BEFORE THE PUBLIC SERVICE COMMISSION OF UTAH

IN THE MATTER OF THE APPLICATION OF QUESTAR GAS COMPANY TO MAKE TARIFF MODIFICATIONS TO CHARGE TRANSPORTATION CUSTOMERS FOR PEAK HOUR SERVICES	Docket No. 17-057-09

REBUTTAL TESTIMONY OF DAVID C. LANDWARD

FOR DOMINION ENERGY UTAH

August 25, 2017

DEU Exhibit 2.0R

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I. INTRODUCTION

Q. Please state your name and business address.

A. My name is David Christian Landward. My business address is 333 South State Street, Salt Lake City, Utah.

Q. What is your title and area of responsibility?

A. I am a Regulatory Analyst for Dominion Energy Utah (Dominion Energy or Company). My responsibilities include forecasting gas demand and customer growth and preparing the estimate of firm sales and transportation demand on a design peak day for the Integrated Resource Plan.

Q. What is you experience and educational background?

A. I have a Bachelor of Science in Mathematics and a Master of Statistics degree from the University of Utah. I've worked for Dominion Energy Utah for the last 22 Years. I began in meter reading and then worked in information technology before I joined the regulatory affairs area in 2008.

Q. What is the purpose of your testimony in this Docket?

A. In his testimony, Mr. Lubow has stated conclusions regarding the estimation of design day demand that are based on an incomplete analysis. In particular, he has excluded the effects of key variables on firm sales demand. The purpose of my testimony is to address each of those variables and how they are used in the estimation of demand under design day conditions.

II. DESIGN DAY

Q. On page 10 of his testimony, Mr. Lubow compares actual firm sales to Design Day requirements in DPU Exhibit 2.2 DIR and concludes that no additional peak hour services are needed at this time. Is this a good assessment?

A. No. Mr. Lubow tries to draw a relationship between historical data and design day, but he omits critical variables in his analysis. He briefly discusses temperature in his testimony but neglects other significant factors, namely wind, prior day demand, day of the week, and holidays. The Company's design day model accounts for all of these factors and uses the historical data to estimate demand under a design day scenario.

Q. Can you explain in more detail how your design day model was developed?

A. The design day model is a multivariate regression analysis of historic daily firm sales data since 2004. The statistically significant variables in the model include heating degree days, mean wind speed, maximum sustained wind gust, day of the week, holidays, and prior day demand. To determine the design day demand for any given Integrated Resource Plan (IRP) year, it is assumed that heating degree days will be 70 (65 degrees Fahrenheit minus -5 degrees); maximum sustained wind speed will be 47 miles per hour; average wind speed will be 26 miles per hour; and that the day will not be a Friday, Saturday or Sunday and will not fall on a holiday, specifically Thanksgiving, Christmas Eve, Christmas Day, or New Year's Day. It should be noted that the Company has explained this modeling approach in various IRP workshops in the past.

Q. How do each of the variables mentioned effect your design day calculation?

A. Let me provide a simple example using the high demand day from the 2016/2017 heating season. On the January 6, 2017 gas day, sales customers used 974,095 Dth. I have outlined the conditions on that day in the table below. Note that these conditions are measured on a gas-day basis which extends from 8:00 A.M. to 8:00 A.M. of the following day:

1	Mean Temperature	4.5 degrees
2	Mean Wind Speed	4.6 miles per hour
3	Maximum Wind Speed	9 miles per hour
4	Day of week	Friday
5	Prior day usage	917,532 Dth

When I apply these 5 factors to the model, the estimate of firm sales demand is 958,098 Dth. This is 15,997 Dth, or 1.6%, lower than the actual demand of 974,095 on that gas day.

Q. How do the conditions that occurred on January 6, 2017 compare with the conditions on a design day?

A. A comparison of the factors is shown in the table below:

		January 6, 2017	Design Day
1	Mean Temperature	4.5 degrees	-5 degrees
2	Mean Wind Speed	4.6 miles per hour	26 mph
3	Maximum Wind Speed	9 miles per hour	47 miles per hour
4	Day of week	Friday	Mon-Thur, No Holiday
5	Prior day usage	917,532 Dth	882,609 Dth

Q. Please explain how these variables affect the difference between the demand on January 6, 2017 and the design day demand estimate.

A. I will address each factor and explain the effect of each on the design day estimate.

Q. Please discuss prior day usage.

A. Prior day usage shows a strong positive correlation with contemporaneous usage. This means that when other factors are accounted for, an increase in usage on a given day generally precedes an increase in usage on the following day. Such a statistical relationship is referred to as first-order autocorrelation and must be accounted for in this type of analysis. A design day scenario is not a forecast of usage at one step ahead of the end of a historical time series; rather, it is an isolated, extreme case that is not linked to a particular date. Nevertheless, to adequately estimate design day demand the prior day usage must be accounted for and therefore estimated. For the design day scenario, a prior day usage of 882,609 Dth was estimated from the same historical data using conditions derived by identifying the maximum value of each variable per year and computing the prior day's portion of that maximum value. The average portion across all years in the data is calculated for each variable and then applied to design day conditions to derive prior day conditions. These prior day conditions are then used to statistically estimate an average demand under such conditions which then serves as the prior day demand value for the estimation of design day usage. It should be noted that this estimated prior day demand is lower than that seen on January 5, 2017. Consequently, an estimate of demand on the January 6 gas day under actual conditions is higher by 14,687 Dth when the actual demand on the January 5 gas day is used instead of the estimated prior day figure.

Q. Please discuss the effect that temperature has on the design day estimate.

A. As Mr. Lubow mentioned, the design day temperature is a mean temperature based on a once in twenty year event, and the last time the temperature was near -5 degrees was in 1990. If, on January 6, 2017, temperatures had been -5 degrees rather than 4.5 degrees, the design day demand would increase by 104,880 Dth to 1,048,291 Dth.

Q. Please discuss the effect that wind speed has on the estimated design day usage?

A. Wind speed has a significant positive effect on gas demand. On average when other factors are accounted for, demand increases with an increase in wind speed. The maximum wind speed of 47 mph and the average wind speed of 26 mph are used to estimate the design day demand.

Q. Are these wind speeds a "one in twenty year event?"

A. No, these wind speeds are much more frequent in occurrence. The maximum wind speed of 47 mph occurred in February 16, 2011. The maximum average wind speed on 26 mph occurred on January 27, 2008. A summary of the maximum and mean wind speeds for the last 13 years is provided in the table below:

	Year	Maximum wind	Mean Wind
1	2004	43	22.6
2	2005	37	21.1
3	2006	36	21.6
4	2007	37	20.7
5	2008	43	25.7
6	2009	39	20.8
7	2010	36	24.5
8	2011	47	21.3
9	2012	38	23.4
10	2013	38	17.4
11	2014	38	18.6
12	2015	40	21
13	2016	36	19.8
14	2017	35	24.8

High winds in the Company's service territory are a real and frequent occurrence and must be considered when planning for an extreme cold weather event because of the positive effect on gas demand.

Q. Why is it important to think about wind speed when comparing high demand days to design peak days?

A. While the temperatures were low during the high demand days, wind speeds were relatively low. The table below shows the average and maximum wind speed on the high demand days for the last three years.

	Design Firm Sales	Actual Firm Sales	Actual Mean Temp	Actual Mean Wind	Actual Max Wind
2014/2015	1,285,857	996,189	12	5.4 mph	12 mph
2015/2016	1,305,701	880,378	10	3.8 mph	9 mph
2016/2017	1,316,588	974,095	6	4.6 mph	9 mph

Note that the highest firm sales demand occurred during the 2014/2015 heating season. Between the two days, the mean temperature on the 2014/2015 high demand day was six degrees warmer, and the Company was serving fewer customers on that day than it was on the 2016/2017 high demand day. However, the wind speed was higher, and consequently, the demand was as well. This illustrates the effect that wind speed alone can have on heating load.

It is not surprising or concerning that the actual firm sales demand has been 20% below design day demand levels in recent years. Lower temperatures coupled with high wind will quickly increase the usage level and make up the 20% difference.

Q. What effect does wind have on the design day estimate?

A. When the average wind speed for the January 6, 2017 gas day of 4.6 mph is replaced with the design value of 26 mph, and the maximum sustained gust of 9 mph is likewise replaced with the design value of 47 mph, the estimated demand increases by 283,464 Dth. As the data show, wind has a significant effect usage.

Q. What effect does the day of the week have on the design day estimate?

A. While the day of the week has a comparatively smaller effect on demand than wind or temperature, it is nonetheless a factor that has statistical significance and must be accounted for. When the model is adjusted to estimate demand under design wind and temperature conditions that occur on a weekday other than Friday and not on a holiday, the design day estimate increases by 10,589 Dth. The resulting demand of 1,342,344 Dth is reduced by 5,164 Dth to account for daily firm demand that shifts from sales to transportation during the

2017/2018 heating season. The result is the 2017/2018 design day firm sales estimate of 1,337,180 Dth stated in the 2017/2018 IRP.

Q. Can you summarize all of the changes you have discussed?

A. Yes. The changes are shown in the table below:

	Scenario	Estimated Demand in Dth	Change in Dth
1	January 6, 2017 Estimate	958,098 Dth	-
2	Reduce Prior day usage to 882,609 Dth	943,411	(14,687)
3	Reduce temperature from 4.5 degrees to -5 degrees	1,048,291	104,880
4	Increase average wind speed from 4.6 to 26 mph and maximum gust speed from 9 to 47 mph	1,331,755	283,464
5	Change day of week from Friday to non-holiday weekday	1,342,344	10,589
6	Reduce by 5,164 Dth to account for daily firm sales shifting to firm transportation service	1,337,180	(5,164)

Q. Can you summarize the statistical analysis done to estimate the effect of each variable addressed in your testimony and to assess the statistical significance of each?

A. Yes. The analysis is done using multivariate, ordinary least squares regression on data extending back to January 1, 2004. The coefficient estimate and statistical significance result of each variable is listed in the table below. A t- statistic value of approximately 2.0 or higher indicates statistical significance at the 5% alpha level. The coefficient estimates are updated annually as new data are added to the data set. Note that heating degree days (HDD) are modeled to capture the non-linear response of firm demand to an increase in HDD. This is done through exponentiation of the HDD variable. This derivation lowers the t-statistic of the non-exponentiated HDD value, but its significant effect is nonetheless verified by the t-statistics of the exponentiated values. Similarly, the mean wind speed is modeled with an interaction with HDD to capture its changing effect on firm sales as HDD increases. This interaction derivation also lowers the mean wind speed t-statistic, but its statistical significance is likewise verified by the t-statistic of the interaction term.

	Coefficient	**Estimate**	**T Statistic**
1	Intercept	50916.91	32.870
2	Heating Degree Days (HDD)	60.21	0.218
3	HDD^2	417.67	16.350
4	HDD^3	-7.69	-9.479
5	HDD^4	0.05	5.956
6	Prior Day Demand	0.42	91.045
7	Friday	-10589.16	-11.15
8	Weekend	-10611.01	-14.42
9	Maximum Wind Gust (mph)	379.8	3.679
10	Mean Wind Speed (mph)	232.95	1.063
11	HDD*Mean Wind Speed	178.94	23.4
12	Holiday	-14675.04	-4.630
13	Adjusted R-squared Value: 0.9893	F-statistic: 4.036	

Q. Can you summarize your testimony?

A. Yes. Mr. Lubow's comparison of actual high usage days to design days is not an appropriate measure of our customers' collective need. The Company must take all of these factors into consideration when planning for a design peak day. To do otherwise would place customers at unreasonable risk of loss of service when a design peak day occurs. Mr. Lubow's analysis ignores important and statistically significant factors that affect firm sales demand.

Q. Does this conclude your testimony?

A. Yes.

State of Utah)
) ss.
County of Salt Lake)

I, David C. Landward, being first duly sworn on oath, state that the answers in the foregoing written testimony are true and correct to the best of my knowledge, information and belief. Except as stated in the testimony, any exhibits attached to the testimony were prepared by me or under my direction and supervision, and they are true and correct to the best of my knowledge, information and belief. Any exhibits not prepared by me or under my direction and supervision are true and correct copies of the documents they purport to be.

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David C. Landward

SUBSCRIBED AND SWORN TO this _____ day of August, 2017.

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Notary Public