

BEFORE THE PUBLIC SERVICE COMMISSION OF UTAH

In the Matter of the Voluntary Request) Docket No. 17-035-39
Of Rocky Mountain Power for Approval)
Of Resource Decision to Repower)
Wind Facilities)

CONFIDENTIAL RESPONSE TESTIMONY OF

PHILIP HAYET

FOR THE

OFFICE OF CONSUMER SERVICES

APRIL 2, 2018

REDACTED

Subject to Rule 746-1-602 and 603

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I. INTRODUCTION2 **Q. PLEASE STATE YOUR NAME, BUSINESS ADDRESS, TITLE AND COMPANY.**3 A. My name is Philip Hayet. My business address is 570 Colonial Park Drive, Suite 305,
4 Roswell, Georgia, 30075. I am Vice President of J. Kennedy and Associates, Inc.
5 (“Kennedy and Associates”).6 **Q. PLEASE STATE ON WHOSE BEHALF YOU ARE TESTIFYING.**

7 A. I am appearing on behalf of the Office of Consumer Services (“Office”).

8 **Q. DID YOU PREVIOUSLY FILE TESTIMONY IN THIS DOCKET?**9 A. Yes, I filed direct testimony on September 20, 2017 and surrebuttal testimony on
10 November 15, 2017.11 **Q. WHAT IS THE PURPOSE OF YOUR RESPONSE TESTIMONY?**12 A. In response to the Company’s November 22, 2017 Unopposed Motion to Amend the
13 Procedural Schedule (the “Motion”) to allow more time to consider the impacts on the wind
14 repowering projects of potential tax reform, the Commission authorized the Company to
15 file revised economic evaluation results in supplemental direct testimony by February 1,
16 2018.¹ I have reviewed the Company’s economic analyses, and present the results of my
17 evaluation in this testimony. In addition, I respond to the supplemental direct testimony
18 filed by Company witnesses Ms. Cindy Crane, Mr. Rick Link, and Mr. Timothy Hemstreet,
19 and I present my conclusions and recommendations regarding the Company’s wind
20 repowering project.21 **Q. PLEASE PROVIDE YOUR CONCLUSIONS.**

¹ The Commission issued its Amended Scheduling Order (“Scheduling Order”) on November 27, 2017.

22 A. The Company continues to propose to repower nearly 1,000 MW of its wind power
23 generation resources and is seeking Commission approval to continue recovering the cost
24 of its existing investment in the facilities, as well as to recover the costs of repowering
25 those units. The Company asserts that these projects will provide net benefits to customers
26 by increasing wind energy production, reducing operating costs, and requalifying the
27 Company's existing wind resources to receive 10 more years of federal Production Tax
28 Credits ("PTCs). The Company has conducted two economic analyses to evaluate the
29 benefits of the repowering projects, one covering a 20-year time horizon, and another
30 covering a 34-year time horizon. I have reviewed the Company's two economic analyses
31 and have concluded there are problems with both analyses.

32 The Company's 20-year analysis, that I refer to as the "to-2036" analysis, includes
33 a modification to the PTC modeling methodology that the Company introduced for the first
34 time in this proceeding, which biases the results in favor of repowering. The Company's
35 longer-term analysis, the "to-2050" analysis also has flaws that I have identified. Primarily
36 these flaws relate to the fact that the Company is unable to run its normal production cost
37 and optimal expansion planning modeling tools, the Planning and Risk ("PaR") and the
38 System Optimizer ("SO") models during the 2037 to 2050 time-period. Instead, the
39 Company uses energy benefits it derives during the 2027 to 2036 time-period and
40 extrapolates those results to produce energy benefits that it applies to the 2037 to 2050
41 time-period.

42 Given the potential bias in the Company's analyses, the potential for risks that the
43 Company did not address such as cost overruns and the projects producing less wind energy
44 than expected, the magnitude of the investments (more than \$1 billion), and the fact that

45 the Company does not have a capacity need driving the decision to repower its projects, I
46 do not believe the Company has complied with the requirements of Utah Code § 54-17-
47 402. This section of the code requires PacifiCorp to include information sufficient for the
48 Commission to determine whether resources are in the public interest taking into
49 consideration several factors including whether the project will most likely result in the
50 acquisition, production, and delivery of electricity at the lowest reasonable cost and least
51 risk possible, while addressing reliability and other factors. I do not believe PacifiCorp has
52 fully demonstrated that the repowering projects are necessary from a reliability perspective,
53 nor will lead to the Company producing energy at the lowest cost, least risk possible.

54 **Q. WHAT ARE YOUR RECOMMENDATIONS?**

55 A. Since I do not believe PacifiCorp has met the requirements of the statute, I believe the
56 Commission should reject the Company's repowering request. However, if the
57 Commission were to approve the repowering projects, I recommend that the Commission
58 approve a more limited set of projects to repower, which would result in a significant
59 savings in capital costs compared to the full proposal without substantially reducing the
60 total benefits.

61 In addition, since these are primarily economic projects, if they are to go forward, I
62 recommend that the ratepayer protections that PacifiCorp has offered should be expanded
63 to protect ratepayers' interests in the case that promised benefits do not materialize. The
64 Company is not just pursuing these projects because of the benefits it believes the
65 repowering projects will provide to ratepayers. The Company stands to increase its rate
66 base and grow its earnings considerably, while ratepayers will be responsible for most of
67 the risks of the project. I outline below some additional conditions that I recommend that

68 the Commission should impose if it allows the Company to proceed with some or all the
69 repowering projects. Also, Ms. Donna Ramas and Ms. Cheryl Murray present additional
70 testimony on behalf of the Office.

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II. ECONOMIC EVALUATION

73 **Q. WHAT SPECIFICALLY DID THE COMMISSION AUTHORIZE IN ITS**
74 **AMENDED SCHEDULING ORDER?**

75 A. At the time PacifiCorp filed its Motion, it expected final action on the tax reform legislation
76 to occur by the end of 2017, which ultimately happened when the Tax Cuts and Jobs Act
77 was signed into Law on December 22, 2017. The Commission's Scheduling Order
78 authorized a brief extension and approved a series of requests that PacifiCorp made in its
79 motion, including to file supplemental testimony describing updated economic evaluations,
80 including evaluations performed on a project-by-project basis, and to account for the tax
81 reform legislation. Additionally, PacifiCorp was permitted to update official forward price
82 curves, it was required to present results at a minimum for the Low Natural Gas/Zero CO₂
83 and the Medium Natural Gas/Medium CO₂ cases, and it was permitted to include updates
84 for known changes in wind repowering costs and performance, and projected changes in
85 CO₂ costs. The Commission amended the procedural schedule such that the new hearing
86 date is scheduled for May 3, 2018.

87 **Q. DID THE COMPANY'S FEBRUARY 1 FILING ADHERE TO THE**
88 **REQUIREMENTS OF THE COMMISSION'S ORDER?**

89 A. Not strictly. According to Ms. Crane's testimony, the Company provided an "updated
90 economic analysis, which accounts for updated market conditions, updated cost and

91 performance metrics, and federal corporate income tax reform.”² While the Company did
92 this, it also made a significant modeling change. It should be noted that without this
93 change, its repowering projects would be uneconomic in some of its analyses. The
94 additional change was that for the first time in three filings of economic evaluation results,
95 the Company modified its representation of PTCs in its analysis.

96 While the change in tax laws was certainly an unforeseen event that had to be
97 addressed, the new modeling methodology could have been included in either PacifiCorp’s
98 direct or rebuttal filings. Whether intended or not, it certainly leaves the impression that
99 PacifiCorp is doing everything it can to ensure that the projects appear to be economic in
100 every analysis performed. The change in the PTC modeling methodology resulted in
101 nearly two hundred million dollars of additional benefit to PacifiCorp’s 20-year (“to-2036
102 study”) economic evaluation results.³ Without the change, the repowering projects would
103 have been uneconomic in many cases in the to-2036 study.

104 **Q. DID THE SAME CHANGE IMPACT THE RESULTS FOR THE COMPANY’S TO-**
105 **2050 ECONOMIC EVALUATION?**

106 A. No, it did not. The modeling change, which will be explained further below, concerns
107 benefits that were previously excluded in the to-2036 study period. In the to-2050 analysis,
108 the benefits fall entirely within the study timeframe, and nothing ends up being excluded.
109 While the benefits are fully captured in the 2050 analysis, I have other concerns about the
110 to-2050 study, which I discuss below.

111 **Q. WHAT ANALYSES DID THE COMPANY PERFORM AND PRESENT IN ITS**
112 **SUPPLEMENTAL DIRECT TESTIMONY?**

² Cindy Crane supplemental direct testimony at line 17.

³ OCS estimate. Refer to DPU 26.14 and UAE 9.2 for Company estimates.

113 A. The Company performed similar studies as it previously presented in its direct and rebuttal
114 testimonies, including its to-2036 and to-2050 analyses. Studies performed to-2036
115 captured costs and benefits that occurred between 2017 and 2036, and studies to-2050
116 captured costs and benefits that occurred over a longer time horizon, between 2017 and
117 2050. In cases in which it did not evaluate all nine price policy scenarios, the Company
118 presented results for the Medium Natural Gas/Medium CO₂, and the Low Natural Gas/Zero
119 CO₂ scenarios. All sensitivity cases were the same as previously presented, including an
120 alternative to-2050 modeling sensitivity, and a new wind/new transmission sensitivity.
121 The only differences in the analyses related to the changes that the Commission authorized
122 the Company to make in its Amended Scheduling Order, and the change the Company
123 chose to include related to the revised PTC modeling methodology. As mentioned, the
124 authorized changes included updated market conditions, updated cost and performance
125 metrics, and changes to incorporate the effects of the new tax legislation.

126 **Q. DISCUSS THE CHANGES THE COMPANY MADE TO ACCOUNT FOR**
127 **UPDATED MARKET CONDITIONS.**

128 A. The Company updated its natural gas and CO₂ price-policy assumptions to reflect its most
129 current assumptions. In its direct testimony, the Company used its April 26, 2017 Official
130 Forward Price Curve (“OFPC”) natural gas price forecasts and versions of third party
131 forecasts that were current at that time. In its most recent testimony, the Company used its
132 December 29, 2017 OFPC natural gas price forecasts and updated third party forecasts.
133 The latest forecasts all reflect lower natural gas prices, which is consistent with long-term
134 trends that I have observed in the natural gas market. The Company also used more recent
135 third-party CO₂ forecasts, which resulted in a reduction in and delay of the start of CO₂

136 costs from what the Company had previously relied on.⁴ This is also consistent with my
137 observations of trends at other utilities regarding their CO₂ forecasts, particularly since no
138 CO₂ legislation has passed at the national level. Furthermore, it is quite possible there will
139 be no CO₂ requirements at all in the to-2036 study horizon, and it is certainly conceivable
140 that there may be no CO₂ requirements in the to-2050 study horizon. Therefore, I continue
141 to believe that there is a high probability that natural gas and CO₂ costs will be in the low
142 to medium price forecast range, and I believe that substantial consideration should be given
143 to the Low Natural Gas/Zero CO₂ results that the Company presented in its supplemental
144 direct testimony.

145 **Q. DISCUSS THE CHANGES THE COMPANY MADE TO ACCOUNT FOR**
146 **UPDATED COST AND PERFORMANCE METRICS.**

147 A. Mr. Hemstreet reported that the Company has worked to conclude its technical studies, and
148 as a result, changes have been made to cost and energy production assumptions. One
149 change is that PacifiCorp reduced the turbine size for Leaning Juniper to ensure that the
150 turbine loading is within allowable load limits. Mr. Hemstreet also stated that PacifiCorp
151 has now assembled more years of historical wind energy data that it used to derive updated
152 energy production estimates at Glenrock I and III and Rolling Hills. Furthermore, based
153 on a recent transmission study, Mr. Hemstreet reported that PacifiCorp is confident that
154 with a transmission investment of \$180,000, a revised interconnection agreement can be
155 executed for the Marengo I and II facilities that will allow them to be able to operate at full
156 capacity and fully deliver all energy they potentially could produce. Finally, based on site-

⁴ For a comparison of natural gas and CO₂ forecasts see Rick Link's supplemental direct testimony at Figures 2-SD and 3-SD, respectively. In those figures, Mr. Link compares forecasts he used in direct versus supplemental direct testimony

157 specific turbine design and foundation analyses that have now been completed for Goodnoe
158 Hills and Leaning Juniper, the Company determined it will have to strengthen the
159 foundations of the wind turbines at those projects to be able to withstand the loads of larger
160 turbines.

161 **Q. DID THE COMPANY CHANGE ANYTHING ELSE THAT AFFECTED THE**
162 **COST OR THE PERFORMANCE OF THE WIND TURBINES?**

163 A. Yes, there was one other change. At the time PacifiCorp initiated work on its economic
164 analyses for its rebuttal testimony, it had not yet received notification from General Electric
165 (“GE”) verifying that PacifiCorp could rely on using [BEGIN CONFIDENTIAL] ██████████
166 ██████████ [END CONFIDENTIAL] turbines at GE sites, and as a result, PacifiCorp
167 conducted its rebuttal studies assuming less favorable turbine [BEGIN
168 CONFIDENTIAL] ██████████ [END CONFIDENTIAL] equipment would be
169 installed. The updated economic analyses have now been performed with assumptions
170 consistent with PacifiCorp’s actual plans, which will be to repower GE turbines using the
171 [BEGIN CONFIDENTIAL] ██████████ [END CONFIDENTIAL] turbines.

172 **Q. WHAT IS THE OVERALL AMOUNT OF THE COST AND PERFORMANCE**
173 **ASSUMPTION CHANGES SINCE REBUTTAL?**

174 A. Overall, total project costs have increased by \$18 million, or by about 1.6 percent compared
175 to rebuttal, and the incremental increase in energy production due to repowering is now
176 assumed to be 25.7 percent, compared to what had been estimated in rebuttal, 24.9 percent.⁵

177 The result of these changes provide an increase in the benefit associated with the

⁵ Rick Link supplemental direct testimony, lines 70-76.

178 repowering projects, however, not enough in some of the cases in the to-2036 analysis to
179 be able to offset the impact of the tax law changes that I discuss next.

180 **Q. WHAT CHANGES DID THE COMPANY MAKE IN ITS SUPPLEMENTAL**
181 **DIRECT ANALYSES TO REFLECT THE RECENTLY PASSED TAX**
182 **LEGISLATION?**

183 A. The recently revised federal tax legislation lowered the corporate tax rate and eliminated
184 bonus depreciation, which PacifiCorp reflected in its updated analyses. Prior to the tax law
185 changes, the federal corporate tax rate was 35 percent, which led to PacifiCorp having a
186 combined federal and state effective tax rate of 37.95 percent. The new tax law changes
187 lowered the federal corporate tax rate to 21 percent, and PacifiCorp's new combined
188 federal and state effective tax rate is now 24.587 percent. The change to the federal
189 corporate tax rate impacts the economic evaluation in three ways: 1) it reduces the amount
190 of income tax related revenue requirements associated with capital projects; 2) it increases
191 the discount rate, which results in lower present value benefits associated with repowering
192 projects; and 3) it substantially lowers the nominal benefits of PTCs, which are grossed up
193 for income taxes. The most significant impact of the three changes is the tax gross up of
194 the PTCs. Previously, with a 35 percent federal corporate tax rate, and a starting PTC
195 benefit of \$24/MWH in 2017, the grossed-up benefit of the PTCs was worth \$38.68/MWH.
196 Now, based on a 21 percent federal corporate tax rate, the grossed-up benefit of the PTCs
197 is worth \$31.82/MWH, which according to PacifiCorp's first supplemental response to
198 UAE 3.1, reduces the benefit of the repowered wind projects by \$177 million from what it
199 otherwise would have been had no federal tax law changes been made.

200 **Q. PLEASE DISCUSS THE CHANGE THE COMPANY MADE TO THE**
201 **METHODOLOGY IT USED TO REPRESENT PTCs IN ITS TO-2036 ECONOMIC**
202 **EVALUATION.**

203 A. It is important to note that costs and benefits that occur beyond 2036 are excluded from the
204 to-2036 analysis. In the Company's direct and rebuttal analyses, the Company treated PTC
205 benefits consistent with the way capital cost income tax effects and other capital related
206 revenue requirements were modeled in the economic evaluation, which was to levelize the
207 costs and benefits. In its supplemental direct testimony, the Company revised its approach
208 to modeling PTC benefits, and applied PTC benefits on a non-levelized basis. While the
209 Company did explain its reasons for making the change, it did not support the change based
210 on any new evidence or on new analyses it performed. Interestingly, it made the change
211 to model PTC costs on a non-levelized basis even though it previously justified modeling
212 PTC benefits on a levelized basis. In the Company's response to OCS 5.8, the Company
213 discussed that PTCs offset income taxes, and therefore, should be levelized the same way
214 that other incomes taxes are treated in deriving capital revenue requirements.⁶

215 Income taxes are a component of revenue requirement, which spreads the initial
216 up-front cost of assets over the life of those assets, accounting for return on
217 investment, return of investment, and taxes. Production tax credits (PTC)
218 represent a credit that offset income taxes, and therefore, a reduction to revenue
219 requirement. Considering that PTCs are a component of income taxes that are
220 included in revenue requirement, they are levelized over the life of the project
221 in the same way that other components of revenue requirement are levelized
222 (i.e., return on and return of investment).
223

224 **Q. DID PACIFICORP ATTEMPT TO EXPLAIN ITS DEPARTURE FROM THIS**
225 **REASONING?**

⁶ The Company's response to OCS 5.8 is included as OCS Exhibit 2.1 Response.

226 A. At line 189 of his testimony, Mr. Link did provide an explanation for the Company's new
227 approach to use non-levelized PTC costs in its to-2036 economic evaluations, in which he
228 stated:

229 This approach better reflects how the federal PTC benefits for the repowered
230 assets will flow through to customers and aligns the treatment of federal PTC
231 benefits in the system modeling results extending out through 2036 with the
232 nominal revenue requirement results extending out through 2050.
233

234 At the end of the day, PacifiCorp's new modeling approach ensures that the entirety of
235 PTC benefits will be captured in the to-2036 economic evaluation, while some of the
236 repowering tax costs and other capital related revenue requirements will be excluded from
237 that analysis.

238 **Q. IF PACIFICORP HAD CONTINUED TO MODEL PTCS AS LEVELIZED**
239 **BENEFITS, HOW WOULD ITS LATEST RESULTS HAVE CHANGED?**

240 A. I have determined that for the PaR Stochastic Mean case, the change in the PTC modeling
241 methodology added approximately \$197 million to the repowering benefits⁷. Table 1
242 below compares Mr. Link's latest to-2036 results (Link Table 5-SD column) to a revised
243 estimate of the results (Previous Approach column) assuming PTC benefits have been
244 modeled the same as PacifiCorp had previously modeled them in direct and rebuttal
245 testimony, in other words, based on a levelized profile.
246

⁷ OCS calculates that the impact of the change in the PTC modeling methodology is \$197 million. The Company supplied alternative estimates in response to DPU 26.14 and UAE 9.2; however, the Company's estimates understate the impact. The Company's most recent estimate from UAE 9.2 estimated that the impact was \$170 million. The understatement was caused by levelizing both the Status Quo and Repower PTC values using the same operating life assumption. The OCS calculation levelizes both separately consistent with the way the Company performed the calculation in prior workpapers.

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Table 1
PaR Stochastic Mean PVRR(d)
(Benefit)/Cost of Wind Repowering with
Price-Policy Cases
To-2036 Study (\$ million)

Price-Policy Scenario PaR to-2036	Link Table 5-SD PTC Costs Non-Levelized	Previous Approach (OCS estimate) PTC Costs Levelized
Low Gas, Zero CO ₂	(141)	56
Low Gas, Medium CO ₂	(139)	58
Low Gas, High CO ₂	(165)	32
Medium Gas, Zero CO ₂	(171)	26
Medium Gas, Medium CO ₂	(180)	17
Medium Gas, High CO ₂	(193)	4
High Gas, Zero CO ₂	(234)	(37)
High Gas, Medium CO ₂	(248)	(51)
High Gas, High CO ₂	(240)	(43)

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Q. DOES THE COMPANY'S CHANGE IN MODELING METHODOLOGY RAISE ANY OTHER CONCERN?

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A. Yes, the Company's change from modeling PTCs on a levelized basis to a non-levelized basis exposes another problem related to modeling capital revenue requirements. The Company states that its change in its to-2036 analysis to now model PTCs on a non-levelized basis better reflects how PTC benefits will flow through to customers through rates, however, it does not attempt to model capital revenue requirements in a similar way to better reflect how capital costs will flow through to customers. Essentially, the

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266 Company's latest to-2036 analysis maximizes PTC benefits, while minimizing the capital
267 revenue requirements in the analysis.

268 Capital revenue requirements are included in rates based on declining revenue
269 requirement profiles, but in economic analyses capital revenue requirements are typically
270 represented using a levelized revenue requirement profile. Because studies are performed
271 based on present value analyses, it would not make a difference how capital costs are
272 represented if the entire operating life of the resource existed within the length of the study
273 period. However, when the operating life of a resource exceeds the study period, such as
274 in the Company's to-2036 repowering analysis, then some of the capital revenue
275 requirements end up being excluded from the study. Depending on the way that capital
276 revenue requirements are represented in the economic analysis, either levelized or non-
277 levelized, can make a difference in the economic analysis results.

278 **Q. COULD YOU GIVE AN EXAMPLE DEMONSTRATING THAT THE WAY**
279 **CAPITAL REVENUE REQUIREMENTS AND PTCS ARE REPRESENTED**
280 **WOULD LEAD TO DIFFERENT COSTS BEING EXCLUDED IN THE**
281 **ECONOMIC ANALYSIS?**

282 A. Yes, the following graph compares cumulative net present value revenue requirements
283 (capital cost revenue requirements less PTCs) for the Rolling Hills projects using the
284 Company's original methodology that it used in direct and rebuttal testimony, "Levelized
285 Capital, Levelized PTC", and its new methodology, "Levelized Capital, Non-Levelized
286 PTC".

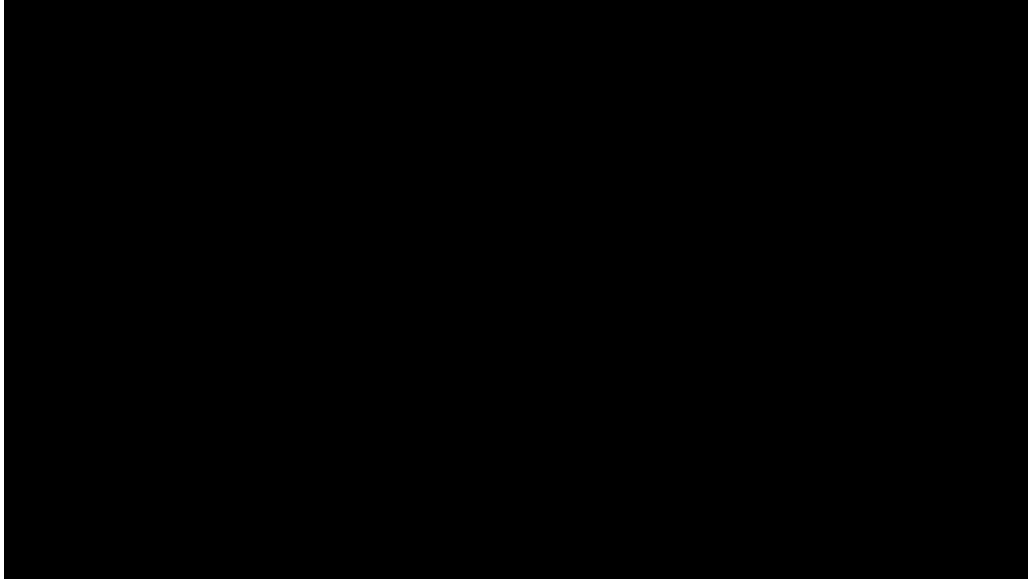
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Figure 1
Comparison of Net Project Costs
Cumulative Present Value Cost Streams

[BEGIN CONFIDENTIAL]



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The vertical line helps to highlight the results in the year 2036, which is significant for the to-2036 analysis. The figure indicates that in studies going through 2050, such as in the to-2050 analysis, the total costs captured in the analysis are identical since the two lines converge to the same point by 2050. The two different methods to represent the costs only affect economic analyses that end prior to 2050, such as in the to-2036 study. Based on the Levelized Capital, Levelized PTC methodology, as the Company previously relied on, some of the capital revenue requirements and PTC benefits are excluded from the to-2036 analysis. Based on the Levelized Capital, Non-Levelized PTC methodology, as the Company relied on in its latest filing, all PTC benefits occur within 10 years of when units are repowered and are fully captured in the to-2036 analysis, however, this PTC representation is inconsistent with the way capital revenue requirements are modeled. In

307 other words, while all PTCs are captured in the analysis, some of the capital revenue
308 requirements are excluded from the analysis. Furthermore, conceptually in ratemaking,
309 capital revenue requirements are typically front-end loaded, which means that capital
310 revenue requirements, which are collected from ratepayers through rates, fall over time due
311 to a declining revenue requirement profile.⁸ By moving from the Levelized Capital,
312 Levelized PTC approach as the Company had relied on in its direct and rebuttal testimony
313 to the Levelized Capital, Non-Levelized PTC approach for its supplemental direct
314 testimony, the Company maximized the inclusion of its PTC benefits, while it minimized
315 the inclusion of capital revenue requirements in its economic analysis.

316 **Q. HAVE YOU ESTIMATED THE IMPACTS OF THE CHANGE IN THE PTC**
317 **MODELING METHODOLOGY ON A PROJECT-BY-PROJECT BASIS?**

318 A. Yes. The following two tables compare the impact of the Company's current PTC
319 modeling approach (Link Table SD column) to its previous PTC modeling approach
320 (Previous Approach column) on a project-by-project basis, but otherwise using all of the
321 Company's latest assumptions from its supplemental direct testimony. Table 2 contains
322 results for the Low Natural Gas/Zero CO₂ case, and Table 3 contains results for the
323 Medium Natural Gas/Medium CO₂ case.

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⁸ This explanation is conceptual and would be completely correct if rates were reset on an annual basis.

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Table 2
Project-by-Project PaR Stochastic Mean PVRR(d)
(Benefit)/Cost of Wind Repowering with Low Natural Gas and
Zero CO₂ Price-Policy Assumptions

PaR To-2036 (\$ million)	Link Table 2-SD PTC Costs Non-Levelized	Previous Approach (OCS Estimate) PTC Costs Levelized
Glenrock 1	(21)	(1)
Glenrock 3	(6)	1
Seven Mile Hill 1	(28)	(4)
Seven Mile Hill 2	(6)	(1)
High Plains	(9)	13
McFadden Ridge	(3)	4
Dunlap Ranch	(22)	6
Rolling Hills	(7)	8
Leaning Juniper	3	18
Marengo 1	(25)	1
Marengo 2	(10)	2
Goodnoe Hills	(15)	1
Total	(149)	48

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Table 3
Project-by-Project PaR Stochastic Mean PVRR(d)
(Benefit)/Cost of Wind Repowering with Medium Natural Gas and
Medium CO₂ Price-Policy Assumptions

PaR To-2036 (\$ million)	Link Table 1-SD PTC Costs Non-Levelized	Previous Approach (OCS Estimate) PTC Costs Levelized
Glenrock 1	(21)	(2)
Glenrock 3	(7)	(0)
Seven Mile Hill 1	(28)	(4)
Seven Mile Hill 2	(7)	(2)
High Plains	(13)	10
McFadden Ridge	(4)	3
Dunlap Ranch	(26)	3
Rolling Hills	(9)	5
Leaning Juniper	0	15
Marengo 1	(33)	(7)
Marengo 2	(14)	(2)
Goodnoe Hills	(18)	(2)
Total	(180)	16

334 The first column (Link Table SD column) reflects the results based on the
335 methodology the Company used in its supplemental direct testimony (levelized capital
336 costs, non-levelized PTCs). The second column (Previous Approach) reflects the results
337 of an analysis based on all of the same assumptions except PTCs have been levelized,
338 which is the way the Company modeled them in its direct and rebuttal testimonies
339 (levelized capital costs, levelized PTCs). The results of the first column indicate that in
340 the supplemental direct filing, by changing the PTC modeling methodology PacifiCorp
341 was able to increase the benefits of each project substantially.

342 The results of Tables 2 and 3 highlight another important result of these analyses.
343 There are significant differences in the value of individual projects, and some projects
344 provide considerably more benefit than others. Even under the Company's new modeling
345 approach (Link Table SD column), there are projects that are either completely uneconomic
346 or just marginally economic. Some of the lesser economic projects include Glenrock 3,
347 Seven Mile Hill 2, High Plains, McFadden Ridge, Rolling Hills, and Leaning Juniper.

348 **Q. WHAT IS YOUR CONCLUSION BASED ON THESE RESULTS?**

349 A. I am concerned that the to-2036 results in PacifiCorp's latest filing appear to demonstrate
350 a bias in favor of the repowering projects. In other words, by modeling PTCs using nominal
351 costs and capital revenue requirements using levelized costs, the end result is that the PTCs
352 are maximized, and capital related revenue requirements are minimized in PacifiCorp's
353 analysis, resulting in many of the projects appearing to be economic under the Company's
354 revised modeling approach. It is important to keep in mind that what appears to be
355 economic today is driven by a methodology that from June 30, 2017 to January 31, 2018
356 was not even considered. PacifiCorp's to-2036 results do not demonstrate conclusively

357 that the least cost, least risk portfolio of resources have been identified, and customers will
358 face risks of higher costs, particularly with those projects that provide the least economic
359 value as mentioned above.

360 **Q. IN ACCORDANCE WITH THE COMMISSION'S ORDER, PACIFICORP'S**
361 **PROJECT-BY-PROJECT RESULTS FOCUS ON THE LOW NATURAL**
362 **GAS/ZERO CO₂ AND MEDIUM NATURAL GAS/MEDIUM CO₂ CASES. DO**
363 **YOU BELIEVE THESE FORECASTS ARE REASONABLE?**

364 A. Yes, I do, and I thought it was particularly reasonable that PacifiCorp has lowered its latest
365 natural gas price forecast. Every utility that I am familiar with as well as the Energy
366 Information Administration, just like PacifiCorp, continue to lower their natural gas price
367 forecasts. The trend towards lower long-term natural gas price forecasts has occurred
368 steadily for about the past ten years, and I have every reason to expect that this trend will
369 continue.

370 **Q. DO YOU HAVE ANY OBSERVATIONS REGARDING PACIFICORP'S LATEST**
371 **CO₂ FORECAST?**

372 A. Yes, since the Company's initial filing in June 2017, and its rebuttal filing in October 2017,
373 the Company updated its CO₂ forecasts based on information it received from third-party
374 vendors, **[BEGIN CONFIDENTIAL]** [REDACTED] **[END CONFIDENTIAL]**
375 The Company's latest CO₂ forecasts are lower and start later compared to the forecasts the
376 Company used in its direct testimony. In fact, the Company pushed out the start of when
377 CO₂ costs will first begin by five years in its Medium CO₂ scenario. Now the Company
378 anticipates that CO₂ costs will not begin until 2030, and since there is no expectation that
379 any CO₂ legislation will be passed anytime soon, it is reasonable to assume that in future

380 studies, PacifiCorp will continue to push out its CO₂ cost forecast and based on that there
381 may be no CO₂ costs through 2036. The farther out in time CO₂ costs are assumed to
382 begin, the less value CO₂ will contribute to the benefits of the repowering projects. I
383 continue to conclude from this that there is a high probability that natural gas and CO₂
384 costs will be in the low to medium price forecast range, and it is quite possible that there
385 will be no CO₂ costs, particularly in the to-2036 analysis study horizon.

386 **Q. THE COMPANY HAS ALSO PRESENTED TO-2050 STUDIES. DON'T THOSE**
387 **STUDIES ELIMINATE THE PROBLEM WITH THE TO-2036 STUDIES?**

388 A. They do, however, as I and others discussed in direct testimony, there are problems with
389 PacifiCorp's to-2050 economic evaluations, as well.⁹ One issue relates to the methodology
390 the Company uses to develop results during the 2037 to 2050 time-period. This is
391 particularly an issue in the Company's repowering study because there is a much larger
392 wind energy differential between the repowering case and the status quo case in the years
393 between 2037 to 2050, as compared to the prior years.¹⁰ The energy benefit derived over
394 the 2037 to 2050 time-period is an important component of the overall repowering benefit,
395 however the mechanics of the Company's modeling approach overstate the benefit during
396 that period.

397 **Q. PLEASE ELABORATE ON YOUR CONCERN WITH THE COMPANY'S TO-**
398 **2050 MODELING METHODOLOGY.**

⁹ See Division witness Mr. Dan Peaco's direct testimony at line 487.

¹⁰ The annual wind energy differential between the status quo case and the repowering case during the 2020 to 2036 time-period is approximately 739 GWH, and the annual differential increases to approximately [BEGIN CONFIDENTIAL] [REDACTED] [END CONFIDENTIAL] GWH in the 2037 to 2050-time period, an increase of [BEGIN CONFIDENTIAL] [REDACTED] [END CONFIDENTIAL]

399 A. Due to model runtime limitations, the Company chose not to run its production cost and
400 expansion plan optimization models (PaR and SO) beyond 2036. This modeling limitation
401 led the Company to derive a proxy method to develop wind energy benefits after 2036.
402 The method extrapolates replacement energy benefit rates derived over the period of 2027
403 to 2036, to determine replacement energy benefit rates over the 2037 to 2050 time-period.
404 Prior to 2037, the annual energy differential between the status quo and repowering case is
405 739 GWH per year. The Company then escalates those replacement energy benefit rates
406 and uses them in an extrapolation calculation to compute wind energy benefits during the
407 2037 to 2050 period when the differential in the wind energy between the cases is about
408 **[BEGIN CONFIDENTIAL]** [REDACTED] **[END CONFIDENTIAL]** GWH per year. The
409 Company's extrapolation method overstates the replacement energy benefits between 2037
410 and 2050.

411 **Q. WHY ARE REPLACEMENT ENERGY BENEFITS OVERSTATED BETWEEN**
412 **2037 AND 2050?**

413 A. As I discussed in my direct testimony, it is not reasonable to assume that the Company's
414 extrapolation approach to create wind energy benefits between 2037 to 2050 from
415 replacement energy rates computed from the 2027 to 2036 time-period would be an
416 appropriate proxy for deriving 2037 to 2050 wind energy benefits as compared to what
417 would have been derived using an optimal expansion planning and production cost
418 modeling approach. This is especially true given that the amount of replacement wind
419 energy during the two time-periods are completely different. In other words, the Company
420 computed a replacement energy benefit rate based on 739 GWH of wind energy per year
421 during the 2027 to 2036 time-period, and then escalated that result and used it to extrapolate

422 energy benefits during the 2037 to 2050 time-period when the annual wind energy
423 differential was much greater, [BEGIN CONFIDENTIAL] [REDACTED] [END
424 CONFIDENTIAL] GWH. Typically, a replacement cost calculation based on a smaller
425 amount of energy would lead to a higher per unit replacement energy cost than a similar
426 calculation based on a larger amount of energy. As such, I believe that PacifiCorp
427 necessarily overstated the value of the replacement energy benefit rate that it computed and
428 used to extrapolate wind energy benefits during the 2037 to 2050 time-period.

429 **Q. DID PACIFICORP ATTEMPT TO ADDRESS THIS ISSUE IN ITS**
430 **SUPPLEMENTAL DIRECT TESTIMONY?**

431 A. Yes, since several parties raised concerns about PacifiCorp's extrapolation methodology
432 in prior rounds of testimony, Mr. Link attempted to address this in his most recent filing.
433 At line 436 of his latest testimony, Mr. Link discusses the Company's use of its
434 extrapolation methodology and he provides an alternative calculation for deriving benefits
435 during the 2037 to 2050 time-period. Mr. Link explains that he used a forecast of flat Palo
436 Verde ("PV") market prices from the Company's December 29, 2017 OFPC to price out
437 the benefit of having an additional [BEGIN CONFIDENTIAL] [REDACTED] [END
438 CONFIDENTIAL] GWH of energy over the 2037 to 2050 time-period. Mr. Link
439 concludes his discussion by explaining that when using 100% of PV market prices, the
440 benefit of the wind repowering project is \$351 million or \$78 million higher than the result
441 he derived using his primary modeling methodology. I do not believe these results are
442 reasonable.

443 **Q. WHY DON'T YOU BELIEVE HIS 100% OF PV CASE RESULTS ARE**
444 **REASONABLE?**

445 A. I base my conclusion on my review of the Nominal Levelized Benefit results that Mr. Link
446 presents in his Table 7-SD. The first row of that table contains results from the Company's
447 original extrapolation methodology. The Nominal Levelized Benefit, which I have referred
448 to as the replacement energy benefit rate, is \$59.08/MWH in that case. The other rows
449 contain results based on his alternative PV methodology. Mr. Link presents 3 cases based
450 on his alternative methodology, one in which he priced out the benefits at 70% of the price
451 of PV, another at 100% of PV, and a third at 130% of PV.

452 As I discussed above, the Company's primary approach relied on an extrapolation
453 methodology to compute wind energy benefits during the 2037 to 2050 time-period that I
454 believe was overstated. Therefore, I believe the correct replacement energy benefit for the
455 2037 to 2050 period should have been lower than \$59.08/MWH as shown in the first row
456 of Table 7-SD, and any alternative approach should result in a replacement energy benefit
457 that would be lower than \$59.08/MWH. The only case using Mr. Link's alternative
458 methodology that had a replacement energy cost benefit that was less than \$59.08/MWH
459 was his 70% of PV case, which had a Nominal Levelized Benefit of \$49.49/MWH. That
460 case resulted in a wind repowering net benefit of \$213 million, which was much lower than
461 the \$351 million net benefit that Mr. Link discussed, it was also lower than the net benefit
462 from his original extrapolation methodology, which was \$273 million. These results
463 highlight the fact, that without performing proper modeling analyses, it would be
464 speculative to even consider the 70% of PV case result reasonable.

465 **Q. PLEASE DISCUSS YOUR SECOND CONCERN ABOUT THE COMPANY'S TO-**
466 **2050 MODELING METHODOLOGY.**

467 A. My second concern relates to the fact that the only resource expansion analysis the
468 Company conducted was for the 2017 to 2036 period. Without developing an optimal
469 expansion plan analysis for the 2037 to 2050 period, the Company assumes no other
470 resources would be added to the system over that time-period, which is unrealistic. This is
471 important because new resources would likely be added earlier in the status quo case
472 compared to the repowering case, due to the capacity and energy differential that exists
473 between the cases. Beginning in 2037, the status quo case is assumed to have
474 approximately 1,000 MW and [BEGIN CONFIDENTIAL] [REDACTED] [END
475 CONFIDENTIAL] GWH less capacity and energy on an annual basis, respectively,
476 compared to the repowering case since the repowered units are expected to operate for an
477 additional ten years beyond when the existing units retire. Without accounting for the
478 additional resources that would have been added earlier in the status quo case based on an
479 optimal expansion plan analysis, the benefits of repowering that the Company determined
480 have likely been overstated.

481 **Q. WHAT ARE YOUR OBSERVATIONS CONCERNING MR. LINK'S TO-2050**
482 **STUDY RESULTS?**

483 A. While the to-2050 results included in Mr. Link's Tables 3 and 6 indicate significant benefits
484 on a portfolio basis, for the reasons I discussed above, I believe the results are not
485 sufficiently credible, are overstated, contain cases that are not realistic, and ultimately
486 should not be relied on for deciding whether PacifiCorp should be allowed to repower its
487 wind units. But, if any consideration is to be given to the to-2050 analysis results, I believe
488 the focus should be on Mr. Link's Table 3-SD, which contains results of both the Medium
489 Natural Gas/Medium CO₂ and Low Natural Gas/Zero CO₂ cases on a project-by-project

490 basis. Note that in response to OCS 14.8, the Company acknowledged there was an error
 491 in Mr. Link's Table 3-SD, and it provided an updated table in that data response. The
 492 results affected the Marengo 1 project in just those tables. For convenience, I have
 493 reproduced the results from the discovery response below. The only lines that changed
 494 were the Marengo 1 results and the Total line, which are both approximately \$25 million
 495 less than what Mr. Link reported in his February 1, 2018 testimony. The values that
 496 changed from Mr. Link's original testimony are highlighted in green.

Table 4
Same as Link Table 3-SD with Marengo 1 Wind Tax Correction
Project-by-Project Nominal Revenue Requirement PVRR(d)
(Benefit)/Cost of Wind Repowering (\$ million)

Wind Facility PaR to 2050	Medium Natural Gas and Medium CO₂	Low Natural Gas and Zero CO₂
Glenrock 1	(\$33)	(\$33)
Glenrock 3	(\$11)	(\$6)
Seven Mile Hill 1	(\$41)	(\$40)
Seven Mile Hill 2	(\$10)	(\$6)
High Plains	(\$22)	(\$6)
McFadden Ridge	(\$7)	(\$2)
Dunlap Ranch	(\$39)	(\$23)
Rolling Hills	(\$15)	(\$5)
Leaning Juniper	(\$8)	\$0
Marengo 1	(\$50)	(\$22)
Marengo 2	(\$20)	(\$7)
Goodnoe Hills	(\$26)	(\$19)
Total	(\$282)	(\$170)

497

498 The fact that this table presents results on a project-by-project basis, is useful
 499 because it calls attention to the fact that there is significant variation in the repowering
 500 benefits between the different projects. For example, in the Low Natural Gas/Zero CO₂

501 case, the project benefits range from zero for Leaning Juniper to \$40 million for Seven
502 Mile Hill 1. Seven of the projects include small benefits less than \$7 million each.

503

504

III. ALTERNATIVE TO-2036 MODELING APPROACH

505 **Q. IS THERE ANOTHER MODELING APPROACH THAT COULD BE USED TO**
506 **REPRESENT CAPITAL REVENUE REQUIREMENTS AND PTCS IN THE**
507 **COMPANY'S TO-2036 ECONOMIC ANALYSIS?**

508 A. Yes, in the case of the repowering the Company's wind resources, the economic analysis
509 largely involves a trade-off between the capital revenue requirements and PTC and energy
510 benefits. Another option for modeling capital related revenue requirements is to represent
511 the capital revenue requirements using a non-levelized, declining capital revenue
512 requirement stream, similar to the way customers will pay for the revenue requirements
513 through rates, and similar to the way that PacifiCorp now proposes to represent the PTC
514 benefit stream.

515 **Q. COULD YOU PROVIDE A GRAPH DEMONSTRATING THE IMPACT OF**
516 **REPRESENTING CAPITAL REVENUE REQUIREMENTS AND PTCS IN**
517 **DIFFERENT WAYS?**

518 A. The following builds on Figure 1 above and demonstrates three ways that both PTCs and
519 capital revenue requirements could be represented; two of the lines reflect the ways
520 PacifiCorp has represented the costs and benefits in this proceeding, and the third is the
521 option that I am now discussing.

522

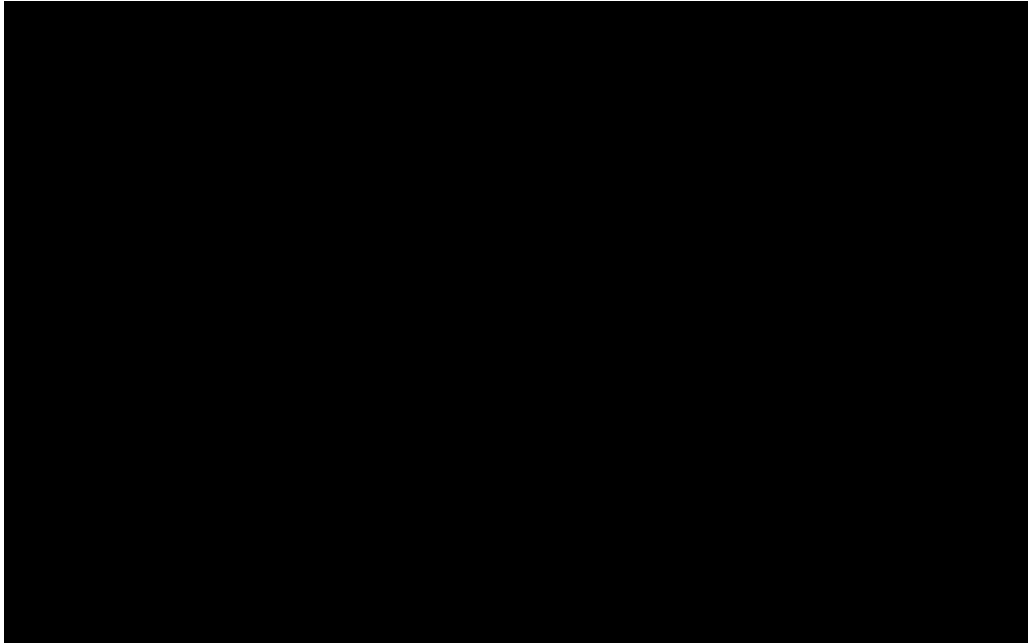
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Figure 2
Comparison of Net Project Costs
Cumulative Present Value Cost Streams

[BEGIN CONFIDENTIAL]



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[END CONFIDENTIAL]

531 The graph is for the Rolling Hills project and shows the capital revenue requirement
532 of the project reduced by the PTC benefits. The capital revenue requirements and PTCs
533 are either modeled as non-levelized costs or as levelized costs, and a calculation has been
534 performed to compute the costs as cumulative present value results, which is why the three
535 graphs converge to the same value when the end of the operating life of the unit is reached.
536 Before considering energy benefits, the graph indicates that by 2050 the cost to repower
537 the unit will exceed the PTC benefit, for a net cost of about **[BEGIN CONFIDENTIAL]**
538 **■ [END CONFIDENTIAL]** million. This figure demonstrates that regardless of how
539 these costs are represented, there is no difference in the results if the study period extends
540 to 2050, at which point the full life-cycle cost of the project is captured. However, if the
541 study period ends in 2036, as in the Company’s to-2036 analysis, then the net present value

542 cumulative costs captured in the study at 2036 are very different depending on how the
543 capital revenue requirements and PTC benefits are represented. The vertical line serves to
544 highlight the results at 2036.

545 The solid line reflects the results from the analysis that the Company reported in its
546 direct and rebuttal testimonies, in which capital revenue requirements and PTCs are both
547 levelized. The dashed line is from the Company's latest analysis in which capital costs are
548 still levelized, but PTCs benefits are represented as non-levelized values, and finally, the
549 line with the diamond markers is the third option I have mentioned, in which capital
550 revenue requirements and PTCs are both represented as non-levelized values.

551 **Q. WHAT ARE YOUR OBSERVATIONS REGARDING THIS GRAPH?**

552 A. The approach the Company used in its direct and rebuttal economic evaluations, in which
553 both capital revenue requirements and PTC benefits are levelized (solid line) would have
554 been the most conservative approach, and one that the Company may have continued to
555 rely on had the results been beneficial for all of the cases in the to-2036 study, which was
556 not the case (see Tables 1, 2, and 3 above). The approach the Company used in its
557 supplemental direct evaluation, levelized capital revenue requirements/non-levelized PTCs
558 (dashed line), will always result in the least amount of cost being captured in the economic
559 analysis because of the way that capital revenue requirements and PTCs are represented
560 and because of the way that some of the costs are excluded from the analysis. The third
561 line (diamond markers) reflects the goal of modeling both PTCs and capital revenue
562 requirements the same way, and in a way consistent with the manner that costs and benefits
563 flow through to customers in rates.

564

565 **Q. HAVE YOU PERFORMED THE TO-2036 PROJECT-BY-PROJECT**
 566 **EVALUATION BASED ON THE OPTION YOU HAVE INTRODUCED?**

567 A. Yes. Table 5 contains the results based on the case in which capital revenue requirements
 568 and PTCs are both modeled using non-levelized costs.

569 **Table 5**
 570 **Project-by-Project PaR Stochastic Mean PVRR(d)**
 571 **(Benefit)/Cost of Wind Repowering**
 572 **Non-Levelized Costs Both Capital and PTCs**
 573 **To-2036 Study (\$ million)**
 574

Price-Policy Scenario PaR to 2036	Low Gas/Zero CO₂	Med Gas/Med CO₂
Glenrock 1	(18)	(18)
Glenrock 3	(5)	(6)
Seven Mile Hill 1	(23)	(24)
Seven Mile Hill 2	(5)	(6)
High Plains	(4)	(8)
McFadden Ridge	(1)	(2)
Dunlap Ranch	(16)	(20)
Rolling Hills	(4)	(7)
Leaning Juniper	5	2
Marengo 1	(20)	(28)
Marengo 2	(7)	(11)
Goodnoe Hills	(11)	(14)
Total	(110)	(142)

575
 576 Based on this third approach, the results indicate there is a reduction of between
 577 21% and 26% in net benefits compared to the Company's current preferred method
 578 (levelized capital/non-levelized PTCs). It is clear from the three methods, that the to-2036
 579 study results are driven by the amount of capital revenue requirements and PTC benefits
 580 that are excluded from the study period. One advantage to the approach reflected in the to-
 581 2036 analysis results in Table 5 is that both capital related revenue requirements and PTC
 582 benefits are represented consistently using non-levelized profiles in the economic

583 evaluation, which is also consistent with the way those costs and benefits will flow through
584 to customers in rates.

585 Table 5 also indicates that the Glenrock 3, Seven Mile Hill 2, High Plains, McFadden
586 Ridge, Rolling Hills, and Leaning Juniper projects are the worst performing projects and
587 present the greatest risk to customers.

588 **IV. PREFERRED PROJECTS**

589 **Q. HAVE YOU CONDUCTED AN ASSESSMENT ON A PROJECT-BY-PROJECT**
590 **BASIS TO DEVELOP A BETTER SELECTION OF PROJECTS TO REPOWER?**

591 A. Yes, for this analysis, I focus on the results that I developed using the Non-Levelized
592 Capital Revenue Requirement, Non-Levelized PTC representation as presented in Table 5
593 above. I focused on the to-2036 analysis as opposed to the to-2050 analysis, because of
594 the concerns that I discussed with the to-2050 analyses, and out of a desire to ensure the
595 projects are economic over the near-term horizon. Also, as mentioned, the Non-Levelized
596 Capital Revenue Requirement, Non-Levelized PTC representation is consistent with the
597 way that capital costs are captured in rates during the 2017 to 2036 period.

598 The project-by-project results from the different analyses above, including Table 5
599 have demonstrated that Glenrock 3, Seven Mile Hill 2, High Plains, McFadden Ridge,
600 Rolling Hills, and Leaning Juniper have consistently been among the lesser economic
601 projects of all the projects the Company proposed. If the Commission would prefer to
602 authorize PacifiCorp to repower just the most economic projects, then I recommend that
603 these six projects should be eliminated and PacifiCorp should just be allowed to repower
604 the Marengo 1 and 2, Glenrock 1, Dunlap Ranch, Seven Mile Hill 1, and Goodnoe Hills
605 projects. By doing this, PacifiCorp could ensure that it would still obtain most of the

606 benefits while eliminating a substantial portion of the costs. This is a risk averse approach,
607 which I believe is important, particularly because so many questions about PacifiCorp's
608 modeling approach have arisen, and because PacifiCorp did not conduct any evaluation of
609 the risks of lower benefits if, for example, capital costs are higher than expected or energy
610 and PTC benefits do not fully materialize.

611 **Q. HAVE YOU PERFORMED AN ANALYSIS TO EVALUATE THE BEST AND**
612 **WORST PERFORMING PROJECTS?**

613 A. Yes. Table 6 below contains the same results as found in Table 5 for the Low Natural
614 Gas/Zero CO₂ case, but it has been rearranged, and includes additional information. The
615 top block of the table contains the most economic projects, and the bottom contains the
616 least economic projects that should be eliminated.

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Table 6
Low Natural Gas, Zero CO₂ Case
To-2036 PaR Stochastic Mean Analysis
Non-Levelized Capital Revenue Requirements
Non-Levelized PTCs
PVRR(d) \$millions

PaR to-2036 (Non-Levelized)	Investment Cost [CONFIDENTIAL]	Net Benefit
Seven Mile Hill 1	[REDACTED]	(23)
Marengo 1	[REDACTED]	(20)
Glenrock 1	[REDACTED]	(18)
Dunlap Ranch	[REDACTED]	(16)
Goodnoe Hills	[REDACTED]	(11)
Marengo 2	[REDACTED]	(7)
Most Economic % of total portfolio	[REDACTED]	(96) 87%
Glenrock 3	[REDACTED]	(5)
Seven Mile Hill 2	[REDACTED]	(5)
Rolling Hills	[REDACTED]	(4)
High Plains	[REDACTED]	(4)
McFadden Ridge	[REDACTED]	(1)
Leaning Juniper	[REDACTED]	5
Eliminated % of total portfolio	[REDACTED]	(14) 13%
TOTAL PORTFOLIO	[REDACTED]	(110)

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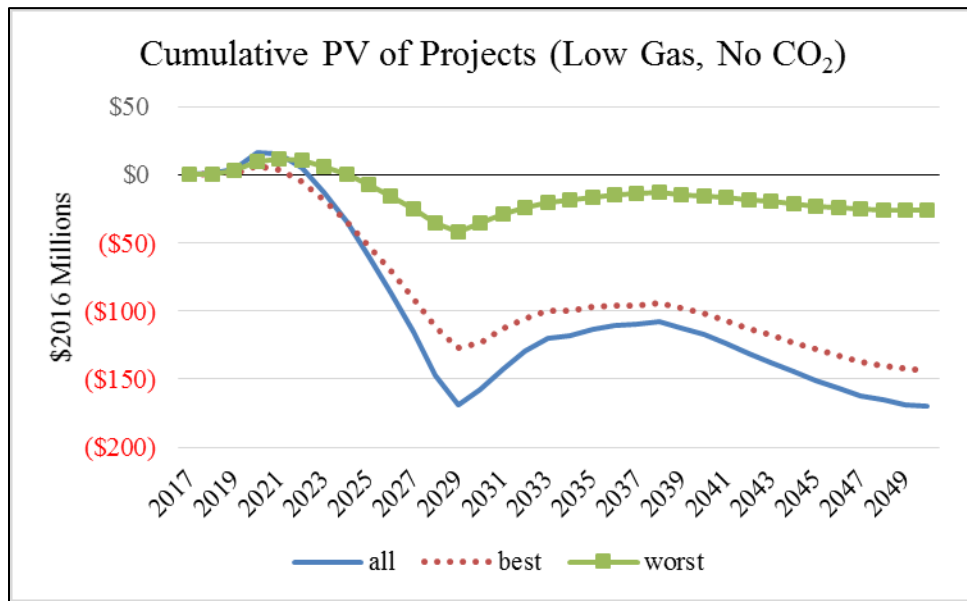
The results indicate that by repowering just the most economic projects, PacifiCorp could preserve 87% of the total benefits (\$96 million out of \$110 million total), while it would keep just [BEGIN CONFIDENTIAL] [REDACTED] [END CONFIDENTIAL] of the total investment costs [BEGIN CONFIDENTIAL] [REDACTED] [END CONFIDENTIAL] million out of [BEGIN CONFIDENTIAL] [REDACTED] [END CONFIDENTIAL] million). Correspondingly, [BEGIN CONFIDENTIAL] [REDACTED] [END CONFIDENTIAL] of the total investments costs would be eliminated ([BEGIN CONFIDENTIAL] [REDACTED] [END CONFIDENTIAL]).

633 [END CONFIDENTIAL] out of [BEGIN CONFIDENTIAL] [REDACTED] [END
634 CONFIDENTIAL] million).

635 Q. COULD YOU COMPARE THE RESULTS OF THE BEST AND WORST
636 PORTFOLIOS ON AN ANNUAL BASIS TO HIGHLIGHT THE BENEFITS OF
637 JUST REPOWERING THE BEST PROJECTS?

638 A. Yes. The following graph depicts the annual cumulative net present value benefits for all
639 projects grouped in their respective categories, in other words, the worst projects, which
640 include Glenrock 3, Seven Mile Hill 2, High Plains, McFadden Ridge, Rolling Hills, and
641 Leaning Juniper are grouped together, and the best projects, which include Marengo 1 and
642 2, Glenrock 1, Dunlap Ranch, Seven Mile Hill 1, and Goodnoe Hills are grouped together.

643 **Figure 3**
644 **Comparison of Portfolio Cumulative NPVRR(d) benefits**
645 **PaR through 2050 (Non-Levelized Capital, Non-Levelized PTC)**
646



647
648 This figure demonstrates that on an annual basis, if PacifiCorp were to repower
649 only the best projects, and eliminate the worst, customers would sacrifice very little.

650 **Q. PACIFICORP CONDUCTED ANALYSES OF DIFFERENT PRICE-POLICY**
651 **SCENARIOS, BUT DID IT CONDUCT ANY ANALYSES CONSIDERING THE**
652 **POSSIBILITY OF HIGHER CAPITAL COSTS OR LOWER WIND ENERGY AND**
653 **PTC PRODUCTION?**

654 A. No, it did not. I performed my own analyses to investigate the impacts on the best and
655 worst performing projects if a 5% increase in total capital cost and a 5% decrease in energy
656 production were to occur, which would lead to corresponding reductions in PTC and
657 energy benefits.¹¹ The Company has indicated that over [BEGIN CONFIDENTIAL]
658 [REDACTED] [END CONFIDENTIAL] of the total projects costs will be based on fixed costs, and
659 in the case of the capital cost sensitivity, I assumed that if a 5% increase in the total project
660 capital cost were to occur that could correspond to approximately a [BEGIN
661 CONFIDENTIAL] [REDACTED] [END CONFIDENTIAL] increase in the non-fixed projects
662 costs.¹²

663 In the case of the energy production sensitivity, I assumed that PacifiCorp's wind
664 energy turbines would only be able to produce 95% of the annual energy that PacifiCorp
665 estimated. I am aware that it would also be possible for the wind energy turbines to exceed
666 expectations, or for the wind energy production to be higher in one year and lower in the
667 next than forecast. However, I don't think it is unreasonable for purposes of a risk analysis
668 to determine potential impacts in the 5% range, considering it is a scenario easily within
669 the realm of possibility.

¹¹ Estimates based on the Company's provided modeling, as the Company did not provide System Optimizer and PaR models for intervenors.

¹² OCS calculation derived from Hemstreet workpaper.

670 **Q. WHAT ARE THE RESULTS OF YOUR 5% CAPITAL COST OVERRUN**
 671 **SCENARIO?**

672 A. Table 7 compares net benefit results of the different scenarios that I analyzed and includes
 673 net benefits results grouped by the best and worst performing projects for the Low Natural
 674 Gas/Zero CO₂ case. Table 8 provides the same results, but for the Medium Natural
 675 Gas/Medium CO₂ case. Four sets of results for the to-2036 analysis are presented,
 676 including what I refer to as the Base Case, which are the same results as included in Table
 677 4 above, the cost overrun sensitivity, the reduced energy production sensitivity, and finally,
 678 a combined sensitivity in which both the 5% capital cost overrun and the 5% reduction in
 679 energy production assumptions are modeled together.

680 **Table 7**
 681 **PaR Stochastic Mean PVRR(d)**
 682 **(Benefit)/Cost of Wind Repowering with**
 683 **Low Gas, Zero CO₂ Sensitivity Cases**
 684 **PTC and Capital Revenue Requirements Non-Levelized**
 685 **To-2036 Study (\$ million)**
 686

	Base Case	5% Cost Overrun	5% Reduced Production	Combined
LEAST ECONOMIC	(14)	(1)	4	17
MOST ECONOMIC	(96)	(74)	(65)	(43)
TOTAL	(110)	(76)	(61)	(26)

687
 688 The Least Economic row reflects the results of the worst performing group of
 689 projects. That group is economic only under the Base Case, but if Cost Overruns were to
 690 occur, or if there was a consistent reduction in energy production, the Least Economic set
 691 of projects would be nearly or completely uneconomic. Because the Most Economic
 692 projects produce positive benefits across all of the sensitivity cases, and because the

693 benefits of the Most Economic case are in fact greater in nearly every scenario compared
 694 to the case in which all of the projects are repowered (Total row), the Most Economic
 695 projects are clearly the least risk projects to ratepayers.

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Table 8
PaR Stochastic Mean PVRR(d)
(Benefit)/Cost of Wind Repowering with
Medium Gas, Medium CO₂ Sensitivity Cases
PTC and Capital Revenue Requirements Non-Levelized
To-2036 Study (\$ million)

	Base	5% Cost Overrun	5% Reduced Production	Combined
LEAST ECONOMIC	(26)	(13)	(8)	6
MOST ECONOMIC	(115)	(94)	(83)	(62)
TOTAL	(142)	(107)	(91)	(56)

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These results again demonstrate the value in pursuing just the best performing projects. Even in the Base Case, the Most Economic Projects alone achieve 81% of the total available benefits (115/142), and the ratio increases across each of the sensitivity cases. In fact, in the combined sensitivity case, customers would be better off if only the Most Economic projects were repowered. Overall, from a risk perspective, it would be better to limit the projects to just repower the best performing projects. However, I would point out once again, that this Medium Gas, Medium CO₂ case should be given less consideration than the Low Gas/Zero CO₂ Case because of the reasonable likelihood there may be no CO₂ costs imposed prior to 2036, and possibly not ever.

716 **Q. PLEASE SUMMARIZE YOUR CONCLUSIONS AND RECOMMENDATIONS.**

717 A. Based on my analysis I do not believe the Company has proven that repowering its wind
718 resources “will most likely result in the acquisition, production, and delivery” of electricity
719 to its customers at the lowest reasonable cost and least risk possible. The Company’s
720 modeling analyses do not provide convincing evidence that the repowering projects would
721 be economic. I have identified problems in both the Company’s to-2036 and its to-2050
722 economic analyses. Regarding the Company’s to-2036 analysis, I examined three potential
723 approaches to modeling PTCs and capital revenue requirements. Had the Company
724 continued to model PTCs using a levelized approach in its to-2036 analysis, as it had relied
725 on in its direct and rebuttal testimony, many of repowering projects would have been found
726 to be uneconomic in that analysis. The potential inaccuracy of the modeling results in both
727 the to-2036 study and the to-2050 study place significant risk on the ratepayer, particularly
728 given that the repowering projects can swing from being economic to uneconomic
729 depending on the modeling method used. I also do not believe the Company has considered
730 all risks that could affect the project including the possibility of cost overruns, lower wind
731 energy production and PTC benefits, and the possibility that other more economic
732 resources such as solar could be part of the Company’s least cost/least risk resource plan.
733 It is a consequential matter that the Company has not updated its wind and solar resources
734 for resource selection in its modeling analyses since the 2017 IRP, and therefore the “status
735 quo” comparison case that assumes no repowering projects likely is not optimal and the
736 Company’s analysis to select repowering may not be economic based on information that
737 has become available through both the 2017R RFP and the 2017S RFP.¹³

¹³ The Company acknowledges this in OCS 16.1 (a) and states that its wind and solar assumptions will not be updated until it conducts its 2017 IRP Update studies.

738 Based on these concerns, my primary recommendation is that the Commission
739 should deny the Company's repowering request. However, if the Commission is inclined
740 to permit the Company to proceed with repowering its wind projects, I have provided an
741 analysis of the most cost-effective set of projects to repower that I believe would result in
742 a significant savings in capital costs, without substantially reducing the total repowering
743 benefits, if they really exist. These projects include Goodnoe Hills, Marengo 1, Seven Mile
744 Hill 1, Dunlap Ranch, Glenrock 1, and Marengo 2. In addition, if the Commission decides
745 to allow the Company to proceed with repowering its wind power projects, I also
746 recommend that the Commission impose a set of ratepayer protection conditions. In
747 addition to conditions that I propose, which follow, Office witness Ramas presents other
748 conditions in her testimony.

749 **Q. WHAT CONDITIONS DO YOU RECOMMEND?**

750 A. If the Commission permits the Company to repower any of its wind projects, I recommend
751 that it impose conditions to protect ratepayers from risks associated with repowering its
752 projects. PacifiCorp has already acknowledged a willingness to accept some risks.
753 Beginning at line 105 of her rebuttal testimony, Ms. Crane states that PacifiCorp is willing
754 to accept risks associated with its performance. Both the Division and the Office asked
755 PacifiCorp to clarify this. In response to DPU 16.4, the Company explained the specific
756 risks associated with its performance as:

757 ...disqualification of some portion of anticipated project production tax credits
758 due to construction delays; failure to meet the 80/20 test; or failure to meet the
759 five-percent safe-harbor threshold (Crane rebuttal, lines 106-109).

760

761 It is evident that PacifiCorp's acceptance of risk is limited to whether it is able to qualify
762 for all PTC benefits that it anticipates it is eligible for. In response to OCS 16.3 PacifiCorp
763 clarified what "associated with its performance" would include, as follows:

764 an in-service delay and loss of production tax credit (PTC) value due to
765 insufficient planning and timely hiring of engineering, procurement, and
766 construction (EPC) contractors. Another example could be the Company not
767 having properly procured wind turbine generators to meet the 5 percent safe
768 harbor requirement.
769

770 **Q. DID PACIFICORP PROVIDE EXAMPLES OF RISKS THAT IT WAS**
771 **UNWILLING TO ACCEPT RESPONSIBILITY FOR?**

772 A. Yes, in the same response, OCS 16.3, PacifiCorp stated:

773 Example risks not attributable to the Company's performance may include
774 changes in electricity market prices once projects have been placed in service,
775 changes in state wind generation taxes, and changes in law or regulations after
776 construction has begun.
777

778 In that response PacifiCorp also stated that any less favorable outcome would have to
779 be assessed to determine whether the outcome was a "result of factors outside of the
780 Company's ability to influence."

781 **Q. ARE YOU SATISFIED WITH PACIFICORP'S STATEMENTS ABOUT THE**
782 **RISKS IT IS WILLING AND NOT WILING TO ASSUME?**

783 A. Not entirely. While I can understand that it might be outside of PacifiCorp's ability to
784 influence electric market prices, or taxes, or changes in law and regulations, I would be
785 concerned if PacifiCorp is taking the position that non-performance by one of its
786 contractors would be outside of its ability to influence. As between the ratepayer and
787 PacifiCorp, PacifiCorp is the party with the contracting, managing and oversight
788 responsibility and should assume full responsibility for the actions of its contractors. I

789 recommend that the Commission require PacifiCorp to assume all responsibility for the
790 successful completion of those projects that the Commission authorizes PacifiCorp to
791 repower, based on the schedule and the costs for those projects as identified in Mr.
792 Hemstreet's supplemental direct testimony.

793 **Q. ARE THERE OTHER CONDITIONS THAT YOU ARE RECOMMENDING?**

794 A. Yes, I recommend the following additional conditions be imposed. PacifiCorp should be
795 limited to recovery of future capital expenditures and O&M costs for the approved
796 repowering projects to the amounts that it included in its economic evaluation in its
797 supplemental direct filing. In addition, PTCs and energy benefits should be guaranteed at
798 95% of the amounts PacifiCorp assumed in its supplemental direct filing analysis for the
799 life of the repowered wind projects. I do not believe this is unreasonable as PacifiCorp has
800 expressed a high degree of confidence in its ability to forecast the amount of wind energy
801 that the projects will produce, and 95% was selected as a reasonable margin to allow for
802 some forecasting error.

803 **Q. DOES THIS CONCLUDE YOUR TESTIMONY?**

804 A. Yes, it does.