NOTICE OF CONFIDENTIALITY
A PORTION OF THIS TESTIMONY OR TESTIMONY AND ATTACHMENTS HAS/HAVE BEEN FILED UNDER SEAL.

BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF COLORADO

* * * * *

IN THE MATTER OF ADVICE LETTER NO. 1906-ELECTRIC OF PUBLIC SERVICE COMPANY OF COLORADO TO REVISE ITS COLORADO PUC NO. 8-ELECTRIC TARIFF TO REVISE JURISDICTIONAL BASE RATE REVENUES, IMPLEMENT NEW BASE RATES FOR ALL ELECTRIC RATE SCHEDULES, AND MAKE OTHER PROPOSED TARIFF CHANGES EFFECTIVE DECEMBER 31, 2022.	**PROCEEDING NO. 22AL-XXXXE**

DIRECT TESTIMONY AND ATTACHMENTS OF JOHN M. GOODENOUGH

ON

BEHALF OF

PUBLIC SERVICE COMPANY OF COLORADO

NOTICE OF CONFIDENTIALITY
A PORTION OF THIS TESTIMONY OR TESTIMONY AND ATTACHMENTS HAS/HAVE BEEN FILED UNDER SEAL.

Highly Confidential: Attachment JMG -4HC

November 30, 2022

**BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF COLORADO**

* * * * *

IN THE MATTER OF ADVICE LETTER NO. 1906-ELECTRIC OF PUBLIC SERVICE COMPANY OF COLORADO TO REVISE ITS COLORADO PUC NO. 8-ELECTRIC TARIFF TO REVISE JURISDICTIONAL BASE RATE REVENUES, IMPLEMENT NEW BASE RATES FOR ALL ELECTRIC RATE SCHEDULES, AND MAKE OTHER PROPOSED TARIFF CHANGES EFFECTIVE DECEMBER 31, 2022.	**) PROCEEDING NO. 22AL-XXXXE**

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Attachment JMG -7	Weather Normalization of Historical Test Year MWh Sales for 12 months ended June 30, 2022

**BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF COLORADO**

* * * * *

IN THE MATTER OF ADVICE LETTER NO. 1906-ELECTRIC OF PUBLIC SERVICE COMPANY OF COLORADO TO REVISE ITS COLORADO PUC NO. 8-ELECTRIC TARIFF TO REVISE JURISDICTIONAL BASE RATE REVENUES, IMPLEMENT NEW BASE RATES FOR ALL ELECTRIC RATE SCHEDULES, AND MAKE OTHER PROPOSED TARIFF CHANGES EFFECTIVE DECEMBER 31, 2022.	**PROCEEDING NO. 22AL-XXXXE**

<u>DIRECT TESTIMONY AND ATTACHMENTS OF JOHN M. GOODENOUGH</u>

I. INTRODUCTION, QUALIFICATIONS, PURPOSE OF TESTIMONY, AND RECOMMENDATIONS

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is John M. Goodenough. My business address is 1800 Larimer Street, Denver, Colorado 80202.

Q. BY WHOM ARE YOU EMPLOYED AND IN WHAT POSITION?

A. I am employed by Xcel Energy Services Inc. ("XES") as Director of Sales, Energy, and Demand Forecasting. XES is a wholly owned subsidiary of Xcel Energy Inc. ("Xcel Energy") and provides an array of support services to Public Service Company of Colorado ("Public Service" or the "Company") and the other utility operating company subsidiaries of Xcel Energy on a coordinated basis.

Q. ON WHOSE BEHALF ARE YOU TESTIFYING IN THE PROCEEDING?

A. I am testifying on behalf of Public Service.

Q. PLEASE SUMMARIZE YOUR RESPONSIBILITIES AND QUALIFICATIONS.

A. I am responsible for the development of forecasted sales data and economic indicators for Public Service and the other Xcel Energy utility operating companies; and the presentation of this information to Xcel Energy's senior management, other Xcel Energy departments, and externally to various regulatory and reporting agencies. I also am responsible for Xcel Energy's Load Research function, which designs, maintains, monitors, and analyzes electric load research samples in the Xcel Energy operating companies' service territories. Additionally, I am responsible for developing and implementing forecasting, planning, and load analysis studies for regulatory proceedings. A description of my qualifications, duties, and responsibilities is included at the end of my Direct Testimony in my Statement of Qualifications.

Q. WHAT IS THE PURPOSE OF YOUR DIRECT TESTIMONY?

A. The purpose of my Direct Testimony is to:

(1) describe the historical electric customer and megawatt-hour ("MWh") sales trends for Public Service's service territory;

(2) present and support the Company's electric customer and MWh sales forecast for the test year of January 1, 2023 through December 31, 2023 ("Test Year");

(3) describe the methodology used to develop the Company's megawatt ("MW") peak demand forecast for the Test Year that is used in this proceeding to develop the jurisdictional allocation factors for the revenue requirement study; and

(4) provide a description of the methodology the Company uses to weather normalize historical electric sales, which is consistent with the Colorado Public Utilities Commission's ("Commission") decision with regard to weather normalization in the Company's last Phase I electric rate case, Proceeding No. 21AL-0317E ("2021 Electric Phase I") and ordered in Proceeding No. 19AL-0268E.

Q. ARE YOU SPONSORING ANY ATTACHMENTS AS PART OF YOUR DIRECT TESTIMONY?

A. Yes, I am sponsoring Attachments JMG-1 through JMG-7, which were prepared by me or under my direct supervision. The attachments are as follows:

- Attachment JMG-1: Monthly Test Year Electric MWh Sales and Number of Customers by Class;
- Attachment JMG-2: Regression Models and Associated Statistics – Sales;
- Attachment JMG-3: Regression Models and Associated Statistics – Customers;
- Attachment JMG-4: Highly Confidential and Public Versions of Test Year Electric MWH Sales and Customers by Tariff Rate Level;
- Attachment JMG-5: Monthly Test Year MW Peak Demand;
- Attachment JMG-6: Regression Models and Associated Statistics – Peak Demand; and
- Attachment JMG-7: Weather Normalization of Informational Historical Test Year MWh Sales.

Q. WHAT RECOMMENDATIONS ARE YOU MAKING IN YOUR DIRECT TESTIMONY?

A. I recommend that the Commission approve the Company's electric sales forecast and customer counts for the Test Year as shown in Attachment JMG-1 and the Test Year peak demand forecast as shown in Attachment JMG-5.

II. HISTORICAL CUSTOMER AND MWH SALES TRENDS

Q. WHAT IS THE PURPOSE OF THIS SECTION OF YOUR DIRECT TESTIMONY?

A. The purpose of this section of my Direct Testimony is to provide relevant background information regarding historical customer and electric sales trends, primarily through the end of 2021. These historical trends help put the remainder of my Direct Testimony, including anticipated sales for 2022-2023 in context.

Q. PLEASE DESCRIBE THE CUSTOMER CLASSES THAT ARE INCLUDED IN THE COMPANY'S ELECTRIC RETAIL SERVICE.

A. The Residential, Commercial and Industrial, Street Lighting, Public Authority, and Interdepartmental classes comprise the Company's total electric retail customers and sales.

Q. PLEASE DISCUSS THE HISTORICAL TRENDS RELATED TO ELECTRIC CUSTOMER GROWTH.

A. Total electric customer counts in the Company's service territory averaged 1,535,755 customers per month in 2021.[1] Total customer counts increased an average of 18,755 customers per year for the 2017 through 2021 time period, for an average annual growth rate of 1.3 percent.

The largest class of customers is the Residential class, which averaged 1,314,481 customers per month during 2021 and represents 85.6 percent of Public Service's total retail customers. Residential customer counts averaged a growth

[1] For purposes within this testimony, an electric customer is generally defined as a unique combination of debtor, premise, and tariff.

rate of 1.4 percent, or 17,235 additions, per year from 2017 through 2021, accounting for 91.9 percent of the total customer growth during this time period.

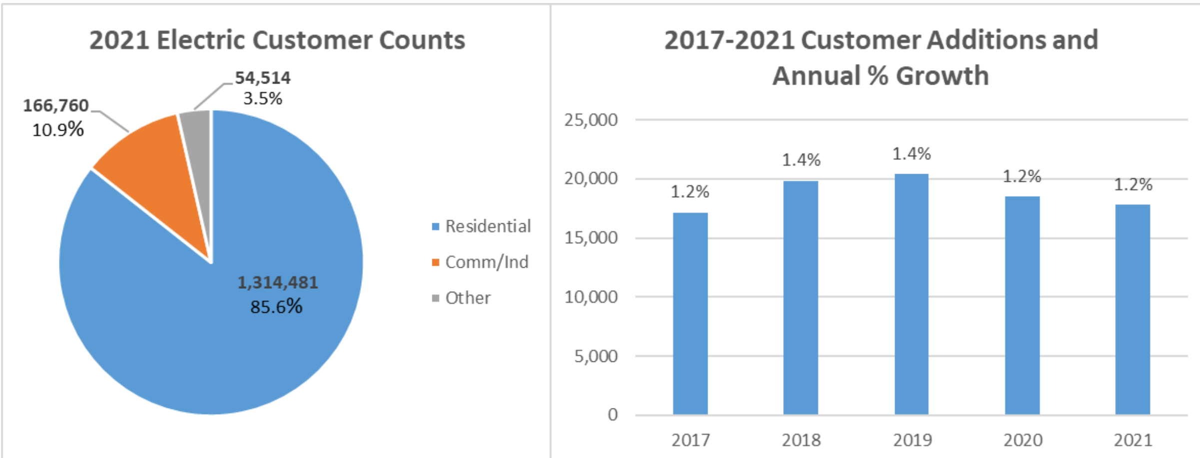
Commercial and Industrial customer counts averaged 166,760 customers per month during 2021, representing 10.9 percent of Public Service's total retail customers. The number of Commercial and Industrial customers grew by an average of 0.9 percent, or 1,423 new customers per year, from 2017 through 2021.

The remaining 3.5 percent of the Company's total customers are in the "Other" category, which is comprised of the Street Lighting, Public Authority, and Interdepartmental classes. Street Lighting customers averaged 54,425 customers per month in 2021 and the number of customers increased at an average rate of 0.2 percent, or 96 customers per year, from 2017 to 2021.[2] The number of Public Authority and Interdepartmental customers is very small, accounting for less than 0.01 percent of the Company's total number of retail customers.

Figure JMG-D-1 provides a summary of the historical customer statistics from 2017-2021.

[2] Street Lighting customer counts reflect customer accounts and do not reflect light counts.

FIGURE JMG-D-1:
Historical Customer Statistics



Q. WHAT FACTORS HAVE BEEN DRIVING RESIDENTIAL CUSTOMER GROWTH OVER THE PAST FIVE YEARS?

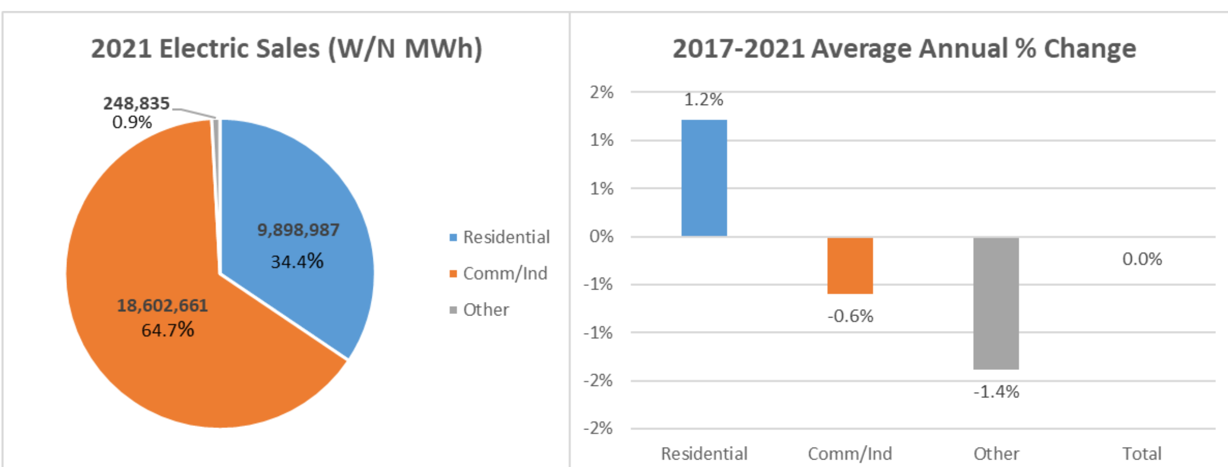
A. Residential customers are highly correlated with population. The strong rate of growth in the number of Residential customers during the past five years is the result of a strong growth rate in population at the aggregated Metropolitan Statistical Area ("MSA") level.[3] Residential customer counts increased at a 1.4 percent average annual rate during the 2017 to 2021 time period while population increased at an average rate of 1.0 percent. The series are highly correlated with a correlation coefficient of 0.9897.

[3] The MSA's in the Company's electric service territory include Denver-Aurora-Lakewood, Boulder, Grand Junction, and Greeley.

Q. PLEASE DISCUSS THE COMPANY'S ELECTRIC MWH SALES TRENDS FROM 2017 THROUGH 2021.

A. After normalizing for weather—a process I explain further below—the Company's total electric retail sales have been about flat during the past five years.[4] While Residential sales increased on average by 1.4 percent per year from 2017 through 2021, total Commercial and Industrial sales decreased at an average annual rate of 0.6 percent per year over the 2017 through 2021 time period. The remaining classes of sales—Street Lighting, Public Authority, and Interdepartmental—accounted for only 0.9 percent of 2021 total sales. These classes had a combined average growth rate of -1.4 percent per year during the past five years. Figure JMG-D-2 provides a summary of the historical MWh sales statistics. Table JMG-D-1 provides annual sales volumes and the compound annual growth rate ("CAGR") percent by class for 2017 through 2021.

FIGURE JMG-D-2
Historical Weather Normalized ("W/N") MWh Sales Statistics



[4] The 2017 to 2021 MWh sales discussed in this section of my Direct Testimony have been weather normalized using the 10-year average weather normalization.

TABLE JMG-D-1
Historical W/N MWh Sales by Class 2017-2021

	MWh Sales						Annual % Change					
	Residential	Total Comm/Ind	Small Comm/Ind	Large Comm/Ind	Other	**Total Sales**	Residential	Total Comm/Ind	Small Comm/Ind	Large Comm/Ind	Other	**Total Sales**
2017	9,206,240	19,281,226	12,793,492	6,487,735	275,866	**28,763,332**	-1.2%	0.6%	-0.5%	2.9%	3.4%	**0.0%**
2018	9,340,209	19,441,662	12,900,601	6,541,061	273,010	**29,054,880**	1.5%	0.8%	0.8%	0.8%	-1.0%	**1.0%**
2019	9,333,689	19,391,586	12,951,542	6,440,044	291,571	**29,016,846**	-0.1%	-0.3%	0.4%	-1.5%	6.8%	**-0.1%**
2020	9,812,681	18,431,072	12,142,767	6,288,306	248,005	**28,491,759**	5.1%	-5.0%	-6.2%	-2.4%	-14.9%	**-1.8%**
2021	9,898,987	18,602,661	12,397,017	6,205,644	248,835	**28,750,483**	0.9%	0.9%	2.1%	-1.3%	0.3%	**0.9%**
						2017-2021 CAGR	1.2%	-0.6%	-0.7%	-0.3%	-1.4%	**0.0%**

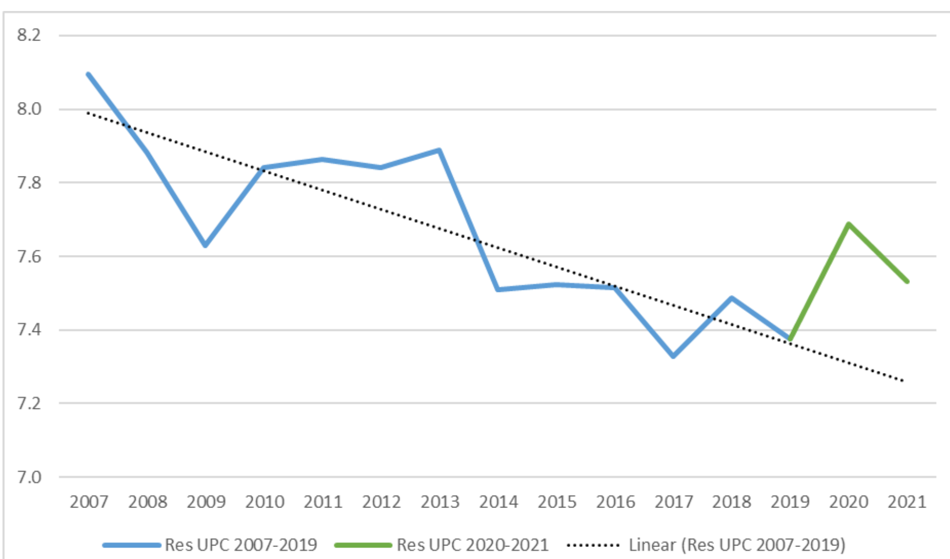
Q. PLEASE DISCUSS THE IMPACT OF THE COVID-19 PANDEMIC ON 2020 AND 2021 RESIDENTIAL SALES.

A. After more than a decade of Residential sales growing slower than customer counts, Residential sales increased 5.1 percent in 2020, due to the impacts of business shutdown, stay-at-home orders, and the expansion of remote work as a result of the COVID-19 pandemic. The 5.1 percent sales growth was driven by 1.3 percent customer count growth and a 3.8 percent increase in use-per-customer. Sales remained at this higher level in 2021, growing 0.9 percent. This was a result of a full year of the pandemic impact partially offset by the "return to normal" as the economy reopened and people left their homes more. The 0.9 percent sales growth in 2021 was driven by 1.2 percent customer count growth partially offset by a 0.3 percent decline in use-per-customer. I discuss 2022 and 2023 later in my Direct Testimony.

Q. WHAT WERE THE DRIVERS OF SALES GROWTH IN THE RESIDENTIAL CLASS PRIOR TO THE ONSET OF THE COVID-19 PANDEMIC?

A. From 2017 to 2019, Residential sales increased at a 0.7 percent average annual growth rate. This growth in Residential sales during the 2017 to 2019 time period is due to an increasing number of customers, partially offset by declining use per customer. Residential use per customer has exhibited a declining trend for many years, with 2019 use per customer 7.9 percent lower than its peak level in 2007. From 2017 to 2019, Residential use per customer declined an average of 0.8 percent per year, driven by end-use efficiency improvements, Company-sponsored Demand-Side Management ("DSM") programs, and increasing amounts of distributed generation solar. Figure JMG-D-3 presents historical weather normalized Residential use per customer for the 2007 to 2021 time period and the historical declining trend for the 2007 to 2019 time period.

FIGURE JMG-D-3:
Residential Use Per Customer (W/N MWh)



Q. PLEASE DISCUSS THE IMPACT OF THE COVID-19 PANDEMIC ON 2020 AND 2021 COMMERCIAL AND INDUSTRIAL SALES.

A. As a result of reductions in economic activity driven by the COVID-19 pandemic, total Commercial and Industrial sales declined 5.0 percent in 2020, as shown in Table JMG-D-1. Sales in the Small Commercial and Industrial class declined 6.2 percent and sales in the Large Commercial and Industrial class declined 2.4 percent. Total Commercial and Industrial sales rebounded 0.9 percent in 2021, with 2.1 percent growth in Small Commercial and Industrial being partially offset by a 1.3 percent decline in Large Commercial and Industrial. The decline in Large Commercial and Industrial was due to reduced sales to a large customer that added distributed solar generation in June 2021. I discuss 2022 and 2023 later in my Direct Testimony.

Q. PLEASE DISCUSS SALES TRENDS IN THE COMMERCIAL AND INDUSTRIAL SECTOR FROM 2016 THROUGH 2019, BEFORE THE COVID-19 PANDEMIC IN 2020.

A. Total Commercial and Industrial sales increased over the 2017 to 2019 time period, with declines in 2019 and increases in 2017 and 2018, as shown in Table JMG-D-1. Small Commercial and Industrial sales increased in 2018, and 2019, and decreased in 2017, for a 0.7 percent average annual growth rate over the 2017 to 2019 time period. Large Commercial and Industrial sales increased at an average rate of 0.7 percent over the 2017 to 2019 time period, with losses in 2019, and gains in 2017 and 2018.[5]

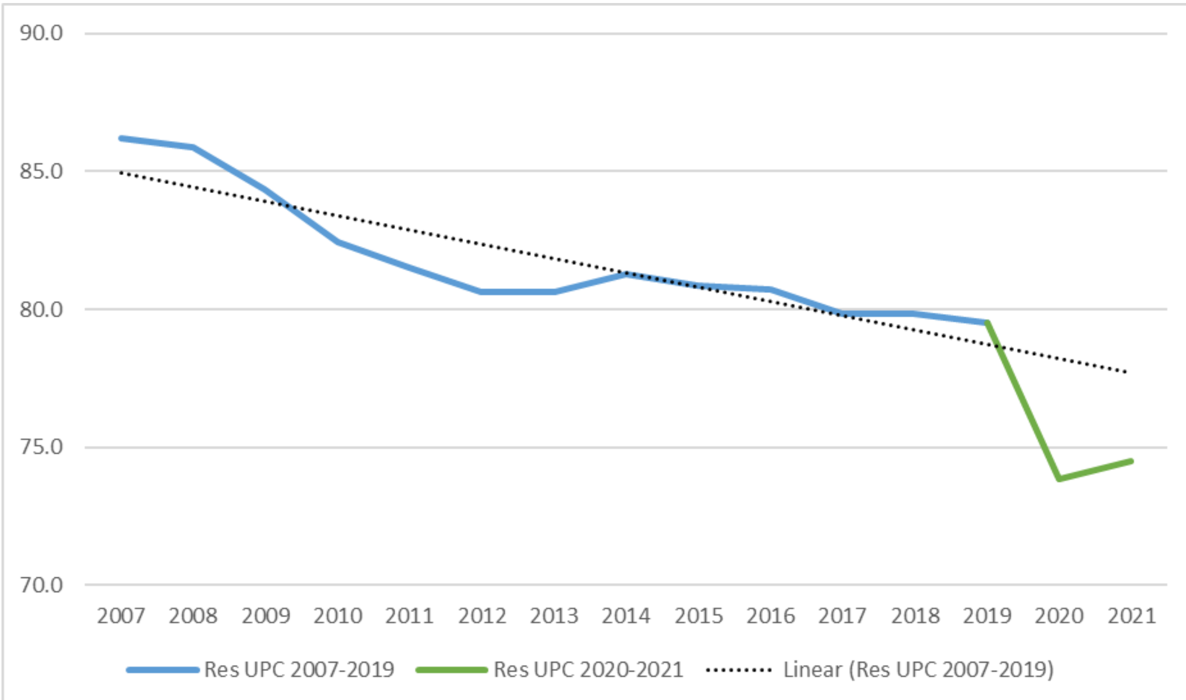
The 0.7 percent average growth in the Small Commercial and Industrial class reflects the combination of customer counts growing at an average annual rate of 0.7 percent and use per customer remaining flat. Similar to the Residential class, Small Commercial and Industrial use per customer has exhibited a declining trend for many years, with 2019 use per customer 7.8 percent lower than in 2007.

The declining trend in use per customer, as shown in Figure JMG-D-4, reflects the impacts of efficiency gains in end uses such as lighting and cooling, Company-sponsored DSM programs, and distributed generation solar.

---

[5] Small Commercial and Industrial is commercial and industrial service requiring less than 1,000 kilowatts billing demand per month on average per year. Large Commercial and Industrial is commercial and industrial service requiring more than 999 kilowatts billing demand per month on average per year.

FIGURE JMG-D-4
Small Commercial and Industrial W/N Use Per Customer (MWh)



The 2019 decline in the Large Commercial and Industrial class as seen in Table JMG-D-1 was due to the addition of combined heat and power capabilities at a Large Industrial customer's facility. The declines in 2020 were due to the COVID-19 pandemic stay at home orders, and the decline in 2021 was due to the addition of solar at a Large Industrial customer's facility.

Q. PLEASE DISCUSS SALES TRENDS FROM 2017 THROUGH 2021 IN THE OTHER SALES CATEGORY.

A. As I previously explained, the Other sales category (Street Lighting, Public Authority, and Interdepartmental) accounted for only 0.9 percent of 2021 total sales and averaged declines of 1.4 percent per year during the past five years. However, growth in any single year has ranged from +6.8 percent to -14.9 percent due to factors such as increases in number of customers, lighting efficiencies, light rail and commuter rail additions by Denver's Regional Transportation District, and pandemic impacts. I discuss 2022 and 2023 later in my Direct Testimony.

III. CUSTOMER AND MWH SALES FORECASTS

Q. WHAT IS THE PURPOSE OF THIS SECTION OF YOUR DIRECT TESTIMONY?

A. The purpose of this section of my Direct Testimony is to provide the Test Year customer and MWh sales forecasts for the Residential, Commercial and Industrial, and Other classes.

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

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

- The monthly and annual electric supply requirements;
- Test year revenue under present rates; and,
- Test year revenue under proposed rates.

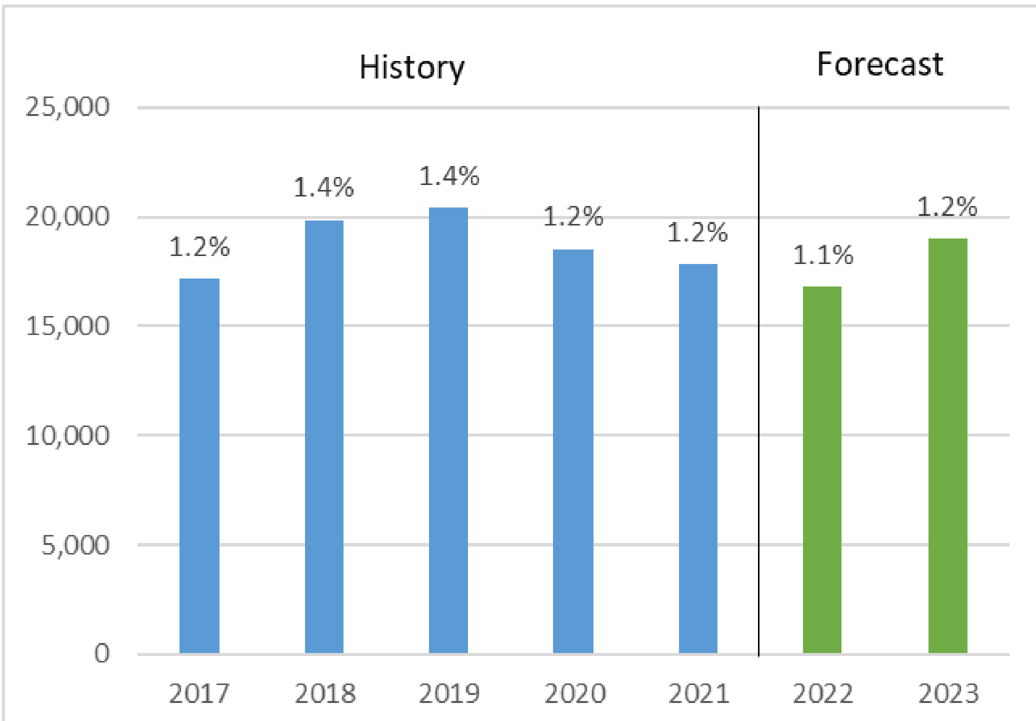
Q. WHAT IS PUBLIC SERVICE'S FORECAST OF RETAIL ELECTRIC SALES AND CUSTOMERS FOR THE TEST YEAR ENDING DECEMBER 31, 2023?

A. Attachment JMG-1 summarizes projected monthly electric MWh sales and number of electric customers for each class for the Test Year. Total electric customers are projected to average 1,571,519 per month in 2023 and total retail sales are projected to be 28,564,848 MWh in 2023.

Q. HOW DOES PUBLIC SERVICE'S PROJECTED ELECTRIC CUSTOMER GROWTH COMPARE WITH HISTORICAL CUSTOMER GROWTH?

A. As I stated earlier, the Company's total number of electric customers increased at an average annual rate of 1.3 percent from 2017 through 2021, or 18,755 customers per year. For 2023, the total number of electric customers is expected to increase at an annual rate of 1.2 percent, or 18,977 customers. Figure JMG-D-5 compares historical and forecasted customer growth.

FIGURE JMG-D-5
2017-2021 Historical and 2022-2023 Forecast Customer Additions and Annual % Growth



Q. HOW DOES PUBLIC SERVICE'S PROJECTED ELECTRIC SALES COMPARE WITH HISTORICAL WEATHER-NORMALIZED SALES?

A. Retail electric sales are expected to decline 0.9 percent in in 2022 and then increase 0.3 percent in 2023. Retail electric sales are expected to average a 0.3 percent annual decline from 2021 through 2023, as compared to a 0.3 percent average annual growth between 2017 and 2019. This average annual decline from 2021 through 2023 is based on declines in Residential sales as customers return to more normal activities outside of the home and a full year of distributed solar at a Large Industrial customer's facility, compared to a partial year in 2021.

Residential sales are expected to decrease 2.9 percent in 2022 and increase 0.9 percent in 2023. Through 2023, the projected average annual Residential sales rate of change is -1.0 percent, which is weaker than the pre-pandemic average annual growth of 0.0 percent from 2017 through 2019. Even with the expected declines, however, Residential sales in 2023 are expected to be 3.9 percent higher than 2019 weather normalized sales.

Total Commercial and Industrial sales are expected to increase 0.2 percent in 2022, followed by flat sales in 2023, resulting in a 0.1 percent average annual rate of change from 2021 to 2023. Sales in the Small Commercial and Industrial sector are expected to increase 2.6 percent in 2022 and another 0.1 percent in 2023 as sales complete the recovery from the pandemic before returning to the longer-term trend of declining use-per-customer. By 2023, sales in the Small Commercial and Industrial class are expected to still lag 2019 weather normalized sales by 1.6 percent. Sales in the Large Commercial and Industrial class are expected to decline 4.7 percent in 2022 and 0.3 percent in 2023 due to a large customer's addition of an on-site solar facility. Large Commercial and Industrial sales in 2022 are expected to be 8.5 percent lower than 2019 sales, with a -2.5 percent 2021 to 2023 average annual rate of change.

Combined sales in the other classes are expected to decline 1.9 percent in 2022 and 2.2 percent in 2023. I will explain the methodologies used to develop the customer and sales forecasts in the following section of my Direct Testimony.

Table JMG-D-2 provides the Company's weather-normalized MWh sales and annual growth rates by class by year for 2020 through 2023.

TABLE JMG-D-2

Weather-Normalized Sales by Class (MWh)

		MWh Sales						Annual % Change					
		Residential	Total Comm/Ind	Small Comm/Ind	Large Comm/Ind	Other	**Total Sales**	Residential	Total Comm/Ind	Small Comm/Ind	Large Comm/Ind	Other	**Total Sales**
Actual	2020	9,812,681	18,431,072	12,142,767	6,288,306	248,005	**28,491,759**	5.1%	-5.0%	-6.2%	-2.4%	-14.9%	**-1.8%**
Actual	2021	9,898,987	18,602,661	12,397,017	6,205,644	248,835	**28,750,483**	0.9%	0.9%	2.1%	-1.3%	0.3%	**0.9%**
Forecast	2022	9,611,805	18,634,013	12,722,943	5,911,070	244,161	**28,489,978**	-2.9%	0.2%	2.6%	-4.7%	-1.9%	**-0.9%**
Test Year	2023	9,694,638	18,631,357	12,738,979	5,892,378	238,852	**28,564,848**	0.9%	0.0%	0.1%	-0.3%	-2.2%	**0.3%**

IV. CUSTOMER AND SALES FORECASTING METHODOLOGY

Q. WHAT IS THE PURPOSE OF THIS SECTION OF YOUR DIRECT TESTIMONY?

A. The purpose of this section of my Direct Testimony is to explain and provide support for the customer and sales forecasting methodology used to prepare the forecasts included with my Direct Testimony.

Q. WHAT IS THE SOURCE OF THE CUSTOMER AND SALES FORECAST PUBLIC SERVICE IS USING FOR THE TEST YEAR?

A. The customer and sales forecast was completed in July 2022 as part of the Company's semi-annual forecasting process.

Q. PLEASE DESCRIBE IN GENERAL TERMS THE METHODS USED BY THE COMPANY TO FORECAST ELECTRIC SALES AND CUSTOMER COUNTS.

A. The preparation of the electric sales and customer forecast utilizes a combination of econometric and statistical forecasting techniques and analyses. The primary forecasting technique used is regression modeling. The Company uses a statistical software package[6] to develop the regression models. Regression models are designed to identify and quantify the statistical relationship between historical sales or customers, and a set of independent predictor variables, such as historical economic and demographic indicators, historical electric prices, and historical weather. Once this relationship is defined, a forecast is developed by simulating the relationship over the forecast period using projected levels of the independent predictor variables.

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[6] Metrix ND 4.7, Copyright © 1997-2016, Itron, Inc., http://www.itron.com.

Regression techniques are very well known and proven methods of forecasting 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.

Q. PLEASE PROVIDE A MORE DETAILED DESCRIPTION OF HOW THE SALES FORECASTS WERE DEVELOPED FOR THE RESIDENTIAL AND THE COMMERCIAL AND INDUSTRIAL CLASSES.

A. Public Service's Residential sales forecast was calculated by multiplying average use per customer times the number of customers. Forecasts of Residential average use and Commercial and Industrial sales (excluding the Primary Standby Service, Secondary Standby Service,[7] Transmission General, and Transmission Standby Service rates) were developed using a Statistically-Adjusted End-Use ("SAE") modeling approach. The SAE method entails specifying energy use as a function of the primary end-use variables (heating, cooling, and base use) and the factors that affect these end-use energy requirements.

Each end-use variable (heating, cooling, and base) is defined as the product of an appliance index variable, which indicates relative saturation and efficiency of the stock of appliances, and a utilization variable, which reflects how the stock is utilized. The appliance index variables reflect both changes in saturation resulting from end-use competition, and improvements in appliance efficiency standards.

[7] There currently are no Secondary Standby Service customers.

The utilization variables are designed to capture energy demand driven by the use of the appliance stock. For the Residential sector, the primary factors that impact appliance use are weather conditions (for the heating and cooling end uses, as measured by heating degree days and cooling degree days), electricity prices, household income, household size, and average number of billed consumption days. For the Commercial and Industrial sector, the utilization of the stock of equipment is a function of electricity prices, business activity (as measured by Gross Metropolitan Product ("GMP")), weather conditions (for the heating and cooling end uses, as measured by heating degree days and cooling degree days), and average number of billed consumption days.

The Residential use per customer and Commercial and Industrial sales forecast models were estimated by regressing historical monthly use per customer or sales on the Cooling, Heating, and Base variables, monthly binary variables, seasonal binary variables, and variables designed to estimate the impacts of the COVID-19 pandemic. These variables include the Google Mobility Index (GMI) and interactions of the GMI with weather concepts. In addition, the monthly number of Commercial and Industrial customers was included in the Commercial and Industrial sales forecast model. Monthly historical data through May 2022 was used in each of the models. The regression models effectively calibrated the end-use concepts to actual monthly sales.

Monthly binary variables were included to account for historical data outliers and seasonal binary variables were included to account for non-weather-related seasonal factors. The GMI variables were included to account for changes in sales and weather response due to the COVID-19 pandemic that were not captured by the underlying economic information. For example, in the Residential model the GMI variables was included to explain the sales increase due to people working remotely and spending more time at home, and therefore being more responsive to weather.

Q. WHAT METHODOLOGY WAS USED TO DEVELOP THE REMAINDER OF THE CUSTOMER AND MWH SALES FORECAST?

A. Regression models provided the foundation for the customer forecasts of the Residential and the Commercial and Industrial classes. In these models, at least 15 years of monthly historical data was used to conduct the analysis, with service territory population as the independent variable along with occupied multi-family housing units in the Residential regression. The modeled relationships were simulated over the forecast period using projected levels of the independent predictor variables. The Street Lighting customer forecast was developed using a statistical model that accounts for gradual changes in the customer counts in this class.

Customer counts in the Public Authority and Interdepartmental classes are small and generally do not exhibit growth. Therefore, the customer forecasts for these classes were developed by holding constant the May 2022 actual customer counts.

The Street Lighting sales forecast was developed by regressing street light sales on service territory population, commercial lighting intensity, monthly seasonal binary variables, and monthly binary variables. The Interdepartmental sales forecast was also developed using a regression model with monthly seasonal binary variables and monthly binary variables as independent variables. Public Authority sales were forecasted based on recent sales levels.

Due to the fewer number of customers and more widely varying business types, the Transmission General Service, Transmission Standby Service, and Primary Standby Service classes were forecasted outside of the SAE modeling framework. The Transmission General Service class was forecasted at a customer level and then aggregated to the rate class level. Each of the individual customers within this class was forecasted based on historical actual sales, the growth trends present in those sales, and input from the account managers who oversee these particular customer accounts. The forecast for the Transmission Standby Service class was developed in a similar fashion, with forecasts developed for each of the individual customers and aggregated to a rate class level. The Primary Standby Service class was forecasted at the rate class level by analyzing historical annual growth rates, forecasting a future annual growth rate and allocating annual sales to a monthly basis using historical allocators.

Q. HOW WERE BINARY VARIABLES USED IN THE REGRESSION MODELS?

A. Seasonal binary variables and monthly binary variables were included as explanatory variables in some of the regression models. A binary variable is a variable made up of two data points (1 and 0). The variable takes the value of 1 during a specific period of time, and a value of 0 for all other periods of time. The inclusion of these binary variables improved the overall model fit and the monthly pattern of the forecast.

Q. PLEASE FURTHER DESCRIBE HOW THE COVID-19 PANDEMIC IMPACTS ON SALES ARE INCLUDED IN THE COMPANY'S MODELS.

A. As I described earlier, Residential sales in 2020 increased significantly due to Residential customers working from home and staying at home during the pandemic and remained at an elevated level in 2021. These changes in behavior are not directly related to a specific economic indicator. For example, personal income often is positively correlated with Residential sales. However, the increase in Residential sales in 2020 was not associated with a similar increase in personal income. The impact of the pandemic on Residential sales was modeled by interacting cooling weather with the Google Mobility Index (GMI), which measures how much less time people are spending at the workplace. This variable is included to model the additional weather response of residential customers due to more time spent at home. The residential use-per-customer model also includes a Shift_COVID variable that models the permanent impact of the pandemic on Residential, non-weather sales.

For the Commercial and Industrial sales models, a variable interacting the GMI with heating and a variable interacting the GMI with cooling is included in the models to measure the ongoing impact of behavior changes due to COVID-19 on sales. The model also includes a Lockdown variable that picks up the extreme impact of business shutdowns on sales.

Q. WERE ANY ADJUSTMENTS MADE TO THE FORECAST MODEL RESULTS?

A. Yes. The Residential and the Commercial and Industrial sales forecast results were adjusted to reflect the expected impact of DSM programs, the implementation of Integrated Volt-VAr Optimization ("IVVO"), and the increase in adoption of electric vehicles ("EVs"). The Commercial and Industrial forecast was also adjusted to include a large, new load starting in 2023.

With regard to DSM, Xcel Energy's DSM Regulatory Strategy and Planning Department develops a forecast of the impact of new DSM programs. The impacts of DSM savings by class were converted from calendar month sales volumes to billing month sales volumes. The resulting DSM savings sales volumes were used to reduce the class level sales forecasts that resulted from the modeling process.

The Residential and Commercial and Industrial sales forecasts also reflect reduced volumes to account for customer-owned distributed generation ("DG") solar. Monthly estimates for MWh solar production were derived by applying a historical load factor[8] to the MW production targets. The MWh production was adjusted for monthly seasonality based on hours of daylight per month. The resulting estimates for monthly DG solar production were used to reduce the respective class sales forecast resulting from the modeling process.

The Residential and Commercial and Industrial sales forecasts were adjusted to reflect the implementation of IVVO as discussed by Company witness Mr. David C. Mino. These impacts were allocated across the primary and secondary distribution level classes. In the 2023 Test Year, IVVO is expected to reduce sales by 274,718 MWh, or 1.0 percent of retail sales.

[8] A load factor is the ratio of the average hourly load during a designated period of time to the maximum hourly load occurring in that period.

Finally, the Residential and Commercial and Industrial sales forecasts were adjusted to reflect an increase in the adoption of EVs. The Light Duty Vehicles forecast was created using Bass diffusion modeling and economic modeling, then averaging the results. The Bass diffusion models are used to describe technology adoption patterns in an existing market through an “S” shaped diffusion characteristic. The Bass diffusion model approach was calibrated using state-specific historical EV sales. The economic models use a simple payback analysis to estimate potential adoption, incorporating factors such as battery prices, tax incentives, fuel savings, and others.

The Company also incorporated into both the Bass diffusion and economic models a factor for the percentage of EVs in urban and rural areas. Presently, higher adoption is occurring in urban areas with the rural areas anticipated to ramp up more slowly. The estimates are also sensitive to several exogenous variables because battery market dynamics are a significant factor in the cost of EVs. These variables may include policy, technology, manufacturing supply chain, and geopolitical factors, among others.

In developing its EV forecast, the Company also utilized a base case Medium Duty Vehicles and Heavy Duty Vehicles forecast that was produced by a third-party consultant.

A. Statistically Modeled Forecasts

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

A. The regression models and associated statistics used in the Company's projections of electric sales are provided in Attachment JMG-2, and the regression models and associated statistics used in the Company's projections of electric customers are provided in Attachment JMG-3. These schedules include, by class, the models with their summary statistics and output, and descriptions for each variable included in the model.

Q. WHAT TECHNIQUES DID PUBLIC SERVICE EMPLOY TO EVALUATE THE VALIDITY OF ITS QUANTITATIVE FORECASTING MODELS AND PROJECTIONS?

A. There are a number of quantitative and qualitative validity tests that are applicable to regression analysis. I will describe several of the more common tests the Company uses.

The coefficient of determination ("R-squared") test statistic is a measure of the quality of the model's fit to the historical data. 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 set of explanatory variables specified in the model is explaining a high degree of the historical sales variability. The regression models used to develop the customers and sales forecasts demonstrated very high R-squared statistics.

The t-statistic of each variable indicates 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 customers and sales forecast. The final regression models used to develop the customers and sales forecast tested satisfactorily under this standard. All variables were statistically significant at greater than the 95 percent confidence level.

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, under the presence of first-order autocorrelation, an overestimate in one time period is likely to lead to an overestimate in the succeeding time period, and vice versa. Thus, when forecasting with regression models, 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.

Q. IS A MODEL REJECTED IF FIRST-ORDER AUTOCORRELATION IS PRESENT?

A. No, not if the model is otherwise theoretically and statistically valid. It is not uncommon for autocorrelation to be present in time-series data. Because the observations are ordered chronologically, there are likely to be intercorrelations among successive observations, especially if the time interval between successive observations is short, such as a month, rather than a year. If the overall regression model is theoretically and statistically sound in all facets except for the presence of autocorrelation, then it is a common forecasting practice to correct for the autocorrelation by applying an autocorrelation correction process. The use of an autocorrelation correction process effectively removes the correlation from the error terms and produces a more reliable forecast.

Q. WHAT OTHER ANALYSIS DID PUBLIC SERVICE RELY ON TO EVALUATE THE VALIDITY OF THE FORECASTING MODELS AND SALES PROJECTIONS?

A. Graphical inspection of each model's error terms (*i.e.,* actual less predicted) was used to verify that the models were not incorrectly specified 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 class' sales that were statistically modeled.

The statistically modeled sales forecasts for each 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 forecast fit well with the respective historical patterns for each 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.

Q. DOES THE COMPANY RELY ON FORECASTS OF ELECTRIC SALES IN OTHER REGULATORY FILINGS?

A. Yes. The Company relies on electric sales forecasts in multiple regulatory filings, including Resource Plans, Renewable Energy Standard Compliance Plans, Demand-Side Management Cost Adjustments, and Electric Commodity Adjustments.

Q. FROM YOUR PERSPECTIVE AS A FORECASTER, DO THE METHODOLOGIES USED BY THE COMPANY PROVIDE ACCURATE FORECASTS?

A. Yes. The Company's methodologies for forecasting sales and customer numbers are robust and provide reasonable, accurate forecasts for this proceeding. The Company's forecasts rely upon the analysis of relationships between sales and several explanatory variables, such as weather, price, and economic indicators.

These relationships and their ultimate explanatory power have been tested, as described above, and they provide viable, reasonable results.

B. Data Preparation

Q. PLEASE DESCRIBE THE DATA AND DATA SOURCES THE COMPANY RELIED ON TO DEVELOP THE ELECTRIC SALES AND CUSTOMER FORECASTS FOR THIS PROCEEDING.

A. Historical billing month sales, monthly number of customers, and billing month rate revenues (excluding service and facility fees) by rate class were obtained from Company billing system reports. Historical electric prices for the Residential and the Commercial and Industrial classes were calculated by dividing the billing month rate revenues by total sales volumes. The price forecast was developed based on annual average growth rates.

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

A. As in prior cases, historical and forecasted economic and demographic variables for the MSA's in the Company's electric service territory were obtained from IHS Markit, a respected economic forecasting firm frequently relied on by forecasting professionals and by the Company since the 1990s. The forecasts from IHS Markit were obtained in June 2022 and reflected the most current information available at the time the forecast was developed. The variables used in the models include aggregated MSA population, personal income per household, household size, and GMP. This information was used to determine the historical relationship between customers and sales, and economic and demographic measures.

Q. WHAT WAS THE COMPANY'S MEASURE OF WEATHER AND WHAT WAS THE SOURCE?

A. Weather is measured in heating degree days and cooling degree days, which are calculated using a 65 degrees Fahrenheit temperature base. Daily weather was obtained from the National Oceanic and Atmospheric Administration ("NOAA") and was measured at the Denver International Airport ("DIA") weather station. Heating degree days 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 20 heating degree days (65 minus 45) were calculated for that day. If the average daily temperature was greater than 65 degrees Fahrenheit, then that day recorded zero heating degree days. Cooling degree days were calculated for each day by subtracting 65 degrees Fahrenheit from the average daily temperature. For example, if the average daily temperature was 75 degrees Fahrenheit, then 10 cooling degree days (75 minus 65) were calculated for that day. If the average daily temperature was less than 65 degrees Fahrenheit, then that day recorded zero cooling degree days.

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

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

Q. WHY IS IT APPROPRIATE TO USE THE DIA WEATHER STATION TO REPRESENT THE COMPANY'S SERVICE TERRITORY?

A. Public Service uses data from the DIA weather station because a large majority (90.4 percent) of its Residential electric sales is within the Front Range region[9] or the eastern part of the state where the DIA weather station is located. Based on total Residential electric sales in 2021, only 9.6 percent of sales were made to customers located outside the Front Range region. These include the Western Division (4.9 percent), the San Luis Valley Division (1.3 percent), and the Mountain Division (3.4 percent). Since these sales represent such a small proportion of the total, it is appropriate to only use the weather station at DIA.

Q. WHAT WEATHER ASSUMPTION WAS USED FOR THE FORECAST PERIOD?

A. Normal weather was used for the forecast period, where normal is defined as a 10-year average of historical values. Daily normal heating degree days and cooling degree days were calculated by averaging 10 years of daily degree days using data from 2012 to 2021, which was the most current historical 10-year time period available at the time the forecast was developed. These daily normal degree days were weighted by billing cycle information to derive normal billing month degree days in the same manner as the historical actual degree days were calculated.

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[9] This includes the Company's Boulder, Denver Metro, Front Range, High Plains, Home Light & Power, Northern, North Metro, Southeast Metro, and Southwest Metro operating divisions.

V. FORECAST BY TARIFF RATE

Q. WHAT IS THE PURPOSE OF THIS SECTION OF YOUR DIRECT TESTIMONY?

A. The purpose of this section of my Direct Testimony is to explain the forecast developed for use in this proceeding at the tariff rate level of detail.

Q. IN ADDITION TO THE CLASS LEVEL FORECAST YOU DESCRIBED ABOVE, DID PUBLIC SERVICE ALSO PREPARE A FORECAST AT THE TARIFF RATE LEVEL OF DETAIL?

A. Yes. The tariff rate level of detail is needed to appropriately estimate sales revenues. For example, the Residential class of service is an aggregation of six tariff rate schedules: Residential General, Residential Demand, Residential Demand-Time Differentiated Rates, Residential Energy Time-of-Use, Residential General Service Opt-Out, and Residential Outdoor Area Lighting. Table JMG-D-3 provides a mapping of the tariff rate level of detail to the rate class level. Public Attachment JMG-4 and Highly Confidential Attachment JMG-4 provide the 2023 Test Year customer and sales forecast by month at the tariff rate level of detail.

1

TABLE JMG-D-3
Tariff Rate to Rate Class Mapping

Rate Class	Tariff Rate within Rate Class
Residential Sales	• Residential General • Residential Demand • Residential Demand-Time Differentiated Rates • Residential Energy Time-of-Use • Residential General Service Opt-Out • Residential Outdoor Area Lighting
Commercial and Industrial Sales	• Commercial • Non Metered Service • Secondary General • Secondary General Low-Load Factor • Secondary General Critical Peak Pricing • Secondary Standby Service • Secondary Time-of-Use • Secondary Photovoltaic Time-of-Use • Secondary Voltage Time-of-Use – Electric Vehicle • Primary General • Primary General Critical Peak Pricing • Primary Standby Service • Primary Time-of-Use • Transmission General • Transmission General Critical Peak Pricing • Transmission Standby Service • Commercial Outdoor Area Lighting • Parking Lot Lighting Service
Street Lighting Sales	• Metered Street Lighting Service • Metered Intersection Service • Energy Only Street Lighting Service • Street Lighting Service • Special Street Lighting Service • Customer-Owned Lighting Service • Street Lighting Service – Unincorporated Areas • Traffic Signal Lighting
Public Authority	• Special Contract Service

Q. HOW WAS THE TARIFF RATE LEVEL FORECAST DERIVED FROM THE CLASS LEVEL DATA?

A. After the class level sales and customer forecasts were completed, the tariff rate level forecasts were developed. Monthly tariff rate sales and customer allocation factors were developed based on tariff rate level sales and customer data obtained from Company billing system reports. The monthly tariff rate allocation factors were based on several years of historical actual data, and these allocation factors were then applied to the class level forecasts to derive the tariff rate level forecasts.

VI. DEVELOPMENT OF PEAK DEMAND FORECAST

Q. WHAT IS THE PURPOSE OF THIS SECTION OF YOUR DIRECT TESTIMONY?

A. The purpose of this section of my Direct Testimony is to describe the process used to develop the Company's Test Year system peak demand forecast. The Test Year peak demand forecast is used to develop the jurisdictional allocation factors for the revenue requirements portion of this proceeding.

Q. WHAT IS THE SOURCE OF THE SYSTEM PEAK DEMAND FORECAST YOU ARE USING FOR THE TEST YEAR?

A. The system peak demand forecast was completed in July 2022 as part of the Company's semi-annual forecast process.

Q. PLEASE DESCRIBE, IN GENERAL TERMS, THE METHODS USED TO FORECAST THE RETAIL SYSTEM PEAK DEMAND.

A. Similar to the electric sales forecast that I discussed earlier in my testimony, Public Service uses regression models to develop its forecast of retail peak demand, with monthly historical peak demand data and peak day weather concepts as inputs. Forecasts were developed for the Residential and Nonresidential sectors and then summed to derive total retail system peak demand. The retail peak demand forecasts were adjusted for the expected peak impacts from the Company's DSM programs, IVVO, DG solar, and the adoption of EVs. Attachment JMG-5 provides projected monthly peak demand for the Test Year. The regression models and associated statistics used in the Company's projections of Residential and Nonresidential peak demand are provided in Attachment JMG-6.

Q. WHAT WEATHER CONCEPTS DID THE COMPANY USE IN THE RETAIL PEAK DEMAND REGRESSION MODELS?

A. The Company used actual peak day cooling and heating degree days in the retail peak demand regression models and assumed a 30-year average of monthly maximum daily cooling degree days and heating degree days for the normal weather assumption during the forecast period. The historical weather was based on data at Stapleton and the normal weather was based on the 30-year period 1992-2021.

Q. HOW WAS THE RESIDENTIAL COINCIDENT PEAK DEMAND FORECAST DEVELOPED?

A. Residential coincident peak demand is expected to increase in response to changes to Residential energy requirements. For the Residential demand regression model, Residential energy requirements were defined seasonal averages of monthly sales for the Residential class. For example, the driver for peak in the summer month of July is driven by sales during that summer period. For this modeling, summer months include May through September, with non-summer months making up the rest of the year. The seasonal average calculation removes the monthly sales cyclical pattern while accounting for peak and sales growth differences between the seasons. Efficiency improvements captured in the Residential sales model were assumed to have the same impact on Residential peak demand. Since peak demand does not necessarily grow at the same rate as the underlying sales, the model also included an end-use saturation and efficiency variable interacted with maximum day weather conditions and Residential customer counts. The end-use saturation and efficiency variable is the same variable used in the calculation of the Cooling variable that is an input to the Residential average use per customer model. By using the end-use saturation and efficiency variable, the sensitivity to maximum day weather changes as Residential cooling saturation and efficiency changes.

Also included in the Residential peak model was maximum day heating degree days, monthly binary variables, and a variable that interacts GMI with peak Day CDDs and customers to pick up the additional peak load due to residential customers spending more time at home. The model results were adjusted to reflect the expected incremental impact of Residential DSM programs, the effect of Residential EV charging on peak demand, distributed generation solar production, and IVVO.

Q. HOW WAS THE NONRESIDENTIAL COINCIDENT PEAK DEMAND FORECAST DEVELOPED?

A. The Nonresidential coincident peak demand forecast was developed using a regression model similar to the Residential peak model. Historical Nonresidential coincident peaks were regressed against Nonresidential energy requirements defined as the 12-month moving average of Nonresidential sales. Also included in the model was a variable that allows peak demand to change at a different rate than sales. This variable, which interacts maximum day weather with non-residential customers, reflects increasing cooling usage as customer counts increase. In addition, the model included seasonal monthly binary variables, monthly binary variables to account for historical data outliers, and a variable accounting for the impact of the COVID-19 pandemic on Nonresidential peak demand. The model results were adjusted to reflect the expected incremental impact of Nonresidential DSM programs, the effect of Nonresidential EV charging on peak demand, distributed generation solar production, and IVVO.

Q. HOW WAS THE FORECAST OF WHOLESALE PEAK DEMAND DEVELOPED?

A. Forecasts of peak demand for each firm wholesale customer were developed based on forecasts from the respective wholesale customers.

VII. WEATHER NORMALIZATION OF HISTORICAL SALES AND BILLING DEMAND

Q. WHAT IS THE PURPOSE OF THIS SECTION OF YOUR DIRECT TESTIMONY?

A. The purpose of this section of my Direct Testimony is to explain the Company's weather normalization methodology and its application to the 12 months ended June 30, 2022 informational historical test year (the 2022 "Informational Historical Test Year" or "2022 IHTY") sales, billing demand, and revenues in this proceeding. The IHTY is being filed for informational purposes only.

Q. HOW ARE HISTORICAL MWH SALES WEATHER NORMALIZED?

A. In order to calculate sales growth from year to year that is not influenced by weather, the Company estimates the MWh impact of the deviation from normal weather, or "weather-normalized" 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 sales class, the Commercial service sales class, and the Primary General service and Secondary General service sales classes.

The weather response coefficients are developed using regression models with the class-level sales as the dependent variable, and monthly weather as the explanatory variables. The weather variables are expressed as heating degree days or cooling degree days, with a different variable defined for each month that exhibits a statistically significant weather response. Each monthly coefficient effectively represents the MWh of weather response per heating or cooling degree day per customer.

The Company uses the MetrixND statistical software package to develop the regression models. The weather response coefficients are updated annually to incorporate the most recent year of actual sales, actual customer counts, and actual weather data. This annual update process results in coefficients that reflect the current relationship between sales and weather.

In the weather normalization regression models, each month's heating or cooling degree days are used as individual variables (*i.e.*, January heating degree days, February heating degree days, July cooling degree days, etc.). This allows each model to identify and quantify a unique weather response for each month, which is appropriate because our customers' response to weather varies from month to month.

The impact of the deviation from normal weather is calculated by multiplying the weather response coefficient for a given month times the number of customers in the month times the deviation in degree days from normal. This impact is then applied to the actual billed sales to derive weather-normalized sales. If summer weather is warmer than normal, the normalization process results in weather-normalized sales that are lower than actual sales. Conversely, if summer weather is cooler than normal, the normalization process results in weather-normalized sales that are higher than actual sales.

Q. HOW IS HISTORICAL KILOWATT ("KW") BILLING DEMAND WEATHER-NORMALIZED?

A. The Company adjusts KW billing demand for weather variances from normal weather based on weather normalized kilowatt-hour ("kWh") sales and a Calculated Demand Factor. The Calculated Demand Factor quantifies the relationship of billing demand to sales for a given month by service class, and is calculated as the ratio of billing demand to sales as follows:

Calculated Demand Factor = Billing Demand (KW) / Sales (kWh)

The Calculated Demand Factor is then applied to the respective month's weather normalized kWh sales, resulting in a weather normalized KW billing demand estimate.

*Weather Normalized Billing Demand = Calculated Demand Factor * Weather Normalized Sales*

The weather normalized sales and weather normalized billing demands are then used to calculate weather adjusted revenues.

Q. IS THIS WEATHER NORMALIZATION PROCESS A NEW PROCESS FOR THE COMPANY?

A. No. The process of calculating the impact of the deviation from normal weather by multiplying a weather response coefficient for a given month times the number of customers in the month times the deviation in degree days from normal, and then applying this impact to the actual billed sales to derive weather-normalized sales is not new. The Company has been using this weather normalization methodology for electric and gas sales for business analysis and internal and external reporting purposes since 2001. The Company's weather normalization methodology is the same methodology that the Company used in Proceeding Nos. 22AL-0046G, 21AL-0317E, 20AL-0049G, 19AL-0268E, 17AL-0363G, 15AL-0135G, 14AL-0660E, 12AL-1268G, and 11AL-947E. The methodology to weather normalize billing demand that I describe later in this section was approved in Proceeding No. 11AL-947E and has been used since then.

While the weather normalization methodology has not changed, the normal weather assumption has changed as a result of the outcomes of Proceeding Nos. 20AL-0049G and 19AL-0268E. For the weather normalization of IHTY sales, the Company defined normal weather as the 10-year average of historical weather from July 2012 through June 2022, that is, the most recent 10-year period including the IHTY. This was approved most recently in Proceeding Nos. 21AL-0317E and 22AL-0046G.

Q. DOES THE COMPANY WEATHER NORMALIZE SALES FOR MORE PURPOSES THAN JUST STATE REGULATORY PROCEEDINGS?

A. Yes. The Company also weather normalizes sales for business analysis and internal and external reporting purposes. Public Service uses the same weather-normalization methodology for all of these purposes. In addition, the weather response coefficients are used in the Company's monthly accounting process to estimate unbilled sales, calendar month sales, and, ultimately, the calendar month revenues that are included in the Company's financial reports, such as the Securities Exchange Commission ("SEC") 10-K filing. As such, oversight of the weather response coefficients is part of the Company's internal controls over financial reporting.

Q. WHAT ARE THE RESULTS OF THE WEATHER NORMALIZATION OF THE IHTY SALES INCLUDED IN THIS RATE CASE FILING FOR INFORMATIONAL PURPOSES?

A. Actual July 2021 through June 2022 heating degree days were 5.6 percent lower than normal and actual cooling degree days were 13.5 percent higher than normal. The hotter-than-normal summer weather, combined with the warmer-than-normal winter weather, result in weather normalized sales being lower than actual sales by 135,861 MWh, or 0.5 percent. This results in weather normalized revenue that is $9.7 million lower than actual revenue. The work papers supporting the weather normalization of the IHTY sales are provided as Attachment JMG-7.

Q. HOW DOES PUBLIC SERVICE EVALUATE THE VALIDITY OF ITS WEATHER NORMALIZATION REGRESSION MODELS THAT YOU PREVIOUSLY DESCRIBED?

A. The Company uses the same techniques that I described earlier with the forecasting models, including the R-squared test statistic, the t-statistic of each variable, the DW test statistic, and graphical inspection of each model's error terms.

Q. PLEASE DESCRIBE THE DATA AND DATA SOURCES THE COMPANY RELIED ON TO DEVELOP ITS WEATHER NORMALIZATION REGRESSION MODELS.

A. The data used in the regression models include historical billing month sales and monthly number of customers from Company billing system reports, number of billing days in each month from Company meter ready schedules, and weather variables based on weather data from NOAA measure at the DIA weather station. The weather data reflected the same billing days as the sales data.

Q. WHAT WEATHER ASSUMPTIONS WERE USED TO WEATHER NORMALIZE THE IHTY SALES PRESENTED IN THIS PROCEEDING?

A. As I explained previously, normal weather was used for the IHTY period, where normal is defined as a 10-year average of historical values including the IHTY period. Daily normal heating degree days and cooling degree days were calculated by averaging 10 years of daily degree days using data from July 2013 through June 2022. These daily normal degree days were weighted by billing cycle information to derive normal billing month degree days in the same manner as the historical actual degree days were calculated.

VIII. CONCLUSION

Q. WHAT ARE YOUR CONCLUSIONS WITH RESPECT TO YOUR DIRECT TESTIMONY?

A. I conclude that the Company's forecasts of electric sales and customer counts for the Test Year, as reflected in Attachment JMG-1, and peak demand, as reflected in Attachment JMG-5, are appropriate for the purpose of determining the revenue requirement and final rates in this proceeding.

Q. DOES THIS CONCLUDE YOUR DIRECT TESTIMONY?

A. Yes, it does.

Statement of Qualifications

JOHN M. GOODENOUGH

As the Director, Sales, Energy, and Demand Forecasting at Xcel Energy, I am responsible for developing load analysis and energy sales forecasting policies, proposals, and strategies to meet corporate financial planning, budgeting, and internal earnings forecasting requirements as well as to support the Company's regulatory objectives and comply with regulatory requirements. I am also responsible for the development and presentation of load research and forecasted data for Xcel Energy's operating companies and reporting historical and statistical information to various regulatory agencies and others. I have been in this role since May 2022, after joining Xcel Energy as the Manager, Energy Forecasting in October 2019.

Prior to Xcel Energy, I worked as a Manager, Energy and Revenue Forecasting and Analysis at Arizona Public Service for three years. Other previous roles include Energy Markets Specialist at Southern California Edison, Principal Analyst at Baltimore Gas and Electric, and Regulatory Affairs Analyst at Pepco Holdings, Inc.

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 testified before the Colorado Public Utilities Commission, the Minnesota Public Utilities Commission, the Public Utility Commission of Texas, and the New Mexico Public Regulation Commission.

BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF COLORADO

* * * *

IN THE MATTER OF ADVICE LETTER NO. 1906-ELECTRIC OF PUBLIC SERVICE COMPANY OF COLORADO TO REVISE ITS COLORADO PUC NO. 8-ELECTRIC TARIFF TO REVISE JURISDICTIONAL BASE RATE REVENUES, IMPLEMENT NEW BASE RATES FOR ALL ELECTRIC RATE SCHEDULES, AND MAKE OTHER TARIFF PROPOSALS EFFECTIVE DECEMBER 31, 2022.	) PROCEEDING NO. 22AL-XXXXE

AFFIDAVIT OF JOHN M. GOODENOUGH ON BEHALF OF PUBLIC SERVICE COMPANY OF COLORADO

I, John M. Goodenough, being duly sworn, state that the Direct Testimony and attachments were prepared by me or under my supervision, control, and direction; that the Direct Testimony and attachments are true and correct to the best of my information, knowledge and belief; and that I would give the same testimony orally and would present the same attachments if asked under oath.

Dated at Denver, Colorado, this 22 day of November, 2022.

[signature]
John M. Goodenough
Director, Sales, Energy, and Demand Forecasting

Subscribed and sworn to before me this 22nd day of Nov, 2022.

[signature]
Notary Public

ANGELICA ALONDRA SANMIGUEL
NOTARY PUBLIC
STATE OF COLORADO
NOTARY ID 20214028821
MY COMMISSION EXPIRES 07/20/2025

My Commission expires 07/20/2025