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Issues: Customer Usage
Weather Normalization

Witness: James A. Gray
Sponsoring Party: MO PSC Staff
Type of Exhibit: Direct Testimony
Case No.: GR-2004-0072
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MISSOURI PUBLIC SERVICE COMMISSION

UTILITY OPERATIONS DIVISION

DIRECT TESTIMONY

OF

JAMES A. GRAY

AQUILA, INC. D/B/A AQUILA NETWORKS MPS AND AQUILA NETWORKS L&P

CASE NO. GR-2004-0072

Jefferson City, Missouri
January 2004

BEFORE THE PUBLIC SERVICE COMMISSION

OF THE STATE OF MISSOURI

In the Matter of Aquila, Inc. d/b/a Aquila Networks - MPS and Aquila Networks - L&P Natural Gas General Rate Increase	)))	Case No. GR-2004-0072

AFFIDAVIT OF JAMES A. GRAY

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

James A. Gray, of lawful age, on his oath states: that he has participated in the preparation of the following testimony in question and answer form, consisting of 17 pages of testimony to be presented in the above case, that the answers in the following 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.

James A. Gray
James A. Gray

Subscribed and sworn to before me this 5th day of January, 2004.

Dawn L. Hake
Notary Public

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

My commission expires _____

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DIRECT TESTIMONY

OF

JAMES A. GRAY

AQUILA, INC.

D/B/A AQUILA NETWORKS – MPS

AND AQUILA NETWORKS – L&P

CASE NO. GR-2004-0072

Q. Please state your name and business address.

A. My name is James A. Gray. 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 (Commission) as a Regulatory Economist in the Tariffs/Rate Design Section of the Commission's Energy Department.

Q. How long have been employed by the Commission?

A. I have been employed with the Commission for approximately twenty-three years.

Q. Please state your educational background.

A. I received a degree of Bachelor of Science in Psychology as well as one in General Studies from Louisiana State University, and I received a degree of Master of Science in Special Education from the University of Tennessee. Additionally, I

completed several courses in research and statistics at the University of Missouri - Columbia.

Q. Please state your professional qualifications.

A. Prior to being employed by the Commission, I was a Research Analyst for two and a half years with the Missouri Department of Mental Health where I conducted statistical analyses. In 1980, I began my employment with the Commission as a Statistician in the Depreciation Department where I submitted testimony regarding depreciation rates, trended-original cost, and trended-original cost less depreciation.

Beginning in 1989 in the Economic Analysis Department, I submitted testimony on weather-normalized sales for natural gas, water, and electric utilities. I reviewed residential electric load forecasts with associated detailed end-use studies and marketing surveys in electric resource plans.

From December of 1997 through June of 2001, I was in the Tariffs/Rate Design Section of the Commission's Gas Department. Since July of 2001, I have been in the Tariffs/Rate Design Section of the Commission's Energy Department. I have reviewed tariffs and applications of natural gas utilities. I have also submitted testimony concerning weather-normalized sales, complaints, certificates of convenience and necessity, and recommended minimum statistical sample sizes for natural gas residential customer billing reviews.

Q. Please list all the cases in which you have submitted prepared written testimony before this Commission.

A. The cases in which I have submitted prepared, written testimony are enumerated in Schedule 1, attached to my testimony.

Q. What is the purpose of your testimony?

A. My testimony addresses the Commission Staff's (Staff) weather-normalization of natural gas sales for the residential natural gas and the general service commercial natural gas customers of Aquila, Inc. (Aquila or Company) d/b/a Aquila Networks – MPS (MPS) and Aquila Networks – L&P (L&P). Then, I use the results of my weather-normalized sales studies to estimate weather-normalized coincident peak-day demand.

WEATHER-NORMALIZED SALES

Q. What firm customer classes did you adjust test year natural gas sales to normal weather conditions?

A. I weather adjusted the residential service and general service's commercial customer classes of Aquila.

Q. How did you segregate Aquila's natural gas service areas for your studies?

A. MPS has three systems – the Northern System, the Southern System, and the Eastern System. Staff witness Dennis Patterson of the Commission's Energy Department provided me with weather data for each of the three systems. L&P has two tariff rates, one for the Fairfax, Rock Port, and Tarkio (FRT) service area, and another tariff rate for the remaining other (Other) service area. Staff witness Dennis Patterson provided me with one set of weather data for both of those service areas. Therefore, I was given four sets of weather data to study five Aquila systems/service area

combinations. Staff witness Anne E. Ross of the Commission's Energy Department will address the General Service – Small Industrial Customers of Aquila.

Q. Please identify the Staff witnesses who utilize the results of your weather-adjusted volumes.

A. I provided the results of my weather-normalized sales volumes to Staff witness V. William Harris of the Commission's Auditing Department, for the Staff's customer growth annualization and revenue calculations, and to Staff witness Henry E. Warren, PhD of the Commission's Energy Tariffs/Rate Design Department, for the Staff's allocation of the weather-normalized sales to the block rates of the general service class. (Aquila's general service class has different unit charges for natural gas volumes falling within blocks of consumption.)

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

A. Since rates are based on natural gas usage during the test year, it is important to remove the influence of abnormal weather. Otherwise, if natural gas usage volumes reflect the influence of abnormal weather, the rates will be distorted by these deviations from normal weather conditions during the test year. My adjustments to test-year sales set the test-year natural gas volumes at the levels that would be experienced under normal weather conditions.

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

A. The predominate use of natural gas in Missouri is for space heating, so natural gas sales increase during colder weather. Space heating refers to natural gas used to heat the inhabited area of a residence or business during colder weather.

Q. How do your analyses adjust test-year natural gas sales if the test year is warmer than normal?

A. Natural gas sales for the test year would be increased to reflect a normal year, because the Company would be expected to sell more natural gas volumes under the cooler, normal weather conditions than it sells during a warmer than normal test year.

Q. How do your analyses adjust test-year natural gas sales if the test year is colder than normal?

A. Natural gas sales for the test year would be decreased to reflect a normal year, because the Company would be expected to sell less natural gas volumes under the warmer, normal weather conditions than it sells during a colder than normal test year.

Q. What weather measure did you use in your analyses?

A. Staff witness Patterson provided me with daily actual and daily normal heating degree days (HDD) for each of MPS' three systems, and one set of weather data for both of the L&P service areas. Mr. Patterson's testimony discusses the calculation of HDD.

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

A. Aquila provided me with monthly natural gas sales in hundreds of cubic feet (Ccf) and monthly numbers of customers for each billing cycle of the test year, by firm customer classifications broken into five system/service area classifications (three MPS systems and two L&P service areas).

Q. What are billing cycles?

A. The Company schedules groups of natural gas accounts into billing cycles that are to be read throughout a month, followed by mailing of the associated bills

throughout the month. Staggering the billing of customers' accounts over the billing months reduces the effort to bill Aquila's customers. Since there are approximately twenty working days in a month, customers' accounts are usually grouped into one of the approximately twenty billing cycles.

These customers' natural gas meters are read approximately every thirty days (a billing month), not a calendar month, because not all natural gas meters are read on the first day of a calendar month. The number of days between meter readings varies among the billing cycles within a billing month. Moreover, individual billing cycles may exhibit month to month variations in the numbers of days between meter readings, due to holidays and variations in the number of days and in the placement of weekends, from one billing month to another. For clarification, a billing month, as used in this testimony, refers to the interval (days) needed to read all of Aquila's twenty billing cycles.

Q. Have you prepared a schedule showing the meter read dates for the February 2002 billing month?

A. Yes, Schedule 2, attached to this testimony, shows how the twenty billing cycles' meter-reading dates are staggered for the billing month of February 2002. The February billing month's cycle numbers are shown in red. Schedule 2 shows the billing month of February starting on January 30, 2002, and ending on February 26, 2002.

Q. Why do you rely on billing cycle usage data?

A. The Company's customer billing records are based on monthly billing cycles. That is, the Company records maintain grouped summary natural gas statistics by billing cycle for each billing month. Using billing cycles allows each billing month's

customer numbers and usage for a particular rate class to be combined and recorded into the approximately twenty billing cycle groups.

It would be ideal to have daily measures of both natural gas usage and weather, to allow precise matching for studies of the relationship of natural gas usage to weather. However, daily usage data for Aquila's residential, commercial, and general service commercial customers are unavailable. Therefore, I relied on the Company's monthly billing cycle data.

Q. How did you analyze space heating natural gas volumes?

A. I performed the analyses for each of the three MPS' systems - Northern System, Southern System, and Eastern System, as well as L&P's service areas - FRT and Other. I calculated two sets of twelve billing month averages by customer class. One set of these averages was the daily average natural gas usage in Ccf and another set was the daily average HDD. These billing month averages were calculated from the data on numbers of customers, natural gas usage in Ccf, and summed HDD from approximately twenty billing cycles for each billing month by customer class.

Q. Why did you sum Staff witness Patterson's daily HDD by billing cycle?

A. To match the daily HDD by billing cycle with the Company's customer billing records, I summed the daily HDD for the dates encompassing each billing cycle. This matches Staff witness Patterson's HDD daily weather series with the Company's customer billing records. These daily weather measures are added over the dates between each billing cycle's meter readings to calculate weather by billing cycle.

Calendar month weather values cannot be accurately analyzed or quantified by date or day. Accordingly, calendar month weather measures would be

inappropriate for billing cycles. Therefore, I relied on the summed HDD that each billing cycle encompasses.

Q. How do the twelve billing month customer-weighted averages of HDD reflect different customer levels among the different billing cycles?

A. Each billing month's daily average HDD in each billing cycle is 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.

Schedule 3, attached to this testimony shows the number of customers, Ccf used, and HDD for the billing month of February 2002 for Aquila's general service commercial customers in MPS' Northern System. The customer numbers vary from five (5) customers for billing cycle number two (2) to 179 customers for billing cycle number eighteen (18). Also, the HDD vary from 834.5 for billing cycle number sixteen (16) to 986.4 HDD for billing cycle number one (1). This shows that there are significant differences among the billing cycles within a billing month. This demonstrates the need to carefully average the HDD across all the billing cycles for each of the twelve billing months of the test year.

Q. How did you average billing month usage in Ccf?

A. I calculated twelve simple, unweighted averages representing daily usage per customer for each month. That is, I divided each cycle's volumes by the number of customers and the number of days in each billing cycle. This stated the Company's natural gas usage by billing cycle on a daily basis. All billing cycles in a billing month are equated on a use per day, regardless of the variations in the number of days between

meter readings among the billing cycles within a billing month. Then, I averaged the approximately twenty billing cycles' entire daily usages per customer over each billing month to calculate one month's daily average usage in Ccf.

Q. How did you quantify the relationship of natural gas sales to HDD?

A. My studies estimate the change in usage in Ccf related to a change in HDD based on the two sets of twelve monthly billing month averages of average daily usage in Ccf per customer and the customer-weighted average daily HDD. These two sets of billing month averages (usage and weather) were used to study the relationship between space-heating natural gas usage in Ccf and colder weather.

I used regression analysis to estimate the relationship for each of the residential and general service commercial customers in the five systems/service areas. The regression analysis describes the relationship between daily space-heating sales per customer in Ccf to the daily HDD.

Q. What are the advantages of using regression?

A. The regression equation develops quantitative measures that describe relationships. The regression equation calculates a straight line that best fits the relationship. The slope (or slant) of the best-fitting straight line estimates a change in the daily natural gas usage per customer whenever the daily average weather changes one HDD. For example in my analyses, the slope of the best-fitting regression line for MPS' residential class in the Northern System is 0.12407. This means that, in MPS' Northern System, a residential customer's estimated usage will change approximately 0.12407 Ccf per day for every change of one HDD. The steeper the slopes of the regression lines or

the larger the numerical value of the slope, the greater the estimated change in space heating usage in Ccf for a change of one HDD.

Also, regression calculates a measure of the goodness of fit. The measure is referred to as *r squared* (r^2). The r^2 ranges from 0.00 to 1.00, with 1.00 being a perfect fit.

Q. How closely did your regression results match actual average daily natural gas sales per customer for the billing months?

A. Schedules 4-1 through 4-5, attached to this testimony, show the regression best-fitting lines and each billing month's actual average daily natural gas sales per customer plotted against the billing month's actual average daily HDD. The plots demonstrate that the regression lines fit the data very closely. Moreover, all of Staff's r^2 values were above 0.93156, which also indicates a good fit.

Q. Up to this point, is your daily estimated usage Ccf based on any normal values?

A. No, the estimated daily usage per Ccf per customer was based on actual HDD and the actual number of days in each billing cycle. I used the estimated relationship between space heating usage in Ccf and HDD to adjust the actual HDD to the normal HDD provided to me by Staff witness Patterson.

Q. How did you adjust monthly natural gas volumes to normal?

A. The first step is to equalize each billing cycle's annual total normal HDD. I added or subtracted a few days to make each billing cycle's annual total days match 365 days. This adjustment for days sets each billing cycle to the same total number of days

and normal HDD. Failure to equalize the normal HDD will result in some billing cycles having the wrong annual or total number of normal HDD.

Once each billing cycle has the proper normal HDD, the second step is to calculate each billing cycle's difference between normal and actual (normal - actual) for HDD. The third step is to multiply these differences times the appropriate estimate from the regression results. I used the estimated relationship between space heating usage in Ccf and HDD from my regression studies to adjust the actual HDD to the normal HDD provided to me by Staff witness Patterson.

The fourth step is to sum each billing cycle's adjustment volumes by billing month. The fifth step is adding the monthly adjustments in Ccf to total monthly natural gas sales to calculate normalized volumes.

Q. Why do you state natural gas usage on a per customer usage basis?

A. The Commission's Auditing Department can multiply its customer levels by my weather-normalized sales per customer to calculate its customers' growth annualization.

Q. Are your normalized sales stated in daily usage per customer equivalent to what a typical customer would use?

A. No, I did not select typical customers. Aquila provided me with all bills rendered during a year. The data include some partial bills, such as new customers receiving service in the middle of the month. Moreover, I did not segregate those customers into heating categories, such as, customers using natural gas for space heating and customers using natural gas only for water heating.

Q. Did the usage data provided by Aquila match the volumes also provided to Staff witness Harris?

A. No, there were discrepancies in L&P's general service commercial volumes for the test year, possibly due to rate switching. If necessary, I will update my schedules to reflect any necessary revisions to Aquila's test-year volumes.

Q. What were the results of your weather-normalized sales studies for the test year?

A. My analyses resulted in an increase to natural gas sales because the weather during the test year was warmer than normal. My analyses result in an approximate 1.7 percent increase from actual natural gas sales for the residential customer class and an approximately a 2.2 percent increase for the general service commercial customers. These increases do not include the Staff's customer growth annualization.

Q. What results did you provide to Staff witness Harris for his customer growth annualization and revenue calculations?

A. I provided monthly, normalized natural gas usage in Ccf per customer for each customer class for each of MPS' systems and the two L&P service areas. These results are contained in Schedule 5, attached to my testimony. Schedule 5 demonstrates the higher natural gas usage per customer in the colder, winter months because of space heating requirements.

Second, for Staff witness Harris's revenue calculations, I provided monthly weather-normalized volumes for the same firm classes and service areas.

Schedule 6, attached to my testimony, contains the monthly weather-normalized volumes.

WEATHER-NORMALIZED COINCIDENT PEAK-DAY DEMAND

Q. What are estimates of weather-normalized coincident peak-day demand by customer class?

A. Briefly, it is the estimated usage per customer by firm customer class on Staff witness Patterson's normally occurring coldest days. The daily peak is the highest daily load or draw of natural gas on a system, and the demand is the rate or amount of natural gas used on that day. My estimates of residential and general service commercial customers' natural gas peak usage are at the time (coincident) of a utility's system daily peak.

Q. Why are estimates of weather-normalized coincident peak-day demands important?

A. These estimates of weather-normalized coincident peak-day demands quantify the relative contributions towards that estimated single-day system peak by the residential, commercial, and small industrial firm customers. For cost-of-service studies, it is important to determine each class' contribution to the peak-day responsibility.

Q. Are the residential and general service customers' peak-daily demands weather-sensitive?

A. Yes, residential and general service customers would be expected to use more natural gas on those colder days since their demand for natural gas is dependent

upon the daily weather in HDD. My studies of weather-normalized sales have verified this weather-sensitive usage through such measures as the r^2 and my plots of the relationship between space-heating daily usage in Ccf and daily HDD.

Q. What weather data did Staff witness Patterson provide to you for estimating weather-normalized coincident peak-day demand?

A. Staff witness Patterson provided me with four sets (three for MPS's systems and one for L&P's two service areas) of thirteen HDD calculated from his estimated weather-normalized coldest day for each month as well as a weather-normalized estimate of an annually occurring coldest day. Staff witness Patterson's testimony discusses how he calculated his estimated weather-normalized coldest days.

Q. Why did you calculate your weather-normalized coincident peak-day demand estimates from the Company's billing data?

A. Acceptable load research data are unavailable for the residential and general service customer classes. Load research is the systematic gathering, recording, and analyzing of data describing utility customers' patterns of energy usage. The customer billing data are the best available surrogate data to estimate weather-normalized coincident peak-day demand by firm customer class on Staff witness Patterson's normally occurring coldest days.

Q. Why must peak-day estimates be adjusted to normal weather conditions?

A. They must be adjusted to normal weather conditions for the same reasons stated previously for my weather-normalized sales studies. Briefly, it is important to remove the influence of abnormal weather.

Q. How did you estimate weather-normalized coincident peak-day usage in Ccf per customer, by customer class, for each month?

A. I used the relationships between natural gas usage per customer and HDD from my weather-normalized sales studies based on the Company's billing data. My regression studies were based on daily usage per customer. Therefore, the results of my weather-normalized sales studies were directly applied to estimate weather-normalized coincident peak-day demand.

My natural gas sales regression studies estimated a change in space heating natural gas usage per customer for a change of one HDD. For example, the slope of the best-fitting line for the residential customers in MPS' Northern System is 0.12407. I multiplied that estimate times Staff witness Patterson's thirteen coldest HDD values calculated from his weather-normalized coldest days.

Then, I added these results or mathematical products to another estimate from my weather-normalized sales studies. It is an estimate of non-weather sensitive usage in Ccf per customer calculated from the regression equation. Non-weather sensitive usage occurs in the summer months when there is no space-heating requirement. That non-weather sensitive usage estimate is located on the left, bottom point on each regression line (intercept) in Schedules 4-1 through 4-5. It is non-weather sensitive because it does not depend upon HDD.

Accordingly, I added the preceding thirteen products to the estimated non-weather sensitive usage per customer during the summer months to calculate a total estimated weather-normalized coincident peak-day demand per customer. In this manner, I used my weather-normalized sales studies results to estimate the natural gas

usage in Ccf per customer on the weather-normalized coldest day of each month and for the entire year (annual). Thus, my studies allocate the weather-normalized coincident peak-day responsibility to the residential and general service commercial customers for MPS's three systems and L&P's two service areas.

Schedule 7, attached to this testimony, shows the estimated weather-normalized coincident peak-day natural gas usage in Ccf per customer by billing month and customer class for MPS' three systems and L&P's two service areas. This information was provided to Staff witness Thomas M. Imhoff of the Commission's Energy Tariffs/Rate Design department for his calculation of total peak-day demand across Aquila's firm customer classes.

Q. Why did you state the weather-normalized coincident peak-day responsibilities on a per customer basis?

A. This allows Staff witness Imhoff to multiply my weather-normalized coincident peak-day demand estimates times the appropriate customer numbers to calculate total weather-normalized coincident peak-day demand volumes by firm customer class.

Q. What is the primary difference in methodology between your adjusting sales volumes to normal weather and your weather-normalized coincident peak-day demand studies?

A. My studies of weather-normalized sales start with sales volumes and adjust those volumes to normal weather conditions. In contrast, I lacked acceptable load research data to determine the actual coincident peak-day demand by firm class to adjust it to normal weather conditions. Therefore, I used the regression results from my

weather-normalized sales studies to directly estimate my weather-normalized coincident peak-day demands by customer class on Staff witness Patterson's normally occurring coldest days. If the actual peak-day demand were available, I would use approximately the same methodology as my weather-normalized sales studies.

RECOMMENDATIONS

Q. Would you please summarize your recommendations?

A. I recommend that the Commission utilize the results of my weather-normalized usage per customer shown in Schedule 5, my weather-normalized total sales volumes shown in Schedule 6, and my estimated weather-normalized coincident peak-day demand in Ccf per customer shown in Schedule 7, attached to this testimony.

Q. Does this conclude your direct testimony?

A. Yes, it does.

Aquila, Inc. d/b/a Aquila Networks – MPS and Aquila Networks – L&P

Case No. GR-2004-0072

Testimonies Submitted by James A. Gray

COMPANY	CASE NO.
Missouri Public Service Company	GR-81-312
Missouri Public Service Company	ER-82-39
Missouri Public Service Company	GR-82-194
Laclede Gas Company	GR-82-200
St. Louis County Water Company	WR-82-249
Missouri Public Service Company	ER-83-40
Kansas City Power & Light Company	ER-83-49
Osage Natural Gas Company	GR-83-156
Missouri Public Service Company	GR-83-186
The Gas Service Company	GR-83-225
Laclede Gas Company	GR-83-233
Missouri Water Company	WR-83-352
Missouri Cities Water Company	WR-84-51
Le-Ru Telephone Company	TR-84-132
Union Electric Company	ER-84-168
Union Electric Company	EO-85-17
Kansas City Power & Light Company	ER-85-128
Great River Gas Company	GR-85-136

Missouri Cities Water Company	WR-85-157
Missouri Cities Water Company	SR-85-158
United Telephone Company of Missouri	TR-85-179
Osage Natural Gas Company	GR-85-183
Kansas City Power & Light Company	EO-85-185
ALLTEL Missouri, Inc.	TR-86-14
Sho-Me Power Corporation	ER-86-27
Missouri-American Water Company, Inc.	WR-89-265
The Empire District Electric Company	ER-90-138
Associated Natural Gas Company	GR-90-152
Missouri-American Water Company, Inc.	WR-91-211
United Cities Gas Company	GR-91-249
Laclede Gas Company	GR-92-165
St. Joseph Light & Power Company	GR-93-42
United Cities Gas Company	GR-93-47
Missouri Public Service Company	GR-93-172
Western Resources, Inc.	GR-93-240
Laclede Gas Company	GR-94-220
United Cities Gas Company	GR-95-160
The Empire District Electric Company	ER-95-279
Laclede Gas Company	GR-96-193
Missouri Gas Energy	GR-96-285
Associated Natural Gas Company	GR-97-272

Union Electric Company	GR-97-393
Missouri Gas Energy	GR-98-140
Laclede Gas Company	GR-98-374
St. Joseph Light & Power Company	GR-99-42
AmerenUE	GA-99-107
Laclede Gas Company	GA-99-236
Laclede Gas Company	GR-99-315
AmerenUE	GR-2000-512
Missouri Gas Energy	GR-2001-292
Gateway Pipeline Company, Inc., et al.	GM-2001-585
Missouri Gas Energy, et al	GC-2001-593
Laclede Gas Company	GR-2002-356
Laclede Gas Company	GA-2002-429
Southern Missouri Gas Company, L.P.	GT-2003-0031
Laclede Gas Company	GT-2003-0032
Missouri Gas Energy	GT-2003-0033
Fidelity Natural Gas, Inc.	GT-2003-0036
Atmos Energy Corporation	GT-2003-0037
Aquila Networks- L&P	GT-2003-0038
Aquila Networks- MPS	GT-2003-0039
AmerenUE	GT-2003-0034
AmerenUE	GR-2003-0517

Aquila, Inc. d/b/a Aquila Networks - MPS and Aquila Networks - L&P
Case No. GR-2004-0072

Scheduled Meter Read Dates by Billing Cycle

Applicable to All Firm Customer Classes

January 2002

Sun	Mon	Tue	Wed	Thu	Fri	Sat
		1 **Holiday**	2 Cycle 2 Read January Billing Month	3 Cycle 3 Read	4 Cycle 4 Read	5
6	7 Cycle 5 Read	8 Cycle 6 Read	9 Cycle 7 Read	10 Cycle 8 Read	11 Cycle 9 Read	12
13	14 Cycle 10 Read	15 Cycle 11 Read	16 Cycle 12 Read	17 Cycle 13 Read	18 Cycle 14 Read	19
20	21 Cycle 15 Read	22 Cycle 16 Read	23 Cycle 17 Read	24 Cycle 18 Read	25 Cycle 19 Read	26
27	28 Cycle 20 Read January Billing Month Ends	29	30 Cycle 1 Read February Billing Month Starts	31 Cycle 2 Read		

February 2002

Sun	Mon	Tue	Wed	Thu	Fri	Sat
					1 Cycle 3 Read February Billing Month	2
3	4 Cycle 4 Read	5 Cycle 5 Read	6 Cycle 6 Read	7 Cycle 7 Read	8 Cycle 8 Read	9
10	11 Cycle 9 Read	12 Cycle 10 Read	13 Cycle 11 Read	14 Cycle 12 Read	15 Cycle 13 Read	16
17	18 Cycle 14 Read	19 Cycle 15 Read	20 Cycle 16 Read	21 Cycle 17 Read	22 Cycle 18 Read	23
24	25 Cycle 19 Read	26 Cycle 20 Read February Billing Month Ends	27	28 Cycle 1 Read March Billing Month Starts		

Aquila, Inc. d/b/a Aquila Networks - MPS and Aquila Networks - L&P
Case No. GR-2004-0072

Total Customers, Usage in Ccf, and Heating Degree Days (HDD) by Billing Cycle

MPS' Northern System's General Service - Commercial Customers

January 2002

Sun	Mon	Tue	Wed	Thu	Fri	Sat
		1 **Holiday**	2 Cycle 2 Cust = 4 Ccf = 3353 HDD= 1017.4	3 Cycle 3 Cust = 57 Ccf = 20170 HDD= 1039.5	4 Cycle 4 Cust = 29 Ccf = 13505 HDD= 1014.3	5
6	7 Cycle 5 Cust = 99 Ccf = 40479 HDD= 1118.9	8 Cycle 6 Cust = 46 Ccf = 28067 HDD= 1161	9 Cycle 7 Cust = 72 Ccf = 24416 HDD= 1176.1	10 Cycle 8 Cust = 63 Ccf = 46303 HDD= 1180.3	11 Cycle 9 Cust = 107 Ccf = 42206 HDD= 1125.4	12
13	14 Cycle 10 Cust = 58 Ccf = 25131 HDD= 1175	15 Cycle 11 Cust = 8 Ccf = 7699 HDD= 1185	16 Cycle 12 Cust = 107 Ccf = 32136 HDD= 1194.1	17 Cycle 13 Cust = 24 Ccf = 12587 HDD= 1195.6	18 Cycle 14 Cust = 20 Ccf = 17086 HDD= 1156.5	19
20	21 Cycle 15 Cust = 93 Ccf = 42550 HDD= 1242	22 Cycle 16 Cust = 106 Ccf = 75625 HDD= 1246.8	23 Cycle 17 Cust = 119 Ccf = 50842 HDD= 1234.3	24 Cycle 18 Cust = 185 Ccf = 108784 HDD= 1237	25 Cycle 19 Cust = 93 Ccf = 68273 HDD= 1090.4	26
27	28 Cycle 20 Cust = 77 Ccf = 27062 HDD= 1102.6	29	30 Cycle 1 Cust = 67 Ccf = 29482 HDD= 986.4	31 Cycle 2 Cust = 5 Ccf = 2969 HDD= 923		

February 2002

Sun	Mon	Tue	Wed	Thu	Fri	Sat
					1 Cycle 3 Cust = 58 Ccf = 21437 HDD= 907.8	2
3	4 Cycle 4 Cust = 30 Ccf = 11829 HDD= 921.6	5 Cycle 5 Cust = 99 Ccf = 36443 HDD= 903.6	6 Cycle 6 Cust = 46 Ccf = 26841 HDD= 895	7 Cycle 7 Cust = 71 Ccf = 21004 HDD= 899.9	8 Cycle 8 Cust = 64 Ccf = 39556 HDD= 908.4	9
10	11 Cycle 9 Cust = 108 Ccf = 44634 HDD= 960.1	12 Cycle 10 Cust = 58 Ccf = 21934 HDD= 914.9	13 Cycle 11 Cust = 10 Ccf = 7860 HDD= 912	14 Cycle 12 Cust = 113 Ccf = 32265 HDD= 909.8	15 Cycle 13 Cust = 23 Ccf = 10428 HDD= 898	16
17	18 Cycle 14 Cust = 73 Ccf = 41357 HDD= 933.9	19 Cycle 15 Cust = 73 Ccf = 28176 HDD= 842.9	20 Cycle 16 Cust = 68 Ccf = 60078 HDD= 834.5	21 Cycle 17 Cust = 118 Ccf = 35963 HDD= 843.8	22 Cycle 18 Cust = 183 Ccf = 78486 HDD= 847.7	23
24	25 Cycle 19 Cust = 92 Ccf = 38261 HDD= 870.7	26 Cycle 20 Cust = 74 Ccf = 23012 HDD= 853.9	27	28 Cycle 1 Cust = 65 Ccf = 23048 HDD= 888.5		

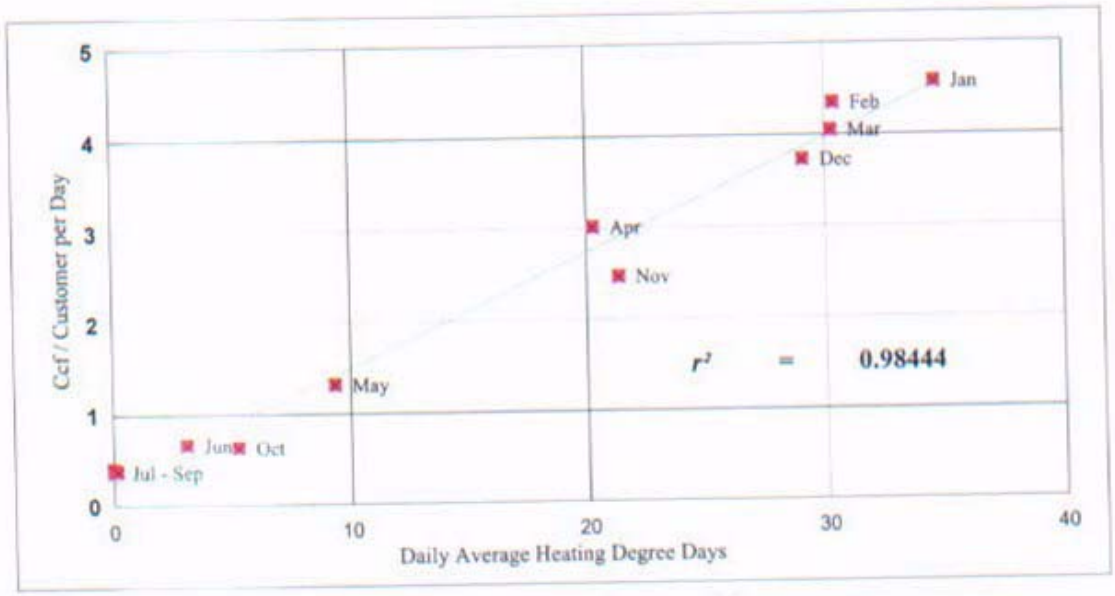
Aquila, Inc. d/b/a Aquila Networks - MPS and Aquila Networks - L&P

Case No. GR-2004-0072

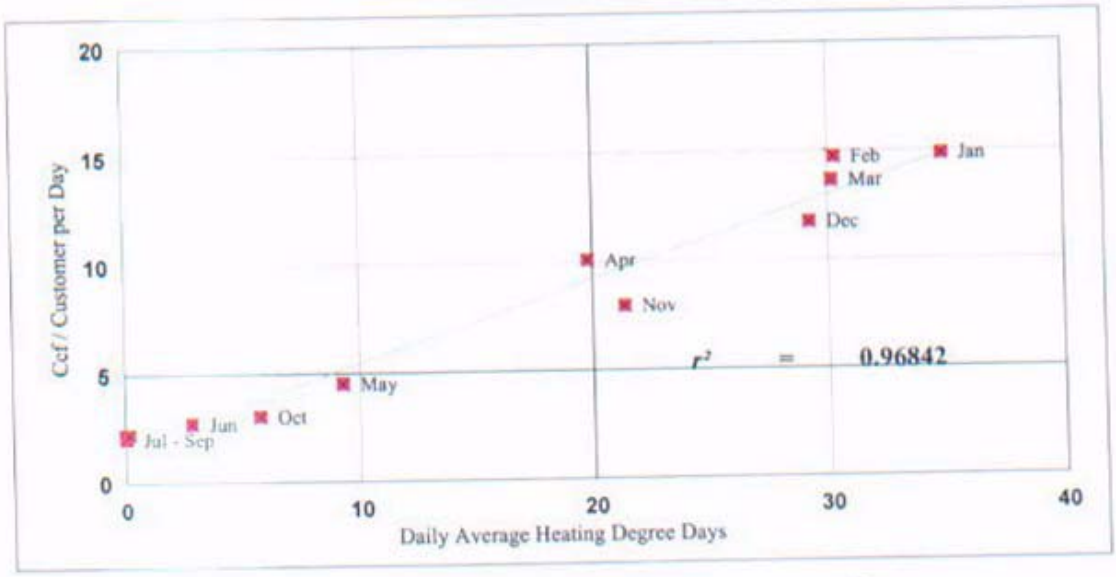
Plots of Billing Month Actual & Estimated Usage vs. Heating Degree Days

MPS - Northern System

Residential Service



General Service - Commercial



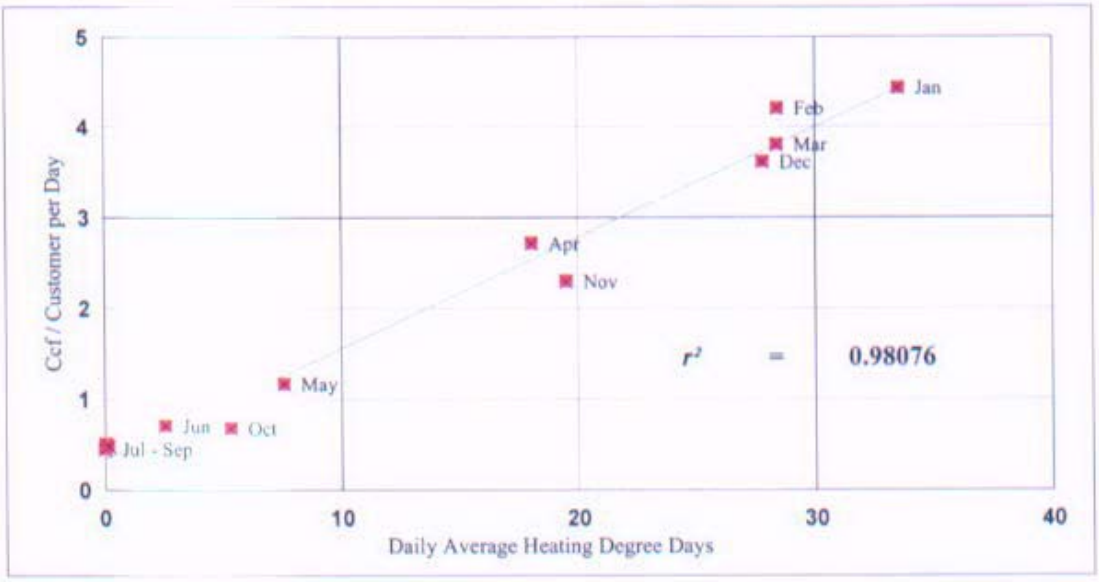
Aquila, Inc. d/b/a Aquila Networks - MPS and Aquila Networks - L&P

Case No. GR-2004-0072

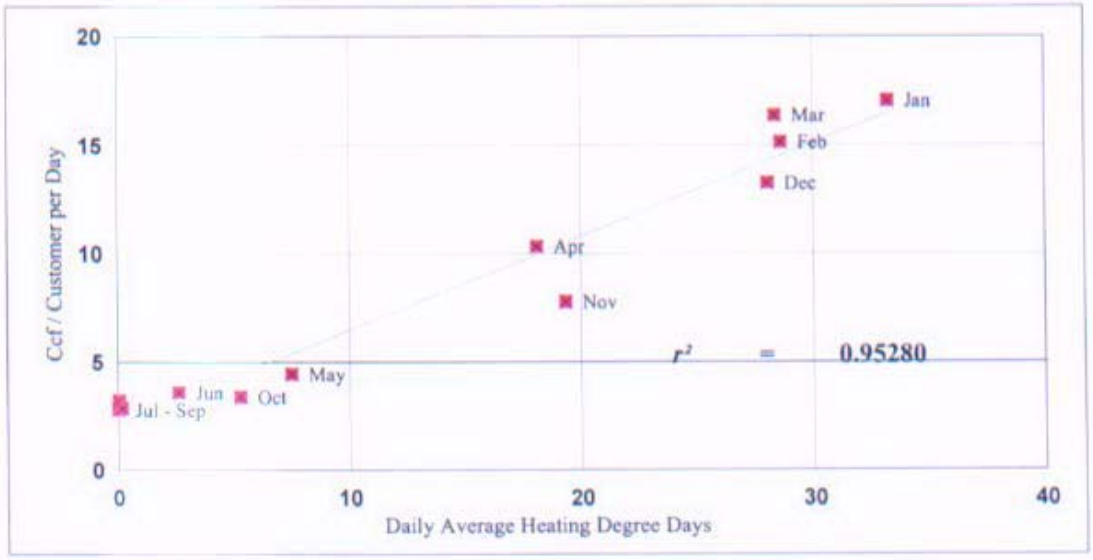
Plots of Billing Month Actual & Estimated Usage vs. Heating Degree Days

MPS - Southern System

Residential Service



General Service - Commercial



Aquila, Inc. d/b/a Aquila Networks - MPS and Aquila Networks - L&P

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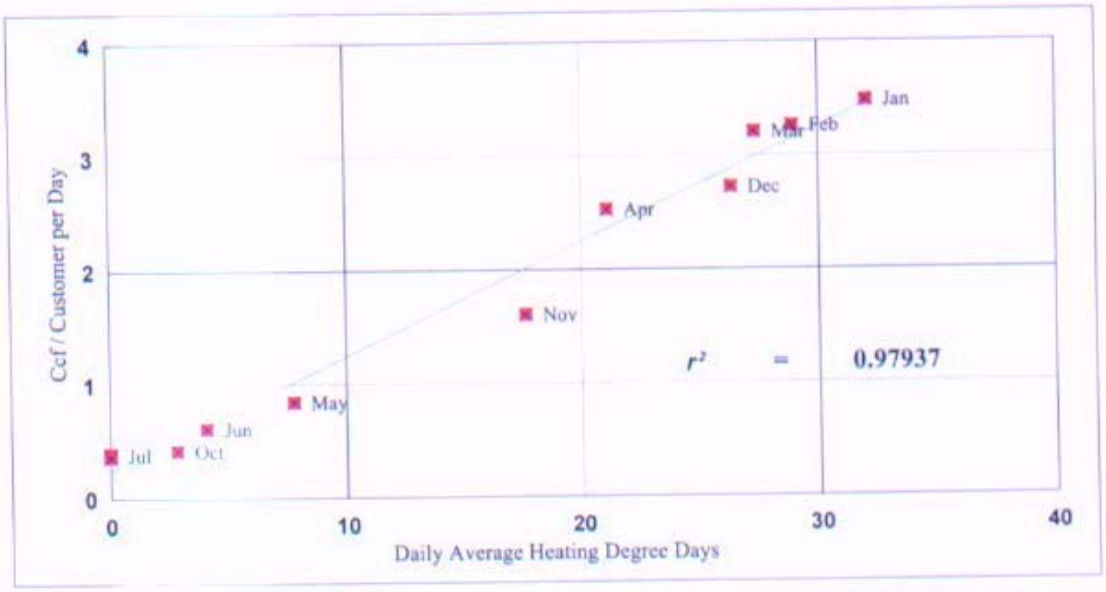
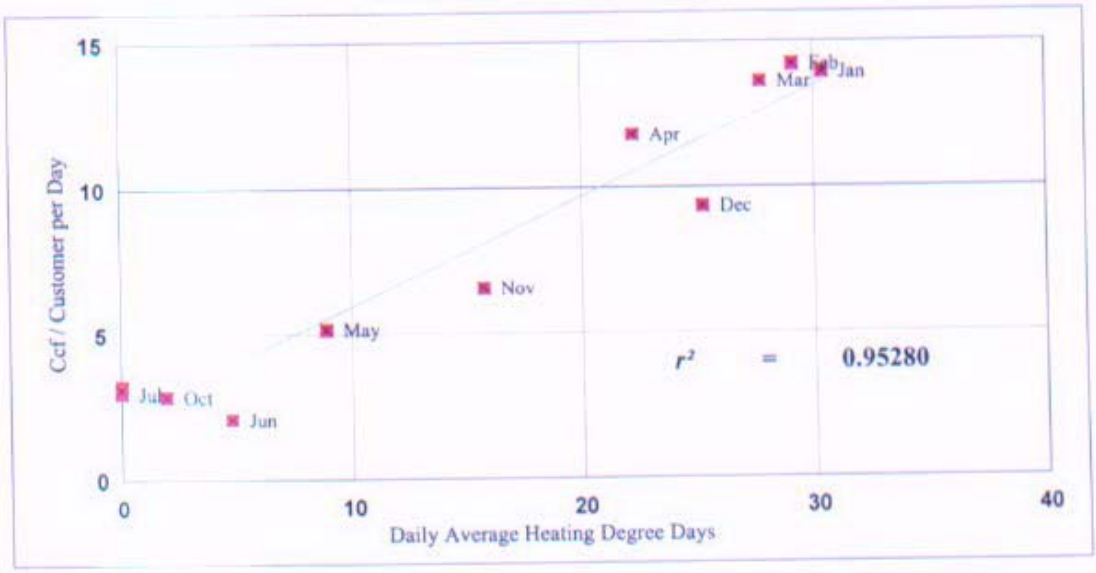
Plots of Billing Month Actual &Estimated Usage vs. Heating Degree Days

MPS - Eastern System

Residential Service



General Service - Commercial



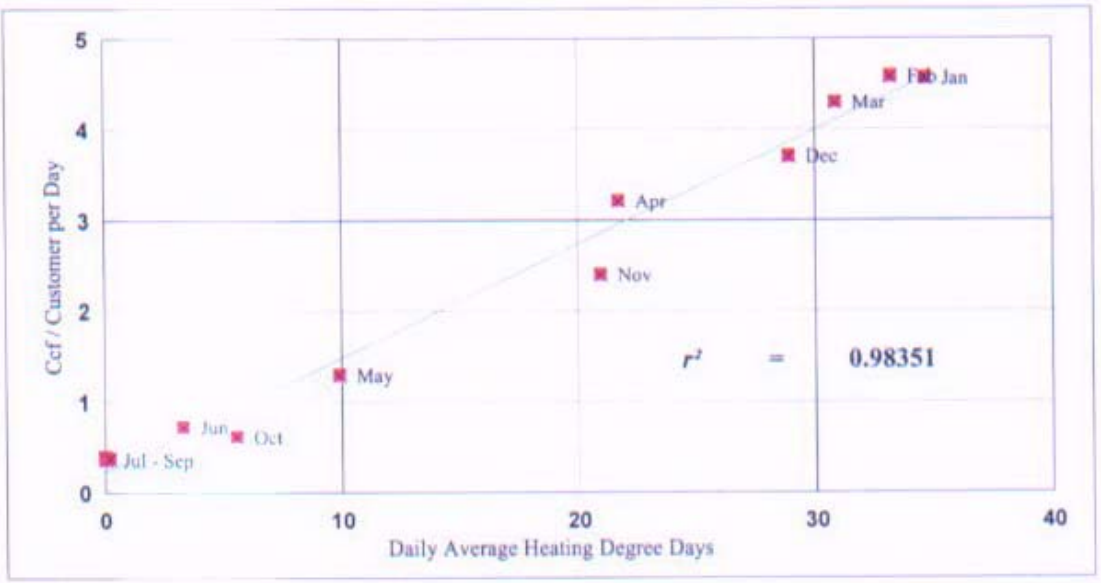
Aquila, Inc. d/b/a Aquila Networks - MPS and Aquila Networks - L&P

Case No. GR-2004-0072

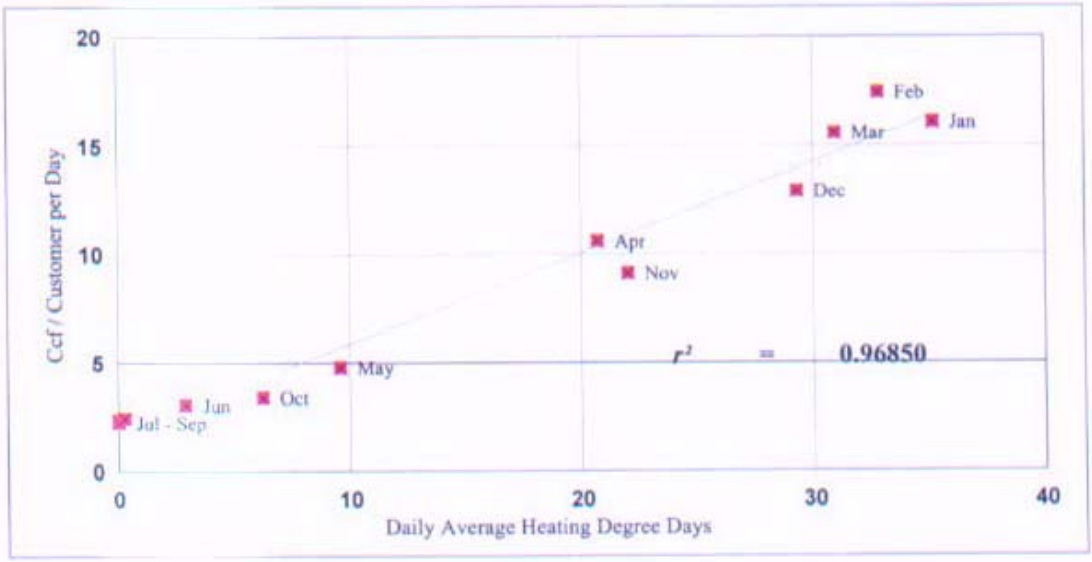
Plots of Billing Month Actual & Estimated Usage vs. Heating Degree Days

L&P - Other Service Areas

Residential Service



General Service - Commercial



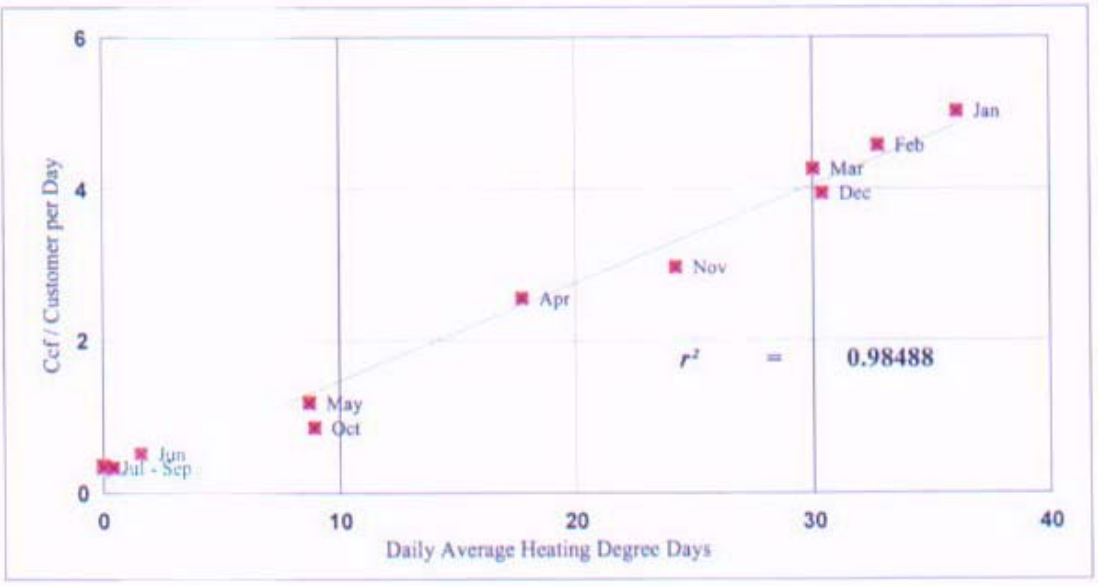
Aquila, Inc. d/b/a Aquila Networks - MPS and Aquila Networks - L&P

Case No. GR-2004-0072

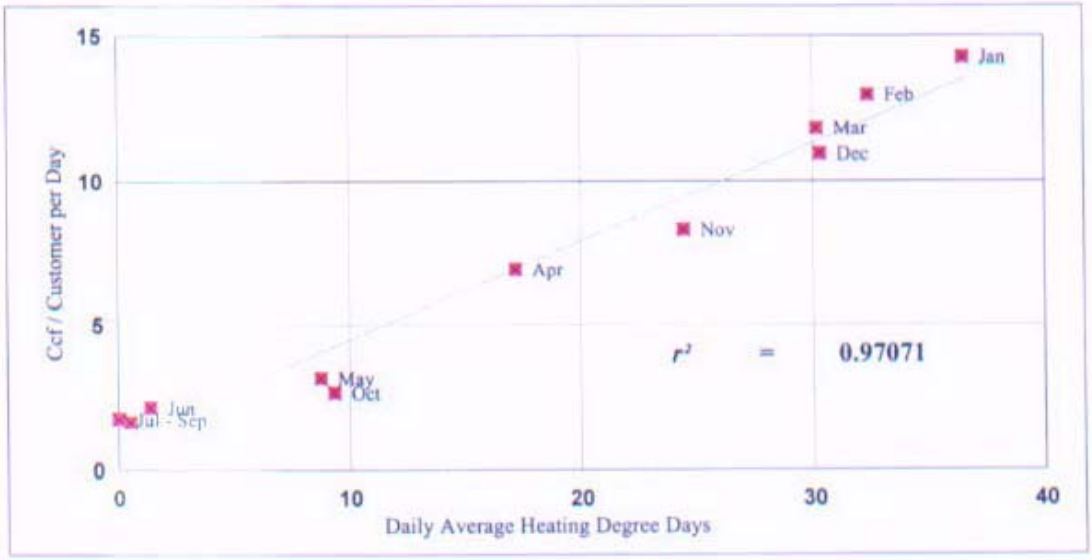
Plots of Billing Month Actual & Estimated Usage vs. Heating Degree Days

L&P - Franklin, Rock Port, & Tarkio Service Areas

Residential Service



General Service - Commercial



Aquila, Inc. d/b/a Aquila Networks - MPS and Aquila Networks - L&P
Case No. GR-2004-0072

Weather Normalized Billing Month Usage in Ccf per Customer
For the Test Year of January 1, 2002 - December 31, 2002

Residential Service

	Aquila Networks - MPS			Aquila Networks - L&P	
	Northern System	Southern System	Eastern System	Franklin, Rock Port, & Tarkio Service Areas	Other Service Areas
Jan '02	171.9798	157.4482	126.1999	187.4028	174.1309
Feb	160.8752	150.6151	117.8054	156.2048	161.6346
Mar	115.8841	104.3103	95.7964	120.4181	126.2107
Apr	84.7845	75.3963	66.0224	73.6701	87.8470
May	40.0924	36.3344	29.2628	30.4828	39.4507
Jun	17.3562	18.5787	13.4051	15.2004	19.2107
Jul	12.9241	15.6602	12.2713	11.0099	12.6377
Aug	11.6664	14.1408	11.9388	10.3957	11.5656
Sep	14.3419	17.2211	11.9325	14.6792	14.0329
Oct	22.8909	21.6983	17.1517	23.1650	22.1275
Nov	53.3086	49.5796	31.2680	69.3384	53.7716
Dec	118.8245	108.9919	77.7829	136.9040	120.8663
Annual	843.2623	774.9762	636.2319	859.5312	849.0437

General Service - Commercial

	Aquila Networks - MPS			Aquila Networks - L&P	
	Northern System	Southern System	Eastern System	Franklin, Rock Port, & Tarkio Service Areas	Other Service Areas
Jan '02	551.7295	600.1536	511.5673	526.1497	593.9359
Feb	535.6022	537.4340	499.7791	441.3152	611.3579
Mar	389.5328	454.5199	417.1388	330.4393	445.1671
Apr	286.0696	286.7405	320.5385	203.6395	293.8487
May	135.5052	140.2833	166.2968	78.3698	142.4699
Jun	76.7597	97.4744	38.9998	66.1105	86.1563
Jul	69.0955	98.3882	99.8344	55.1372	74.6454
Aug	63.1450	87.5185	93.4938	53.7392	70.6411
Sep	78.3720	96.0554	94.8170	63.7696	83.6793
Oct	100.8725	107.0898	112.7629	70.5749	110.4212
Nov	179.1476	166.3110	162.5958	196.8028	203.2958
Dec	379.1203	400.7899	264.4534	379.6968	433.9495
Annual	2,911.6930	3,087.7015	2,833.6028	2,495.4673	3,180.2056

Aquila, Inc. d/b/a Aquila Networks - MPS and Aquila Networks - L&P
Case No. GR-2004-0072

Weather Normalized Billing Month Usage in Ccf
For the Test Year of January 1, 2002 - December 31, 2002

Residential Service

	Aquila Networks - MPS			Aquila Networks - L&P	
	Northern System	Southern System	Eastern System	Franklin, Rock Port, & Tarkio Service Areas	Other Service Areas
Jan '02	1,622,630	4,453,896	479,812	240,438	712,543
Feb	1,524,615	4,242,826	448,014	199,630	657,045
Mar	1,099,277	2,959,701	366,325	153,413	511,027
Apr	799,688	2,130,699	248,178	93,561	357,010
May	370,293	1,017,472	104,849	38,408	162,300
Jun	157,838	518,384	46,342	18,970	77,035
Jul	114,391	434,413	40,974	13,542	50,311
Aug	101,999	391,615	39,386	12,714	45,904
Sep	124,860	474,527	39,437	17,865	55,767
Oct	201,463	598,700	57,458	28,701	87,868
Nov	488,254	1,388,576	112,534	87,713	216,646
Dec	1,104,711	3,076,188	285,230	173,184	487,696
Annual	7,710,017	21,686,998	2,268,538	1,078,139	3,421,151

General Service - Commercial

	Aquila Networks - MPS			Aquila Networks - L&P	
	Northern System	Southern System	Eastern System	Franklin, Rock Port, & Tarkio Service Areas	Other Service Areas
Jan '02	791,732	2,170,155	240,437	117,331	367,052
Feb	767,518	1,838,024	236,895	98,413	378,431
Mar	560,538	1,639,908	195,638	74,349	276,004
Apr	410,796	1,034,846	151,294	45,208	181,305
May	188,217	496,463	76,330	17,398	87,334
Jun	103,626	342,525	17,628	14,346	51,694
Jul	90,999	344,654	43,827	11,634	44,937
Aug	82,973	305,702	40,576	11,339	42,243
Sep	102,511	333,408	41,340	13,583	50,040
Oct	134,060	372,565	49,390	15,032	65,921
Nov	253,673	585,082	75,607	42,116	123,604
Dec	536,834	1,431,621	126,938	82,015	268,181
Annual	4,023,474	10,894,955	1,295,901	542,764	1,936,745

Aquila, Inc. d/b/a Aquila Networks - MPS and Aquila Networks - L&P
Case No. GR-2004-0072

Weather Normalized Coincident Peak Day Demand in Ccf per Customer
For the Test Year of January 1, 2002 - December 31, 2002

Residential Service

	Aquila Networks - MPS			Aquila Networks - L&P	
	Northern System	Southern System	Eastern System	Franklin, Rock Port, & Tarkio Service Areas	Other Service Areas
Jan '02	8.8916	7.9480	6.8186	9.1926	8.9832
Feb	8.3209	7.6557	6.3476	8.9474	8.7449
Mar	6.3110	5.5725	4.8845	6.9726	6.8267
Apr	4.4252	4.0985	3.2409	4.6752	4.5950
May	2.5394	2.3442	1.9682	2.7650	2.7394
Jun	1.1499	0.9555	0.8859	1.2290	1.2474
Jul	0.5047	0.5291	0.3648	0.4159	0.4576
Aug	0.6660	0.5534	0.4950	0.7256	0.7585
Sep	2.4153	2.3930	1.9081	2.7779	2.7520
Oct	3.9662	3.5746	3.0505	4.3267	4.2565
Nov	6.2490	5.4385	4.6440	6.6500	6.5132
Dec	8.6186	7.8628	6.6182	9.2959	9.0835
Annual	**8.8916**	**7.9480**	**6.8186**	**9.2959**	**9.0835**

General Service - Commercial

	Aquila Networks - MPS			Aquila Networks - L&P	
	Northern System	Southern System	Eastern System	Franklin, Rock Port, & Tarkio Service Areas	Other Service Areas
Jan '02	28.0784	29.1061	26.8128	24.8907	30.9181
Feb	26.3324	28.0702	25.0501	24.2429	30.1225
Mar	20.1832	20.6899	19.5745	19.0268	23.7164
Apr	14.4135	15.4676	13.4239	12.9584	16.2635
May	8.6439	9.2526	8.6609	7.9128	10.0666
Jun	4.3926	4.3324	4.6105	3.8558	5.0841
Jul	2.4188	2.8218	2.6603	1.7080	2.4462
Aug	2.9122	2.9082	3.1479	2.5262	3.4511
Sep	8.2643	9.4253	8.4359	7.9469	10.1085
Oct	13.0091	13.6118	12.7113	12.0379	15.1330
Nov	19.9934	20.2152	18.6744	18.1745	22.6696
Dec	27.2434	28.8039	26.0627	25.1634	31.2530
Annual	**28.0784**	**29.1061**	**26.8128**	**25.1634**	**31.2530**