Exhibit No.: _____
Issue: Test-Year Sales Normalization
Witness: Eric Fox
Type of Exhibit: Direct Testimony
Sponsoring Party: The Empire District Electric Company
Case No.: ER-2021-0312
Date Testimony Prepared: May 2021

Before the Public Service Commission
of the State of Missouri

Direct Testimony

of

Eric Fox

on behalf of

The Empire District Electric Company

May 2021

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THE EMPIRE DISTRICT ELECTRIC COMPANY
BEFORE THE MISSOURI PUBLIC SERVICE COMMISSION
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DIRECT TESTIMONY OF ERIC FOX
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I. INTRODUCTION

Q. Please state your name and business address.

A. My name is Eric Fox. My business address is 20 Park Plaza, 4th Floor, Boston, Massachusetts, 02116.

Q. By whom are you employed and in what capacity?

A. I am employed by Itron, Inc. ("Itron") as Director, Forecast Solutions.

Q. On whose behalf are you testifying in this proceeding?

A. I am testifying on behalf of The Empire District Electric Company ("Empire" or "Company").

Q. Please describe your educational and professional background.

A. I received my M.A. in Economics from San Diego State University in 1984 and my B.A. in Economics from San Diego State University in 1981. While attending graduate school, I worked for Regional Economic Research, Inc. ("RER") as a SAS programmer. After graduating, I worked as an Analyst in the Forecasting Department of San Diego Gas & Electric. I was later promoted to Senior Analyst in the Rate Department. I also taught statistics in the Economics Department of San Diego State University on a part-time basis.

In 1986, I was employed by RER as a Senior Analyst. I worked at RER for three years before moving to Boston and taking a position with New England Electric as a Senior Analyst in the Forecasting Group. I was later promoted to Manager of Load

Research. In 1994, I left New England Electric to open the Boston office for RER, which was acquired by Itron in 2002.

Over the last 25 years, I have provided support for a wide range of utility operations and planning requirements including forecasting, load research, weather normalization, rate design, financial analysis, and conservation and load management program evaluation. Clients have included traditional integrated utilities, distribution companies, independent system operators, generation and power trading companies, and energy retailers. I have presented various forecasting and energy analysis topics at numerous forecasting conferences and forums. I also direct electric and gas forecasting workshops that focus on estimating econometric models and using statistical-based models for monthly sales and customer forecasting, weather normalization, and calculation of billed and unbilled sales. Over the last few years, I have provided forecast training to several hundred utility analysts and analysts in other businesses.

In the area of energy and load weather normalization, I have implemented and directed numerous weather normalization studies and applications used for utility sales and revenue variance analysis and reporting and estimating booked and unbilled sales and revenue. This work has included developing weather normalized class profiles for cost allocation and rate design, estimating rate class hourly profile models to support retail settlement activity, weather normalizing historical billing sales for analyzing historical sales trends, developing customer class and weather normalized end-use profiles as part of a utility integrated resource plan, and developing normal daily and monthly weather data to support sales and system hourly load forecasting. Recent work has included evaluating temperature trends as part of regional climate change assessments and translating trends into long-term energy and demand impacts. My resume is included in Direct Schedule EF-1.

Q. Have you previously testified before the Missouri Public Service Commission ("Commission") or any other regulatory agency?

A. Yes. I provided weather normalization testimony for Empire's 2019 general rate case (Case No. ER-2019-0374). I have also provided testimony related to weather normalization and forecasting before other regulatory agencies. My regulatory experience is included in Direct **Schedule EF-1**.

Q. What is the purpose of your Direct Testimony in this proceeding?

A. The purpose of my Direct Testimony is to support test-year sales and system load weather normalization. The test-year period includes October 2019 through September 2020. I directed the development of rate class and system weather normalization models, calculation of actual and normal test-year weather variables, and estimation of test-year normalized sales; this included normalizing sales for the COVID-19 economic disruption.

Q. Are you sponsoring any schedules with your testimony?

A. Yes. I am sponsoring Direct **Schedule EF-2**, which shows calculated test-year weather normalized sales, and Direct **Schedule EF-3**, which includes the estimated weather response models and associated model statistics.

Q. From what sources was the information contained in the schedules obtained?

A. The normalized rate-class sales are based on historical load research data and billed sales and customer data provided by the Company. Historical and normal weather data were provided by the Staff of the Commission ("Staff").

II. SUMMARY

Q. What is the purpose of weather normalization?

A. The purpose of weather normalization is to adjust the test-year sales and energy for abnormal weather conditions. The objective is to establish test-year sales and energy requirements for determining revenue requirements and costs that reflect typical or normal weather conditions. In addition to the impact of weather, test-year sales are adjusted for the impact of COVID-19. Over the test-year period, the country experienced an economic shift that has never been experienced before as government response to COVID-19, forced business shut-downs and millions of people to work from home. For the Company, this resulted in a significant increase in residential sales and decreases in commercial sales.

Q. Please describe test-year weather conditions.

A. The test-year period includes a relatively mild winter with Heating Degree-Days (HDD using a base temperature of 55 degrees) 7.6% below normal. On a calendar-month basis, cooling requirements, as measured by Cooling Degree-Days (CDD using a base temperature of 65 degrees), are close to normal. However, on a billing-month basis, CDD are 8.5% higher than normal. The reason for the difference is that the test-year October billing-month includes usage from unusually warm weather in September (2019) because the first billing cycle for October started on September 4. Table 1 shows the test-year actual and normal CDD (base of 65 degrees) and HDD (base of 55 degrees) for the calendar test-year period and Table 2 shows CDD and HDD for the test-year billing month period.

Table 1: Test-Year Actual and Normal Calendar-Month Degree-Days

Date	CDD65	NrmCDD65	HDD55	Nrm HDD55
Oct-19	38.7	20.6	104.8	58.0
Nov-19	-	-	354.7	268.9
Dec-19	-	-	441.8	585.8
Jan-20	-	-	563.2	675.2
Feb-20	-	-	511.0	529.2
Mar-20	5.0	-	176.2	288.7
Apr-20	8.3	14.6	112.8	78.6
May-20	47.3	87.3	36.0	4.6
Jun-20	319.2	276.9	-	-
Jul-20	476.0	424.3	-	-
Aug-20	341.7	405.6	-	-
Sep-20	162.3	165.5	-	-
Total	**1,398.5**	**1,394.7**	**2,300.5**	**2,489.0**

Table 2: Test-Year Actual and Normal Billing Month Degree-Days

Date	CDD65	NrmCDD65	HDD55	Nrm HDD55
Oct-19	224.2	87.5	21.2	11.0
Nov-19	3.9	2.6	244.6	166.3
Dec-19	-	-	402.4	419.9
Jan-20	-	-	494.0	616.9
Feb-20	-	-	541.5	624.1
Mar-20	0.2	-	365.0	430.8
Apr-20	10.1	8.6	151.3	184.7
May-20	15.6	31.7	68.4	33.8
Jun-20	221.4	226.9	12.2	1.7
Jul-20	397.2	351.6	-	-
Aug-20	400.4	403.5	-	-
Sep-20	286.1	324.5	-	-
Total	**1,559.1**	**1,436.8**	**2,300.5**	**2,489.0**

Q. What is the basis for normal CDD and HDD variables?

A. Normal CDD and HDD are derived from temperature data from the Springfield-Branson National Airport based on a 30-year average. Staff provided an Excel file with the daily normal degree-days for the test-year period.

Q. Why was the Staff's information utilized?

A. The Commission has previously utilized Staff's approach for calculating normal weather in prior cases, and Empire does not object to the use of this approach. Staff defines a temperature variable that is a weighted average of the current-day (2/3 weighting) and prior-day (1/3 weighting). For modeling consistency, actual daily degree-days are also calculated using the weighted temperature concept. The Staff spreadsheet calculates daily normal weighted temperature and rotates the daily normal temperature to align with the actual test-year weather pattern. Normal daily degree-days for different temperature breakpoints (e.g., CDD with 65, 70, and 75 degrees) are calculated from the daily normal temperature series. The Staff's approach for calculating daily normal temperatures are reasonable and have been commonly utilized for the purpose of normalizing test-year sales.

Q. What is the weather impact on test-year sales?

A. Table 3 shows the test-year weather normalized sales for those customer classes whose usage is weather-sensitive. Normalized sales reflect actual and normal weather for the billing month period.

Table 3: Test-Year Billed Sales (MWh)

Class	Actual	WthrNrm	Wthr Adjustment	Pct Impact
Residential	1,687,410	1,690,496	3,086	0.2%
Commercial	314,761	313,683	-1,078	-0.3%
General Power	806,929	805,892	-1,037	-0.1%
Small Heating	77,552	78,115	563	0.7%
TEB	316,516	318,449	1,933	0.6%
Large Power	760,107	761,212	1,105	0.1%
Total	**3,963,276**	**3,967,847**	**4,571**	**0.1%**

The total weather adjustment is small; sales are adjusted up just 0.1% (4,571 MWh). Sales are adjusted up for milder than normal winter weather conditions and adjusted down for warmer than normal temperatures across most of the cooling months. Rate classes that are more sensitive to changes in HDD (Residential, Small Heating, and Total Electric Building) have small positive adjustments. The Commercial and General Power rate classes, which are less impacted by changes in HDD, are adjusted down for the warmer than normal cooling period weather.

Q. Did COVID-19 impact sales?

A. Yes. State-mandated COVID-19 business shutdowns and shelter-at-home directives had a much larger impact on test-year sales than weather; test-year residential sales are significantly higher, and non-residential sales are significantly lower than in prior years. Given COVID-19 is, hopefully, a onetime event, test-year sales are also adjusted for COVID-19 impacts. Table 4 below shows weather, COVID-19, and total sales adjustment.

Table 4: Test-Year Sales Adjustments (MWh)

Class	Weather	COVID-19	Total
Residential	3,086	(27,955)	(24,869)
Commercial	(1,078)	6,932	5,854
General Power	(1,037)	24,083	23,046
Small Heating	563	1,734	2,297
TEB	1,933	23,913	25,846
Large Power	1,105	33,414	34,519
Total	**4,571**	**62,120**	**66,692**

Total sales are adjusted up by 62,692 MWh – a 1.7% increase over test-year sales. Table 5 shows test-year actual sales, weather-normalized sales, and sales adjusted for both weather and COVID-19 (Total Adjusted).

Table 5: Test-Year Sales (MWh)

Class	Actual	WthrNrm	Total Adjusted
Residential	1,687,410	1,690,496	1,662,541
Commercial	314,761	313,683	320,615
General Power	806,929	805,892	829,975
Small Heating	77,552	78,115	79,849
TEB	316,516	318,449	342,362
Large Power	760,107	761,212	794,626
Total	**3,963,276**	**3,967,847**	**4,029,968**

III. TEST-YEAR SALES NORMALIZATION

Q. Please describe how electric sales are weather normalized.

A. Rate class sales are weather normalized using a set of statistically estimated weather response models; a separate model is estimated for each rate class. The models relate daily average use (derived from load research data) to daily HDD, CDD, and other non-weather variables such as seasons, weekends, and holidays (captured with binary variables). Once estimated, the models are used to generate daily weather impacts based on the difference in actual and normal degree-days. Daily impacts are weighted based on the meter-read schedule and used to generate monthly billed sales adjustment factors. The modeling approach is based on a method developed by the Staff. The Staff's method results in reasonable weather impacts as well as consistent normalized daily peaks and hourly rate class load profiles. The same modeling approach is used for weather-normalizing system energy, peak, and hourly loads.

Q. Please describe how the degree-day weather variables are determined.

A. In the short-term, cooling and heating requirements are primarily driven by changes in temperature. Typically, changes in cooling requirements are modeled with CDD and heating requirements with HDD. NOAA (National Oceanic and Atmospheric Administration) defines CDD and HDD with a 65-degree temperature base. CDD is calculated as the daily average temperature – 65 degrees. CDD is 0 if the temperature is less than or equal to 65 degrees. HDD are the opposite; HDD take on a positive value when temperatures are below 65 degrees. HDD is calculated as 65 – daily average temperature. The HDD is 0 if the average daily temperature is at or above 65 degrees.

CDD with a 65-degree base works well for explaining cooling-related loads though the load/CDD relationship can often be improved by using other temperature breakpoints. Large commercial customers for example, will experience cooling loads with average temperatures as low as 60 degrees; in this case a CDD with temperature base of 60 degrees can improve on the statistical fit. On the heating side, HDD with a defined temperature breakpoint of 60 degrees or 55 degrees generally explains the usage pattern better than the standard 65 degree-day base; there is little measurable heating until average temperature falls below 60 degrees. Figure 1 shows the residential daily use/temperature relationship and Figure 2 the commercial use/temperature relationship.

Figure 1: Residential Rate Class Usage/Weather Relationship

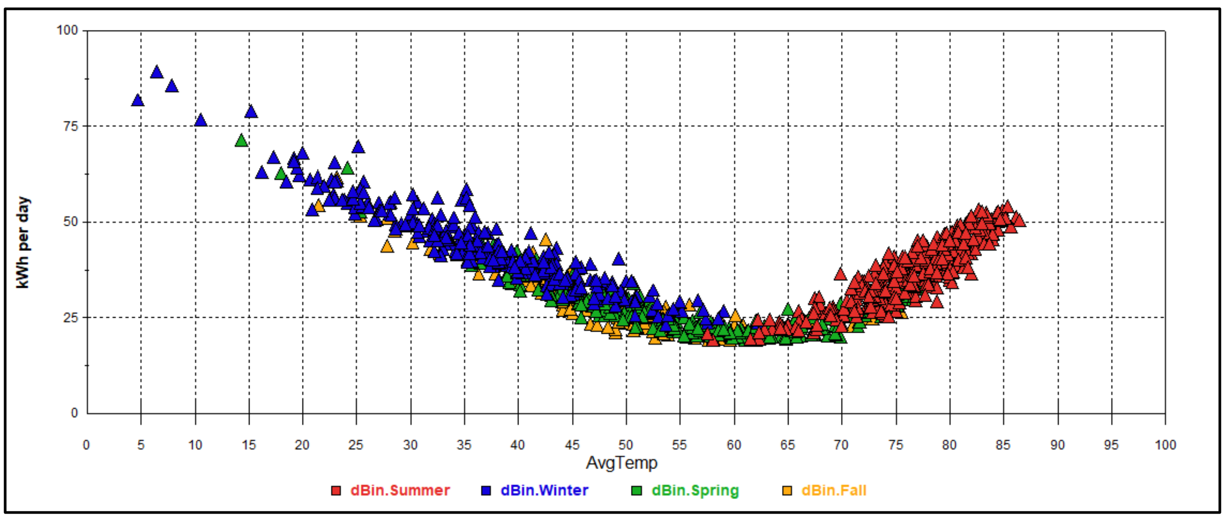
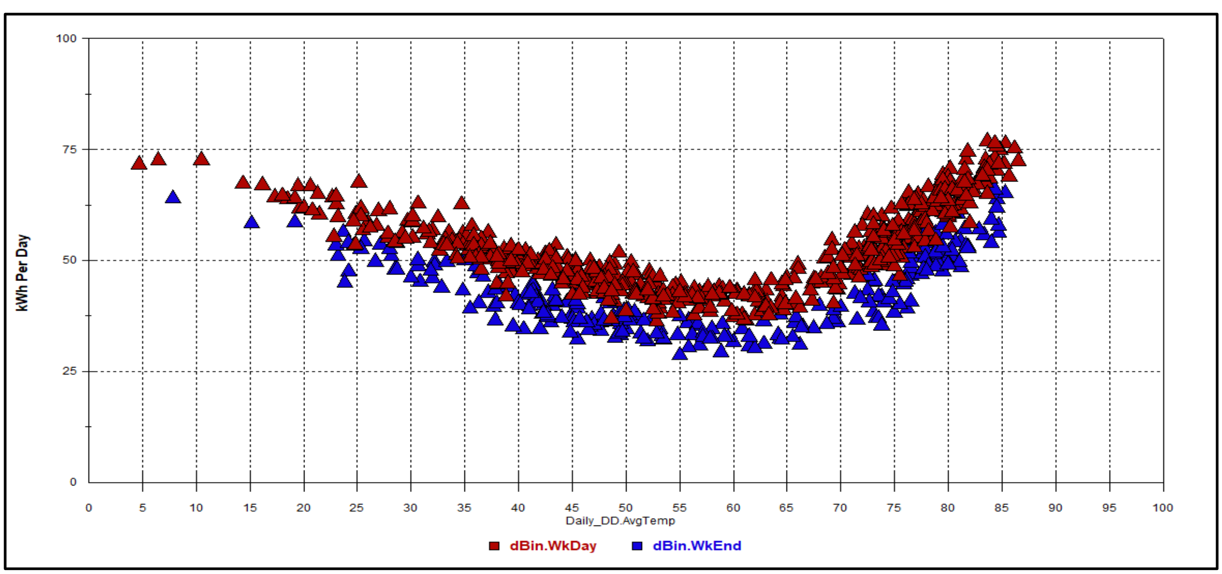


Figure 2: Commercial Rate Class Usage/Weather Relationship



Q. What do these diagrams show?

A. The scatter plots show there is a strong correlation between daily average use (Y axis) and the two-day weighted temperature (X axis). The residential scatter plot shows no heating until the average temperature falls below 60 degrees; the kWh/temperature relationship is much stronger when the average temperature falls below 55 degrees. Residential cooling-related use is visible when average temperature exceeds 65 degrees; the cooling use/temperature relationship is much stronger (the curve is steeper) when average temperature exceeds 70 degrees. The commercial scatter plot shows cooling beginning around 60 degrees and heating below 55 degrees; the graph also shows sales are significantly lower on weekends than during the week. The scatter plots (including scatter plots for the other rate classes) are used to identify the HDD and CDD temperature breakpoints that best explain the usage/temperature relationship. Table 6 shows the degree-day breakpoints for each model.

Table 6: Model Degree Days

Class	HDD	CDD
Residential	55,60	65,75
Commercial	55	65,75
General Power	55	60
Small Heating	55	65,75
TEB	55	60,75
Large Power	-	60

Q. Please describe how weather response models are estimated.

A. The weather response models are estimated using linear regression that relate daily average load (the dependent variable) to CDD, HDD, and binaries that account for non-weather seasonal variation, weekends vs. weekdays, and holidays. Often, the statistical fit can be improved by including HDD and CDD with more than one temperature breakpoint. This is the case with the residential model that includes HDD with a 55-

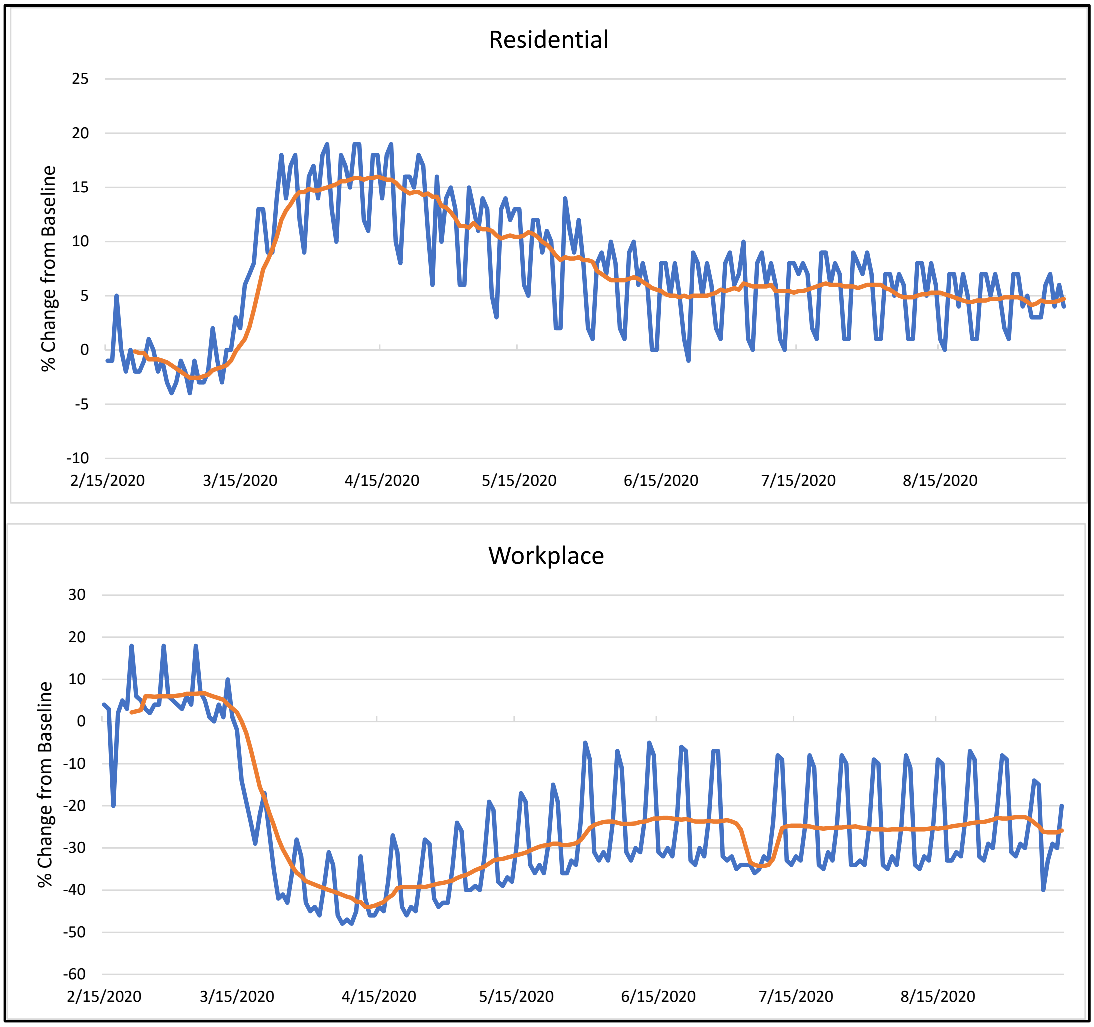
degree day base and a 60-degree day base and CDD with a 65-degree day base and a 75-degree day base. One additional factor included in the Models for the Company relates to a COVID-19 variable designed to capture the impact of COVID-19 on customer class sales.

Separate daily weather response models are estimated for each of the weather-sensitive rate classes. Models are estimated using rate-class average daily use derived from the Company's load research data and historical daily temperature data provided by Staff. Models also include day of the week, holiday's, monthly, and annual binaries to account for non-weather-related use variation. The model estimation period is October 1, 2017 to September 30, 2020 (three years). Estimated rate class normalization models and statistics are included in Direct **Schedule EF3**.

Q. Please describe how the COVID-19 impact is captured.

A. Beginning March 2020, there was a significant increase in residential sales and a drop in commercial sales resulting from COVID-related stay-at-home and business curtailment directives previously discussed. The shift in daily use is captured by residential and commercial COVID impact variables derived from Google Mobility Trend Data (GMT). The GMT is published weekly and provides daily change in cell phone activity based on location. Activity is categorized as residential, workplace, and retail and recreation. The index measures the variation from baseline cell phone activity where the baseline is 0. The indices are strongly correlated with the change in usage patterns. The Residential index has been above 0 as there is more activity at home than before the pandemic. On the flip side, the Workplace index has been negative as there is less activity at businesses. The Missouri Residential index is used in the residential model and the Workplace index is used in the commercial rate class models. The system model includes a weighted index (Workplace, Residential, and Retail and Recreation). Figure 3 shows the Residential and Workplace indices.

Figure 3: Missouri Google Mobility Trend Indices



Q. What do you take from these indices?

A. The indices have correlated well with the sales pattern. At the beginning of the pandemic there was a significant jump in residential sales and drop in commercial sales. Residential sales have been trending down through the end of the test-year period and commercial sales have been trending up. The GMT indices have also been following this trend.

The weather response models include the GMT indices. The GMT indices are estimated using the 7-day moving average (shown as the orange line). We assume COVID's impact on regional business and sales began mid-March shortly after the World Health Organization (WHO) declared a worldwide pandemic. The COVID variable is set to 0 prior to March 16. The COVID variables are statistically significant and explain the increase in residential usage and drop in commercial daily usage after March 15th.

Q. How are the estimated models used to normalize sales?

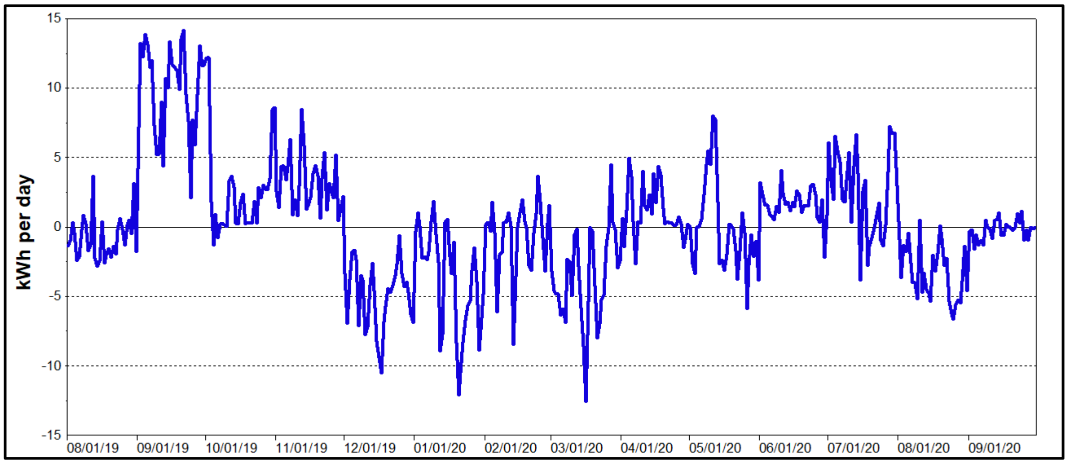
A. Normalized sales are generated using the estimated weather response models. The models are used to normalize for both weather conditions and COVID-19 sales impact.

HDD and CDD coefficients (B_{HDD} and B_{CDD}) derived from the weather response models are used to calculate daily weather impacts over the test-year period. The impacts are calculated by multiplying the degree-day coefficients with the difference between actual and normal degree-days:

$$WthrImpact = B_{HDD} \times (HDD_{actual} - HDD_{normal}) + B_{CDD} \times (CDD_{actual} - CDD_{normal})$$

The weather impacts are calculated using the MetrixND *Simulation Object* (MetrixND is Itron's load modeling and analysis application). Figure 4 shows the test-year daily weather impact for the residential customer class.

Figure 4: Residential Test-Year Daily Weather Impact (kWh)



The daily weather impacts are derived from the load research data. Given potential definition and measurement differences between load research sample data and revenue-class billed sales, the estimated weather impacts are not directly used. The weather impacts are instead used to calculate monthly *weather adjustment factors* that are then applied to test-year billed-sales average use. The weather adjustment factors are derived by first weighting the daily use and impacts to reflect the meter read schedule and then summing over the billing-month period. Monthly estimates are then used to calculate bill-sales adjustment factors for each rate schedule (r) and month (m):

$$Wthr\ Adj\ Factor_{rm} = Wthr\ Nrm\ Avg\ Use_{rm} / Avg\ Use_{rm}$$

Table 7 shows the monthly adjustment factors. The calculations of the weather adjustment factors are provided in Direct **Schedule EF-2**.

Table 7: Billed Sales Average Use Weather Adjustment Factors

Class	Oct-19	Nov-19	Dec-19	Jan-20	Feb-20	Mar-20	Apr-20	May-20	Jun-20	Jul-20	Aug-20	Sep-20
Res	0.790	0.905	1.015	1.095	1.068	1.066	1.038	0.967	0.992	0.951	1.004	1.062
Com	0.868	0.966	1.007	1.044	1.031	1.027	1.014	1.001	1.000	0.962	1.003	1.040
GP	0.931	0.993	1.004	1.016	1.012	1.009	1.004	1.018	1.003	0.980	1.001	1.017
SH	0.867	0.916	1.015	1.093	1.066	1.064	1.044	0.963	0.993	0.965	1.002	1.036
TEB	0.911	0.942	1.013	1.073	1.052	1.048	1.032	0.987	0.995	0.974	1.002	1.025
LP	1.000	1.002	1.000	1.000	1.000	0.994	1.014	1.022	0.984	0.983	1.023	0.997

Factors below 1.00 weather adjust billed-sales average use down. Factors above 1.00 weather adjust billed-sales average use up. Normalized sales are calculated by multiplying weather normal average use by the number of customers in each test-year month. Normalized billed sales by month are provided in Direct **Schedule EF-2**.

Q. Please describe how test-year sales are normalized for weather and COVID-19.

A. In addition to weather, the models include the COVID variable described above. The estimated daily response model is used in simulating daily use for normal daily temperatures and with the COVID variable set to 0. This generates a predicted daily series that reflects what daily use would be for normal weather without COVID-19. The daily impact is the difference between actual daily use and the weather-normal no-COVID data series. Both the actual and normalized (for weather and COVID) daily means series are aggregated to the billing-month period based on the meter-read schedule. Billing-month adjustment factors are calculated as the ratio of the normalized bill-month means data to actual bill-month means data. Table 8 shows the total impact adjustment factors.

Table 8: Billed Sales Average Use Total Adjustment Factors

Class	Oct-19	Nov-19	Dec-19	Jan-20	Feb-20	Mar-20	Apr-20	May-20	Jun-20	Jul-20	Aug-20	Sep-20
Res	0.790	0.905	1.015	1.095	1.068	1.063	0.977	0.890	0.957	0.932	0.985	1.043
Com	0.868	0.966	1.007	1.044	1.031	1.029	1.070	1.076	1.042	0.995	1.035	1.073
GP	0.931	0.993	1.004	1.016	1.012	1.013	1.076	1.110	1.060	1.027	1.048	1.061
SH	0.867	0.916	1.015	1.093	1.066	1.067	1.110	1.057	1.043	1.002	1.039	1.074
TEB	0.911	0.942	1.013	1.073	1.052	1.056	1.243	1.286	1.163	1.104	1.127	1.151
LP	1.000	1.002	1.000	1.000	1.000	1.029	1.155	1.119	1.048	1.050	1.088	1.060

Direct **Schedule EF-2** shows the calculated total impact adjustment factors. The adjustment factors are applied to test-year billed average use. Table 9 shows billed sales average use, weather normalized average use, and total (weather plus COVID-19) normalized average use.

Table 9: Test-Year Billed Sales Average Use

	2019			2020									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Residential													
kWh per Cust	938	927	1,183	1,273	1,261	1,081	822	741	875	1,249	1,287	1,104	12,741
WN kWh per Cust	741	838	1,200	1,394	1,347	1,152	854	717	868	1,188	1,293	1,172	12,763
WN/COVID kWh per Cust	741	838	1,200	1,394	1,347	1,149	803	659	838	1,164	1,268	1,152	12,552
Commercial (CB)													
kWh per Cust	1,434	1,293	1,441	1,455	1,431	1,353	1,099	1,034	1,687	1,703	1,740	1,582	17,252
WN kWh per Cust	1,245	1,249	1,451	1,519	1,475	1,389	1,114	1,035	1,687	1,639	1,745	1,646	17,193
WN/COVID kWh per Cust	1,245	1,249	1,451	1,519	1,475	1,392	1,176	1,113	1,758	1,694	1,801	1,698	17,572
General Power													
kWh per Cust	36,585	36,770	36,538	37,777	35,499	35,111	31,898	32,082	35,170	43,219	45,196	42,796	448,642
WN kWh per Cust	34,049	36,514	36,684	38,395	35,918	35,423	32,027	32,664	35,272	42,335	45,256	43,524	448,061
WN/COVID kWh per Cust	34,049	36,514	36,684	38,395	35,918	35,553	34,317	35,605	37,269	44,378	47,354	45,420	461,456
Small Heating													
kWh per Cust	1,977	2,218	2,475	2,727	2,725	2,310	1,563	1,438	1,624	2,142	2,319	2,135	25,654
WN kWh per Cust	1,715	2,031	2,513	2,981	2,904	2,458	1,632	1,385	1,613	2,068	2,325	2,211	25,837
WN/COVID kWh per Cust	1,715	2,031	2,513	2,981	2,904	2,464	1,735	1,520	1,694	2,147	2,411	2,293	26,409
Total Electric Building													
kWh per Cust	29,142	28,275	33,203	32,899	32,061	29,001	22,249	18,649	21,338	29,637	31,817	29,307	337,580
WN kWh per Cust	26,559	26,649	33,643	35,307	33,714	30,383	22,963	18,412	21,241	28,873	31,881	30,043	339,668
WN/COVID kWh per Cust	26,559	26,649	33,643	35,307	33,714	30,621	27,664	23,991	24,813	32,705	35,865	33,723	365,254
Large Power													
kWh per Cust	1,748,915	1,615,871	1,610,284	1,419,825	1,532,021	1,437,696	1,507,100	1,378,561	1,541,140	1,661,434	1,785,625	1,721,180	18,959,652
WN kWh per Cust	1,749,769	1,618,758	1,610,284	1,419,825	1,532,021	1,429,268	1,528,034	1,408,460	1,515,953	1,632,597	1,826,416	1,716,025	18,987,411
WN/COVID kWh per Cust	1,749,769	1,618,758	1,610,284	1,419,825	1,532,021	1,479,723	1,740,252	1,542,494	1,614,693	1,744,050	1,943,402	1,824,766	19,820,037

The COVID impact adjustments begin in March. Residential average use is adjusted down. The non-residential rate classes are adjusted up. Total normalized sales are the product of the normalized average use and number of customers. Calculations and results are provided in Direct **Schedule EF-2**.

IV. CONCLUSION

Q. Please briefly summarize your Direct Testimony.

A. Test-year sales are weather-normalized using an approach utilized by Staff in past rate cases. The approach has been well vetted over the years and produces reasonable results. The method entails developing daily rate class load models and utilizing estimated model coefficients to estimate daily use for normal daily degree-days. Both actual and normalized daily series are summed to the billing-month period based on the meter-read schedule and used in calculating billing-month weather adjustment factors. The daily temperature variable (a two-day weighted temperature variable) and daily normal degree-days (also based on a two-day weighted temperature variable) are provided by Staff. Evergy and Ameren have also used this approach. In this case, the approach has been extended to account for COVID-19 sales impacts; COVID-19 impact is calculated using Google Mobility Data for Missouri.

Estimated models capture weather and COVID-19 impacts relatively well; the weather and COVID variables are statistically significant as measured by the variable T-Statistics. Overall model fit statistics are reasonable as measured by model in-sample t statistics (i.e., Adjusted R-Squared, standard error, mean absolute deviation, Durbin-Watson statistic).

The models combined with actual and normal daily temperatures produced reasonable weather impacts and resulting normalized sales. The test-year period is warmer than normal both through the heating and cooling months. As a result, heating related sales are adjusted up and cooling-related sales are adjusted down. The net effect is relatively small with a 0.1% increase in total test-year sales.

COVID-19 has a much larger impact on test-year sales with residential sales significantly higher than normal and commercial rate class sales significantly lower than normal. The net effect is a 1.6% positive adjustment. The total weather and COVID-19 impact are a 1.7% positive sales adjustment.

Q. How are these adjustments used in this case?

A. Empire witness Gregory Tillman's Direct Testimony supports normalized revenues, to include the adjustments described above.

Q. Does this conclude your Direct Testimony at this time?

A. Yes.

VERIFICATION

I, Eric Fox, under penalty of perjury, on this 28th day of May, 2021, declare that the foregoing is true and correct to the best of my knowledge and belief.

/s/ Eric Fox