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Direct Testimony and Schedules
John M. Goodenough

Before the North Dakota Public Service Commission
State of North Dakota

In the Matter of the Application of Northern States Power Company
for Authority to Increase Rates for Natural Gas Service in North Dakota

Case No. PU-23-____
Exhibit___(JMG-1)

Sales Forecast

December 29, 2023

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Schedules

I. INTRODUCTION AND QUALIFICATIONS

Q. PLEASE STATE YOUR NAME AND OCCUPATION.

A. My name is John M. Goodenough. I am the Director of the Sales, Energy and Demand Forecasting department for Xcel Energy Services Inc. (XES), which provides services to Northern States Power Company (Xcel Energy, NSP or the Company).

Q. PLEASE SUMMARIZE YOUR QUALIFICATIONS AND EXPERIENCE.

A. I graduated from the University of Delaware with a Doctor of Philosophy degree in Economics. I also hold a Master of Arts degree in Economics from the University of Delaware and a Bachelor of Arts degree in Economics from the University of Maryland. I have worked in a sales forecasting role since 2007. I began my career in forecasting as a Regulatory Affairs Analyst at Pepco Holdings, Inc. from 2007–2010, followed by a role as a Principal Analyst at Baltimore Gas and Electric from 2010–2014. I worked as an Energy Markets Specialist at Southern California Edison from 2014–2016 and as a Manager, Energy and Revenue Forecasting and Analysis at Arizona Public Service from 2016–2019. I started my prior role as Manager, Energy Forecasting for Xcel Energy in October 2019 and was promoted to my current role as Director of Sales, Energy, and Demand Forecasting in May 2022. My resume is included as Exhibit___(JMG-1), Schedule 1.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY IN THIS PROCEEDING?

A. I sponsor the Company's forecasts of sales and customers for the 2024 test year. I recommend that the North Dakota Public Service Commission (Commission) adopt my forecasts of sales and customers for the purpose of determining the revenue requirement and final rates in this proceeding. In support of my recommended forecasts, I first compare our customer and sales forecast to historical customer and decatherm (Dkt) sales trends for Xcel Energy's North Dakota service territory. Then, I present details of the methods I used to develop the gas Dkt sales and customer forecasts and the results.

Q. ARE THERE DEFINED TERMS YOU PLAN TO USE IN YOUR TESTIMONY?

A. Yes. The definitions of terms that are included in my testimony are provided in Exhibit___(JMG-1), Schedule 2.

II. CUSTOMER AND SALES FORECAST

Q. WHAT GEOGRAPHICAL AREA DO THE TEST YEAR SALES REFLECT?

A. My testimony and exhibits reflect gas usage and customers in Xcel Energy's North Dakota service territory. Xcel Energy's North Dakota service territory includes approximately 63,000 customers in and around Fargo and Grand Forks, North Dakota.

Q. PLEASE DESCRIBE THE CUSTOMER CATEGORIES INCLUDED IN XCEL ENERGY'S CUSTOMER AND SALES FORECASTS.

A. The following customer classes comprise Xcel Energy's North Dakota gas customer and sales forecasts:

- *Residential* – service to any residential customer for domestic use of natural gas.
- *Commercial and Industrial* – service to any commercial and industrial customer for general use of natural gas.

- *Small Interruptible* – interruptible service to a commercial or industrial customer whose maximum hourly requirements are in excess of 10 Therms and whose maximum daily requirements are less than 2,000 Therms.
- *Large Interruptible* – interruptible service to a commercial or industrial customer whose maximum hourly requirements are in excess of 10 Therms and whose maximum daily requirements are 2,000 Therms or more.
- *Large Commercial Interruptible Transportation Service* – interruptible service to a customer who has made arrangements to have gas other than Company system supply delivered to a Company town border station, whose maximum daily requirements are more than 2,000 Therms.
- *Large Commercial Firm Transportation Service* – firm service to a customer who has made arrangements to have gas other than Company system supply delivered to a Company town border station and whose maximum daily requirements are more than 2,000 Therms.

The Large Commercial Interruptible Transportation Service and Large Commercial Firm Transportation Service classes are comprised of a small number of customers. Therefore, to maintain customer confidentiality, information for the Large Commercial Interruptible Transportation Service class has been combined with the Large Interruptible class, and information for the Large Commercial Firm Transportation Service class has been combined with the Commercial and Industrial class.

Q. HOW ARE CUSTOMER AND SALES FORECASTS USED IN THIS PROCEEDING?

A. The customer and sales forecasts are used to calculate the following:

1) Test year revenue under present rates; and
2) Test year revenue under proposed rates.

Q. PLEASE PROVIDE AN OVERVIEW OF THE ECONOMIC LANDSCAPE OF XCEL ENERGY'S NORTH DAKOTA GAS SERVICE TERRITORY.

A. Xcel Energy's North Dakota customers are primarily located in Fargo, West Fargo, and Grand Forks, with 92 percent of the customer base in these three locations. Just over two-thirds of the customers are located in Fargo and West Fargo and about one-quarter are in Grand Forks.

Q. WHAT IS XCEL ENERGY'S FORECAST OF GAS SALES AND CUSTOMERS FOR THE TEST YEAR ENDING DECEMBER 31, 2024?

A. Exhibit___(JMG-1), Schedule 3 summarizes monthly test year Dkt sales and number of customers for each customer class. Total sales are projected to be 14,337,878 Dkt for the test year, with an average of 64,674 total customers. For context, total sales in 2022 were 14,290,888 Dkt with an average of 62,125 total customers.

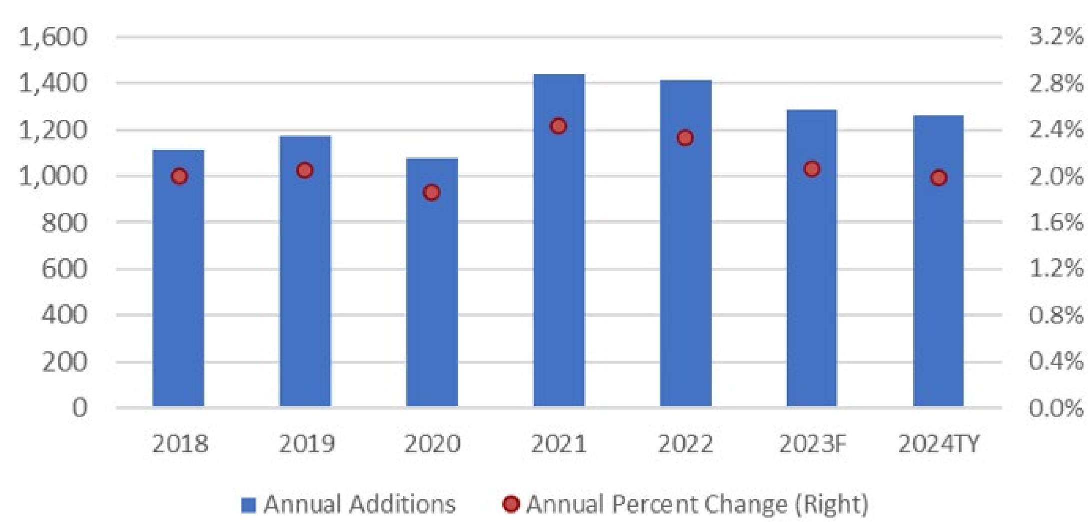
Q. WHAT HAS BEEN THE RECENT HISTORICAL CUSTOMER GROWTH IN NORTH DAKOTA?

A. Over the past 5 years (2017-2022) the total number of gas customers has increased by 11 percent or 6,223 customers, growing from 55,902 in 2017 to 62,125 in 2022. This equals a 2.1 percent average annual growth rate over this period of time. The largest class of customers is the Residential class, which represented 85 percent of total customers in 2022, and has averaged growth of 2.1 percent per year on average during the period from 2017 through 2022. The Commercial and Industrial class accounted for 14.9 percent of total customers in 2022, and averaged growth of 2.2 percent 2017 through 2022. The remaining 0.1 percent of customers are in the Interruptible classes and in aggregate has been decreasing, driven by a 5.3 percent average annual decline between 2017 and 2022 in the Small Interruptible class.[1]

Q. HOW DOES THE PROJECTED TEST YEAR CUSTOMER GROWTH COMPARE WITH HISTORICAL GROWTH?

A. Test year total customer growth is expected to be in line with the 2017-2022 average historical growth. As shown in Figure 1 below, customer growth has ranged from about 1,100 to 1,400 customers per year since 2018 and the forecast for 2023 and 2024 is to add between 1,250 and 1,300 customers per year. The growth rates in 2023 and 2024 are 2.1 percent and 2.0 percent, respectively, which is in line with the recent 5-year trend.

Figure 1
Annual Customer Additions and Percent Growth, 2018-2024



[1] The Transport class consists of three customers as of January 2021.

Table 1 below provides the historical and forecast annual customer growth rate by class for the time period 2017-2024. I will explain the methodologies used to develop this forecast in the following section of my testimony.

Table 1
2017-2024 Avg Annual Percent Change in Customers

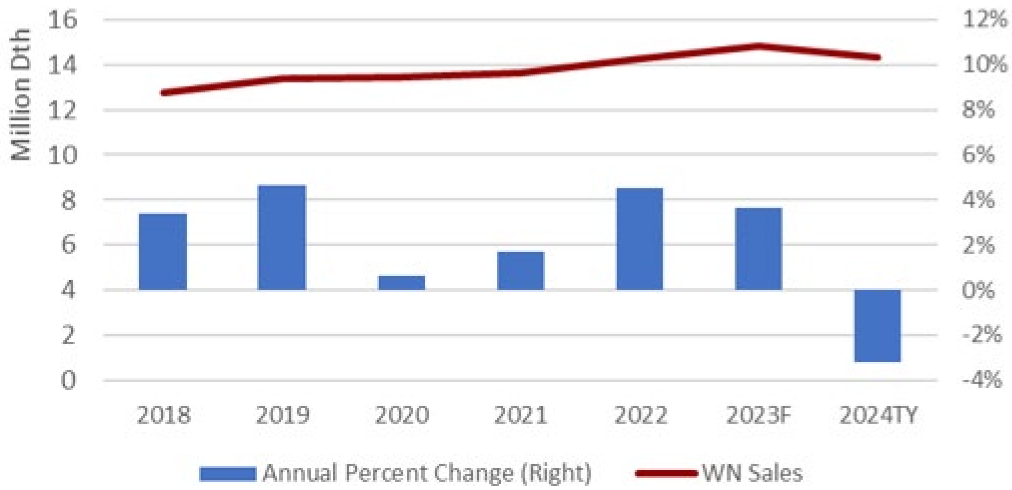
Customer Class	2017-2022	2022-2024
Residential	2.1%	2.0%
Comm & Ind	2.2%	2.2%
Interruptible	-3.7%	-2.4%
Total	**2.1%**	**2.0%**

Q. WHAT HAS BEEN THE RECENT HISTORICAL WEATHER NORMALIZED GAS SALES GROWTH IN NORTH DAKOTA?

A. After normalizing for weather,[2] Xcel Energy's North Dakota service territory total gas sales have increased an average of 3.0 percent per year during the period of 2017 through 2022. During that same period, Residential sales have increased 2.3 percent, Commercial and Industrial sales have increased 7.1 percent, Small Interruptible sales have decreased 6.8 percent, and Large Interruptible sales have decreased 4.3 percent per year on average. Figure 2 shows the 2017-2024 historical and forecasted weather-normalized sales and annual growth rates.

[2] In order to calculate sales growth from year to year not influenced by weather, the Company estimates the Dkt impact of abnormal weather to arrive at "weather normalized" (W/N) sales. The Company uses actual and normal weather, along with the actual number of customers and weather response coefficients to conduct this weather normalization of historical sales. The weather normalization is performed for the Residential, Commercial and Industrial, Small Interruptible, and Large Interruptible sales classes.

Figure 2
Annual WN Sale and Percent Growth, 2018-2024



Q. HOW DO 2024 TEST YEAR SALES COMPARE TO HISTORICAL SALES?

A. Total Dkt sales reflected in the 2024 test year are expected to be slightly higher than the 2022 weather normalized levels, growing 0.2 percent per year on average. Table 2 below provides the historical and forecast annual weather normalized sales growth rate by class for the time period 2017-2024. I will explain the methodologies used to develop this forecast in the following section of my testimony.

Table 2
2017-2024 Avg Annual Percent Change in Sales

Customer Class	2017-2022	2022-2024
Residential	2.3%	1.0%
Comm & Ind	7.1%	-1.7%
Small Interruptible	-6.8%	5.1%
Large Interruptible	-4.3%	4.0%
Total	**3.0%**	**0.2%**

Q. PLEASE DISCUSS HISTORICAL AND PROJECTED RESIDENTIAL SALES.

A. Residential sales accounted for 29.4 percent of total sales in 2024 and have increased at an average annual rate of 2.3 percent over the 2017 to 2022 time period. This growth has been driven by a 2.1 percent average annual increase in the number of residential customers as I previously discussed, and a 0.2 percent average annual increase in use per customer. Use per customer is expected to decrease at about 1.0 percent per year from 2022 through the 2024 test year.

Q. PLEASE DISCUSS HISTORICAL AND PROJECTED FIRM COMMERCIAL AND INDUSTRIAL SALES.

A. Firm sales to the Commercial and Industrial sector accounted for the largest share of total sales in 2022 (53.0 percent) and have increased at an average annual rate of 7.1 percent over the 2017 to 2022 time period. Firm Commercial and Industrial sales are expected to decline about 1.7 percent per year from 2022 through the 2024 test year.

Q. PLEASE DISCUSS HISTORICAL AND PROJECTED INTERRUPTIBLE SALES.

A. Sales to the Small Interruptible and Large Interruptible classes account for 17.6 percent of total sales. Small Interruptible sales have been declining 6.8 percent per year on average since 2017 as customers migrate from the Interruptible class to the Commercial and Industrial class. The Small Interruptible class is expected to grow through the 2024 test year, with 2022 sales projected to be 10.5 percent higher than 2022. Sales in the Large Interruptible class are very volatile due to customers moving into or out of this class. Sales in the sector declined significantly in 2020 with customer movement to the Commercial and Industrial class and are expected to increase in both 2023 and 2024.

Q. PLEASE DISCUSS THE FIRM AND INTERRUPTIBLE TRANSPORT CLASSES.

A. Prior to 2021, the Interruptible Transport class had a single customer, and there were no customers in the Firm Transport class. **[TRADE SECRET BEGINS…**

…TRADE SECRET ENDS]

III. OVERVIEW OF SALES AND CUSTOMER FORECASTING METHODOLOGY

Q. PLEASE DESCRIBE IN GENERAL TERMS THE METHODS USED TO FORECAST SALES AND CUSTOMERS.

A. The sales forecast was prepared in summer 2023 using a combination of econometric and statistical forecasting techniques and analyses. The forecast was based on actual customers and sales through May 2023.

Q. HOW WERE THE TEST YEAR SALES FORECASTS DEVELOPED FOR THE RESIDENTIAL, COMMERCIAL AND INDUSTRIAL, SMALL INTERRUPTIBLE, AND LARGE INTERRUPTIBLE CUSTOMER CLASSES?

A. Regression models were developed as the foundation for the sales forecasts of the Residential, Commercial and Industrial, Small Interruptible, and Large Interruptible customer classes. Regression techniques are very well-known, proven methods of forecasting and are commonly accepted by forecasters throughout the utility industry. This method provides reliable, accurate projections, accommodates the use of predictor variables, such as economic or demographic indicators and weather, and allows clear interpretation of the model. Xcel Energy has been using these types of regression models since 1991.

Monthly sales forecasts for these customer classes were developed based on regression models designed to define a statistical relationship between the historical sales and the independent predictor variables, including historical economic indicators, historical weather (expressed in heating-degree days (HDD),[3] number of billing days, and historical number of customers. In all of the models except for residential customers, monthly historical data from June 2008 through May 2023 was used to determine these relationships. The residential customer model used data from January 2012 through May 2023. The modeled relationships were then simulated over the forecast period by assuming normal weather (expressed in terms of 20-year-averaged HDD) and the projected levels of the independent predictor variables.

Q. WHAT PROCESS WAS USED TO FORECAST SALES IN THE OTHER CUSTOMER CLASSES?

A. Sales in the Firm Transport and Interruptible Transport classes were developed by assessing historical trends of each customer in these classes.

Q. WHAT PROCESS WAS USED FOR FORECASTING THE NUMBER OF CUSTOMERS?

A. The number of customers by customer class for the Residential and Commercial and Industrial classes is forecasted using demographic data in regression models. The historical number of customers by class is derived from the

[3] I describe the calculation of HDD in Section VI.

Company's billing system. The customer forecasts for all other classes were developed either by holding constant the average number of customers at the May 2023 level or applying a trend based on historical actual data.

IV. STATISTICALLY MODELED FORECASTS

Q. PLEASE DESCRIBE THE REGRESSION MODELS AND ASSOCIATED ANALYSIS USED IN XCEL ENERGY'S STATISTICAL PROJECTIONS OF SALES AND CUSTOMERS.

A. The regression models used in Xcel Energy's statistical projections of sales are provided in Exhibit___(JMG-1), Schedule 4, and the regression models used in Xcel Energy's statistical projections of customers are provided in Exhibit___(JMG-1), Schedule 5. These schedules include, by customer class, the models with their summary statistics and descriptions for each variable included in the model.

Q. WHAT TECHNIQUES DID XCEL ENERGY EMPLOY TO EVALUATE THE REASONABLENESS OF ITS QUANTITATIVE FORECASTING MODELS AND SALES PROJECTIONS?

A. There are a number of quantitative and qualitative validity tests that are applicable to regression analysis.

First, the coefficient of determination (R-squared) test statistic is a measure of the quality of the model's fit to the historical data (expressed as a decimal number between 0.0 and 1.0). It represents the proportion of the variation of the historical sales around their mean value that can be attributed to the functional relationship between the historical sales and the explanatory variables included in the model. If the R-squared statistic is high, the model is explaining a high degree of the historical sales variability. The regression models used to develop the Residential, Commercial and Industrial, and Small Interruptible sales forecast demonstrate very high R-squared statistics, ranging between 0.870 and 0.996. The regression model used to develop the Large Interruptible sales forecast demonstrated an R-squared statistic of 0.713, which is acceptable given the amount of volatility seen in the historical sales in this class.

Next, the t-statistics of the variables indicate the degree of correlation between that variable's data series and the sales data series being modeled. The t-statistic is a measure of the statistical significance of each variable's individual contribution to the prediction model. Generally, the absolute value of each t-statistic should be greater than 1.98 to be considered statistically significant at the 95 percent confidence level and greater than 1.66 to be considered statistically significant at the 90 percent confidence level. This criterion was applied in the development of the regression models used to develop the sales forecast. The final regression models used to develop the Company's test year sales forecast tested satisfactorily under this standard. All variables except for one were statistically significant at greater than the 94 percent confidence level, and most variables were statistically significant at the 95 percent confidence level or higher.

In addition, each model was inspected for the presence of first-order autocorrelation, as measured by the Durbin-Watson (DW) test statistic. Autocorrelation refers to the correlation of the model's error terms for different time periods. For example, an overestimate in one period is likely to lead to an overestimate in the succeeding period, and vice versa, under the presence of first-order autocorrelation. Thus, when forecasting with a regression model, absence of autocorrelation between the error terms is very important. The DW test statistic ranges between 0 and 4 and provides a measure to test for autocorrelation. In the absence of first-order autocorrelation, the DW test statistic equals 2.0. Autocorrelation was present in each of the Company's initial regression models. Therefore, the Company applied an autocorrelation correction process so that the final regression models used to develop the sales forecast tested satisfactorily for the absence of first-order autocorrelation, as measured by the DW test statistic.

Next, the Company conducted a graphical inspection of each model's error terms (*i.e.* actual less predicted) to verify that the models were not misspecified, and that statistical assumptions pertaining to constant variance among the residual terms and their random distribution with respect to the predictor variables were not violated. Analysis of each model's residuals indicated that the residuals were homoscedastic (constant variance) and randomly distributed, indicating that the regression modeling technique was an appropriate selection for each customer class' sales that were statistically modeled.

Finally, the statistically-modeled sales forecasts for each customer class have been reviewed for reasonableness as compared to the respective monthly sales history for that class. Graphical inspection reveals that the patterns of the test year sales forecast fit well with the respective historical patterns for each customer class. The annual total forecast sales have been compared to their respective historical trends for consistency. Similar qualitative tests for reasonableness and consistency have been performed for the customer level projections.

The results of these quantitative and qualitative validity tests support the reasonableness of the quantitative forecasting models and test year customer count and sales projections.

V. WEATHER NORMALIZATION OF TEST YEAR SALES

Q. HOW DID XCEL ENERGY ADJUST ITS TEST YEAR SALES FORECAST FOR THE INFLUENCE OF WEATHER ON SALES?

A. Residential, Commercial and Industrial, Small Interruptible, and Large Interruptible sales projections were developed through the application of quantitative statistical models. For each of these classes, sales were not weather-adjusted prior to developing the respective statistical models. The respective regression models used to forecast sales included weather, as measured in terms of heating-degree days, as an explanatory variable. In this way, the historical weather impact on historical consumption for each class was modeled through the respective coefficients for the HDD variables included in each class' model. Test year sales were then projected by simulating the established statistical relationships over the forecast horizon.

Q. HOW WAS NORMAL WEATHER DETERMINED?

A. Normal daily weather was calculated based on the average of historical HDD for the 20-year time period 2003 to 2022. These normal HDD were related to the forecasted billing month in the same manner as were the actual HDD.

Q. WHAT WAS XCEL ENERGY'S MEASURE OF WEATHER, AND WHAT WAS THE SOURCE?

A. The measure of weather used was HDD, using a 65-degree temperature base. This information was obtained from the National Oceanic and Atmospheric Administration (NOAA) weather station in Fargo, North Dakota, which captures the weather impact to our service area.

Q. IS IT APPROPRIATE TO USE THE FARGO WEATHER STATION TO REPRESENT XCEL ENERGY'S NORTH DAKOTA SERVICE TERRITORY?

A. Yes, it is. As I mentioned previously, about two thirds of Xcel Energy's North Dakota gas customers reside within the Fargo area. The coefficients for the HDD variables included in each class' model were determined based on the historical relationship between sales throughout Xcel Energy's eastern North Dakota service territory and Fargo weather. Therefore, the coefficients accurately reflect the distribution of customers geographically within the North Dakota service territory. Since this geographic distribution is not expected to change during the test year, it is appropriate to use this historical relationship and Fargo weather.

Q. DID THE WEATHER REFLECT THE SAME BILLING DAYS AS THE SALES DATA?

A. Yes. The HDD were weighted by the number of times a particular day was included in a particular billing month. These weighted HDD were divided by the total billing days to arrive at average daily HDD for a billing month.

VI. DATA PREPARATION

Q. PLEASE DESCRIBE THE DATA AND DATA SOURCES XCEL ENERGY USED TO DEVELOP THE TEST YEAR SALES AND CUSTOMER COUNT FORECASTS.

A. Historical billing-month sales and number of customers were obtained from Xcel Energy's billing system reports. Monthly historical data from June 2008 through May 2023 was obtained and used.

Q. WHAT IS THE SOURCE OF WEATHER DATA?

A. As I explained previously in my testimony, NOAA weather data measured at the Fargo weather station was my data source, and the measure of weather used was HDD. Eight temperature readings per day were obtained, and the average daily temperature was determined by averaging the eight temperature readings. The Company used HDD as a measure of cold weather. HDD were calculated for each day by subtracting the average daily temperature from 65 degrees Fahrenheit. For example, if the average daily temperature was 45 degrees Fahrenheit, then 65 minus 45 or 20 HDD were calculated for that day. If the average daily temperature was greater than 65 degrees Fahrenheit, then that day recorded zero HDD. Normal daily HDD were calculated by averaging 20 years of daily HDD using data from 2003 to 2022.

Q. WHAT WAS YOUR SOURCE OF ECONOMIC AND DEMOGRAPHIC DATA?

A. Historical and forecasted economic and demographic variables for the state and the Fargo metropolitan area were obtained from IHS Markit, a respected economic forecasting firm frequently relied on by forecasting professionals and by the Company since the 1990s. These variables include Fargo and North Dakota employment and Fargo population. This information is used to determine the historical relationship between customers and sales, and economic and demographic measures. The Company used the most current economic and demographic data available from IHS Markit at the time of modeling.

VII. UNBILLED SALES AND CALENDAR MONTH SALES DERIVATION

Q. PLEASE EXPLAIN THE TERM "UNBILLED SALES".

A. Xcel Energy reads gas meters each working day according to a meter-reading schedule based on 21 billing cycles per billing month. Meters read early in the month mostly reflect consumption that occurred during the previous month. Meters read late in the month mostly reflect consumption that occurred during the current month. Therefore, the "billing month" sales recorded by the current month's meter reads reflect consumption that occurred in both the previous month and the current month. Thus, billing-month sales lag calendar-month sales. Unbilled sales reflect gas consumed in the current calendar month that is not billed to the customer until the succeeding month.

Q. WHAT IS THE PURPOSE OF THE UNBILLED SALES ADJUSTMENT?

A. The purpose is to align the test year revenues with the relevant projected test year expenses, which have been estimated on a calendar-month basis.

Q. IS XCEL ENERGY REFLECTING UNBILLED REVENUE ON ITS BOOKS FOR ACCOUNTING AND FINANCIAL PURPOSES?

A. Yes. Xcel Energy adopted this practice during fiscal year 1992.

Q. HOW WERE THE ESTIMATED MONTHLY NET UNBILLED SALES VOLUMES DETERMINED?

A. Xcel Energy determined its test year monthly net unbilled sales as the difference between the estimated monthly calendar-month sales, and the projected billing-month sales. The projected billing-month sales were created using the statistical models and other forecasting methods previously described.

Q. HOW WERE THE ESTIMATED MONTHLY CALENDAR-MONTH SALES DETERMINED?

A. For the Residential, Commercial and Industrial, Small Interruptible, and Large Interruptible classes, Xcel Energy calculated the test year calendar-month sales based on the projected billing-month sales. The test year calendar-month sales were calculated in terms of the sales load component that is not associated with weather (base load), and the sales load component that is influenced by weather (total weather load). The weather was measured in terms of normal HDD, as described above. The base-load sales and the total weather sales components were calculated for each class. The two components were then combined to provide the total calendar-month volumes.

The calendar-month base-load component was calculated as follows:

Step 1 The billing-month total weather load was calculated. This was accomplished by multiplying the billing-month sales weather normalization regression coefficients (defined in terms of billing-month HDD and number of customers), times billing-month normal HDD, times the projected customers.

Step 2 The billing-month base-load component was calculated by taking the difference between the projected total billing-month sales and the billing-month total weather load (as calculated in Step 1).

Step 3 The billing-month base-load sales per billing day was determined by dividing the billing-month base-load sales (from Step 2) by the average number of billing days per billing month.

Step 4 The calendar-month base-load sales were then calculated by multiplying the billing-month base-load sales per billing day (from Step 3) times the number of days in the calendar month.

The calendar-month total weather load component was calculated the same way the billing-month total weather load was calculated (as described in Step 1 above). However, the calculation was performed by substituting the calendar-month sales weather normalization regression coefficient (defined in terms of calendar-month HDD and number of customers) and the calendar-month normal HDD THI. The calendar-month total sales were calculated by combining the calendar-month base-load and calendar-month total weather load components.

The Firm Transport and Interruptible Transport classes are forecasted on a calendar-month basis. Therefore, for these classes, no conversion from a billing-month sales forecast to a calendar-month sales forecast is necessary.

VIII. CONCLUSION

Q. IN YOUR OPINION, DO THE XCEL ENERGY SALES AND CUSTOMER FORECASTS PROVIDE A REASONABLE BASIS FOR ESTABLISHING RATES IN THIS CASE?

A. Yes. The forecast data is reasonable based on the economic conditions that were foreseeable when the forecast was developed and supports the test year revenue projections

Q. DOES THIS CONCLUDE YOUR DIRECT TESTIMONY?

A. Yes, it does.

JOHN GOODENOUGH, PHD

EDUCATION

PhD in Economics, University of Delaware **2012**
Dissertation: *Economic Welfare Impacts of Real-Time Pricing and CO2 Emissions Trading: Simulation Results at the Customer Class Level for an Investor-Owned Utility*

MA in Economics, University of Delaware **2006**

BA in Economics, University of Maryland **2002**

PROFESSIONAL EXPERIENCE

XCEL ENERGY **Denver, CO**
Manager, Energy Forecasting **10/2019-05/2022**
Director of Sales, Energy, and Demand Forecasting **05/2022-Present**

Management and Leadership:

- Manage the work and development of six employees
- Serve as company witness for sales forecasting and weather normalization in rate cases and resource plans
- Provide regulatory support for routine filings, Integrated Resource Plans, and rate cases
- Provide analytical and statistical analysis for special projects

Load Forecasting:

- Develop monthly short and long-term forecasts of electric customers, sales, and peak demand using time-series analysis and end-use modeling for four OpCos operating in eight states
- Sponsor projects to improve forecast accuracy and develop new forecasting tools
- Track regional economic indicators in support of forecasting models

ARIZONA PUBLIC SERVICE (APS) **Phoenix, AZ**
Manager, Energy and Revenue Analysis and Forecasting **11/2016-10/2019**

Management and Leadership:

- Manage the work and development of six employees
- Serve as expert on matters related to load forecasting and act as liaison to external stakeholders
- Provide regulatory support for monthly fuel cost filings, annual transmission filings, bi-annual Integrated Resource Plans, and rate cases
- Provide economic commentary for quarterly earnings release
- Provide analytical and statistical analysis for special projects

Load Forecasting:

- Develop monthly short and long-term forecasts of electric customers, sales, prices, and revenue using time-series analysis and end-use modeling
- Provide hourly system demand forecasts for use in medium and long-term dispatch modeling
- Develop company forecasts of customer adoption of electric vehicles and distributed generation
- Develop price elasticity models to assess customer response to changing rate design
- Track and forecast regional economic indicators in support of forecasting models

Financial Analysis:

- Analyze monthly financial impacts of fuel prices, plant dispatch, and plant outages
- Conduct monthly variance analysis and financial reporting
- Evaluate billing determinants and rate design impacts on company revenue

SOUTHERN CALIFORNIA EDISON (SCE) **Rosemead, CA**
Senior Energy Market Specialist, Short-Term Demand Forecasting **07/2014-10/2016**

Load Forecasting:

- Developed hourly short-term load forecasts using time-series analysis
- Created hourly prompt month load forecasts for the territory and the ISO
- Monitored short-term load forecasting errors and analyzed the impacts on procurement costs
- Developed semi-parametric econometric model for forecasting bundled load
- Created daily market bids for integrated demand response resources

EXELON CORPORATION, BALTIMORE GAS AND ELECTRIC (BGE) **Baltimore, MD**
Principal Analyst, Load Analysis and Settlements **06/2010-06/2014**

Management and Leadership:

- Supervised the work of employees in the forecasting unit
- Participated in quarterly calls with senior management explaining regional trends in energy usage and economics
- Represented BGE Load Forecasting in the PJM Load Forecasting Group
- Supported conservation and electric supply groups in policy development and goal setting
- Conducted ad-hoc analysis for senior management

Load Forecasting and Financial Analysis:

- Provided monthly short and long-term forecasts of gas and electric sales, customers, prices, and revenue using time-series analysis
- Developed annual gas design-day forecast
- Conducted monthly variance analyses and financial reporting

PEPCO HOLDINGS, INC. **Washington, DC**
Regulatory Affairs Analyst **12/2007-06/2010**

DEPARTMENT OF ENERGY, ENERGY INFORMATION ADMINISTRATION **Washington, D.C.**
Program Assistant **Summer, 2007**

DEPARTMENT OF LABOR, BUREAU OF LABOR STATISTICS **Washington, D.C.**
Economist **02/2003-08/2004**

DEPARTMENT OF COMMERCE, BUREAU OF THE CENSUS **Suitland, MD**
Survey Statistician **06/2002-01/2003**

Definition of Terms

Base Load - Component of sales not associated with weather.

Billing Days - Based on the meter reading schedule for the 21 billing cycles. For example, there are approximately 651 (21 cycles * 31 days) billing days during a typical billing month period.

Billing-Month Sales - Billed sales based on the meter reading schedule for the 21 billing cycles.

Calendar-Month Sales - Estimated sales, equal to the billing month sales, adjusted for the estimated unbilled sales of the current calendar month, less the estimated unbilled sales from the previous calendar month.

Commission – North Dakota Public Service Commission.

Company – Northern States Power Company, a Minnesota corporation.

Dkt – decatherm; measure of gas sales

DW Test Statistic - Durbin-Watson test statistic; tests for the presence of first-order autocorrelation. In the absence of first-order autocorrelation, the statistic equals 2.0.

Error Terms - The difference between the actual values of the data series being modeled (customers or sales) and the regression model's predicted, or "fitted" values for that series. Also called Residual Terms.

HDD - Heating Degree Days - Measure of weather. Calculated by subtracting the average daily temperature from a base of 65 degrees Fahrenheit.

NOAA – National Oceanic and Atmospheric Administration.

Normal Weather – the average of twenty years of historical weather.

NSP – Northern States Power Company

Definition of Terms (continued)

R-squared - Coefficient of determination; measures the quality of the model's fit to the historical data. The higher the R-squared statistic, the better the model is explaining the historical data.

Regression Model - Statistical technique employing multiple independent variables to model the variation of the dependent variable about its mean value.

Residual Terms - The difference between the actual values of the data series being modeled (customers or sales) and the regression model's predicted, or "fitted" values for that series. Also called Error Terms.

t-Statistic - Measures the importance of the independent variable to the regression. The higher the absolute value of the t-statistic, the more likely it is that the variable has a relationship to the dependent variable and is making an important contribution to the equation.

Test Year – January 1, 2022-December 31, 2022.

Total Weather Load - Component of sales influenced by weather.

Unbilled Sales – Electricity consumed in the current month but not billed to customers until the succeeding month.

W/N – Weather normalized

Weather Normalized – MWh sales adjusted to remove the impact of abnormal weather.

Xcel Energy – Northern States Power Company.

XES – Xcel Energy Services Inc.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Xcel Energy - North Dakota State													
2	Test Year Sales and Customers by Customer Class													
3														
4	Weather Normalized Calendar Month Sales (Dkt)													
5														
6		Jan 2024	Feb 2024	Mar 2024	Apr 2024	May 2024	Jun 2024	Jul 2024	Aug 2024	Sep 2024	Oct 2024	Nov 2024	Dec 2024	Year 2024
7														
8	Residential	858,707	736,932	573,325	304,254	147,681	65,570	41,614	49,362	76,589	229,061	466,663	735,372	4,285,129
9	Commercial & Industrial (1)	1,221,953	1,067,898	914,811	540,164	360,977	255,617	222,964	225,760	231,054	432,261	755,976	1,086,353	7,315,788
10	Small Interruptible	64,889	47,946	54,275	54,160	30,261	26,520	22,215	25,903	25,223	37,476	48,763	59,836	497,468
11	Medium Interruptible (2)	246,673	222,114	236,308	212,007	162,973	145,383	122,809	136,060	145,639	166,057	204,480	238,990	2,239,494
12														
13	Total Sales	2,392,223	2,074,890	1,778,720	1,110,585	701,892	493,089	409,602	437,085	478,505	864,855	1,475,881	2,120,551	14,337,878
14														
15														
16														
17	Number of Customers													
18														
19		Jan 2024	Feb 2024	Mar 2024	Apr 2024	May 2024	Jun 2024	Jul 2024	Aug 2024	Sep 2024	Oct 2024	Nov 2024	Dec 2024	Year 2024
20														
21	Residential	54,622	54,669	54,705	54,727	54,774	54,806	54,892	54,975	55,057	55,224	55,385	55,544	54,948
22	Commercial & Industrial(1)	9,625	9,638	9,645	9,635	9,631	9,622	9,608	9,619	9,629	9,664	9,703	9,740	9,647
23	Small Interruptible	55	55	55	55	55	54	54	54	54	54	53	53	54
24	Medium Interruptible(2)	25	25	25	25	25	25	25	25	25	25	25	25	25
25														
26	Total Customers	64,328	64,387	64,430	64,442	64,484	64,507	64,579	64,673	64,765	64,967	65,167	65,363	64,674

(1) Includes Large Commercial Firm Transportation

(2) Includes Large Interruptible Transportation

Xcel Energy North Dakota Residential
2024 Test-Year Sales Forecast

Variable	Coefficient	StdErr	T-Stat	P-Value
WeatherTrans.ResCust_HDD65_Jan	0.009	0.000	81.818	0.00%
WeatherTrans.ResCust_HDD65_Feb	0.009	0.000	72.689	0.00%
WeatherTrans.ResCust_HDD65_Mar	0.008	0.000	71.204	0.00%
WeatherTrans.ResCust_HDD65_Apr	0.008	0.000	43.674	0.00%
WeatherTrans.ResCust_HDD65_May	0.008	0.000	21.084	0.00%
WeatherTrans.ResCust_HDD65_Jun	0.006	0.001	5.125	0.00%
WeatherTrans.ResCust_HDD65_Oct	0.005	0.000	12.332	0.00%
WeatherTrans.ResCust_HDD65_Nov	0.006	0.000	26.505	0.00%
WeatherTrans.ResCust_HDD65_Dec	0.007	0.000	54.653	0.00%
WeatherTrans.ResCust_Fcst	0.867	0.092	9.447	0.00%
AR(1)	0.164	0.078	2.090	3.82%
SAR(1)	0.410	0.081	5.074	0.00%

Xcel Energy North Dakota Residential
2024 Test-Year Sales Forecast

Model Statistics	
Iterations	12
Adjusted Observations	167
Deg. of Freedom for Error	155
R-Squared	0.996
Adjusted R-Squared	0.996
AIC	19.539
BIC	19.763
F-Statistic	#NA
Prob (F-Statistic)	#NA
Log-Likelihood	-1,856.50
Model Sum of Squares	11,009,554,100,172.60
Sum of Squared Errors	44,273,163,392.30
Mean Squared Error	285,633,312.21
Std. Error of Regression	16,900.69
SAR(1)	11,287.02
Mean Abs. % Err. (MAPE)	5.71%
Durbin-Watson Statistic	1.983
Durbin-H Statistic	#NA
Ljung-Box Statistic	29.98
Prob (Ljung-Box)	0.186
Skewness	-0.186
Kurtosis	5.831
Jarque-Bera	56.731
Prob (Jarque-Bera)	0.000

Xcel Energy North Dakota Commercial and Industrial
2024 Test-Year Sales Forecast

Variable	Coefficient	StdErr	T-Stat	P-Value
CONST	82888.347	13104.169	6.325	0.00%
WeatherTrans.SmCommCust_HDD65_Jan	0.059	0.002	38.886	0.00%
WeatherTrans.SmCommCust_HDD65_Feb	0.062	0.002	38.988	0.00%
WeatherTrans.SmCommCust_HDD65_Mar	0.061	0.002	39.551	0.00%
WeatherTrans.SmCommCust_HDD65_Apr	0.055	0.002	24.459	0.00%
WeatherTrans.SmCommCust_HDD65_May	0.052	0.004	11.912	0.00%
WeatherTrans.SmCommCust_HDD65_Jun	0.040	0.013	3.009	0.31%
WeatherTrans.SmCommCust_HDD65_Oct	0.032	0.005	6.195	0.00%
WeatherTrans.SmCommCust_HDD65_Nov	0.046	0.003	14.842	0.00%
WeatherTrans.SmCommCust_HDD65_Dec	0.056	0.002	31.751	0.00%
BinaryTrans.EconBoom	55879.784	12059.070	4.634	0.00%
SALES_ND_SmCom_2023v2.Outlier_2022_Jan	102875.209	33905.448	3.034	0.28%
SALES_ND_SmCom_2023v2.Outlier_2023_Jan	119874.265	38142.917	3.143	0.20%
AR(1)	0.310	0.078	3.954	0.01%
SAR(1)	0.477	0.073	6.501	0.00%

Xcel Energy North Dakota Commercial and Industrial 2024 Test-Year Sales Forecast

Model Statistics	
Iterations	19
Adjusted Observations	167
Deg. of Freedom for Error	152
R-Squared	0.990
Adjusted R-Squared	0.990
AIC	20.922
BIC	21.202
F-Statistic	1124.608208
Prob (F-Statistic)	0
Log-Likelihood	-1,968.95
Model Sum of Squares	17,631,444,203,821.20
Sum of Squared Errors	170,216,709,348.94
Mean Squared Error	1,119,846,772.03
Std. Error of Regression	33,464.11
SAR(1)	20,866.25
Mean Abs. % Err. (MAPE)	6.42%
Durbin-Watson Statistic	2.087
Durbin-H Statistic	#NA
Ljung-Box Statistic	38.69
Prob (Ljung-Box)	0.0294
Skewness	-0.097
Kurtosis	11.063
Jarque-Bera	452.583
Prob (Jarque-Bera)	0.0000

Xcel Energy North Dakota Small Interruptible
2024 Test-Year Sales Forecast

Variable	Coefficient	StdErr	T-Stat	P-Value
WeatherTrans.SVICust_HDD65_Jan	0.420	0.018	22.989	0.00%
WeatherTrans.SVICust_HDD65_Feb	0.396	0.022	18.052	0.00%
WeatherTrans.SVICust_HDD65_Mar	0.539	0.022	23.985	0.00%
WeatherTrans.SVICust_HDD65_Apr	0.484	0.036	13.530	0.00%
WeatherTrans.SVICust_HDD65_May	0.624	0.069	9.023	0.00%
WeatherTrans.SVICust_HDD65_Jun	0.620	0.202	3.072	0.25%
WeatherTrans.SVICust_HDD65_Oct	0.308	0.088	3.494	0.06%
WeatherTrans.SVICust_HDD65_Nov	0.308	0.047	6.627	0.00%
WeatherTrans.SVICust_HDD65_Dec	0.412	0.025	16.771	0.00%
WeatherTrans.SVICust_Fcst	267.422	15.887	16.832	0.00%
SALES_ND_SVI_2023v2_Customers.Customers_Shift_2017	9941.738	1243.357	7.996	0.00%

SAR(1)

Xcel Energy North Dakota Small Interruptible 2024 Test-Year Sales Forecast

Model Statistics	
Iterations	1
Adjusted Observations	180
Deg. of Freedom for Error	169
R-Squared	0.877
Adjusted R-Squared	0.870
AIC	18.303
BIC	18.498
F-Statistic	#NA
Prob (F-Statistic)	#NA
Log-Likelihood	-1,891.65
Model Sum of Squares	100,785,984,339.34
Sum of Squared Errors	14,156,271,128.54
Mean Squared Error	83,764,917.92
Std. Error of Regression	9,152.32
SAR(1)	6,194.29
Mean Abs. % Err. (MAPE)	12.29%
Durbin-Watson Statistic	2.048
Durbin-H Statistic	#NA
Ljung-Box Statistic	44.11
Prob (Ljung-Box)	0.007
Skewness	0.467
Kurtosis	6.526
Jarque-Bera	99.780
Prob (Jarque-Bera)	0.000

Xcel Energy North Dakota Large Interruptible
2024 Test-Year Sales Forecast

Variable	Coefficient	StdErr	T-Stat	P-Value
CONST	72849.972	13912.533	5.236	0.00%
WeatherTrans.MVICust_HDD65_Jan_LessUND	2.580	0.374	6.896	0.00%
WeatherTrans.MVICust_HDD65_Feb_LessUND	2.241	0.419	5.345	0.00%
WeatherTrans.MVICust_HDD65_Mar_LessUND	2.670	0.430	6.206	0.00%
WeatherTrans.MVICust_HDD65_Apr_LessUND	2.573	0.659	3.905	0.01%
WeatherTrans.MVICust_HDD65_May_LessUND	3.592	1.287	2.792	0.59%
Cust_Sales.MVICust_SummerBin2_LessUND	1142.338	576.277	1.982	4.91%
WeatherTrans.MVICust_HDD65_Oct_LessUND	3.184	1.625	1.959	5.19%
WeatherTrans.MVICust_HDD65_Nov_LessUND	4.045	0.856	4.726	0.00%
WeatherTrans.MVICust_HDD65_Dec_LessUND	2.484	0.473	5.254	0.00%
SALES_ND_LessUND_MVI_2023v2_Customers.Outlier_2014_Jan	74831.664	25209.432	2.968	0.35%
SALES_ND_LessUND_MVI_2023v2_Customers.Outlier_2018_Jan	77609.755	24933.891	3.113	0.22%
SALES_ND_LessUND_MVI_2023v2_Customers.Outlier_2018_Dec	62800.138	24272.853	2.587	1.05%
SALES_ND_LessUND_MVI_2023v2_Customers.Outlier_2019_Jan	53180.89456	24347.412	2.1842525	0.0303718
SAR(1)	47616.739	24737.883	1.924851	0.0559992
AR(1)	0.970147228	0.0149673	64.817877	2.882E-46
MA(1)	-0.927935993	0.0389301	-23.83595	4.79E-29

Xcel Energy North Dakota Medium Interruptible
2024 Test-Year Sales Forecast

Model Statistics	
Iterations	20
Adjusted Observations	179
Deg. of Freedom for Error	162
R-Squared	0.713
Adjusted R-Squared	0.685
AIC	20.226
BIC	20.528
F-Statistic	25.211
Prob (F-Statistic)	0.0000
Log-Likelihood	-2,047.19
Model Sum of Squares	224,119,663,288.53
Sum of Squared Errors	90,008,077,668.06
Mean Squared Error	555,605,417.70
Std. Error of Regression	23,571.28
SAR(1)	16,417.31
Mean Abs. % Err. (MAPE)	16.84%
Durbin-Watson Statistic	1.864
Durbin-H Statistic	#NA
Ljung-Box Statistic	21.74
Prob (Ljung-Box)	0.5945
Skewness	-0.552
Kurtosis	5.992
Jarque-Bera	75.853
Prob (Jarque-Bera)	0.0000

Xcel Energy North Dakota Residential
2024 Test-Year Customer Forecast

Model Statistics	
Iterations	18
Adjusted Observations	123
Deg. of Freedom for Error	111
R-Squared	1.000
Adjusted R-Squared	1.000
AIC	8.297
BIC	8.572
F-Statistic	#NA
Prob (F-Statistic)	#NA
Log-Likelihood	-672.82
Model Sum of Squares	1,448,832,982.96
Sum of Squared Errors	406,122.72
Mean Squared Error	3,658.76
Std. Error of Regression	60.49
Mean Abs. Dev. (MAD)	42.99
Mean Abs. % Err. (MAPE)	0.09%
Durbin-Watson Statistic	1.994
Durbin-H Statistic	#NA
Ljung-Box Statistic	26.268
Prob (Ljung-Box)	0.340
Skewness	0.613
Kurtosis	4.858
Jarque-Bera	25.397
Prob (Jarque-Bera)	0.000

Xcel Energy North Dakota Residential
2024 Test-Year Customer Forecast

Variable	Coefficient	StdErr	T-Stat	P-Value
EconT.HH_FGO_Smooth	495.169	13.599	36.411	0.00%
BinaryTrans.Jan	262.371	41.682	6.295	0.00%
BinaryTrans.Feb	217.474	41.165	5.283	0.00%
BinaryTrans.Mar	160.825	37.023	4.344	0.00%
BinaryTrans.Apr	91.168	29.042	3.139	0.22%
BinaryTrans.May	49.284	17.541	2.810	0.59%
BinaryTrans.Oct	96.472	18.172	5.309	0.00%
BinaryTrans.Nov	181.256	30.054	6.031	0.00%
BinaryTrans.Dec	265.285	37.970	6.987	0.00%
CUST_ND_Res_2022v2_SmoothHHFGO.Outlier_2014_Sep	85.429	33.007	2.588	1.09%
AR(1)	1.531	0.080	19.055	0.00%
AR(2)	-0.539	0.080	-6.733	0.00%

Xcel Energy North Dakota Residential
2024 Test-Year Customer Forecast

Variable	Coefficient	StdErr	T-Stat	P-Value
Economic_FGO.NR_FGO	39.996	8.122	4.924	0.00%
BinaryTrans.Jan	63.755	5.980	10.661	0.00%
BinaryTrans.Feb	62.828	6.189	10.151	0.00%
BinaryTrans.Mar	58.618	5.999	9.771	0.00%
BinaryTrans.Apr	37.673	5.391	6.988	0.00%
BinaryTrans.May	19.487	4.192	4.649	0.00%
BinaryTrans.Nov	27.623	4.055	6.812	0.00%
BinaryTrans.Dec	53.065	5.311	9.992	0.00%
BinaryTrans.SummerBin	-23.840	3.062	-7.785	0.00%
AR(1)	0.998	0.005	214.126	0.00%
SAR(1)	0.201	0.082	2.445	1.56%

Xcel Energy North Dakota Residential
2024 Test-Year Customer Forecast

Model Statistics	
Iterations	24
Adjusted Observations	167
Deg. of Freedom for Error	156
R-Squared	1.000
Adjusted R-Squared	1.000
AIC	5.262
BIC	5.468
F-Statistic	#NA
Prob (F-Statistic)	#NA
Log-Likelihood	-665.38
Model Sum of Squares	119,546,189.98
Sum of Squared Errors	28,246.20
Mean Squared Error	181.07
Std. Error of Regression	13.46
Mean Abs. Dev. (MAD)	10.27
Mean Abs. % Err. (MAPE)	0.13%
Durbin-Watson Statistic	1.782
Durbin-H Statistic	#NA
Ljung-Box Statistic	20.71
Prob (Ljung-Box)	0.6558
Skewness	0.502
Kurtosis	3.645
Jarque-Bera	9.919
Prob (Jarque-Bera)	0.007

STATE OF NORTH DAKOTA
BEFORE THE
PUBLIC SERVICE COMMISSION

NORTHERN STATES POWER COMPANY 2024 NATURAL GAS RATE INCREASE APPLICATION	)))))	Case No. PU-23-___

AFFIDAVIT OF
John M. Goodenough

I, the undersigned, being first duly sworn, depose and say that the foregoing is the Direct Testimony of the undersigned, and that such Direct Testimony and the exhibits or schedules sponsored by me to the best of my knowledge, information and belief, are true, correct, accurate and complete, and I hereby adopt said testimony as if given by me in formal hearing, under oath.

____
John M. Goodenough

Subscribed and sworn to before me, this 21st day of December, 2023.

____
Notary Public
My Commission Expires: April 13, 2027

KAREN NICOLE MURILLO
NOTARY PUBLIC
STATE OF COLORADO
NOTARY ID 20234014197
MY COMMISSION EXPIRES APRIL 13, 2027