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December 14, 2015

Via Electronic Filing

Public Utility Commission of Oregon
Attn: Filing Center
201 High St. SE, Suite 100
Salem OR 97301

Re: OPUC Investigation to Explore Issues Related to a Renewable Generator's Contribution to Capacity
Docket No. UM 1719

Dear Filing Center:

Enclosed for filing in the above-referenced docket, please find the Opening Testimony of Bradley G. Mullins on behalf of the Industrial Customers of Northwest Utilities.

Thank you for your assistance. If you have any questions, please do not hesitate to call.

Sincerely,

/s/ Jesse O. Gorsuch
Jesse O. Gorsuch

Enclosure

BEFORE THE PUBLIC UTILITY COMMISSION

OF OREGON

UM 1719

In the Matter of PUBLIC UTILITY COMMISSION OF OREGON, Investigation to Explore Issues Related to a Renewable Generator's Contribution to Capacity	)))))))))

OPENING TESTIMONY OF BRADLEY G. MULLINS

ON BEHALF OF THE INDUSTRIAL CUSTOMERS OF NORTHWEST UTILITIES

December 14, 2015

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Exhibit ICNU/102—Utility Responses to ICNU Data Requests

I. INTRODUCTION AND SUMMARY

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Bradley G. Mullins, and my business address is 333 SW Taylor Street, Suite 400, Portland, Oregon 97204.

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

A. I am an independent consultant representing industrial customers throughout the Western United States. I am appearing on behalf of the Industrial Customers of Northwest Utilities ("ICNU"). ICNU is a non-profit trade association whose members are large industrial customers served by electric utilities throughout the Pacific Northwest, including Portland General Electric Company ("PGE") and Pacific Power & Light Company ("PacifiCorp"), collectively the "Utilities."

Q. PLEASE SUMMARIZE YOUR EDUCATION AND WORK EXPERIENCE.

A. A summary of my education and work experience can be found at ICNU/101.

Q. WHAT IS THE PURPOSE OF YOUR OPENING TESTIMONY?

A. My testimony discusses the appropriate methodologies for determining the capacity contribution—as used in the Utilities' long-term planning—of wind and solar resources.

Q. PLEASE PROVIDE AN OVERVIEW OF YOUR TESTIMONY.

A. I am generally supportive of using the effective load carrying capability ("ELCC") methodology to determine the capacity contribution of wind and solar resources. Because the ELCC methodology can be performed in many different ways, however, there are four considerations that I recommend be reflected in the Utilities' ELCC calculations. First, because the Company's planning models typically assign a 100%

capacity contribution to thermal resources—despite having an ELCC of less than 100%—the ELCC of a renewable resource should be compared to the ELCC of a thermal resource to determine the capacity contribution of the renewable resource. Second, similar to how thermal resource outages are modeled stochastically in a Monte Carlo reliability study, the generation profile of the wind and solar resource should be modeled as a stochastic variable in the reliability studies underlying the ELCC calculations. Third, the reliability metric used in the ELCC calculation should be based on a loss of load expectation ("LOLE") days/year, which is a measurement of the expected number of days per year with a loss of load event. Fourth, diversity benefits associated with a portfolio of renewables should be reflected in the ELCC calculations. I discuss each of these considerations below.

II. BACKGROUND

Q. PLEASE PROVIDE A BRIEF SUMMARY OF THIS DOCKET TO DATE.

A. During PGE's 2013 Integrated Resource Plan ("IRP"), there was debate surrounding the value PGE's renewable portfolio adds to system capacity. The parties to that docket requested that the Commission open an investigation to evaluate a renewable resource's contribution to capacity, which the Commission subsequently did at its March 10, 2015 Open Meeting. On August 17, 2015, the Commission held a workshop to hear presentations from three third-party experts on capacity planning: Michael Milligan from the National Renewable Energy Laboratory ("NREL"); Andrew Mills from the Lawrence Berkeley National Laboratory; and John Fazio from the Northwest Power and Conservation Council. Following this workshop, Administrative Law Judge ("ALJ") Sarah Rowe held a prehearing conference to establish the schedule for this docket. ALJ

Rowe's Prehearing Conference Memorandum requested that the parties address the following matters: (1) the preferred methodology to calculate a renewable generator's contribution to capacity; and (2) the pros and cons of (a) using an ELCC calculation, (b) requiring an alternative or approximation method to be benchmarked against an ELCC calculation, and (c) requiring the utilities to use the same calculation method.

III. POLICY CONSIDERATIONS

Q. SHOULD A UNIFORM WIND AND SOLAR CAPACITY CONTRIBUTION BE ASSIGNED TO THE UTILITIES?

A. No. Capacity contribution should be specific to the Utilities' distinct, respective resource portfolios. The interaction between the various resources in each of the Utilities' resource portfolios will influence the capacity contribution of any particular resource, or resource type, within the respective portfolio, and accordingly, it is important that the Utilities calculate capacity contribution in a manner that reflects the distinct nature of their respective resource portfolios.

Q. SHOULD THE COMMISSION REQUIRE THE UTILITIES TO USE THE SAME CALCULATION METHODOLOGY?

A. While the Utilities should be given a great deal of flexibility to account for the unique aspects of their respective systems, a common framework, and common principles, should be adopted for calculating the capacity contribution of renewables. I generally agree with Mr. Milligan's observation that "[c]onsistent and accurate methods are needed to calculate capacity values attributable to variable generation,"[1/] and support the use of

[1/] "Methods to Model and Calculate Capacity Contributions of Variable Generation," Presentation of Michael Milligan to the Commission at 5 (Aug. 17, 2015) ("Milligan Presentation").

the ELCC methodology, taking into account the four considerations that I discuss in Section IV of my testimony.

Q. WHY DO YOU SUPPORT THE USE OF THE ELCC METHODOLOGY?

A. The ELCC methodology has long been regarded as the industry standard modeling methodology for evaluating how a resource contributes to the overall reliability of an electrical system.[2/] Third-party experts Messrs. Milligan and Fazio were both supportive of using an ELCC methodology to calculate capacity contribution for renewables in the papers they provided to the Commission at the August 17, 2015 technical workshop.[3/] Because the ELCC methodology is based on a model of a utility's resource portfolio, it is specifically designed to account for the distinct aspects of each of the Utilities' resource portfolios. Depending on how the reliability model is developed, an ELCC calculation can be designed to account for any number of utility-specific factors, such as the availability of existing resources, transmission constraints, and other factors.

Q. HOW DOES AN ELCC CALCULATION WORK?

A. The ELCC is based on a sequence of reliability studies designed to calculate the incremental capacity from a particular resource needed to meet an increment of load, while maintaining the same level of modeled system reliability. The papers presented by Mr. Milligan and Mr. Fazio in the August 17, 2015 technical workshop both provided an overview of how the ELCC can be calculated.[4/]

2/ See e.g. L. L. Garver, Effective load carrying capability of generating units, IEEE Trans. Power App. Syst., vol. PAS-85, no. 8 at 910–919 (Aug. 1966).

3/ North American Electric Reliability Corporation, "Methods to Model and Calculate Capacity Contributions of Variable Generation for Resource Adequacy Planning" at 28-31 (March 2011) ("Milligan Paper"); Memorandum from John Fazio to Northwest Power and Conservation Council re: "Wind Load Carrying Capability" at 4-5 (March 6, 2012) ("Fazio Paper").

4/ See Milligan Paper at 9-20; Fazio Paper at 5-8.

Q. DO THE UTILITIES CURRENTLY USE THE ELCC TO CALCULATE THE CAPACITY CONTRIBUTION OF RENEWABLES?

A. No. In their most recent IRPs, both PGE and PacifiCorp estimated the ELCC of renewables based on approximation techniques.[5/]

Q. DO YOU SUPPORT THE USE OF AN ELCC APPROXIMATION METHODOLOGY TO CALCULATE CAPACITY CONTRIBUTION?

A. No. I recommend that the Utilities perform full ELCC studies, rather than relying on approximation techniques, because approximation techniques have the potential to produce a wide range of capacity contribution values, which may or may not be an accurate reflection of the actual ELCC. In addition, the computational intensity that has historically been a barrier to performing full ELCC studies is not as problematic as it once was. The Utilities commonly develop and perform the type of reliability studies necessary to calculate an ELCC in the context of their IRPs. For example, both PGE and PacifiCorp perform the same type of reliability studies that are used to perform ELCC calculations as a component of their respective IRPs, for purposes of calculating planning reserve margins or measuring portfolio risk.[6/]

Q. HOW SHOULD AN ELCC BE USED TO CALCULATE CAPACITY CONTRIBUTION?

A. It is important to note that the ELCC of a resource is not necessarily the same thing as its capacity contribution. ELCC is representative of how a resource contributes to system reliability in a reliability model. Capacity contribution, in contrast, typically represents the amount of a resource that can be counted towards meeting system peak load obligations, including a planning reserve margin, in a capacity expansion model. While I

5/ See ICNU/102, PacifiCorp's resp. to ICNU Data Request ("DR") 002 and PGE's resp. to ICNU DR 002.
6/ PGE, 2013 IRP at 190-200. PacifiCorp, 2015 IRP, Vol. II, Appx. I at 135-143.

recommend that ELCC be used to calculate capacity contribution of renewables, the calculations must be done in a manner that is consistent with how the renewable resources are counted towards meeting system peak load obligations in the Utilities' planning. Accordingly, I have outlined a few principles that I believe the Commission should require of Utilities when performing ELCC calculations for the purpose of determining capacity contribution of renewables.

IV. ELCC RECOMMENDATIONS

A. ELCC of a Renewable Resource Should Be Compared to the ELCC of a Thermal Resource

Q. PLEASE SUMMARIZE HOW RENEWABLE ELCC SHOULD BE CONVERTED INTO CAPACITY CONTRIBUTION.

A. Similar to the California Public Utility Commission Staff requirement to compare "the reliability impact of including the resource type to the reliability impact of including an idealized, 'perfect generator,'"[7] I recommend that the ELCC of renewables be compared to the ELCC of a thermal resource to determine capacity contribution. In the Utilities' capacity planning models, a thermal resource is modeled to provide 100% capacity contribution, despite having an ELCC of less than 100%. Thus, to determine what amount of capacity from a renewable can be counted in a capacity expansion model, it should be based on providing the same, or similar, level of reliability as a thermal resource. The ELCC is traditionally based on the amount of capacity required to maintain reliability for an increment of load, which is not consistent with how capacity is counted and applied towards a planning reserve margin in a capacity planning model.

[7] California Public Utilities Commission, Resource Adequacy Proceeding R.11-10-023, Effective Load Carrying Capacity and Qualifying Capacity Calculation Methodology for Wind and Solar Resources ("CPUC Paper"), at 6.

Q. HOW IS CAPACITY COUNTED IN A CAPACITY PLANNING MODEL?

A. In the Utilities' capacity planning, the capacity contribution of a thermal resource is 100%, even though its ELCC is lower, often around 90%. The thermal capacity contribution exceeds ELCC because the capacity expansion models include a planning reserve margin, which accounts for the availability of the thermal plant considering forced outages, reserves and other factors. The use of a planning reserve margin in capacity planning is, therefore, already designed to reflect the ELCC of a thermal resource—albeit by increasing peak loads, rather than by reducing the thermal generator's nameplate capacity. As such, one unit of capacity added in a capacity planning model is representative of the level of capacity provided by a thermal resource. Because the capacity contribution from the renewable resource, however, is applied to the same planning reserve margin in the capacity expansion models, the renewable ELCC calculation should be adjusted to be based on the same level of reliability provided by a thermal resource.

Q. HOW SHOULD THIS COMPARISON BE PERFORMED?

A. Rather than performing two sets of ELCC studies—one for a thermal resource and another for the renewable resource—I recommend performing the ELCC study in a manner that calculates the incremental capacity from a thermal resource needed to replace an increment of renewable capacity, while maintaining the same level of modeled system reliability. Mathematically, this should be the equivalent of comparing the ELCC of a renewable to the ELCC of a thermal resource, though requiring fewer runs. I will discuss the mechanics of this proposal below.

B. The Utilities Must Use Stochastic Generation Output

Q. WHY SHOULD RENEWABLE GENERATION BE MODELED AS A STOCHASTIC VARIABLE IN AN ELCC CALCULATION?

A. Similar to how forced outages are simulated and randomized in a reliability model, the profile of renewables should be modeled as a stochastic variable in an ELCC calculation. The use of a stochastic profile is necessary to account for risk associated with relying on the available capacity from a renewable resource to meet peak load obligations, as there is a probability that in any given hour the output from a renewable resource may be unavailable.

Q. DO THE UTILITIES MODEL RENEWABLES AS A STOCHASTIC VARIABLE IN THEIR RELIABILITY MODELS?

A. In its IRP, PGE generates stochastic wind profiles in its Monte Carlo reliability studies.[8/] PacifiCorp, on the other hand, does not model wind and solar as stochastic resources in in its IRP.[9/] PacifiCorp's reliability model only includes stochastic variables for load, hydro generation, and thermal unit outages, and assumes the same, fixed level of generation for renewables in a given hour for each iteration in its reliability model.[10/]

Q. DO THE THIRD-PARTY EXPERTS DISCUSS MODELING WIND AND SOLAR OUTPUT AS A STOCHASTIC VARIABLE TO CALCULATE ELCC?

A. Yes. Mr. Milligan discusses the data requirements associated with modeling renewables in a Monte Carlo reliability study.[11/] He specifically states that "[h]ourly wind, solar, and load data must be from the same year for consistent analysis and plausible results" in

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8/ PGE, 2013 IRP at 197-199.
9/ PacifiCorp, 2015 IRP, Vol. II, Appx. I at 137.
10/ Id.
11/ Milligan Paper at 21-22.

order to "[p]reserve[] underlying correlations between wind, solar, and load with temperature, [and] other weather phenomena."[12/]

Q. DO YOU AGREE WITH MR. MILLIGAN THAT THESE CORRELATIONS SHOULD BE RETAINED?

A. Conceptually, I agree that the weather-driven interrelationships between loads and renewable output ought to be retained in stochastic modeling, if possible. As a practical matter, however, it is very difficult, if not impossible, to capture these historical correlations in a reliability model that uses a stochastic renewable output. In addition, these correlations, for wind in particular, are not all that significant.

Q. WHY DO YOU CONCLUDE THAT THE CORRELATIONS BETWEEN LOAD AND WIND OUTPUT ARE NOT SIGNIFICANT?

A. First, independent studies have shown this to be the case. For example, the New York Independent System Operator found that the "[c]orrelation between wind generation and load as measured by Adjusted R Squared is consistently close to zero."[13/] Accordingly, they found "that the matching of particular load shape year and wind shape year is less critical."[14/] Second, the correlations between wind and load will change from year-to-year depending on the weather. For example, the correlations between loads in an El Niño year may be different than the correlations in a normal weather year. A reliability model contains multiple iterations deigned to simulate load conditions in different types of weather years, and accordingly, it is nearly impossible to know what the appropriate correlation is in any given iteration of the model.

12/ Milligan Presentation at 15.

13/ New York Independent System Operator, Analysis of Wind Plant Generation vs. Load for the Thirty Highest Daily Peaks, 2009 – 2012 at 14-15, available at: http://www.nysrc.org/pdf/MeetingMaterial/ICSMeetingMaterial/ICS_Agenda144/Wind%20Plant%20Gen%20VS%20Load%20%20Presentation%20to%20ICS%20Final.pdf

14/ Id.

Q. HOW DO YOU RECOMMEND THAT THE STOCHASTIC OUTPUT OF WIND BE MODELED?

A. I support a methodology that models wind as a somewhat random variable. The methodology that I support is to develop a set of daily wind profiles for a given month, based on actual historical data. For each day in the reliability model, the Monte Carlo model should randomly draw a daily profile from the historical set of daily profiles that corresponds to the given month. Under this method, the same day of the month will be drawn for all wind resources, preserving the diversity between wind resources. The draws, however, will not be dependent upon daily load, so the correlation between daily load and wind will not be retained.

Q. HOW DO YOU RECOMMEND THAT THE STOCHASTIC OUTPUT OF SOLAR BE MODELED?

A. For solar, preserving the relationship between loads and solar output is more important than for wind because there are likely stronger correlations between solar output and load than there are between wind output and load. In general, loss of load probability in the summer may be more likely to occur on a day with low cloud cover, resulting in higher solar output. Similarly, loss of load probability in the winter may be more likely to correspond to a storm, a day with high cloud cover, resulting in lower solar output. Accordingly, I recommend that solar be modeled using a methodology that accounts for some relationship between load and solar output. Specifically, I propose a method similar to that described above for wind, with the exception that the set of daily profiles available in the Monte Carlo simulation are limited to the three days in any given month with the highest loads. Thus, the daily solar profiles used, for the entire month, will be representative of the output expected on the days with the highest loads, which presumably are days with higher loss of load probability.

C. Loss of Load Expectation Should be Measured in Days/Year

Q. WHAT RELIABILITY METRIC DO YOU PROPOSE TO USE IN THE ELCC STUDY?

A. LOLE typically represents the expected value of the number of periods in which an unserved load event occurs in a reliability model.[15/] I support using this metric, as recommended by Mr. Milligan,[16/] and as deployed by the Midcontinent Independent System Operator.[17/] Specifically, I support calculating LOLE based on the number days per year expected to have a loss of load event. For example, if a reliability model consisting of 100 iterations shows ten days with loss of load events, irrespective of how long or severe the events are, the LOLE days/yr will be $\frac{10\ day/yr}{100\ games} = 0.1\ LOLE\ days/yr.$, the equivalent of a one-in-ten-year loss of load event.

Q. WHY DO YOU SUPPORT USING AN LOLE DAYS/YR METRIC?

A. A reliability metric based on days/year is a better reflection of how a resource contributes to meeting peak load obligations. In contrast to metrics based on expected unserved energy ("EUE"), which measures the magnitude of potential load curtailments, or Loss of Load Hours ("LOLH"), which measures the duration of reliability events, LOLE focuses on the elimination of the frequency or occurrence of reliability events.

15/ Milligan Paper at 28-29.

16/ Id.

17/ See Midcontinent Independent System Operator, Planning Year 2014-2015 Wind Capacity Credit, at 5-7, available at: https://www.misoenergy.org/Library/Repository/Study/LOLE/2014%20Wind%20Capacity%20Report.pdf.

Q. WHY IS IT IMPORTANT TO FOCUS ON THE OCCURRENCE OF RELIABILITY EVENTS IN CAPACITY PLANNING?

A. The purpose of capacity planning is to determine what resources to build and when to build them. Accordingly, the focus should not be on reducing the length of reliability events, nor should it be on reducing the magnitude of reliability events. If a resource was to be built for the sole purpose of making a reliability event shorter, or making the magnitude of a reliability event less severe, it would not be as effective a capacity resource as one that is capable of eliminating the occurrence of a reliability event altogether. Thus, when making capacity planning decisions, based on the capacity contribution values developed through this process, the key consideration should be how effective a resource is at reducing the occurrence of outages, favoring the use of LOLE days/yr in the ELCC calculation.

D. ELCC Must Capture Diversity Benefits

Q. WHY MUST DIVERSITY BENEFITS BE CAPTURED IN THE ELCC METHODOLOGY?

A. It is generally understood that the capacity contribution of a geographically diverse portfolio of renewable resources is typically greater than the capacity contribution of any individual resource viewed in isolation.[18/] It is also generally understood that as a portfolio of resources becomes less diverse—for instance, in the case of high penetrations of solar in a single geographic area—the capacity contribution may decline.[19/] In any instance, if the ELCC methodology does not account for these diversity impacts, it will misstate the renewable capacity contribution to the Utilities.

18/ See, e.g., Milligan Paper at 50-51.

19/ See, e.g., Ernest Orlando Lawrence Berkeley National Laboratory, "An Evaluation of Solar Valuation Methods Used in Utility Planning and Procurement Processes," Andrew Mills at 4 (Apr. 2013).

Q. HOW DO YOU PROPOSE TO CAPTURE THESE DIVERSITY BENEFITS IN THE ELCC CALCULATIONS?

A. I recommend that the calculations be performed in a manner that aggregates the generation portfolio of a given resource type, taking into consideration transmission limitations. This treatment would be largely consistent with how the California Public Utility Commission Staff accounts for these diversity benefits, as detailed in its January 2014 ELCC paper.[20/] By using the aggregate renewable generation profile, the historical diversity between resources of a particular type will be reflected in the capacity contribution calculation.

Q. HOW SHOULD THIS CALCULATION BE PERFORMED FOR WIND?

A. For wind, for example, the Utilities would aggregate their entire wind fleet, calculating capacity contribution based on the expected capacity factor of the entire wind portfolio. In the ELCC calculations, the incremental wind resource added to the study would be based on the system capacity factor, rather than the capacity factor of the individual plant. In addition, to the extent that a resource is subject to transmission limitations, such as the limitations between the PacifiCorp's eastern and western balancing areas, those transmission limitations should be respected in the aggregated capacity factor calculation.

Q. HOW SHOULD THIS CALCULATION BE PERFORMED FOR SOLAR?

A. Because the Utilities do not have a long history of solar generation data, a solar generation portfolio based on probable locations of solar development should be simulated and used to calculate capacity contribution for solar resources.

20/ CPUC Paper at 4-5.

V. METHODOLOGICAL RECOMMENDATIONS

Q. GIVEN THE ABOVE CONSIDERATIONS, HOW DO YOU RECOMMEND THAT THE ELCC CALCULATIONS BE PERFORMED?

A. Based on the above considerations, I recommend that the ELCC studies be performed in the following manner:

- Perform a base reliability study based on the utility's preferred portfolio, including an incremental 100 MW renewable resource and incremental 100 MW of shaped load. The study should include a stochastic generation profile for the existing and incremental renewable resources, based on the aggregate capacity factor of a particular resource type. The LOLE days/yr of the base reliability study should be measured.
- Perform a sensitivity scenario, removing the 100 MW renewable resource and adding an amount of thermal resources initially expected to result in the same level of LOLE days/yr as the base study.
- Perform incremental sensitivity studies, increasing or decreasing the amount of thermal capacity, until the amount of thermal capacity required to maintain the same level of LOLE days/yr as the base study can be reasonably determined, interpolating or extrapolating where necessary.
- Calculate the capacity contribution as the ratio of the amount of thermal capacity required to maintain the same level of LOLE days/yr as the base study over the renewable resource capacity in the base study.

Q. DO YOU REQUEST THAT THE UTILITIES PERFORM THE ABOVE STUDIES AND PRESENT THE RESULTS IN THEIR REPLY TESTIMONY?

A. Yes. I request that the utilities perform the above studies for both wind and solar resources and present those studies in their reply filing, explaining any assumptions they make.

Q. DOES THIS CONCLUDE YOUR OPENING TESTIMONY?

A. Yes.

BEFORE THE PUBLIC UTILITY COMMISSION

OF OREGON

UM 1719

In the Matter of	)
	)
PUBLIC UTILITY COMMISSION OF	)
OREGON,	)
	)
Investigation to Explore Issues Related to a	)
Renewable Generator's Contribution to	)
Capacity	)
	)

EXHIBIT ICNU/101

QUALIFICATION STATEMENT OF BRADLEY G. MULLINS

Q. PLEASE SUMMARIZE YOUR EDUCATION AND WORK EXPERIENCE.

A. I received Bachelor of Science degrees in Finance and in Accounting from the University of Utah. I also received a Master of Science degree in Accounting from the University of Utah. After receiving my Master of Science degree, I worked as a Tax Senior at Deloitte Tax, LLP, where I provided tax compliance and consulting services to multi-national corporations and investment fund clients. Subsequently, I worked at PacifiCorp Energy as an analyst involved in regulatory matters primarily surrounding power supply costs. I began performing independent consulting services in September 2013 and provide consulting services to large utility customers, and independent power producers on matters ranging from power costs and revenue requirement to power purchase agreement negotiations.

Q. PLEASE PROVIDE A LIST OF YOUR REGULATORY APPEARANCES.

A. I have sponsored testimony in regulatory proceedings throughout the Western United States, including the following:

- Wy.PSC, 20000-469-ER-15 In The Matter of the Application of Rocky Mountain Power for Authority of a General Rate Increase in Its Retail Electric Utility Service Rates in Wyoming Of $32.4 Million Per Year or 4.5 Percent
- Wa.UTC, UE-150204: In re Avista Corporation, General rate increase for electric services

- Wy.PSC, 20000-472-EA-15: In re the Application of Rocky Mountain Power to Decrease Rates by $17.6 Million to Recover Deferred Net Power Costs Pursuant To Tariff Schedule 95 to Decrease Rates by $4.7 Million Pursuant to Tariff Schedule 93
- Wa.UTC, UE-143932: Formal complaint of The Walla Walla Country Club against Pacific Power & Light Company for refusal to provide disconnection under Commission-approved terms and fees, as mandated under Company tariff rules
- Or.PUC, UE 296: In re PacifiCorp, dba Pacific Power, 2016 Transition Adjustment Mechanism
- Or.PUC, UE 294: In re Portland General Electric Company, Request for a General Rate Revision
- Or.PUC, UM 1662: In re Portland General Electric Company and PacifiCorp dba Pacific Power, Request for Generic Power Cost Adjustment Mechanism Investigation
- Or.PUC, UM 1712: In re PacifiCorp, dba Pacific Power, Application for Approval of Deer Creek Mine Transaction
- Bonneville Power Administration, BP-16: 2016 Joint Power and Transmission Rate Proceeding
- Wa.UTC, UE-141368: In re Puget Sound Energy, Petition to Update Methodologies Used to Allocate Electric Cost of Service and for Electric Rate Design Purposes
- Wa.UTC, UE-140762: In re Pacific Power & Light Company, Request for a General Rate Revision Resulting in an Overall Price Change of 8.5 Percent, or $27.2 Million

- Wa.UTC, UE-141141: In re Puget Sound Energy, Revises the Power Cost Rate in WN U-60, Tariff G, Schedule 95, to reflect a decrease of $9,554,847 in the Company's overall normalized power supply costs
- Wy.PSC, 20000-446-ER-14: In re The Application of Rocky Mountain Power for Authority to Increase Its Retail Electric Utility Service Rates in Wyoming Approximately $36.1 Million Per Year or 5.3 Percent
- Wa.UTC, UE-140188: In re Avista Corporation, General Rate Increase For Electric Services, RE: Tariff WN U-28, Which Proposes an Overall Net Electric Billed Increase of 5.5 Percent Effective January 1, 2015
- Or.PUC, UM 1689: In re PacifiCorp, dba Pacific Power, Application for Deferred Accounting and Prudence Determination Associated with the Energy Imbalance Market
- Or.PUC, UE 287: In re PacifiCorp, dba Pacific Power, 2015 Transition Adjustment Mechanism.
- Or.PUC, UE 283: In re Portland General Electric Company, Request for a General Rate Revision
- Or.PUC, UE 286: In re Portland General Electric Company's Net Variable Power Costs (NVPC) and Annual Power Cost Update (APCU)
- Or.PUC, UE 281: In re Portland General Electric Company 2014 Schedule 145 Boardman Power Plant Operating Adjustment
- Or.PUC, UE 267: In re PacifiCorp, dba Pacific Power, Transition Adjustment, Five-Year Cost of Service Opt-Out (adopting testimony of Donald W. Schoenbeck).

BEFORE THE PUBLIC UTILITY COMMISSION

OF OREGON

UM 1719

In the Matter of	)
	)
PUBLIC UTILITY COMMISSION OF OREGON,	)
	)
Investigation to Explore Issues Related to a Renewable Generator's Contribution to Capacity	)

EXHIBIT ICNU/102

UTILITY RESPONSES TO ICNU DATA REQUESTS

UM 1719/PacifiCorp
November 24, 2015
ICNU Data Request 002

ICNU Data Request 002

Please state the peak load capacity contribution of the following resource types assumed in the Company's most recent Integrated Resource Plan:

(a) Wind;

(b) Solar;

(c) Run-of-river Hydro;

(d) Thermal renewables (e.g. Biomass);

(e) Geothermal;

(f) Any other resource type with a capacity contribution less than 100%.

Response to ICNU Data Request 002

(a) The peak load capacity contribution factors for wind and solar are provided in the Company's 2015 Integrated Resource Plan (IRP), Volume II, Appendix N – Wind and Solar Capacity Contribution Study, Table N-1 Peak Capacity Contribution Values for Wind and Solar, page 405. The factor is multiplied with the resource nameplate capacity to calculate peak load capacity contribution of new resources.

Chapter 5 of the 2015 IRP contains assumed capacity values for existing resources. Table 5.2 provides a cumulative total of peak contribution by resource type. Nameplate capacity and capacity contribution of owned and contracted wind resources are included in Table 5.5 and Table 5.6. For small qualifying facilities (QF) the capacity contribution is the average monthly energy output in July.

(b) Please refer to the Company's response to subpart (a) above. Also refer to Table 5.7 of the 2015 IRP for contributions assumed from non-owned solar resources.

(c) The peak load capacity contribution is the monthly average energy in July for run of river resources. Table 5.9 and Table 5.10 in the 2015 IRP lists capacity contributions assumed for contracted and owned hydro resources. The following are the hydro run of river resources:

- Big Fork
- Fish Creek
- Irongate
- JC Boyle
- Lemolo 2
- Merwin

- Rogue
- Soda Springs
- Small East Hydro
- Small West Hydro
- Toketee-Slide

(d) New biomass resources are assumed to have a peak load capacity contribution equivalent to the resource nameplate capacity. Existing biomass / biogas is discussed on page 66 of the 2015 IRP. Small biomass QFs are assumed to have a capacity contribution equivalent to their monthly average energy for July.

(e) Geothermal resources are assumed to have a peak load capacity contribution equivalent to the resource nameplate capacity. Please refer to page 65 of the 2015 IRP for discussion of existing geothermal assumptions. Small geothermal QFs are assumed to have a capacity contribution equivalent to their monthly average energy for July.

(f) The Class 2 demand side management (DSM) is treated as a resource for the Company's IRP modeling. Discussion of peak load capacity contribution is provided in Company's response to ICNU Data Request 003.

Please refer to Confidential Attachment ICNU 002; specifically tab "StationCapacityReport", for the peak contribution of the Company's existing resources.

The confidential attachment is designated as Protected Information under Order No. 15-366 and may only be disclosed to qualified persons as defined in that order.

November 24, 2015

TO: Brad Van Cleve
Tyler C. Pepple
Bradley G. Mullins

FROM: Patrick Hager
Manager, Regulatory Affairs

PORTLAND GENERAL ELECTRIC
UM 1719
PGE Response to ICNU Data Request No. 002
Dated November 10, 2015

Request:

Please state the peak load capacity contribution of the following resource types assumed in the Company's most recent Integrated Resource Plan ("IRP"). Please update your response when the Company releases its next IRP:

- **a. Wind;**
- **b. Solar;**
- **c. Run-of-river Hydro;**
- **d. Thermal renewables (e.g. Biomass);**
- **e. Geothermal;**
- **f. Any other resource type with a capacity contribution less than 100% (please specify each such resource).**

Response:

The table below provides descriptions of the estimated peak-load capacity contributions for the above listed resource types assumed in PGE's 2013 IRP capacity load-resource balances (LRB) and portfolios. The 2013 IRP is PGE's most recently filed IRP. PGE will update this response when the 2016 IRP is filed.

PGE notes that these capacity contributions were used to assess capacity needs and portfolio compositions. These differ from the 2013 IRP loss of load study which was based on stochastic modeling of loads and resources. The loss of load study is discussed in detail in Section 9.6 of the 2013 IRP.

Resource Type	Capacity Contribution Description	Notes
A. Wind	5% of nameplate capacity	
B. Solar	5% of AC rating	
C. Run-of-river Hydro (small)	average energy or 0%	Based on average hydro conditions. 0% for very small/variable projects. See below for Clackamas projects.
D. Thermal Renewables (Biomass)	annual capacity	Not derated for forced outages or maintenance.
E. Geothermal	annual capacity	Not derated for forced outages or maintenance.
F. Clackamas, Mid-C, and Portland Hydro Project	January/August sustainable peak capacity	4-hr sustainable peak capacity in average hydro conditions.
G. Existing Coal and Gas	January/August capacity	Based on monthly average temperatures. Not derated for forced outages or maintenance.
H. Digester and Biogas QFs	average energy	

Additional information regarding the capacity contribution estimates is provided in PGE's response to ICNU Data Request No. 002.