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Witness:	*Michael L. Stahlman*
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MISSOURI PUBLIC SERVICE COMMISSION

INDUSTRY ANALYSIS DIVISION

TARIFF/RATE DESIGN DEPARTMENT

REBUTTAL TESTIMONY

OF

MICHAEL L. STAHLMAN

UNION ELECTRIC COMPANY
d/b/a Ameren Missouri

CASE NO. ER-2021-0240

Jefferson City, Missouri
October 2021

REBUTTAL TESTIMONY
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UNION ELECTRIC COMPANY
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FILE NO. ER-2021-0240

Q. Please state your name and business address.

A. My name is Michael L. Stahlman, and my business address is Missouri Public Service Commission, P.O. Box 360, Jefferson City, Missouri, 65102.

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

A. I am employed by the Missouri Public Service Commission ("Commission") as a Regulatory Economist in the Tariff/Rate Design Department in the Industry Analysis Division of the Commission's Staff.

Q. Are you the same Michael L. Stahlman that filed direct testimony in this docket and portions in Staff's Cost of Service ("COS") and Class Cost of Service ("CCOS") Reports?

A. Yes.

Q. What is the purpose of your testimony?

A. I will discuss the differences between Staff's and Ameren Missouri's weather, weather normalization method, and adjustments for Covid-19 as described by Ameren Missouri Witness Nicholas Bowden.

Q. Please summarize your testimony.

A. Ameren Missouri and Staff largely used the same method to perform weather normalization. The chief difference between Ameren Missouri and Staff is due to differences in our approaches in attempting to normalize for the changes brought on by Covid-19. While it is

not possible to know precisely how Covid-19 will affect electrical consumption on an ongoing basis, Staff's approach of determining the weather and Covid-19 impacts simultaneously is more methodically consistent and less likely to have statistically biased results. For the reasons discussed herein, Staff continues to recommend the weather and Covid-19 normalization adjustments made in its COS Report.

Normal Weather

Q. Do Staff and Ameren Missouri use the same normalized weather?

A. No. Both Ameren Missouri and Staff used the same method to develop the normal weather based on a historical 30 year period, but Staff included three years of actual weather for its regression analysis while Ameren Missouri used only two years. To clarify, for weather normalization in an electric rate case, there are three time periods that Staff and Ameren Missouri use: there is a historical 30 year period used to establish a year of normal weather; there is a two or three year period used in regression models where actual weather is compared to actual usage to determine the relationship between weather and electric consumption; and there is the test year and/or update period where an actual year of usage is adjusted to estimate what the usage would be if the weather matched the year of normal weather. Because the 30 year historical period should not overlap with the period being examined,[1] Staff's 30 year weather period was from January 1, 1988 through December 31, 2017 while the Company's 30 year weather period was from January 1, 1989 through December 31, 2018.

Q. What is the difference in Heating Degree Days (HDDs) and Cooling Degree Days (CDDs) between the two 30-year periods?

[1] In a sense, the 30 year historical period acts as a sort of control period, so there should be no interaction between the control period and the "experimental" period.

A. Staff's normal weather for a non-leap year had slightly more HDDs (4438 HDD compared to Ameren Missouri's 4432 HDD) and slightly less CDDs (1621 CDD compared to Ameren Missouri's 1638 CDD) than Ameren Missouri.[2]

Q. Why is Staff's three-year review more reasonable than Ameren's two-year review?

A. Covid-19. Because the test year included a period of abnormal usage as a result of the shutdown due to Covid-19, Staff decided to include two years that were pre-pandemic to better capture what the "normal" pre-pandemic usage was. In a sense, if you have only two years and one of them is an outlier, it can be a little ambiguous on determining the normal between them. However, if you have three years, the model becomes more robust since the normal can be better captured with two non-outlier years providing weight against the known outlier year.

The use of two or three years to estimate the customer class's reaction to weather is consistent with historical practice. More than one year is examined since it increases the confidence in our estimates and can add additional information that may be missing in a single year (e.g. a single year can miss information about cold weather if the winter was unusually warm). Staff has limited the analysis to two or three years out of concern for other factors, like improvements in energy efficiency, becoming more relevant with a longer time period. While Staff may normally only review two years of actual usage, three years may also be reviewed in other circumstances, such as an economic downturn.

Q. If there was no pandemic in 2020, would Staff's weather have matched Ameren Missouri's?

[2] Both Heating Degree Days and Cooling Degree Days are based around 65° Fahrenheit, where HDD is the maximum of 65 minus the mean daily temperature or zero and CDD is the maximum of the mean daily temperature minus 65 or zero.

A. Yes. In prior cases, Staff usually only included two years of review in its weather normalization. Because Staff and Ameren Missouri use the same method in determining normal weather, Staff and Ameren Missouri's normal weather would have been identical.

Weather and Covid-19 Normalization

Q. What are the differences between Ameren Missouri's and Staff's normalization for weather and Covid-19?

A. One of the largest differences is that Staff, because of the later filing date for direct testimony, had the advantage of reviewing the 12 months ending April 30, 2021 instead of the test year (ending December 2020). This means that the two months with the largest impacts from Covid-19, March and April 2020, while analyzed, were not part of Staff's adjustments since those months fell outside the time period used for determining billing determinates. The updated period also allowed Staff to have a better sense of post-Covid-19 usage.

Another large difference was the approach to normalizing for Covid-19. Staff normalized for Covid-19as part of the weather normalization process; Staff included variables accounting for Covid-19's impact in its regression analysis and simulated those variables in order to provide normalized usage. Ameren Missouri includes a dummy variable[3] in its weather normalization process, but did not use that information to determine the impact of Covid-19, but used a separate method described on pages 21 through 24 of the Direct Testimony of Nicholas Bowden, PhD.

[3] A dummy variable is a variable that is either a 1 or a 0. In this case, Ameren Missouri's dummy variable was a 1 for March 23, 2020 and all dates thereafter, and a zero for all other dates.

Other differences tend to be more stylistic, such as the treatment of holidays. There is a concern that the Durbin-Watson statistic indicates a first-order autocorrelation[4] issue that was left untreated in Ameren Missouri's models, but as autocorrelation leaves coefficient estimates unbiased and since the focus is more on the dependent variable (kWh used) rather than the independent variables, this issue is not overly concerning.

Q. Should the impact of Covid-19 be evaluated simultaneously with the weather in a regression analysis?

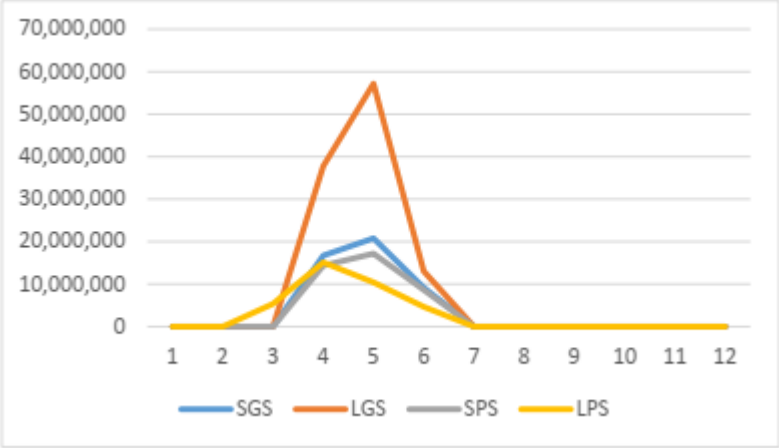
A. If the data is available, yes. Omitting an important independent variable can result in biased estimates of the other independent variables. A biased estimate is less likely to give a result close to the "true" value. In this case, the reaction to the Covid-19 virus has had a significant impact on usage in the different customer classes.

Q. Did Ameren Missouri include a variable to account for Covid-19?

A. Yes. As mentioned earlier, they included a dummy variable in its weather normalization process. However, a dummy variable would be indicative of an effect that had a constant impact over the whole effective period, rather than an initial pandemic shock that has no lasting impact beyond a few months. As shown in Figure 5 of Dr. Bowden's direct testimony (Figure 1 below), Ameren's estimation of the impact of Covid-19 does not match the variable used to estimate the impact of Covid-19 used in the weather normalization model.

[4] First-order autocorrelation, in this model, is an indication that there is information error term from the prior day that influences the decision to use energy in the current day. This concept is consistent with our use of a two-day weighted mean daily temperature, and indicates there may be a better formulation of our model. Staff treated the first-order autocorrelation with the ARMA process options included in the MetrixND software used in this this regression analysis.

Figure 1: Figure 5 of Dr. Bowden's Direct Testimony Showing Ameren Missouri's Initial Pandemic Shock Adjustments (kWh per Month)[5]



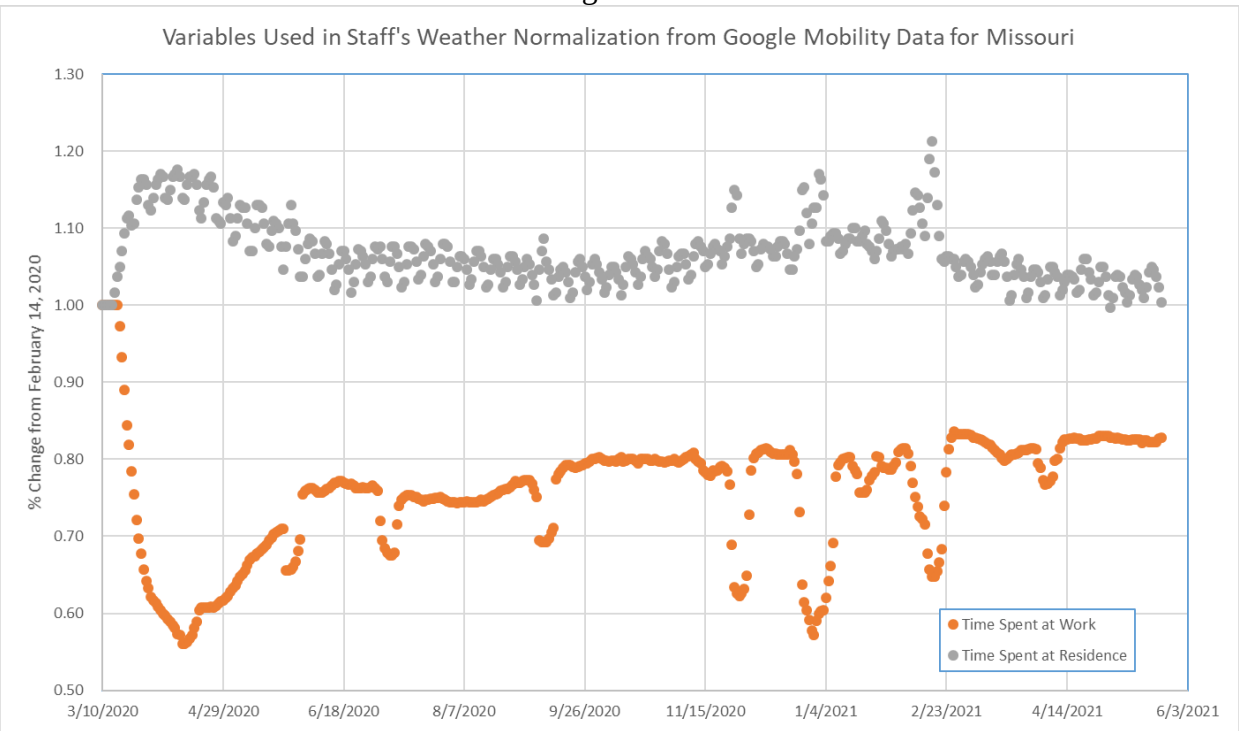
If the estimated impact of Covid-19 matched the dummy variable used in the weather regression model, you would expect to see a sharp increase followed by a relatively flat, ongoing, and level impact for all remaining months instead of the increase followed by a quick return to zero. So while the inclusion of the dummy variable would help account for some of Covid-19's impact, there is room to improve the specification of the variable for this model.

Q. What did Staff use to account for Covid-19?

A. As discussed in Staff's COS Report, Staff developed variables using the Google Mobility Data for Missouri.[6] This method was discussed in an Itron Brown Bag Webinar [7] I attended on April 22, 2021. Google monitors the locations of cell phones and provided an estimate of how much time people spent at various locations compared to a base of February 14, 2020. Figure 2 below shows a graph of the variables used in Staff's regression.

[5] The x axis reflects the months January 2020 through December 2020 and the y axis reflects kWh.
[6] Google. (2021). "Google COVID-19 Community Mobility Reports." https://www.google.com/covid19/mobility/.
[7] Itron is the developer of MetrixND and MatrixLT, which is regression software used by all electric utilities in Missouri for weather normalization. Itron periodically hosts free seminars ("Brown Bag Webinars") to discuss forecasting issues.

Figure 2:



The "Time Spent at Residence" variable was used for the residential customer class and the "Time Spent at Work" was used for all other classes except wholesale and lighting. The subsequent peaks or troughs seen on the charts are a result of holidays, such as Christmas, when people tend to spend more time at home and businesses close. Figure 2 as shown above demonstrates that Staff's method is more methodically consistent. Excluding those peaks/troughs as done by Staff and demonstrated in Figure 2 that the resulting variables more closely resemble adjustments made by Ameren Missouri that supports the inclusion of Google Mobility Data in Staff's weather normalization model.

Q. Is there any concern for the interaction between holidays and the Google Mobility Data?

A. Some, however Staff excluded holidays from its weather regression analysis, which mitigates the concern. .

Q. Are there additional reasons to use the Google Mobility Data over a dummy variable?

A. Yes. The Google Mobility Data performed much better in the regression analysis; the R-squares were higher and the variables showed more significance. Additionally, using the Google Mobility Data variables more easily allows Staff to normalize for Covid-19 to levels that are more consistent with the usage levels seen in the latter part of the update period.

Q. How is Staff's normalization for Covid-19different than Ameren Missouri's?

A. Staff assumed that the normal usage going forward is different than the usage pre-Covid-19, where Ameren Missouri made an adjustment of its usage comparing back to pre-Covid-19 levels.[8] It is difficult to know exactly what will happen, but it seems that the near future has some structural differences, such as more people continuing to work from home, which means slightly higher usages for the residential class and lower usage for non-residential classes. From Figure 2, Staff judged that the Google Mobility Data largely stabilized by September or October 2020. Thus Staff simulated the months prior to September 2020 by substituting the actual Google Mobility Data in that time period with values approximating the stabilized value of the Google Mobility Data around October 2020.[9] The months after this maintained the actual Google Mobility Data, so there was no adjustment for Covid-19.

The advantage of this method is that it is able to assume a level of usage that is different from pre-Covid-19 usage but has recovered from the initial shock of the pandemic.

[8] Ameren Missouri's adjustments are only for March 2020 through June, so there is a combination of the early months of the test year reflecting a pre-Covid-19 usage and the later months, which are not adjusted for Covid-19, reflecting a post-Covid-19 usage.

[9] The dates are for the non-residential customer classes that were weather normalized. The Google Mobility Data for the residential class seemed to have stabilized a month earlier.

Ameren Missouri's weather regression model, which used a one-or-zero dummy variable to account for Covid-19, is unable to recognize a partial recovery.

Q. Please summarize your testimony.

A. Both Ameren Missouri and Staff used similar methods to perform their weather normalization. However, Ameren Missouri used a second method to normalize for Covid-19. By employing Google Mobility Data, Staff was able to make a better and more consistent model to account for Covid-19's impacts on usage and to simulate normalized usage that has largely, but not completely, recovered for the most severe impacts of Covid-19.

Q. Does this conclude your rebuttal testimony?

A. Yes it does.