**Rates & Regulatory Affairs**
UG-181053
2018 WA General Rate Revision
**Data Request Response**

DR Request: February 11, 2019
Date of Response: February 26, 2019
Responder: Rob Wyman
Telephone: (503) 226-4211 ext. 5857
Email: r2w@nwnatural.com
Witness: Kevin McVay

**Request No.**: UG-181053 WUTC DR 32

32. Please describe any changes your company made to the weather normalization methodologies from the previous general rate case, including but not limited to data sample, temperature baseline for heating degree days, benchmarks for normal heating degree day (e.g., 20 year versus 30 year), usage calculation, and regression models.

**Response:**

The Company made a few changes to its weather normalization methodologies relative to the model filed in its last Washington general rate case in 2008. These changes were made largely in order to simplify, through linearization, the regression model specification. This simplification more easily allows the Company to demonstrate the relationship between temperature and load to outside parties, including customers.

In the 2008 case, we used a rolling 20 year historic benchmark for normal heating degree days, beginning October 1, 1987 and ending September 30, 2007. For the UG-181053 filing, we continued to use the 20 year rolling historic benchmark, with weather data beginning June 1, 1998 through May 31, 2018.

We used a 59 degree Fahrenheit base for residential schedules and a 58 degree Fahrenheit base for commercial schedules as our temperature set points for heating degree days (HDDs). The Company used a 65 degree Fahrenheit set point for both residential and commercial schedules for its last Washington general rate case filing in 2008. Please see WUTC DR 33 for a further discussion of the temperature set points.

The 2008 and 2018 models are both based on usage data on a cycle basis, and both match actual weather observations with the days between cycle meter read dates. Both models appropriately weight the number of days and HDDs for each cycle. The 2008 model builds its heating coefficient using a regression of 814 cycles (37 months), aggregated to revenue months; the 2018 model uses 1,518 cycles (69 months), also aggregated to revenue months. Revenue months are used so that the raw usage and premise data can be tied back to the Company's financial reporting data.

The 2008 use-per-customer (UPC) estimates were built using two separate regressions that built: (1) the heat use coefficient; and (2) the base use coefficient. The two regressions were combined to create a weather normalized UPC based on test period customers and a 20 year historic HDD benchmark. Regression (1) was log-based and regressed the natural log of the UPC per day (adjusted to remove an estimated coefficient for price) against the natural log of HDDs per day. Regression (2) was linear and regressed UPC per day against HDDs per day, using only the summer months of July through September. The estimated coefficients were used to build the weather normalized UPC on a monthly basis. Regression (1) used a log transformation to estimate heat use as a function of HDDs because it used a 65 degree Fahrenheit set point.

The 2018 model estimates UPCs using a single linear regression to build the heat use and base use coefficients. On a cycle basis and rate schedule basis, we weight premises and days and aggregate these factors up to revenue months. We weight actual HDDs by premises and aggregate to revenue months. We use these aggregates to regress therm use per premise per day against HDDs per day, using a linear specification. We also use an independent dummy variable for the summer months July through September. The estimated coefficients were used to build the weather normalized UPC on a daily basis using the HDD benchmark. This model used a linear specification because we linearized the relationship between therm load and HDDs using the 59 and 58 degree Fahrenheit set points.

After we estimated the daily normalized UPC, we applied a demand side management (DSM) savings forecast adjustment to each schedule on a monthly basis. We did not apply a DSM adjustment to the 2008 model. Please see WUTC DR 35 for a further discussion of the DSM adjustment.

The 2008 model only built normalized class-wide UPCs for all residential and all commercial rate schedules. The 2018 model built normalized UPCs for individual rate schedules within the residential and commercial classes. This was so that we may more granularly build the revenue requirement, as well as to create groupings of schedules for our Decoupling Mechanism proposal.

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**Request No.**: UG-181053 WUTC DR 33

33. a) Please describe the rationale for selecting 59 degree Fahrenheit for residential schedules and 58 degree Fahrenheit for commercial schedules as the base temperature for heating degree days. Please provide any supporting data, graphs or analyses for the decision to choose these temperature baselines.

b) Has the company experimented with using temperature baselines other than 59 and 58 degree Fahrenheit in temperature normalization analyses?

c) If the answer to sub-question (b) is yes, please provide the analyses using the other temperature baselines and the results of those analyses.

d) If the answer to sub-question (b) is no, please explain why the company has decided not to use other temperature baselines.

**Response:**

a) The Company used the 59 degree Fahrenheit base for residential schedules and 58 degree Fahrenheit base for commercial schedules as our temperature set points for heating degree days (HDDs) because we believe that these values produce the best linear relationship between therm load and HDDs. We use the set points to linearize the relationship so that we can use simple linear regression models to derive our weather normalized load by month and rate schedule.

Please refer to attachment, “UG-181053 WUTC DR 33 Attachment 1”, which documents the Company’s original adoption of the 59 and 58 degree Fahrenheit set point standard in 2002. This Load Forecast Documentation was created by an outside consultant, Forefront Economics, to support the Company’s 2002 Oregon general rate case filing. Beginning at page 19, the document discusses the choice of 59 and 58 degree set points because they had the best statistical properties and best fit to historic usage of several reference temperatures that were tested.

b) The Company has used the 59 and 58 degree Fahrenheit set points for its last three Oregon general rate cases beginning in 2002. The Company did use a 65 degree Fahrenheit set point for both residential and commercial schedules for its last Washington general rate case filing in 2008 but this set point was not considered for this current rate case, UG-181053. We have not experimented with any other set points other than these mentioned in any rate case filings since 2002.

c) N/A.

d) The Company decided to use the 59 and 58 degree Fahrenheit set points because we believe they best linearize the relationship between therm load and HDDs. We believe that linearizing the model allows us to more simply explain the statistical relationship between temperature and usage to our customers and outside parties.

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36. Please provide the relevant statistics to demonstrate the backcast accuracy for the weather normalization regression models (e.g., mean absolute percent error).

**Response:**

Prior to filing our last Oregon general rate case in December 2017, we analyzed how our weather normalization regression model was performing against actual results. We performed a backcast test of the model accuracy on system-wide load (e.g., combined Oregon and Washington load) for the residential and commercial class. We performed three backcast tests using different vintages of data and calculated overall evaluation metrics for mean absolute percent error (MAPE) and mean bias.

Please see attachment, UG-181053 WUTC DR 36 Attachment 1, for the backcast analysis.

Attachment 1 calculates the MAPE and mean bias using a weighting matrix that weights the forecasting ability of each backcast test by year. Heavier weights are given to the first year of predictions, and lower weights to latter years. The MAPE is calculated by multiplying these weights by the absolute value differences between annual predicted load and actual load by customer class. The bias is calculated in much the same manner, except it is based off of total difference between annual predicted load and actual load by customer class (plus and minus). We calculated an overall MAPE of 1.88% and bias of -1.68% for the combined weighted results of the three backcast tests. The MAPE value indicates, on an absolute value basis, that the model is producing just a 1.88% prediction error based on a scale of 0% to 100% (the lower the error value, the better the model is at predicting actual load).

Due to high performance of our weather normalization model, as evidenced by the weighted MAPE and bias results, we used the same model specifications for both our Oregon and Washington general rate case filings.