Exhibit No.:	
Issues:	Weather
Witness:	Henry E. Warren, PhD
Sponsoring Party:	MO PSC Staff
Type of Exhibit:	Supplemental Direct Testimony
Case No.:	ER-2006-0315
Date Testimony Prepared:	July 17, 2006

MISSOURI PUBLIC SERVICE COMMISSION

UTILITY OPERATIONS DIVISION

SUPPLEMENTAL DIRECT TESTIMONY

OF

HENRY E. WARREN, PhD

THE EMPIRE DISTRICT ELECTRIC CO.

CASE NO. ER-2006-0315

Jefferson City, Missouri
July 2006

BEFORE THE PUBLIC SERVICE COMMISSION

OF THE STATE OF MISSOURI

In the matter of The Empire District Company of Joplin, Missouri for authority to file tariffs increasing rates for electric service provided to customers in Missouri service area of the Company.	))))	Case No. ER-2006-0315

AFFIDAVIT OF HENRY WARREN

STATE OF MISSOURI)
) ss.
COUNTY OF COLE)

Henry Warren, of lawful age, on his oath states: that he has participated in the preparation of the foregoing Supplemental Direct Testimony in question and answer form, consisting of 5 pages to be presented in the above case; that the answers in the foregoing Supplemental Direct Testimony were given by him; that he has knowledge of the matters set forth in such answers; and that such matters are true and correct to the best of his knowledge and belief.

Henry E Warren
Henry Warren

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

Sharon S. Wiles
Notary Public

SHARON S WILES
Notary Public - Notary Seal
STATE OF MISSOURI
COLE COUNTY
MY COMMISSION EXP. SEPT 11,2006

My commission expires September 11, 2006.

SUPPLEMENTAL DIRECT TESTIMONY

OF

HENRY E. WARREN, PhD

THE EMPIRE DISTRICT ELECTRIC CO.

CASE NO. ER-2006-0315

Q. Please state your name and business address.

A. My name is Henry E. Warren and my business address is 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 (PSC or Commission) as a Regulatory Economist in the Energy Department of the Utility Operations Division.

Q. How long have you been employed by the Commission?

A. I have worked at the Commission thirteen years.

Q. What is your educational and professional background?

A. I received my Bachelor of Arts and my Master of Arts in Economics from the University of Missouri-Columbia, and a Doctor of Philosophy (PhD) in Economics from Texas A&M University. Prior to joining the PSC Staff (Staff), I was an Economist with the U.S. National Oceanic and Atmospheric Administration (NOAA). At NOAA I conducted research on the economic impact of climate and weather. I began my employment at the Commission on October 1, 1992, as a Research Economist in the Economic Analysis Department. My duties consisted of calculating adjustments to test-year energy use based on test-year weather and normal weather, and I also assisted in the review of Electric Resource

Plans for investor owned utilities in Missouri. From December 1, 1997, until May 2001, I was a Regulatory Economist II in the Commission's Gas Department where my duties still included analysis of issues in natural gas rate cases and were expanded to include reviewing tariff filings, applications and various other matters relating to jurisdictional gas utilities in Missouri. On June 1, 2001, the Commission organized an Energy Department and I was assigned to the Tariff/Rate Design Section of the Energy Department. My duties in the Energy Department include analysis of issues in natural gas rate cases, tariff filings, applications and various other matters relating to jurisdictional gas utilities in Missouri as well as tariff filings, review of Electric Resource Plans, and review of Regulatory Plans for investor owned electric utilities in Missouri. I have also served on Task Forces, Collaboratives, and Working Groups dealing with issues relating to jurisdictional natural gas and electric utilities.

Q. Are you a member of any professional organizations?

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

Q. Have you previously filed testimony before the Commission?

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

Q. What is the purpose of your testimony?

A. The purpose of my testimony is to address the *Order Requiring Additional Information or Supplemental Filing* (Order) issued June 20, 2006, in Case No. ER-2006-0315, which asks for information in response to five questions. In my testimony, I am responding to Question 1. regarding the time interval used in the historical average for weather variables: in particular, whether the period should be three years, five years, 10

years, 15 years, 30 years or some other time period. I will also provide support for the 30 year time period that Staff uses in electric rate cases to calculate a set of daily maximum and minimum temperatures which are used in calculations to adjust test year net system input; a procedure termed *weather normalization.*

Q. What is Staff's opinion regarding the length of the time period that the Commission should use in adjusting the test year usage in the rate case?

A. It is Staff's opinion that the Commission should use the 30 year time period that the National Oceanic and Atmospheric Administration (NOAA) uses to calculate daily normal weather variables. Currently the time period used by NOAA to calculate normal weather variables is January 1, 1971 through December 31, 2000. The choice of this 30 year period by Staff is based on previous Staff analysis, Commission decisions and guidelines for normal weather variables established by the NOAA and the World Meteorological Organization.

Q. Why does Staff believe that 30 years is the correct length of time to calculate daily normal weather variables?

A. The use of this time period is based on testimony submitted on behalf of Staff by then Missouri State Climatologist, Dr. Wayne Decker in Case No. GR-92-165. (Schedule 3). On page 6, beginning with line 24, Dr. Decker gives his recommendation for the 30 year time period for defining normal heating degree days.

> A. I would recommend that the most recent thirty-year period with a recalculation every decade be used for the following reasons:
> (1) it would not allow events which have occurred nearly a century ago to be equally weighted with more recent events in the calculation of normals;
> (2) it would allow for an adjustment for changes in climate, both natural and anthropogenic;
> (3) this procedure would bring the techniques used in Missouri in line with those used by the National Weather Serve and other States;

(4) the thirty-year period is long enough to produce statistics that are stable without major variations from decade to decade;
(5) during the most recent thirty-year period (1961-1990), the observations at Lambert Field have been taken from the same site using the same type of weather instruments.

The Commission affirmed the Staff's use of 30 years in its decision in Case Nos. GR-96-285 (Relevant portion is shown in Schedule 4) and ER-97-394 (Relevant portion is shown in Schedule 5).

Q. Did Staff compare daily average temperatures calculated using three, five, ten, fifteen, and thirty years?

A. No, given the time allowed to respond to the questions in the Commission's order, Staff has not been able to do a comprehensive comparative analysis of the effect of using daily temperatures based on the five time periods in Question 1. -- 3 years, 5 years, 10 years, 15 years, 30 years for this filing.

However, Staff has done a comparison of the effect on the range of daily maximum, minimum and average temperatures in the five time periods in Question 1 (Schedule 6). Schedule 6 contains a graph of the average of the ten highest maximum, ten lowest minimum, and all daily mean temperatures for the five periods requested by the Commission and the time period used by Staff to calculate daily normal weather variables, 1971-2000. As can be seen in Schedule 5, as the time period increases, the average temperature decreases only 1.7°F from one year of daily temperatures, 2005, to thirty years of daily temperatures, 1976-2005. However, the change in the ten highest daily maximum temperatures average increases 6.1°F and the ten lowest daily minimum temperatures average decreases 25.5°F. The extreme temperatures are typically the primary determinant of the peak loads, so the longer time period gives a better indication of the extremes in temperature that need to be considered for the weather normalization of net system inputs that are used in the estimation of fuel and

purchased power. Staff's methodology for creating daily normal variables and the importance of including extreme temperatures can be found in supplemental direct testimony of Staff witness Lena M. Mantle and in Staff witness Shawn E. Lange's direct testimony filed on June 23, 2006.

Q. Why not use the most recent 30 year time period?

A. In order for the normal weather variables to be stable but also reflect changes in weather patterns, NOAA normal temperatures are computed every ten years on the most recent three whole decades starting in a year ending in one. Currently this time period is January 1, 1971 through December 31, 2000. In computing normal temperatures, NOAA processes and screens the data so that as much as possible the data series is "free of any inconsistencies in observational practices" (Schedule 2). This process takes time and resources, so it is performed in ten year intervals. Also, if the most recent thirty years could be used, the normal weather variables would change every year. Updating every decade is a compromise that provides normal weather variables that are accurate, stable for ten years, and adaptable when an earlier decade is dropped and the most recent one is added.

Q. Is the time period used to determine normal weather typically disputed in electric cases?

A. No it is not. Currently, all of the jurisdictional electric utilities have used the 30 year history from January 1971 through December 31, 2000, to calculate normal weather variables for computing normal usage in rate cases.

Q. Does this conclude your supplemental direct testimony?

A. Yes, it does.

The Empire District Electric Company

CASE NO. ER-2006-0315

PREVIOUS CASES IN WHICH PREPARED TESTIMONY WAS PRESENTED BY:

HENRY E. WARREN, PHD

COMPANY NAME	CASE NUMBER
St. Joseph Light and Power Company	GR-93-042[1]
Laclede Gas Co.	GR-93-149
Missouri Public Service	GR-93-172[1]
Western Resources	GR-93-240[1]
Laclede Gas Co.	GR-94-220[1]
United Cities Gas Co.	GR-95-160[1]
The Empire District Electric Co.	ER-95-279[1]
Laclede Gas Co.	GR-96-193[1]
Missouri Gas Energy	GR-96-285[1]
The Empire District Electric Co.	ER-97-081[1]
Union Electric Co.	GR-97-393[1]
Missouri Gas Energy	GR-98-140[1]
Laclede Gas Co.	GR-98-374[1]
St. Joseph Light & Power Company	GR-99-246[1]
Laclede Gas Co.	GR-99-315[1]
Union Electric Company (d/b/a AmerenUE)	GR-2000-512[1]
Missouri Gas Energy	GR-2001-292[1]
Laclede Gas Co.	GR-2001-629[1]
Laclede Gas Co.	GR-2002-0356[1]
Laclede Gas Co.	GT-2003-0117
Aquila Networks (MPS and L&P)	GR-2004-0072[1]
Missouri Gas Energy	GR-2004-0209

[1] Testimony includes computations to adjust test year volumes, therms, or kWh to normal weather.

U.S. Climate Normals 1971-2000, Products

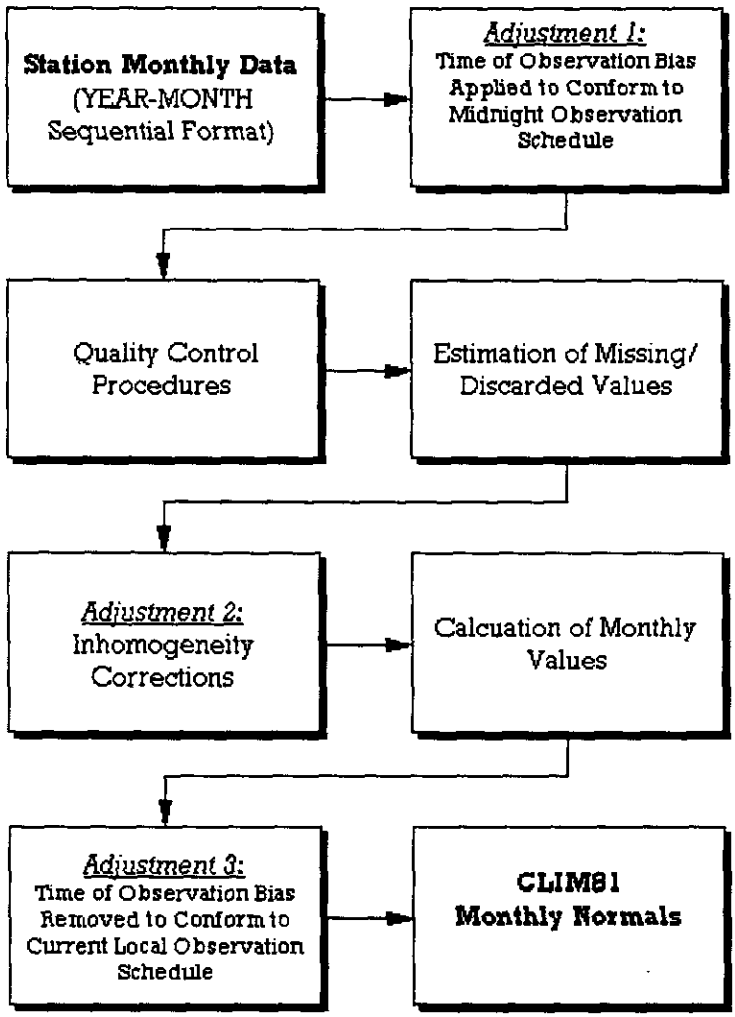
Computational Procedures

A. Adjustments to the Data

A climate normal is defined, by convention, as the arithmetic mean of a climatological element computed over three consecutive decades (WMO, 1989). Ideally, the data record for such a 30-year period should be free of any inconsistencies in observational practices (e.g., changes in station location, instrumentation, time of observation, etc.) and be serially complete (i.e. no missing values). When present, inconsistencies can lead to a non-climatic bias in one period of a station?s record relative to another. In that case, the data record is said to be ?inhomogeneous?. Since records are frequently characterized by data inhomogeneities, statistical methods have been developed to identify and account for these data inhomogeneities. In the application of these methods, adjustments are made so that earlier periods in the data record more closely conform to the most recent period. Likewise, techniques have been developed to estimate values for missing observations. After such adjustments are made, the climate record is said to be ?homogeneous? and serially complete. The climate normal can then be calculated simply as the average of the 30 values for each month observed over a normals period like 1971 to 2000. By using appropriately adjusted data records, where necessary, the 30-year mean value will more closely reflect the actual average climatic conditions at all stations.

The methodology used to address inhomogeneity and missing data value problems stations is described in Figure 2. As with all automated quality control and statistical adjustment techniques, only those data errors and inhomogeneities falling outside defined statistical limits can be identified and appropriately addressed. In addition, even the best procedures can occasionally apply corrections where none are required or misidentify the exact year of a discontinuity. In the 1971-2000 monthly normals calculations, the sequential year-month data were adjusted to conform to a common midnight-to-midnight observation schedule. This is necessary since changes in observation time also can lead to non-climatic biases in a station?s record. The data were then quality controlled to identify suspect observations and missing or erroneous values were estimated. Finally, the serially complete data series were adjusted for non-climatic inhomogeneities. In the 1971-2000 normals, all stations were processed through the same procedures, whereas in the 1961-1990 normals only NWS First Order stations were evaluated for inhomogeneities. Each of the steps in the data processing procedures used in the 1971-2000 normals calculations is described briefly below.

Figure 2
CLIM81 Processing Steps (Temperature)



In order to effectively compare records among various stations, the time of observation bias, if present, must be removed. While the practice at all NWS First Order stations is to use the calendar day (midnight recording time) for daily summaries, Cooperative Network Station observers record observations once per day summarizing the preceding 24-hour period ending generally in the local morning or evening hours. Observations based on observation times other than midnight can exhibit a bias relative to those based on a midnight observation time (see e.g., Baker, 1975). Moreover, observation times at any one station may change during a station?s history resulting in a potential inhomogeneity at that station. To produce records that reflect a consistent observational schedule, the technique developed by Karl et al. (1986) was used to adjust the monthly maximum and minimum temperature observations to conform to observations recorded on a midnight-to-midnight schedule. However, no time of observation

bias adjustments were applied to stations in Alaska, Hawaii, or the U.S. possessions since no model for adjustment presently exists for these regions.

All monthly temperature averages and precipitation totals were cross-checked against archived daily observations to ensure internal consistency. In addition, each monthly observation was evaluated using an adaptation of the quality control procedures described by Peterson et al.(1998). In this approach, observations at each station are expressed as a departure from the long-term monthly mean. Then, monthly anomalies at a candidate station are compared with the anomalies observed at neighboring stations. Where anomalies at the candidate disagree substantially with those of its neighbors, the observations at the candidate are flagged as suspect and an estimate for the candidate is calculated from neighboring observations (see below). If the original observation and the estimate differ by a wide margin (standardized using the observed frequency distribution at the station), the original is discarded in favor of the estimate. Very few observations were eliminated based on the quality control evaluation.

To produce a serially complete data set, missing or discarded temperature and precipitation observations were replaced using the observed relationship between a candidate?s monthly observations and those of up to 20 neighboring stations whose observations exhibited the highest correlation with those at the candidate site. Monthly estimates are calculated using the climatological relationship between candidate and neighbor as well as a weighting function based on the neighbor?s correlation with the candidate. For temperature estimates, neighboring stations were drawn from the pool of stations found in the U.S. Historical Climatology Network (USHCN; Karl et al. 1990) whereas for precipitation estimates, all available stations were potentially used as neighbors in order to maximize station density for estimating the more spatially variable precipitation values.

Peterson and Easterling (1994) and Easterling and Peterson (1995) outline the method that was used to adjust for temperature inhomogeneities. This technique involves comparing the record of the candidate station with a reference series generated from neighboring data. The reference series is reconstructed using a weighted average of first difference observations (the difference from one year to the next) for neighboring stations with the with the highest correlation with the candidate. The underlying assumption behind this methodology is that temperatures over a region have similar tendencies in variation. For example, a cold winter followed by a warm winter usually occurs simultaneously for a candidate and its neighbors. If this assumption is violated, the potential discontinuity is evaluated for statistical significance. Where significant discontinuities are detected, the difference in average annual temperatures before and after the inhomogeneity is applied to adjust the mean of the earlier block with the mean of the latter block of data. Such an evaluation requires a minimum of five years between discontinuities. Consequently, if multiple changes occur

within five years or if a change occurs very near the end of the normals period (e.g. after 1995), the discontinuity may not be detectable using this methodology.

The methodology employed to generate the 1971-2000 normals is not the same as in previous normals calculations. For example, in the calculation of the previous normals no attempt was made to adjust Cooperative Network observer data records for inhomogeneities other than those associated with the time of observation bias. Therefore, serial year-monthly data for overlapping periods between normals (e.g., for the 20 years in common between the 1961-90 and 1971-2000 normals) will not necessarily be identical.

The following white paper (United States Climate Normals, 1971-2000: Inhomogeneity Adjustment Methodology) [PDF] is available regarding procedures for adjusting station data to account for inhomogeneities due to changes in station locations, instrumentation, time of observation, surrounding environment, observing practice, sensor drift, etc. The purpose of such adjustments is to produce a time series and normals statistics that are representative of the observing practices as of the end of the normals period (December 2000), since these are the conditions under which future observations will likely be compared.

Exhibit No.:
Issues: Weather Normalization

Witness: Wayne L. Decker
Type of Exhibit: Direct
Sponsoring Party: MoPSC Staff
Case No.: GR-92-165

MISSOURI PUBLIC SERVICE COMMISSION

LACLEDE GAS COMPANY

Case No. GR-92-165

DIRECT TESTIMONY

OF

WAYNE L. DECKER

Jefferson City, Missouri

July, 1992

Exhibit No. 3
Date 8/13/92 Case No. GR-92-165
Reporter GM

SCHEDULE 3-1

DIRECT TESTIMONY

OF

WAYNE L. DECKER

LACLEDE GAS COMPANY

CASE NO. GR-92-165

Q. What is your name and address?

A. I am Wayne L. Decker. I live at 1007 Bulen Drive, Columbia, Missouri 65203.

Q. What is your professional position?

A. I serve the University of Missouri-Columbia as a Professor of Atmospheric Science. I have also been designated as the State Climatologist for Missouri.

Q. How long have you been employed by the University of Missouri?

A. I came to the University of Missouri an Assistant Professor in September 1949. I was designated as the State Climatologist when the National Weather Service phased-out their program of service to the States in the late 1960's.

Q. Where were you employed prior to your appointment at the University of Missouri?

A. I worked as a climatologist for the National Weather Service (called at that time the U. S. Weather Bureau) and served in World War II as a meteorologist with the U. S. Navy in the Pacific theater.

Q. What has been your formal education?

A. My undergraduate education was at Central College in Pella, Iowa with a major in Chemistry. I received post-graduate training in Meteorology at UCLA in 1943-44. I hold MS and Ph.D degrees from Iowa State University in Climatology.

Q. Do you have any other professional qualifications?

A. Yes. To save time, I have attached a copy of relevant biographical information as Schedule 1.

Q. What does the field of Climatology cover?

A. Climatology is the study of the variations in climate, both spatial and temporal, and documentation of the effects of these variations on man. Climatology involves the use of statistical procedures for determining the risks of climatic events from a probability point of view. The climatologist must asses the effects of discontinuities in the climatic records due to natural causes, changes in observational procedures, and effects of man on the environment. The climatologist interprets the historical observational series in terms of the effects of climate on human food supply and health, weather sensitive operations and economic growth and development.

Q. Does climatology provide information of value to the assessment of heating demands?

A. Yes. For many years the utility companies, consumers, and the State Commissions regulating the supply of fuel and power have used climatic records as a basis for setting rates and anticipating energy needs. The climatologist can provide valuable assistance with the interpretation of the historical climatic records.

Q. Does it make a difference where the weather observations are taken for describing the climatic characteristics of a city or region?

A. Yes, when one interprets climate data over an extended period it is very important to review the history of the weather station locations and the type of instrumentation used. Attached to this testimony as Schedule 2 is a summary prepared by the National Oceanic and Atmospheric Administration (NOAA) of the downtown and Lambert Field locations where weather observations have been taken and the instrumentation used in St. Louis.

Q. Is it a standard practice for climatologists to refer to such a NOAA summary when reviewing historical weather station locations and instrumentation?

A. Yes. In this instance, I reviewed Schedule 2 in the course of preparing this testimony.

Q. According to the data contained in Schedule 2, have the weather records at St. Louis been taken at the same location throughout the time of record keeping?

A. No, the records were first taken at a location in the center of the downtown area of St. Louis. Later, with the establishment of the airport (Lambert Field) these responsibilities were transferred to the airport location.

The downtown temperature observations were taken at roof-top, about 200 feet above the street from 1903 onward until the closing of the observing station in 1968. Prior to 1903, the roof-top station was located about 100 feet above the street.

Unless one carefully reviews the station location descriptions, it would appear that the Lambert Field Station did not experience much of a change since it was established in 1929. There are, however, two changes in the location of the instruments at Lambert Field requiring analysis.

Q. What are these changes?

A. In November 1943 the site of the temperature measurement at Lambert Field was moved from a position away from the building (in an instrument shelter at five feet above the ground) to a roof-top location on the second floor of the Administration Building. This position allowed the dark roofing and the vents from the first floor to provide a less than ideal location for documenting the climate of the area. I have reviewed the degree day values reported for Lambert Field for this period (1943 through September 1957) and these records show the period as one with low heating degree day totals. The

average degree days from the period extending from the 1943-44 season through the 1956-57 season is some 6% lower than the mean of 4838 calculated for the period currently used by the Public Service Commission. It is very likely that the warmer temperatures were, at least in part, due to heat added by the roof exposure.

On April 18, 1958, the site of measurement at Lambert Field was moved to a position between the runways and over grass. This move may have resulted in a cooler environment than when the instruments were located close to or on buildings.

Q. Have the weather records always been derived from the same type of weather instruments in St. Louis?

A. For most of the period since the late 1890's the temperature records have come from liquid in glass thermometers (mercury or alcohol in glass). These thermometers were shaded from the sun and protected from the earth's radiation by a louvered box mounted about five feet above the ground or roof top.

However, when the instruments were moved to the runway location at Lambert Field in April 1958, the system of measuring temperatures employed by the National Weather Service in St. Louis was changed. This change consisted of discontinuing the use of liquid thermometers mounted in the white instrument shelter in favor of electrical thermometers exposed in a reflective cylinder over the grass areas between the runways. The observations from these instruments are recorded on indicators in the National Weather Service Office. This new system was installed at all airport observing stations of the National Weather Service at about this same time. Since the instruments were located away from the buildings and the paved tarmac, the temperatures are typically cooler than those previously reported from exposures near the buildings. This system has continued in use for the past three decades. It can be noted that the heating degree days in recent years (since 1960) are markedly higher, suggesting that

the new location provides a sampling of temperatures for a slightly cooler climate for the Lambert Field area. Even when one includes the degree day totals for the warmer most recent decade (1981-82 through 1990-91) the thirty-two year average (1958-59 through 1990-91) is very close to the value suggested by the Commission as the long-time average.

Q. For describing the climatic characteristics does the climatologist usually use the entire period of record available for a particular station?

A. Climatologists tend to use a subset of the entire period of record for describing the characteristics of the climate of a city or region. The length of record for this subset should be long enough to represent the climate of the region in a manner that reduces the changes of a short sequence of cool or warm years influencing the climatic statistics. Clearly the period should be long enough to be "representative" of the climate of the region, but not be so long that it measures a condition that has already past and no longer valid for the climatological time series. This problem of defining a base period for the "normal" climate has plagued climatologists for many years. The World Meteorological Organization (a UN agency which coordinates national programs in meteorology and climatology) and the National Weather Service in the U. S. have adopted the policy of using the most recent thirty-year period as the average for comparison purposes. Under their policy, the average is "rolled over" at the beginning of each decade. The newly established "normals" are then used for the next ten years.

Q. Is using the "thirty year normals" better than using the entire record available for St. Louis?

A. The climate of any region is dynamic in the sense that there is a constant change. Some of these changes appear to be

random while others are systematic. The "rolled over average" is used for the normals to minimize the systemic errors.

One source of the systemic error is the change in the type of instruments used to measure temperature and the exposure of these instruments. It appears obvious that if a different procedure was previously used for measuring temperature than is used today that the older records should not be included in the base period which defines the climatic normals.

Another systemic error in temperature is the changes associated with the growth of the city of St. Louis. The "urban heat island" is a well documented phenomenon which notes that the urban temperatures are warmer than the nearby rural temperatures, particularly at night. This temperature difference is related to size of the city (area and population). The center of warming and the extent of warming depends on the configuration of the city. In the case of St. Louis, there has been some documentation of the urban effect from detailed studies in the 1960's. It appears that the center of development in St. Louis has been away from the Mississippi River, and the urbanization of the area around Lambert Field is apparent. The opportunity for an urban climate change in the Lambert Field weather records, although not documented, is certainly present.

Q. What would you recommend the Commission use for the "base period" in defining degree day normals for St. Louis?

A. I would recommend that the most recent thirty-year period with a recalculation every decade be used for the following reasons:

(1) it would not allow events which have occurred nearly a century ago to be equally weighted with more recent events in the calculation of the normals;

(2) it would allow for an adjustment for changes in climate, both natural or anthropogenic;

(3) this procedure would bring the techniques used in Missouri in line with those used by the National Weather Service and other States;

(4) the thirty-year period is long enough to produce statistics that are stable without major variations from decade to decade;

(5) during the most recent thirty-year period (1961-1990), the observations at Lambert Field have been taken from the same site using the same type of weather instruments.

Q. Does that conclude your testimony?

A. Yes.

SCHEDULE 3-8

BEFORE THE PUBLIC SERVICE COMMISSION

OF THE STATE OF MISSOURI

In the Matter of Missouri Gas Energy's Tariff Sheets Designed to Increase Rates for Gas Service in the Company's Service Area.	))))	Case No. GR-96-285

REPORT AND ORDER

Issue Date: January 22, 1997

Effective Date: February 1, 1997

Schedule 4-1

WK NORM P.16

On December 2, 1996, Riverside/Mid-Kansas filed a motion to strike a portion of late-filed Exhibit 172. Riverside/Mid-Kansas requests that the portion beginning with page 3, line 7, through the bottom of page 4, be stricken, because it goes beyond the information requested by Commissioner Crumpton.

On December 10, 1996, MGE filed a response to the motion to strike. MGE argues that all of late-filed Exhibit 172 is responsive to Commissioner Crumpton's request.

The Commission finds that all of Exhibit 172 is responsive to Commissioner Crumpton's request. The Commission will deny the motion to strike.

The Commission has received no objections to the receipt of the late-filed exhibits other than the objection of Riverside/Mid-Kansas discussed above.

Late-filed Exhibits 113, 114, 115, 116, 117, 120, 163, 163HC, 164, 171, 172, 173, 174, 179 and 179HC shall be received into the record.

Findings of Fact

The Missouri Public Service Commission, having considered all of the competent and substantial evidence upon the whole record, makes the following findings of fact.

I. Revenue Adjustments

A. Weather Normalization Adjustment

This issue concerns the appropriate period of time to use for the purpose of establishing "normal" temperatures in the context of setting rates for MGE. MGE advocates the use of ten years of data ending March 31, 1996. Staff advocates the use of 30 years of data (1961 through 1990). Public Counsel agrees with the Staff on this issue.

MGE witness Cummings maintains that the ten-year average of Heating Degree Days (HDD) compiled by the National Oceanographic and Atmospheric Administration (NOAA) better reflects the temperatures experienced in recent years and is not influenced by several consecutive cold winters which occurred many years ago and have not repeated themselves. (Ex. 9, p. 8). Dr. Cummings performed an analysis where he calculated the median temperatures over the last ten and fifteen years and he concluded that the ten-year measure is more representative of recent years' temperatures than the use of the 1961-1990 measure. (Ex. 9, p. 9). The reason for this result is that there were some winters with extremely cold temperatures a number of years ago that are reflected in the 30-year measure, and these extremes have not repeated themselves in the last decade. (Ex. 9. p. 10).

Staff maintains that the Commission should use the 30-year measure of normal temperatures published by NOAA, which are based on properly adjusted monthly Heating Degree Day data from the FAA weather stations at Kansas City International Airport and the Joplin Airport. Staff argues that the 30-year average is the more proper measure of "normal weather" rather than the ten-year moving average proposed by the Company. NOAA's 30-year normal averages are compiled independently of the regulatory process and are set for a period of ten years at a time after each decade of data can be analyzed. The calculations of "normals" are done only once every ten years because they require a substantial effort and commitment of NOAA's resources. The published normals used by Staff remain the same for those ten years until another decade's worth of data is collected and analyzed by NOAA.

Staff believes that the 30-year period utilized by NOAA is necessary to constitute a normal period. This period is long enough to compensate for shorter-term cycles that may be present in the data, while not being so long that

historical conditions which are no longer relevant might influence the calculations of normals. Staff maintains that the use of a ten-year moving average as proposed by MGE results in great fluctuations of "normals" which has no place in setting rates on a forward-looking basis.

The Commission finds that NOAA's 30-year normals is the more appropriate benchmark. The ten-year moving average would needlessly cause frequent rate changes based on the introduction of new data every year. If one takes MGE's argument to its logical extreme, the Commission would use the most recent year's experience in MGE's service territory and re-set rates each year. This could lead to serious financial problems for MGE if its rates were set after a record-setting cold year. In addition, the data upon which Staff's recommendation is based has gone through the processes established by NOAA to ensure the best data possible. This safeguard is not present in MGE's approach.

B. Economic Development Discounts

OPC maintains that the Commission must impute the full level of revenues based on the Large Volume contract rate. OPC bases this position on the tariff language contained on MGE's Sheet 74, which states:

> Prior to any determination of the Company's revenue requirement for rate making purposes before the Commission, test year revenues shall first be adjusted to the level corresponding to that which would be produced under the standard Large Volume contract rate schedule with respect to the customers qualified for service hereunder.

OPC maintains that this language precludes Staff and MGE from making their recommended adjustment that has the effect of having ratepayers fund approximately 25 percent of the amount of economic development discounts.

This issue is the extent to which MGE's shareholders should bear the cost associated with discounted rates which MGE offers under MGE's economic

BEFORE THE PUBLIC SERVICE COMMISSION

OF THE STATE MISSOURI

In the Matter of Missouri Public Service, a Division of UtiliCorp United Inc.'s Tariff Designed to Increase Rates for for Electric Service to Customers in the Missouri Service Area of the Company.	)	Case No. ER-97-394
In the Matter of the Filing of Tariff Sheets by Missouri Public Service, a Division of UtiliCorp United Inc., Relating to Real-Time Pricing, Flexible Rates/Special Contracts, Line Extension Policy and Energy Audit Program.	)	Case No. ET-98-103
The Staff of the Missouri Public Service Commission, Complainant, vs. UtiliCorp United Inc., d/b/a Missouri Public Service, Respondent.	)	Case No. EC-98-126

REPORT AND ORDER

Issue Date: March 6, 1998

Effective Date: March 18, 1998

Schedule 5-1

December 31, 1996, and 7.88 percent on June 30, 1997. The OPC recommends the June 30, 1997 figure.

The Commission finds the cost of long-term debt, including the cost of embedded short-term debt as proposed by the Staff, to be the most reasonable proposal and will adopt the Staff's position.

Revenue Issues

Weather Normalization - C-1

This issue involves the normalization of the influences of historical weather on test year sales and therefore revenues for ratemaking purposes. This is necessary to assist in obtaining a sales revenue amount which reflects and normalizes the influence of variations in the weather patterns over a period of time. A normalized sales revenue amount reflects the anticipated amount of sales in a year in which the weather is as close to "average" as possible.

A weather normalization adjustment is made to modify test year revenues (sales) to reflect a level of sales that would occur under conditions of "normal" historical weather. The revenue requirement value of approximately $1.2 million reflects the difference between UtiliCorp's and the Staff's estimates of the effects of abnormal weather during the test year on revenues. There are two primary factors that cause this difference: 1) the models used to predict sales; and 2) the weather data that is used as an input to these models.

UtiliCorp used a set of econometric models to forecast and weather normalize monthly electric sales. The models project the level of monthly electricity sales for the various rate classes as a function of heating and cooling degree days, economic driver variables (e.g. number of households for the residential classes, commercial employment for the commercial rate

codes, and industrial output for the industrial rate codes), energy prices, price elasticities and end-use parameters (for the residential classes only). UtiliCorp states that the variation in monthly sales due to degree day variations shows substantial weather sensitivity for appropriate rate classes.

The Staff used the Electric Power Research Institute (EPRI) Hourly Load Electric Model (HELM) to calculate the weather normalization adjustment to the billing month sales. The Staff uses HELM because it has the advantage in that it bases its weather normalization estimation on daily usage data. The Staff states that there is a direct relationship between the amount of energy a weather sensitive customer uses and the weather experienced on any day. In addition, the response of the weather sensitive customers to daily fluctuations in weather can be dramatic and varied across a group of customers. The Staff argues that because UtiliCorp uses monthly data in its models, it is impossible to obtain detailed information about class usage.

Both UtiliCorp and the Staff selected the weather station at the Kansas City International Airport (KCI) as a source of daily temperature data and used the period from 1961 to 1990 to define normal weather. However, because daily weather data was not collected at KCI prior to 1973, both parties had to manufacture data for the period from 1961 to 1972.

UtiliCorp used statistical regression analysis to fit equations that relate that the temperature measured at the KCI weather station to the temperature measured at the older Kansas City Downtown Airport (KCDT) during a period when both weather stations were reporting. The resulting equations were used to backfill the missing temperature values in the daily series for the KCI weather station. UtiliCorp claims its temperature data

is more appropriate for weather normalizing heating and cooling loads because it better matches the normal heating and cooling degree days published by the National Oceanic and Atmospheric Administration (NOAA).

The Staff compiled a data set for the KCI weather station based on two NOAA data sets, one containing adjusted monthly temperature data, and another containing daily temperature data from the selected weather stations. From these data sets, the Staff produced a series of daily minimum, maximum and mean temperatures for the thirty-year period ending December 31, 1990 adjusted so that the average monthly values are equal to the monthly NOAA values published for KCI. The Staff claims that when using the UtiliCorp data set, Staff was unable to closely match the monthly NOAA normal temperature values. In addition, UtiliCorp values tended to show seasonal biases in the spring and summer months.

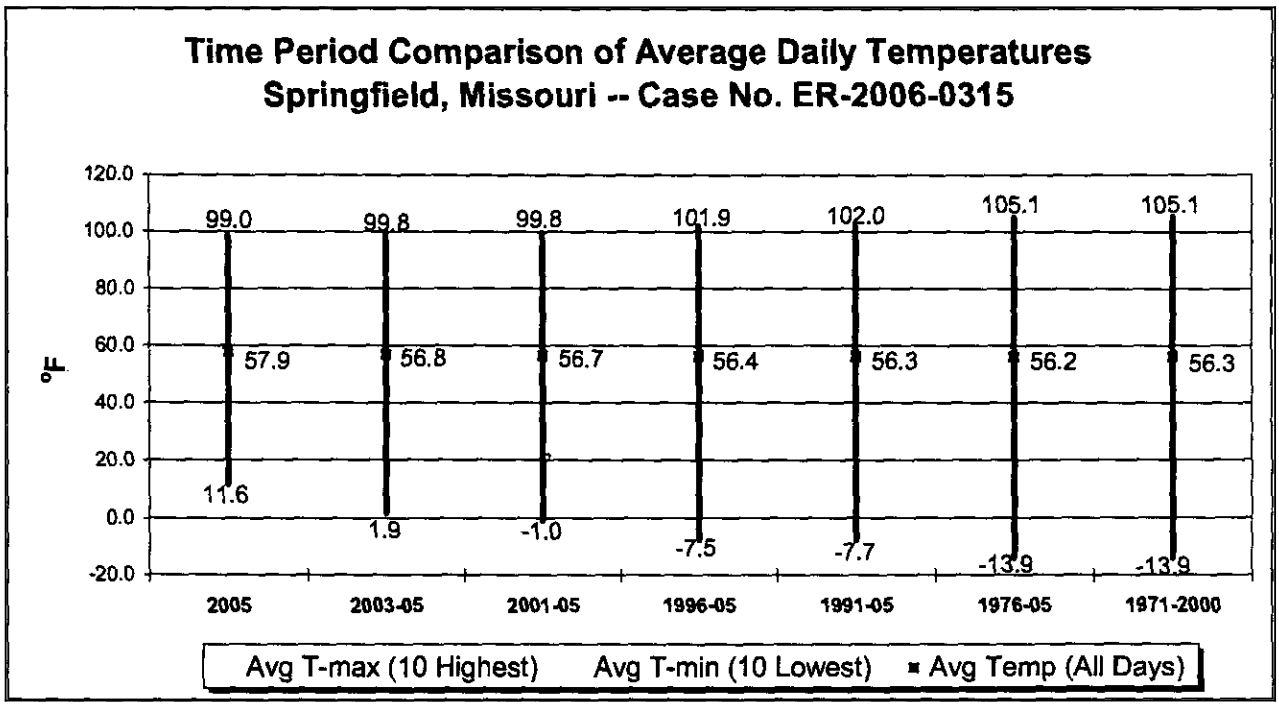
No other party has taken a position on this issue.

The Commission finds the substantial evidence presented by the Staff to be the most reasonable and appropriate analysis of historical weather on test year sales and will, therefore, adopt the revenue requirement adjustment of the Staff, net of fuel expense.

Economic Development Rider Revenue - C-2

MPS has a current tariff, approved by stipulation and agreement in Case No. ET-92-171, which allows MPS to enter into contracts with certain qualifying customers for reduced electric service rates. This tariff is generally referred to as the economic development rider (EDR) and is offered to large commercial and industrial customers.

The Staff is proposing an adjustment to test year revenues of approximately $821,000 to elevate the test year revenue to the level it would have been absent the EDR discounts. The Staff maintains that


Time Period Comparison of Average Daily Temperatures
Springfield, Missouri -- Case No. ER-2006-0315
°F
120.0
100.0
80.0
60.0
40.0
20.0
0.0
-20.0
99.0
99.8
99.8
101.9
102.0
105.1
105.1
57.9
56.8
56.7
56.4
56.3
56.2
56.3
11.6
1.9
-1.0
-7.5
-7.7
-13.9
-13.9
2005
2003-05
2001-05
1996-05
1991-05
1976-05
1971-2000
Avg T-max (10 Highest)
Avg T-min (10 Lowest)
Avg Temp (All Days)