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Issues: Weather Normalization
Witness: Lena M. Mantle
Sponsoring Party: MoPSC
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Case No.: ER-2001-299
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MISSOURI PUBLIC SERVICE COMMISSION

UTILITY OPERATIONS DIVISION

DIRECT TESTIMONY

OF

LENA M. MANTLE

THE EMPIRE DISTRICT ELECTRIC COMPANY

CASE NO. ER-2001-299

Exhibit No. 59
Date 5/23/01 Case No. ER-2001-299
Reporter KLR

Jefferson City, Missouri
April, 2001

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DIRECT TESTIMONY

OF

LENA M. MANTLE

THE EMPIRE DISTRICT ELECTRIC COMPANY

CASE NO. ER-2001-299

Q. Please state your name and business address.

A. My name is Lena M. Mantle and my business address is Missouri Public Service Commission, P. O. Box 360, Jefferson City, Missouri 65102.

Q. What is your present position with the Missouri Public Service Commission (Commission)?

A. I am a Utility Regulatory Engineer I in the Engineering Section of the Electric Department, Utility Operations Division.

Q. Would you please review your educational background and work experience?

A. I received a Bachelor of Science Degree in Industrial Engineering from the University of Missouri, at Columbia, in May 1983. I joined the Commission Staff (Staff) in August 1983. I am a registered Professional Engineer in the State of Missouri. I have been weather normalizing electricity usage and hourly loads for the Staff since 1988.

Q. What is the purpose of your direct testimony?

A. The purpose of my testimony is to recommend that the Commission adopt the weather adjustments to class usage for the Missouri weather sensitive rate classes of the Empire District Electric Company (EDE) shown on Schedule 1. Staff witness Janice Pyatte calculated an adjustment to revenues based on these weather adjustments to class usage. The

adjustments to class usage were also included in the calculation of the hourly generation requirements.

I also recommend that the Commission adopt the hourly net system load that I calculated. Staff witness Leon Bender used these hourly loads in estimating the normalized fuel and purchase power costs for the test year. A monthly summary of the normalized net system load is shown on Schedule 2.

The remainder of my testimony includes discussions on the weather normalization of class usage, the normalization of hourly net system load and the method that I used to calculated the daily normal variables that were used in both of these analysis.

NORMALIZATION OF CLASS USAGE

Q. Why is it necessary to weather normalize electricity usage?

A. Electricity use is very sensitive to weather conditions. The magnitude of EDE's load is directly related to daily temperatures due to the high percentage of EDE's customers that have air conditioning and electric space heating. The weather fluctuated greatly in the test year. The last part of the winter of 2000 (January 2000- April 2000) was mild and therefore, EDE's customers used less electricity than they would have had the weather been "normal." The first part of the summer (June 2000 and July 2000) was cooler than normal and so, again, the customers used less than they would have, given normal weather. August 2000 and September 2000 were hot, so the usage in those months was higher than they would have been, given normal weather. November and December were extremely cold so therefore, EDE's customers used more than they would have, given normal weather.

Q. What method did you use to calculate the weather adjustments to class usage?

A. I used the Electric Power Research Institute (EPRI) Hourly Electric Load Model (HELM) to calculate the weather adjustments to class usage. In this model, the response to daily weather is first estimated for each of the rate classes from hourly class level load data. Weather normalized usage is then calculated for each month for each of the weather sensitive classes, given normal weather variables based on the estimated response. The weather variables are carefully matched to correspond to the usage in the time period over which usage was recorded. The weather adjustment to class usage is calculated as the difference between the weather normalized usage and the actual usage.

Q. What are the inputs to this model?

A. There are four data inputs into the model – monthly class usage, hourly class load data, and actual and normal daily weather variables. The monthly class usage and the hourly class loads were supplied by EDE. Staff witness Dennis Patterson supplied the actual high and low temperatures for the test year and the history of high and low temperatures that I used to calculate daily normal weather.

Q. Do any Missouri electric utilities use HELM?

A. AmerenUE is using HELM to weather normalize its monthly class usages and UtiliCorp United, Inc. has informed Staff that it intends to use HELM to normalize its St. Joseph Light and Power and Missouri Public Service division's monthly class usages. Kansas City Power and Light Company and UtiliCorp have used HELM in the past to analyze hourly loads in their Missouri resource planning processes.

Q. Has the staff previously used HELM?

A. Yes. We used HELM in the last EDE rate case, Case No. ER-97-81, and the last rate case of Missouri Public Service, a Division of UtiliCorp United, Inc., Case No. ER-97-394.

Q. What other staff witnesses used the weather adjustments to class usage that you estimated?

A. Staff witness Janice Pyatte calculated an adjustment to Missouri retail revenues corresponding to the weather adjustments to class usage. Staff witness Roy Boltz used the normalized class usage in estimating the adjustment in class usage due to customer growth. The weather adjustments to class usage were also used in the calculation of the total test year usage that was used in the normalization of fuel costs.

HOURLY NET SYSTEM LOAD

Q. What is hourly net system load?

A. Net system load is the hourly electric supply requirements placed on EDE to meet the energy demands of its customers and the internal needs of EDE.

Q. Briefly describe the process of normalizing net system loads.

A. The actual hourly net system loads are weather normalized. The sum of these hourly loads is then reconciled to the normalized usage requirements of EDE and its customers. These normalizations include the weather adjustments to class usage that I previously described and growth and annualization adjustments calculated by other Staff witnesses.

Q. What method did you use to weather normalize hourly net system loads?

A. The weather normalization procedure that I used was developed by the former Economic Analysis Department of the Commission in 1988. The process is described in detail in the document "Weather Normalization of Electric Loads, Part A: Hourly Net System Loads" (November 28, 1990), written by Dr. Michael Proctor of the Commission.

Q. Briefly summarize the process you used.

A. Daily peaks and average loads are independently adjusted to reflect normal weather using the same methodology. Daily average load is calculated as the daily energy divided by twenty-four hours. A regression model estimates both a base component, which is allowed to fluctuate across time, and a weather sensitive component, which measures the response to daily fluctuations in weather. The regression parameters, along with the difference between normal and actual cooling and heating measures, are used to calculate a weather adjustment to both the average energy and peak load for each day. The adjustments for each day are added to the actual average energy and peak for each day.

The starting point for allocating the average energy to the hours is the actual hourly loads. A unitized load curve is calculated for each day as a function of the actual peak and average loads for that day. The corresponding weather normalized daily peak and average loads, along with the unitized load curves, are used to calculate weather normalized hourly loads.

Q. Are checks for reasonableness a part of the process?

A. Yes, they are. The process starts with input data checks and ends with output data checks. Checks and balances are included in the spreadsheets that are used. In addition, the analyst is required to examine the data at several points in the process.

Q. Has this process been used in other cases?

A. Yes, it has. This method has been used to weather normalize net system load in nine rate cases, two rate design cases and two earning investigations for merger cases.

Q. What data was used in the weather normalization of hourly loads?

A. EDE net system load for the time period July 1999 through December 2000 was used. The daily temperature values used were the same as used in the weather normalization of class usage.

Q. How were the modifications made to the test year weather normalized hourly system loads to account for adjustments made to test year usage?

A. I applied a ratio to the hourly net system loads so that the annual sum of the hourly net system loads equals the test year usage. Staff witness Janice Pyatte supplied the annualization adjustment and Staff witness Roy Boltz supplied customer growth adjustments. I applied these adjustments to EDE's total usage. I multiplied this annual usage by the loss factor of 7.61 percent as supplied to me by Staff witness Allen Bax in order to obtain the amount of generation necessary to meet this usage. The ratio of this generation requirement to the sum of the weather normalized hourly loads for the test year was applied to each hourly load of the weather normalized net system loads. This resulted in the annual sum of the hourly loads being equal to the adjusted test year net usage plus losses. A monthly summary of the adjusted hourly loads is shown on Schedule 2. Staff witness Eve Lissik presents Mr. Bax's analysis in her direct testimony.

Q. Which staff witness used the hourly normalized loads?

A. Staff witness Leon Bender used the test year hourly normalized net system loads as an input to the production cost model Staff used to develop the normalized level of fuel expense.

NORMAL WEATHER

Q. What did you use to represent normal weather in these calculations?

A. The normal weather used in both the normalization of class usage and hourly net system loads was calculated using Staff's ranking method and daily weather values for the time period January 1, 1961 through December 31,1990. Staff's ranking method estimates daily normal values for the year, which range from the temperature value that is "normally" the hottest to the temperature value that is "normally" the coldest. This is important in estimating generation costs because these costs are greatly impacted by daily weather extremes. Since every year normally has some days with extreme temperatures, the daily normal variables should also contain some extremes. The ranking method that I used estimates normal extremes.

Q. How are these extremes derived?

A. The daily normal variables are calculated by ranking the temperatures in each year of the history. These temperatures are then averaged across the rank, not the day of the year. This results in the normal extreme being the average of the most extreme temperatures in each year of the history. The second extreme normal variable is based on the average of the second most extreme day of each year and so forth. The normal variables calculated from this ranking are then assigned to the days in the test year based on the rankings of the actual temperatures in the year. This results in as little weather normalization occurring on each day as is possible.

Q. Who supplied the history of daily high and low temperatures used in your calculation of daily normals?

A. Mr. Patterson supplied the history of daily temperatures that I used in calculating the daily normal weather values.

Q. Does this conclude your direct testimony?

A. Yes, it does.

BEFORE THE PUBLIC SERVICE COMMISSION

OF THE STATE OF MISSOURI

IN THE MATTER OF THE APPLICATION OF THE EMPIRE DISTRICT ELECTRIC COMPANY FOR A GENERAL RATE INCREASE	))))	Case No. ER-2001-299

AFFIDAVIT OF LENA M. MANTLE

STATE OF MISSOURI)
) **ss**
COUNTY OF COLE)

Lena M. Mantle, of lawful age, on her oath states: that she has participated in the preparation of the foregoing written testimony in question and answer form, consisting of 3 pages of testimony to be presented in the above case, that the answers in the attached written testimony were given by her; that she has knowledge of the matters set forth in such answers; and that such matters are true to the best of her knowledge and belief.

Lena M Mantle
Lena M. Mantle

Subscribed and sworn to before me this 29th day of March, 2001.

DAWN L. HAKE
Notary Public – State of Missouri
County of Cole
My Commission Expires Jan 9, 2005

Dawn L. Hake
Notary Public

My commission expires

Weather Normalization Adjustments to Missouri Sales
Empire District Electric Company
ER-2001-299

Month	Residential			Commercial Service		
	Booked	Wthr Adj	Wthr Norm	Booked	Wthr Adj	Wthr Norm
Jan	149,803,931	10,814,014	160,617,945	12,875,083	798,905	13,673,988
Feb	115,600,152	17,876,283	133,476,435	29,624,764	1,421,860	31,046,624
Mar	102,017,689	8,043,389	110,061,078	23,933,641	453,179	24,386,820
Apr	87,243,279	-286,561	86,956,718	15,496,082	292,705	15,788,787
May	87,348,984	-7,174,115	80,174,869	26,199,423	-1,372,532	24,826,891
Jun	101,241,950	16,900,977	118,142,927	27,753,040	2,703,183	30,456,223
Jul	146,371,356	16,545,695	162,917,051	33,029,919	1,867,870	34,897,789
Aug	170,502,700	-26,292,647	144,210,053	39,356,519	-3,105,830	36,250,689
Sep	127,060,221	-7,966,399	119,093,822	28,619,332	-1,200,496	27,418,836
Oct	81,029,681	-2,347,922	78,681,759	18,102,559	-1,464,521	16,638,038
Nov	105,864,936	-15,408,567	90,456,369	28,589,514	-1,402,982	27,186,532
Dec	183,049,479	-37,011,441	146,038,038	30,616,646	-2,306,674	28,309,972
Total	1,457,134,358	-26,307,294	1,430,827,064	314,196,522	-3,315,333	310,881,189

Month	Commercial Small Heating			Total Electric Building		
	Booked	Wthr Adj	Wthr Norm	Booked	Wthr Adj	Wthr Norm
Jan	11,028,053	1,006,021	12,034,074	16,821,081	1,674,351	18,495,432
Feb	9,556,434	1,310,966	10,867,400	23,115,211	2,900,251	26,015,462
Mar	9,063,261	538,881	9,602,142	23,709,799	907,880	24,617,679
Apr	7,217,913	67,930	7,285,843	21,032,972	174,735	21,207,707
May	7,985,752	-326,792	7,658,960	25,446,922	-765,593	24,681,329
Jun	7,038,302	585,650	7,623,952	20,918,590	1,568,828	22,487,418
Jul	10,163,819	441,709	10,605,528	29,267,182	1,196,519	30,463,701
Aug	11,283,820	-790,029	10,493,791	30,615,979	-1,778,347	28,837,632
Sep	7,329,798	-188,499	7,141,299	22,809,611	-560,027	22,249,584
Oct	7,130,479	-386,711	6,743,768	23,657,810	-763,779	22,894,031
Nov	8,588,388	-744,678	7,843,710	27,786,427	-2,329,589	25,456,838
Dec	12,056,237	-2,531,681	9,524,556	37,762,670	-4,841,795	32,920,875
Total	108,442,256	-1,017,233	107,425,023	302,944,254	-2,616,566	300,327,688

Month	General Power		
	Booked	Wthr Adj	Wthr Norm
Jan	50,497,220	1,028,860	51,526,080
Feb	52,853,857	1,116,238	53,970,095
Mar	50,589,653	447,623	51,037,276
Apr	51,537,670	744,238	52,281,908
May	60,697,616	-1,964,480	58,733,136
Jun	61,346,639	1,755,344	63,101,983
Jul	63,685,825	1,811,644	65,497,469
Aug	73,234,385	-2,533,145	70,701,240
Sep	56,099,249	-625,947	55,473,302
Oct	59,516,067	-1,941,971	57,574,096
Nov	61,714,828	-1,196,493	60,518,335
Dec	58,826,244	-2,666,547	56,159,697
Total	700,599,253	-4,024,636	696,574,617

Schedule 1

Empire District Electric Company
Net System Load
Normalized Test Year
ER-2001-299

Month	Monthly Usage (MWh)				Monthly Peaks (MW)				Load Factor	
	Actual	Normal	Adj	% Adj	Actual	Normal	Wthr Adj	% Adj	Actual	Normal
Jan-00	407,112	434,498	27,386	6.73%	794	897	102.84	12.95%	0.689161	0.651177
Feb-00	356,493	393,860	37,367	10.48%	792	881	89.29	11.27%	0.646720	0.642116
Mar-00	348,363	364,551	16,188	4.65%	604	663	59.31	9.82%	0.775215	0.738704
Apr-00	313,853	320,326	6,473	2.06%	608	634	25.74	4.23%	0.716952	0.702021
May-00	361,743	353,632	(8,111)	-2.24%	830	785	(45.24)	-5.45%	0.585800	0.605680
Jun-00	381,752	410,787	29,035	7.61%	822	882	60.38	7.35%	0.645026	0.646590
Jul-00	467,146	493,424	26,278	5.63%	946	983	36.59	3.87%	0.663726	0.674958
Aug-00	524,611	489,440	(35,171)	-6.70%	993	984	(8.98)	-0.90%	0.710093	0.668533
Sep-00	402,110	390,339	(11,771)	-2.93%	961	913	(48.48)	-5.04%	0.581151	0.594110
Oct-00	345,997	340,554	(5,443)	-1.57%	743	699	(43.85)	-5.90%	0.625908	0.654699
Nov-00	385,243	364,174	(21,069)	-5.47%	754	732	(22.05)	-2.92%	0.709628	0.691032
Dec-00	498,965	447,938	(51,027)	-10.23%	941	898	(42.81)	-4.55%	0.712701	0.670311
Annual	4,793,388	4,803,523	10,135	0.21%	993	984	(8.98)	-0.90%	0.551048	0.557252
Summer	1,775,619	1,783,990	8,371	0.47%	993	984	(8.98)	-0.90%	0.610702	0.619181
Other	3,017,769	3,019,533	1,764	0.06%	941	898	(42.81)	-4.55%	0.549894	0.5764394

Schedule 2