Witness OCS- 1D

BEFORE THE PUBLIC SERVICE COMMISSION OF UTAH

In the Matter of Rocky Mountain	:	
Power's Voluntary Request for	:	
Approval of Resource Decision to	:	Docket No. 12-035-92
Construct Selective Catalytic	:	
Reduction Systems on	:	
Jim Bridger Units 3 and 4	:	

DIRECT TESTIMONY OF

RANDALL J. FALKENBERG

ON BEHALF OF THE

OFFICE OF CONSUMER SERVICES

REDACTED

NOVEMBER 30, 2012

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. Randall J. Falkenberg, PMB 362, 8343 Roswell Road, Sandy Springs, Georgia 30350.

Q. PLEASE STATE YOUR OCCUPATION, EMPLOYMENT, AND ON WHOSE BEHALF YOU ARE TESTIFYING.

A. I am a utility regulatory consultant and President of RFI Consulting, Inc. ("RFI"). I am appearing on behalf of the Office of Consumer Services ("OCS").

Q. WHAT CONSULTING SERVICES ARE PROVIDED BY RFI?

A. RFI provides consulting services related to electric utility system planning, energy cost recovery issues, and revenue requirements.

Q. PLEASE SUMMARIZE YOUR QUALIFICATIONS AND APPEARANCES.

A. My qualifications and appearances are provided in Exhibit OCS 1.1. I have participated in numerous cases involving PacifiCorp and Rocky Mountain Power (or the "Company") power costs, capacity acquisition and other issues over the past ten years.

Q. HAVE YOU PREVIOUSLY TESTIFIED IN CASES CONCERNING SIMILAR RESOURCE ISSUES?

A. Yes. I have testified in many cases concerning power plant expansion planning. I testified in the Certification proceedings concerning the Company's Currant Creek and Gadsby Combustion Turbine ("CT") power plants. I also testified concerning the economics of environmental upgrades v. gas conversion for the Naughton 3 coal-fired power plant in the Wyoming certification case (Docket No. 20000-400-EA-11). I recently testified in a Georgia Power case involving the decision to either retire or make environmental investments on some 2000 MW of coal-fired capacity and an Entergy Arkansas proceeding regarding the economics of reacquisition of coal and nuclear resources. Over the years I have also testified concerning generation planning issues in numerous other jurisdictions.

I. INTRODUCTION AND SUMMARY

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?

A. My testimony addresses the Company's voluntary request for approval to construct Selective Catalytic Reduction ("SCR") systems for Bridger Units 3 and 4.

Q. PLEASE SUMMARIZE YOUR FINDINGS AND RECOMMENDATIONS.

A. The Company's request cannot be approved by the Commission at this time due to a number of significant errors, unproven or inconsistent assumptions, and unexamined planning uncertainties that are embedded in the Company's filing. Below is a summary of my major findings.

1. The Company has justified the SCR investment for the Bridger Units 3 and 4 SCR on the basis of Exhibit RTL-3, the System Optimizer ("SO Model") studies. The Company originally reported a benefit of [redacted] million[1] compared to conversion of Bridger Units 3 and 4 to natural gas. However, I have identified a number of errors and problematic assumptions that call into question the Company's results.

2. PacifiCorp's implementation of the System Optimizer model lacks transparency because the SO Model is not available to regulators and intervening parties for review or verification and the reports developed from the model are very limited in detail and poorly organized. This makes error tracking very difficult and lowers confidence in the model results.

<u>Significant Errors</u>

3. There are a number of serious errors in the SO Model studies. The Company has understated the mine capital costs in the gas conversion case by $105 million PVRR (d).[2] The Company also incorrectly included SCR system costs of $16 million in the gas conversion case.[3] Combined these errors produce additional benefits due to the SCR project of almost $90 million PVRR(d).

4. The Company has overstated the capacity of the Wyodak plant in the SO Model study which causes the dispatch benefits of Bridger in the SCR (coal) case to be understated, though the Company has not quantified the impact.

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1 Present Value Requirements Difference ("PVRR (d)") between the SCR and gas conversion cases.

2 OCS 12.1

3 OCS 12.3

Unproven and Inconsistent Assumptions

5. The Company assumes that if Bridger Units 3 and 4 do not continue coal-fired operation, it will be necessary to stop surface mining operations and complete reclamation of the surface mine before 2030. This increases the cost of the gas conversion case by [redacted] million PVRR (d). While OCS has examined this issue in discovery, the Company has not adequately justified these assumptions.

6. The Company has updated the estimated cost for the Bridger SCR system, reducing the cost of the continued coal operation case by [redacted] million PVRR(d). The final SCR cost is unknown, and crucial to the economics of the continued coal operation case. The Commission should not grant approval for any more than the amount assumed by the Company in its filing, [redacted].

7. The SO Model studies present results from a December 2011 Official Forward Price Curve ("OFPC") along with low and high gas and power price forecasts developed around the same time. In the past eleven months the Company's OFPC has changed substantially, and the economics of the SCR decision portrayed by the Company in Exhibit RTL-3 have been substantially diminished. It is not reasonable for the Company to update the cost estimates for the SCR system, but fail to do so for other inputs, such as the forward price curve.

8. The Company acknowledges that the Bridger Units 3 and 4 outage rates used in the case of continued coal operation are lower than any values used in any general rate case since 2001. Further, the outage rates used for Bridger are far lower than recent actual results and the unit averages for the past 20 years. This overstates the benefits of continued coal operation.

9. There are no must run assumptions for Gadsby and Currant Creek in the SO Model, which is inconsistent with the Company's normal GRID model rate case assumptions. This enhances the benefit of continued coal operation.

10. The SO Model evaluation of the benefit of the SCR system under base case assumptions exceeds comparable results derived from the GRID model by [redacted] million PVRR (d). This is surprising given that the GRID inputs were "aligned" by the Company with the SO Model inputs and lowers confidence in the SO Model results.

Planning Uncertainties – Coal Fleet Strategy, Transmission, RPS Wind

11. The SO Model study fails to consider whether other coal plants may also be retired early or converted to natural gas in addition to or before Bridger Units 3 and 4. I present screening level results of an analysis that considers this issue and identify other coal resources that may be candidates for gas conversion. Conversion of these resources could significantly impact the SCR decision.

12. The Company has not examined whether transmission related investments may be deferred or avoided by alternatives to the Bridger SCR decision. Consequently, the Company has not demonstrated that installation of the Bridger SCR in conjunction with the currently planned Gateway transmission projects is the least cost alternative. Transmission system impacts should be studied in additional scenario analyses. Such studies should examine a combined cycle replacement for Bridger Units 3 and 4 located nearer to load centers, with transmission system impacts quantified.

13. In developing the SO Model 2016-2030 base plan, the Company assumes a 925 MW expansion of wind capacity in Wyoming is necessary to meet the existing RPS requirements in California, Oregon and Washington. The Company also includes an additional 250 MW of Wyoming wind capacity to meet *assumed* federal RPS requirements and 900 MW of incremental Wyoming wind capacity on policy and risk mitigation grounds. This aspect of the Company's expansion plan has adverse impacts on the Bridger SCR scenario. Alternative assumptions should be further explored with scenario analysis.

14. A proper analysis should also consider the <u>least cost</u> expansion plan compliant with existing law, in addition to scenarios that explore new CO_2 regulations, RPS requirements and changes in regulatory policy. This would be consistent with the Commission's order in Docket No. 07-035-94 requiring a zero CO_2 tax study to understand the cost of compliance associated with changes in environmental regulations. Consequently, the Company should produce studies which evaluate the impact of removing the incremental wind resources and those added to meet the assumed federal RPS from its SO Model studies and market price forecasts.

15. These wind related assumptions also appear to be linked to the Gateway transmission investments modeled by the Company, which may also impact the Bridger SCR decision. Assuming a continuation of situs allocation of the cost and energy of RPS resources, the Commission may wish to view the economic analyses of major investments such as the Bridger SCR (or the Gateway projects) without the RPS wind resources to obtain a more accurate view of their impact on the Utah jurisdiction.

Q. WHAT IS YOUR OVERALL RECOMMENDATION?

A. Due to the various problems and concerns I have identified, the Commission lacks the information necessary to reach a decision in this proceeding at this time.

II. ANALYSIS OF PACIFICORP'S SO MODEL BRIDGER COAL V. GAS STUDIES

Background

Q. DISCUSS THE CURRENT AND EXPECTED ENVIRONMENTAL REQUIREMENTS FOR BRIDGER UNITS 3 AND 4, AND HOW THEY WILL IMPACT THE COSTS AND PERFORMANCE OF THESE UNITS.

A. Best Available Retrofit Technology ("BART") compliance requires the installation of the SCR systems on Bridger Units 3 and 4, or the units must cease operation on January 1, 2016 and January 1, 2017 respectively. These systems will require a capital investment of $[redacted][4] reduce the capacity of these units by [redacted] MW and increase O&M expenses and capital additions costs over the remaining life of the plant.

Q. WHAT ARE THE OPTIONS AVAILABLE TO THE COMPANY WITH RESPECT TO BRIDGER UNITS 3 AND 4?

A. The Company could make the above-referenced environmental quality investments and incur whatever additional costs are required to comply with the currently pending and unknown future regulations, convert the units to gas-fired operation, or retire these units and replace them with purchased power or combined cycle generation at the Bridger location or elsewhere. The SO Model studies focused on the gas conversion option, which, appears to be the least cost if one accepts the Company's set of assumptions.

Q. WHAT IS THE PROPER METRIC FOR COMPARISON OF THESE ALTERNATIVES?

A. The primary metric for the decision process is the Present Value of Revenue Requirements ("PVRR") for each alternative. This measures the cost to customers over the planning horizon of each alternative. Normally one looks at the <u>difference</u> in PVRR [called PVRR (d)] between costs to ratepayers of each resource option. In this case, the planning horizon used by the Company is 2013-2030. This period is shorter than the remaining life of the

[4] Exhibit CAT-1.2.

Bridger units, but is consistent with the time horizon used in the Company's typical IRP modeling.[5] If economic considerations do not provide a clear-cut basis for making a decision, then certainly other factors could be taken into consideration.

Q. HOW DOES ONE ADDRESS THE VARIOUS UNCERTAINTIES DISCUSSED ABOVE IN THIS PROCESS?

A. One normally examines multiple scenarios reflecting the outcome of each decision process in the different possible futures projected. The Company has examined three gas price forecasts,[6] and three different CO_2 tax forecasts, to address the economic uncertainty. Ideally, one would compare the various alternatives (e.g. continued coal operation v. gas conversion) against the least cost expansion plan for the system under each set of assumptions. This can be important because evaluating alternatives assuming an uneconomic expansion plan can clearly bias the results.

Q. PLEASE EXPLAIN HOW THAT COULD HAPPEN.

A. Assume hypothetically that the Company's expansion plan included construction of unnecessary and/or uneconomic[7] coal-fired resources simply on the basis of a policy decision of the Company to include such resources in its expansion plan. In that case, some of the benefits of continued coal operation of Bridger Units 3 and 4 would be supplanted by the hypothetical coal plants in the expansion plan which might never actually be built. Consequently, it is important to have a realistic, economic expansion plan as the backdrop for evaluation of alternatives. This situation actually occurred in a case I was in, Georgia Power Docket 3498-U, in 1985. The Company has actually done the same thing in this case to some extent. By including additional, hypothetical wind

[5] This will be explained in more detail later. Combined Cycle plant alternatives will have a longer remaining life. However, this can be addressed by use of proper techniques to reflect the added value of longer lived resources in the context of this study.

[6] Each gas price scenario drives an alternative market power price forecast as well.

[7] Bear in mind this is merely hypothetical. I'm not suggesting that coal-fired resources are never economic.

resources in its underlying expansion plan, it will supplant low cost energy that might otherwise be provided by the Bridger units with incremental wind energy that may or may not actually be built. Ironically, this also serves as a detriment to development of actual wind projects by third party developers as the additional wind energy in the forecast tends to suppress avoided costs. This occurs because the extra wind generation included in the plan, displaces higher resources in the models used to determine avoided costs. In effect, the "hypothetical" wind resources are "crowding out" actual ones that might be developed.

Q. THE FUTURE IS LARGELY UNKNOWABLE. ARE THESE SORTS OF ECONOMIC STUDIES USEFUL IN THE DECISION PROCESS?

A. Yes. While computer models are not a "crystal ball" that allow one to make the "perfect" decision going forward, they can enable better decisions to be made. It is useful to evaluate a range of scenarios in order to determine those options that should be avoided as they could lead to the greatest harm under plausible assumptions. Avoiding a costly mistake may be much more important than selecting the most "perfect" plan. To be of value, however, scenario studies should be relevant, accurate and unbiased.

<u>The PacifiCorp System Optimizer Studies</u>

Q. WHAT STUDIES HAS THE COMPANY USED TO SUPPORT ITS REQUEST?

A. The Company provided several analyses in its filing. Exhibit RTL-3 provides seven comparisons of Bridger Units 3 and 4 versus the gas conversion alternative based on combined gas and CO_2 tax scenarios. In the same exhibit, the Company examines gas conversion of a single unit (either Bridger 3 or Bridger 4) based on the same economic assumptions. I concentrate on the two unit scenarios as they appear to be more significant and relevant. Some of my comments do apply to the single unit scenarios as well.

Confidential Table 1 below summarizes the results the Company obtained from its 2012-2030 scenarios. The Company studies were performed using the System Optimizer model, which combines production cost modeling and revenue requirements analysis. Results are shown for a number of gas/power price forecasts and CO_2 tax assumptions.

Q. DISCUSS THE GRID MODEL RESULT SHOWN ON CONFIDENTIAL TABLE 1.

A. The Company also provided a study prepared using the GRID model that parallels the assumptions of the SO Model base case (December OFPC) SCR v. gas conversion study. The Company did not discuss this study in its direct testimony, but did so in the parallel CPCN proceeding (Docket No. 20000-418-EA-12) now being processed in the Wyoming jurisdiction. It was requested by parties to the Naughton 3 CPCN proceeding in Wyoming (Docket No. 20000-400-EA-11) that the Company prepare a GRID study for comparison purposes in future CPCN cases. It appears that the GRID study provided was designed by the Company to address that request.

Redacted

Confidential Table 1

Q. DO THE GRID MODEL STUDY RESULTS RAISE ANY CONCERNS?

A. Yes. The SO Model result, as filed, produces a 40% higher benefit than the comparable GRID model study.[8] Given the much higher level of detail of the GRID model, I believe these results cast some doubt on the SO Model results. I have reviewed the GRID study for comparative purposes and conducted discovery related to it. I have some concerns regarding the GRID study and the Company has admitted to a number of errors in that study as well. Because the Company has focused on the SO Model in this proceeding, I limit my discussion of the GRID model assumptions and results except where there is an implication for the SO Model studies.

Q. WHAT ARE YOUR GENERAL COMMENTS REGARDING THE SO MODEL?

A. The SO Model is probably most appropriate in the context of an Integrated Resource Plan ("IRP"), where the <u>overall direction</u> of the Company's expansion planning is examined. Use of the SO Model requires training and entails paying a substantial license fee. As a result, it may be impractical for regulators and other stakeholders to use the model in cases with a short turn-around time such as this. Further, the reporting information (at least as provided by the Company) is rather limited or exists in a rather "user-unfriendly" format,[9] making third-party analysis and verification of the final results difficult. In addition, the SO Model has limited modeling capabilities relative to other models such as GRID or PaR. This includes less detailed unit representation, and less detailed load and market price modeling. The SO also lacks realistic reserve modeling and unit scheduling capabilities. Despite the simplifications inherent in the SO Modeling capabilities it takes a very long

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[8] The Company has acknowledged certain errors which impact both the GRID and SO Model studies, and which would impact the percentage reported. However, lacking a complete set of corrections to the issues I raise, I limit the discussion here to the SO Model results as filed by the Company.

[9] In OCS 1.63a number of reports were requested. Instead of providing useful output reports only raw data was provided. As this response was highly voluminous and confidential I don't provide it as an exhibit.

time (24 hours or more) to run. In the end, the SO Model should be regarded by the Commission as opaque and unproven, at least as implemented in this case by the Company.[10]

Q. WHY THEN DOES THE COMPANY USE THE SO MODEL? WHAT IS THE ADVANTAGE ONE HOPES TO GAIN FROM USE OF THE SO MODEL?

A. The primary advantage of the SO Model is that it enables processing of a large number of scenarios and resource options and that it develops an "optimal" expansion plan for each set of economic conditions and technology choices. In theory this should enable one to avoid the problem I discussed earlier, where a suboptimal expansion plan can adversely impact one of the alternatives examined in a study. This may be important when the underlying economic assumptions or technology choices show wide variations.

Q. DOES THAT ADVANTAGE APPEAR TO HAVE BEEN A CRITICAL FACTOR IN THIS INSTANCE?

A. No. The actual expansion plans used in the SO Model between the coal and gas conversion cases changed little, suggesting that the additional run times required to re-optimize the system expansion plan had little practical impact. Another important point is that based on the Company's input assumptions, the capital cost differences between combined cycle plants (with duct firing capability) and combustion turbines is minimal. Due to the lower operating costs of combined cycle plants, the model seems to nearly always select combined cycle resources. This makes the optimization element of the problem relatively unimportant for this application, at least.

Further, certain resources are fixed in the SO Model expansion plans on policy rather than economic grounds, which, again, tends to moot the optimization problem and at

[10] If applied to its intended purposes, with correct data and properly used the SO Model may provide useful information.

the same time may compromise the results, as discussed above. Consequently, the value of the SO Model for a proceeding such as this is rather questionable. A more straightforward approach would be to use a relatively fixed expansion plan as the backdrop for evaluation of generation alternatives, rather than a complete re-optimization for each economic scenario. This would allow more detailed models to be applied, and perhaps presentation of a wider range of useful scenarios. Effectively, this is what the Company did with the GRID model, but only for one scenario.

Q. PLEASE CONTINUE WITH YOUR OBSERVATIONS REGARDING THE SO MODEL STUDIES (EXHIBIT RTL-3) PERFORMED BY THE COMPANY.

A. The SO Model studies contain a number of serious errors and inconsistent assumption and the model inputs are not transparent, or well documented. A further problem is the narrow focus on economic variables (such as fuel prices) as sources of uncertainty, while the Company failed to examine significant planning uncertainties with the SO Model. I have several concerns in these areas and identify them below. In the end, the SO Model Studies are seriously compromised and, at present, do not provide the Commission with useful information for its decision.

Q. IS IT POSSIBLE THAT ADDRESSING THESE ISSUES WILL CHANGE THE COMPANY'S DECISION TO INSTALL SCR ON BRIDGER UNITS 3 AND 4?

A. It may or may not do so and I have not attempted in this testimony to correct all of the problems in the Company's analysis. Unfortunately, the Company's incorrect and inconsistent analytical framework has served to compound the uncertainty in this proceeding, rather than reduce it as one might hope.

<u>Summary of Potential Issues</u>

Q. PLEASE DESCRIBE TABLE 2.

A. Table 2 below summarizes the various issues and concerns that apply to the Company's SO Model studies. In a few cases, I have quantified the impact on the SO Model studies for the base case assumptions and have obtained agreement from the Company as to the actual value of the adjustment. In other cases I have estimated a range of impacts. Lacking the SO Model itself, the best one can do is provide an estimate or range of possible impacts. The adjustments shown are not necessarily cumulative and most depend on the gas and power prices. Consequently, one cannot simply add these adjustments together to get a final result. However, Table 2 makes one acutely aware that the benefit [redacted] in favor of SCR claimed by the Company is a very tenuous number at best.

Redacted

Confidential Table 2

II. IMPLEMENTATION ERRORS IN THE SO MODEL STUDIES

Q. PLEASE COMMENT ON THE COMPANY'S IMPLEMENTATION OF THE SO MODEL STUDIES.

A. The OCS review has identified many serious data errors and inconsistent assumptions in the Company's SO Model studies. These problems have a PVRR impact which amount to a substantial fraction of the benefit provided for continued coal operation in the Company's SO Model study results. Overall, these errors greatly diminish confidence in the SO Model studies and suggest the Company has failed to provide sound evidence.

Q. PLEASE EXPLAIN.

A. Confidential Table 2 above shows a number of acknowledged errors, biases and inconsistent assumptions which cloud the Company's results. The most significant error was a -$105 million PVRR (d) error related to mine capital costs in the gas conversion case. The Company acknowledged this error in its response to OCS 12.1

Q. WHAT WAS THE REASON FOR THIS ERROR?

A. The Company left out the mine capital costs associated with the continued underground mining operations of Bridger Units 1 and 2 in the case of gas conversion when computing one of the numerous after the fact adjustments made to the SO Model study results.

Q. EXPLAIN THE NEXT ERROR RELATED TO SCR COSTS INCLUDED IN THE GAS CONVERSION CASE SHOWN ON TABLE 1.

A. In the gas conversion case the Company included the fixed costs associated with Bridger Unit 4 in 2015 in the SO Model. While this was proper because it was assumed the unit would still be running on coal at the time, the calculation included SCR costs associated with the coal firing case. The Company acknowledged this error produced a present value impact of $16 million in OCS 12.2 and 12.3.

Q. WITH REGARDS TO THESE TWO ERRORS DO YOU SEE A REASON WHY THEY MAY HAVE OCCURRED?

A. Yes. These calculations are quite complex and it took several rounds of discovery before OCS was able to identify these problems and pose data requests seeking confirmation of our conclusions. A major problem is that the SO Model reports provided by the Company did not break out all the costs of individual resources. Once the information was provided these problems became much more obvious. The reporting limitations obscured these problems.

Q. ARE THESE THE ONLY PROBLEMS IN THE SO MODEL STUDY THAT MIGHT BE TRACED TO THE LACK OF DETAILED REPORTS?

A. No. In response to DPU request 9.1 the Company acknowledged the SO Model used the total plant capacity of Wyodak ([redacted] MW) rather than PacifiCorp's 80% ownership share (264 MW). This error is listed on Table 1, with an estimated impact of $-13 to -18 million PVRR(d).

III. UNPROVEN OR INCONSISTENT ASSUMPTIONS

Coal Reclamation Costs

Q. HOW DO COAL RECLAMATION COSTS IMPACT THE SO MODEL STUDIES?

A. The Company assumes that in the event of the termination of coal firing of Bridger Units 3 and 4, reclamation of the surface mine would need to begin immediately. The Company states in the response to OCS 4.8 that surface mining reclamation was assumed to start as early as 2012 because Wyoming regulations require that reclamation begin as soon as possible, and that gas conversion would result in early closure of the surface mining operations. These assumptions may increase the cost of the gas conversion scenario by as much as [redacted] million. This assumption, however, was not built into the SO Model, but rather is another "after the fact" adjustment to the study.

Q. HAS OCS EXAMINED THIS ISSUE IN DISCOVERY?

A. Yes. In OCS 6.25 we inquired as to why the Company would not try to sell the Bridger coal to a third party. In the response the Company indicated it believed there was no market for the coal:

OCS Data Request 6.25

Please explain whether the Bridger coal mine would be a viable operation for selling coal into the open market in the event that Bridger 3 and 4 cease operations? Please respond to the same question for all four Bridger units. Please explain the answer.

Response to OCS Data Request 6.25

No. Bridger Coal Company is located in southwest Wyoming, a relatively small niche market. The vast majority of the coal produced in this region is consumed locally either by the "trona" patch companies or power plants. Currently, an imbalance exists between supply and demand for Southwest Wyoming coal. Kiewit Mining initially commenced operation of the Haystack mine in 2011; however, the Company understands that Kiewit Mining has now delayed development of the mine due to lack of demand. The planned conversion of Naughton Unit 3 from coal to natural gas will further exacerbate the current market disequilibrium. Finally, the lack of competitive transportation alternatives undermines the ability of Southwest Wyoming coals to economically compete with coals from other production basins.

Q. DO YOU AGREE WITH THE COMPANY'S CALCULATIONS OF THE IMPACT OF THE EARLY SURFACE MINE CLOSURE AND THE IMPACT OF RECLAMATION COSTS ON THE GAS FIRING SCENARIO?

A. No. The Company has created a mismatch between the recovery of the costs associated with the final reclamation in the SCR and gas-firing cases. In the continued coal operation case, some of the reclamation costs are not recovered until the period after the end of the study horizon, while full recovery occurs in the gas conversion case. However, the liability for full cost recovery exists in either case. A more reasonable approach would be to compare the PVRR(d) of the actual reclamation costs in both scenarios. The Company did not do such an analysis, however.

Q. WHAT IS YOUR RECOMMENDATION?

A. This is a very important issue, which greatly increases the benefit associated with the continued coal operation case. At present, I view this assumption as unproven by the Company and far too important to be accepted without better support.

SCR Capital Costs

Q. DID THE COMPANY UPDATE THE SCR COST ESTIMATES IT USED IN THE SO MODEL?

A. Yes. The Company has reduced the capital cost estimates lowering the assumed costs from the SO Model inputs (which are generally mid to late 2011 vintage) through another after the fact adjustment. While it is reasonable to update data in such situations, the Company has not been consistent in its updating process, and has not updated other data that is not favorable to the SCR option. Further, until the project is complete, the final cost will not be known. As a result, should the Commission approve the Company's request, it should not approve ultimate recovery of more than the [redacted] million assumed by the Company in its updated study.

Gas, Power and CO_2 Price Forecasts

Q. DO THE BASE, LOW AND HIGH FORECASTS USED BY THE COMPANY IN THE SO MODEL STUDIES REPRESENT CURRENT INFORMATION?

A. No. These forecasts represent data from December 2011, and are now almost one year out of date. The base forecast is the OFPC from December, 2011. The OFPC has now been updated at least three times since the December, 2011 forecast was filed. When the Company filed this case, the June 30, 2012 OFPC was the most recent forecast. Since that time, the Company updated the OFPC again on September 30, 2012. The analysis I have performed with the GRID model indicates that use of the more recent OFPC would reduce the benefit of the SCR option by as much as [redacted] million PVRR (d).[11] This represents a significant fraction of the Company's projected benefit of the SCR system. Clearly, use of outdated forward prices is providing for less useful study results. As noted above, if the Company is to update its assumptions, it should not limit the updates to the capital costs of the SCR system, particularly when there has been a major change in the forward price curve in recent months.

Q. ARE THERE OTHER ASPECTS TO THIS PROBLEM?

A. Yes. The Company did update the coal prices for the Bridger units in one of the after the fact adjustments, lowering the cost of coal. Again, it is inconsistent to update coal prices for Bridger Units 3 and 4, but to not update the OFPC.

<u>Other Modeling Inconsistencies</u>

Q. ARE THERE OTHER INCONSISTENCIES IN THE SO MODEL STUDIES?

A. Yes. The Company assumed that Bridger Units 3 and 4 would have outage rates of [redacted] and [redacted] (coal-fired) respectively.[12] These are lower than the unit outage rates that have been used in any Utah GRC since 2001.[13] These figures are substantially below both the most recent four year averages used for rate case purposes [redacted][14] for Units 3 and 4) and the average outage rate for these units that occurred over the last twenty years ([redacted][15] for Units 3 and 4.) The former pair of figures were developed from the same vintage data as used to derive the SO Model inputs, and would have been applied in the GRID study had the Company not chosen to override those inputs in favor of the more

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11 This includes correction to an after the fact adjustment included in the GRID model study results presented by the Company.

12 Voluminous Confidential Attachment. OCS 17-1

13 OCS 1.61

14 Voluminous Confidential Attachment. OCS 17-1. This is the figure that would otherwise be used in GRID in a typical rate case application.

15 See OCS 1.60

optimistic ones. This assumption favors continued coal operation. These more favorable outage rate assumptions are undocumented. We requested the supporting analysis a number of times and had a conference call with the Company to discuss the issue. In its First Supplemental response to OCS 1.55 the Company provided only hard coded data that neither supports the figures used in the SO Model, nor provides any apparent basis for determining how the figures reported were even calculated. In the end, the figures used appear to be lacking in support.[16]

Q. ARE OTHER ASSUMPTIONS IN THE SO MODEL CONSISTENT WITH THOSE THE COMPANY NORMALLY USES IN ITS RATE CASES?

A. No. In the SO Model, it was assumed that the Currant Creek and Gadsby CT units would be able to cycle on and off without limit. In contrast, in the GRID model study the Company provided with the filing (as well as in recent rate case GRID model studies) the Company assumed that Currant Creek would run 100% of the time, and that the Gadsby CTs would run every single day of the year. While I have previously questioned the validity of these assumptions, the Company should at least be consistent between cases.

Further, it appears that the Company used no must run assumptions for coal plants in the SO Model either. This would allow daily cycling of coal plants in the SO Model. While this may not matter under base case or no CO_2 tax assumptions, it could be significant in the high CO_2 tax or low gas cases when gas units may move below coal plants in the dispatch sequence.

[16] In response to OCS 15.13 provided at the end of day Nov. 28, 2012 the Company provided some additional information it contends support these figures including a revised version of Confidential Attachment OCS 1.55. However, the additional attachments were not provided until the following day, after testimony needed to be completed. As the response was already several days late and reflected information that should have been provided with OCS 1.55, OCS reserves the right to address the additional information later. In any case, it appears from the non-confidential part of the response that subjective adjustments are made to the input data.

Q. ARE THERE REASONS WHY THE SO MODEL AND GRID MODEL COULD SIMULATE THESE RESOURCES DIFFERENTLY?

A. Yes. A must run designation indicates the presence of actual operational considerations that cause a generator to depart from purely economic commitment and dispatch. One of the reasons I dispute the designation for the GRID model is that GRID already simulates reserve requirements and reserve allocations to individual units in a detailed manner. Further, there was little evidence of reserve shortages in the GRID simulations. However, the SO Model does not model reserves. Consequently, the SO Model would probably be a more logical candidate for must run modeling as a means of capturing reserve requirements than the GRID model. Yet the Company modeling is quite the opposite. If the Company were consistent in the SO and GRID model it would likely decrease the benefit of the SCR projects determined in the SO Model studies. This issue may again be traced to the limited reports available from the SO Model because the generation of the gas units was not included in the information the Company filed in its workpapers.

<u>Final Comments Regarding the SO Model</u>

Q. DO YOU HAVE ANY FINAL COMMENTS CONCERNING THE COMPANY'S IMPLEMENTATION OF THE SO MODEL?

A. Yes. There are a number of factors that suggest the SO Model, as implemented by the Company, is not appropriate for this type of proceeding. First, the inputs used by the Company are poorly documented or in some cases undocumented. In the confidential, voluminous response to OCS 1.17 the Company provided detailed workpapers supporting the initial determination of various GRID model inputs. We asked for the same information in OCS 1.18 for the SO Model. Initially the Company provided only the SO Model inputs themselves and no supporting documents in its response to OCS 1.18. After first indicating that there were no supporting workpapers the Company supplemented the response to OCS 1.18, OCS 1.55, and OCS 1.64 to provide some additional support for some of the inputs. However, even these additional documents, though voluminous, provide sparse support for many of the SO Model inputs.

The response to OCS 1.55 was intended to provide additional support for the SO Model heat rate and outage rate assumptions. However, the document provided contained only hard-coded data, with no real explanation as to how the inputs were derived. Further, comparison of the actual SO Model inputs didn't show that the SO Model inputs matched the supporting document.

During a conference call the Company indicated that much of the data in the SO Model was input using its Graphical User Interface ("GUI"). The GUI applies input data to project values for a number of years into the future. For example, a cost input might be entered in 2012 dollars with an escalation rate and the model would project the data for future years. While arguably efficient for purposes of generating a data base it does not provide an audit trail to demonstrate that the inputs were correctly entered. The only way to verify the accuracy of the figures actually used in the simulation would be to attempt to trace through the output reports. Given the low detail reports provided this is effectively impossible. Finally, the Company indicated that some of the SO Model data was accumulated over many years and supporting information was not available. Consequently, these types of issues result in the SO Model being a less reliable tool than necessary for this sort of application. While the Company may have confidence in the SO Model and its implementation, its own track record in recent cases similar to this one, is not confidence inspiring.[17]

[17] The Lake Side 2 Significant Energy Resource Decision proceeding was marred by a number of acknowledged modeling errors in the Company studies of the APEX project as was the case in the recent

Q. ARE THERE OTHER ISSUES RELATED TO THE SO MODEL?

A. The model is only available via a license agreement with the vendor, Ventyx. This limits the ability of parties to utilize the model in this sort of proceeding. Even if available, the model has an excessive run time – taking up to a day or longer to complete a run. A run time of that length indicates that for all practical purposes validation of the model's actual calculations would be impossible. Given the slow run time, it is often necessary to make corrections through after the fact adjustments, rather than by correcting inputs. However, such corrections complicate the analysis and in this case new errors have been introduced in the after the fact adjustments.

<u>Comparison of the GRID and SO Model Results</u>

Q. IS THERE A WAY TO TEST THE VALIDITY OF THE SO MODEL?

A. Not directly. With many of the inputs essentially undocumented and the model itself unavailable, validation is clearly a problem. The Company did supply a GRID model study and database along with the SO Model study it included with the filing. Unfortunately, the GRID study inputs were "aligned" with the SO Model inputs, which in a number of cases introduced new errors (outage rates and incorrect fuel costs adjustment) into the GRID data and study results. Further, as noted above, in the case of the must run inputs, the models used differing assumptions. In the end, the GRID model study produced substantially different results (more than an [redacted][18] million PVRR (d) difference in the net power costs results provided by the two models.) Although it is about an 11%[19] difference in NPC between the GRID and SO Models, it amounts to a substantial portion

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Naughton 3 proceeding in Wyoming. In both cases the Company reversed significant resource decisions after correcting a number of errors or inconsistencies in their analyses.

[18] This includes correction of an after the fact adjustment made to GRID which introduced an error in the results.

[19] [redacted] million divided by $[redacted] million, corrected NPC.

of the total SCR benefit projected by the Company in this case. As the more detailed GRID model study predicts a lower benefit, it is troubling that the Company failed to reconcile these two results. Were circumstances a bit different (for example, the sign of the mine capital error) or some of the other assumptions that I have questioned quantified, it seems quite possible that the two models could reach alternative conclusions regarding whether the SCR system is economic or not. It would be quite troubling if the outcome of such a decision were to hinge on the model used or what errors were detected rather than actual economic considerations.

IV. PLANNING UNCERTAINTIES

Coal Fleet Strategy

Q. DO YOU HAVE ANY OTHER CONCERNS REGARDING THE STUDY DESIGN EMPLOYED BY THE COMPANY IN THIS CASE?

A. Yes. The Company studies examine the decision to install the SCR system or convert the units to gas in isolation from other resources on the system. However, the issues of early retirement or gas conversion are ones potentially facing every one of the Company's coal resources. Evaluations such as this should not be performed only when a major investment decision is being requested. Instead, it should be part of the Company's on-going activities because there may be other resources with higher costs that should be considered for early retirement or gas conversion either before or in addition to Bridger Units 3 and 4.

Q. WHY IS THIS IMPORTANT?

A. Whenever a resource is removed from the system mix, it impacts the economics of all the remaining resources. The pending retirement of the Carbon plant and the gas conversion of Naughton 3 serve to enhance the benefits of continued coal operation of Bridger Units 3 and 4. If other coal plants are retired or converted to gas, it could also serve to improve the economics of continued operation of Bridger Units 3 and 4. The Company has not addressed this in its SO Model studies.

Q. HAS THE COMPANY PERFORMED A COAL RETIREMENT STUDY?

A. Yes. In February 2012 the Company did present results from a coal-retirement study.[20] However, that analysis simply compared the costs of existing coal generators to the Company's forward price curve and did not examine various system constraints or gas conversion. Simply retiring units would likely create capacity deficits. Given the Company's need to replace capacity long term if units are retired early, gas conversion is a more logical alternative than replacement with market purchases. As the intended purpose of the Company study was merely to rank (or screen) coal plants for prioritization of future studies, these limitations were not considered important by the Company. However, they do limit the value of the study for purposes of this case as it does not evaluate the economics of actual retirement or conversion for coal plants. Further, the Company did not analyze the costs and benefits of continued operation of all of its coal generators.

Q. HAVE YOU PERFORMED AN ANALYSIS THAT COMPARES THE COSTS AND BENEFITS OF CONTINUED OPERATION OF ALL THE COMPANY'S COAL RESOURCES AS COMPARED TO GAS CONVERSION USING A PRODUCTION COST MODEL?

A. Yes, though I excluded Carbon since it is already scheduled for retirement in 2015. Through use of an alternative production cost model, called *Cumulus*, I performed an analysis of all remaining current PacifiCorp coal resources for gas conversion. I have used the Cumulus model in numerous regulatory proceedings, and benchmarked it against various industry standard models over a period of decades. I also completed a benchmark of the model against GRID. Cumulus was the best choice for this type of analysis because

[20] Confidential Attachment OCS 6.54

it considers system loads, planned resource additions, various operational issues and generating unit constraints, such as minimum loadings, must run designations, reserve requirements and factors that limit power purchases and sales such as market caps and transmission limits The Cumulus model provides comparable results but runs much more quickly than GRID or the SO Model. This is accomplished through application of a rigorous mathematical simulation technique, called "the Method of Moments" or "Probabilistic Cumulants." This technique has been widely applied in many models in use in the industry over the years. The methodology is well accepted and documented in technical journals.[21] This quick run time was important as it was necessary to perform runs examining some 24 generating units and multiple price and CO_2 forecasts over an 18 year planning horizon.

Q. WHY DID YOU ANALYZE GAS CONVERSION?

A. Gas conversion represents the most logical alternative to replace coal capacity that would otherwise be retired. I used the Cumulus model to evaluate each coal resource on the system by comparing the cost of continued coal operation as compared to gas-fired operation. The continued operation costs were taken directly from the SO Model inputs without adjustments or updates.[22] Coal specific environmental compliance costs (as applicable) were excluded from the gas conversion costs. It was also assumed that capital additions and fixed O&M expenses would be reduced for these units if converted to gas.[23] Because gas conversion costs are quite site specific, the final results would have to be adjusted to reflect the costs of adding gas firing capability at specific sites, rather than the

[21] For example, <u>Production Costing Using the Cumulant Method of Representing the Equivalent Load Curve</u>, Stremel, Jenkins, Babb and Bayless, Vol. PSAS-99, Sept./Oct. 1980.

[22] See Voluminous Confidential Attachment OCS 17.4

[23] Assumptions consistent with the Company's approach in the Naughton 3 case were applied.

generic figures I used. Nonetheless, the model provides a reasonable basis for determining what other coal plants might be converted to gas.

Q. WHAT KIND OF DATA DOES THE CUMULUS MODEL REQUIRE?

A. The model uses the same sort of data as GRID and the SO Model. It is less detailed than GRID, but in some respects more detailed than the SO Model. I started by developing the Cumulus model inputs by converting the GRID model inputs from the most recent long run avoided costs model data provided by the Company in Docket No. 11-035-200.[24]

I then benchmarked the model against the GRID model to validate the results. From the avoided cost study model, I benchmarked total annual NPC for the year 2013-2029 both with and without Naughton 3. The present value of NPC in both cases differed from GRID by less than 1.4%. The PVRR(d) between the with and without Naughton 3 cases differed by 4%.

Q. WHY DID YOU USE THE LONG TERM AVOIDED COST GRID MODEL DATA AS YOUR STARTING POINT?

A. I was already quite familiar with the avoided cost database as it was used in the Wyoming Naughton 3 proceeding (Docket No. 20000-400-EA-11) and the most recent Wyoming and Utah General Rate Cases in support of one of my adjustments. The GRID model data for the long-term avoided cost is of generally the same vintage (mid-2011) as the data used in this case in GRID and the SO Model. I was concerned that some of the GRID model data supplied by the Company in this case (notably outage rates) was based on questionable SO Model inputs and contained certain errors, so I started from the avoided cost database.

The current GRID data base and the prior avoided cost model have a lot of data in common, though the GRID model supplied in this case was updated with new prices, loads

[24] Provide in confidential, voluminous response to OCS 1.15

and expansion plans. I reflected this updated data in the Cumulus model inputs. There were also a few other inputs that were changed (specifically must run assumptions, reserve modeling, certain outage rates, and other inputs) to provide a more realistic set of results. I did not update fixed cost items from the avoided cost database, such as contract prices or other inputs that would not impact the PVRR(d) comparisons between alternative scenarios.[25] I used the model with fixed cost assumptions applicable to gas conversion or the SCR system used in both the GRID and the SO Model to determine the overall result from the Company's base case comparison of continued coal operation v. gas conversion.

Q. WHAT ARE THE RESULTS OF THE MODELING YOU PERFORMED?

A. Based on the base case assumptions I show a PVRR(d) benefit of the continued coal operation of [redacted] million, as compared to [redacted] million for GRID and [redacted] million for the SO Model study.[26] For the current GRID model, I performed other runs with and without various coal, gas and wind resources as a proxy for the type of analysis to be performed in a retirement/conversion study. The PVRR(d) between these with and without cases varied between the models by 1.3 to 8.8%. Exhibit OCS 1.2 shows the results of this comparison study. The results confirm the GRID and Cumulus models can produce results that are quite similar given consistent inputs.

Q. DESCRIBE THE GAS CONVERSION ANALYSIS YOU PERFORMED.

A. I performed scenarios with the December Base, Low and High forecast with \$16 $C0_2$ taxes and the most recent (September 2012) OFPC forecasts. I also examined a zero CO_2 tax case based on the December OFPC. I computed the \$/KW benefit or detriment of coal

[25] These inputs do not change between scenarios, thus do not affect the PVRR(d) of a comparison of coal or gas conversion for a particular unit. The Company actually just deleted a number of these kinds of inputs in its new GRID model study, presumably for the same reason.

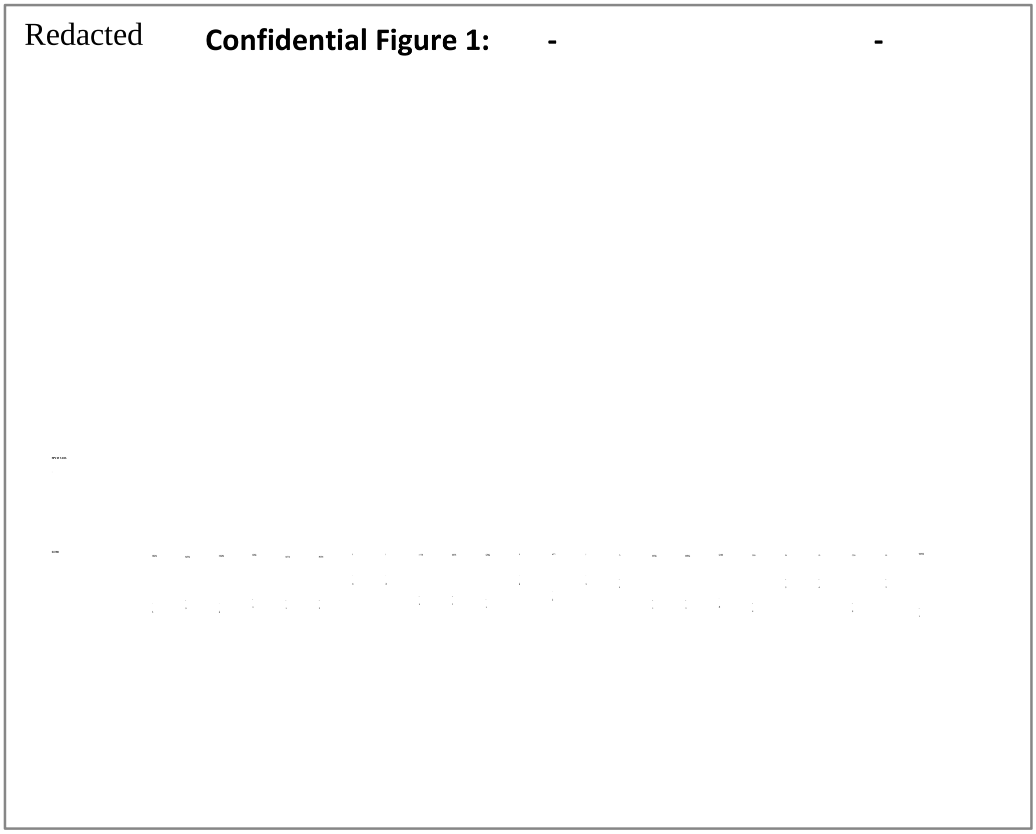
[26] These results for GRID differ from those reported by the Company due to an error the Company acknowledged in an after the fact fuel cost adjustment, which I estimate to be approximately \$9M PVRR(d) .

operation v. gas conversion assuming a 2015 conversion date. A negative value indicates continued coal operation is lower cost than gas conversion, while a positive value indicate the converse is true.

Q. WHAT ARE THE RESULTS OF YOUR ANALYSIS?

A. The results for the September 2012, OFPC are shown on Figure 1 below. Exhibit OCS 1.3 shows the complete results for the resources under the various forecasts. The chart shows the PVRR(d) comparison between coal and gas-fired operation for the various coal units, for the period 2015-2030. The line on the chart shows a generic gas conversion and demand charge costs. If the bar exceeds the line, the cost of gas operation for the plant is less than the cost of continued coal operation. The figures indicate that Bridger Units 3 and 4 are not necessarily the only, or best, candidates for gas conversion. In fact, there is potentially 88-523 MW of additional capacity that may be candidates for gas conversion either before (or in addition to) Bridger Units 3 and 4. Some of smaller units (Craig-2 and Hayden) appear to be the most likely retirement/conversion candidates.[27] Other units may not be conversion candidates, but may be better candidates than Bridger Units 3 and 4.

[27] The Company is a minority owner, so the Company would likely have to obtain agreement of the other owners. This is true for Bridger as well. It is unclear how the other owners would view such a decision.



Q. DOES THE FIGURE ABOVE ALSO ADDRESS THE GAS CONVERSION OF NAUGHTON 3?

A. Yes. The figure shows the final forecasts of the gas conversion and continued coal operation costs for Naughton 3 from Docket 20000-400-EA-11, including the final estimate of the pipeline and conversion costs. For Naughton 3 gas conversion was indeed the more economic choice because the unit was one of the most costly coal resources on the system, given the need to install both a baghouse and an SCR system.

Q. BASED ON THIS ANALYSIS, ARE YOU SUGGESTING MORE THAN 500 MW OF COAL FIRED CAPACITY SHOULD BE CONVERTED TO NATURAL GAS?

A. No. The goal here was simply to examine the Bridger decision in the context of the system as a whole. The figures discussed do not reflect site specific costs that would need to be analyzed. The analysis does demonstrate that further gas conversions may be economic and there could be other resources that are better choices. However, the Company should perform a more detailed analysis of its resources (using better modeling methods than its prior study) in the future. I presume this issue will be addressed in the current IRP process.

Q. ARE YOU IMPLYING THAT GAS CONVERSION OR EARLY RETIREMENT OF BRIDGER UNITS 3 AND 4 ARE UNLIKELY TO BE THE MOST ECONOMIC DECISION?

A. Not necessarily. In the case of Bridger there is a very site specific issue of the transmission benefits associated with early retirement that has not yet been addressed as well as the other unresolved issues I've identified. Further, the costs modeled for Bridger Units 3 and 4 are subject to various other uncertainties and errors as discussed above. I believe that what this analysis, and the rest of my testimony has shown, however, is that the Company needs to take a more complete view of its system in making decisions, and not view issues such as the Bridger SCR decision in isolation from other considerations such as retirement of other plants.

<u>Transmission System Implications of Continued Bridger Operation</u>

Q. PLEASE DISCUSS THE POTENTIAL TRANSMISSION IMPLICATIONS OF CONTINUED COAL OPERATION AS COMPARED TO ALTERNATIVE RESOURCES.

A. The Company's modeling takes the planned Gateway transmission expansion as fixed and attempts to derive the least cost generation expansion plan from the competing generation alternatives. The Bridger plant would be one of the resources connected to the proposed Windstar to Populus 500 kV expansion assumed to be completed by 2019. This expansion has an estimated total cost of [redacted][28] A related project is the Populus to Boardman 500 kV line which would be completed in 2021 at a cost of $[redacted][29] Together these transmission projects comprise the Gateway West expansion considered by

[28] Confidential Attachments to OCS 11.1 and 11.2. This excludes the costs of the Windstar to Aeolis segment which will be completed earlier and amounts to an upgrade of an existing 230 kV line.

[29] OCS 1.4 Confidential Attachment

the Company to be an element of its future transmission plans. Ultimately these projects will nearly double the amount of transfer capacity between Bridger and the Company's load centers. It will also add a new path between Bridger and eastern and northeastern Wyoming (location of nearly all of the Company's Wyoming wind generation and other coal resources).

Q. WHAT POTENTIAL ISSUES ARISE DUE TO THESE TRANSMISSION ASSUMPTIONS?

A. There are two fundamental problems. First, a rather obvious question is whether the need for the Windstar to Populus investment would be impacted by early retirement of Bridger Units 3 and 4 or their conversion to natural gas. Second, given the large amounts of wind capacity already located in Wyoming, the Company's assumption that it will install more wind generation in that state, and the Company's contention that transmission constraints already are a serious problem, the question arises whether the Bridger station would be adversely impacted if the Gateway expansion does not occur under the currently proposed schedules. Transmission expansion is complex, difficult and time consuming and the Gateway West expansion may not be completed when expected by the Company, if ever. A related issue, which I will discuss later is the assumption of a major expansion in Wyoming wind generation, which is tied to RPS assumptions and the Gateway additions.

Q. HAVE YOU INVESTIGATED THIS TRANSMISSION ISSUE?

A. Yes. OCS inquired about these issues in discovery. Unfortunately, the responses were not very specific and lacking in supporting documentation. In OCS 1.83 the Company was asked regarding the impact of retirement of Bridger Units 3 and 4 on the need for the Gateway expansion:

OCS Data Request 1.83

Would early retirement of Bridger Units 3 and 4 enable the deferral or avoidance of any of the Gateway transmission links? If so, please identify which links and over what period of time. If not, please explain all reasons why not.

Response to OCS Data Request 1.83

Retirement of Jim Bridger 3 and 4 would reduce the need to transport thermal resources westward between the proposed Anticline substation and existing Populus substations from Wyoming to the Company's load centers but, it would not avoid the need for more transmission capacity out of Wyoming. The Company's existing transmission system in Wyoming is highly constrained east of Bridger and limits the Company's ability to reliably transport low cost energy including existing and future thermal and renewable energy sources therein. Retirement of Bridger Units 3 and 4 would not avoid the need for Gateway West in that regard.

In OCS 1.84 the Company further asserted that replacement of the Bridger capacity with combined cycle generation located closer to load centers would have no impact on the need for the Gateway projects. In OCS 8.19 the Company was asked to produce documents supporting these responses and provided only a single chart allegedly demonstrating that east of Bridger flows were constrained. It did not address flows west of Bridger, which is the normal path from Bridger's to load centers.

In OCS 6.28 the Company was asked if the retirement or replacement of Bridger Units 3 and 4 would delay the need for any of the Gateway additions. The Company responded that it was studying the issue and would not have an analysis completed until the fourth quarter of 2012. In OCS 6.35 the Company was asked if additional wind generation were not built in Wyoming and if Bridger Units 3 and 4 were retired would the Company still need the Gateway additions. The Company asserted the assumed Wyoming wind power expansion was needed to meet assumed RPS requirements and it did not believe linking these issues was appropriate. In effect, the Company simply refused to consider this issue.

Q. ARE THESE RESPONSES SATISFACTORY?

A. No. The Company's responses largely amount to assertions regarding the need for the Gateway projects and an admission that further analysis is required to address the matter. This issue is far too significant to summarily dismiss and is one that should be considered carefully by the Commission. Further, the assumption that more than 2000 MW of future wind generation by necessity *must* be located in Wyoming, irrespective of the impact on transmission costs is simply not reasonable, nor prudent.

Q. HAVE YOU PERFORMED AN ANALYSIS TO EXAMINE HOW A FAILURE TO COMPLETE THE GATEWAY EXPANSIONS AS CURRENTLY PLANNED WOULD IMPACT THE ECONOMICS OF THE BRIDGER UNITS 3 AND 4 SCRs?

A. Yes. I performed GRID runs removing the Gateway West (Windstar to Populus to Boardman) and Gateway South (Aeolis to Mona) expansions. While the purpose was to test if failure to complete the Gateway projects would result in transmission problems rendering Bridger Units 3 and 4 coal operation less viable, it also sheds some light on the benefits of the Gateway project vis-à-vis Bridger Units 3 and 4.

Q. DISCUSS THE SUITABILITY OF GRID FOR ANALYSIS OF THIS ISSUE.

A. GRID includes a detailed transmission topology and models hourly loads and supply resources. While GRID is not a transmission load flow model, it does provide some insight into this issue. This helps to determine whether failure to complete the Gateway expansion on time (or at all) would adversely affect the benefits of continued coal operation of Bridger Units 3 and 4. Further, the Company has used the GRID model in the past to examine transmission issues. The Company relied on a GRID model study in an evaluation of the Centralia Point to Point contract according to testimony the Company filed in previous cases.[30]

Q. PLEASE DISCUSS THE GRID MODEL STUDY RESULTS.

A. Confidential Table 3 below, shows the result from the GRID model study of Net Power Costs ("NPC") with and without the Gateway West and South expansion and the NPC differences between the SCR and Gas Conversion cases with and without the Gateway West and South links. Unserved energy is also shown for the SCR (base) case with and without the Gateway expansions. Unserved energy represents an imbalance between requirements and supply in a specific transmission area.

The second column shows the annual NPC benefit of the Gateway West and South transmission lines as determined by the GRID model, assuming continued <u>coal operation</u> of Bridger. These figures were computed by running GRID with and without Gateway West and South. The figures demonstrate that the Gateway West and South projects provide a benefit of only [redacted] million PVRR (d) over the 2019 to 2030 study horizon. Given the total project cost exceeds [redacted] billion it begs the question of whether the project should ever be completed due to its apparent lack of economic benefits.

[30] See Exhibit RMP___ (GND-6R) from Docket No. 11-035-200. The same exhibit was filed in other cases.

Confidential Table 3
GRID Model Study Results
Impact of Removal of Gateway West and South

	---------------NPC Results In $1000---------------						
	Gateway	Bridger SCR v. Gas NPC Benefits			Gateway Unserved Energy Benefit		
Year	NPC Benefit	W Gateway	WO Gateway	Difference	With	Without	Difference
2019	[redacted]						
2020							
2021							
2022							
2023							
2024							
2025							
2026							
2027							
2028							
2029							
2030							
PVRR(d) @							
2013-2030							

The next two columns show the total annual NPC Bridger coal operation and gas conversion. The next column shows the difference, or NPC benefit of coal v. gas operation. The analysis shows that the Gateway projects have an impact of only [redacted] million on the NPC differences between the continued coal operation and gas conversion cases. Though perhaps counter-intuitive, the value of continued coal operation is slightly *enhanced* if the Gateway projects were not completed in the planning horizon. Consequently, the Gateway project does not, by itself, enhance the value of continued coal operation of Bridger Units 3 and 4, nor does it appear that completion of Gateway is necessary to enable continued efficient operation of Bridger Units 3 and 4. I surmise that completion of Gateway serves to reduce the value of coal-fired operation of Bridger Units 3 and 4 because the improved flow of energy on the system would make replacement energy available at lower cost in the event of gas conversion. Similar results emerged in my analysis in the Wyoming Naughton 3 case.

The last three columns on Confidential Table 3 explore the reliability benefits of the Gateway expansion and the figures are presented in MWH, not dollars. Unserved energy is reported for the continued coal operation of Bridger Units 3 and 4 with SCR case with and without the Gateway expansion. Unserved energy in this instance amounts to shortages in various transmission areas due to lack of ability to import sufficient energy from other areas. The GRID study results indicate that there will be little if any impact on unserved energy until 2028 due to the Gateway projects. In 2030 the impact is only an 11% increase without Gateway. The analysis does not consider whether installation of new resources or purchases at other locations would serve to mitigate the unserved energy at lower cost. This analysis demonstrates that while the continued coal operation of Bridger Units 3 and 4 does not appear to require the Gateway additions, there should be some doubt as to the necessity and value of these projects or at the very least, their timing. In any case, this analysis clearly suggests the Company has failed to address significant issues.

Q. DO YOU HAVE ANY ADDITIONAL EVIDENCE THAT DEMONSTRATES THE RELATIONSHIP BETWEEN THE TRANSMISSION AND GENERATION ISSUES IN THIS CASE?

A. Yes. Figure 2 below shows the annual load duration curve for the Jim Bridger to Idaho Power Company East transmission areas for 2019 as modeled in GRID.

Figure 2 Redacted

The figure compares the flows from Bridger to Idaho Power (which is the first path increased by the Gateway West expansion) for 2019 under the base case (continued coal operation), and the gas conversion case. Also shown is the maximum transfer capability with the Gateway expansion (2111 MW). The average difference between the flows is [redacted] while the difference between maximum flows is [redacted] MW, but would be larger were it not for the paths being constrained in the coal operation case.[31] The gas conversions case shows substantial surplus capacity on this path. Consequently, the need for the new transmission lines expansion would certainly be diminished in the gas conversion case. Of course, transmission, like generation, is required to meet peak conditions, so the gas conversion option may not provide the ability to defer or avoid the Gateway West

[31] Note, however, that the maximum flows would not necessarily occur at the same time.

expansion. However, a combined cycle plant, located closer to load centers may provide a better alternative. Consequently, this issue is unresolved at present.

Q. WHAT ARE THE COSTS ASSOCIATED WITH THE GATEWAY WEST EXPANSION?

A. The complete Windstar to Boardman path would add approximately [redacted] times the cost of the Bridger SCR system to the PacifiCorp rate base in 2019 and 2021 and cost many multiples of the benefit the Company claims will stem from the installation of the SCR system to enable continued coal-fired operation. The real levelized annual revenue requirement of these new transmission lines, when both are completed would be $[redacted] million, per year. This amount is quite comparable to the entire SCR investment at stake in this case. Avoidance of the Gateway West expansion in total would produce a reduction to PVRR of [redacted] billion over the period 2013-2030. This amount is roughly comparable to the cost of [redacted] of new combined cycle capacity based on data contained in the Company's IRP. And unlike transmission capacity, a generator can produce energy, rather than simply transport it. Further, if conversion to gas resulted in a only four year delay in the completion of the Gateway West project it would produce a savings of over $400 million, PVRR(d).

Q. ARE YOU SUGGESTING THE GATEWAY WEST EXPANSION WOULD NOT BE NEEDED IF BRIDGER UNITS 3 AND 4 WERE RETIRED AND/OR CONVERTED TO NATURAL GAS ON THE BASIS OF THIS ANALYSIS?

A. Not necessarily. Transmission planning is much more complex than this. However, this analysis does suggest that this issue is a major uncertainty that has not been considered by the Company in its analysis of the SCR upgrade. Further, a delay of the project may be a plausible alternative in the event of gas conversion or installation of a combined cycle plant elsewhere.

In a larger sense, this discussion also highlights a serious concern regarding the Company's generation and transmission expansion plans. The Company's IRP assumes substantial increases in wind generation in Wyoming in the years ahead. This strategy may be understandable if it is driven by a desire to capture the locations on the system where the wind potential is the greatest. However, the costs of expanding the transmission system to accommodate the assumed increase in wind capacity may be greater than the value lost by locating wind generation closer to load centers, even though the wind potential may not be as great in those locations. The Company needs to consider generation and transmission planning in a coordinated manner that considers the location of generation in conjunction with the implication for transmission costs.

Q. THE GATEWAY PROJECTS HAVE GENERATED CONTROVERSY OVER THE YEARS. DISCUSS THE RELATIONSHIP BETWEEN THE GATEWAY ISSUE AND THE BRIDGER SCR.

A. If the Gateway projects are clearly needed or totally unnecessary, irrespective of the continued operation of Bridger, then the question is moot – as regards Bridger. There would be no transmission impact in either case. However, *if* the need for the Gateway projects can be shown to hinge to some extent on the future status of the Bridger power plants, transmission related cost could impact the outcome of the SCR analysis in an important way. This provides another major reason why the Commission cannot make a decision at this time, as the Company has not provided the evidence necessary for an informed decision to be made.

<u>RPS Requirements, Incremental Wind and Relationship to the Bridger SCR Decision</u>

Q. HOW MUCH ADDITIONAL WIND GENERATION IS INCLUDED IN THE SO MODEL STUDY USED TO EVALAUTE THE BRIDGER SCR DECISION?

A. Over the period 2019 to 2030 the Company assumed that approximately 2075 MW of new wind capacity will be installed in Wyoming. At a 35% annual capacity factor, these new wind resources will produce generation comparable to Bridger Units 3 and 4. However, based on the Company's recent comments during the IRP Stakeholder meetings, this wind expansion would ultimately only provide about 80 MW of peaking contribution.

Based on Table 5.3 of the 2011 IRP Update (CAT-7), the Company assumes that 925 MW of this additional wind capacity is needed to meet existing state RPS requirements. The Company further assumes in the IRP that 250 MW of additional wind capacity is added in Wyoming to meet an assumed federal RPS requirement. Addition of these resources diminishes the benefit of continued coal operation of Bridger Units 3 and 4 due to the low variable cost energy the projects would provide if installed. The responses to OCS 1.19 and OCS 6.1 indicate that these wind resources are added to meet existing state and assumed federal RPS requirements, and not selected by the SO Model on the basis of relative economics.

Further, the IRP indicates an additional 900 MW of wind capacity is added to the IRP expansion plan from 2025 to 2030. The Company states "*these additional long-term wind resources in the IRP Update portfolio are included in recognition of long-term regulatory compliance/incentive uncertainty, long-run public policy goals, and risk mitigation benefits of zero carbon, zero fuel cost renewable resources.*" (CAT-7, page 47) Again, this implies that these resources are not the least cost alternatives available to the Company. As discussed earlier, the presence of such resources in the expansion plan, may compromise the Company's evaluation of the Bridger SCR decision. If nothing else, it indicates the Company needs to perform additional analyses.

Q. HOW DO THESE RESOURCES IMPACT THE ECONOMICS OF THE BRIDGER SCR SYSTEM?

A. Based on GRID model runs, removal of these 2075 MW of new Wyoming wind additions would enhance the economics of the coal-fired option by approximately $50 million PVRR(d). Further, it would stand to reason that introduction of 2075 MW of additional wind capacity to meet western state RPS requirements would put more pressure on the existing and planned transmission network. Consequently, this issue has a bearing on the benefits of the SCR system, and the related issue of the need for the Gateway West investments.

Q. HOW ARE THE COSTS OF THE RPS RESOURCES ALLOCATED UNDER THE CURRENT MULTISTATE PROTOCOL AGREEMENT?

A. It is my understanding that the current protocol requires that costs associated with a resource acquired pursuant to a State Portfolio Standard, which exceed the costs PacifiCorp would have otherwise incurred, will be assigned on a situs basis to the State adopting the standard. However, transmission investments are not allocated on a situs basis, even if the primary reason for the investment is to deliver resources required for RPS compliance. This is a major issue which the Commission should consider.

While the current protocol expires in 2016[32] it seems reasonable to assume that the situs allocation of RPS resources would continue into the future. Consequently, it is likely the eastern states (Idaho, Wyoming and Utah) will not pay any amounts in excess of avoided costs associated with the resources. This can be approximated by removing these resources from the supply mix. As a result, one could logically assume that to determine the impact of the Bridger SCR decision on Utah, removal of the costs and energy of these resources from the SO Model should at least be examined in this proceeding and future

32 OCS 13.3

cases that are impacted by the existing and assumed RPS requirements and the incremental wind capacity.

Q. IS THERE ANY ANOTHER REASON TO QUESTION WHETHER ALL OF THE 925 MW RPS WIND CAPACITY IN THE PLAN WILL ACTUALLY BE BUILT?

A. The Oregon RPS has a rate cap that places limits on the compliance requirements. If the cost of additional wind power becomes higher than the statutory cap, the Oregon RPS would not require these additions. Alternatively, the Company may have to find other (lower cost) alternatives. Consequently, it is possible that the Oregon RPS requirement may be reduced or eliminated if the cost to ratepayers in that state are too high. This provides another reason to examine the results of eliminating or reducing the 2075 MW of additional Wyoming wind power.

Q. ARE THERE OTHER IMPACTS DUE TO THE ASSUMED FEDERAL RPS?

A. Yes. The Company also assumes that a federal RPS begins [redacted] for purposes of determining forward prices.[33] In the response to OCS 12.7, the Company acknowledged it had not performed any analysis to determine the impact of this assumption on its market price forecast. While the impact is unclear, I believe it is reasonable to assume that the addition of such resources to the region would suppress market prices.

Q. PLEASE DISCUSS THE FURTHER IMPLICATIONS OF THIS ASSUMPTION.

A. In the development of the market price forecast the Company is assuming passage of congressional legislation, much the same as it assumes imposition of CO_2 taxes. In the Order in Docket No. 07-035-94, the Commission ordered the Company to file studies providing results including a "without CO_2 tax" scenario to aid in understanding the cost of changes in the cost of a change in environmental regulations. I believe the "without

[33] See Voluminous Confidential Attachment OCS 10.4, June 2012 OFPC Documentation.

CO_2 tax" scenarios should also reverse the federal RPS assumptions in both the SO Model studies and the market price forecasts. This would be consistent with the logic of presenting results based solely on existing requirements and law.

Q. SHOULD THE 900 MW INCREMENTAL WIND CAPACITY BE INCLUDED IN THE EVALUATION OF THE BRIDGER SCR DECISION?

A. I recommend the Commission evaluate sensitivities which exclude these resources. There is no guarantee the Company will actually install this amount of wind capacity on the system if not compelled to do so for RPS compliance. Nor is it clear that regulators will allow recovery on such resources. An imprudence disallowance has already been made by Oregon regulators in the case of the Rolling Hills project located in Wyoming, even though that project was arguably needed for RPS compliance in Oregon.[34]

Q. ARE THERE OTHER REASONS WHY THE COMPANY SHOULD PREPARE AN ANALYSIS WITHOUT THE WYOMING WIND EXPANSION?

A. Yes. It appears that the Wyoming wind expansion is one of the key drivers behind the Gateway investments. While Wyoming may be the most favorable location on the system for wind capacity, other sites may be more economic if the Gateway investments can be delayed or avoided. A better geographic distribution of wind generation additions should reduce integration costs and may improve the capacity contribution of wind. By locating all wind generation in Wyoming the Company may be diminishing some of the value of new wind resources. Further, I understand that wind generation is now becoming viewed less favorably by Wyoming residents and the permitting of future wind additions in that state may become more difficult. Finally, Page 81 of PacifiCorp's 2011 IRP states: "*Unless significant wind resources are added to Wyoming as in the high CO_2 and high natural gas cost scenarios, the utilization percentage of Gateway West and Gateway South*

[34] Oregon Public Utility Commission Docket No. UE 200, Order 08-548, pages 19-20

would be fairly minimal. This would be a prime factor for the Company to decide not to pursue building these incremental transmission segments." This suggests the Gateway projects are tied to the assumed wind expansion. One could certainly raise the question as to whether the assumed expansion of wind capacity in Wyoming is merely intended as a means of providing further justification for the massive Gateway expansion, with the plans to add such resources abandoned quickly once the Gateway projects are approved.

While there may be good reasons for inclusion of these new wind resources in the expansion plans modeled in this case, an informed decision should consider both the inclusion of the incremental 900 MW of wind capacity, and alternative scenarios where it is not installed particularly, in conjunction with scenarios that remove the Gateway projects, and examine combined cycle replacement options.

<u>Conclusions</u>

Q. PLEASE SUMMARIZE THE CONCLUSIONS OF YOUR TESTIMONY.

A. The Company's filing in this case does not provide sufficient support for the request for approval of the investment in the Bridger SCR systems. The Company filing is deficient for the following reasons:

- The SO Model is not transparent and the inputs are not well supported. It does not compare well to the GRID model results. Consequently, it is difficult to rely upon for purposes of this case.

- Serious errors in the analysis undermine confidence in the Company's results. The errors amount to a large fraction of the total projected SCR system benefits as determined by the Company.

- The Company has made a number of assumptions that are either unproven or inconsistent with the assumptions used in its recent rate cases.

- The Company has failed to consider important planning uncertainties related to conversion of other coal plants, transmission issues and RPS wind additions in its analysis of this decision.

Q. PLEASE DESCRIBE EXHIBIT OCS 1.4.

A. This exhibit presents non-confidential, non-voluminous responses to OCS data requests that I have referenced in this testimony. It is provided for the convenience of the Commission.

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes.