BEFORE THE WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION

WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION, Complainant, v. PACIFICORP, d/b/a Pacific Power & Light Company, Respondent.	DOCKET NO. UE-050684

TESTIMONY OF

YOHANNES K.G. MARIAM

STAFF OF
WASHINGTON UTILITIES AND
TRANSPORTATION COMMISSION

RE: PACIFICORP GENERAL RATE CASE

November 3, 2005

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LIST OF EXHIBITS

1	**I.**	**INTRODUCTION**

2

3 **Q.** **Please state your name and business address.**

4 A. My name is Yohannes K.G. Mariam. My business address is 1300 S.

5 Evergreen Park Drive S.W., P.O. Box 47250, Olympia, WA 98504. My email

6 address is ymariam@wutc.wa.gov.

7

8 **Q.** **By whom are you employed and in what capacity?**

9 A. I am employed by the Washington Utilities and Transportation Commission

10 as Regulatory Analyst (Economist).

11

12 **Q.** **How long have you been employed by the Commission?**

13 A. I have been employed by the Commission since September 1999.

14

15 **Q.** **Have you prepared an exhibit that states your educational and**

16 **professional background?**

17 A. Yes. My Exhibit No. ___ (YKGM-2), entitled "Qualifications and Experience

18 of Yohannes K.G. Mariam," summarizes my qualifications.

19

20

		II. SCOPE OF TESTIMONY

1

2

3 **Q.   What is the scope of your testimony?**

4 A.   I present Staff's recommendation regarding PacifiCorp's proposed

5   temperature normalization adjustment, including the impact on the

6   Company's proforma revenue requirement.

7   The temperature normalization adjustment is also called the "weather

8   normalization" adjustment. In my testimony, both terms refer to the same

9   issue: adjusting test year electricity usage based on the difference between

10   normal temperature and test year average temperature.

11

12   III.   SUMMARY OF TESTIMONY

13

14 **Q.   Please summarize your testimony.**

15 A.   Staff's temperature normalization adjustment reduces PacifiCorp's revenue

16   requirements by $1.485 million.

17   Staff's adjustment increases PacifiCorp's test year normalized

18   electricity consumption by 43,629 MWh, as shown in my Exhibit No. ___

19   (YKGM-3), Table 9a. This results in a pro forma revenue increase of $2.215

20   million, as shown in the same table. The cost of these additional MWH

1   increases the Company's pro forma operating expenses by $698,000. After

2   adjusting for accounting adjustments such as taxes, the Staff weather

3   normalization adjustment increases PacifiCorp's Net Operating Income

4   (NOI) by $881,000.

5   Staff Witness Thomas Schooley is responsible for incorporating the

6   impact of this adjustment on the Company's net operating income, revenue

7   requirements, and rates.

8   I also explain that the Commission should reject PacifiCorp's

9   temperature normalization adjustment because the Company cannot show it

10   is supported by reliable data, current data, or data applicable to Washington.

11   The Commission should also order PacifiCorp to acquire and maintain

12   appropriate data, model and statistical results regarding weather

13   normalization data. My specific recommendations in this regard are found

14   in Section V.

15

16   **IV.   DISCUSSION**

17

18   **A.   The Need For a Temperature Normalization Adjustment**

19

20 **Q.   Why is a temperature normalization adjustment necessary?**

1   A.   The Commission sets rates based on normal temperatures. In Washington,

2   PacifiCorp's customers use electricity for space heating and air conditioning.

3   Consequently, temperature greatly impacts usage of electricity by residential,

4   commercial and industrial class. This impact is reflected in the Company's

5   total revenues.

6   To take a simple example, assume a utility had no air conditioning

7   load, just heating load. If the test year was warmer than normal, customers

8   would heat less, and the test year revenues recorded by the utility would be

9   lower than normal. Conversely, if the test year was colder than normal,

10   customers would heat more, and the test year revenues recorded by the

11   utility would be higher than normal. In either case, a temperature

12   normalization adjustment is necessary in order to determine the proper level

13   of revenue based on normal temperature conditions.

14

15   **B.   The Basic Calculation of a Temperature Normalization Adjustment**

16

17   **Q.   What parameters are required in order to compute temperature normalized**

18   **electricity consumption for the test year?**

1 A. Four parameters are needed to compute electricity temperature normalized

2 consumption for the test year. These are normal temperature, variations

3 from normal temperature using unbilled heating and cooling degree days,

4 temperature sensitivity coefficients and test year number of customers.

5

6 Q. **How is normal temperature determined?**

7 A. Normal temperature is determined from data published by the National

8 Oceanographic and Atmospheric Administration (NOAA). NOAA

9 computes normal heating and cooling degree days at various locations,

10 including locations in PacifiCorp's service area in Washington.

11 NOAA relies on standards established by the World Metrological

12 Organization (WMO), of which the United States is a member. The WMO

13 develops weather normals based on 30 years of observations. The WMO has

14 set the end of a decade as the proper term for a 30-year period from which to

15 calculate climatic conditions. The average value of a meteorological variable

16 such as precipitation or temperature over the 30 years is defined as a

17 "climatological normal," or "climate normal."[1]

---

[1] World Meteorological Organization, 1984: Technical Regulations, Vol. I. WMO Publication No. 49, Geneva, Switzerland.

1   Thus, NOAA computes 30-year climate normals every ten years. The

2   premises behind the development of normals every ten year are: (1) there

3   would be adequate temperature data to capture trends; and (2) climate

4   normals calculated every 10 years would smooth out the year-to-year

5   variations.

6   NOAA provides normal temperatures for the three largest cities in

7   PacifiCorp's service territory: Yakima, Walla Walla and Sunnyside, for the

8   period 1971-2000. This data is shown in my Exhibit No. ___(YKGM-3),

9   Tables 4b, 6b, and 8b.

10   NOAA implements a relatively robust method to remove or minimize

11   the effects of missing data, errors in recording data, changes in

12   instrumentation, observation practices, observation time, temperature

13   abnormalities, and so on, in order to derive normal temperature.

14

15 **Q.**   **How are variations from normal calculated?**

16 A.   Variations from normal are computed using heating degree-days ("HDD")

17   and cooling degree days ("CDD").

18   In normalizing test year electricity consumption, the temperature of

19   each day of the test year is compared to the normal temperature for that day.

1   The difference, or variation between normal and actual test year

2   temperature, is called unbilled heating or cooling degree days.

3   One heating degree day, or 1 HDD, is a day when the average daily

4   temperature was one degree below 65 degrees Fahrenheit (65^0F). Conversely,

5   one cooling degree day, or CDD, is a day when the average daily

6   temperature was 66^0F: one degree above 65^0F. A zero degree day is a day

7   when the temperature was 65^0F. In other words, a heating degree day

8   measures the difference between average temperature for the day and 65

9   degrees Fahrenheit.

10   65^0F is an internationally accepted average outside temperature that

11   would result in an indoor bodily comfortable temperature. When the

12   outside temperature is below 65^0, the indoor temperature needs to be

13   increased by space heating.

14

15 **Q. How are temperature sensitivity coefficients and test year customers used**

16   **in the calculation of the adjustment?**

17 A. Temperature sensitivity coefficients or factors are developed by applying

18   appropriate statistical methods to the heating and cooling degree day

19   information. These coefficients are multiplied by unbilled heating and

1   cooling degree days and the number of customers. The result is temperature

2   normalized electricity consumption for the test year.

3

4   **C.**   **Staff's Temperature Normalization Adjustment**

5

6   *1.*   *Staff's method*

7

8   **Q.**   **Please explain Staff's weather normalization method.**

9   A.   In Staff's weather normalization method:

10   (1)   Staff used Company-provided monthly temperature and retail sales
11   data for the period 1995-2004, and calculated electrical use per
12   customer;
13

14   (2)   Staff used 65^0F as the "base" or "cut-off" temperature to calculate test
15   year heating and cooling degree days for each month;[2]
16

17   (3)   Staff obtained 1971-2000 normal heating and cooling degree days from
18   NOAA for PacifiCorp's service area (Yakima, Sunnyside, and Walla
19   Walla). *See my Exhibit No. ___ (YKGM-3), Tables 4b, 6b, &8b*;
20

21   (4)   Staff incorporated non-weather related variables (*e.g.*, holidays,
22   seasons, month and year) that may affect use per customer;
23

24   (5)   Staff implemented an "Autoregressive Moving Average" (ARMA)
25   statistical procedure to estimate the impact of temperature on use per
26   customer relating to the development of temperature (heating and

---

[2] In this testimony, the terms "base," or "cut-off" temperature are used interchangeably. They refer to the choice of temperature value(s) from which departures are calculated to determine HDD and CDD. Commission Staff uses 65^0F as the base or cut-off temperature.

1		cooling) sensitivity coefficients. *See my Exhibit No. ___ (YKGM-3), Tables 1, 3, 4a, 5, 6a, 7, & 8a;*
2		
3		
4	(6)	Staff obtained monthly total number of customers in the test year;
5		
6	(7)	Staff multiplied the weather sensitivity coefficients by the number of
7		customers and unbilled heating and cooling degree days. The results
8		are monthly temperature normalized test year electricity
9		consumption. *See my Exhibit No.__(YKGM-3), Tables 3, 4a, 5, 6a, 7, &*
10		*8a;* and
11		
12	(8)	Staff multiplied the temperature normalized test year electricity
13		consumption by the energy rates to estimate the pro forma revenue
14		impact of Staff's temperature adjustment procedure.
15		

16 2. *Statistical tests showing the reliability of Staff's data*

17

18 **Q.** **Did Staff conduct any testing to assure the reliability of its data?**

19 A. Yes. For example, Staff applied the coefficients it developed to test year

20 usage, to derive estimated use per customer. Staff then compared this

21 estimated use per customer to the actual use per customer for the period

22 1995-2004.

23 The results are presented in my Exhibit No. ___ (YKGM-3), Table 2.

24 Table 2 shows that the average difference between the estimated and actual

25 use per customer is 0.39%. This level of accuracy, based on monthly retail

26 sales data, reflects a robust analysis.

1   The 95% confidence level for the estimated use per customer data

2   showed that the average margin of error is 2.68%. This means that the

3   average difference between estimated and actual use per customer obtained

4   from Staff's analysis is about seven (2.68%/0.39%= 7) times less than what

5   would be obtained under a 95% confidence level. *Exhibit No. ___ (YKGM-2),*

6   *Table 2.*

7   Therefore, Staff's procedure closely approximates actual use per

8   customer and is accurate in capturing the impact of changes in temperature

9   on use per customer.

10

11   **Q.   What other statistical tests did Staff use to test the reliability of the data**

12   **used in Staff's adjustment?**

13   A.   In calculating weather sensitivity coefficients, Staff corrected for serial

14   correlation using the Autoregressive Moving Average (ARMA) statistical

15   procedure.

16

17   **Q.   Please describe serial correlation, and explain the importance of correcting**

18   **for serial correlation in the weather normalization adjustment.**

19   A.   Serial correlation, also called autocorrelation, refers to the relatively higher

20   degree of association between components of two observations (often

1   adjacent or consecutive time periods) that cannot be explained by variables

2   included in the analysis (also called error or residual terms).

3   The statistical measure that determines the existence of serial

4   correlation is called the "Durbin-Watson" or "D-W" statistic. In general, if

5   the value of the D-W statistic is close to 2.00, then there is no problem with

6   serial correlation. For a sample size ≥100, a D-W statistic that lies between

7   1.57 and 2.20 implies that there is no problem of serial correlation.

8   It is important to correct for serial correlation because otherwise, one

9   could be led to conclude that the statistical estimates are more precise than

10   they really are. This could result in consistently under-estimating or over-

11   estimating future values of the same variables. That is, the estimated level of

12   electricity usage for the next one, two, three, or five years could be

13   significantly higher or lower compared with results obtained from a model

14   that makes a correction for these kinds of correlations.

15   Therefore, in order to improve the reliability of estimates of weather

16   sensitive electricity usage, it is necessary to correct correlations between

17   residuals of adjacent observations.

18

19 **Q.   How does Staff's weather normalization adjustment correct for serial**

20   **correlation?**

1   A.   As I indicated earlier, Staff implemented the Autoregressive Moving

2   Average (ARMA) procedure to estimate the weather sensitivity coefficients.

3   As my Exhibit No. ___ (YKGM-3), Table 1, shows, the D-W statistics are close

4   to 2.00. Consequently, there is no serial correlation problem in Staff's data.

5

6   *3.   The power cost offset*

7

8   **Q.   What is the amount of additional power costs associated with the**

9   **additional MWh reflected in Staff's Weather Normalization Adjustment?**

10 A.   The additional power costs are $698,000.

11

12 **Q.   How did you calculate that $698,000 figure?**

13 A.   That figure was calculated using PacifiCorp's system wide net power cost of

14   about $895 million, divided by the Company's net system load of 57 million

15   MWh, for an average energy cost of $16/MWh. I multiplied $16/MWH times

16   Staff's additional 43,629 MWhs from its weather normalization analysis,

17   resulting in a power cost increase of $698,000.

18

1   **Q.**   **Is that a precise calculation?**

2   A.   No. But, it is the best calculation possible under the circumstances. A more

3   precise calculation would be made by performing a weather normalization

4   calculation for all PacifiCorp's jurisdictions, not just Washington. However,

5   that was not possible.

6

7   **Q.**   **Did Staff request PacifiCorp to calculate the power cost and revenue**

8   **impact of Staff's weather normalization adjustment?**

9   A.   Yes. Staff requested that information in Staff Data Request No. 260. The

10   Company's Response is contained in my Exhibit No. ___ (YKGM-4).

11

12 **Q.**   **Is the data the Company provided in that response useful?**

13 A.   No. There are three reasons why the information supplied by the Company

14   is not useful:

15   (1)   PacifiCorp improperly added Staff's normalized test year

16   volumes to normalized system-wide test year volume in the

17   Company's calculation of production factor;

18   (2)   PacifiCorp erred in using the system generation (SG) factor to

19   calculate the power cost impact of Staff's weather normalization

20   adjustment; and

1   (3)   PacifiCorp cannot show the information in the Company's

2   Response is reliable, accurate and statistically valid because it is based

3   on an RTI study from the 1980's that has the same deficiencies.

4

5   **Q.   Please describe the production factor and how it is used in this rate**

6   **proceeding.**

7   A.   Staff Witness Mr. Schooley provides an explanation in his testimony

8   regarding the determination PacifiCorp's production factor. As he explains,

9   the production factor is applied to the pro forma power costs and

10   generation-related rate base to bring the projected costs of the rate year back

11   to the test year level of electricity consumption.

12   The production factor is the ratio of test year normalized megawatt

13   hours (MWH) to rate year MWH.

14

15   **Q.   Why was it improper for PacifiCorp to add Staff's normalized Washington**

16   **test year load to system-wide rate year load in computing the production**

17   **factor in the Company's Response to Staff Data Request No. 260?**

18   A.   PacifiCorp derived the system-wide rate year load using a method different

19   than the method Staff used to calculate Washington's normalized test year

1   load. Because the loads were not calculated in a consistent manner, it is not

2   appropriate to simply add them together.

3   To be consistent, PacifiCorp should have computed system-wide

4   normalized test year loads using the same method Staff used in its weather

5   normalization adjustment for Washington. PacifiCorp did not use a

6   consistent method, so the results in its Response are erroneous.

7

8 **Q. Why was it improper for PacifiCorp to use the SG factor to calculate the**

9   **power cost impact of Staff's weather normalization adjustment?**

10 A. The Company's System Generation (SG) factor is based on the same flawed

11   method for calculating weather normalized loads as the Company used in its

12   weather normalization adjustment. Therefore, it is not appropriate to use

13   that factor in the Company's Response to Staff Data Request No. 260.

14   The Company's SG factor is a weighted average of the System

15   Capacity (SC) factor, which is a measure of peak load responsibility, and the

16   System Energy (SE) factor, which is a measure of annual use. The SG factor

17   weights the SC factor 75 percent and the SE factor 25 percent (*i.e.*,

18     $SG_{WA}=0.75*SC_{WA}+0.25*SE_{WA}$).

19   The SE factor PacifiCorp used in developing the SG factor is the ratio

20   of each jurisdiction's temperature adjusted energy to system total

1   temperature adjusted energy. The Company calculates these temperature

2   adjusted energy figures using the same temperature normalization method

3   the Company uses in its weather normalization adjustment. As I explain

4   later in my testimony, the Company's method is flawed.

5

6 **Q.**   **Why was it improper for PacifiCorp to use the RTI study in preparing its**

7   **Response?**

8 A.   As I explain in more detail later in my testimony, Staff cannot verify the

9   reliability or accuracy of the data, methods, and statistical results of the RTI

10   study PacifiCorp used in developing the Company's weather normalization

11   adjustment. Because the Company also relied on the RTI study to prepare its

12   Response to Staff Data Request No. 260, the Company cannot show that its

13   Response is reliable, accurate or statistically valid.

14

15 **Q.**   **Is Staff's cost calculation conservative in the Company's favor or the**

16   **ratepayers' favor?**

17 A.   It is conservative in the Company's favor because the power cost I used was

18   based on aggregate total Company figures. Staff's calculation of the power

19   cost impact due to weather normalization adjustment is in the Company's

1 favor because it imputes a somewhat higher power cost compared to Staff's

2 power supply and cost allocation analysis.

3

4 **Q. In future PacifiCorp rate cases, does the Staff intend to apply the**

5 **temperature normalization method it used in this case?**

6 A. Not necessarily. Staff's method is applicable in this rate proceeding, but the

7 methods, data, and relevant information can and should be improved. In

8 Section V of this testimony, I provide a list of specific recommendations

9 designed to develop improved data. If the Commission orders PacifiCorp to

10 comply with those conditions, and if PacifiCorp complies, the temperature

11 normalization analysis in future cases will be improved.

12

13 **D. Comparison of Staff and Company Temperature Normalization**
14 **Adjustments**
15

16 **Q. What temperature normalization adjustment does PacifiCorp offer in this**

17 **case?**

18 A. PacifiCorp is offering Adjustment 3.1, entitled "Weather Normalization."

19 The Company's adjustment reduces test year revenue by $2,698,406, as

20 shown in Mr. Wrigley's Exhibit No. ___ (PMW-3), page 3.0, column 3.1.

21

1 **Q.** **What is the difference in MWh and revenues between the Staff and**

2 **Company Weather Normalization Adjustments?**

3 A. Staff's weather normalization method results in increases actual test year

4 electricity consumption by 43,629MWh. This results in an increase to test

5 year revenues of $2.215 million. These figures are shown in the "Total"

6 column of my Exhibit No. ___ (YKGM-3), Table 9a.

7 PacifiCorp's adjustment, on the other hand, reduces actual test year

8 electricity consumption by 51,081 MWh. This results in a pro forma

9 reduction in test year revenues of $2.698 million. These figures are shown in

10 the "Total" column of my Exhibit No. ___ (YKGM-3), Table 9b.

11 Consequently, Staff and Company adjustments differ by 94,710MWh

12 and $4.913 million in revenue, as shown on my Exhibit No. ___ (YKGM-3),

13 Table 10.

14

15 **Q.** **What is the difference in revenue requirement between Staff and**

16 **Company Weather Normalization Adjustments?**

17 A. Staff's adjustment reduces revenue requirements by $1.485 million. The

18 Company's adjustment increases revenue requirements by $2.823 million.

19 Accordingly, the Staff and Company adjustments differ by $4.3 million at the

20 revenue requirement level.

1 Staff determined its revenue requirement figure by taking the $2.215

2 million in additional revenue determined by Staff, subtracting the additional

3 power costs of $698,000, and deducting the revenue-related costs and taxes,

4 resulting in an NOI increase of $881,000. The net effect reduces revenue

5 requirements by $1.485 million.[3]

6 The Company's adjustment decreases revenues by $2.698 million in

7 the test year. The Company's Adjustment 3.1 shows no change in power cost

8 due to temperature normalization, because PacifiCorp subsumes that power

9 cost change in its Net Power Cost Adjustment 5.1. In addition, Company

10 Adjustment 3.1 does not include any effects on revenue-related costs and

11 taxes.

12 Accordingly, for comparison purposes, Staff calculated a power cost

13 reduction of $817,000 associated with the Company's weather normalization

14 adjustment. This figure was calculated on the same basis as Staff's power

15 cost.[4] After reflecting revenue-related costs of about $119,000, the

16 Company's adjustment decreases NOI by $1.093 million,[5] for a revenue

17 requirement deficiency of $1.843 million.[6]

---

[3] See Mr. Schooley's Exhibit No. ___ (TES-3) at 20.
[4] $16/MWh x (51,081 MWh) = ($817,296). Numbers in brackets are negative.
[5] ($2,698,000) +$817,000 +$119,000+669,000 = ($1,093,000).
[6] ($1,093,000) / 0.59305 = -$1,843,000 revenue requirement deficiency.

1   As I mentioned earlier, Staff Witness Mr. Schooley is responsible for

2   the calculations of the impact of Staff's weather normalization adjustment on

3   the Company's net income and revenue requirements.

4

5   **Q.**   **What are the significant differences between Staff and Company**

6   **calculations?**

7   A.   There are three major differences. First, Staff used 1971-2000 normal

8   temperature data from NOAA. PacifiCorp used 1961-1990 data.

9   Second, Staff used 65^0F as the "base" temperature from which to

10   compute degree days, rather than the four temperature ranges PacifiCorp

11   used.

12   Finally, Staff used monthly retail sales data from PacifiCorp's

13   Washington service area, and implemented an Autoregressive Moving

14   Average (ARMA) estimation method to determine temperature sensitivity

15   coefficients, a method that removes the impact of serial correlation.

16   PacifiCorp used hourly data from 1983 and 1984 from its Utah service area,

17   and the Company cannot document the statistical method it used to

18   determine temperature sensitivity coefficients.

19

1   **Q.**   **Please describe in more detail how the Company's calculated its Weather**

2   **Normalization adjustment, compared to Staff's.**

3   A.   PacifiCorp's adjustment was calculated as follows:

4   (1)   PacifiCorp used "normal" temperature data from NOAA for the
5   period 1961-1990, rather than the more current NOAA data for the
6   period 1971-2000 that Staff used;

7

8   (2)   PacifiCorp computed degree days using four ranges of temperature as
9   its "base" or "cut-off" temperatures, rather then the 65°F base
10   temperature Staff used;

11

12   (3)   PacifiCorp calculated test year unbilled degree days as the difference
13   between test year actual temperature and the four base points
14   described under (2) above;

15

16   (4)   PacifiCorp calculated unbilled electricity usage by multiplying
17   updated coefficients based on the model developed by a consultant's
18   study from the 1980's, times the test year unbilled degree days and
19   number of customers in each rate schedule. PacifiCorp's coefficients
20   were based on the four base points. Staff developed coefficients based
21   on variations of test year temperature from the 65°F base point and
22   monthly retail electrical usage; and

23

24   (5)   PacifiCorp multiplied the unbilled electric usage from Item 4 by the
25   energy rate to arrive at unbilled sales revenue, which resulted in
26   PacifiCorp's Weather Normalization Adjustment 3.1.

27

28   **Q.**   **Has the Commission approved the sorts of data and assumptions**

29   **PacifiCorp used in its adjustment?**

30   A.   No. In this case, PacifiCorp is using the same sorts of data and assumptions

31   that it used in its weather normalization adjustment in Docket No. UE-

1   032065. However, that case was settled, and the Commission did not

2   approve the Company's adjustment in that docket.

3

4   **E.   Critique of PacifiCorp's Weather Normalization Adjustment**

5

6 **Q.   Is the Company's temperature normalization adjustment appropriate?**

7 A.   No. There are several problems with the Company's adjustment: 1) The

8   Company used outdated normal temperature data; 2) The Company's

9   provided insufficient support for its calculation of HDD and CDD to develop

10   four base temperature ranges; 3) The Company's study is unreliable because

11   it used data that is over 20 years old, and the data was collected for only two

12   years, which is also insufficient; and finally, 4) The Company cannot provide

13   sufficient statistical support for its adjustment.

14

15 *1.   Normal temperature data*

16

17 **Q.   Did the Company use appropriate data for normal temperature?**

18 A.   No. PacifiCorp should have used the most recent data available. As I

19   described earlier, NOAA's most recent release of normal temperature data is

1   for the period 1971-2000. PacifiCorp used normal temperature data for the

2   period 1961-1990. Staff's adjustment uses more current data.

3

4   2.   *Calculation of heating degree days (HDD), cooling degree*
5   *days (CDD), and base points*
6

7   **Q.   Please describe how PacifiCorp calculated HDD and CDD.**

8   A.   PacifiCorp calculated HDD and CDD as the difference between actual test

9   year temperature and one of four different "cut-off" or "base" temperatures.

10

11   **Q.   What temperature ranges did the Company use for its base temperatures?**

12   A.   The Company used the following four temperature ranges:

13   (1)   Heating degree days-winter (HDD) = 55-average daily
14   temperature, if temperature is $\leq$ 55;
15
16   (2)   Heating degree days-shoulder (HDDSH)= 65-average daily
17   temperature, if $55 <$ Temp ≤ 65;
18
19   (3)   Cooling degree days-Shoulder (CDDSH) = 68-Average daily
20   temperature, if $65 <$ Temp < 68; and
21
22   (4)   Cooling degree days summer (CDD) = Average daily temperature
23   - 68, if Temp $\geq$ 68.
24

1   **Q.   Why did the Company use four temperature ranges?**

2   A.   PacifiCorp contends that the traditional definition of degree-days based on

3   65°F does not necessarily match its customers' use of electric heating and

4   cooling equipment. The Company's contention also implies that the impact

5   of temperature on retail sales varies for different ranges of temperature.

6

7   **Q.   What is the basis for the Company's contention?**

8   A.   The Company's contention is based on a study conducted in the 1980's by a

9   PacifiCorp consultant, Research Triangle Institute (RTI). PacifiCorp retained

10   RTI to develop a weather normalization adjustment procedure.

11   RTI used hourly load data from Utah. The data was collected in 1983

12   and 1984, so the data is now more than 20 years old.

13   RTI made graphical analyses of changes in electricity usage per

14   customer associated with changes in temperature. RTI plotted electricity

15   usage per customer against average hourly and daily temperature. Based on

16   the shape of the curve, RTI identified four ranges of temperature.

17   From this, RTI concluded that the transition from heating to cooling

18   points is not linear. Subsequently, RTI proposed a transition period between

19   cooling and heating degree-days, called "shoulder months." Therefore, in

20   addition to the conventional heating and cooling degree-days, RTI

1   developed cut-off points for the shoulder months. RTI also computed

2   shoulder heating and cooling degree days.

3   Graphical analysis of temperature and use per customer relationships

4   led RTI to implement regression analysis using different temperature points.

5   RTI used the results of the regression and graphical analysis as the basis for

6   the final determination of the four cut-off or base temperatures.

7

8   Q. **Please explain the problems with PacifiCorp's HDD and CDD calculations**

9   **and the base temperature ranges.**

10 A. The most significant problem is that the Company cannot prove the validity

11   of its numbers. As I explain later, Staff asked PacifiCorp to supply the data,

12   model and statistical results used in the RTI study, but PacifiCorp was

13   unable to provide that information.

14   While it is plausible that electricity usage might not change within a

15   specific temperature range, PacifiCorp needs to supply accurate and reliable

16   hourly or daily usage data in order for Staff to confirm that such a

17   relationship actually exists. PacifiCorp has not shown the data it relies on is

18   accurate and reliable.

19

1   Q.   **Are there other problems with the Company's four base temperature**

2   **ranges?**

3   A.   Yes. The determination of a base temperature range requires a detailed

4   study that takes into account the following factors:

5   a) Structure of the house (windows, doors, square foot, etc.) and year
6   built;
7
8   b) Number and composition of household members (by age group);

9   c) Humidity, radiant temperature, cloud cover, and wind
10   observations; and
11
12   d) Types or kinds of electric appliances and magnitude of reject heat

13   or heat releases.

14   Data on these and related factors should be collected over a period of

15   at least three years to assure an adequate number of observations, and to

16   determine trends in the data.

17   The findings from these kinds of detailed studies may be aggregated

18   to a class of customers, provided that the sample studied represents that

19   class of customers.

20   The Company's study contains none of these details. Moreover, as I

21   discussed earlier, the data supporting the Company's study was collected

22   over only two years, which is not sufficient. Without a reliable study, the

23   Commission should not accept PacifiCorp's base temperature ranges. In

1   other words, until PacifiCorp provides the Commission with empirical proof

2   to establish a different base temperature, the Commission should retain the

3   single point 65°F base temperature.

4

5   3.   *The vintage and quantity of the data PacifiCorp used, and its applicability to*
6   *Washington*
7

8 **Q.**   **Assuming the Company properly calculated HDD, CDD and base**

9   **temperature, would that data be acceptable?**

10 A.   No, for several reasons. First, PacifiCorp has presented no evidence that the

11   hourly or daily usage data used in the RTI study is accurate for present

12   purposes. The RTI study data is now more than 20 years ago. It cannot be

13   assumed that the relationships found 20 years ago still exist today. Usage

14   patterns, customer characteristics, temperature and other relevant factors

15   change over time. Consequently, the models and estimated coefficients

16   PacifiCorp is using that were derived from data in the 1980's might not

17   reflect the true sensitivity of electricity usage to changes in temperature in

18   the test year.

19   In addition, the RTI study used only two years of data. Not only can

20   Staff not determine the representativeness of the sample used in the study,

1   but Staff cannot determine whether or not the two years of data captured by

2   RTI adequately captured year to year variability.

3   Finally, the RTI study PacifiCorp relies upon applied to Utah, and it

4   used Utah data. Utah is a jurisdiction that exhibits very different

5   temperature, customer behavior and socioeconomic characteristics compared

6   to Washington. Consequently, even if the accuracy of PacifiCorp's data could

7   be verified, there is no reason to believe the study results should apply to

8   Washington.

9

10 **Q.   Have you prepared an exhibit showing some of the different**

11 **socioeconomic characteristics of Washington compared to Utah?**

12 A.   Yes. Please refer to my Exhibit No. ___ (YKGM-5), entitled "Comparison of

13 Selected Socioeconomic Characteristics of Washington and Utah." In that

14 exhibit, I present various statistics from 2000 census survey and 2004

15 population estimate applicable to Washington and Utah. There are

16 significant differences in average size of household, age of population and

17 other behavioral factors that can affect electrical usage. Accordingly, it is not

18 apparent that a Utah-based study, conducted over 20 years ago, is applicable

19 to Washington today.

1

2   *4.   Statistical support for the Company's adjustment*

3

4   **Q.   What statistical results did PacifiCorp provide in support of its weather**

5   **normalization adjustment?**

6   A.   PacifiCorp provided an output that contains estimates related to the four

7   base temperature ranges used in the Company's weather normalization

8   adjustment.

9

10   **Q.   Was this information useful?**

11   A.   No. These estimates alone do not provide any useful information. For

12   example, from this information, it is not possible to evaluate: (1) the method

13   of estimation; (2) the plausibility of variables included in the model; or (3)

14   the indicators regarding the fitness of the model. Consequently, I cannot

15   confirm the robustness of the model PacifiCorp used.

16

17   **Q.   Did Staff request the Company to provide that information?**

18   A.   Yes. Staff requested this information in Staff Data Request No. 100.

19

20   **Q.   What was the Company's Response to that Data Request?**

1   A.   The Company stated in part: "The coefficients used for weather

2   normalization are developed periodically. However, the specific data used

3   for and equations resulting from their development are no longer available

4   in the Company's records." The Company's complete response to this data

5   request is my Exhibit No. ___ (YKGM-6).

6

7   Q.   **Based on what the Company has provided, can Staff confirm the propriety**

8   **of the statistical method PacifiCorp used in its weather normalization**

9   **adjustment?**

10   A.   No. As I mentioned, PacifiCorp could not even provide Staff with

11   documentation on how RTI selected the statistical model used in its weather

12   normalization adjustment. There is no basis for Staff to agree or disagree

13   with the statistical method PacifiCorp used. Consequently, the Company

14   has supplied insufficient justification for its Weather Normalization

15   Adjustment.

16   Finally, because PacifiCorp has not supplied the data, model and

17   detailed output of the statistical analysis employed, Staff cannot confirm the

18   validity of the non-weather related variables included in the study, such as

19   income and price.

20

1 **Q. Earlier, in your explanation of Staff's adjustment, you explained how Staff**

2 **corrected for the impact of serial correlation on the estimation of weather**

3 **sensitivity coefficients. Did the Company appropriately evaluate the**

4 **impacts of serial correlation in its adjustment?**

5 A. I do not know. The Company was unable to supply the information

6 necessary for me to make that assessment.

7

8 **Q. Is the Company's inability to provide Staff the data Staff needs to analyze**

9 **the Company's method new to this case?**

10 A. No. Staff asked for the same sort of information in the Company's last

11 general rate case, Docket No. UE-032065. My Exhibit No. ___ (YKGM-7) is

12 the Company's Response to Staff Data Request No. 203 in that Docket. That

13 exhibit shows PacifiCorp could not provide the necessary information in that

14 docket either.

15

16 **Q. Was the Company able to provide Staff the original RTI study the**

17 **Company is relying on in this proceeding?**

18 A. No. As shown in Exhibit No. ___ (YKGM-7), page 1, the Company did not

19 retain the RTI study.

20

1   V.   CONCLUSIONS AND RECOMMENDATIONS

2

3   Q.   Why should the Commission adopt Staff's temperature normalization

4   adjustment and reject the Company's?

5   A.   Staff's adjustment uses the most current Washington use per customer and

6   normal temperature data available to develop weather sensitivity

7   coefficients. Staff also used data, model and statistical results that are

8   verifiable, robust and statistically supported.

9   By contrast, PacifiCorp's adjustment used 20 year old Utah-based

10   data, and normal temperature data that are also outdated. Moreover, the

11   Company has not shown that its data, model and statistical results are

12   verifiable, robust, statistically supported, or even applicable to Washington.

13

14   Q.   What does Staff recommend for future PacifiCorp rate cases?

15   A.   For future rate cases, the Commission should order the Company to

16   implement the following changes to its temperature normalization

17   procedure:

18   (1)   PacifiCorp should develop daily electricity usage data by rate
19   schedule for 10 years, including the test year.
20

1   Because the Company used billing cycle data to develop calendar-

2   month usage that matches temperature records, it would not be difficult to

3   develop daily usage data.

4   (2)   PacifiCorp should use 65^0F for the base temperature, which is the
5   balance point temperature adopted by NOAA, WMO, and other
6   national and international organizations.
7
8   NOAA's method accounts for the impact of factors that may influence

9   normal temperature observed over several years. These include adjustments

10   for missing data, for time of observation bias, instruments used, abnormal

11   temperature, and so on. The objective of these adjustments is to ensure that

12   the impacts of external factors on temperature are taken into account, and

13   that the data become homogenous and representative. Therefore, this

14   methodology produces a better gauge of temperature norms. PacifiCorp

15   should continue to use 65-degree base temperature and normal temperature

16   from the most recent 30-year data until NOAA, WMO, and other national

17   and international organizations agree to change them.

18   (3)   PacifiCorp should attempt to collect data on variables, such as income,
19   price, family size, and attributes of housing that may affect use per
20   customer; and
21
22   (4)   PacifiCorp should document, update and retain all statistical
23   estimation procedures that it uses to develop the weather
24   normalization adjustments, and it should justify the choice of
25   empirical models and estimation procedures.
26

1   PacifiCorp needs to implement these changes to improve the accuracy

2   of its estimates of temperature sensitive heating and cooling loads, so that

3   PacifiCorp's revenue requirements and prices properly reflect the impact of

4   changes in temperature.

5

6   **Q.**   **Does this conclude your testimony?**

7   A.   Yes.