Exhibit No.
Issue: Weather Normalization
Witness: Mr. Mark Quan
Type of Exhibit: Rebuttal Testimony
Sponsoring Party: Empire District Electric Co.
Case No.
Date Testimony Prepared: April 2010

Before the Public Service Commission
Of the State of Missouri

Rebuttal Testimony

of

Mr. Mark Quan

April 2010

REBUTTAL TESTIMONY
OF
MR. MARK QUAN
ON BEHALF OF
THE EMPIRE DISTRICT ELECTRIC COMPANY
BEFORE THE
MISSOURI PUBLIC SERVICE COMMISSION
CASE NO. ER-2010-0130

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Mark Quan. I am a Principal Consultant for Itron's Forecasting Solutions group. My business address is 11236 El Camino Real, San Diego, California 92130.

Q. ARE YOU THE SAME MARK QUAN THAT PREVIOUSLY FILED DIRECT TESTIMONY IN THIS CASE?

A. Yes I am.

Q. WHAT IS THE PURPOSE OF YOUR REBUTTAL TESTIMONY?

A. The purpose of my testimony is to address the differences between The Empire District Electric Company ("Empire" or "Company") and Missouri Public Service Commission Staff ("Staff") weather normalization calculations. My weather normalization calculations, on behalf of Empire, are contained in my direct testimony submitted on October 29, 2009. Staff's weather normalization calculations are contained in the Staff Report - Cost of Service submitted on February 26, 2010. My rebuttal testimony addresses the position statements of Staff witnesses Walt Cecil and Manisha Lakhanpal which are located between page 53 and 56 of Staff's Cost of Service Report.

Q. WHAT ARE THE PRIMARY SIMILARITIES BETWEEN THE STAFF'S AND EMPIRE'S WEATHER NORMALIZATION PROCESS?

A. Based on the Staff's available workpapers, the basic normalization framework applied by Staff and Empire is the same. The basic steps for the normalization process are described in my testimony in Schedule MQ-2.

Q. WHAT ARE THE PRIMARY DIFFERENCES BETWEEN THE STAFF'S AND EMPIRE'S NORMALIZATION PROCESS?

A. There are two issues which drive the difference between Empires' and Staff's Residential Weather Normalization results. Those issues are: (1) Staff's calculation error, and (2) the normal weather period assumption.

Q. WHAT IS THE STAFF CALCUATION ERROR?

A. In the normalization process both Staff and Empire use the following fundamental equation, which is discussed in my direct testimony:

$$NormalSales_{month} = \frac{ModelNormalSales_{month}}{ModelActualSales_{month}} \times ActualSales_{month}$$

The Staff's calculation error is in the calculation of $ModelNormalSales_{month}$. The calculation requires using a regression model, which captures the relationship between daily sales and weather, then applying normal weather in their model. In Staff's calculation, three weather variables are used (ResCool, ResWarm, and TransfrmRes). When applying normal weather into the estimated model, Staff only applied normal weather to the ResCool and ResWarm variables and neglected to apply normal weather to the TransfrmRes variable.

Q. WHAT IS THE EFFECT OF THE STAFF CALCUATION ERROR?

A. The TransfrmRes variable is defined as follows:

((year - 2002) + period / 366) * CDD_HDD.ResCool

In the middle of the test year, the value of the first component of the variable is approximately seven (7), as shown below.

((**2009** - 2002) + **1**/366) = 7

The Staff model contains a coefficient on the TransfrmRes variable of 0.049. The "CDD_HDD.ResCool" component of the variable is defined as heating degree days with a reference temperature of 56 degrees. As a result, for each degree below 56, the TransfrmRes variable would have a (7) x (0.049) kWh impact, or 0.343 kWh/degree impact. Considering that the heating impact in the Staff model (ResCool variable coefficient) is 0.595 kWh/degree, Staff has miscalculated the heating normalization impact and should increase the impact by 58% (0.343/0.595). Placing this error in the context of the test year being colder than normal, normal energy sales should be further reduced. In other words, Staff's normal energy sales are too high because of this error.

Q. WHAT IS THE NORMAL WEATHER PERIOD ASSUMPTION?

A. In Ms.Lakhanpal's statement (page 55), she states that Staff developed normal weather based on the "30-year period (January 1, 1971 – December 30, 2000)". In my direct testimony, I developed normal weather based on the most recent 30 years from January 1979 through December 2008. For comparison purposes, the changing of the normal weather period decreases

normal CDDs by 38 (1,370-1,332) and decreases the normal HDDs by 94 (2,592-2,498). These changes are shown in Table 1 and are normalized based on two-day weighted mean temperatures consistent with Staff's weather normalization process. If the most recent 30 years of weather history are used to develop normal temperatures, the reduction in CDD and HDD values would result in decreases to the normal energy sales.

Table 1: Normal Weather Comparison

Year	Month	Actual HDD	Actual CDD	1971-2000 Normal HDD	1971-2000 Normal CDD	1979-2008 Normal HDD	1979-2008 Normal CDD
2008	7	-	392	-	428	-	415
2008	8	-	350	-	400	-	395
2008	9	-	119	1	181	1	159
2008	10	78	23	51	22	62	20
2008	11	349	-	288	-	292	-
2008	12	674	-	605	-	599	-
2009	1	764	-	747	-	685	-
2009	2	396	-	515	-	493	-
2009	3	263	6	296	-	279	-
2009	4	130	24	86	10	84	12
2009	5	5	53	3	70	3	76
2009	6	-	318	-	258	-	254
Annual		2,660	1,284	2,592	1,370	2,498	1,332

Q. WHAT IS THE IMPACT OF CORRECTING THE CALCULATION ERROR AND USING THE MOST RECENT 30 YEARS OF WEATHER HISTORY?

A. Changing these two assumptions in Staff's calculation of normal sales results in the values shown in Table 2. In Table 3, I show the normal sales results contained in my direct testimony, for comparative purposes.

Table 2: Updated Staff Residential Normal Values

Month	Actual Billed Sales (kWh)	Normal Billed Sales (kWh)	Normal Calendar Sales (kWh)
Jul 2008	146,574,495	148,768,070	175,839,064
Aug 2008	170,766,196	176,590,048	167,745,197
Sep 2008	140,593,324	150,598,038	117,882,031
Oct 2008	97,412,338	102,186,846	94,602,476
Nov 2008	101,542,375	98,084,349	122,330,642
Dec 2008	168,433,266	160,137,328	182,902,925
Jan 2009	214,629,985	204,106,754	200,944,498
Feb 2009	177,404,135	177,838,316	161,954,099
Mar 2009	139,982,565	145,193,947	132,233,725
Apr 2009	122,421,619	120,894,735	97,437,244
May 2009	99,004,828	95,853,809	109,355,305
Jun 2009	107,305,890	106,935,656	132,883,498
Annual	1,686,071,015	1,687,187,896	1,696,110,703

Table 3: Empire Residential Normal Values

Month	Actual Billed Sales (kWh)	Normal Billed Sales (kWh)	Normal Calendar Sales (kWh)
Jul 2008	146,864,124	148,903,378	173,015,938
Aug 2008	170,819,723	176,565,123	170,243,365
Sep 2008	141,332,660	151,990,318	122,911,968
Oct 2008	96,815,175	102,737,897	95,012,874
Nov 2008	101,414,636	99,876,750	120,358,211
Dec 2008	168,479,701	161,972,255	182,784,489
Jan 2009	214,536,500	206,238,811	198,612,398
Feb 2009	177,206,962	177,374,254	163,825,311
Mar 2009	140,142,971	144,805,560	137,703,072
Apr 2009	122,552,244	123,885,310	103,057,895
May 2009	98,713,072	98,249,227	109,326,674
Jun 2009	106,839,072	105,484,178	126,828,117
Annual	1,685,716,839	1,698,083,059	1,703,680,312

Q. ARE THERE OTHER ASSUMPTION DIFFERENCES?

A. Yes. While changing these first two assumptions demonstrates that Staff's process yields results similar to those contained in my direct testimony, other assumption differences still remain. These assumptions appear to result in only minimal changes to the overall energy normalization results. These assumption differences are summarized below.

Rank and Average Basis. In my testimony, I develop normal weather by performing the rank and average method on daily average temperatures. Staff developed normal weather by performing the rank and average method on two-day weighted mean temperatures.

Calculation of normal HDD and CDD. In my testimony, I calculated the HDD and CDD values in each of the 30 historical years before averaging across the years to obtain normal HDD and CDD values. Staff calculated the 30 average temperatures and then developed normal HDD and normal CDD values from the 30 year average.

Billing Cycle Weights. In my testimony, I assumed equal weights to the twenty (20) billing cycles. Staff assumed unequal weights in the billing cycles based on a set of energy factors.

Regression Models. The statistical models in both sets of testimony contain a different set of variables. While the models are different, they both produce r-squared values above 0.95.

Definition of Average Temperature. In my testimony, I calculated the average temperature based on the sum of the twenty-four hours of temperatures divided by twenty-four. Staff calculated average temperature based on the high plus low temperature divided by two.

Q. DOES THIS CONCLUDE YOUR REBUTTAL TESTIMONY?

A. Yes, it does.

AFFIDAVIT OF MARK QUAN

STATE OF CALIFORNIA)
) ss
COUNTY OF SAN DIEGO)

On the 31st day of March 2010, before me appeared Mark Quan, to me personally known, who, being by me first duly sworn, states that he is a Principal Consultant for Itron's Forecasting Solution Group and acknowledges that he has read the above and foregoing document and believes that the statements therein are true and correct to the best of his information, knowledge and belief.

Mark Quan

Subscribed and sworn to before me this 31st day of March, 2010.

Notary Public

My commission expires: July 9, 2012

State of California County of
San Diego
Subscribed and sworn to (or affirmed)
before me on this 31 day of March, 2010, by
Mark Quan
proved to me on the basis of satisfactory evidence
to be the person(s) who appeared before me.
Signature
(Seal)

WALTER E. PUESCHEL
Commission # 1795955
Notary Public - California
San Diego County
My Comm. Expires Jul 9, 2012