NOTICE OF CONFIDENTIALITY
AN ATTACHMENT TO THIS TESTIMONY HAVE BEEN FILED UNDER SEAL

BEFORE THE PUBLIC UTILITIES COMMISSION

OF THE STATE OF COLORADO

*** * * * ***

RE: IN THE MATTER OF ADVICE	**)**
LETTER NO. 912-GAS FILED BY	**)**
PUBLIC SERVICE COMPANY OF	**)**
COLORADO TO REVISE ITS	**) PROCEEDING NO. 17AL-____G**
COLORADO PUC NO. 6-GAS TARIFF	**)**
TO IMPLEMENT A GENERAL RATE	**)**
SCHEDULE ADJUSTMENT AND	**)**
OTHER RATE CHANGES EFFECTIVE	**)**
ON 30-DAYS NOTICE.	**)**

DIRECT TESTIMONY AND ATTACHMENTS OF JANNELL E. MARKS

ON

BEHALF OF

PUBLIC SERVICE COMPANY OF COLORADO

NOTICE OF CONFIDENTIALITY
AN ATTACHMENT TO THIS TESTIMONY HAVE BEEN FILED UNDER SEAL

Highly Confidential: Attachment JEM-5

June 2, 2017

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

*** * * * ***

RE: IN THE MATTER OF ADVICE LETTER NO. 912-GAS FILED BY PUBLIC SERVICE COMPANY OF COLORADO TO REVISE ITS COLORADO PUC NO. 6-GAS TARIFF TO IMPLEMENT A GENERAL RATE SCHEDULE ADJUSTMENT AND OTHER RATE CHANGES EFFECTIVE ON 30-DAYS NOTICE.	**) PROCEEDING NO. 17AL-________G**

SUMMARY OF THE DIRECT TESTIMONY OF JANNELL E. MARKS

Ms. Jannell E. Marks is Director, Sales, Energy and Demand Forecasting of Xcel Energy Services Inc. ("XES"). Ms. Marks is responsible for the development of forecasted sales data and economic indicators for Public Service Company of Colorado ("Public Service" or "Company") and the other Xcel Energy Inc. ("Xcel Energy") utility operating companies. Ms. Marks also is 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, Ms. Marks is responsible for developing and implementing forecasting, planning, and load analysis studies for regulatory proceedings, including proceedings before the Colorado Public Utilities Commission ("Commission").

In her testimony, Ms. Marks describes the Company's historical gas customer and dekatherm ("Dth") throughput trends for its related service territory, and presents and supports its gas customer and Dth throughput forecast for the Multi-Year Plan ("MYP") period of January 1, 2018 through December 31, 2020. Ms. Marks presents the Company's forecast at both the customer class and rate schedule level of detail. Ms. Marks also includes in her testimony a discussion regarding the forecast methodology and the methodology the Company uses to weather normalize historical gas throughput.

Ms. Marks testifies that the Company expects the number of gas customers to increase at a slightly faster rate than actual growth experienced over the past five years, in line with the stronger population growth seen in the recent past and expected to continue over the next few years. She further testifies that Dth sales will increase from current levels due to customer growth, even though use per customer is expected to decline. Ms. Marks also testifies that total gas throughput (sales plus transportation volumes) is expected to increase each year through 2019 and then to decline in 2020 due to decreasing volumes of gas transported for electric generation.

Ms. Marks recommends that the Commission adopt the Company's forecasts of gas throughput and customers for the purpose of determining the revenue requirement and final rates in this proceeding.

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

* * * * *

RE: IN THE MATTER OF ADVICE	**)**
LETTER NO. 912-GAS FILED BY	**)**
PUBLIC SERVICE COMPANY OF	**)**
COLORADO TO REVISE ITS	**) PROCEEDING NO. 17AL-________G**
COLORADO PUC NO. 6-GAS TARIFF	**)**
TO IMPLEMENT A GENERAL RATE	**)**
SCHEDULE ADJUSTMENT AND	**)**
OTHER RATE CHANGES EFFECTIVE	**)**
ON 30-DAYS NOTICE.	**)**

DIRECT TESTIMONY AND ATTACHMENTS OF JANNELL E. MARKS

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Attachment JEM-2	Regression Models and Associated Statistics Used in the Company's Projections of Gas Throughput
Attachment JEM-3	Regression Models and Associated Statistics Used in the Company's Projections of Gas Customers
Attachment JEM-4	Work Papers Supporting the Weather Normalization of the 2016 HTY Throughput
HIGHLY CONFIDENTIAL Attachment JEM-5	Highly Confidential Version of Monthly MYP Gas Dth Throughput and Number of Gas Customers for Each Rate Schedule – Filed Under Seal

GLOSSARY OF ACRONYMS AND DEFINED TERMS

Acronym/Defined Term	Meaning
2015 Gas Rate Case	Proceeding No. 15AL-0135G
2018 Forward Test Year	The 12 months ending December 31, 2018
2019 Forward Test Year	The 12 months ending December 31, 2019
2020 Forward Test Year	The 12 months ending December 31, 2020
Commission	Colorado Public Utilities Commission
DIA	Denver International Airport
DSM	Demand-Side Management
Dth	Dekatherm
Dth Throughput	All deliveries of gas made from Public Service's system for end-users located in Colorado
DW	Durbin-Watson
FERC	Federal Energy Regulatory Commission
GSP	Colorado Gross State Product
Historical Test Year or HTY	Historical Test Year - 12 months ending December 31, 2016
LDC	Local Distribution Company
MSA	Metropolitan Statistical Area
MYP	Multi-Year Plan period of January 1, 2018 through December 31, 2020, which includes the 2018, 2019, and 2020 Forward Test Years.
NOAA	National Oceanic and Atmospheric Administration

Acronym/Defined Term	**Meaning**
Public Service, or the Company	Public Service Company of Colorado
R-Squared	Coefficient of Determination Test Statistic
SAE	Statistically-Adjusted End-Use
Weather Normalized	The Company's estimation of the Dth impact of the deviation from normal weather sales due to abnormal weather.
Xcel Energy	Xcel Energy Inc.
XES	Xcel Energy Services Inc.

BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF COLORADO

* * * * *

RE: IN THE MATTER OF ADVICE LETTER NO. 912-GAS FILED BY PUBLIC SERVICE COMPANY OF COLORADO TO REVISE ITS COLORADO PUC NO. 6-GAS TARIFF TO IMPLEMENT A GENERAL RATE SCHEDULE ADJUSTMENT AND OTHER RATE CHANGES EFFECTIVE ON 30-DAYS NOTICE.	**) PROCEEDING NO. 17AL-________G**

DIRECT TESTIMONY AND ATTACHMENTS OF JANNELL E. MARKS

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

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Jannell E. Marks. 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, 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 “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 testimony.

Q. WHAT IS THE PURPOSE OF YOUR DIRECT TESTIMONY?

A. The purpose of my testimony is to: (1) describe the historical gas customer and dekatherm ("Dth") throughput trends for Public Service's service territory, (2) present and support the Company's gas customer and Dth throughput forecast for the Multi-Year Plan ("MYP") period of January 2018 through December 2020, and (3) provide a description of the methodology the Company uses to weather normalize historical sales.

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

A. Yes, I am sponsoring Attachment JEM-1 (monthly MYP gas Dth throughput and number of gas customers for each customer class), Attachment JEM-2 (regression models and associated statistics used in the Company's projections of gas throughput), Attachment JEM-3 (regression models and associated statistics used in the Company's projections of gas customers), Attachment JEM-4 (work papers supporting the weather normalization of the 2016 Historical Test Year ("HTY") throughput), and the public and highly confidential versions of Attachments Highly Confidential JEM-5 and Public JEM-5, respectively (monthly MYP gas Dth throughput and number of gas customers for each rate schedule). These attachments were prepared by me or under my direct supervision.

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

A. I recommend that the Commission adopt the Company's forecasts of gas throughput and customers, as reflected in Attachment JEM-1, for the purpose of determining the revenue requirement and final rates in this proceeding.

II. HISTORICAL CUSTOMER AND DTH THROUGHPUT TRENDS

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

A. The purpose of this section of my testimony is to provide relevant background regarding historical customer and throughput trends. These trends help put the remainder of my testimony in context.

Q. BEFORE DISCUSSING HISTORICAL CUSTOMER AND DTH THROUGHPUT TRENDS, PLEASE EXPLAIN WHAT IS INCLUDED IN "DTH THROUGHPUT" FOR PURPOSES OF YOUR DIRECT TESTIMONY.

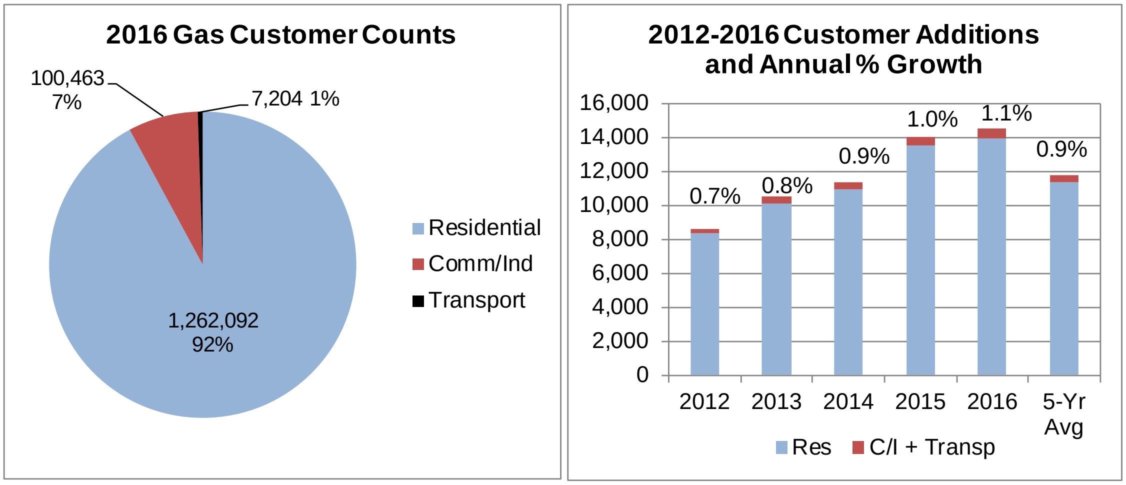
A. "Dth throughput" includes all deliveries of gas made from Public Service's system for end-users located in Colorado. Public Service provides both gas sales and transportation services. To explain the latter, Public Service is a significant transporter of natural gas, when the end-use customer does not purchase its gas supplies from Public Service, but rather, buys the gas from third-party suppliers or gas marketers and ships the gas across Public Service's system to its end-use facilities. Stated another way, "Dth throughput" includes all end-use sales by Public Service and all Colorado Public Utilities Commission ("Commission")-jurisdictional gas transportation quantities delivered by Public Service in Colorado.

Public Service also provides a small amount of gas transportation that is subject to the jurisdiction of the Federal Energy Regulatory Commission ("FERC"), when Public Service delivers at interconnections with interstate pipelines for subsequent delivery outside of Colorado. My Direct Testimony only addresses the Public Service intrastate gas business, which is subject to the Commission's jurisdiction. The Dth throughput numbers I present do not reflect the FERC-jurisdictional transportation services that we provide.

Q. PLEASE DISCUSS THE COMPANY'S HISTORICAL GAS CUSTOMER TRENDS.

A. Total gas customer counts in the Company's service territory averaged 1,369,758 customers per month in 2016, the last full year of available historical data. Total customer counts increased an average of 11,831 customers per year for the 2012 through 2016 time period, for an average annual growth rate of 0.9 percent. The largest class of customers is the Residential class, which averaged 1,262,092 customers per month during 2016 and represents 92.1 percent of total customers. Residential customer counts averaged a growth rate of 0.9 percent, or 11,378 additions, per year during the time period of 2012 through 2016, accounting for more than 96 percent of the total customer growth during this time period. Commercial and Industrial sales customer counts averaged growth of 0.1 percent, or 63 additions, per year during the time period of 2012 through 2016. The number of customers in this class declined in 2012 and 2013, as customers switched to transportation service. The number of transportation customers increased 6.5 percent, or 390 additions, per year during the time period of 2012 through 2016. Figure JEM-D-1 provides a summary of the historical customer statistics.

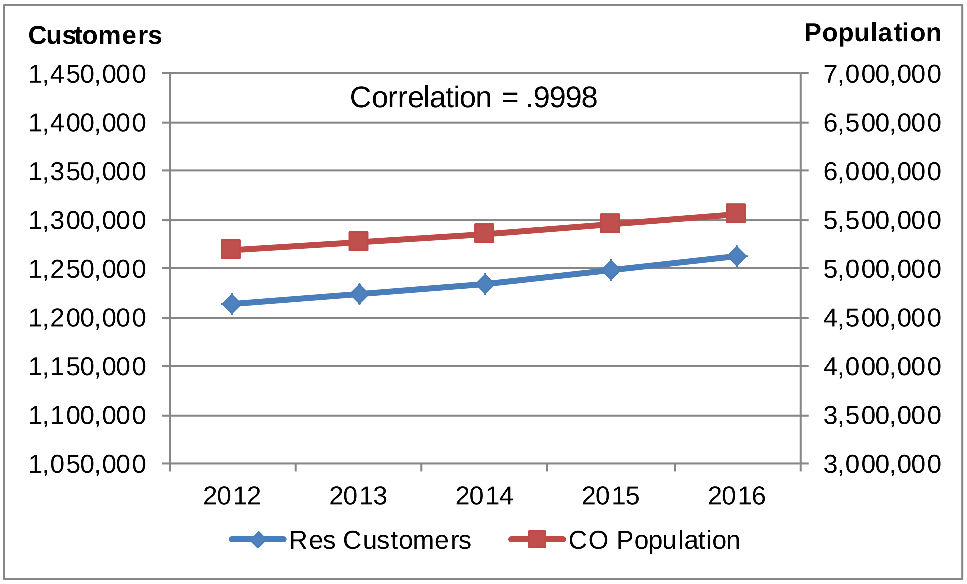
Figure JEM-D-1 Historical Customer Statistics



Q. WHAT IS THE DRIVER OF RESIDENTIAL CUSTOMER GROWTH?

A. Residential customers are highly correlated with population. The increasing rate of growth in the number of customers over the past five years is the result of an increasing rate of growth in population. Figure JEM-D-2 compares Residential customers and Colorado population over the 2012 to 2016 time period and shows that the two data series are highly correlated, with a correlation coefficient of 0.9998.

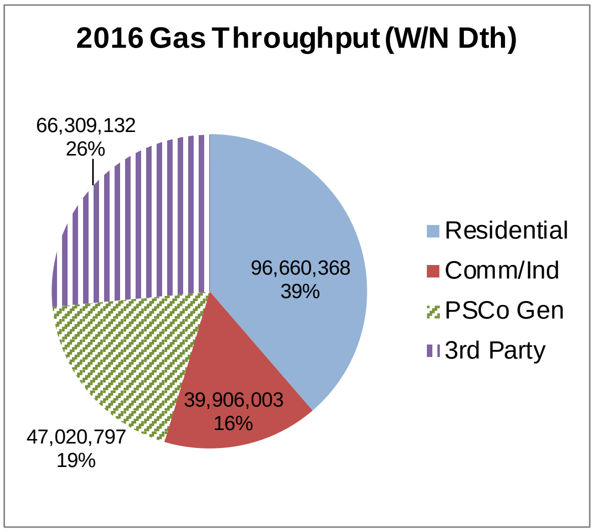
Figure JEM-D-2 Residential Customers and Colorado Population



Q. PLEASE DISCUSS THE COMPANY'S HISTORICAL GAS DTH THROUGHPUT TRENDS.

A. After normalizing for weather - a process I explain further below - the Company's total gas sales have increased an average of 0.5 percent per year over the past five years. Residential sales have averaged annual growth of 0.4 percent and total Commercial and Industrial sales have increased at an average rate of 0.8 percent over the 2012 through 2016 time period. Total transportation volumes have increased at an average annual rate of 3.4 percent during the time period of 2012 through 2016. Transportation for Public Service electric generation has increased, on average, 4.2 percent per year during this period, while other third-party transportation has increased 2.8 percent per year on average. Total throughput (weather-normalized sales plus transportation volumes) has increased at an average annual rate of 1.8 percent over the past five years, driven mostly by growth in the transportation sector. Figure JEM-D-3 provides a summary of the historical Dth throughput statistics. Table JEM-D-1 provides annual throughput volumes and percent growth by class for 2012 through 2016.

Figure JEM-D-3 Historical Dth Throughput Statistics



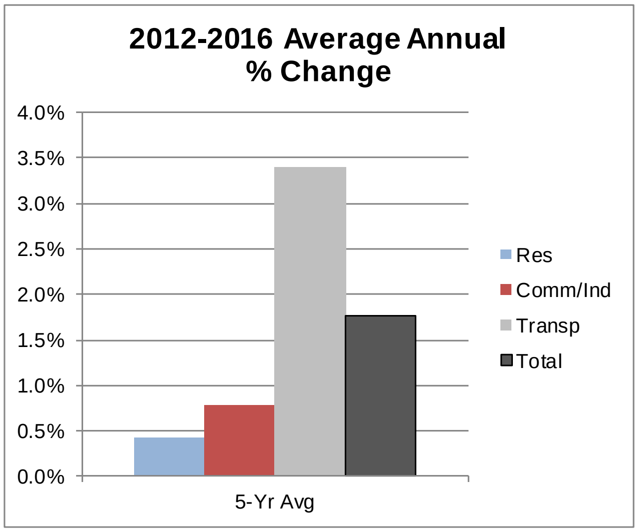


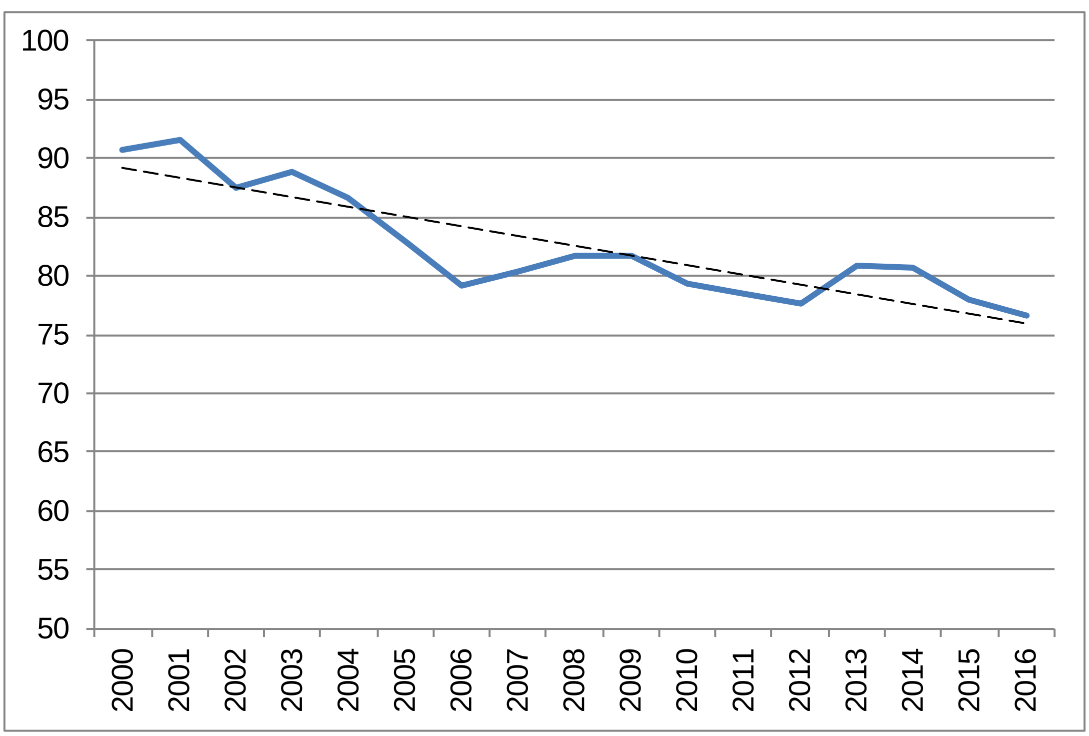
Table JEM-D-1 Historical W/N Dth Throughput by Class 2012-2016

Customer Class	2012	2013	2014	2015	2016
Residential	94,171,049	98,988,616	99,603,752	97,288,145	96,660,368
Annual % Change	*-0.5%*	*5.1%*	*0.6%*	*-2.3%*	*-0.6%*
Total Commercial & Industrial	38,172,759	39,617,498	40,526,061	39,993,585	39,906,003
Annual % Change	*-0.6%*	*3.8%*	*2.3%*	*-1.3%*	*-0.2%*
Total Sales	**132,343,808**	**138,606,114**	**140,129,813**	**137,281,729**	**136,566,372**
Annual % Change	*-0.5%*	*4.7%*	*1.1%*	*-2.0%*	*-0.5%*
Public Service Electric[1]	36,722,152	36,359,773	39,307,505	42,732,247	47,020,797
Annual % Change	*-4.0%*	*-1.0%*	*8.1%*	*8.7%*	*10.0%*
3rd Party	57,537,525	62,660,346	63,737,456	63,858,491	66,309,132
Annual % Change	*-0.2%*	*8.9%*	*1.7%*	*0.2%*	*3.8%*
Total Transportation	**94,259,677**	**99,020,119**	**103,044,961**	**106,590,738**	**113,329,929**
Annual % Change	*-1.7%*	*5.1%*	*4.1%*	*3.4%*	*6.3%*
Total Throughput	**226,603,485**	**237,626,233**	**243,174,774**	**243,872,467**	**249,896,301**
Annual % Change	*-1.0%*	*4.9%*	*2.3%*	*0.3%*	*2.5%*

[1] Transportation of natural gas used by the electric generation plants either owned by Public Service or for which Public Service is responsible for acquiring natural gas supplies.

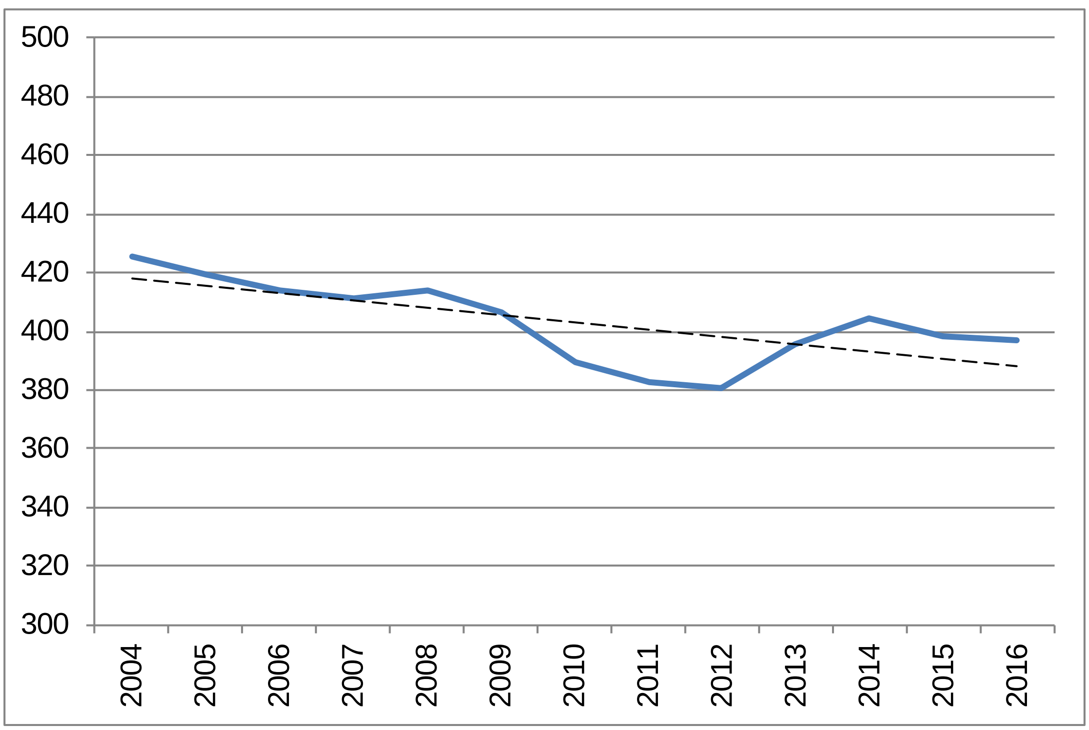
Growth in Residential sales over the past five years is due to increasing number of customers, dampened by declining use per customer. Residential use per customer has exhibited a declining trend for many years, with 2016 use per customer more than 15 percent lower than use per customer in 2000 and more than 3 percent lower than ten years ago. Over the past five years, Residential use per customer has averaged declines of 0.5 percent per year. Figure JEM-D-4 presents historical weather normalized Residential use per customer (solid line) and the historical declining trend (dashed line). While there have been years that use per customer increased, these years have been followed by decreasing use per customer, resulting in a long-term declining trend.

Figure JEM-D-4 Residential Use Per Customer (Weather Normalized Dth)



While Commercial and Industrial sales have increased at an average annual rate of 0.8 percent over the past five years, Table JEM-D-1 shows that most of this growth occurred in 2013. Since 2013, Commercial and Industrial sales have been relatively flat, with growth averaging only 0.2 percent per year. As shown in Figure JEM-D-5, Commercial and Industrial use per customer has shown a declining trend for many years, similar to Residential use per customer. The growth in 2013 and 2014 was a recovery from the lower-than-trend use per customer in the recession and post-recession time period. Since 2014, use per customer has resumed a slowly declining trend.

Figure JEM-D-5 Commercial and Industrial Use Per Customer (Weather Normalized Dth)



III. CUSTOMER AND DTH THROUGHPUT FORECASTS

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

A. The purpose of this section of my testimony is to provide forecasts for the Residential, Commercial and Industrial, and Transportation customer classes, as well as total gas throughput.

Q. PLEASE DESCRIBE THE CUSTOMER CATEGORIES INCLUDED IN THE COMPANY'S CUSTOMER AND GAS THROUGHPUT FORECASTS.

A. The Residential and the Commercial and Industrial classes comprise the Company's total gas customer and sales forecasts. The Transportation class is added to derive the total gas throughput forecasts.

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

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

a) The monthly and annual gas supply requirements;

b) Test year revenue under present rates for each test year of the MYP; and,

c) Test year revenue under proposed rates for each test year of the MYP.

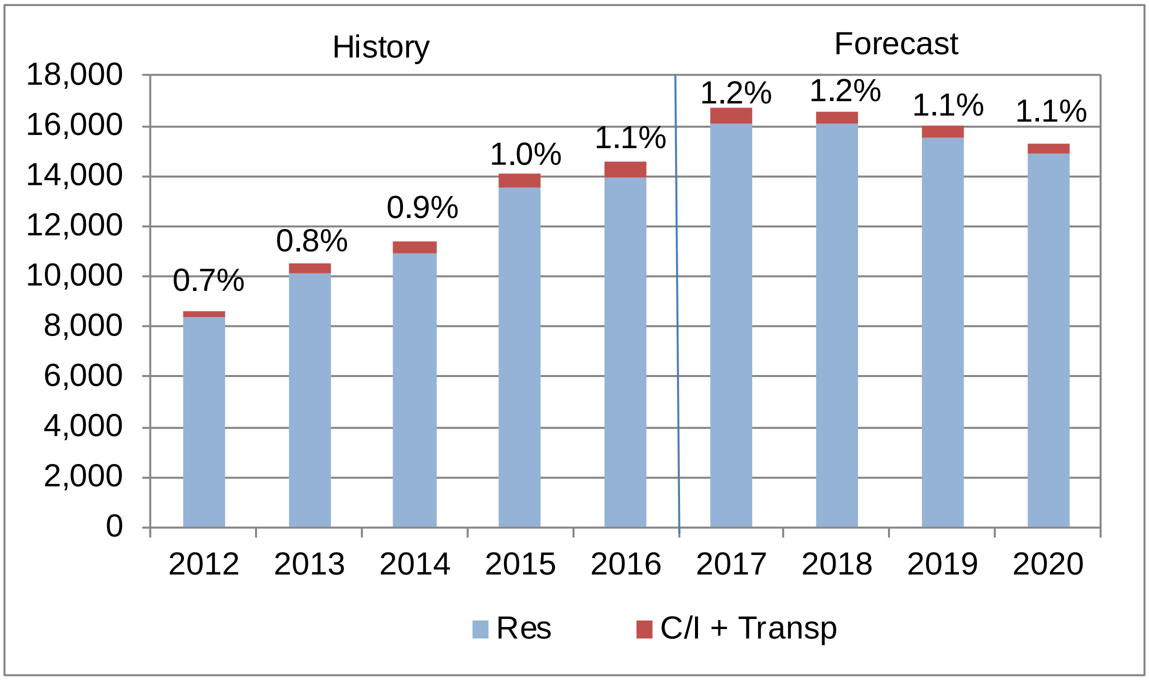
Q. WHAT IS PUBLIC SERVICE'S FORECAST OF GAS THROUGHPUT AND CUSTOMERS FOR THE MYP ENDING DECEMBER 31, 2020?

A. Attachment JEM-1 summarizes projected monthly gas Dth throughput and number of gas customers for each customer class for 2018 through 2020. Total gas customers are projected to average 1,402,962 per month in 2018, 1,418,939 per month in 2019, and 1,434,246 per month in 2020. Total throughput is projected to be 263,301,113 Dth in 2018, 267,773,484 Dth in 2019, and 259,910,524 Dth in 2020.

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

A. As I stated earlier, the Company's total number of gas customers increased at an average annual rate of 0.9 percent from 2012 through 2016, or 11,831 customers per year. The total number of gas customers is expected to increase at an annual rate of 1.2 percent, or 16,680 customers, in 2017, followed by growth of 1.2 percent (16,524 customers) in 2018, 1.1 percent (15,977 customers) in 2019, and 1.1 percent (15,307 customers) in 2020. The expected average customer growth through 2020 is 1.2 percent, which is slightly stronger than the actual average customer growth over the past five years. However, the 1.2 percent average growth is in line with the actual growth of 1.1 percent in 2016, and is reflective of the stronger population growth seen in the recent past and expected to continue over the next few years. Figure JEM-D-6 compares historical and forecasted customer additions.

Figure JEM-D-6 2012-2016 Historical and 2017-2020 Forecast Customer Additions and Annual % Growth



Q. HOW DOES THE PROJECTED GAS THROUGHPUT COMPARE WITH HISTORICAL WEATHER-NORMALIZED GAS THROUGHPUT?

A. Total gas sales are expected to increase 0.9 percent in 2017 from 2016 sales, though these 2016 sales reflected a decline of 0.5 percent from 2015 weather-normalized sales. Going forward, total sales are projected to increase an additional 1.0 percent in 2018, 0.2 percent in 2019, and 0.9 percent in 2020. The average annual total gas sales growth through 2020 is 0.7 percent, which is a little stronger that the 0.5 percent average annual growth over the past five years. This slightly stronger growth is mostly due to stronger expected Residential customer growth and a slower decline in use per customer than experienced over the past five years.

Residential sales decreased 0.6 percent in 2016 but are predicted to increase 1.0 percent in 2017, 1.1 percent in 2018, 0.3 percent in 2019, and 1.2 percent in 2020. Through 2020, the projected average annual Residential sales growth is 0.9 percent. This is stronger than the average annual growth of 0.4 percent from 2012 through 2016 due to stronger customer growth and a slower decline in use per customer. Commercial and Industrial sales decreased 0.2 percent in 2016, and are expected to increase 0.7 percent in 2017 and 0.8 percent in 2018. Commercial and Industrial sales then are expected to decrease slightly (0.2 percent) in 2019 and remain flat in 2020. Through 2020, Commercial and Industrial sales are expected to average annual sales growth of 0.3 percent, which is in line with the average growth seen in this class since 2013. Total throughput (sales plus transportation volumes) increased 2.5 percent in 2016 from 2015 weather-normalized levels, and are expected to increase 1.8 percent in 2017. Total throughput is expected to increase 3.5 percent in 2018, increase an additional 1.7 percent in 2019, and decline 2.9 percent in 2020. I will explain the methodologies used to develop the customer and throughput forecasts in the following section of my testimony.

Table JEM-D-2 provides the Company’s weather-normalized Dth throughput by customer class by year for 2016 through 2020 and the annual growth rates.

Table JEM-D-2 Weather-Normalized Throughput by Class (Dth)

Customer Class	2016 Weather Normalized Actual	2017 Forecast	2018 Forecast	2019 Forecast	2020 Forecast
Residential	96,660,368	97,671,998	98,726,443	99,057,646	100,274,564
Annual % Change	*-0.6%*	*1.0%*	*1.1%*	*0.3%*	*1.2%*
Total Commercial & Industrial	39,906,003	40,189,842	40,505,043	40,406,719	40,425,030
Annual % Change	*-0.2%*	*0.7%*	*0.8%*	*-0.2%*	*0.0%*
Total Sales	**136,566,372**	**137,861,839**	**139,231,486**	**139,464,364**	**140,699,594**
Annual % Change	*-0.5%*	*0.9%*	*1.0%*	*0.2%*	*0.9%*
Public Service Electric	47,020,797	47,313,793	54,320,261	58,753,355	49,772,114
Annual % Change	*10.0%*	*0.6%*	*14.8%*	*8.2%*	*-15.3%*
3rd Party	66,309,132	69,121,840	69,749,366	69,555,765	69,438,816
Annual % Change	*3.8%*	*4.2%*	*0.9%*	*-0.3%*	*-0.2%*
Total Transportation	**113,329,929**	**116,435,633**	**124,069,627**	**128,309,120**	**119,210,930**
Annual % Change	*6.3%*	*2.7%*	*6.6%*	*3.4%*	*-7.1%*
Total Throughput	**249,896,301**	**254,297,472**	**263,301,113**	**267,773,484**	**259,910,524**
Annual % Change	*2.5%*	*1.8%*	*3.5%*	*1.7%*	*-2.9%*

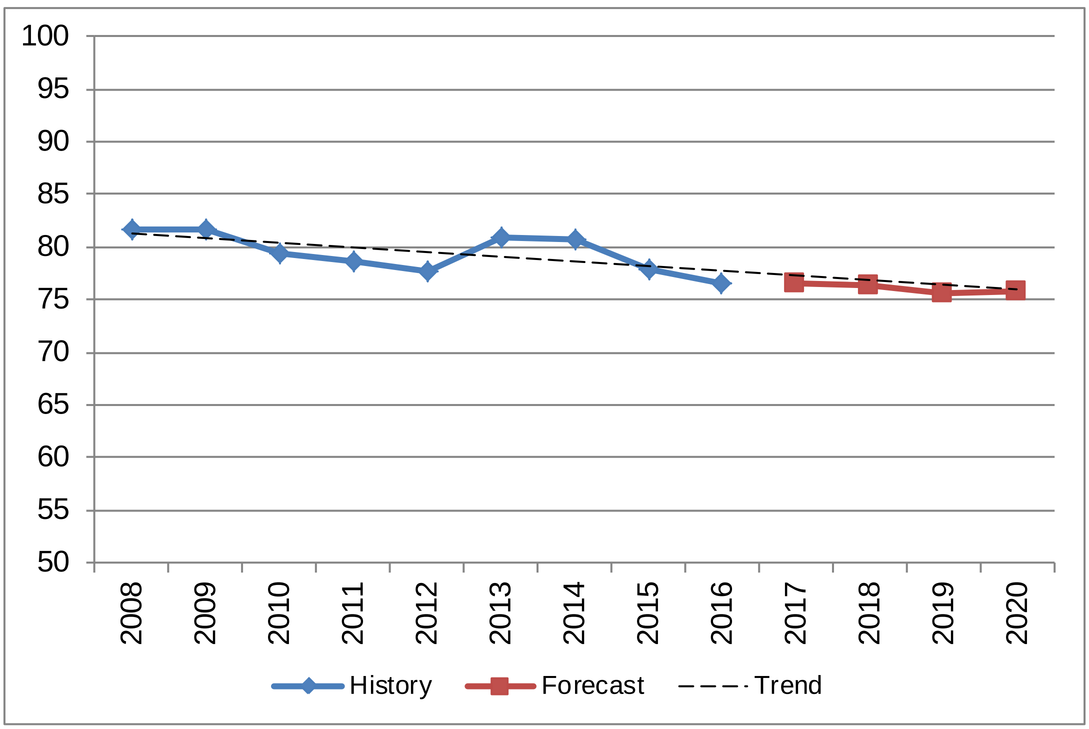
Q. WHAT IS DRIVING THE DECLINING RESIDENTIAL USE PER CUSTOMER TREND?

A. As I previously explained, Residential use per customer has exhibited a declining trend for many years. This trend is expected to continue due to expected efficiency improvements across all end uses. The U.S. Energy Information Administration's *2017 Annual Energy Outlook*[2] forecasts residential gas usage per household to decline at an average annual rate of 0.7 percent from 2017 to

[2] https://www.eia.gov/outlooks/aeo/data/browser/#/?id=4-AEO2017&cases=ref2017&sourcekey=0

2020, with expected annual average declines ranging between 0.4 percent and 0.7 percent for the various end uses, except the "Other Uses" category. The "Other Uses" category includes such appliances as outdoor grills, exterior lights, pool heaters, spa heaters, and backup electricity generators, and is projected to decline an average of 1.5 percent per year from 2017 to 2020. Figure JEM-D-7 presents the forecast of Residential use per customer and demonstrates how the forecast is in line with the declining trend in historical use per customer.

Figure JEM-D-7 Residential Use Per Customer (Weather Normalized Dth)



Q. WHAT IS CONTRIBUTING TO THE LARGE INCREASES IN PUBLIC SERVICE ELECTRIC TRANSPORTATION IN 2018 AND 2019, FOLLOWED BY A DECLINE IN 2020?

A. First, as explained earlier in my testimony, electric transportation involves natural gas used by the electric generation plants, either owned by Public Service or for which Public Service is responsible for acquiring natural gas supplies. The increase and subsequent decrease in generation gas transport is due to a combination of factors. In 2018 and 2019, gas generation increases in spite of the new Rush Creek wind due to coal retirements and maintenance. In 2020, gas generation decreases due to the addition of the wind and increases in forecasted natural gas prices.

IV. CUSTOMER AND THROUGHPUT FORECASTING METHODOLOGY

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

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

Q. WHAT IS THE SOURCE OF THE CUSTOMER AND ENERGY SALES FORECASTS YOU ARE USING FOR THE MYP?

A. The customer and sales forecast was completed in March 2017 as part of the Company's semi-annual forecasting process.

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

A. The preparation of the gas sales and customer forecast utilizes a combination of econometric and statistical forecasting techniques and analyses. The primary forecasting technique used is regression modeling. 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 natural gas 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.

Regression techniques are very well known and 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. The Company has been using these types of models for more than twenty-five years.

Q. WERE THE FORECASTS THAT YOU DEVELOPED REVIEWED BY UPPER MANAGEMENT?

A. Yes. After the customer and sales forecasts were prepared, both the forecasts and the underlying assumptions were presented to and reviewed by various levels of leadership within the Company, including Mr. David Eves, the President of Public Service. No modifications were made to the forecast based on this review process, and the forecasts and assumptions were approved as presented.

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 is calculated by multiplying average use per customer times the number of customers. The Residential average use and Commercial and Industrial sales[3] forecasts were developed using a Statistically-Adjusted End-Use ("SAE") modeling approach. An SAE model is an

[3] The Commercial and Industrial sales model includes gas volumes transported to Public Service's Transportation Full rate Commercial and Industrial customers.

econometric model that incorporates end-use concepts. The SAE method entails specifying natural gas use as a function of end-use variables (both heating and other) and monthly weather impacts on natural gas sales.

The heating end-use variable is an index that incorporates economic indicators, natural gas prices, and heating appliance efficiency trends. It is defined as the product of a heating appliance index variable, which indicates relative saturation and efficiency of the stock of heating appliances, and a heating utilization variable, which reflects how the stock is utilized. The heating appliance index variable reflects both changes in saturation resulting from end-use competition, and improvements in heating appliance efficiency standards. The heating utilization variable is designed to capture natural gas consumption driven by the use of the heating appliance stock. For the Residential sector, the primary factors that impact heating appliance use are natural gas prices, Colorado household income, Colorado average household size, and monthly weather as measured by Heating Degree Days. For the Commercial and Industrial sector, the utilization of the stock of heating equipment is a function of natural gas prices, business activity (as measured by Colorado Gross State Product (“GSP”)) and weather.

The “other” end-use variable is developed in the same manner as the heating end-use variable. The appliance index variable reflects the changes in saturation of other gas appliances (such as water heaters, dryers, and cooking appliances), and the average efficiency of the existing stock of appliances based on seasonal usage. The utilization variable is designed to capture natural gas consumption of other appliances driven by the use of the appliance stock. For the commercial and industrial sector, the primary factors that impact the use of other appliances are natural gas prices, business activity (as measured by Colorado GSP), and the number of billing days in a month.

The Residential average use and the Commercial and Industrial sales forecast models were estimated by regressing monthly natural gas usage by class on the end-use variables and other variables such as billing days, trend variables, and monthly seasonal variables. The regression models effectively calibrated the end-use concepts to actual monthly usage.

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

A. Regression models provided the foundation for the customer forecasts of the Residential and the Commercial and Industrial[4] customer classes. In all of the models, at least ten years of monthly historical data was used to conduct the regression analysis. The modeled relationships were simulated over the forecast period using projected levels of the independent predictor variables.

Customer counts in the Interdepartmental customer class are small and generally do not exhibit growth. Therefore, the customer forecast for this class

[4] The Commercial and Industrial customer model includes Public Service's Transportation Full rate Commercial and Industrial customers.

was developed by holding constant the December 2016 actual customer count. Interdepartmental sales were forecast based on historical growth rates.

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

A. Seasonal 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. In the regression models used to develop the forecast presented here, monthly binary variables were included in the Residential use per customer model and the Commercial and Industrial customer model to account for non-weather-related seasonal factors. The inclusion of these binary variables improved the overall model fit and the monthly pattern of the forecast.

Q. PLEASE EXPLAIN HOW THE REMAINDER OF THE GAS TRANSPORTATION FORECAST WAS DEVELOPED.

A. As previously explained, throughput for customers capable of moving between the Company's sales and transportation services are forecasted as part of the total Commercial and Industrial sector. The transportation customers that are forecasted separately from the Commercial and Industrial sector are predominantly large firm transportation customers that typically do not shift between the Company's sales and transportation service due to business or regulatory concerns. They include gas transportation services provided to most large industrial customers including Public Service's gas-fired electric generation facilities and transportation gas deliveries to downstream Local Distribution Companies ("LDC").

Except for gas transportation deliveries to Public Service's generation facilities, the foundation for the gas transportation forecast is based upon twelve months of historical throughput data from February 2016 to January 2017. Most large industrial transportation customers operate on a fairly consistent basis, so forecasts for these are based on historical usage or trends without weather normalization. The historical volumes for the LDC customers are weather-normalized, as explained more fully later in my Direct Testimony.

Q. HOW IS TRANSPORTATION THROUGHPUT FOR DOWNSTREAM LDC'S FORECAST?

A. Forecasting for a downstream LDC presents challenges, as we are essentially "blind" to the level of new customer connections occurring on the LDC's system behind the delivery meter, as well as the extent to which load is being offset by gas delivered directly into the LDC from an alternative supply source, such as a processing plant or pipeline. Therefore, we utilize historical throughput data as the basis for our LDC customers, and apply assumed weather normalization and adjustments for known changes. We typically apply a modest growth factor of 0.2 percent, which reflects an assumed level of new service connects.

Q. HOW ARE GAS TRANSPORTATION VOLUMES FOR THE COMPANY'S ELECTRIC GENERATION RESOURCES FORECAST?

A. The information contained in the gas transportation forecast reflects estimated gas use for each of the electric generation plants (again either owned by Public Service or for which Public Service is responsible for acquiring natural gas supplies) as calculated from the PLEXOS® production cost model of the anticipated electric dispatch.

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

A. Yes. The Residential and the Commercial and Industrial sales forecast model results were adjusted to reflect the expected incremental impact of Demand-Side Management ("DSM") programs. Xcel Energy's DSM Regulatory Strategy and Planning Department develops a forecast of the impact of new DSM programs. Impacts from all program installations through 2016 are assumed to be embedded in the historical data, so only new program installations are included in the DSM adjustment. The impacts of DSM savings by customer class are converted from calendar month sales volumes to billing month sales volumes. The resulting DSM savings sales volumes are used to reduce the class level sales forecasts that result from the modeling process.

Q. DID THE COMPANY USE SIMILAR METHODOLOGIES TO DEVELOP THE FORECAST PRESENTED IN ITS 2015 GAS RATE CASE IN PROCEEDING NO. 15AL-0135G?

A. Yes. The Company relied on regression and trend analysis techniques to develop the forecast presented in its 2015 Gas Rate Case. One change that the Company has made since the 2015 Gas Rate Case is to include gas volumes transported to Public Service's Transportation Full rate Commercial and Industrial customers when modeling the Commercial and Industrial sector sales and volumes. This change was made so that the entire population of Commercial and Industrial customers capable of moving between sales and transportation services is modeled together.

Q. HOW ACCURATE WAS THE COMPANY'S FORECAST PRESENTED IN ITS 2015 GAS RATE CASE IN PROCEEDING NO. 15AL-0135G?

A. The Company presented a MYP for 2015-2017 in its 2015 Gas Rate Case. Actual results are available for 2015 and 2016 and show that the Company's forecasts of total retail sales and customer counts were very accurate. For example, the Company's Rebuttal testimony forecast of total customers was less than 300 customers different (0.0 percent) than actual customer counts. The Company's Rebuttal forecast of total retail sales developed using the regression methodology was less than 400,000 Dth (0.3 percent) higher than weather-normalized actual retail sales. The variances for the transportation forecasts were larger, as reflected in Table JEM-D-3 below, but this is not surprising given the greater volatility historically seen in this class. Table JEM-D-3 provides the customer forecast variances for the forecasts presented in the 2015 Gas Rate Case and Table JEM-D-4 provides the throughput variances.

Table JEM-D-3 2015 Gas Rate Case Customer Forecast Variance

Class	Year	Actual	Direct	Diff	% Diff	Rebuttal	Diff	% Diff
Residential	2015	1,248,169	1,247,605	564	0.0%	1,247,871	298	0.0%
	2016	1,262,092	1,261,989	103	0.0%	1,262,571	-479	0.0%
Non-Residential	2015	107,020	106,881	139	0.1%	107,066	-46	0.0%
	2016	107,666	107,146	520	0.5%	107,389	277	0.3%
Total	2015	1,355,189	1,354,487	702	0.1%	1,354,937	252	0.0%
	2016	1,369,758	1,369,135	623	0.0%	1,369,960	-202	0.0%

Table JEM-D-4 2015 Gas Rate Case Throughput Forecast Variance (Dth)

Class	Year	Actual	Direct	Diff	% Diff	Rebuttal	Diff	% Diff
Residential	2015	97,288,145	97,356,521	-68,377	-0.1%	98,647,000	-1,358,855	-1.4%
	2016	96,660,368	97,187,689	-527,321	-0.5%	98,146,658	-1,486,289	-1.5%
Commercial and Industrial	2015	39,993,585	38,344,060	1,649,525	4.3%	39,017,902	975,683	2.5%
	2016	39,906,003	38,246,116	1,659,887	4.3%	38,574,914	1,331,089	3.5%
Total Sales	2015	137,281,729	135,700,582	1,581,148	1.2%	137,664,902	-383,172	-0.3%
	2016	136,566,372	135,433,805	1,132,567	0.8%	136,721,572	-155,200	-0.1%
Transportation	2015	106,590,738	98,828,521	7,762,217	7.9%	101,365,990	5,224,748	5.2%
	2016	113,329,929	109,661,620	3,668,309	3.3%	105,265,421	8,064,508	7.7%
Total Throughput	2015	243,872,467	234,529,102	9,343,365	4.0%	239,030,892	4,841,576	2.0%
	2016	249,896,301	245,095,425	4,800,876	2.0%	241,986,994	7,909,307	3.3%

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 gas throughput are provided in Attachment JEM-2, and the regression models and associated statistics used in the Company's projections of gas customers are provided in Attachment JEM-3. These schedules include, by customer 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 SALES 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 demonstrate very high R-squared statistics. The R-squared statistics are larger than 0.98 for all regression models -- *i.e.,* the regression models explain more than 98 percent of the historical customers and sales variability.

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 except two were statistically significant at the 95 percent confidence level or higher. For the two exceptions, one variable was statistically significant at the 94.8 percent confidence level and the other was statistically significant at the 93.1 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 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.

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 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.

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 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.

Q. HAS THE COMPANY RELIED ON FORECASTS OF GAS SALES AND TRANSPORTATION VOLUMES IN OTHER REGULATORY FILINGS?

A. Yes. The Company has relied on forecasts of gas sales and/or transportation volumes for Demand Side Management Cost Adjustment filings, the Gas Purchase Plan, and Gas Cost Adjustment filings.

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

A. Yes. I believe the Company's methodologies for forecasting throughput and customer numbers are sufficiently robust to provide 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.

Q. IS YOUR FORECASTING METHODOLOGY SUFFICIENTLY FLEXIBLE TO ALLOW MODIFICATION IN THE EVENT OF ANY SIGNIFICANT CHANGES IN ECONOMIC OR OTHER CONDITIONS?

A. Yes. As new economic information or other information becomes available, our models can be quickly updated to reflect any significant changes in economic and other relevant conditions and to provide the most up-to-date forecast available.

B. Data Preparation

Q. PLEASE DESCRIBE THE DATA AND DATA SOURCES THE COMPANY RELIED ON TO DEVELOP THE GAS THROUGHPUT AND CUSTOMER FORECASTS.

A. Historical billing month throughput, monthly number of customers, and billing month rate revenues by rate class were obtained from Company billing system reports. Historical natural gas prices for the Residential and the Commercial and Industrial sales classes were calculated by dividing the billing month rate revenues by total sales volumes. The forecast of gas prices was based on the monthly change in prices from a Weighted Average Cost of Gas forecast and adjusted for losses and base rate inflation.

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

A. Weather is measured in heating degree days, which are calculated using a 65 degree 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.

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

A. Yes. The heating degree days were weighted by the number of times a particular day was included in a particular billing month. These weighted heating degree days were divided by the total billing cycle days to arrive at average heating 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 (89.8 percent) of its Residential gas sales is within the Front Range region[5] or the eastern part of the state. Based on total Residential gas sales in 2016, only 10.2 percent of sales were made to customers located outside the Front Range region. These include the Western Division (5.1 percent), the San Luis Valley Division (0.7 percent), and the Mountain Division (4.4 percent). Since these sales represent such a small proportion of the total, it is appropriate to use only the weather station at Denver International Airport.

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 30-year rolling average of historical values. Daily normal heating degree days

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

were calculated by averaging 30 years of daily heating degree days using data from 1987 to 2016. These daily normal heating degree days were weighted by billing cycle information to derive normal billing month heating degree days in the same manner as the historical actual heating degree days were calculated. Public Service has calculated normal weather in the manner since 2001, and the Commission has accepted or approved both the calculation of normal weather and the weather-normalization process, which I describe later in my Direct Testimony, in the Company's two prior gas rate cases in Proceeding No. 15AL-0135G[6] and Proceeding No 12AL-1268G.[7]

Q. DOES NOAA ALSO CALCULATE 30-YEAR NORMALS?

A. Yes. However, NOAA updates its normals every 10 years. By rolling the normals annually, the Company is using the most current data available, thus minimizing the potential impact of any underlying trends in the actual weather data.

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

A. Historical and forecasted economic and demographic variables for the state of Colorado and the nation were obtained from Global Insight, Inc. The forecasts from Global Insight, Inc. were obtained in January 2017, and reflected the most current information available at the time the forecast was developed. The variables used in the model include Colorado population, personal income, and Gross State Product. This information is used to determine the historical

[6] Decision No. C16-0123, Order Paragraph 6 and Recommended Decision R15-1204, Paragraph 268.
[7] Decision No. C13-1568, Order Paragraph 3 and Recommended Decision R13-1307, Paragraph 465.

relationship between customers and sales, and economic and demographic measures. Table JEM-D-5 provides a summary of the historical and forecasted indicators for 2012 through 2020.

Table JEM-D-5 Colorado Economic Indicators

Year	Real Gross State Product		Real Personal Income		Population	
	B2009$	Annual % Ch	M2009$	Annual % Ch	Thousands	Annual % Ch
2012	257.7	2.1%	218,065	4.6%	5,200	1.4%
2013	265.7	3.1%	225,910	3.6%	5,278	1.5%
2014	277.9	4.6%	239,746	6.1%	5,363	1.6%
2015	286.8	3.2%	249,121	3.9%	5,460	1.8%
2016	290.9	1.4%	254,919	2.3%	5,552	1.7%
2017	297.9	2.4%	263,424	3.3%	5,643	1.6%
2018	306.8	3.0%	274,161	4.1%	5,732	1.6%
2019	315.2	2.7%	284,156	3.6%	5,819	1.5%
2020	323.0	2.5%	292,846	3.1%	5,901	1.4%

Q. WHY DOES PUBLIC SERVICE USE STATEWIDE DATA RATHER THAN DATA THAT MATCHES THE GEOGRAPHY OF THE PUBLIC SERVICE SYSTEM?

A. There are several reasons. First, to develop economic and demographic data that most closely represents the service territory level would require summing the various economic and demographic indicators on a county-level basis for the counties in which Public Service provides gas sales service. Statewide economic and demographic data are generally more readily available from reliable and credible sources and are more commonly reported and analyzed than county-level data.

Second, it is appropriate to use statewide data because the counties in which Public Service provides gas sales service account for the majority of the state's economy, with nearly all large counties and cities represented in Public Service's service territory. In fact, 78.5 percent of the state's population is located in these counties.

Third, an assessment of population trends for both the state and the service territory indicates very little difference between the two, on both a historical and a forecast basis. Historical and forecast population is available from the Colorado State Demography Office and is one of the few indicators available at an annual frequency and on a county-level basis. Historically, the average annual percent growth in the gas service territory population has been almost identical to the growth in the state's population. For the time period 2006 through 2016, service territory population increased at an annual average rate of 1.7 percent, while statewide population increased at 1.6 percent per year on average. The forecast of population growth from 2017 through 2020 is also nearly identical, with the service territory level projected to increase at an annual average rate of 1.74 percent, and the statewide population projected to grow at an average annual rate of 1.71 percent. As is evident from these statistics, there is very little difference in either the historical or projected rate of population growth between the two groups of data.

Q. PLEASE DISCUSS THE COMMISSION'S RECENT ORDER TO USE METROPOLITAN STATISTICAL AREA ("MSA") AGGREGATED DATA IN PROCEEDING NO. 16A-0396E.[8]

A. In the Company's Electric Resource Plan proceeding, the Commission ordered the Company to use MSA-aggregated data to develop the electric demand and sales forecasts used for the Company's resource planning. The Commission determined that MSA-aggregated data is more tailored to the Company's service area than state-level data because the Company's service area has stronger economic growth indicators as compared to the indicators for the State of Colorado as a whole.

Q. DID THE COMPANY CONSIDER USING MSA-AGGREGATED DATA TO DEVELOP THE GAS FORECAST PRESENTED IN YOUR TESTIMONY?

A. Yes. The Company developed the gas forecast presented here using state-wide economic indicators before the Commission issued an order in Proceeding No. 16A-0396E. After the Commission issued its decision in this proceeding involving the Company's Electric Resource Plan, the Company developed a new forecast based on MSA-aggregated economic indicators representing the Company's gas service area (Denver, Boulder, Fort Collins, Pueblo, and Grand Junction). The MSA-aggregated economic indicators have grown at a faster rate than the state indicators over the past few years, and are generally expected to grow at a slightly faster pace (around 0.1 percent per year faster) over the next few years.

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[8] Decision No. C17-0316, Paragraph 59.

Q. WHAT WERE THE RESULTS OF USING MSA-AGGREGATED DATA?

A. The forecast based on MSA-aggregated indicators is very similar to, but slightly lower than, the forecast based on state level indicators. The MSA-based Residential customer count forecast is 5,600 customers (0.4 percent) lower in 2020, and total sales are 600,000 Dth (0.5 percent) lower in 2020.

Q. WHY IS THE MSA-BASED FORECAST LOWER, GIVEN THE MSA-BASED INDICATORS ARE GROWING AT A FASTER RATE?

A. When the regression models are re-estimated using MSA-aggregated data in place of state data, the relationships between the historical customers and sales and the economic indicators are redefined. Using Residential customers as an example, the state indicator-based model identifies the relationship of 0.938 between customer growth and population growth. This is known as the elasticity between the two series, and means that a one percent change in state population results in a 0.938 percent change in customers. The MSA indicator-based model identifies the relationship as 0.866, *i.e.*, a one percent change in MSA population results in a 0.866 percent change in customers. Stated another way, based on the historical relationships, a faster growing economic indicator produces a smaller percent change in customers than a slower growing economic indicator. Thus, using faster growing MSA indicators may not result in a higher customer or sales forecast, and in this case, it did not.

Q. IS IT MORE ACCURATE TO USE METROPOLITAN STATISTICAL AREA ("MSA") DATA THAN STATEWIDE DATA TO REPRESENT THE COMPANY'S SERVICE TERRITORY?

A. A review of the regression model statistics can provide some insight into which approach – MSA or state – more accurately fits the historical customers and sales being modeled. The model statistics indicate that the regression models developed using MSA data are not statistically better than models developed with statewide data. Because the MSA-based models are not statistically better, and the resulting forecasts are not materially different, I conclude that using the statewide data is appropriate and results in a customer and sales forecast that appropriately reflects future growth in the Company's service area.

V. WEATHER NORMALIZATION OF HISTORICAL GAS THROUGHPUT

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

A. The purpose of this section of my testimony is to explain the Company's weather normalization methodology and its application to the HTY sales and revenues in this proceeding.

Q. HOW ARE HISTORICAL GAS SALES WEATHER NORMALIZED?

A. In order to calculate sales growth from year to year not influenced by weather, the Company estimates the Dth impact of the deviation from normal weather, or "weather-normalized" sales. The Company uses actual and normal weather as I previously described, 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 both the Residential class and the Commercial and Industrial sales class, including Public Service's Transportation Full rate Commercial and Industrial customers.

The weather response coefficients are the regression coefficients from the weather variables included in weather normalization regression models that quantify the relationship between sales and weather. The weather variables are expressed as customer-weighted heating degree days, with a different variable defined for each month that exhibits a statistically significant weather response. The coefficient effectively represents the Dth per heating degree day per customer of weather response.

The Company uses a statistical software package[9] 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 degree days are used as individual variables (*i.e.,* January heating degree days, February heating 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 heating degree days from normal. This impact is then applied to the actual billed sales to derive weather-normalized sales. If weather is warmer than normal, the normalization process results in weather-normalized sales that are higher than actual sales. Conversely, if weather is colder than normal, the normalization process results in weather-normalized sales that are lower than actual sales.

[9] Metrix ND 4.5.1, Copyright © 1997-2011, Itron, Inc., http://www.itron.com

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

A. No. The Company has been using this weather normalization process for gas sales for business analysis and internal and external reporting purposes since 2001. This weather normalization process was accepted by the Commission in the Company's last two gas rate cases. The only aspect that is different from the last two rate cases is that the Company has weather normalized the throughput volumes for the Transportation Full rate Commercial and Industrial customers. As I explained previously, the Transportation Full rate Commercial and Industrial customers can take sales or transport volumes, and, therefore, exhibit weather sensitivity similar to the Commercial and Industrial sales customers. The Company has identified the transportation volumes for this group of Transportation Full rate customers and included this group in the weather normalization process.

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 10-K filing. As such, oversight of the weather response coefficients is part of the Company's internal controls over financial reporting.

Q. DID THE COMPANY WEATHER NORMALIZE THE 2016 HISTORICAL TEST YEAR SALES USED BY MR. BERMAN TO CALCULATE PRESENT BASE RATE REVENUE?

A. Yes. The work papers supporting the weather normalization of the 2016 HTY throughput are provided as Attachment JEM-4. Weather for the HTY was 8.3 percent warmer than normal, which resulted in weather-normalized HTY sales that are 7,652,543 Dth (5.6 percent) higher than actual HTY sales.

Q. DOES THE COMPANY USE THE SAME PROCESS TO WEATHER NORMALIZE HISTORICAL GAS TRANSPORTATION VOLUMES FOR LDC DELIVERIES?

A. No. The process to weather normalize historical gas transportation volumes for LDC deliveries is different. A base load volume is established equal to July delivered volumes (historically the month with the fewest heating degree days). The base load volume is then subtracted from the historical monthly volumes to establish the estimated weather-sensitive portion of load. A correction percentage is then applied to the weather-sensitive volumes reflecting the difference between the actual monthly heating degree day data for the historical month based on local data reports from the National Climatic Data Center, and the normal heating degree days under the NOAA weather for the 30 year period

1981 – 2010. The resulting calculated volume is considered the volume attributable to weather conditions either colder or warmer than normal. This volume is then added to or subtracted from the total LDC throughput volume.

Deliveries to third party LDC's can be volatile because in some areas the LDC has the ability to receive gas supplies from other transportation sources. Because the annual volatility can be due to factors other than weather, the statistical approaches used for other classes does not work as well with the LDC volumes. The weather normalization of the LDC class is done solely to establish a baseline for forecasting purposes. However, the Company does not use this weather normalization for any internal or external reporting purposes.

VI. RATE SHEET FORECAST

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

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

Q. IN ADDITION TO THE CUSTOMER CLASS LEVEL FORECAST YOU DESCRIBED ABOVE, DO YOU ALSO PREPARE A FORECAST AT THE RATE SCHEDULE LEVEL OF DETAIL?

A. Yes. The rate schedule level of detail is needed to estimate revenues appropriately. For example, the Residential class of service is an aggregation of two rate schedules: Residential Gas Service and Residential Gas Outdoor Lighting Service. Table JEM-D-6 provides a mapping of the rate schedule level of detail to the customer class level. Attachments JEM-5 and 5A provide the MYP gas customer and throughput forecast by month at the rate schedule level of detail.

Table JEM-D-6 Rate Schedule to Rate Class Mapping

Customer Class	Rate Schedules within Customer Class
Residential Sales	◦ Residential Gas Service ◦ Residential Gas Outdoor Lighting Service
Commercial and Industrial Sales	◦ Commercial Gas Service Small ◦ Commercial Gas Service Large ◦ Commercial Gas Outdoor Lighting Service ◦ Interruptible Industrial Gas Service ◦ Firm Gas Transportation Service Small (Back-up Supply) ◦ Firm Gas Transportation Service Large (Back-up Supply) ◦ Interruptible Gas Transportation Service (Back-up Supply) ◦ Interdepartmental
Public Service Electric Transportation	◦ Firm Gas Transportation Service Large ◦ Interruptible Gas Transportation Service
3rd Party Transportation	◦ Firm Gas Transportation Service Small ◦ Firm Gas Transportation Service Large ◦ Interruptible Gas Transportation Service

Q. HOW IS THE RATE SCHEDULE LEVEL FORECAST DERIVED FROM THE CUSTOMER CLASS LEVEL FORECAST?

A. After the class level sales and customer forecasts are completed, the rate schedule level forecasts are developed. Monthly rate schedule sales and customer allocation factors are developed based on historical 2016 rate schedule level sales and customer data. The monthly rate schedule allocation factors are applied to the class level forecasts to derive the rate schedule level forecasts. The transportation forecast is developed at the rate schedule level of detail, so no additional derivation for that service is necessary.

VII. CONCLUSION

Q. PLEASE SUMMARIZE YOUR RECOMMENDATIONS IN YOUR DIRECT TESTIMONY FOR THE COMMISSION TO CONSIDER.

A. I recommend that the Commission adopt the Company's forecasts of gas throughput and customers, as reflected in Attachment JEM-1, 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

Jannell E. Marks

February 2007 – Present

Director, Sales, Energy and Demand Forecasting, Xcel Energy

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. 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. Testified on forecasting issues before the Public Utility Commission of Texas, the Colorado Public Utilities Commission, the Minnesota Public Utilities Commission, the North Dakota Public Service Commission, the South Dakota Public Utilities Commission, the Public Service Commission of Wisconsin, and the New Mexico Public Regulation Commission.

August 2000 – February 2007

Manager, Energy Forecasting, Xcel Energy

Responsible for the development and presentation of forecasted data for Xcel Energy's operating companies and also for reporting historical and statistical information to various regulatory agencies and others. Testified on forecasting issues before the Public Utility Commission of Texas, the Colorado Public Utilities Commission, and the Minnesota Public Utilities Commission.

May 1997 – August 2000

Manager, Demand, Energy and Customer Forecasts, New Century Energies, Inc.

Responsible for developing demand, energy, and customer forecasts for New Century Energies, Inc.'s operating companies. Also directed the preparation of statistical reporting for regulatory agencies and others regarding historical and forecasted reports. Testified on forecasting issues before the Public Utility Commission of Texas and the Colorado Public Utilities Commission.

1991-1997

Senior Research Analyst, Public Service Company of Colorado

Responsible for developing the customer and sales forecasts for Public Service Company of Colorado and the economic, customer, sales and demand forecasts for Cheyenne Light, Fuel and Power Company.

1982-1991

Research Analyst, Public Service Company of Colorado

Education

Colorado State University – Bachelor of Science: Statistics 1982

Training and Professional Associations

I have attended the Institute for Professional Education's Economic Modeling and Forecasting Class; Itron's Forecasting Workshops; and the Electric Power Research Institute's REEPS (Residential End-Use Energy Planning System), COMMEND (Commercial End-Use Planning System), and INFORM (Industrial End-Use Forecasting Model) Training Classes and User Group Meetings.

I am a member of Itron's Energy Forecasting Group and the Edison Electric Institute's Load Forecasting Group.

BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF COLORADO

* * * *

RE: IN THE MATTER OF ADVICE LETTER NO. 912-GAS FILED BY PUBLIC SERVICE COMPANY OF COLORADO TO REVISE ITS COLORADO PUC NO. 6-GAS TARIFF TO IMPLEMENT A GENERAL RATE SCHEDULE ADJUSTMENT AND OTHER RATE CHANGES EFFECTIVE ON 30-DAYS NOTICE.	**) PROCEEDING NO. 17AL-____G**

AFFIDAVIT OF JANNELL E. MARKS
PUBLIC SERVICE COMPANY OF COLORADO

I, Jannell E. Marks, being duly sworn, state that the Direct Testimony and attachments were prepared by me or under my supervision, control, and direction; that the 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 twenty-fourth day of May 2017.

Jannell E. Marks
Jannell E. Marks
Director, Sales, Energy and Demand Forecasting

Subscribed and sworn to before me this 24 day of MAY, 2017.

AMANDA G. ALLEN
NOTARY PUBLIC
STATE OF COLORADO
NOTARY ID 20164011605
MY COMMISSION EXPIRES MARCH 24, 2020

Notary Public

My Commission expires 03/24/2020