CASE: UM 1719

PUBLIC UTILITY COMMISSION
OF
OREGON

Joint Supporting Testimony

[Joint Party Exhibit 100]

April 2016

Q. Please state your name, occupation, and business address.

A. My name is Rick Link. I am employed by PacifiCorp, d/b/a Pacific Power (PAC) as Director, Origination. My Witness Qualification Statement is found in PAC/100, Link/1.

My name is Franco Albi. I am the Manager of Integrated Resource Planning for Portland General Electric (PGE). My Witness Qualification Statement is found in PGE/100, Albi-Macfarlane/31-32.

My name is Rick Haener. I am employed by Idaho Power Company (Idaho) as the Power Supply Planning Leader. My Witness Qualification Statement is found in Idaho Power/100, Haener/1.

My name is John Crider. I am employed as a Utility Analyst in the Electric Rates and Planning Section of the Public Utility Commission of Oregon (Staff). My Witness Qualification Statement is found in Staff/101, Crider/1.

My name is Nadine Hanhan. I am a Utility Analyst with the Citizens' Utility Board of Oregon (CUB). My Witness Qualification Statement is found in CUB/101, Hanhan/1.

My name is Bradley Mullins. 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). My Witness Qualification Statement is found in Exhibit ICNU/101, Mullins/1-3.

My name is Michael O'Brien. I am a Senior Policy Advisor with Renewable Northwest (RNW). My Witness Qualification Statement is found in RNW/100, O'Brien/1.

My name is Phil Carver. I am a Senior Policy Analyst with the Oregon Department of Energy (ODOE). My Witness Qualification Statement is found in Exhibit Joint Party/101.

My name is John Lowe. I am the director of the Renewable Energy Coalition (REC). My Witness Qualification Statement is found in Exhibit Joint Party/102.

Q. What is the purpose of this Joint Supporting Testimony?

A. Staff, PAC, PGE, Idaho, CUB, ICNU, REC RNW, and ODOE (collectively the Stipulating Parties) jointly provide this testimony in support of the Stipulation, filed concurrently with this Joint Supporting Testimony in this docket (UM 1719). The Stipulating Parties request that the Commission issue an order approving the Stipulation and implementing its terms.

Q. Did you prepare exhibits for this Testimony?

A. Yes. The exhibits for this testimony are the witnesses' qualification statements for ODOE (Joint Party/101) and for REC (Joint Party/102).

Q. What is the purpose of Docket UM 1719?

A. Since the introduction of large scale renewable generation in Oregon there has been a question regarding the preferred method for calculating the capacity contribution of these generators towards a utility meeting its need for resource adequacy on a planning level. The purpose of Docket UM 1719 is to explore a

range of methods, assess their respective pros and cons, and ultimately to issue a recommendation for Commission action.

Q. Please summarize the UM 1719 Stipulation.

A. The parties agree that for the purpose of Integrated Resource Plans (IRP), Idaho Power, PacifiCorp and PGE (collectively, Utilities) will estimate the capacity contributions from wind and solar generators using either an Effective Load Carrying Capability (ELCC) or Capacity Factor (CF) approximation.[1] The following items are also included in the stipulation:

- Definitions for the two methodologies, including specification that the contributions will be based on assessments of all hours in a year.
- Provision for using interpolation or extrapolation from calculated ELCC and CF approximation values as needed.
- A waiver process for other methodologies.
- Acceptance of Idaho Power's existing methodology as a CF approximation with the addition of an analysis based on all hours in a year.
- Clarification that the Stipulation does not establish the translation from renewable capacity contribution percentages to prices or dollar values for other dockets or filings.

[1] REC supports adoption of the Stipulation its entirety. REC took no position on the specific methodology for estimating the capacity contributions for wind and solar, but was concerned about their application to non-intermittent resources. REC specifically supports the provision of the Stipulation limiting the use of these methodologies to wind and solar.

Q. Why did the parties agree on these two methods?

A. The Stipulating Parties generally agree that the ELCC is an analytically rigorous method and is likely to produce results that are meaningful. An ELCC method that examines all hours of the year has the potential to provide a result that reflects reliability concerns not only during the system peak load but also for other times during the year that the system may be stressed. All parties recognize the ELCC method as having wide acceptance in the academic community. For the purpose of settlement, the Stipulating Parties are willing to accept the CF approximation as an alternative to a full ELCC calculation. The Stipulating Parties support the use of either method in the IRP.

Q. **Please explain the term requiring the contribution to be estimated based on all hours in a year.**

A. This addresses concerns raised by some parties that calculations based on a small subset of peak hours do not capture contributions that may occur outside of the subset of hours. To resolve this issue, the Stipulating Parties agreed that Utilities will use all hours in a year.

Q. **Please explain the reason for provision for using interpolations and extrapolation from calculated values.**

A. ELCC calculations produce results for specific test periods and specific combinations of resources. Some parties noted that ELCC calculations can be time and data intensive, making it impractical to produce full ELCC calculations for every year of an entire IRP or for every possible resource combination. To

resolve this issue, parties agreed that it is acceptable for Utilities to interpolate and extrapolate as needed.

Q. Please explain the purpose of the waiver.

A. The waiver provision allows a utility to apply to the Commission for permission to use an alternate methodology, provided that the utility can demonstrate that the proposed methodology produces results reasonably comparable to the ELCC method. This allows flexibility to address case-by-case issues while maintaining the same level of robustness as achieved with the approved methodologies.

Q. Please discuss the term regarding Idaho Power's methodology.

A. This term clarifies that the for the purpose of settlement, the Stipulating Parties agreed that Idaho Power's 2015 IRP methodology can continue to be used, with the addition of conducting a loss of load probability analysis based on all hours of the year. Supplementing Idaho Power's current methodology with a loss of load probability analysis is an acceptable methodology to measure wind and solar capacity contributions.

Q. Please explain the term regarding other dockets or filings.

A. The compromise reached by the Stipulating Parties is regarding wind and solar capacity contributions calculated in the IRP. This term clarifies that this agreement does not establish methodologies for translating those values to prices or dollar values for other dockets or filings.

Q. **In addition to the actions recommended in the Stipulation, is there an informative component to this docket?**

A. Yes. The docket began with a Staff report discussing capacity contribution issues raised in prior IRP proceedings. Next, three industry experts presented information about capacity contribution calculations at a Commission workshop. Following the workshop, parties were given direction for minimum topics to address in Opening Testimony. Parties filed testimony on December 2, 2015.

Q. What issues were to be considered by the parties in Testimony?

A. The Parties were instructed by the Commission to discuss: 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 all utilities to use the same calculation method.[2]

Q. Did all Stipulating Parties submit Opening Testimony in this Docket?

A. No. Idaho Power, PGE, PAC, RNW, CUB, ICNU and Staff provided Opening Testimony. ODOE, REC and Community Renewable Energy Association (CREA) did not submit Opening Testimony, but all participated in subsequent settlement discussions. No party opposes the Stipulation although CREA has chosen not to be a signatory to it.

Q. Please summarize the parties' Opening Testimony regarding Issue 1, the preferred methodology to calculate a renewable generator's contribution to capacity.

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[2] UM 1719. Memorandum and Notice of Prehearing Conference. Accessed at: http://edocs.puc.state.or.us/efdocs/HDA/um1719hda162837.pdf

A. Several of the parties drew a distinction between the preferred methodologies from a theoretical standpoint vs. the preferred methodology from the viewpoint of actual implementation. All parties recognize the ELCC method as having wide acceptance in the academic community. Several parties, however, also recognize the extensive data and computational resources required by the ELCC method and so, as a practical consideration, deem a well-designed approximation to the ELCC as the preferred methodology. Relevant Opening Testimony from some of the Stipulating Parties on Issue 1 is presented below:

> *Idaho*
> ***Q. Has Idaho Power developed a preferred methodology to calculate a renewable generator's contribution to capacity?***
> *A. Yes. Idaho Power approximates the ELCC when calculating a renewable generator's contribution to capacity.*[3]
>
> *PGE*
> ***Q. Please summarize PGE's response to the first issue regarding a preferred methodology to calculate a renewable generator's contribution to capacity***
> *A. The preferred methodology for calculating renewable resource capacity contribution values depends on several factors, including the nature of the capacity question and the specific system of the utility. PGE is unaware of a single methodology that is preferred for all questions and all systems regarding capacity contributions.*[4]
>
> *PAC*
> ***Q. What is the Company's preferred method for deriving capacity contribution values for renewable resources?***
> *A. Considering the computational complexities and data requirements associated with the ELCC method, the Company prefers the CF Method, which considers hourly LOLP metrics, to develop its capacity contribution values for wind and solar resources.*[5]
>
> *ICNU*
> *"I am generally supportive of using the effective load carrying capability ("ELCC") methodology to determine the capacity contribution of wind and*

[3] Idaho Power/100, Haener/3
[4] PGE/100, Albi-MacFarlane/24
[5] PAC/100, Link/6

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."[6]

CUB
"Rather than state a preferred metric, CUB will provide a list of characteristics that should go into determining contribution to capacity. The ELCC method may suffice for some of these, but CUB notes that PacifiCorp's CF method in calculating contribution to capacity may be just as accurate and seemingly less computationally intensive as ELCC." [7]

Q. Have the Stipulating Parties reached agreement on Issue 1?

A. While the Stipulating Parties expressed differences of preferred methodologies, after two settlement conferences and several email discussions, the Stipulating Parties agreed that the capacity calculation for wind and solar generators will be performed either with an ELCC method or with the CF approximation method for IRP purposes, with the provisions for interpolation, extrapolation, and Commission approved waivers as discussed previously. The Stipulating Parties generally agree that both of these methods should produce reasonable and accurate results.

Q. Please summarize the parties' Opening Testimony positions regarding Issue 2a, the pros and cons of using an ELCC method.

A. The parties' Opening Testimony presents varied perspectives regarding the pros and cons of using an ELCC method. Some of the parties recognize that the ELCC method captures more hours of reliability risk than methods which only assess system peak hours. Some parties believe that the ELCC is also able to capture the system benefits of renewable generation diversity and thus

[6] ICNU/100, Mullins/1
[7] CUB/100, Hanhan/16

provide an accurate assessment of capacity value given geographic and temporal factors. Some parties also independently listed similar drawbacks to the ELCC method – namely that extensive, time-synchronized data sets are required for proper analysis, and that the iterative nature of the ELCC requires multiple simulation runs. Some parties testified that performing an ELCC analysis can require substantially more analyst and computation time to produce results that are not greatly dissimilar to results achieved by certain approximation methods. Supporting statements from selected Opening Testimonies are summarized below:

> *Idaho*
> ***Q. What are some of the pros and cons of the ELCC methodology?***
> A. *One of the positive aspects of the ELCC methodology is that the ELCC is a theoretical calculation which, to date, has often been accepted as the theoretical standard. However, the ELCC has negative aspects as well. The ELCC requires extensive utility-specific generation and load data and the data may be proprietary or confidential. The ELCC calculations are often conducted by specialized utility technicians or specialized outside consultants on proprietary software and therefore the ELCC calculations are not easily replicated by outside parties. The ELCC calculations are iterative and complex and some of the current power supply, transmission, and demand-side models used by utilities may not be easily adapted to the complex iterative ELCC process. Finally, the ELCC calculations may not be well understood by members of the public, which may lead to legitimate concerns regarding transparency.*[8]
>
> *PGE*
> ***Q. Please summarize PGE's response to Item 2a regarding the pros and cons of using ELCC calculations.***
> *A. Some of the advantages of using ELCC calculations include the following:*
> ** The calculations can provide rigorous reliability-based assessments of capacity contributions for many systems;*
> ** ELCC methodologies have the ability to capture complex correlations between resources and load;*
> ** The calculations can capture interactive effects between different renewable resources.*

[8] Idaho Power/100, Haener/3

Key challenges and risks for ELCC methodologies include the following:
** ELCC methodologies are not necessarily suited for assessing all systems or applications;*
** ELCC calculations require extensive data, data processing, and computation time;*
** ELCC models are often complex to validate and explain;*
** Rigor, in and of itself, should not be equated to accuracy, but at times complexity can mask issues created by inadequate or poor quality data, leading to false confidence in results.*[9]

PAC

Q. Please describe the pros of using an ELCC Calculation.

A. the ELCC method is a robust technique for estimating the capacity contribution of renewable resources. The method effectively calculates capacity contribution values for renewable resources that maintain a target level of system reliability when renewable resources are added to the system resource mix. The primary pro of the ELCC method is that it is a robust technique, tied to system reliability, for calculating capacity contribution values for renewable resources that is widely accepted in the literature.[10]

Q. Please describe the cons of using an ELCC Calculation.

A. The primary con of the ELCC method is that it is computationally burdensome.[11]

RNW

Q: What are the pros of the ELCC method?

A: The ELCC method is recognized as a common and robust approach to determining capacity credit. The North American Electric Reliability Corporation ("NERC") recommended "the use of LOLP, LOLE, or related metrics for resource adequacy calculations and for determining the capacity contribution of VG [variable generation]". In addition, the National Renewable Energy Laboratory ("NREL") concluded that the ELCC method is "…well recognized and widely used due to [it's] robustness'.[12]

Q: What are the cons of the ELCC method?

A: The data requirements for an ELCC are non-trivial. Generation data from the renewable resources and load data—both of which data sets are driven by weather and therefore correlated—from the same year are needed for consistent analysis and plausible results.[13]

Q. What are the pros of using an approximation method?

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[9] PGE/100, Albi-Macfarlane/24
[10] PAC/100, Link/8
[11] PAC/100, Link/8
[12] RNW, O'Brien/5
[13] RNW/100, O'Brien/5

A: The use of approximation methods can avoid some of the data requirements necessary for an ELCC calculation. A rigorous capacity valuation of variable generation requires sufficiently long term data on wind and solar, which may not be available. NREL concludes that while the ELCC method is widely used due to its robustness, the found that some approximation techniques can yield similar results, finding that "the CF (capacity factor approximation method) to be the most dependable technique".[14]

Q: What are the cons of using an approximation method?
A: In presenting to the Commission, NREL's Michael Milligan, Ph.D., described approximation methods as "less than ideal," adding that they "often do not take LOLP or risk into account"[15]

ICNU
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.[16]

Q. Have the Stipulating Parties reached an agreement regarding the use of an ELCC and the use of an approximation method?

A. Yes. The Stipulating Parties appreciate that an ELCC method accurately calculates the capacity contribution of wind and solar resources for IRP purposes.[17] However, for the purpose of settlement, the Stipulating Parties were willing to accept the CF approximation method as an alternative to a full

[14] RNW/100, O'Brien/6
[15] RNW/100, O'Brien/6
[16] ICNU/100, Mullins/5
[17] ICNU notes that it is not opposed to the use of the ELCC or CF methodology for purposes of stochastic capacity planning. However, it does not necessarily agree that the ELCC or CF methodology is the most accurate methodology for all intents and purposes. For example, in a resource adequacy framework for a regional independent system operator, ICNU believes that there may be other methodologies that are more accurate than, or provide the same degree of accuracy as, an ELCC or CF methodology. Also, ICNU notes that there are many different ways that an ELCC or CF study can be implemented, and those details would have a material impact on the degree to which ICNU believes such an ELCC or CF study is accurate. These are details which were not necessarily decided in this docket.

ELCC calculation. The Stipulating Parties support the use of either method in the IRP process.

Q. Please summarize selected parties' Opening Testimony regarding Issue 2b, requiring an approximation to be benchmarked against an ELCC.

A. None of the parties that favored an approximation method were in favor of requiring benchmarking of that approximation against an ELCC. Generally, the position stated was that a benchmark requirement would force the ELCC to be performed whether an approximation was used or not. Therefore, requiring a benchmark would be tantamount to requiring an ELCC. Some of the parties were also supportive of the use of a well-defined approximation to the ELCC as long as the approximation considers all hours of the year and is based on a measure of loss-of-load statistics. The following sections of submitted Opening Testimony support the Stipulating Parties' joint position:

> *Idaho*
> ***Q. Should other alternative approximation methodologies be benchmarked against an ELGC calculation?***
> *A. Idaho Power agrees that an alternative approximation should be verified by comparison with other calculations in order to assure acceptance by the public, independent generators, and regulators. However, requiring the alternative method to be benchmarked only with the ELCC appears to be overly prescriptive. There may be other accepted benchmarks published by independent parties that are equally valuable.*[18]
>
> *PGE*
> ***Q. Are there benefits to requiring other methodologies to be benchmarked against an ELCC?***
> *A. In some instances, such as the use of generalizations to interpolate between or extrapolate from calculated ELCC values, an ELCC calculation could be used to check that the interpolation or extrapolation method is*

[18] Idaho Power/100, Haener/14

reasonable; however, due to the complexity of ELCC calculations, it likely would not be practical to check all generalizations.[19]

Q. Are there any drawbacks to requiring other methodologies to be benchmarked against an ELCC?
A. Yes. Such a requirement would disallow other reasonable ways of supporting methodologies without using an ELCC calculation and would not guarantee that the benchmark produces a useful assessment of the methodology in question.[20]

Q. Please summarize PGE's response to Item 2b regarding the pros and cons of requiring methodologies to be benchmarked against an ELCC calculation.
A. Requiring an ELCC calculation as a benchmark for other methodologies would bring few benefits and may be problematic or impractical for a given system or set of data, including adding significant requirements of time and resources without necessarily providing a meaningful benchmark. It unnecessarily disallows other means of supporting methodologies.[21]

PAC
Q. Should the Commission require utilities to benchmark an approximation method against an ELCC calculation?
A. No. The Commission should not require ELCC benchmarking when a utility uses an approximation method. The very benefit of using an approximation method is to significantly reduce the computational burden while achieving a reasonable capacity contribution value for renewable resource.[22]

Q. Did the Stipulating Parties reach an agreement regarding issue 2b regarding the use and benchmarking of an approximation method?

A. Yes. After two settlement conferences and discussion amongst all parties, a compromise was reached that one particular approximation, the "Capacity Factor" method, as defined in the Stipulation, is a reasonable alternative to the ELCC method for the IRP process. As such, the Stipulating Parties agree that both methods (ELCC and Capacity Factor approximation) are acceptable for

[19]PGE/100, Albi-Macfarlane/13
[20]PGE/100, Albi-Macfarlane/13
[21]PGE/100, Albi-Macfarlane/25
[22]PAC/100, Link/10

estimation of the capacity contribution for wind and solar generators for IRP purposes.

Q. Please summarize the parties' Opening Testimony position regarding Issue 2c, requiring the Stipulating Utility-Parties to use a uniform method.

A. Generally, the Stipulating Parties do not support an explicit directive that restricts the flexibility of a utility to choose the proper approach to performing the capacity calculation. The Stipulating Parties support the Commission approving a limited number of proven calculation methods for the IRP process, and then allowing a utility to implement the one that it prefers in a given situation. Statements regarding Issue 2c from the parties' Opening Testimony follow below:

> <u>Idaho</u>
> ***Q. Should the Commission require that all utilities use the same calculation methodology in determining the contribution to peak of a renewable resource?***
> *A. No, Idaho Power does not support requiring all utilities use the same calculation methodology. The "one size fits all" approach may not be the best approach for accuracy and flexibility in determining the contribution to peak of renewable generation on each of the utility systems. There are significant differences between the utilities.*[23]
>
> <u>PGE</u>
> *"A requirement for a standardized methodology will not benefit customers, utilities, developers, or IPPs. It will not improve results and may be problematic or impractical for a given system, a given application, or a given set of resource data"* [24]
>
> ***Q. Please summarize PGE's response to Item 2c regarding the pros and cons of requiring utilities to use the same calculation method.***

[23] Idaho Power/100, Haener/15
[24] PGE/100, Albi-MacFarlane/4

A. Requiring utilities to use the same methodology is not of service to customers, utilities, developers, or IPPs and does not improve results. The potential benefit of regulatory simplicity is outweighed by the disadvantages.[25]

PAC

Q. Should the Commission require all utilities to rely on the same methodology for calculating capacity contribution values for renewable resources?

A. The Commission should not require identical methodologies for different utilities. Utilities are not homogeneous, rather they are quite different. [26]

(Follow-up question)

Q. What do you recommend?

A. I recommend that the Commission provide utilities with flexibility in choosing a capacity contribution methodology. Should the Commission wish to better align methodologies among the utilities, I recommend that the Commission guide utilities to choose from at least two methodologies, whereby one of the methodologies is the CF Method, or to require utilities to adopt a methodology that relies on hourly LOLP metrics. Finally, I recommend that the Commission not require utilities to benchmark approximation methods to an ELCC calculation.[27]

ICNU

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.[28]

RNW

Q: Should the utilities be required to use the same calculation method?

A: Specific utilities should not necessarily be required to use the same calculation methodology. A utility may have insufficient data to perform an ELCC, or, given a utility's system size, such a calculation could be too complicated. In the latter case, the utility may have to perform an approximation.[29]

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[25] Ibid.,26
[26] PAC/100, Link/12
[27] Ibid., 13-14
[28] ICNU/100, Mullins/3
[29] RNW/100, O'Brien/8-9

Q. To summarize, what is the Stipulating Parties' agreement regarding issue 1, identifying the preferred methodology to calculate a renewable generator's contribution to capacity?

A. The Stipulating Parties generally agree that the ELCC methodology accurately calculates a renewable generator's contribution to capacity for planning purposes within the IRP process. The Stipulating Parties agree that the capacity calculation for wind and solar generators should be performed either with an ELCC method or with the CF approximation method. The Stipulating Parties agree that both of these methods should produce reasonable and accurate results.

Q. What is the Stipulating Parties' position regarding issue 2, the pros and cons of using an ELCC or an approximation to the ELCC?

A. The Stipulating Parties generally agree that the primary advantage of using an ELCC is that the ELCC is an analytically rigorous method and thus is likely to produce results that are both accurate and precise. An ELCC method that examines all hours of the year has the potential to provide a result that reflects reliability concerns not only during the system peak load but also for other times during the year that the system may be stressed. A potential disadvantage of the ELCC is that it is iterative in nature, meaning that it may take many trial runs for the model to converge to an answer.

A concern was expressed that the ELCC requires highly granular data which may not be routinely collected by the company, or which might not be available to the needed degree of precision. Conversely, an approximation

method reduces the need for resources and data, easing implementation. While the primary disadvantage of the approximation may be a loss of precision and accuracy, some of the experts who presented at the August 17, 2015 Commission workshop agreed that this loss of fidelity is acceptable for planning purposes. Accordingly, all parties were willing to accept the CF approximation method for settlement purposes.

Q. Do the Stipulating Parties have a recommendation for the Commission?

A. Yes. The Stipulating Parties request that the Commission approve and adopt the Stipulation and subsequently order that the capacity contribution of wind and solar generators be calculated by using the ELCC method or the Capacity Factor approximation method (as defined in the Stipulation) for inclusion in a Stipulating Utility-Party's IRP.

Q. Does this conclude the Stipulating Parties' Joint Supporting Testimony?

A. Yes.

Joint Party/101
Carver/1

WITNESS QUALIFICATION STATEMENT

NAME:	Philip H. Carver
EMPLOYER:	Oregon Department of Energy (ODOE)
TITLE:	Senior Policy Analyst
ADDRESS:	625 Marion St. NE Salem, Oregon 97301
EDUCATION:	I have a bachelor's degree in economics from the University of California, San Diego (1972) and a Ph.D. in natural resource and utility economics from the Johns Hopkins University (1978).
EXPERIENCE:	From 1978 to 1980, I was an assistant professor at Dartmouth College. From 1980 until 2008, I worked for the ODOE. During that time I testified in a number of Oregon Public Utility Commission (OPUC) dockets, including UM 1129. From November 2008 to July 2008, I was the lead OPUC staff on the Renewable Portfolio standards rulemaking (AR 518). From May 2010 to December 2012, I was a half-time senior policy analyst with the OPUC. Since then I have worked half-time for ODOE. This work focuses on removing key barriers to the generating more renewable power and reducing energy use.

Overview

Director, Renewable Energy Coalition

Relevant Work Experience

2007-Present: Renewable Energy Coalition
Represent the Coalition and individual members in five regional states; power purchase agreement and interconnection consulting.

1975-2006: PacifiCorp, left as Manager of Qualifying Facility contracts, Portland, OR
Lead roles in company implementation of Public Utility Regulatory Policies Act, including, but not limited to power purchase agreements and interconnection contracting, staff supervision and management, and high level coordination of company's distribution interconnections for qualifying facilities.

1975: Graduate Oregon State, BS