet, lines 160 – 174.
[44] Id., lines 191-207.

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Q. Please describe any issues with respect to Avoided Costs that remain a concern.

A. The Company did not address the concerns I raised regarding the Company's capital cost estimate as it applies to avoided capital expenditures, that is the avoided capital expenditures that would have been made on the existing projects if not repowered. The Company still has not addressed the uncertainties associated with the consideration of avoided capital expenditures. I have shown in the economic analysis section of this testimony that the assumed avoided costs are significant and are a primary component of the benefits that are proposed.

The concerns I raised in prior testimony remains a significant concern today.

Q. Please summarize the aspect of uncertainties in project production estimates that the Company addressed in its rebuttal.

A. In my direct testimony, I described the risks that customers would bear in the Company's proposal associated with the uncertainty and variability of energy production from the repowered facilities.

Mr. Hemstreet disagrees with my representation of the methodology used by the Company to develop the energy production values as presented in his Confidential Exhibit RMP(TJH-1R) and provides an explanation of the methodology used to develop those values. He asserts that my testimony does not consider the potential for the production to be higher than the values in his exhibit.[45]

[45] Rebuttal Testimony of Timothy Hemstreet, lines 484 – 542.

Q. Please describe any issues with respect to project Energy Production estimates that remain a concern.

A. Mr. Hemstreet offered a few updates to the energy production estimates for the repowering projects, including updating an analysis for three projects to include four years of historical data.[46] However, he does not address the concerns I raised regarding the uncertainty of production in the future relative to the four years of history. That issue remains a concern and a risk that would accrue to ratepayers.

Q. Please summarize the aspect of uncertainties in Project Life that the Company addressed in its rebuttal.

A. The Company provided no additional information on project life issues. The concern remains the same as addressed in my prior testimony.

VII. Conclusions and Recommendations

Q. Does the Company's analysis demonstrate that each of the 12 repowering projects will deliver cost-effective energy to Utah ratepayers?

A. No, it does not. The Company's analysis fails to demonstrate that the Company's repowering proposal offers a high likelihood of economic benefits to customers. Further, the Company's project-by-project analysis does show that some projects could be more beneficial than others. While the Company has not demonstrated that any of the 12 projects provide a high likelihood of economic benefits, it is clear that a smaller set of

[46] Id., lines 50 – 96 and Confidential Exhibit RMP (TJH-1SD).

projects might be defined to increase the potential for customer benefits by eliminating the projects with the poorest performance.

Q. Is the Company's modeling analysis of the repowering projects sound and does that analysis provide an accurate representation of the economic benefits of each of the 12 repowering projects?

A. No, it is not. As was the case in the Company's direct testimony, I have found that the Company's model analysis produces anomalous results and does not provide a reasonable basis for assuring high likelihood of benefits to ratepayers.

Q. Does the Company's analysis provide a reasonable representation of all of the uncertainties that have bearing on the risk to Utah ratepayers?

A. No, it does not. These risks include project cost uncertainty, project energy production estimate uncertainty, and assumptions regarding project life. While the Company asserts that it has demonstrated net benefits to customers over a wide range of scenarios, the analysis presented does not include any analysis of these factors for those price-policy scenarios that produce the least attractive benefit outcomes for customers.

Q. Are the repowering projects likely to be lowest reasonable cost resources?

A. While it is possible that some of the projects could be lowest reasonable cost resources, there is a significant probability that they are not, at least in the aggregate. Given the issues I have identified with the Company's modeling and the lack of consideration of several important risk factors, the Company has not adequately demonstrated that its proposed repowering projects will likely result in the acquisition, production, and

delivery of utility services at the least cost or at a lowest reasonable cost to the Company's retail customers.

Q. What are the short-term and long-term impacts to Utah ratepayers?

A. The Company's presentation on the projects relies on significant benefits in the first ten years resulting from PTC qualification and benefits in years 20 to 30 of project life associated with extending the life of the projects with new assets. The PTC benefits, if realized, would mitigate much of the cost in the first 10 years. However, the risks regarding PTC qualification and changes in corporate tax rates could materially alter that outlook. Conversely, much of the benefit in the Company's analysis is derived from years 20 to 30 of the projects, the life extension period. These benefits have been estimated using an extrapolation analysis that is problematic, relies on obtaining 30 years of life, and are only realized in the very long term. Furthermore, the inherent uncertainties of economic forecasts could significantly alter the conclusion.

Q. Based on your findings, what are your recommendations at this time?

A. I recommend that the Company's Application for the twelve repowering projects be denied. However, there is potential for a downsized repowering program to be considered by the Company. I recommend that the Company consider a revised program proposal that eliminates at least six of the least attractive sites and limits the repowering to those turbines that have the problematic gearbox equipment that is slated for replacement. As shown in my testimony, based on the Company's analysis, removing at least 6 of the 12 sites and eliminating the repowering of towers that have already had new gearbox

equipment replaced would deliver a higher probability of benefits at a substantially reduced cost to ratepayers.

Based on my economic analysis, the Seven Mile Hill I and II, Glenrock I and III, Dunlop Ranch, and Marengo I demonstrate better economics and merit further consideration. The Goodnoe Hills, Marengo 2, Rolling Hills, McFadden Ridge, High Plains, and Leaning Juniper are the most economically challenged sites and should be removed from further consideration. The Company could consider revising its repowering program to focus on the six best sites and, within those sites, the turbines that have the problematic gearbox equipment.

Even if the repowering program is reduced in size to target the best investment opportunities, the ratepayer risk issues will not be eliminated, only mitigated. If any of these projects are to be approved, the Company should be held accountable for meeting the PTC requirements and effectively managing the other risks that I have identified.

Q. Does this conclude your testimony?

A. Yes, it does.