Exhibit No.:	
Issues:	Weather Normalization
Witness:	Shawn E. Lange
Sponsoring Party:	MO PSC Staff
Type of Exhibit:	Direct Testimony
Case No.:	ER-2007-0002
Date Testimony Prepared:	December 15, 2006

MISSOURI PUBLIC SERVICE COMMISSION

UTILITY OPERATIONS DIVISION

DIRECT TESTIMONY

OF

SHAWN E. LANGE

UNION ELECTRIC COMPANY d/b/a AMERENUE

CASE NO. ER-2007-0002

Jefferson City, Missouri
December 2006

BEFORE THE PUBLIC SERVICE COMMISSION

OF THE STATE OF MISSOURI

In the Matter of Union Electric Company d/b/a AmerenUE for Authority to File Tariffs Increasing Rates for Electric Service Provided to Customers in the Company's Missouri Service Area.	)))))	Case No. ER-2007-0002

AFFIDAVIT OF SHAWN E. LANGE

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

Shawn E. Lange, of lawful age, on his oath states: that he has participated in the preparation of the following Direct Testimony in question and answer form, consisting of 9 pages of Direct Testimony to be presented in the above case, that the answers in the following Direct Testimony were given by him; that he has knowledge of the matters set forth in such answers; and that such matters are true to the best of his knowledge and belief.

Shawn E Lange
Shawn E. Lange

Subscribed and sworn to before me this 14th day of December, 2006.

NOTARY PUBLIC NOTARY SEAL STATE OF MISSOURI

SUSAN L. SUNDERMEYER
My Commission Expires
September 21, 2010
Callaway County
Commission #06942086

Susan L Sundermeyer
Notary Public

My commission expires 9-21-10

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UNION ELECTRIC COMPANY d/b/a AMERENUE

CASE NO. ER-2007-0002

Q. Q. Please state your name and business address.

A. My name is Shawn E. Lange and my business address is Missouri Public Service Commission, P.O. Box 360, Jefferson City, MO 65102.

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

A. I am a Utility Engineering Specialist II in the Engineering Analysis Section, Energy Department, Utility Operations Division.

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

A. In December 2002, I received a Bachelor of Science Degree in Mechanical Engineering from the University of Missouri, at Rolla. Since then, I have pursued dual Masters Degrees in Mechanical Engineering at the University of Missouri, at Columbia and Business Administration at William Woods University. I joined the Commission Staff (Staff) in January 2005. I am a registered Engineer-in-Training in the State of Missouri.

Q. Have you previously filed testimony before this Commission?

A. Yes, I have. A list of the cases in which I have filed testimony can be found in Schedule SEL-1.

EXECUTIVE SUMMARY

Q. Please provide a brief summary of your testimony.

A. I recommend that the Commission adopt the Staff's weather and days adjustments to class usage and the weather-normalized hourly net system loads that are summarized in the schedules attached to this testimony. In my testimony I will provide a general description of weather normalization, describe the process I used, and present the results.

Normalization of Usage

Electricity use is very sensitive to weather conditions. Because of the high saturation of air conditioning and the presence of significant electric space heating in Union Electric Company d/b/a AmerenUE's (AmerenUE) service territory, the level of usage and the magnitude and shape of AmerenUE's load curve is directly related to daily temperatures.

The weather during the test year differed from normal conditions. The heating months of January and February 2006 were warmer than normal. The effect of this was that the amount of electricity usage was lower than if the temperatures had been normal. The cooling months of July through October 2005 and June 2006 were warmer than normal. The effect of this was that the amount of electricity usage was higher than if the temperatures had been normal.

Schedule SEL-2 contains the adjustments to sales by rate class for AmerenUE. The results of the weather normalization of sales were used by Staff Witness Jim Busch to normalize revenues.

Normal Weather Variables

The normal weather variables were developed using the method described in the document "Weather Normalization of Electric Loads, Demonstration: Calculation of Weather Normals" (October 25, 1991), written by Martin Turner, the former Manager of Missouri Public Service Commission's Research and Planning Department. The normal weather variables were developed using the consecutive 30 years from January 1, 1971 to December 31, 2000. Staff witness Curt Wells provided the weather data that I used to calculate normal weather.

Hourly Net System Loads

The hourly loads were normalized using the method described in the document "Weather Normalization of Electric Loads, Part A: Hourly Net System Loads" (November 28, 1990), written by Dr. Michael Proctor, Missouri Public Service Commission's Chief Economist.

Schedule SEL-3 contains a summary of the adjustments to usage to attain the annual sum of the net-system load, Schedule SEL-4 contains a monthly summary for the normalized net system load for AmerenUE, and Schedule SEL-5 contains a list of cases in which Staff's weather normalization method was used in the normalization of net system loads. The weather-normalized loads were used as an input to the fuel run Staff witness Michael Rahrer used to normalized fuel and purchased power expense.

NORMALIZATION OF USAGE

Q. Did you independently perform a weather impact analysis on hourly class load data to determine the appropriate weather response functions?

A. Yes, I did. However, I did use the same methodology as AmerenUE. Before using AmerenUE's methodology, I did a review of AmerenUE's weather normalization procedures and weather response functions. The procedures used by AmerenUE contained the most important characteristics of what constitutes a good quality weather normalization process; e.g., the use of daily load research data to determine non-linear class responses to weather, and the incorporation of different base usage parameters for different times of the year.

From this review, I determined that the AmerenUE's weather normalization procedures and weather response functions were generally reasonable for Staff to use in the normalization of revenues for the weather sensitive classes.

Q. How did you determine which rate classes were weather sensitive?

A. AmerenUE supplied hourly class load data from, at least, June 1, 2005 through June 30, 2006. The hourly loads were plotted against mean daily temperature to ascertain the weather sensitivity of each class.

Q. Which classes were deemed to be weather sensitive?

A. The rate classes that were deemed to be weather sensitive were the residential (RES), small general service (SGS), large general service (LGS), and small primary service (SPS).

Q. Did you make any adjustments or corrections to the billing cycle usage data?

A. Yes. While reviewing the billing cycle usage data provided by AmerenUE, I noticed billing errors, billing cancellations, and rebills. Since the billing cycle usage data is used to calculate weather impact on sales, it is important to use the most accurate billing cycle

usage data possible. Accordingly, I had to make some adjustments in order to correct for billing errors, billing cancellations, and rebills.

Q. How was the days adjustment determined?

A. I calculated the "days adjustment" as the difference between the annual weather normalized calendar month usage and the annual weather normalized billing month usage.

NORMAL WEATHER VARIABLES

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

A. The normal weather used in the normalization of class usage was calculated using Staff's ranking method and daily weather values for the time period January 1, 1971 through December 31, 2000. Staff's ranking method estimates daily normal values for the test year, which range from the temperature value that is "normally" the hottest to the temperature value that is "normally" the coldest.

Q. How are the daily normals derived?

A. The daily normal variables are calculated by ranking the temperatures in each year of the history. These temperatures are then averaged by rank, not by the day of the year. This results in the normal hottest variable being the average of the hottest days in each year of the history. The second normal hottest variable is based on the average of the second hottest days 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 assignment results in as small a weather normalization adjustment to the hourly loads on each day as is possible for a given annual adjustment.

HOURLY NET SYSTEM LOADS

Q. What is hourly net system load?

A. Hourly net system load is the hourly electric supply necessary to meet the energy demands of a utility's customers and the utility's own internal needs. It is net of (i.e., does not include) station use, which is the electricity requirement of the company's generating plants. The hourly loads used in my analysis of the test year, July 2005 through June 2006, were provided by AmerenUE in response to Staff Data Request No. 137 and the respective supplements to that request. I also used hourly load data submitted monthly by AmerenUE in compliance with Commission rule 4 CSR 240-3.190 to cross check and correct errors that were found in the data request response.

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

A. The Staff's weather normalization procedure was developed by the 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, Missouri Public Service Commission's Chief Economist.

Q. What did you use for normal weather variables?

A. Different weather variables are used for class usage and Net System Input but the normals for both are based on the same minimum and maximum temperatures supplied by Staff witness Curt Wells and the same methodology (i.e., ranking) was used to calculate normals for all the weather variables.

Using ranked normals is important in estimating fuel and purchased power expense because these expenses are greatly impacted by the range and fluctuations of daily weather.

Since every year has a range of high and low temperatures, the daily normals should also reflect the range of the weather distribution (normal highs and lows). The ranking method that was used estimates normal high and low temperatures.

Q. Briefly summarize the process you used.

A. In order to reflect normal weather, daily peak and average loads are adjusted independently, but using the same methodology. Independent adjustments are necessary because average loads respond differently to weather than peak loads.

Daily average load is calculated as the daily energy divided by twenty-four hours and the daily peak is the maximum hourly load for the day. Separate regression models estimate 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 for daily average loads and peak loads. The regression parameters, along with the difference between normal and actual cooling and heating measures, are used to calculate weather adjustments to both the average and peak loads for each day. The adjustments for each day are added respectively to the actual average and peak loads for each day. The starting point for allocating the weather normalized daily peak and average loads 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.

This process includes many checks and balances, which 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 method been used in other rate cases?

A. Yes, this method has been used in several cases brought before this Commission. Please refer to Schedule SEL-5 for a list of these cases.

Q. What data was used in this process?

A. Actual hourly net system loads for the time period from January 1, 2005 through June 30, 2006 were provided by AmerenUE. Staff witness Curt Wells provided the actual daily weather variables. I calculated the normal weather variables using a method developed by the Staff in 1991. The process is described in the document "Weather Normalization of Electric Loads, Demonstration: Calculation of Weather Normals" (October 25, 1991), written by Martin Turner, the former Manager of Missouri Public Service Commission's Research and Planning Department, and summarized in the next section of my testimony.

Q. Were modifications made to the test year weather normalized hourly net system loads to account for Staff's adjustments to test year usage?

A. Yes. I adjusted the weather normalized hourly net system loads to be consistent with the Staff's weather normalized, annualized test year usage.

Q. How were the hourly loads adjusted to account for the annual adjustments to usage?

A. I added weather normalized wholesale usage to the Staff's weather normalized, annualized test year usage for Missouri. Then, I increased the annual usage adjustment by the loss factor supplied to me by Staff witness Erin Maloney in order to obtain the additional amount of generation (net system input) necessary to serve this additional generation. A factor was applied to each hour of the weather-normalized loads to produce an annual sum of the hourly net-system loads that equals the adjusted test year usage, plus losses, and consistent

with normalized revenues. A table showing each of these adjustments to attain the annual sum of the net-system load is shown in Schedule SEL-3. A monthly summary of the adjusted loads is shown on Schedule SEL-4.

Q. Which Staff witness used your hourly-normalized net system loads?

A. Staff witness Michael Rahrer used the test year hourly normalized system loads in developing test year fuel and purchased power expense.

Q. Does this conclude your direct testimony?

A. Yes, it does.

Testimony of Shawn E. Lange

Direct Testimony

ER-2005-0436	(Aquila Inc.)
ER-2006-0315	(Empire District Electric Company)
ER-2006-0314	(Kansas City Power & Light Company)

Rebuttal Testimony

ER-2005-0436	(Aquila Inc.)
ER-2006-0315	(Empire District Electric Company)

Surrebuttal Testimony

ER-2005-0436	(Aquila Inc.)
ER-2006-0314	(Kansas City Power & Light Company)

Union Electric Company d/b/a AmerenUE
Actual and Weather Normalized Sales (kWh)
July 2005- June 2006
RES-Residential

Billing Month	Actual	Weather Norm	Weather Adj	% Weather Adj
Jul-05	1,469,641,282	1,353,907,485	(115,733,797)	-7.87%
Aug-05	1,538,332,176	1,439,548,015	(98,784,161)	-6.42%
Sep-05	1,409,793,820	1,241,671,075	(168,122,744)	-11.93%
Oct-05	1,029,386,687	912,266,207	(117,120,480)	-11.38%
Nov-05	863,151,258	882,589,387	19,438,129	2.25%
Dec-05	1,212,067,272	1,247,478,332	35,411,059	2.92%
Jan-06	1,338,616,660	1,431,850,220	93,233,560	6.96%
Feb-06	1,153,014,316	1,244,574,167	91,559,851	7.94%
Mar-06	1,076,587,060	1,104,140,798	27,553,739	2.56%
Apr-06	901,923,160	910,196,444	8,273,284	0.92%
May-06	763,436,456	757,264,655	(6,171,801)	-0.81%
Jun-06	1,176,816,790	1,080,964,828	(95,851,961)	-8.15%
Total	13,932,766,937	13,606,451,613	(326,315,323)	-2.34%
Days Adj	18,057,756			

Union Electric Company d/b/a AmerenUE
Actual and Weather Normalized Sales (kWh)
July 2005- June 2006
SGS-Small General Service

Billing Month	Actual	Weather Norm	Weather Adj	% Weather Adj
Jul-05	363,922,006	347,975,615	(15,946,392)	-4.38%
Aug-05	373,054,922	360,502,095	(12,552,827)	-3.36%
Sep-05	362,910,253	339,854,263	(23,055,991)	-6.35%
Oct-05	309,814,077	291,626,424	(18,187,653)	-5.87%
Nov-05	272,510,096	271,676,235	(833,861)	-0.31%
Dec-05	316,374,941	319,484,746	3,109,804	0.98%
Jan-06	330,485,829	349,885,276	19,399,448	5.87%
Feb-06	296,282,236	316,115,765	19,833,529	6.69%
Mar-06	288,085,096	293,673,905	5,588,809	1.94%
Apr-06	270,337,402	269,873,638	(463,763)	-0.17%
May-06	260,531,660	256,778,491	(3,753,169)	-1.44%
Jun-06	320,127,430	307,878,218	(12,249,211)	-3.83%
Total	3,764,435,948	3,725,324,670	(39,111,278)	-1.04%
Days Adj	6,125,357			

Union Electric Company d/b/a AmerenUE
Actual and Weather Normalized Sales (kWh)
July 2005- June 2006
LGS-Large General Service

Billing Month	Actual	Weather Norm	Weather Adj	% Weather Adj
Jul-05	776,310,810	756,441,439	(19,869,372)	-2.56%
Aug-05	790,273,727	774,173,866	(16,099,861)	-2.04%
Sep-05	780,273,490	750,239,183	(30,034,307)	-3.85%
Oct-05	706,291,856	681,676,294	(24,615,561)	-3.49%
Nov-05	637,151,392	634,775,465	(2,375,926)	-0.37%
Dec-05	691,440,182	695,322,452	3,882,269	0.56%
Jan-06	700,110,313	730,012,231	29,901,918	4.27%
Feb-06	626,055,339	656,402,624	30,347,285	4.85%
Mar-06	610,232,858	617,728,197	7,495,340	1.23%
Apr-06	581,915,912	578,388,546	(3,527,365)	-0.61%
May-06	610,680,101	603,307,197	(7,372,904)	-1.21%
Jun-06	743,234,479	724,683,532	(18,550,946)	-2.50%
Total	8,253,970,457	8,203,151,026	(50,819,431)	-0.62%
Days Adj	29,293,675			

Union Electric Company d/b/a AmerenUE
Actual and Weather Normalized Sales (kWh)
July 2005- June 2006
SPS-Small Primary Service

Billing Month	Actual	Weather Norm	Weather Adj	% Weather Adj
Jul-05	381,572,680	375,950,661	(5,622,019)	-1.47%
Aug-05	388,534,235	384,312,962	(4,221,273)	-1.09%
Sep-05	400,974,664	391,908,612	(9,066,052)	-2.26%
Oct-05	372,912,740	364,209,324	(8,703,416)	-2.33%
Nov-05	330,413,595	327,501,802	(2,911,793)	-0.88%
Dec-05	329,176,153	328,244,158	(931,994)	-0.28%
Jan-06	348,295,266	351,671,531	3,376,264	0.97%
Feb-06	316,009,658	319,655,292	3,645,634	1.15%
Mar-06	313,522,871	314,247,751	724,880	0.23%
Apr-06	316,352,657	314,365,624	(1,987,032)	-0.63%
May-06	331,331,747	328,836,447	(2,495,300)	-0.75%
Jun-06	369,795,531	365,812,047	(3,983,484)	-1.08%
Total	4,198,891,797	4,166,716,213	(32,175,584)	-0.77%
Days Adj	(14,523,992)			

UNION ELECTRIC COMPANY d/b/a AmerenUE
COMPONENTS OF ANNUAL NET SYSTEM INPUT
ER-2007-0002

	As Recorded Sales (kWh)	Large Customer Annualizations	Normalization for Weather	Days Adjustment	Additional kWh from Cust Growth	Total AmerenUE Normalized kWh
Mo Retail	38,625,554,922	21,794,021	(448,421,616)	46,140,154	233,107,107	38,478,174,588
Wholesale	632,342,031	0	(1,474,812)	0	0	630,867,219
MSD	164,757					164,757
NSI w/o losses	39,258,061,710	21,794,021	(449,896,427)	46,140,154	233,107,107	39,109,206,564
NSI with Losses 4.49%	41,103,613,977	22,818,575	(471,046,411)	48,309,239	244,065,655	40,947,761,035

UNION ELECTRIC COMPANY d/b/a AmerenUE
Net System Load
Normalized for July 2005 through June 2006*
ER-2007-0002

Month	Monthly Usage (MWh)				Monthly Peaks (MW)				Load Factor	
	Actual	Normal	Adj	% Adj	Actual	Normal	Adj	% Adj	Actual	Normal
Jul-05	3,956,941	4,042,528	85,587	2.16%	8,221	8,195	(26)	-0.32%	0.65	0.66
Aug-05	3,912,160	3,868,027	(44,132)	-1.13%	7,864	7,793	(72)	-0.91%	0.67	0.67
Sep-05	3,397,865	3,297,888	(99,978)	-2.94%	6,997	6,802	(195)	-2.79%	0.67	0.67
Oct-05	2,973,029	3,029,232	56,204	1.89%	6,427	5,581	(846)	-13.16%	0.62	0.73
Nov-05	2,946,830	3,116,646	169,816	5.76%	5,517	5,839	322	5.83%	0.74	0.74
Dec-05	3,576,415	3,679,574	103,159	2.88%	6,276	6,525	249	3.97%	0.77	0.76
Jan-06	3,250,728	3,811,031	560,303	17.24%	5,465	6,641	1,176	21.52%	0.80	0.77
Feb-06	3,073,634	3,226,864	153,229	4.99%	5,794	6,160	366	6.32%	0.79	0.78
Mar-06	3,090,202	3,230,987	140,785	4.56%	5,315	5,648	333	6.27%	0.78	0.77
Apr-06	2,780,778	2,860,100	79,323	2.85%	5,514	5,176	(338)	-6.13%	0.70	0.77
May-06	3,129,759	3,117,284	(12,475)	-0.40%	6,756	5,888	(867)	-12.84%	0.62	0.71
Jun-06	3,624,184	3,667,599	43,416	1.20%	7,734	7,753	19	0.25%	0.65	0.66
Annual	39,712,524	40,947,761	1,235,237	3.11%	8,221	8,195	(26)	-0.32%	0.55	0.57

* Normalized for weather, growth, and large customers

Cases in Which Staff's Weather Normalization Method Was Used
in the Normalization of Net System Loads

EO-87-175	ER-94-163	EM-2000-292
EO-90-101	ER-94-174	ER-2001-299
EO-90-138	ER-95-279	ER-2001-672
ER-93-37	ER-97-81	EC-2002-1
ER-93-41	EM-97-575	ER-2002-424
EO-93-351	ER-2004-0034	ER-2004-0570
ER-2005-0436	ER-2006-0315	