EXH. AEJ-1T
DOCKETS UE-240004/UG-240005 et al.
2024 PSE GENERAL RATE CASE
WITNESS: ALLISON E. JACOBS

BEFORE THE
WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION

WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION, **Complainant,** **v.** **PUGET SOUND ENERGY,** **Respondent.**	**Docket UE-240004** **Docket UG-240005**
In the Matter of the Petition of **PUGET SOUND ENERGY** **For an Accounting Order Authorizing deferred accounting treatment of purchased power agreement expenses pursuant to RCW 80.28.410**	**Docket UE 230810** **(*consolidated*)**

PREFILED REBUTTAL TESTIMONY (NONCONFIDENTIAL) OF

ALLISON E. JACOBS

ON BEHALF OF PUGET SOUND ENERGY

SEPTEMBER 18, 2024

PUGET SOUND ENERGY

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I. INTRODUCTION

Q. Please state your name, business address, and position with Puget Sound Energy.

A. My name is Allison E. Jacobs, and my business address is Puget Sound Energy, P.O. Box 97034, Bellevue, Washington 98009-9734. I am employed by Puget Sound Energy ("PSE" or "Company") as Consulting Energy Resource Planning/Acquisition Analyst in the Load Forecasting & Analysis Team.

Q. Have you prepared an exhibit describing your education, relevant employment experience, and other professional qualifications?

A. Yes, I have. It is Exh. AEJ-2.

Q. What are your duties as Consulting Energy Resource Planning/Acquisition Analyst for PSE?

A. As Consulting Energy Resource Planning/Acquisition Analyst for the Load Forecasting & Analysis Team, I primarily lead the development of the long-term natural gas load forecast, which includes forecasts of customer growth, energy, and peak load forecasts. These forecasts are used for general rate case filings and long-term planning.

Q. What is the purpose of your rebuttal testimony?

A. My rebuttal testimony responds to recommendations made by Commission Staff witness Glenn Watkins in his prefiled response testimony, Exh. GAW-1T, regarding the residential gas use per customer normalization and forecast.

Q. Please summarize your testimony.

A. PSE does not agree with Staff's recommendation to make adjustments to the natural gas residential (Rate 23) sales (therms) and base rate revenue forecasts due to fundamental flaws in the model Mr. Watkins developed to recalculate residential natural gas use per customer ("UPC"). My rebuttal testimony demonstrates that Mr. Watkins' model incorrectly captures the temperature response in residential natural gas usage, which leads to an unreasonably high estimate of normalized test year and forecasted residential sales. The Commission should disregard Mr. Watkins' model and use PSE's model, which more accurately captures the relationship between weather and customer usage patterns.

II. COMMISSION STAFF'S RESIDENTIAL USE PER CUSTOMER MODEL IS FLAWED

Q. Please summarize Mr. Watkins' assessment of the Company's natural gas normalized and forecasted usages per customer ("UPCs") for the residential class (Rate 23).

A. Mr. Watkins presents testimony claiming that the Company's normalized test year and forecasted UPCs for the gas residential class are understated. He compares

the recent years' actual UPCs in relation to observed temperatures (in the form of Heating Degree Days ("HDDs")[1]) and points out the test year normalized and forecasted UPCs are significantly lower than the recent actual UPCs with similar HDDs. Mr. Watkins also conducted his own multivariate regression analysis of the residential natural gas UPC. Based on results of his model, he recommends increases to the test year weather normalized sales (therms) and forecasted rate year sales (therms) for the natural gas residential class.[2]

Q. Do you agree with Mr. Watkins' multivariate regression analysis?

A. No. A regression model uses historical actual observed data to determine the relationship of energy use to temperatures. This relationship is then used to calculate energy sales under normal temperature conditions. However, it is important to develop a regression model that properly captures the impact of temperature on energy consumption correctly. Mr. Watkins' model does not do this.

Q. How do you determine whether a regression model is properly capturing the impact of temperature on energy consumption?

A. To determine if a regression model is appropriately capturing the relationship between temperature and energy consumption, we can examine whether the

[1] HDDs are a measure of how cold the temperature was on a given day or during a period of days.
[2] Exh. GAW-1T at 5:6-10:5.

model is specified reasonably. A model may generate a high R^2 value,[3] as Mr. Watkins' model does,[4] but fail other important statistical tests that indicate a model has been misspecified. Mr. Watkins' model fails the standard statistical tests for multi-collinearity. The practical result of this model misspecification is that Mr. Watkins' model shows large monthly changes to non-heating sensitive loads that are clearly correlated with heat, which I illustrate below. The implication of his model misspecification is that his load forecast is not sensitive enough to changes in HDD. In contrast, PSE's model passes the standard multi-collinearity test. My testimony provides an illustration to contrast the reasonableness of how weather sensitive usage changes across months in my model.

Q. What is multi-collinearity and how it is detected?

A. In statistical analysis, multi-collinearity occurs when multiple independent variables in a model are interconnected and could result in the variables misrepresenting how much of a role they have on the dependent variable, in this case UPC. This means that in a multiple regression model, these variables are not as independent as they seem and could cause double-counting or undercounting of the impact. To identify and quantify the level of multi-collinearity, the standard practice is to apply a technique called the variance inflation factor ("VIF"). The

[3] R^2 is a statistical determination of how well the regression model prediction approximates the real data points. The closer the R^2 is to 1 the more of the observed variation is replicated by the model. Mr. Watkins' model had a high R^2 value.

[4] Exh. GAW-1T at 7:18-19.

VIF calculates how much the variance of the estimated regression coefficients increases when the predictor variables are linearly related, compared to when they are not. The VIF score provides insight into the correlation level: a score of 1 indicates no correlation, 1-5 suggests moderate correlation, and 5 or more indicates high correlation between variables.

Q. What were Mr. Watkins' VIF multi-collinearity scores?

A. Table 1 below displays the VIF scores for each variable in Mr. Watkins' model. The high VIF scores indicate that multi-collinearity is present in Mr. Watkins' model.

Table 1. VIF score from Mr. Watkins' regression model for natural gas UPC.

Variable	VIF
Constant	NA
HDD65	21.6
JAN	1.9
FEB	1.9
MAR	2.1
APR	3.7
MAY	7.0
JUN	10.1
JUL	13.3
AUG	13.5
SEP	11.1
OCT	4.8
NOV	2.4

Q. Does Mr. Watkins' model produce reasonable results?

A. No, it does not. As demonstrated by Mr. Watkins' VIF scores, the model Mr. Watkins developed was misspecified, failing the standard statistical tests for multi-collinearity, and produced results that are misleading and do not make sense.

Q. Please describe how Mr. Watkins' model was misspecified.

A. Mr. Watkins' regression model specification includes an intercept, weather variation (HDD65), and monthly dummy variables for all months except December.[5] This model specification is not suitable for estimating temperature sensitivity. While Mr. Watkins uses the industry standard practice of degree-days (HDD) to capture the temperature sensitive usage, the way he uses that information in his model displays severe multi-collinearity between HDD65 and month variables. As a result, it understates how sensitive PSE's gas residential customers are to cold temperatures.

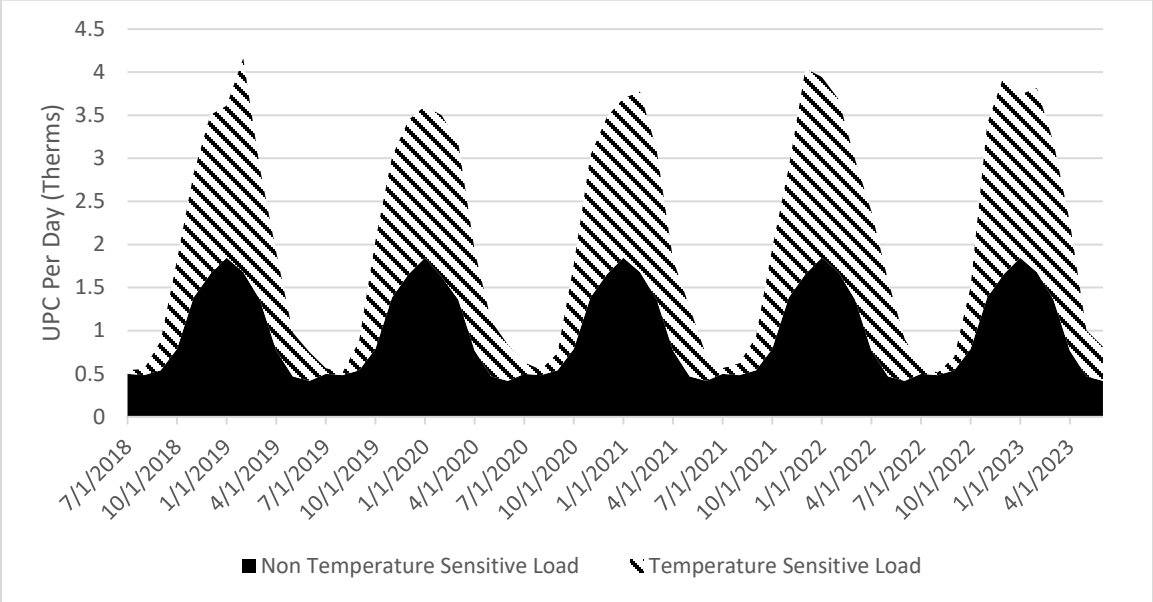
Q. Please explain why the multi-collinearity in Mr. Watkins' model is a problem in estimating the UPC temperature sensitivity.

A. Multi-collinearity is a problem because it distorts the statistical significance of the independent variables. In the temperature analysis, non-weather sensitive usage components should be uncorrelated with weather sensitive usage components.

[5] Exh. GAW-1T at 7:5-8:8.

The following charts illustrate the differences between Mr. Watkins' and PSE's models weather load impact estimation. Predicted values of average daily UPC are disaggregated into weather sensitive components, as derived from the weather coefficients in the regression models, and the remainder, which are non-weather sensitive components. Figure 1 represents estimated weather sensitive and non-weather sensitive components from Mr. Watkins' model, both of which exhibit a strong positive correlation with temperature. That is concerning, as the non-weather dependent components of the model appear to be strongly correlated with the weather fluctuations without a plausible explanation. In plain language, typical gas usage in the home is either strongly weather dependent, such as furnace or fireplace use, or is not weather dependent, such as water heater, cooking, and dryer usage. Therefore, Mr. Watkins' model is modelling something that does not exist within PSE customers' homes. It is for this reason Mr. Watkins' model is not reasonable.

Figure 1. Mr. Watkins' residential UPC model: Temperature sensitive and non-temperature sensitive model components.



Q. How does PSE's model compare?

A. In contrast to Mr. Watkins' model, Figure 2 shows PSE's model estimates, which demonstrate minor and minimal correlation between the weather and non-weather loads. PSE's modelling process avoids the multi-collinearity issue by not including monthly dummy variables, which are related to weather, but do not predict weather. Table 2 shows the VIF score for PSE's model variables, which pass the multi-collinearity test. Therefore, PSE's model more accurately captures the relationship between weather and customer usage patterns.

Figure 2. PSE's residential UPC model: Temperature sensitive and non-temperature sensitive model components.

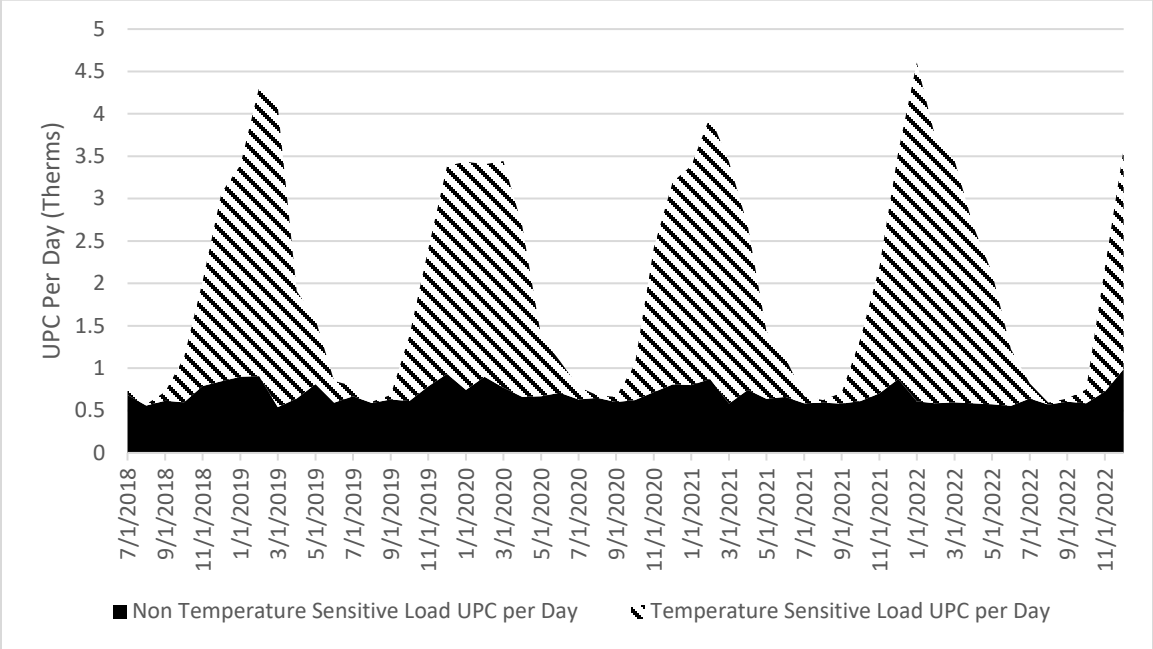


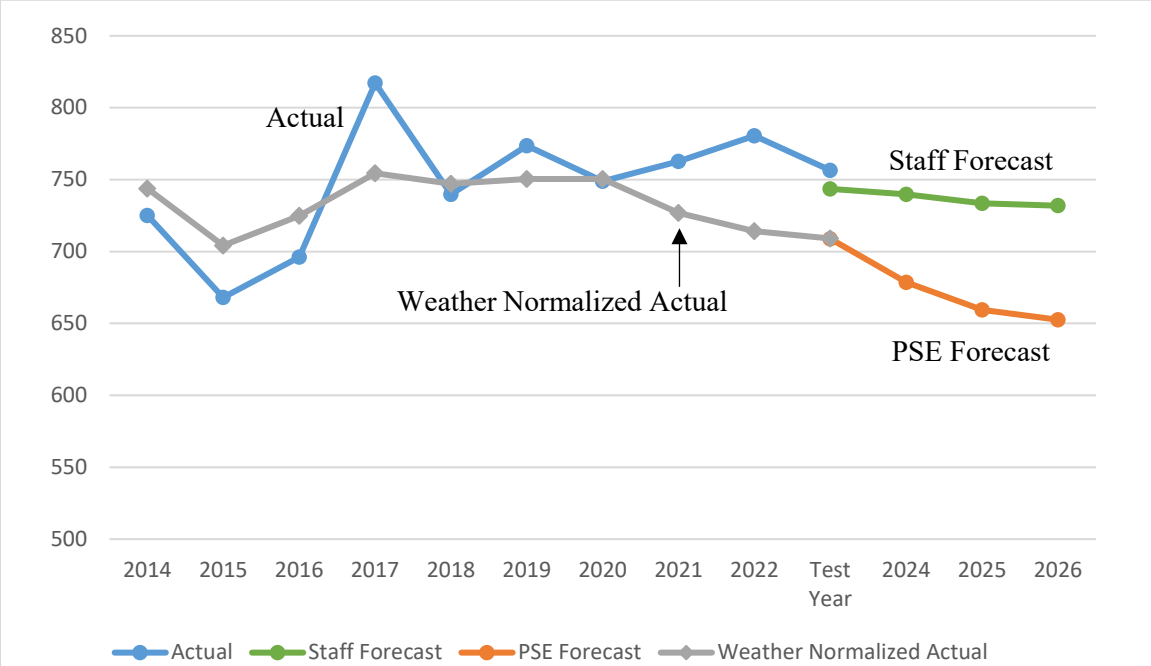
Table 2. VIF score from PSE's regression model for natural gas UPC.

Variable	VIF
Constant	NA
Residential HDD Per Day	2.5
Price Index	1.0
Residential HDD Per Day Winter months	2.5

Q. Please provide a graphical depiction of recent actual and weather normalized actual Residential UPCs to those forecasted by PSE and Staff.

A. The following graph is very similar to the graph Mr. Watkins provides on page 9 of his testimony; however, it also includes data for a longer period back in history both on an actual and weather normalized actual basis.

Figure 3. Actual, weather normalized, and forecasted natural gas residential UPC.



As the graph shows, the weather normalized actuals for the test year and the two years prior are lower than Staff's forecast. Additionally, you can see that the PSE forecast for the test year is in line with the weather normalized actual in the test year. Therefore, PSE's lower forecast is more reasonable than Staff's forecast.

Q. Should the proposed natural gas residential UPC in Mr. Watkins' testimony and the subsequent calculations on energy sales and base rate revenues be accepted?

A. No. Mr. Watkins' normalized test year UPC and forecasted UPC for 2025 and 2026 should be rejected because the model he proposes is flawed in how it represents weather and non-weather components of usage. Therefore, his

subsequent calculations using that forecast for energy sales and base rate revenues should be rejected as well.

III. CONCLUSION

Q. Does that conclude your testimony?

A. Yes, it does.