

Exhibit No.:  
Issues: Weather Normalization

Witness: Henry E. Warren  
Sponsoring Party: MO PSC Staff  
Type of Exhibit: Direct Testimony  
Case No.: GR-2007-0208  
Date Testimony Prepared: May 4, 2007

**MISSOURI PUBLIC SERVICE COMMISSION**

**UTILITY OPERATIONS DIVISION**

**DIRECT TESTIMONY**

**OF**

**HENRY E. WARREN**

**LACLEDE GAS COMPANY**

**CASE NO. GR-2007-0208**

**Jefferson City, Missouri  
May 2007**

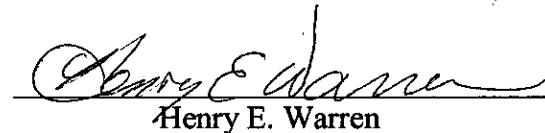
**BEFORE THE PUBLIC SERVICE COMMISSION  
OF THE STATE OF MISSOURI**

In the Matter of Laclede Gas Company's )  
Tariff to Revise Natural Gas Rate ) Case No. GR-2007-0208  
Schedules )

**AFFIDAVIT OF HENRY E. WARREN**

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

Henry E. Warren, 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 10 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.

  
Henry E. Warren

Subscribed and sworn to before me this 3<sup>rd</sup> day of May, 2007.



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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1                           **DIRECT TESTIMONY**  
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5                           **HENRY E. WARREN**  
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7                           **LACLEDE GAS COMPANY**  
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9                           **CASE NO. GR-2007-0208**

10                  Q.     Please state your name and business address.

11                  A.     My name is Henry E. Warren and my business address is P. O. Box 360,  
12 Jefferson City, Missouri, 65102.

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

14                  A.     I am employed by the Missouri Public Service Commission (PSC or  
15 Commission) as a Regulatory Economist in the Energy Department of the Utility Operations  
16 Division.

17                  Q.     What is your educational and professional background?

18                  A.     I received my Bachelor of Arts and my Master of Arts in Economics from the  
19 University of Missouri-Columbia, and a Doctor of Philosophy (PhD) in Economics from  
20 Texas A&M University. Prior to joining the PSC Staff (Staff), I was an Economist with the  
21 U.S. National Oceanic and Atmospheric Administration (NOAA). At NOAA I conducted  
22 research on the economic impact of climate and weather. I began my employment at the  
23 Commission on October 1, 1992 as a Research Economist in the Economic Analysis  
24 Department. My duties consisted of calculating adjustments to test year energy use based on  
25 test-year weather and normal weather, and I also assisted in the review of Electric Resource  
26 Plans for investor owned utilities in Missouri. From December 1, 1997, until May 2001, I  
27 was a Regulatory Economist II in the Commission's Gas Department, where my duties  
28

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3 included analysis of issues in natural gas rate cases and were expanded to include reviewing  
4 tariff filings, applications and various other matters relating to jurisdictional gas utilities in  
5 Missouri. On June 1, 2001 the Commission organized an Energy Department and I was  
6 assigned to the Tariff/Rate Design Section of the Energy Department. My duties in the  
7 Energy Department include analysis of issues in rate cases of natural gas and electric utilities,  
8 tariff filings, applications, and various other matters relating to jurisdictional gas and electric  
9 utilities in Missouri, including review of Electric Resource Plans and Regulatory Plans for  
10 investor owned electric utilities in Missouri. I have also served on various task forces,  
11 collaboratives, and working groups dealing with issues relating to jurisdictional natural gas  
12 and electric utilities.

13 Q. Are you a member of any professional organizations?

14 A. Yes, I am a member of the International Association for Energy Economics  
15 and the Western Economics Association.

16 Q. Have you previously filed testimony before the Commission?

17 A. Yes, I have filed testimony in the cases listed in Schedule 1 attached to this  
18 testimony.

#### EXECUTIVE SUMMARY

19 Q. What is the purpose of your direct testimony?

20 A. My direct testimony covers the adjustment of billing units for the test year for  
21 normalized weather and meter read cycle days, the allocation of these units to revenue blocks  
22 for the test year for the general service (GS) Residential Class, Commercial and Industrial  
23 (C&I) Classes I, II, and III of the Laclede Gas Company (Laclede or Company). The test  
24 year therms, the normal therms, and computed adjustments are shown in Schedules 2.1  
through 2.8, attached to my testimony.

3 **GENERAL SERVICE BILLING DETERMINANTS**

4 Q. What billing determinants in rates were established for the commodity charge  
5 for the GS class by the current rate design and how are normalized therms for the test year  
6 determined and allocated according to these billing determinants?

7 A. Billing determinants in Laclede's current GS rates are differentiated according  
8 to a commodity charge that is divided into two blocks for GS customers. The first block  
9 differs according to the rate class and the season of the year for C&I Classes II and III. For  
10 residential customers, the *first block, or initial block*, is defined as the first 65 Therms (one  
11 hundred thousand British Thermal Units, BTU) of natural gas used in the month, the *second  
block, or tail block*, is defined as all therms over 65 Therms per month, and the blocks are the  
12 same each month. For the C&I Class I customers the *first block*, is defined as the first 100  
13 Therms of natural gas used in the month, the *second block, or tail block*, is defined as all  
14 therms over 100 Therms per month, and the blocks are the same each month. For the C&I  
15 Class II customers the *first block*, is defined as the first 100 Therms of natural gas used in the  
16 months of May through October, the *second block, or tail block*, is defined as all therms over  
17 100 Therms per month. In the months of November through April the *first block*, is defined  
18 as the first 1000 Therms of natural gas used, the *second block, or tail block*, is defined as all  
19 therms over 1000 Therms per month. For the C&I Class III customers the *first block*, is  
20 defined as the first 100 Therms of natural gas used in the months of May through October,  
21 the *second block, or tail block*, is defined as all therms over 100 Therms per month. In the  
22 months of November through April the *first block*, is defined as the first 6000 Therms of  
23 natural gas used, the *second block, or tail block*, is defined as all therms over 6000 Therms  
per month. In order for Staff witness Ms. Kim Bolin, PSC Accounting Department, to

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1 compute the revenues associated with the normal therms, the normal therms must be computed  
2 and be properly allocated monthly to each block. This, in turn, allows Ms. Bolin to determine  
3 the rate at which the therms are to be computed.

4 Q. What data are used to compute these billing determinants?

5 A. The Company provided Staff with test year (October 2005 - September 2006)  
6 monthly active meters and monthly Therms per customer (Therms/Cust) for the first block  
7 and total Therms/Cust for the GS rate codes and customer classes served on the GS tariff. I  
8 used the Company's test year first block Therms/Cust and total Therms/Cust to determine the  
9 normal usage falling into each rate block and the total usage for each month for each GS rate  
10 class in the Laclede Division, St. Charles Division, Midwest Division, and Missouri Natural  
11 Division. (Note that in data furnished by the Company, the Company uses the term Bills  
12 rather than Customers when referring to monthly therm usage.)

13 Q. How did you use that data to determine normalized billing determinants for  
14 the test year?

15 A. For each GS class in the Divisons, there are two blocks. Using the monthly  
16 first block Therms/Cust and total Therms/Cust for October 2005 – September 2006, the  
17 monthly usage in the second block was computed as the difference between the total and the  
18 first block. The Laclede GS tariff groups the lower use months of May through October  
19 (non-heating) together and the heating months of November through April with differing  
20 rates for the heating and non-heating seasons. For each GS customer class in each division  
21 monthly normal usage was estimated using regression analysis to compute a statistical  
22 relationship between cold weather and the Therms/Cust.

3                   **WEATHER-NORMALIZED SALES**

4           Q.     Why is it important to adjust test-year natural gas sales to normal weather?

5           A.     Since rates are based on natural gas usage during the test year, it is important  
6 to remove the influence of abnormal weather. Staff's weather-normalized adjustments to the  
7 amount of natural gas sales correct for deviations from normal weather conditions during the  
8 test year.

9           Q.     Why are natural gas sales dependent upon weather conditions?

10          A.    The predominant use of natural gas in Missouri is for space heating.  
11 Therefore, Laclede's natural gas sales are very dependant on the duration and intensity of  
12 colder weather.

13          Q.    How do Staff's analyses adjust test-year natural gas sales if the test year is  
14 warmer than normal?

15          A.    Staff's studies would increase test year natural gas sales to adjust sales to the  
16 level that would be expected to occur under normal (colder) weather.

17          Q.    How do Staff's analyses adjust test-year natural gas sales if the test year is  
18 colder than normal?

19          A.    Staff's studies would decrease test year natural gas sales to adjust sales to the  
20 level that would be expected to occur under normal (warmer) weather.

21          Q.     What firm sales customer classes were studied?

22          A.    They were the general service residential, and C&I customer classes of  
23 Laclede.

24          Q.     Were Laclede's billing records for the general service residential and C&I  
25 classes I, II, and III subdivided further for the studies?

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3                   A.     Yes, Laclede's Missouri billing records were subdivided into four geographic  
4                   regions, in the Laclede Division, St. Charles Division, Midwest Division, and Missouri  
5                   Natural Division.

6                   Q.     Please identify the Staff witness who relies upon the results of the weather-  
7                   normalization studies.

8                   A.     Staff witness Ms. Kim Bolin of the Commission's Auditing Department relies  
9                   on my results for the Staff's customer growth annualization and revenue calculations.

10                  Q.     What was your source for the billed natural gas usage data?

11                  A.     Laclede provided Staff with monthly natural gas sales expressed as  
12                   Therms/Cust for the first block and total use, and the monthly numbers of customers for each  
13                   billing cycle by GS customer class and geographic region for the test year.

14                  Q.     What are billing cycles?

15                  A.     The Company schedules groups of natural gas accounts into billing cycles that  
16                   are to be read throughout a month. Next, the Company bills the accounts based on the meter  
17                   reading. Since there are approximately twenty-one working days in a month, customers'  
18                   accounts are usually grouped into one of the approximately twenty-one billing cycles.  
19                   Staggering the billing of customers' accounts over the billing month spreads the amount of  
20                   work necessary to bill Laclede's customers.

21                  Q.     How did Staff analyze space heating natural gas therms?

22                  A.     Staff performed an analysis for each GS customer group in the four  
23                   geographic regions. Staff calculated sets of twelve billing month averages by customer class.  
Actual daily average heating degree days (HDD), normal daily average heating degree days  
(NHDD) and deviation from normal daily average heating degree days (DFNHDD=NHDD-

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HDD) were calculated. Actual daily average water heating degree days (WHDD), normal daily average water-heating degree days (NWHDD), and deviation from normal water heating degree days ( $DFNWHDD = NWHDD - WHDD$ ) were also calculated. For each billing month, these billing month averages were calculated by customer class from the data on numbers of customers, and summed HDD, NHDD, DFNHDD, WHDD, NHDD, and DFNWHDD from approximately twenty-one billing cycles.

Q. Did Staff compute the HDD, NHDD, WHDD and NWHDD for the test year?

A. Yes, these computations were done by Staff Witness, Mr. Curt Wells and results were furnished to me. I computed the DFNHDD and DFNWHDD.

Q. Were the twelve billing month HDD, NHDD, WHDD and NWHDD customer-weighted averages weighted to reflect different customer levels among the different billing cycles?

A. Yes, each billing month's daily average HDD, NHDD, WHDD and NWHDD in each billing cycle was weighted by the percentage of customers in that billing cycle. Thus, the billing cycles with the most customers are given more weight in computing the billing month daily average HDD, NHDD, WHDD and NWHDD.

Q. How did Staff obtain billing month usage in Therms/Cust?

A. The Company supplied the monthly average-usage-per-customer amounts across the approximately twenty-one billing cycles for the first block and total usage and the days in each cycle. These were used to calculate one month's daily average usage in Therms/Cust.

Q. How did Staff quantify the relationship of natural gas sales to weather?

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3           A.       The Company's GS tariff prices usage in the heating and non-heating seasons  
4           and usage in the first block and second block differently. Based on the differences in the  
5           tariff and the data furnished by the Company, monthly Therms/Cust in the first block and  
6           total Therms/Cust, Staff's studies estimate the change in usage in Therms/Cust related to a  
7           change in weather based on the sets of monthly billing month averages; *i.e.*, average daily  
8           usage in Therms/Cust, and the customer-weighted average daily NHDD and DFNHDD or  
9           NWHDD and DFNWHDD depending on the season and the block. For the heating season  
10          months Therms/Cust in the second block were analyzed using NHDD and DFNHDD in the  
11          regression. For the heating season months Therms/Cust in the first block were analyzed  
12          using NWHDD and DFNWHDD in the regression. For the non-heating season Therms/Cust  
13          in both the first block and the second block were analyzed using NWHDD and DFNWHDD.  
14          These sets of billing month averages (usage and weather) were used to study the relationship  
15          between natural gas usage in Therms/Cust and weather.

16           Staff used regression analysis to estimate the four relationships for each of the GS  
17          customer classes in the four geographic regions.

18           Q.       What are the advantages of using regression?

19           A.       The regression equation develops quantitative measures that describe the  
20          relationship between daily space-heating or water-heating sales per customer in Therms/Cust  
21          to the daily NHDD and DFNHDD or NWHDD and DFNWHDD. The regression equation  
22          estimates a change in the daily natural gas usage per customer whenever the daily average  
23          weather changes as measured by NHDD and DFNHDD or NWHDD and DFNWHDD.

24           Q.       Were the results of the regressions always used for each of the four segments -  
25          - non-heating season first block, non-heating season second block, heating season first block,

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1 and heating season second block -- for each of the GS customer classes in each of the  
2 divisions?

3 A. No, there was actually no instance where the results of the four regressions  
4 were all used for a customer class in a division to estimate normal usage. When the  
5 regression was not used the test year actual daily Therms/Cust were used for the normal  
6 values. The regressions were not used if it was deemed that they were not statistically  
7 significant or consistent. If the goodness of fit as measured by adjusted R<sup>2</sup> term was less than  
8 .80 (0< R<sup>2</sup><1), the regression was deemed not to be statistically significant and the results  
9 were not used. Similarly, if the coefficient of the t-statistic of the DFNHDD or DFNWHDD  
10 term was not statistically significant at the 95% level, the regression was deemed not to be  
11 statistically significant and the results were not used. Finally, if the sign of the coefficient of  
12 NHDD or DFNHDD was negative the results were not used due to inconsistency, or if the  
13 sign of the coefficient of NWHDD or DFNWHDD was negative the regression results were  
14 not used to estimate normal values due to inconsistency.

15 Q. For a GS class in a division, after the normal values were obtained for the first  
16 and second blocks in a season, was any further analysis done?

17 A. Yes, the last analysis was to check to see if the adjustments to the first and  
18 second blocks to normalize the blocks were both in the same direction. If the normal  
19 adjustments to the first and second blocks in a season were in opposite directions, the  
20 adjustment to the first block was set to zero and the total adjustment was assigned to the  
21 second block.

22 Q. What were the results of Staff's weather-normalized sales studies for the test  
23 year?

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3                   A.       Staff's analyses resulted in increases to natural gas sales for the test year  
4                   because overall the weather during the test year was warmer than normal. Staff's analyses  
5                   result in an approximate 9.7 percent increase from actual natural gas sales for the residential  
6                   customer class and for the C&I general service class I, II and III increases of 6.9 percent, 2.4  
7                   percent and 4.7 percent respectively. These increases do not include the Staff's customer  
8                   growth annualization.

9                   Q.       What results were provided to Staff witness Bolin for Staff's customer growth  
10                  annualization and revenue calculations?

11                  A.       First, Staff provided monthly, normalized natural gas usage in Therms by rate  
12                  block for each of the GS residential customer class for Laclede's four divisions. These  
13                  results are contained in Schedules 2-1 through 2-10, attached to my testimony. Schedules 3-1  
14                  through 3-10 demonstrate the higher natural gas usage per customer in the colder, winter  
15                  months because of space heating requirements.

16                  Second, to enable the calculation of weather-normalized revenue, Staff witness Bolin  
17                  was provided monthly weather-normalized therms for GS C&I class I, II, and III for  
18                  Laclede's four divisions. Schedules 2-1 through 2-10, attached to my testimony, contain  
19                  those monthly weather-normalized therms and Schedules 3-1 through 3-10 contain the  
20                  weather-normalized therms per bill.

21                  Q.       Does this conclude your direct testimony?

22                  A.       Yes, it does.

**LACLEDE GAS COMPANY**

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**PREVIOUS CASES IN WHICH PREPARED TESTIMONY, REPORT OR  
REVIEW WAS SUBMITTED BY:**

**HENRY E. WARREN, PHD**

<b><u>COMPANY NAME</u></b>	<b><u>CASE NUMBER</u></b>
St. Joseph Light and Power Company	GR-93-042 <sup>1</sup>
Laclede Gas Co.	GR-93-149
Missouri Public Service	GR-93-172 <sup>1</sup>
Western Resources	GR-93-240 <sup>1</sup>
Laclede Gas Co.	GR-94-220 <sup>1</sup>
Kansas City Power & Light Co.	EO-94-360
United Cities Gas Co.	GR-95-160 <sup>1</sup>
UtiliCorp United, Inc.	EO-95-187
The Empire District Electric Co.	ER-95-279 <sup>1</sup>
The Empire District Electric Co.	EO-96-56
St. Joseph Light and Power Company	EO-96-198
Laclede Gas Co.	GR-96-193 <sup>1</sup>
Missouri Gas Energy	GR-96-285 <sup>1</sup>
The Empire District Electric Co.	ER-97-081 <sup>1</sup>
Union Electric Co.	GR-97-393 <sup>1</sup>
Missouri Gas Energy	GR-98-140 <sup>1</sup>
Laclede Gas Co.	GR-98-374 <sup>1</sup>
St. Joseph Light & Power Company	GR-99-246 <sup>1</sup>
Laclede Gas Co.	GR-99-315 <sup>1</sup>
Union Electric Company (d/b/a AmerenUE)	GR-2000-512 <sup>1</sup>

**PREVIOUS CASES IN WHICH PREPARED TESTIMONY, REPORT OR**

**REVIEW WAS SUBMITTED BY:**  
**HENRY E. WARREN, PHD**  
**(CONTINUED)**

<b><u>COMPANY NAME</u></b>	<b><u>CASE NUMBER</u></b>
Missouri Gas Energy	GR-2001-292 <sup>1</sup>
Laclede Gas Co.	GR-2001-629 <sup>2</sup>
Union Electric Co. (d/b/a AmerenUE)	GC-2002-388
Laclede Gas Co.	GC-2002-0110
Laclede Gas Co.	GR-2002-0356 <sup>1</sup>
Aquila, Inc.	GC-2003-0131
Laclede Gas Co.	GC-2003-0212
Laclede Gas Co.	GT-2003-0117
Aquila Networks (MPS and L&P)	GR-2004-0072 <sup>1</sup>
Missouri Gas Energy	GR-2004-0209
Laclede Gas Co.	GC-2004-0240
Kansas City Power & Light	EO-2005-0329
Union Electric Co. (d/b/a AmerenUE)	EO-2006-0240
The Empire District Electric Company	ER-2006-0315
The Atmos Energy Corporation	GR-2006-0387
Missouri Gas Energy	GR-2006-0422 <sup>1</sup>
Union Electric Co. (d/b/a AmerenUE)	GR-2007-0003 <sup>1</sup>
Kansas City Power & Light	EO-2007-0008

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<sup>1</sup> Testimony includes computations to adjust test year volumes, therms, or kWh to normal weather.

<sup>2</sup> Testimony includes computations to adjust test year volumes, therms, or kWh to normal weather.







































