Rocky Mountain Power's Responses to Technical Workshop Questions

DPU QUESTIONS

1. Please explain the difference between the December 31, 2019 OFPC in the Avoided Cost Docket (19-035-18) and the December 31, 2019 OFPC in the Hedging Docket.

   PacifiCorp Response: *The OFPC is the same in both dockets. It appears that different market points were shown in docket 19-035-18 and in the Hedging Docket, which makes comparison difficult.*

2. Please provide a flow chart of how the avoided cost prices are determined (very brief as not to take up much time).
   PacifiCorp Response: *Please see the presentation accompanying these responses.*

3. Please describe how the proxy resources are chosen?

   PacifiCorp Response: *Please see the presentation accompanying these responses.*

4. Please explain the concept of effective capacity contribution as it relates to the Commission approved like-for-like deferral and the concept of the proxy resource, which is identified as the next deferrable generating unit in the Company's most recent IRP.

   PacifiCorp Response: *Please see the presentation accompanying these responses.*

5. In interpreting renewable resources of the same type, you have indicated that the "type" is meant to reflect the operational characteristics of the QF on the Company's system. Please provide a brief description of the difference between the operational characteristics of the Wyoming wind resource and the Utah wind resource?

   PacifiCorp Response: *As proposed and approved under the current Proxy/PDDRR methodology, a Wyoming wind resource and a Utah wind resource are both considered the same type, i.e. "wind". PacifiCorp's proposed a non-routine change for wind because the evidence indicates that the current Proxy/PDDRR methodology does not result in reasonable avoided costs for wind, as resulting avoided costs when deferring Wyoming wind are in excess of the costs associated with resources that are comparable to the QF.*

6. Please explain why is the avoided costs associated with Wyoming wind deferral is greater than that associated with the deferral of Utah wind?

   PacifiCorp Response: *The capital and fixed costs associated with the Gateway South transmission are a significant amount of the total price, amounting to approximately $23/megawatt-hour ("MWh") in 2024, which is much of the increase in avoided costs for the*

Wyoming wind resource relative to the Utah wind resource. Because the Wyoming wind proxy has a lower capacity contribution than the Utah wind proxy and avoided fixed costs are based on capacity equivalent amounts, fixed costs are a greater portion of the total avoided cost when the Wyoming wind proxy is deferred. Because avoided fixed costs are more closely tied to capacity needs and capacity value, they tend to provide greater value than avoided energy costs.

7. Please provide a brief explanation of capacity contribution (ELCC, LOLP, LOLE) theory and calculation.

   PacifiCorp Response: *Please see the background provided by WRA, and the response the WRA2. This topic is also addressed in the presentation.*

8. Please explain the difference between the 12x24 and 8760 analysis. How would, which of these profiles you use impact the calculation of capacity contribution?

   PacifiCorp Response: *The difference between the 12x24 and 8760 analysis is the granularity of the loss of load probability (LOLP) data used in the capacity factor approximation method calculation. The 8760 LOLP data reflects shortfall timing that is tied to the profiles of the renewable resources in the portfolio being evaluated and which vary from day to day as well as from hour to hour. Loss of load events are likely to be highest when resource availability is lowest, especially when lots of resources with similar generation profiles have reduced output at the same time. The renewable resource profiles in the 2019 IRP were based on CY2017 hourly generation profiles, while those in the GRID model reflect more recent data from CY2018. Applying the 8760 LOLP data directly to the CY2018 hourly generation profiles would fail to account for the correlation between the LOLP events and the renewable generation profiles.*

   To account for this relationship between LOLP and generation profiles, PacifiCorp calculated the ratio of the capacity contribution under the 12x24 LOLP and under the 8760 LOLP for each of the proxy wind and solar profiles in the 2019 IRP (i.e. each of the five states that were modeled). Details on these calculations are shown in the workpaper provided for UCE9. Because there is a lot of Utah solar and a lot of Wyoming wind, these resources have a relatively large impact on the distribution of LOLP events, so they have larger adjustments. This results in a lower capacity contribution for these resources, and is also consistent with a declining capacity contribution as resource penetration increases.

9. Please explain the interplay between the IRP portfolio selection and the PDDRR methods?

   PacifiCorp Response: *The basic principle of the Proxy/PDDRR methodology is that the resources included in the preferred portfolio are the most cost-effective combination of the proxy resource options available. Cost-effective resources included in the preferred portfolio are available for deferral by a QF, but renewable resources in the preferred*

portfolio can only be deferred by QFs of the same type, i.e. wind by wind, solar by solar. In the absence of renewable resources of the same type as a QF, all resources are eligible to defer thermal resources in the preferred portfolio.

10. Please explain, for Schedule 37, the difference between the wind avoided costs based on the deferral of Wyoming wind and Utah wind and what accounts for that difference?

    PacifiCorp Response: *Please see the response to DPU6.*

11. Please provide a brief description of the rationale behind the non-routine update to wind pricing when the Proxy/PDDRR method does not allow deferral on not cost-effective resource.

    PacifiCorp Response: *The basis for excluding deferral of resources that are not cost-effective is that avoided costs could be excessive, as the cost of deferred asset would be higher than the benefits it provides. In this instance, avoided costs based on a resource that was not shown to be cost-effective (UT wind) are lower than avoided costs based on the cost-effective alternative (WY wind). To the extent there are concerns about UT wind being not cost-effective, the solution would be to make avoided costs lower.*

    The basic principle of the Proxy/PDDRR methodology is that the resources included in the preferred portfolio are the most cost-effective combination of the proxy resource options available. But the essential principle of PURPA is that costs should not exceed the cost the utility would incur to acquire equivalent capacity and energy. The proxy UT wind resource is directly equivalent to the UT wind QF for which pricing has been prepared. Recognizing that the IRP assumes that PacifiCorp has the option to acquire an equivalent resource based on the costs in the supply-side table, it would be inconsistent with PURPA to require customers to pay more than that cost.

OCS QUESTIONS

1. Please discuss in detail the major factors for the changes in capacity contributions for wind and solar in the table below (from previous filings to the current filing). Table 1 figures are from Lines 355 – 356 of Mr. MacNeil's testimony. Contribution factors from previous filings are from 2018 & 2019 Schedule 37 filings in Utah.

Capacity Contribution	Previous Filings	Table 1 Current Filing
Wind	15.8%	17.9%
Fixed Solar	37.9%	4.3%
Tracking Solar	59.7%	9.9%

Gas	100.0%	100.0%

PacifiCorp Response: *Both versions reflect the capacity factor approximation methodology. Under this methodology there are two factors in the calculation: a resource's expected generation profile (hourly capacity factor) and the distribution of loss of load events across the year. For the 2019 IRP, the capacity factors used to develop capacity contribution values are resource-specific, rather than having a single value for all wind or solar resources on the east side of PacifiCorp's system. For wind, much of the east-side wind resources were in Wyoming, with significant correlation that is not present in Utah wind resources. As shown in Table 1, the capacity contribution of Wyoming wind resource in the 2019 IRP (at Aeolus) is 12.7%, a reduction from that in the 2017 IRP. This indicates that a portion of the increase in the wind capacity factor is associated with moving to a Utah-specific wind profile. Because the capacity factor of the east-side solar resources used tin the 2017 IRP were all in Utah, this is not expected to be a significant driver for solar. Instead, the reduction in solar capacity contribution is attributable to changes in the distribution of loss of load events across the year. This is driven by increasing penetration of solar resources in the Company's portfolio. As more solar resources are added, loss of load events become decreasingly likely during daytime hours, and proportionately more likely in evening hours when solar resources are not generating.*

2. Refer to Table 2 from Mr. MacNeil's testimony below.
    a. Please discuss in detail the reasons for the differences between the price for a base load resource and the price for each of the other four resources (wind & solar). What are the major factors for each difference?

    PacifiCorp Response: *There are two major factors in the price differences, the energy value of generation profile of each QF type, and the assumed resource deferral. These factors can be partially broken apart by looking at the annual price detail on tab "Table 3 Comparison" of the first three years of the non-confidential workpaper "20-035-T04 RMP Appendix 1 - AC Study Summary 03-26-20.xlsx" provided with the Company's April 9, 2020 filing.*

    b. Please discuss why the very low solar prices are reasonable? How do these solar prices compare to market prices – i.e. could the Company purchase power from the market at such prices? Please explain.

Table 2: Schedule 37 Avoided Cost by Resource and Start Date

15 Year Nominal Levelized Prices @ 6.92% Discount Rate ($/MWh)			
	Start Date		
Resource	2021	2022	2023
Base Load	$29.14	$31.47	$34.02
Wind Defer WY	$57.73	$65.19	$73.20
Wind Defer UT	$30.07	$33.26	$36.62
Fixed-Tilt Solar	$14.80	$15.41	$15.92
Tracking Solar	$17.61	$18.47	$19.33

PacifiCorp Response: *The solar prices are lower than market prices. Please refer to the workpaper accompanying this response for details. Through 2023, solar prices reflect primarily reduction in relatively low-cost coal generation, with modest impacts to gas generation and market transactions. Avoided costs are less than market due to transmission limits and market sales caps. Once all market purchases are avoided and market sales limits are reached, avoided costs reflect savings from backing down lower cost resources. Because of the large quantity of solar resources in PacifiCorp's portfolio, in many hours market sales limits are already reached prior to the addition of the QF.*

Starting in 2024, roughly 75% of the avoided cost is associated with the fixed costs of the deferred proxy solar and storage resource from the 2019 IRP. Over time, the energy value from the solar QF increases, reaching roughly 50% of the total by the end of the study period.

3. The Company proposes that a Utah wind QF would displace the customer preference Utah wind resource in the 2019 IRP Preferred Portfolio. Please discuss if it is actually possible for a wind QF to replace the customer preference resource – i.e. would the customer accept a wind QF as a replacement resource and would the contract with the customer allow for such a substitution?

PacifiCorp Response: *The customer preference Utah wind resource in the 2019 IRP preferred portfolio is a proxy intended to represent a generic supply to meet customer demand for renewable resources and is not assigned to a specific customer. In accordance with prior Commission orders, the Company would retain the renewable energy credits (RECs) associated with the QF starting in 2023, and those RECs could technically be sold to a specific customer. Many customers seeking RECs look for "additionality", the idea that, but for their contribution, a project would not have been built. Because QFs are a must purchase obligation and payment for the REC is part of the avoided cost price, they are unlikely to be considered additional, so many customers might not be interested. PacifiCorp would also note that there are a vast number of new renewable resources in the IRP. All renewable resources in the 2019 IRP preferred portfolio that were not added for customer preference requirements were cost-effective without assuming any REC value. To the extent customers are interested in acquiring RECs from the wind QF in*

this example, there are significant quantities of equivalent RECs available from current and planned resources.

4. Please explain why it is appropriate that a tracking solar QF would replace a solar/battery combination resource from the 2019 IRP.

PacifiCorp Response: *Deferral of solar/battery from the 2019 IRP by a tracking solar QF is consistent with the Company's current implementation of the Proxy/PDDRR methodology, as solar QFs that include battery storage have been assumed to defer stand-alone solar resources in the IRP preferred portfolio. Regardless of whether the solar resource in question is a QF or a proxy resource, the addition of a battery allows a portion of the generation to be shifted to periods with greater loss of load probability, increasing the capacity contribution relative to a solar resource on its own. However, the capacity contribution associated with the underlying solar asset is still present. In the 2019 IRP, the solar resource corresponds to roughly one third of the total contribution, while the battery represents two-thirds. Capacity deferral based on a resource that is effectively one-third solar is still preferable to deferral of resources without any solar characteristics.*

5. It appears that the Company is proposing that if a QF displaces wind in Wyoming, the QF would also receive credit for displacing part of the GWS transmission line. Please explain how this additional credit would be calculated. Also, please explain why it is appropriated for a small QF resource to defer part of GWS when transmission investments are very lumpy – i.e. essentially you build all of it or none of it.

PacifiCorp Response: *In the January 23, 2019 order in Docket 17-035-37, the Commission required the Company to include both wind resources and associated transmission as deferrable resources for wind QFs. At that time, the resource was associated new wind as part of Energy Vision 2020, and the transmission was the Aeolus-to-Bridger/Anticline transmission line. The situation at this time is analogous, so the calculation of avoided costs based on the Wyoming wind resource was consistent with that past precedent and included costs associated with Gateway South. PacifiCorp agrees that transmission investments are lumpy, but notes that one of the premises of the Proxy/Partial Displacement Differential Revenue Requirement methodology is "partial displacement". Under the Proxy/PDDRR methodology, resources are displaceable until a commitment has been made to acquire them (or not acquire them). Details on the calculation of the credit are available in the non-confidential workpaper "20-035-T04 RMP Wkpr - Avoided Cost Study-WY Wind 03-26-20.xlsx" provided with the Company's April 9, 2020 filing.*

UCE QUESTIONS

1. Please provide a table with a step comparison of the impact on each resource type of each element of the Proxy/PDDRR methodology that has changed, similar to the Step Study in Appendix C of the Company's January 10 2019 Q3 filing, including,

a. The avoided cost impact of the addition of a geographic component to the determination of the resource type, compared to deferral based solely on technology type.
b. The avoided cost impact of the new 2019 IRP capacity contribution values, compared to the capacity contribution values used previously for each resource type.
c. Any additional changes or enhancements to the Proxy/PDDRR methodology not described above.

PacifiCorp Response: *The Company as not identified the specific impacts of each change for each resource type. In general changes are related to either a resource's generation profile, or its assumed capacity deferral. Base load resources have a uniform generation profile across the day and the year, so they are impacted equally by changes in all periods. Solar resources have high output during the day and during spring/summer/fall. Wind resources often have slightly higher output in the evening and in the winter, somewhat opposite of solar. To the extent market prices are uniformly higher, all resources would experience higher avoided costs. This effect could be muted to the extent market prices are only a small portion of the avoided cost results, as avoided coal costs would not be impacted, for instance. With the addition of new solar resources, the impact on solar pricing would be higher than the impact shown for a baseload resource, and the impact on wind pricing would likely be lower than the impact shown for a base load resource. To provide another data point for interpreting the impact of solar resource costs in the 2019 IRP, the workpaper accompanying these responses provides the estimated first-year real-levelized costs for solar resources in Utah from the 2019 IRP, by year.*

Resource Deferral Determination Enhancements to Proxy/PDDRR

1. **Please refer to Rocky Mountain Power witness Daniel J. MacNeil's April 2020 direct testimony regarding identification of like resource types.** Does the Company's practice of defining resource "type" based on five different geographic locations, in addition to technology of the resource, affect any elements of the avoided cost methodology other than identification of the proxy resource?

   PacifiCorp Response: *Yes. Geographic location is used to account for the difference between 8760 LOLP and 12x24 LOLP. This is used to determine the capacity contribution of each wind or solar resource.*

2. **Please refer to Rocky Mountain Power witness Daniel J. MacNeil's April 2020 direct testimony regarding identification of like resource types.** Are there any combinations of resource technology and geographic location that a developer might want to build as a QF that do not have a good corollary for a proxy resource in the 2019 IRP?

   PacifiCorp Response: *To the extent geographic location is a driver of weather conditions that are also impacting nearby resources, then it will impact capacity contribution. While five geographic locations are identified in the IRP, the hourly wind and solar shaping used to model QFs accounts for differences in location and generation profile. The "like-for-like" methodology does not distinguish between location, so all wind and solar resources will have a proxy. All other resource types would be assumed to defer thermal resources, e.g. the 2026 SCCT.*

Tracking Solar QF Compliance Prices

3. **Please refer to Appendix B.2 of the 2019 Q3 Quarterly Compliance Filing**. Please explain the derivation of $1,228/kW figure shown in 2024 on Table 3. Please reconcile this calendar year 2024 figure with the $1,609/kW plant capacity cost figure shown at the bottom of this table.

   PacifiCorp Response: *The 2019 IRP includes cost escalation rates solar, wind, and battery storage that are less than inflation. All other resource capital costs are assumed to grow over time at inflation. The assumed rates were shown in Figure 6.3 in the 2019 IRP. Cost de-escalation between 2018 and 2024 results in the referenced values.*

4. **Please refer to Appendix B.2 of the 2019 Q3 Quarterly Compliance Filing**. Please refer to Table 1 in the appendix. In the Capacity Price column, PacifiCorp calculates a capacity price of $28.04/kW-yr starting in 2024 and escalating in each subsequent year. In the workpaper deriving these values, it appears that PacifiCorp has calculated a capacity amount using an IRP resource with a nameplate capacity of 24.72 MW and then used 80 MW for the QF to determine the QF price in $/kW-yr. Under the like for like QF regimen, please explain why these two MW values are not the same. Under PacifiCorp's calculation, isn't the capacity value of 24.72 MW simply being distributed across the 80 MW QF resource? Put another way, isn't the capacity credit for the 80 MW QF resource being constrained to just 24.72 MW of displaced like-for-like capacity?

   PacifiCorp Response: *The QF tracking solar resource has a lower capacity contribution than the proxy solar + storage resource from the IRP preferred portfolio. "Like-for-like" does not mean that capacity contribution is identical – for example, both fixed and tracking solar are considered "solar", while they have different capacity contributions. Details on these calculations are shown in the workpaper accompanying these responses.*

5. **Please refer to Appendix B.2 of the 2019 Q3 Quarterly Compliance Filing**. Please refer to Table 1 in the appendix. Note the capacity price of $28.04 kW/yr for 2024. Under the like-for-like regime, shouldn't the $kW-yr capacity price in 2024 instead equal the $90.76 kw-yr Total Resource cost for 2024 shown in Table 3, col (h), if the technologies used for the deferred resource and QF resource are identical?

   PacifiCorp Response: *As discussed in the response to question 4, the technologies of the deferred resource (tracking solar with storage) and the QF resource (tracking solar) are not identical.*

Wind QF Compliance Prices

6. **Please refer to Appendix B.3 of the 2019 Q3 Quarterly Compliance Filing**. Please fully explain how the lost Production Tax Credits (PtCs) are reflected in the avoided costs prices for wind QFs. Please provide a schedule showing the derivation of the lost PTC and include the derivation of the PTC $/MWh credit used in each year.

PacifiCorp Response: *The GRID model dispatches all wind and solar resources that can be controlled by PacifiCorp (i.e. not QFs), based on their economics, which include the loss of contracted renewable energy credits (RECs) and production tax credits (PTCs), where applicable. For details on the derivation of the lost REC and PTC volumes, please refer to the Confidential workpapers with names containing "GRID AC Study" provided with PacifiCorp's April 9, 2020 filing. Specifically, tab "Trapped Adj" within those files. The GRID model does not support negative values, so a formulaic adjustment is used to represent resources with negative costs in GRID in a manner that ensures economic dispatch. Details on the PTC credit values are provided in the workpaper accompanying these responses.*

PacifiCorp Non-Routine QF Wind Pricing Proposal

7. **Please refer to Rocky Mountain Power witness Daniel J. MacNeil's April 2020 direct testimony regarding the proposed non-routine change for wind QF pricing**. Is PacifiCorp intending to displace the Utah customer preference resources with any QF resource if this non-routine change was adopted?

   PacifiCorp Response: *The Company is proposing that the Utah customer preference wind resource in the preferred portfolio would be displaced by Utah wind QFs that request avoided cost pricing. If those Utah wind resources are fully displaced, the Company will continue to use the costs and characteristics of those resources to calculate avoided costs, by adding Utah wind resources with equivalent capacity to the QF in the base study and removing them in the avoided cost study with the QF added. The Company is not aware of any specific wind QFs that this would apply to at this time.*

8. **Please refer to Rocky Mountain Power witness Daniel J. MacNeil's April 2020 direct testimony regarding the proposed non-routine change for wind QF pricing**. In deriving the Wyoming wind + transmission prices described in the testimony (and in the 2019 Q3 Quarterly Report), has PacifiCorp made any adjustments to the avoided cost prices to reflect lost transmission benefits as permitted by the PSC's Final Order in Dockets 17-035-T07/17-035-37? If not, please explain why the avoided cost price was not adjusted for any lost transmission benefits as ordered by the Commission.

   PacifiCorp Response: *When Wyoming wind and transmission is deferred, the transmission transfer capability modeled in GRID associated with Gateway South was reduced at the same time, consistent with the Commission order in Dockets 17-035-T07/17-035-37. The 2019.Q3 report shows Utah wind avoided costs that include the non-routine change, so it doesn't include deferral of Gateway South transmission. The "Wind Defer WY" scenario provided in the Supplemental filing and in support of the proposed Schedule 37 rates does include a reduction of the Gateway South transfer capability within the GRID model, along with the associated costs in the avoided cost results.*

2019 Capacity Contribution study

9. **Please refer to Rocky Mountain Power witness Daniel J. MacNeil's April 2020 direct testimony regarding adjustments to capacity contributions from the 2019 IRP**. Please provide a chart showing the adjustments made to capacity contributions for each resource type, as described in lines 337 – 341.

   PacifiCorp Response: *Please refer to the workpaper accompanying these responses.*

10. **"Table 1: Proxy Resource Deferral Calculations"** shows a capacity contribution of 17.9% for wind, 4.3% for fixed tilt solar, and 9.9% for tracking solar (line 355). Please explain how these figures relate to the capacity contribution value for wind and solar as identified in the 2019 IRP, and why they are different. (See 2019 IRP Figure 5.3 – Summer Peak Capacity Contribution Value for Wind and Solar, and Figure 5.4 – Winter Peak Capacity Contribution Value for Wind and Solar.)

    PacifiCorp Response: *The referenced values represent the capacity contribution of incremental resources relative to the Company's preferred portfolio in testimony. These are analogous to the values presented in Appendix N: Capacity Contribution Study, specifically figure N.4.*

    The capacity contribution values for wind and solar in Figures 5.3 and 5.4 reflect the average capacity contribution of all wind and all solar in the portfolio, including both proxy resource additions and owned and purchased resources already present in PacifiCorp's portfolio. As discussed in Appendix N, capacity contribution values decline as penetration of resources with correlated output increases. As a result, the average capacity contribution for wind and solar shown in Figures 5.3 and 5.4 is higher than that reported in Appendix N and used for avoided cost calculations. The significant decline in capacity contribution in 2024 seen in Figures 5.3 and 5.4 is related to the sizeable additions of proxy wind and solar resources in the preferred portfolio in that year. The magnitude of the additions, and the relatively low incremental capacity contribution, results in a significant reduction in the overall average contribution, as shown.

Displacement of Solar and Storage

11. **Please refer to Rocky Mountain Power witness Daniel J. MacNeil's April 2020 direct testimony, lines 369 – 377.** Please describe how the Proxy/PDDRR methodology is used to determine avoided costs for a solar QF deferring a solar and storage resource.

    PacifiCorp Response: *Please refer to the PacifiCorp's response to UCE4, particularly the accompanying workpapers. A solar and storage resource has a significantly higher capacity contribution than a solar-only resource of equivalent size. Resource deferral under the Proxy/PDDRR methodology is based on equivalent capacity contribution, so a solar-only QF defers a smaller nameplate capacity of the proxy solar and storage resource from the 2019 IRP preferred portfolio. As shown in the workpaper for UCE4, an 80 MW QF would defer 24.7 MW of solar and storage in 2024. The storage component is 25% of the solar nameplate, with four hour duration, so the QF defers approximately 6.2 MW of battery capacity (24.7 MW * 25%) and 24.7 MWh of storage capacity (24.7 MW * 25% * 4 hours).*

WRA QUESTIONS

Background. The effective load carrying capability (ELCC) method appears to be the most accurate way to calculate the capacity contribution of renewable resources (*see, e.g.*, this recent WIRAB webinar on long-term resource adequacy, with associated slide presentation (page 16)). In its August 16, 2013, *Order on Phase II Issues*, the Commission directed PacifiCorp to calculate capacity contribution of wind and solar resources using either the ELCC or capacity factor approximation methods (as outlined in this NREL paper) because those methods "reasonably account for [loss of load probability (LOLP)]." Page 30. While the ELCC was recommended as the industry standard approach, parties also recommended the capacity factor approximation approach because it was less data intensive, reasonably accurate, and simpler to compute.

1. Please provide a process example of how the Company calculated the capacity contribution of a proxy resource (e.g. a wind resource). Include explanations about how this process augments or differs from the capacity factor approximation method (CFAM).

PacifiCorp Response: *Please refer to the presentation accompanying these responses.*

2. After seven years since the 2013 Order, given enhancements in computing power and PacifiCorp's increased experience with wind and solar resources, does the data intensity of the ELCC method still pose an obstacle to using this method? Please explain why or why not.

PacifiCorp Response: *Under the equivalent load-carrying capability (ELCC) method, a quantity of a resource is added and load is increased until the loss of load hours from the portfolio are equal to level in the portfolio without the added resource. Loss of load hours can only be determined when viewing a wide range of conditions, for instance PacifiCorp's analysis uses 500 iterations of stochastic load, hydro conditions, and thermal outages. Even with improvements in computing power, this is still several days of analysis using PacifiCorp's existing models. Furthermore, this analysis must be repeated for every resource and location, so it is a very extensive analysis. The equivalent conventional power method is a variant of the ELCC method wherein the resource being evaluated is added and the nameplate capacity of a conventional resource (e.g. a simple cycle combustion turbine) is reduced until loss of load hours are equal to the original level. The data and analytical requirements are comparable to the ELCC method.*

Both of the aforementioned methods provide a snapshot of capacity contribution for a single resource, relative to a static portfolio. Because the IRP is evaluating futures with dramatic changes in the resource portfolio over time, results based on these methods can rapidly become obsolete. For example, additions of solar resources can result in declining capacity contributions for solar, but may result in higher capacity contributions for batteries because loss of load events become concentrated in a

shorter period in the evening, rather than spanning the afternoon and evening. This result is inherently dynamic and the ELCC method is not designed to account for these relationships.

3. According to this NREL paper (page 13), approximation methods are reasonably accurate relative to ELCC so long as there is a strong correlation between high demand and LOLP. As the amount of renewable energy on the grid increases and as net load may be more relevant to system reliability relative to peak periods, does that correlation still hold? That is, is LOLP still correlated primarily with high demand (or is it also correlated with mismatches between net load and resource availability)?

PacifiCorp Response: *The referenced NREL paper distinguishes between risk-based methodologies, and time-period based methodologies. Time-period based methodologies substitute high demand for LOLP, so a strong correlation between demand and LOLP is necessary for accurate results. The CFAM uses a single LOLP estimate, so it is a risk-based methodology, though it is simplified, and it is able to capture the impact of net load, as reflected in LOLP results. For a 1MW resource being added to a large portfolio, the results of the CFAM are effectively identical to a more data intensive ELCC calculation. But as the portfolio changes, LOLP will shift in response. So, after making significant portfolio changes, PacifiCorp produced an updated LOLP estimate based on one of its near final portfolios in the 2019 IRP, and repeated the CFAM. This produces a new point forecast, but one which is more closely aligned with the preferred portfolio than the one developed at the start of the 2019 IRP.*

4. Is PacifiCorp aware of more current academic or industry studies, reports, or presentations related to the accuracy of CFAM (or other methods) relative to ELCC? If so, please provide them.

PacifiCorp Response: *PacifiCorp has not identified any significant developments in methodology from the literature. However, to address concerns related to the dynamic nature of capacity contribution as a function of the resource portfolio as a whole, PacifiCorp's 2019 IRP included a reliability assessment which ensured that a selected portfolio had sufficient resources to serve load and meet all operating reserve requirements in all periods. Additional details are provided in the Reliability Study Methodology section of Volume II, Appendix R (Coal Studies).*

5. Is PacifiCorp aware of modeling improvements (e.g. related to integrated resource planning) that would facilitate ELCC-based capacity contribution calculations?

PacifiCorp Response: *PacifiCorp has licensed a new model, "PLEXOS", from Energy Exemplar and is currently developing databases for IRP analysis. While it is often employed for energy market analysis, PLEXOS is fundamentally an optimization engine, so it can be deployed flexibly for highly granular analysis, though at the expense of run time. Among other expected modeling improvements, it is expected that Plexos will produce a more granular optimization than the current IRP model, System Optimizer. Today, the IRP's System Optimizer model takes user-supplied winter and summer capacity contribution values for each resource, and uses those two values as the basis for constructing a portfolio*

that meets a specified level of capacity. The Plexos model can evaluate resource supply down to an hourly level and ensure that the generation profile of selected resources is sufficient to meet capacity requirements in each hour. While it may not be run at quite that level of granularity due to calculation limitations, the principle of a single interchangeable "capacity" value is fundamentally discarded in this type of analysis. PacifiCorp's reliability assessment process in the 2019 IRP accomplishes a similar outcome, of ensuring that a portfolio as a whole is reliable throughout the study period, but the current IRP models cannot endogenously optimize portfolio selections to achieve this result.