PACIFIC POWER
A DIVISION OF PACIFICORP

825 NE Multnomah, Suite 2000
Portland, Oregon 97232

January 22, 2007

Yohannes Mariam
Washington Utilities and Transportation Commission
1300 S. Evergreen Park Drive SW
Olympia, WA 98504-7250

Re: PacifiCorp's Plan for a Long-Term Temperature Normalization Solution in Washington

Dear Mr. Mariam:

A Temperature Normalization Stipulation was developed during the proceeding for Docket Number UE-050684 in January 2006 and filed with the Washington Utilities and Transportation Commission (WUTC) on January 27, 2006. The Stipulation was an agreement between PacifiCorp and the WUTC Staff containing an interim agreement on the temperature normalization of loads and retail sales between the two parties and a requirement to file a collaborative proposal for the direction of the long-term solution of the temperature normalization of load and retail sales.

A draft plan was filed with the WUTC Staff on July 17, 2006. The draft plan was finalized and agreed during a conference call on January 18, 2007. Enclosed is the final version of the Long-Term Temperature Normalization Solution.

Sincerely,

Melissa A. Seymour
Washington Regulatory Affairs Manager, PacifiCorp

Enclosures

PacifiCorp's Plan for a Long-Term Temperature Normalization Solution in Washington

I. Introduction

A Temperature Normalization Stipulation was developed during the proceeding for Docket Number UE-050684 in January 2006 and filed with the Washington Utilities and Transportation Commission (WUTC) on January 27, 2006. The Stipulation was an agreement between PacifiCorp and the WUTC Staff containing an interim agreement on the temperature normalization of loads and retail sales between the two parties and a requirement to file a collaborative proposal for the direction of the long-term solution of the temperature normalization of load and retail sales. The temperature normalization of retail sales is used to assist in the calculation of the Company's revenue requirement and the temperature normalization of hourly loads is used to assist in the calculation of net power costs. The purpose of this report is to propose a collaborative solution for temperature normalization methodology to use for the long-term in support of rate cases in Washington. This is a defined goal in Sections 7.b and 7.c of the Stipulation Agreement.

II. Background

The conditions of the interim agreement were satisfied by the Company on March 31, 2006. The methodology of the interim agreement is to remain in effect until there is sufficient data such that the long-term solution for temperature normalization is satisfied. The long-term solution for temperature normalization is to be determined through a collaborative process with interested parties. PacifiCorp invited representatives from the WUTC Staff, Public Counsel, Industrial Customers of Northwest Utilities (ICNU), the Energy Project, and National Resource Defense Counsel (NRDC) to be part of this process. The work established through this process was used to develop this report, and should continue until a final methodology is agreed.

III. Overview of Collaborative Process

The first collaborative discussion was held June 8, 2006 via teleconference. During the meeting, PacifiCorp proposed a process for working with parties on temperature normalization methodology issues which were identified based on PacifiCorp's most recent general rate case. A follow-up conference call was held on June 27, 2006 to discuss Issues # 1 and #2 as defined in Section IV. The information presented for these two issues, including PacifiCorp's recommendation, are in the report.

PacifiCorp anticipates ongoing discussions with parties related to the recommendations outlined in the report.

IV. Issues and Proposed Solutions

PacifiCorp prepared a list of issues based on Staff's testimony in the General Rate Case and conversations with Staff on temperature normalization methodology. PacifiCorp has proposed a solution to address each issue which is discussed in detail below. The following list of issues represents the primary areas for discussion:

1. The types and amount of data to be gathered for temperature normalization, e.g., interval load research data, billing data, total hourly load data.
2. The technique implemented to analyze and estimate coefficients from the data needs to be determined.
3. What information is available from the different types of data.
4. The linkage between the estimation of the coefficients of the total hourly load data and the monthly billed retail sales.
5. Coefficients update frequency should be considered.
6. Cost items to be included in recovery, e.g., any additional load research data needed for analysis, additional software or personnel needed for analysis of additional data.

Issue #1: The Types and Amounts of Data to be Collected for Temperature Normalization

Interval Metering Requirements

As implied in rebuttal testimony and data requests during the last rate case, Docket Number UE-050684, the purpose of the load research data is to determine the appropriate "break-points" for use in the monthly billed temperature normalization equations. In order to be sensitive to the costs that could possibly be included in the rate base, the number of meters recommended by PacifiCorp is the number of meters already installed for schedules 16, 24 and 36 within the state of Washington. The number of such meters is found in Table 1.

Table 1: Interval Meter Sample Sizes by Rate Schedule

Rate Schedule	Sample Size
16 (residential)	48
24 (small commercial)	40
36 (large commercial)	5

The collection of information from these meters is currently occurring and there is approximately 18 months worth of hourly data collected as of June 8, 2006.

Amount of Monthly Billed Sales Needed for the Temperature Normalization of Retail Sales

The temperature normalization of billed retail sales is necessary as an input to revenue requirement. Initially the amount of billed sales data collected for the estimation of the temperature normalization of retail billed sales will be five years. This value may increase or decrease depending on the statistical analysis and testing of the temperature normalization equations as discussed later in the Issue #2 section. The data will be collected for the districts of Yakima, Walla-Walla, and Sunnyside and for schedules 16 (residential), 24 (small commercial), and 36 (large commercial).

Amounts of Total Hourly Load Data Needed for the Temperature Normalization of Total Hourly Load for the Washington Service Territory

The temperature normalization of total hourly load is necessary as an input to net power cost calculations. Initially the amount of total hourly load collected for this endeavor will be three years. The number of years used in estimation may increase or decrease depending on the statistical analysis and testing of the temperature normalization equations as discussed later in the issue #2 section.

Weather Information

The weather information collected for this analysis will be hourly temperature and humidity for the Yakima, and possibly Walla-Walla weather stations. The temperature, humidity, hourly heating and cooling degree day variable(s) information will be used in the hourly equations, i.e., load research and total hourly loads. The temperature values will be converted into monthly heating and cooling degree day variable(s) for use in the monthly billed retail sales equations. A further discussion of the use of these values will occur in the next issues section, Issue #2.

Issue #2: The Techniques Implemented to Analyze and Estimate Coefficients for the Three Sources of Data

Analysis of Hourly Meter Information

The analysis of hourly loads will include a Hinich test of non-linearity which may indicate a necessity for temperature splines within the hourly load regression equation. If the Hinich test indicates that the hourly loads are non-linear, then the hourly load data will be modeled using multivariate adaptive regression spline techniques with appropriate weather and binary variables. The weather and binary variables may take the form of interaction terms as well as individual regressor terms.

Based on the spline techniques analysis the associated temperature splines, other variables, and interaction terms will be used in hourly load regression equation produced by the Statistical Analysis Systems, Inc. (SAS) software implementing a stepwise procedure to insure the inclusion of all relevant variables. After completing the SAS analysis an inspection of potential multicollinearity between terms in the equation will occur using the appropriate technique, e.g., the Variance Inflation Factor (VIF). If it indicates that a weather term and a binary term is collinear within the equation, the binary term will be modified or deleted in order to exclude the impact of multicollinearity. Once the final model is estimated through ordinary least squares (OLS) in SAS, necessary autoregressive (AR) terms will be included in the equation under two conditions:

1) An analysis of the partial autocorrelogram indicates the need for AR terms.
2) The inclusion of such terms does not change coefficient estimates by a statistically significant amount. If coefficient estimates are changed by a statistically significant amount, then the AR terms will not be included.[1]

The analysis of the hourly loads for the first year using the spline and subsequent SAS analysis will occur when the first full year of data is collected. When the second full year of data is collected, this information will be included in the spline and subsequent SAS analysis. However, the hourly load information from an earlier year(s) may not be included if the following occurs:

1) The spline analysis indicates that the temperature splines have changed, and/or
2) The coefficient estimates from a later year(s) is statistically different from an earlier year(s) during the SAS analysis of the data.

Both of these conditions will be implemented to determine the optimal number of years to be included in the spline and SAS analysis of the interval hourly loads.[2] This type of analysis may also be used to determine the frequency of this phase of the analysis. If the spline analysis and

[1] If OLS is implemented even with autocorrelation, the OLS estimates remain to be unbiased but not efficient.

[2] Multiple years of dissimilar hourly data may be included in the analysis if binary variables are included as potential interaction terms with weather variables to represent coefficient estimate changes over time or temperature spline changes over time. Examples of these binary variables could include annual, seasonal, monthly, or weekly binary terms.

the statistical tests of coefficient estimates indicate no change for a majority of the rate schedules as measured by their kWh, then the estimation of the weather normalization equations for billed sales will cease at this point for that year and the weather normalization equations of retail sales by schedule and location from the prior year will be used. If a majority of the rate schedules as measured by the rate schedules kWh have experienced either "breakpoint" changes and/or statistically different coefficient values, then a re-estimation of the monthly billed retail sales will occur for that year. This practice will occur on an annual basis until three years expire at which time an automatic re-estimation of the monthly billed retail sales will occur.

Technique for the Estimation of Weather Normalization Equations for Billed Sales

The results of the analysis of hourly load research loads will be implemented by the weather normalization equations of monthly billed sales. The weather normalization equations will be produced by SAS. The steps of the monthly billed sales analysis includes:

1) A correlation of monthly billed sales for each location and relevant rate schedule with heating and cooling degree days with a 65 degree base for that location. If the correlation coefficient is greater than some minimum value, e.g., 0.8, then weather normalization equations will be produced. The period of correlation will be for five years.
2) Separate heating and cooling equations will be produced for the relevant locations and rate schedules. Heating months are from October through May and cooling months are from June through September.
3) The splines from the hourly load research results will be incorporated into the monthly billed sales analysis through the conversion of the splines into heating and cooling degree variables with bases reflecting the "breakpoint" values. Statistically significant heating and cooling degree variables will remain in the equation while insignificant heating and cooling degree day variables will not remain in the equation.
4) The initial estimation of the equations using the degree day variables and appropriate binary variables will be through a stepwise procedure. Statistically significant variables having the correct sign will remain in the equation while insignificant variables or variables with incorrect signs will not remain in the equation.[3]
5) Appropriate binary and interaction variables will be included in the equation. If a binary or interaction variable appears to be collinear with a weather variable, then the binary variable will either be transformed or deleted to avoid the impact of multicollinearity.
6) AR terms may be allowed in the equation provided both of two conditions are met:

[3] An example of an incorrect sign would be a negative sign on a primary heating degree day variable in a heating equation. A degree day variable may have a negative sign if it is a secondary degree day variable which would reflect a decrease in the slope between electricity usage and degree days.

a. An analysis of the partial autocorrelogram of the residuals of the equation indicates the need for AR terms.
b. The inclusion of such terms does not change coefficient estimates by a statistically significant amount. If coefficient estimates are changed by a statistically significant amount, then the AR terms will not be included.

7) The estimation period for the monthly billed weather normalization equation will be a maximum of five years or the period of time when the coefficient estimates are statistically unchanged and/or the period of time when splines remain unchanged from the hourly load research analysis. [4]
8) If the hourly load research (spline) analysis is unchanged from one year to the next, then the monthly billed sales weather normalization analysis for that year is unnecessary.[5] The prior year's estimation will be implemented for the calculation of weather adjustment amounts.
9) The weather normalized amounts will be calculated using the normal weather conditions of 1971 to 2000 from the National Weather Service. The normal weather conditions will be changed when weather conditions for 2010 is available. At that time the normal weather conditions will be based on the average from 1981 to 2010.

Technique Used for Jurisdiction Total Hourly Load Weather Normalization

The weather adjustment of jurisdiction total hourly loads is needed in the net power cost calculation. The total hourly load analysis is similar to the analysis performed on the hourly load research data. This analysis will include a Hinich test of non-linearity which will indicate that there is a necessity for temperature splines within the weather normalization regression equation. If the Hinich test indicates that the hourly loads are non-linear, then the hourly load data will be modeled using multivariate adaptive regression spline techniques with appropriate weather and binary variables. The weather and binary variables may take the form of interaction terms as well as individual regressor terms.

[4] Multiple years of dissimilar monthly billed data may be included in the analysis if binary variables are included as potential interaction terms with weather variables to represent coefficient estimate changes over time or temperature spline changes over time. Examples of these binary variables could include annual, seasonal, or monthly binary terms.

[5] If the spline analysis and the statistical tests of coefficient estimates indicate no change for a majority of the rate schedules as measured by their kWh, then the estimation of the weather normalization equations for billed sales will cease at this point for that year and the weather normalization equations of retail sales by schedule and location from the prior year will be used. If a majority of the rate schedules as measured by the rate schedules kWh have experienced either "breakpoint" changes and/or statistically different coefficient values, then a re-estimation of the monthly billed retail sales will occur for that year. This practice will occur on an annual basis until three years expire at which time an automatic re-estimation of the monthly billed retail sales will occur.

Based on the spline techniques analysis the associated temperature splines and other variables and interaction terms will be used in hourly load regression equation produced by the Statistical Analysis Systems, Inc. (SAS) software implementing a stepwise procedure to insure the inclusion of all relevant variables. After completing the SAS analysis an inspection of potential multicollinearity between terms in the equation will occur using the appropriate technique, e.g., the Variance Inflation Factor (VIF). If it indicates that a weather term and a binary term is collinear within the equation, the binary term will be modified or deleted in order to exclude the impact of multicollinearity. Once the final model is estimated through ordinary least squares (OLS) in SAS, necessary autoregressive (AR) terms will be included in the equation under two conditions:

1) An analysis of the partial autocorrelogram and autocorrelogram of the residuals of the equation indicates the need for AR terms.
2) The inclusion of such terms does not change coefficient estimates by a statistically significant amount. If coefficient estimates are changed by a statistically significant amount, then the AR terms will not be included.

The number of years used in the estimation of the jurisdiction hourly loads depends on if there have been changes in the coefficient estimates over time. Initially a three-year period of estimation will be used. However, if the coefficient estimates are statistically different when using an earlier time period within the estimation period, then the earlier time period will be excluded from the estimation. Also, if the temperature splines change over time, then only the most recent time period with unchanging splines will be used in the estimation. [6]

The weather normalized amounts will be calculated using the normal weather conditions of 1971 to 2000 from the National Weather Service. The normal weather

[6] Multiple years of dissimilar hourly data may be included in the analysis if binary variables are included as potential interaction terms with weather variables to represent coefficient estimate changes over time or temperature spline changes over time. Examples of these binary variables could include annual, seasonal, monthly, or weekly binary terms.

conditions will be changed when weather conditions for 2010 are available. At that time the normal weather conditions will be based on the average from 1981 to 2010.

Issue #3: The Timing of When to Use the Various Coefficient Types

At various times during the year it is difficult to determine whether summer coefficients should be used or winter coefficients should be used to weather normalize. This is particularly true when separating the monthly billed retail sales equations into summer and winter weather normalizing equations. These occasions of uncertainty predominantly occur during the "shoulder" months of April, May, September, and October. For example, during one year the month of May could be a "winter" month since heating degree days dominate over the cooling degree days while during the following year the month of May could be a "summer" month since the cooling degree days dominate over the heating degree days. These events occurred during the years of 2005 and 2006 within Oregon. For May of 2005 the 65-degree base heating degree days for Medford were 176 and the 65-degree base cooling degree days were 28. The normal degree days for Medford are 233 and 24 for heating and cooling degree days, respectively. Since the cooling degree days were near the normal values for the month and the heating degree days were relatively below normal for the month, it was appropriate to treat the month as a winter month and use the coefficients from the winter equation. For May of 2006 the heating degree days were 128 and the cooling degree days were 51. Since the heating degree days were over 100 less than normal and the cooling degree days were over double the normal amount, it was appropriate to treat May 2006 as a summer month and use the coefficients from the summer equation.

There is no clear "rule of thumb" as to when to use the summer or the winter equation coefficients for a "shoulder" month. One indication to switch from the winter coefficients to the summer coefficients is to compare the heating and cooling degree days against the normal values. But, a more reliable test is to compute the weather normalized amounts using both sets of coefficients and to compare the weather normalized adjustment amounts against total sales for the month. If a disproportionate amount of weather adjustment occurs using the winter coefficients in conjunction with actual heating degree days being substantially below the normal heating degree days and the actual cooling degree days being substantially above the normal cooling degree days, then the summer coefficients may be appropriate. Again there is no conclusive "rule of thumb" for these occurrences and judgment has to be used on a case-by-case basis for these "shoulder" months.

Issue #4: Consistency Between Hourly Jurisdictional Weather Normalized Loads and Monthly Billed Weather Normalized Retail Sales

There will be a comparison between the weather normalized results of total jurisdictional hourly loads and the weather normalized results of the monthly retail sales by location and rate schedule. The comparison will be made to insure that the implied temperature splines used within each of the two techniques are similar.

Issue #5: Coefficients update frequency should be considered.

This issue is considered and discussed within the discussion of Issues #1 and #2. Please refer to those sections for the coefficient update frequencies for the various weather adjustment equations.

Issue #6: Items for Recovery Cost

Section 7.c. of the "Stipulation on Temperature Normalization Adjustment" for Docket Number UE-050684 indicates that "Staff will not oppose the rate recovery of reasonable costs associated with development and implementation of a mutually acceptable weather normalization program." It is recommended that these costs should include, but not be limited to, such items as the cost of the additional meters, the installation of additional meters, and personnel and software necessary for the reading and analyzing the additional meters. PacifiCorp will make every effort to insure that such costs are reasonable and the meters, the installation of the meters, and the reading and analysis of the information are completed in a cost-effective manner.

Issue #7: Sharing of Information

PacifiCorp will make available all data and analysis associated with the weather normalization of hourly loads and monthly billed retail sales for rate case purposes to the Staff of the WUTC. It is recommended that all data and analysis be sent automatically to staff during the filing of future rate cases. Additional data and analysis of weather adjusted loads and retail sales, i.e., analysis and data not associated with Washington jurisdiction rates cases, will be sent to Staff as requested. The response to requests of this information by other parties will be considered as part of PacifiCorp's data request procedure. This data will be retained electronically for five years.

V. Future Reseach findings and Issues

The collaborative discussions have been beneficial for both parties and will continue tobe the forum to discuss any issues related to the process.

In the future it may be useful for presentations of the methods or final temperature normalization results to other interested members of the representative groups. Information and the education of techniques to interested stakeholders will occur through testimony and technical workshops related to specific rate cases, if warranted.

VI. Resolution Criteria

In the event that future issues arise from any parties or PacifiCorp, the resolution of such issues will follow the format of the seven issues presented in this report. That is, an issue will be identified either in writing or during conversations. PacifiCorp will make a response to the issue(s) with discussions occurring between the parties and PacifiCorp until a resolution is reached on any and all issues.

VII. Implementation of the Long-Term Solution

The collaborative process will be the forum to complete the implementation strategy by PacifiCorp as the appropriate level of load research data becomes available or new information comes to light through additional research. This will include discussion on implementation phases and the impact of implementation on rate cases, planning activity, and other effects this may have on the Company.