Oregon

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August 13, 2009

Via Electronic Filing and U.S. Mail

OREGON PUBLIC UTILITY COMMISSION
ATTENTION: FILING CENTER
PO BOX 2148
SALEM OR 97308-2148

RE: **Docket No. UM 1355** – In the Matter of THE PUBLIC UTILITY COMMISSION
OF OREGON Investigation into Forecasting Forced Outage Rates for
Electric Generating Units.

Enclosed for electronic filing in the above-captioned docket is the Public Utility
Commission Staff's Supplemental Reply Testimony.

/s/ Kay Barnes
Kay Barnes
Regulatory Operations Division
Filing on Behalf of Public Utility Commission Staff
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c: UM 1355 Service List (parties)

PUBLIC UTILITY COMMISSION
OF OREGON

UM 1355

STAFF
SUPPLEMENTAL REPLY TESTIMONY
OF Kelcey Brown

In the Matter of
THE PUBLIC UTILITY COMMISSION OF OREGON
Investigation into Forecasting Forced Outage Rates
for Electric Generating Units.

<u>REDACTED VERSION</u>
August 13, 2009

PUBLIC UTILITY COMMISSION
OF
OREGON

STAFF EXHIBIT 300

Supplemental Reply Testimony

<u>REDACTED VERSION</u>
August 13, 2009

CERTAIN INFORMATION CONTAINED IN STAFF EXHIBIT 300,

PAGE 17, IS CONFIDENTIAL AND SUBJECT TO PROTECTIVE

ORDER NO. 08-549. YOU MUST HAVE SIGNED

APPENDIX B OF THE PROTECTIVE ORDER IN

DOCKET UM 1355 TO RECEIVE THE

CONFIDENTIAL VERSION

OF THIS EXHIBIT.

1   Q. **PLEASE STATE YOUR NAME, OCCUPATION, AND BUSINESS**

2   **ADDRESS.**

3   A. My name is Kelcey Brown. My business address is 550 Capitol Street NE

4   Suite 215, Salem, Oregon 97301-2551. I am a Senior Economist in the

5   Electric and Natural Gas Division of the Utility Program of the Public Utility

6   Commission of Oregon (OPUC).

7   Q. **ARE YOU THE SAME KELCEY BROWN THAT FILED OPENING AND**

8   **REPLY TESTIMONY IN THIS PROCEEDING?**

9   A. Yes. My Witness Qualification Statement can be found in Exhibit Staff/101,

10   Brown/1.

11 Q. **WHAT IS THE PURPOSE OF YOUR SUPPLEMENTAL REPLY**

12   **TESTIMONY?**

13 A. I will provide additional statistical support for the increased forecast accuracy of

14   Staff's proposed "Benchmark" mechanism, also referred to as the "Collar,"

15   previously proposed in my Opening and Reply testimony. Additionally, I will

16   rebut PacifiCorp's proposed methodology to exclude outlier events in the four-

17   year average and its characterization and misrepresentation of Staff's

18   proposed mechanism. I will also rebut PacifiCorp's following claims:

19   1. That the North American Electric Reliability Council (NERC)

20   Generating Availability Data System (GADS) lacks validity,

21   2. That the age of PacifiCorp's fleet is the cause of high forced outage

22   rates,

1   3. That excluding outlier events from the four-year average equates to

2   performance based ratemaking,

3   4. That the purpose of the four-year average forecast of forced outage

4   rates is to allow recovery of costs from prior periods, and;

5   5. That PacifiCorp's proposed Benchmark mechanism is superior to

6   Staff's mechanism.

7   Lastly, I will discuss Industrial Customer of Northwest Utilities (ICNU) issues

8   related to the heat rate curve adjustment and minimum deration of a thermal

9   facility.

10

11   **Increased Accuracy of the Forecast**

12 **Q. PLEASE DISCUSS YOUR PROPOSED OUTLIER METHODOLOGY,**

13   **REFERRED TO AS THE "BENCHMARK" MECHANISM.**

14 A. The proposed benchmark mechanism, now termed "Collar" is intended to

15   improve the predictive ability of the four-year rolling average forecast of forced

16   outage rates. With only four years of data being used it is important that the

17   data set reflect values that are likely to occur in the test year and would not be

18   considered outliers.

19 **Q. HOW DOES THE COLLAR METHODOLOGY WORK?**

20 A. The Collar is a mechanism that uses NERC data for the comparable plant size

21   and fuel type in order to objectively determine the point at which an annual

22   forced outage rate (FOR) would be considered an outlier. Taking 2008 as an

23   example year, and using the most recent four years of NERC data, one

1   calculates the 90th and 10th percentile values to compare to the reported forced

2   outage rate in 2008. If the outage rate fell above the 90th or below the 10th

3   percentile values the outlier value would be replaced with the NERC 90th or

4   10th percentile value for all four years of the four-year rolling average

5   calculation.[1]

6   **Q. DOES THE COLLAR METHODOLOGY IMPROVE THE ACCURACY OF**

7   **THE FOUR-YEAR ROLLING AVERAGE?**

8   A. Yes. I used the data that PacifiCorp provided in its Supplemental testimony[2]

9   and a Root Mean Squared Error (RMSE) test for accuracy on the PacifiCorp

10   fleet of coal facilities that are in the 300-700 MW range. My analysis,

11   comparing the forecasted FOR, utilizing the Collar, to the actual FOR over all

12   65 observations, demonstrates that using the Collar improves the accuracy of

13   the four-year average. In addition, Staff's proposed Collar methodology has a

14   greater improvement over the simple four-year average than PacifiCorp's

15   alternative mechanism.

16   **Q. WHAT IS THE ROOT MEAN SQUARED ERROR TEST?**

17   A. The RMSE is a statistic used to evaluate the accuracy of a forecast. At its

18   core, the calculation is the squared difference between the forecasted value

19   and the actual value. Analysts use RMSE[3] to compare different forecasting

20   models for a determination of how well they explain a given set of

21   observations.

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[1] For further discussion of the Collar see Staff/100, Brown/18-21 and Staff/200, Brown/8-11.
[2] See PPL/104/Godfrey/1-4 and PPL/105/Godfrey/1-2.
[3] See Pindyck, R. & Rubinfeld, D. (1991). Econometric Models & Economic Forecasts (3rd ed., pp. 338-339). New York: McGraw Hill, INC.

1   **Q. IS THERE ANOTHER TEST TO DETERMINE THE ACCURACY OF ONE**

2   **METHODOLOGY VERSUS ANOTHER METHODOLOGY?**

3   A. Yes. In addition to the RMSE, I also used the Absolute Mean Error (AME) test.

4   Both tests yielded the same results: that the Collar mechanism is a more

5   accurate forecast methodology than simple use of the four-year average.

6   **Q. PLEASE DISCUSS YOUR RESULTS.**

7   A. The following table shows two comparisons. The first is a comparison of the

8   forecast accuracy of the four-year average forecast of forced outages rates to

9   Staff's Collar Mechanism forecast of forced outages rates for PacifiCorp's coal-

10   fired facilities. The second is a comparison of the forecast accuracy of the

11   four-year average forecast of the equivalent outage rates (EOR) to PacifiCorp's

12   Mechanism forecast for the coal-fired facilities.

Model	RMSE	Sum of ABS Error
FOR four-year average	5.12	273.11
Collar four-year average	4.17	218.71
Change from Simple Avg.	-0.95	-54.39
EOR four-year average	4.87	261.15
PacifiCorp four-year average	4.01	215.27
Change from Simple Avg.	-0.87	-45.88

14   A negative value in the "Change from Simple Avg." row indicates the

15   improvement from the simple four-year average. The table makes it clear that

16   both the Staff and PacifiCorp approach improves the accuracy of the simple

17   four-year average. However, the Collar methodology is approximately 20%

18   more accurate, and the PacifiCorp methodology is approximately 18% more

19   accurate, therefore, Staff continues to recommend the Collar mechanism.

1 Q. CAN YOU COMPARE THE ACTUAL ERROR TERMS OF THE STAFF

2   METHODOLOGY TO THE PACIFICORP METHODOLOGY?

3 A. No. For example, it would be inappropriate to compare the 4.17 RMSE of the

4   Staff proposal to the 4.01 RMSE of the PacifiCorp proposal because the RMSE

5   calculations are based on different data sets. However, it is possible to

6   compare the relative improvement over the corresponding four-year average

7   for each proposed mechanism.

8 Q. WHEN THE COMMISSION ORDERED THE OPENING OF A GENERIC

9   DOCKET TO FURTHER INVESTIGATE THE FORCED OUTAGE RATE,

10   WHAT WAS ITS PRIMARY GOAL?

11 A. In Order No. 07-015, the Commission stated that it sought "...the most

12   accurate forecast of forced outages at the relevant plants."[4]

13 Q. PACIFICORP HAS CRITICIZED STAFF'S STATEMENT IN A WORKSHOP

14   THAT IT USED A "VISUAL INTERPRETATION" OF THE DATA SET IN

15   ORDER TO DETERMINE THE 90TH PERCENTILE, RATHER THAN USING

16   STATISTICAL ANALYSIS. HOW DO YOU RESPOND TO THIS

17   CRITICISM?

18 A. Both Mr. Duvall and Mr. Godfrey have criticized Staff's statement that it made a

19   "visual interpretation" that the 90th percentile is the appropriate point in the data

20   set of which to determine that a unit has incurred an outlier year. However,

21   economics is a science that is filled with graphical representations of

22   underlying data. Economists rely on graphical analysis and interpretation of

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[4] See Order No. 07-015, page 14.

1   large data sets in order to determine underlying trends, specific patterns or

2   variations. Although visual interpretation of data can be misleading, and the

3   concepts of standard deviation and confidence intervals have been developed

4   to help identify outliers, PacifiCorp's assertion that visual interpretation should

5   never be used is incorrect. Using and reading visual forms of data is an

6   important type of data analysis and interpretation.

7   **Q. DO YOU CONTINUE TO SUPPORT THE USE OF THE 90TH PERCENTILE**

8   **OF THE NERC PEER GROUP AS THE APPROPRIATE POINT IN ORDER**

9   **TO OBJECTIVELY DETERMINE AN OUTLIER?**

10 A. Yes. As can be seen in the graph below, which is the same graph I provided at

11 the workshop on May 28, 2009, there is a consistent deviation in the slope of

12 the lines of the rank and order of annual forced outage rates from 1999-2007 at

13 the 90th percentile. While visual interpretation is not the only means by which

14 to identify outliers, it is reasonable in this case.

Staff Illustration
May 28, 2009

NERC 600-699 MW
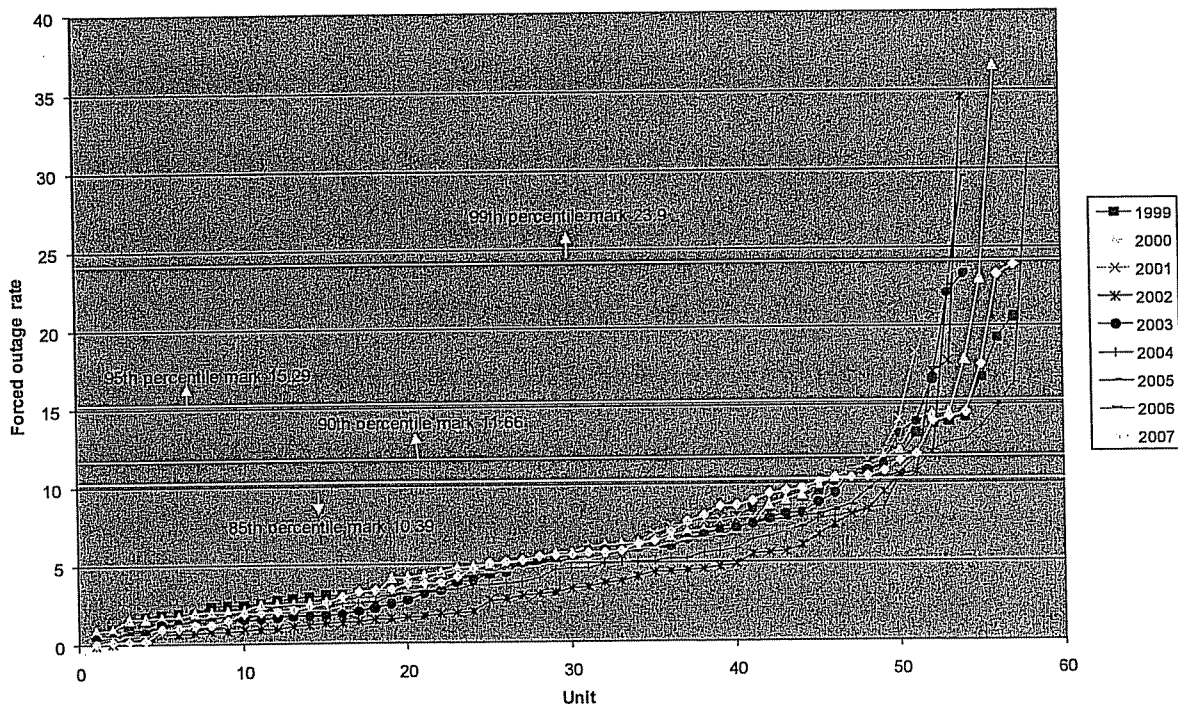
Q. **HOW DO YOU RESPOND TO PACIFICORP'S CRITICISM OF USING A DATA SET COMPOSED OF FOUR YEARS OF DATA TO CALCULATE THE 90TH PERCENTILE AND THEN COMPARING THAT TO THE UNITS FORCED OUTAGE RATE FOR THE YEAR?[5]**

A. PacifiCorp states that it is inappropriate to compare the 90th percentile to the single calendar year forced outage rate of a unit, and instead it should be compared to the four-year average of the unit. However, the purpose of the Collar is to exclude outlier years from the simple four-year average. The PacifiCorp methodology validates this purpose by also adjusting and

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[5] See PPL/102/Godfrey/6/Lines 14-22.

1   comparing its data point on an individual year basis, rather than comparing it to

2   the four-year average.

3

4   **Validity of the NERC Data**

5   Q. **WHY DO YOU USE NERC DATA RATHER THAN THE HISTORICAL**

6   **PERFORMANCE OF THE FACILITY?**

7   A. The NERC information is a data set that incorporates a significant number of

8   units for each peer group. The availability of a unit's own plant data can vary

9   significantly. For example, Colstrip 3 and Colstrip 4 have been in operation

10   since 1984 and 1986 respectively, yet the only data that PacifiCorp claims is

11   available is 1999 to present. This lack of data is also true of Craig 1 and 2 and

12   Hayden 1 and 2. The same problem (lack of data) would exist if a new plant

13   were built or acquired. Therefore, without a consistent data set for all facilities

14   it is unreasonable to base a mechanism on a varying number of years and

15   have this represent the full spectrum of what is possible for the unit.

16 Q. **PACIFICORP HAS IMPLIED THAT THE NERC DATA IS UNRELIABLE.[6]**

17   **DO YOU AGREE?**

18 A. No. Taking a quote from the NERC website "The quantity and quality of its

19   data have made GADS (Generating Availability Data System) an indispensable

20   industry asset. Utilities, manufacturers, architect/engineers, consultants,

21   regulators, and others rely on GADS to help them improve the availability of

22   generating units and equipment."

[6] See PPL/102/Godfrey/3-4.

1 **Q. DO YOU AGREE WITH PACIFICORP'S CLAIM THAT THE NERC DATA IS**

2 **UNVERIFIABLE AND INCONSISTENT?[7]**

3 A. No. NERC provides a "comprehensive set of guidelines, called the GADS Data

4 Reporting Instructions, which assures data comparability between utilities and

5 units. Exacting validation procedures assures data accuracy."[8]

6 **Q. IS PACIFICORP'S ASSERTION THAT THE COLLAR METHODOLOGY**

7 **RESULTS IN EXCESSIVE REPLACEMENT OF UNIT SPECIFIC DATA**

8 **WITH INDUSTRY DATA VALID?**

9 A. No. PacifiCorp implies throughout its testimony[9] that the Collar methodology is

10 replacing the unit's own plant data every year, and is playing a much larger role

11 in the forecasting of forced outage rates for the test period. This is simply

12 untrue. The Collar mechanism is used to identify outlier years as compared to

13 all units in its peer group by size and fuel type.

14 **Q. DOES THE PAST PERFORMANCE OF THE PLANT CONTINUE TO BE**

15 **USED IN STAFF'S PROPOSED METHODOLOGY?**

16 A. Yes. The function of the Collar methodology is to eliminate outlier years from

17 the test period forecast, so that the forecast will not be unreasonably skewed or

18 biased. Additionally, over 153 observations (1999-2007, units 300-799 MW)

19 the Collar mechanism would have been implemented only 16 percent of the

20 time for the 90th percentile.

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[7] *Id.*
[8] See http://www.nerc.com/page.php?cid=4|43, August 11, 2009.
[9] See PPL/102/Godfrey/8, and PPL/405/Duvall/6.

1   Q   PACIFICORP QUOTES THE NERC BENCHMARKING SERVICE, WHICH

2   STATES THAT FOR PURPOSES OF BENCHMARKING IT RECOMMENDS

3   A SELECTED PEER GROUP.[10] DO YOU BELIEVE THIS STATEMENT

4   APPLIES TO THE COLLAR METHOD?

5   A. No. The NERC data is used by the industry for many purposes: availability

6   trend analysis, comparative performance studies, unit benchmarking, vendor

7   evaluations, spare parts inquiries, probability assessments, and unit modeling

8   are just a few.   For all these purposes there will potentially be a different set of

9   data. The Benchmarking service, which NERC provides, is a specific type of

10   service wherein statistical information of a specific peer group is used so that a

11   utility may set reasonable cost-effective goals of performance.

12   Q. IS THE COLLAR METHOD ATTEMPTING TO SET PERFORMANCE

13   GOALS?

14   A. No.

15   Q. WHY IS THE NERC PEER GROUP, BASED ONLY ON SIZE AND FUEL

16   TYPE, THE APPROPRIATE GROUP TO CONSIDER IN THE COLLAR

17   METHOD?

18   A. For purposes of determining the full spectrum of possible outage rates of a unit

19   it is important to sample a large data set. Typically, all else being equal, a

20   larger sample size leads to increased precision in estimates. As the sample

21   size grows, the variation in these estimates will decrease, thus producing a

22   more consistent and more accurate result.

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[10] See PPL/102/Godfrey/3.

1

2

Factors that Affect Forced Outage Rates

3 Q. **DO YOU AGREE WITH PACIFICORP'S CLAIM THAT THE AGE OF ITS**

4 **FLEET IS A SIGNIFICANT FACTOR IN THE OCCURRENCE OF FORCED**

5 **OUTAGES?**[11]

6 A. No. The statistics of its own fleet do not support the PacifiCorp statement that

7 the age of the unit negatively affects the forced outage rate of the facility. In

8 fact, when looking at the four oldest of the PacifiCorp units, as compared to the

9 four youngest, the statistics are as follows:

10

	Average EOR	Average Age
Four Oldest Facilities	5.31	51.00
Four Youngest Facilities	8.74	25.50

11 Q. **DO THE PACIFICORP UNITS COMPARE TO THE AVERAGE AGE OF**

12 **THE NERC UNITS IN ITS PEER GROUPS?**

13 A. Yes. When comparing the PacifiCorp units to the NERC data in its relevant

14 peer group it is striking how closely related they are with respect to the relative

15 age of the units. The following chart shows the NERC data as compared to the

16 PacifiCorp fleet.

Unit Size	PacifiCorp Number of Units	PacifiCorp Average Age	NERC Average Age	NERC Number of Units
0-99	1	54	48	181
100-199	5	48	49	242
200-299	3	40	44	118
300-399	4	34	37	80
400-599	11	31	31	156
600-799	2	24	29	95
Total	26	38	40	872

17

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[11] "Older units are more likely to have more frequent forced outages." See PPL/102/Godfrey/2/Lines8-9.

1   As is shown, the NERC industry average age is on average higher than the

2   average age of the PacifiCorp units.

3 Q DID PACIFICORP ALSO CLAIM THAT OTHER OPERATIONAL

4   CHARACTERISTICS WOULD CAUSE HIGHER INCIDENCES OF FORCED

5   OUTAGES?

6 A. Yes. At PPL/102, Godfrey/2, Mr. Godfrey claimed that not only the age of the

7   unit, but also operational characteristics would cause the unit to have higher or

8   lower forced outages. However, the Company provided no support for its

9   conclusions. As Staff has shown, from a statistical point of view, for

10   PacifiCorp's units the age of the unit has no merit in predicting the incidence of

11   forced outages.

12 Q. CAN MAINTENANCE PRACTICES CAUSE HIGHER INCIDENCES OF

13   FORCED OUTAGES?

14 A. Yes. If a utility does not perform the suggested maintenance, or fails to

15   adequately maintain its units this will cause the unit to fail at a greater rate than

16   a unit that is more appropriately maintained. If a utility is consistently

17   performing at the bottom of the group with respect to reliability, it may need to

18   consider reviewing its maintenance practices, which may yield better results.

19

20   **Performance Based Ratemaking**

21 Q. IS THE COLLAR METHODOLOGY INTENDED TO SET LEVELS THAT

22   WOULD IMPLY PERFORMANCE BASED RATEMAKING TREATMENT?

1   A.   No. PacifiCorp claims[12] that the Collar methodology is akin to performance

2   based ratemaking. However, performance based ratemaking is typically tied to

3   a goal that the utility would attempt to meet or exceed, and if it exceeded that

4   goal it would reap the benefit, or vice-versa, incur greater cost. PacifiCorp

5   insinuates that Staff is setting a performance goal so that PacifiCorp's units

6   must beat the worst ten percent of its class, by size and fuel type. As stated

7   previously, the collar mechanism is intended to improve the accuracy of the

8   simple four-year average.

9   Q.   **HAS PACIFICORP RAISED CONCERNS ABOUT SPECIFIC PLANTS**

10   **CONSISTENTLY FALLING OUTSIDE OF THE 90TH PERCENTILE?[13]**

11   A.   Yes. In response, Staff makes two points with regard to PacifiCorp's complaint

12   that a small number of its units are *consistently* falling below the worst ten

13   percent of its group.

14   First, PacifiCorp erred in its application of the Collar methodology and the

15   instances of it replacing the plants forced outage rate with the NERC data are

16   less than what the Company claims.[14] In addition, the outage data is not re-

17   evaluated every year. Rather, it is compared to the relevant NERC time period

18   only once. In the Collar methodology, it is that value which will remain for the

19   entire four year time period.

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[12] See PPL/405/Duvall/12.
[13] See PPL/405/Duvall/6.
[14] In response to PacifiCorp's data request No. 3.1 Staff stated that the 90th percentile value is calculated using the full four years of data, not calculating each individual year and then averaging each percentage value. It is inaccurate to average the percentages given that from year to year the denominator is a different value. PacifiCorp ignored the response and inaccurately calculated the 90th percentile point this resulted in an incorrect application of the collar.

1   Second, if a unit were to consistently fall below the worst ten percent of its

2   peer group, Staff is open to discussing with the Company reasons for that

3   performance and possible solutions. For example: is the appropriate

4   maintenance being performed? Are there unique components or operating

5   characteristics at the plant that suggest a more comparable peer group should

6   be identified for purposes of determining outlier events?

7

8   **Retroactive Ratemaking**

9 **Q. HAS PACIFICORP STATED THAT BY CHANGING THE FORECAST OF**

10   **THE FORCED OUTAGE RATE FOR THE TEST PERIOD IT WOULD BE**

11   **UNABLE TO RECOVER COSTS FROM PRIOR PERIODS?**

12 A. Apparently so, Mr. Duvall states at PPL/405, Duvall/10 "The result is that

13   Staff's benchmark mechanism may function to deny recovery of prudent costs."

14 **Q. WHAT PROCEDURAL OPTIONS ARE AVAILABLE TO THE UTILITY IF IT**

15   **EXPERIENCES AN EXTREME OUTAGE EVENT?**

16 A. If a utility experiences an extreme forced outage event it has two procedural

17   options, it can seek deferral of the excessive costs associated with that event,

18   or it can choose to do nothing.

19 **Q. IS RETROACTIVE RATEMAKING GENERALLY ALLOWED IN THE**

20   **STATE OF OREGON?**

21 A. No, absent deferred accounting authority under ORS 757.259. In dockets DR

22   10/UE 88/UM 989, Order No. 08-487, the Commission stated the following:

23   "Utility rates are based on a utility's anticipated expenses and revenues. The

1   rule against retroactive ratemaking prohibits the Commission from setting rates

2   to allow a utility to recover past losses or require it to refund past profits. The

3   rule against retroactive ratemaking is intended to ensure that customers are

4   paying rates that reflect the cost of service at the time the service is

5   rendered."[15]

6 **Q. IS THE TRANSITION ADJUSTMENT MECHANISM (TAM) A COST**

7 **RECOVERY MECHANISM FOR PAST REGULATORY COSTS?**

8 A. No. The TAM is an automatic adjustment clause that allows the Company to

9   update its variable power costs, which provides significant benefit for the

10   Company on a year-to-year basis. The forced outage rate four-year rolling

11   average is part of the annual update in the TAM. This update is not intended to

12   be a retroactive ratemaking tool in which the Company can increase rates in

13   the test year in order to recover costs from prior periods. Again, the purpose of

14   the TAM is to determine the most accurate forecast for the test period,

15   consistent with the objective identified in Order No. 07-015 – not to recover

16   costs from prior periods.

17 **Q. HAS THE COMMISSION DISCUSSED ITS RESERVATIONS ON**

18 **INCLUDING OUTLIERS IN THE FORECASTED TEST PERIOD?**

19 A. Yes. In PacifiCorp's 2007 TAM filing, UE 191, Order No. 07-446, the

20   Commission stated the following: "The Company documents show that the

21   anticipated duration of the resulting outage was five to seven weeks. An

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[15] See Order No. 08-847 at 36.

1   outage of that duration, no matter what the cause, is anomalous, and raises

2   issues regarding its inclusion in normalized rates."

3

4   **PacifiCorp's Proposed Methodology**

5   Q. **HAS PACIFICORP INTRODUCED A NEW METHODOLOGY FOR**

6   **EXCLUDING OUTLIER EVENTS IN ITS SUPPLEMENTAL TESTIMONY?**

7   A. Yes. PacifiCorp has proposed a mechanism to identify outlier years from

8   being included in the four-year average forced outage rate forecast. The

9   PacifiCorp method is a two-step method based on a unit's history of outage

10   rates, from 10-20 years depending on the unit. First, the Company identifies

11   outage events that are greater than 28 days. Those days beyond the 28th day

12   are removed and replaced with prior period information.[16] Second, the

13   Company calculates a confidence interval using the mean (average) of the

14   data and the standard deviation. It then uses this mean and standard deviation

15   to determine the 95 percent confidence level that a forced outage rate will

16   occur.

17   Q. **WHAT ARE YOUR CONCERNS WITH THE APPROACH THAT**

18   **PACIFICORP HAS TAKEN IN ITS PROPOSAL?**

19   A. As I discussed previously, using varying lengths of time periods is problematic

20   with respect to the PacifiCorp data. With such a limited data set, such as in the

21   case of Colstrip 3 and 4, only 10 years worth of data points can create erratic

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[16] I was unable to verify the first step in the PacifiCorp process due to the Company's claim that the data was an output from the "Visual FoxPro" and therefore they were not able to provide this as a work paper. (Source: PacifiCorp e-mail from Joelle Steward on 7/28/2009)

1   results on a year to year basis. For example, in 2002 Colstrip 3 incurred a

2   prolonged outage event and had an equivalent outage rate of ████████.

3   The PacifiCorp method first reduces this to ██████████ (to account for an

4   outage that lasted greater than 28 days) and then calculates a 95 percent

5   confidence level which indicates that with 95 percent confidence the units

6   forced outages will fall below ███████████. As you can see, the inclusion of

7   this data point, in only ten points, caused the confidence interval to be

8   extremely large, especially when taking into consideration the average EOR of

9   the plant, not including the outlier year, ██████████. Under this criterion, a

10   year which included outages that lasted in duration of up to 83 days would be

11   considered normal. Conversely, the Craig 2 unit, also only consisting of 10

12   years worth of data, is showing that an outlier year is defined as greater than or

13   equal to ██████████.[17]

14   **Q. IS TWENTY YEARS WORTH OF DATA A MORE VALID DATA SET TO**

15   **CALCULATE PACIFICORP'S PROPOSED CONFIDENCE INTERVAL?**

16   A. No. Using a data set with only twenty data points again has the potential to

17   give too much weight to significant events, and give erroneous indications of

18   what would be considered an outlier. Using the NERC data set, with the

19   significant number of data points, provides a full spectrum of the possible

20   outages that may occur, and gives a more accurate and consistent indication of

21   outlier years.

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[17] See PPL/105/Godfrey/1.

1   **Q. IS THE PACIFICORP METHODOLOGY MORE ACCURATE THAN THE**

2   **FOUR-YEAR AVERAGE?**

3   A. Yes. However, as I showed previously, the PacifiCorp methodology improves

4   the accuracy on average by approximately 18 percent, while the Collar

5   methodology showed an overall improvement of approximately 20 percent.[18]

6   **ICNU Recommendations**

7   **Q. DOES PACIFICORP ADDRESS THE ICNU RECOMMENDATIONS**

8   **ASSOCIATED WITH THE HEAT RATE CURVE ADJUSTMENT AND THE**

9   **MINIMUM OPERATING CAPACITY ADJUSTMENT IN ITS**

10   **SUPPLEMENTAL TESTIMONY?**

11   A. Yes. Mr. Duvall addresses these issues at PPL/405/Duvall/16-20.

12   **Q. PLEASE SUMMARIZE ICNU'S RECOMMENDATION ASSOCIATED WITH**

13   **THE HEAT RATE CURVE ADJUSTMENT.**

14   A. ICNU recommends that PacifiCorp be required to adjust the heat rate curve of

15   its thermal facilities so that "…it produces the same heat consumption at the

16   derated maximum and minimum capacities as the unit would actually

17   experience in normal operations…"[19]

18   **Q. WHAT IS A HEAT RATE CURVE?**

19   A. A heat rate curve is the input/output relationship for a generating unit.

20   Generally, thermal units show a declining amount of thermal energy needed as

21   output rises; they become more efficient at converting fuel into energy as the

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[18] The 18 and 20 percent improvement of the simple four-year average is calculated by comparing the three error terms of the four year average to the respective outlier methodology error terms.
[19] See ICNU/100/Falkenberg/55.

1   output increases. When PacifiCorp's model derates the maximum capacity of

2   the unit, (i.e. 600 MW to 540 MW) the corresponding heat rate indicates the

3   plant is less efficient than it actually is at the operating maximum, and creates

4   an unrealistic scenario in the GRID model.

5 Q. DOES PGE MAKE THIS ADJUSTMENT, AS DESCRIBED BY MR.

6   FALKENBERG?

7 A. Yes. PGE's model recognizes that the derating of the unit in the model,

8   associated with forced outages, has no impact on the unit's efficiency at

9   converting fuel into energy.

10 Q. DO YOU SUPPORT MR. FALKENBERG'S RECOMMENDATION, THAT

11   THE MODEL SHOULD INCORPORATE AN ADJUSTMENT TO THE HEAT

12   RATE CURVE, CONSISTENT WITH PGE?

13 A. Yes.

14 Q. PLEASE SUMMARIZE ICNU'S RECOMMENDATION ASSOCIATED WITH

15   AN ADJUSTMENT TO THE MINIMUM CAPACITY OF THE UNIT.

16 A. As stated previously, in the PacifiCorp model a unit is derated in order to reflect

17   a forced outage rate for the unit. For example, if a 600 MW unit had a forced

18   outage rate of 10%, this would be reflected in the model as an availability rating

19   of 90 percent and a maximum capacity of only 540 MW.[20] However, the

20   PacifiCorp model does not adjust a unit's minimum operating capacity. For

21   example, when the unit dispatches in the model at its maximum operating

22   capacity it will only dispatch at 540 MW. If the minimum operating capacity

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[20] 600 MW x 10% = 60 MW, 600 MW – 60 MW = 540 MW.

1 were 200 MW, and the model were to dispatch at the minimum operating

2 capacity it would reflect the unit as having 100 percent availability.   The below

3 example illustrates the dispatch of the unit at the different operating levels.

	Size	Hours	MWh
Maximum operating capacity	600 MW	20	12,000
90% availability	540 MW	20	10,800
Minimum operating capacity	200 MW	20	4,000
90% availability	180 MW	20	3,600

5 **Q. DOES PGE MAKE THIS ADJUSTMENT, AS DESCRIBED BY MR.**

6 **FALKENBERG?**[21]

7 A. Yes. PGE makes an adjustment to the unit's minimum operating capacity in

8 MONET so that it reflects the correct availability rating.

9 **Q. DO YOU SUPPORT MR. FALKENBERGS RECOMMENDATION, THAT**

10 **THE MINIMUM OPERATING CAPACITY OF A UNIT SHOULD BE**

11 **ADJUSTED TO REFLECT THE CORRECT AVAILABILITY RATING?**

12 A. Yes. Consistent with PGE modeling, Staff supports Mr. Falkenberg's

13 recommended adjustment.

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

15 A. Yes.

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[21] See ICNU/100/Falkenberg/52-53.

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CERTIFICATE OF SERVICE

UM 1355

I certify that I have this day served the foregoing document upon all parties of record in this proceeding by delivering a copy in person or by mailing a copy properly addressed with first class postage prepaid, or by electronic mail pursuant to OAR 860-13-0070, to the following parties or attorneys of parties.

Dated at Salem, Oregon, this 13th day of August, 2009.

Kay Barnes

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