NP

2007-2026 Integrated Resource Plan
for
The Empire District Electric Company

Volume II
Load Analysis and Forecasting (4 CSR 240-22.030)

September 2007

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ES.0 Executive Summary

ES.1 Background

Per 4 CSR 240-22, The Empire District Electric Company (Empire) is required to file an Electric Resource Plan in 2007. Additionally, as part of the requirements of the stipulation and agreement to settle Case No. EO-2005-0263 (seeking approval from the Missouri Public Service Commission (MPSC) of a regulatory plan that would in part sanction Empire's ownership participation in the Iatan 2 unit being developed by Kansas City Power & Light (KCP&L)), Empire agreed to continue briefing the MPSC semiannually on the status of its integrated resource planning process (IRP), to file an IRP in July 2006 (to cover at least a twenty-year period), and to incorporate its July 2006 Resource Plan into its August 2007 Electric Resource Plan filing. As part of its 2006 Resource Plan, Empire committed to incorporate a new forecasting methodology into its 2007 Electric Resource Plan process in conformance with the Stipulation and Agreement in Case No. EO-2005-0263.

Empire used *MetrixND* to perform the load forecast for this 2007 Electric Resource Plan filing. The load analysis techniques used and the load forecast developed from this work effort are provided in this document.

ES-2 Load Forecast

The annual peak demand and energy forecast associated with the base case are shown in Figures ES-1 and ES-2 and Table ES-1. The base forecast reflects an average growth rate of **____** for the annual energy and **____** for peak demand growth over the 20-year planning horizon. The base case forecast is based on average customer growth of about **__** per year over the entire 20-year planning horizon. In accordance with the Rule, high and low load forecasts were also prepared. The high load forecast reflects average customer growth of about **____** per year and the low load forecast reflects average customer growth of about **____**. The probabilities assumed for each load forecast are low (38%), base (50%), high (12%).

Figure ES-1

Annual System Peak Demand
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Figure ES-2

Total Annual System Energy
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Table ES-1
Base Case Forecast*

Year	Peak Demand (MW)	Peak Load Growth (%)	Annual Energy (MWh)	Energy Load Growth (%)	Load Factor (%)
1996	863		4,204,598		55.5
1997	896	3.8	4,250,155	1.1	54.1
1998	935	4.4	4,471,314	5.2	54.6
1999	1,007	7.7	4,473,229	0.0	50.7
2000	1,004	-0.3	4,794,585	7.2	54.4
2001	1,009	0.5	4,800,756	0.1	54.3
2002	997	-1.2	4,917,875	2.4	56.3
2003	1,045	4.8	4,950,161	0.7	54.3
2004	1,014	-3.0	4,972,159	0.4	54.4
2005	1,087	7.2	5,293,643	6.5	55.6
2006	1,159	6.6	5,330,214	0.7	52.5
2007	** **	** **	** **	** **	** **
2008	** **	** **	** **	** **	** **
2009	** **	** **	** **	** **	** **
2010	** **	** **	** **	** **	** **
2011	** **	** **	** **	** **	** **
2012	** **	** **	** **	** **	** **
2013	** **	** **	** **	** **	** **
2014	** **	** **	** **	** **	** **
2015	** **	** **	** **	** **	** **
2016	** **	** **	** **	** **	** **
2017	** **	** **	** **	** **	** **
2018	** **	** **	** **	** **	** **
2019	** **	** **	** **	** **	** **
2020	** **	** **	** **	** **	** **
2021	** **	** **	** **	** **	** **
2022	** **	** **	** **	** **	** **
2023	** **	** **	** **	** **	** **
2024	** **	** **	** **	** **	** **
2025	** **	** **	** **	** **	** **
2026	** **	** **	** **	** **	** **
*Note: Historical data not weather normalized.					

ES.3 Load Forecast Methodology

The forecast for Empire's peak demand and energy throughout the planning horizon was developed individually by jurisdiction by rate class with an econometric model, developed with the software known as *MetrixND*. Eleven years (1996-2006) of historical sales and weather data were used. Historical data used for modeling were derived by summing the monthly billing data by rate class by jurisdiction by pricing plan.

Regression analysis techniques were used to determine weather-normalized peak demands and energies for Empire's historical load. The load impacts of implemented demand-side management (DSM) programs are incorporated in the base load forecast, but the loads impacts of new DSM programs proposed by this IRP are not.

The pricing plans were forecast individually by jurisdiction using historical sales and weather, monthly binaries, weather splines, and economic variables. System energy, peak demands, customer count, and sales were forecast with linear regression analysis employing the "least squares" method to determine the best fit line through a set of historical observations. The pool of economic drivers used to forecast most of the pricing plans included retail sales, population, gross regional product, employment, households, mean household income, and wealth. The most relevant economic drivers were selected for the pricing plan being forecast. The forecasts for a few of the smaller pricing plans used a moving average technique called "exponential smoothing." Data for the drivers on a county-by-county basis were obtained by Empire from Woods & Poole Economics. Pricing plans were mapped to revenue classes to determine forecasts for each of residential, commercial, industrial, on-system wholesale, and other.

The annotated summary provided in the Introduction (Section 1.0) of this report demonstrates Empire's compliance with Load Analysis and Forecasting Rules from 4 CSR 240-22.030.

1.0 Introduction

1.1 Background

The Empire District Electric Company (Empire) is an operating public utility engaged in the generation, purchase, transmission, distribution and sale of electricity in parts of Missouri, Kansas, Oklahoma and Arkansas. Empire's service territory includes an area of about 10,000 square miles with a population of over 450,000. The service territory is located principally in southwestern Missouri and also includes smaller areas in southeastern Kansas, northeastern Oklahoma and northwestern Arkansas. The principal activities of these areas include light industry, agriculture and tourism.

Empire's total 2006 retail electric revenues were derived approximately 87.6% from Missouri customers, 6.1% from Kansas customers, 3.0% from Oklahoma customers and 3.3% from Arkansas customers. Empire supplies electric service at retail to 121 incorporated communities and to various unincorporated areas and at wholesale to four municipally owned distribution systems. The largest urban area served is the city of Joplin, Missouri, and its immediate vicinity, with a population of approximately 157,000. Empire's 2007 system peak was 1,173 MW which occurred on August 15, 2007, when the temperature was 102°F, surpassing the 2006 peak of 1,159 MW. Empire's 2006 customer load was 5,330,214 MWh. Empire's electric operating revenues in 2006 were derived as follows: residential 41.7%, commercial 30.1%, industrial 16.9%, wholesale on-system 4.6%, wholesale off-system 3.2% and other 3.5%.

1.2 Regulatory Requirements

Per 4 CSR 240-22, The Empire District Electric Company (Empire) is required to file an Electric Resource Plan in 2007. Additionally, as part of the requirements of the stipulation and agreement to settle Case No. EO-2005-0263 (seeking approval from the Missouri Public Service Commission (MPSC) of a regulatory plan that would in part sanction Empire's ownership participation in the Iatan 2 unit being developed by Kansas City Power & Light (KCP&L)), Empire agreed to continue briefing the MPSC semiannually on the status of its integrated resource planning process (IRP), to file an IRP in July 2006 (to cover at least a twenty-year period), and to incorporate its July 2006 Resource Plan into its August 2007 Electric Resource Plan filing. As part of its 2006 Resource Plan, Empire committed to incorporate a new forecasting methodology into its 2007 Electric Resource Plan process in conformance with the Stipulation and Agreement in Case No. EO-2005-0263.

Empire used *MetrixND* software to perform the load forecast for this 2007 Electric Resource Plan. The load analysis techniques used and the load forecast developed from this work effort are provided in this document.

1.3 Annotated Summary

4 CSR 240-22.030 (8) describes the reporting requirements for the load analysis and forecasting effort undertaken as part of an integrated resource plan. 4 CSR 240-22.030 (8) (H) requires the inclusion of an annotated summary that shows how the methods used to develop all forecasts required by the Electric Utility Resource Planning Rule comply with the specific provisions of those rules. The annotated summary that follows demonstrates Empire's compliance with the provisions of the rules and denotes those sections of the rules for which Empire applied for a waiver.

4 CSR 240-22.030 Load Analysis and Forecasting

PURPOSE: This rule sets minimum standards for the maintenance and updating of historical data, the level of detail required in analyzing and forecasting loads, and for the documentation of the inputs, components and methods used to derive the load forecasts.

(1) Historical Data Base. The utility shall develop and maintain data on the actual historical patterns of energy usage within its service territory. The following information shall be maintained and updated on an ongoing basis:
  (A) Customer Class Detail. The historical data base shall be maintained for each of the following major classes: residential, commercial, industrial, interruptible and other classes that may be required for forecasting (for example, large power, wholesale, outdoor lighting and public authorities).
    1. Taking into account the requirement for an unbiased forecast as well as the cost of developing data at the subclass level, the utility shall determine what level of subclass detail is required for forecasting and what methods to use in gathering subclass information for each major class.
    2. The utility shall consider the following categories of subclasses: for residential, dwelling type; for commercial, building or business type; and for industrial, product type. If the utility uses subclasses which do not fit into these categories, it must explain the reasons for its choice of subclasses;
  (B) Load Data Detail. The historical load data base shall contain the following data:
    1. For each jurisdiction under which the utility has rates established and for which it prepares customer and energy forecasts, each major class, and to the extent data is required to support the detail specified in paragraph (1)(A)1., for each subclass, actual monthly energy usage and number of customers and weather-normalized monthly energy usage;
    2. For each major class, estimated actual and weather-normalized demands at the time of monthly system peaks; and
    3. For the system, actual and weather-normalized hourly net system load;
  (C) Load Component Detail. The historical data base for major class monthly energy usage and demands at time of monthly peaks shall be disaggregated into a number of units component and a use kilowatt-hour (kWh) per unit component, for both actual and weather-normalized loads.
    1. Typical units for the major classes are—residential, number of customers; commercial, square feet of floor space or commercial employment level; and

industrial, production output or employment level. If the utility uses a different unit measure, it must explain the reason for choosing different units.

2. The utility shall develop and implement a procedure to routinely measure and regularly update estimates of the effect of departures from normal weather on class and system electric loads.
   A. The estimates of the effect of weather on class and system loads shall incorporate the nonlinear response of loads to daily weather and seasonal variations in loads.
   B. For at least the base year of the forecast, the utility shall estimate the cooling, heating and non-weather-sensitive components of the weather-normalized major class loads.
   C. The utility shall document the methods used to develop weather measures and the methods used to estimate the effect of weather on electric loads. If statistical models are used, the documentation shall include at least: the functional form of the models; the estimation techniques employed; the data used to estimate the models, including the development of model input data from basic data; and the relevant statistical results of the models, including parameter estimates and tests of statistical significance; and

(D) Length of Data Base. Once the utility has developed the historical data base, it shall retain that data base for the ten (10) most recent years or for the period of time used as the basis of the utility's forecast, whichever is longer.

1. The development of actual and weather- normalized monthly class and system energy usage and actual hourly net system loads shall start from January 1982 or for the period of time used as the basis of the utility's forecast of these loads, whichever is longer.
2. Estimated actual and weather-normalized class and system monthly demands at the time of the system peak and weather-normalized hourly system loads shall start from January 1990 or for the period of time used as the basis of the utility's forecast of these loads, whichever is longer.

(2) Analysis of Number of Units. For each major class or subclass, the utility shall analyze the historical relationship between the number of units and the economic or demographic factors (driver variables) that affect the number of units for that major class or subclass. These relationships shall be specified as statistical or mathematical models that relate the number of units to the driver variables.

(A) Choice of Driver Variables. The utility shall identify appropriate driver variables as predictors of the number of units for each major class or subclass. The critical assumptions that influence the driver variables shall also be identified.

(B) Documentation of statistical models shall include the elements specified in subparagraph (1)(C)2.C. Documentation of mathematical models shall include a specification of the functional form of the equations.

(C) Where the utility has modeled the relationship between the number of units and the driver variables for a major class, but not for subclasses within that major class, it shall consider how a change in the subclass shares of major class units could affect the major class forecast.

(3) Analysis of Use Per Unit. For each major class, the utility shall analyze historical use per unit by end use.

(A) End-Use Detail. For each major class, use per unit shall be disaggregated by end use where information permits.

1. Where applicable for each major class, end-use information shall be developed for at least lighting, process equipment, space cooling, space heating, water heating and refrigeration.
2. For each major class and each end use, including those listed in paragraph (3)(A)1., if information is not available, the utility shall provide a schedule for acquiring this end-use information or demonstrate that either the expected costs of acquisition were found to outweigh the expected benefits over the planning horizon or that gathering the end-use information has proven to be infeasible.
3. If the utility has not yet acquired end-use information on space cooling or space heating for a major class, the utility shall determine the effect that weather has on the total load of that major class by disaggregating the load into its cooling, heating and non-weather- sensitive components. If the cooling or heating components are a significant portion of the total load of the major class, then the cooling or heating components of that load shall be designated as end uses for that major class.
4. The difference between the total load of a major class and all end uses for which the utility has acquired end-use information shall be designated as an end use for that major class.

(B) The data base and historical analysis required for each end use shall include at least the following:

1. Measures of the stock of energy-using capital goods. For each major class and end use, the utility shall implement a procedure to develop and maintain survey data on the energy- related characteristics of the building, appliance and equipment stock including saturation levels, efficiency levels and sizes where applicable. The utility shall update these surveys before each scheduled filing pursuant to 4 CSR 240-22.080; and
2. Estimates of end-use energy and demand. For each end use, the utility shall estimate end-use monthly energies and demands at time of monthly system peaks and shall calibrate these energies and demands to equal the weather-normalized monthly energies and demands at time of monthly peaks for each major class for the most recently available data.

(4) Analysis of Load Profiles. The utility shall develop a consistent set of daily load profiles for the most recent year for which data is available. For each month, load profiles shall be developed for a peak weekday, a representative of at least one (1) weekday and a representative of at least one (1) weekend day.

(A) Load profiles for each day type shall be developed for each end use, for each major class and for the net system load.

(B) For each day type, the estimated end-use load profiles shall be calibrated to sum to the estimated major class load profiles and the estimated major class load profiles shall be calibrated to sum to the net system load profiles.

(5) Base-Case Load Forecast. The utility's base-case load forecast shall be based on projections of the major economic and demographic driver variables that utility decision-makers believe to be most likely. All components of the base-case forecast shall be based on the assumption of normal weather conditions. The load impacts of implemented demand-side programs shall be incorporated in the base-case load forecast but the load impacts of proposed demand-side programs shall not be included in the base-case forecast.

(A) Customer Class and Total Load Detail. The utility shall produce forecasts of monthly energy usage and demands at the time of the summer and winter system peaks by major class for each year of the planning horizon. Where the utility anticipates that jurisdictional levels of forecasts will be required to meet the requirements of a specific state, then the utility shall determine a procedure by which the major class forecasts can be separated by jurisdictional component.

(B) Load Component Detail. For each major class, the utility shall produce separate forecasts of the number of units and use per unit components based on the analysis described in sections (2) and (3) of this rule.

1. Number of units forecast. The utility's forecast of number of units for each major class shall be based on the analysis of the relationship between number of units and driver variables described in section (2). Where judgment has been applied to modify the results of a statistical or mathematical model, the utility shall specify the factors which caused the modification and shall explain how those factors were quantified.
   A. The forecasts of the driver variables shall be specified and clearly documented. These forecasts shall be compared to historical trends and significant differences between the forecasts and long-term and recent trends shall be analyzed and explained.
   B. The forecasts of the number of units for each major class shall be compared to historical trends. Significant differences between the forecasts and long-term and recent trends shall be analyzed and explained.
2. Use per unit forecast. The utility's forecast of monthly energy usage per unit and seasonal peak demands per unit for each major class shall be based on the analysis described in section (3).
   A. The forecasts of the driver variables for the use per unit shall be specified. The utility shall document how the forecast of use per unit has taken into account the effects of real prices of electricity, real prices of competitive energy sources, real incomes and any other relevant economic and demographic factors.
   B. End-use detail. For each major class and for each end use, the utility shall forecast both monthly energy use and demands at time of the summer and winter system peaks.
   C. The stock of energy-using capital goods. For each end use for which the utility has developed measures of the stock of energy-using capital goods and where the utility has determined that forecasting the use of electricity associated with these energy-using capital goods is cost-effective and feasible, it shall forecast those measures and document the relationship between the forecasts of the measures to the forecasts of end-use energy

and demands at time of the summer and winter system peaks. The values of the driver variables used to generate forecasts of the measures of the stock of energy-using capital goods shall be specified and clearly documented.

D. The major class forecasted use per unit shall be compared to historical trends in weather-normalized use per unit. Significant differences between the forecasts and long-term and recent trends shall be analyzed and explained.

(C) Net System Load Forecast. The utility shall produce a forecast of net system load profiles for each year of the planning horizon. The net system load forecast shall be consistent with the utility's forecasts of monthly energy and demands at time of summer and winter system peaks for the major rate classes.

(6) Sensitivity Analysis. The utility shall analyze the sensitivity of the components of the base-case forecast for each major class to variations in the key driver variables, including the real price of electricity, the real price of competing fuels and economic and demographic factors identified in section (2) and subparagraph (5)(B)2.A.

(7) High-Case and Low-Case Load Forecasts. Based on the sensitivity analysis described in section (6), the utility shall produce at least two (2) additional load forecasts (a high-growth case and a low-growth case) that bracket the base-case load forecast. Subjective probabilities shall be assigned to each of the load forecast cases. These forecasts and associated subjective probabilities shall be used as inputs to the strategic risk analysis required by 4 CSR 240-22.070.

(8) Reporting Requirements. To demonstrate compliance with the provisions of this rule, and pursuant to the requirements of 4 CSR 240-22.080, the utility shall prepare a report that contains at least the following information:

(A) For each major class specified in subsection(1)(A), the utility shall provide plots of number of units, energy usage per unit and total class energy usage.

1. Plots shall be produced for the summer period (June through September), the remaining non-summer months and the calendar year.
2. The plots shall cover the historical data base period and the forecast period of at least twenty (20) years.
   A. The historical period shall include both actual and weather-normalized energy usage per unit and total class energy usage.
   B. The plots for the forecast period shall show each end-use component of major class energy usage per unit and total class energy usage for the base-case forecast.

(B) For each major class specified in subsection (1)(A), the utility shall provide plots of class demand per unit and class total demand at time of summer and winter system peak. The plots shall cover the historical data base period and the forecast period of at least twenty (20) years.

1. The plots for the historical period shall include both actual and weather-normalized class demands per unit and total demands at the time of summer and winter system peak demands.
2. The plots for the forecast period shall show each end-use component of major class coincident demands per unit and total class coincident demands for the base-case forecast.

(C) For the forecast of class energy and peak demands, the utility shall provide a summary of the sensitivity analysis required by section (6) of this rule that shows how changes in the driver variables affect the forecast.

(D) For the net system load, the utility shall provide plots of energy usage and peak demand.
1. The energy plots shall include the summer, non-summer and total energy usage for each calendar year.
2. The peak demand plots shall include the summer and winter peak demands.
3. The plots shall cover the historical data base period and the forecast period of at least twenty (20) years. The historical period shall include both actual and weather-normalized values. The forecast period shall include the base-case, low-case and high-case forecasts.
4. The utility shall describe how the subjective probabilities assigned to each forecast were determined.

(E) For each major class, the utility shall provide estimated load profile plots for the summer and winter system peak days.
1. The plots shall show each end-use component of the hourly load profile.
2. The plots shall be provided for the base year of the load forecast and for the fifth, tenth and twentieth years of the forecast.

(F) For the net system load profiles, the utility shall provide plots for the summer peak day and the winter peak day.
1. The plots shall show each of the major class components of the net system load profile in a cumulative manner.
2. The plots shall be provided for the base year of the forecast and for the fifth, tenth and twentieth years of the forecast.

(G) The data presented in all plots also shall be provided in tabular form.

(H) The utility shall provide a description of the methods used to develop all forecasts required by this rule, including an annotated summary that shows how these methods comply with the specific provisions of this rule. If end-use methods have not been used in forecasting, an explanation as to why they have not been used shall be included. Also included shall be the utility's schedule to acquire end-use information and to develop end-use forecasting techniques or a discussion as to why the acquisition of end-use information and the development of end-use forecasting techniques are either impractical or not cost effective.

Table 1 shows where in this volume of the IRP report a specific portion of 4 CSR 240-22.030, the IRP Rules for Load Analysis and Forecasting, has been addressed. If a variance was requested or a clarification provided in Empire's July 23, 2007 filing, the notation "App for Variance" or "App for Clarification" is shown for "Location in Report."

Table 1
Summary of Compliance with IRP Rule for Load Analysis and Forecasting
(4 CSR 240-22.030)

Rule	Description	Location in Report
22.030 (8) (A)	Plot specifications	Sections 3.0, 4.0, 5.0, 6.0, 8.0, Appendix B
22.030 (8) (B)	Plots for summer and winter peak	Section 2.0, Appendix B
22.030 (8) (C)	Sensitivity analysis summary	Section 2.2, Table 22, Table 27, Table 32
22.030 (8) (D)	Net system load plot specifications	Section 2.0, Figure 1, Figure 2, Appendix B
22.030 (8) (E)	Load profile plots – summer & winter peaks	Section 2.0, Figures 3-10
22.030 (8) (F)	Net system load – peak days	Figures 3-10
22.030 (8) (G)	Tables to accompany plots	Sections 2.0, 3,0, 4,0, 5,0, 6,0, Appendix C
22.030 (8) (H)	Annotated summary	Empire has completed the effort proposed to and approved by the MPSC in its July 23, 2007 Appliance for Variance and Clarification: To produce class level forecasts by season with econometric models using regression analysis at the customer class level using customer, weather, energy usage, and economic variables. Empire's forecasting models are explained in this report.

2.0 Load Forecast Results

2.1 Base Case

The annual peak demand and energy forecast associated with the base case are shown in Figures 1 and 2 and Table 2. This forecast reflects an average growth rate of **___%** for the annual energy and **____** for peak demand growth over the 20-year planning horizon. The base case forecast is based on average customer load growth of about **___* per year. As can be seen from the graphs, no significant variances exist between the historical data and the forecast.

Figure 1
Annual System Peak Demand
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Figure 2
Total Annual System Energy
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Table 2
Base Case Forecast*

Year	Peak Demand (MW)	Peak Load Growth (%)	Annual Energy (MWh)	Energy Load Growth (%)	Load Factor (%)
1996	863		4,204,598		55.5
1997	896	3.8	4,250,155	1.1	54.1
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2001	1,009	0.5	4,800,756	0.1	54.3
2002	997	-1.2	4,917,875	2.4	56.3
2003	1,045	4.8	4,950,161	0.7	54.3
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2017	** **	** **	** **	** **	** **
2018	** **	** **	** **	** **	** **
2019	** **	** **	** **	** **	** **
2020	** **	** **	** **	** **	** **
2021	** **	** **	** **	** **	** **
2022	** **	** **	** **	** **	** **
2023	** **	** **	** **	** **	** **
2024	** **	** **	** **	** **	** **
2025	** **	** **	** **	** **	** **
2026	** **	** **	** **	** **	** **
*Historical data not weather normalized.					

A comparison of historical and forecast energy consumption by revenue class is provided on Table 3. No historical peak demand by rate or revenue class has been provided as such values would be estimates, only, based on energy allocations, and cannot be calculated or determined directly.

Table 3
Revenue Class Energy Usage – Historical and Forecast (MWh)*

Year	Residential	Commercial	Industrial	Other Retail	On-System Wholesale	Total Sales
1996	1,440,512	1,154,879	923,730	97,309	262,330	3,878,760
1997	1,429,787	1,171,849	943,287	102,810	273,035	3,920,768
1998	1,548,630	1,246,323	960,784	90,589	299,256	4,145,582
1999	1,509,176	1,260,598	988,114	101,279	297,614	4,156,781
2000	1,664,719	1,333,095	1,009,284	97,698	309,633	4,414,429
2001	1,681,085	1,375,620	1,004,899	101,784	322,336	4,485,724
2002	1,726,449	1,378,165	1,027,446	102,805	323,103	4,557,968
2003	1,728,315	1,386,807	1,058,730	103,898	308,574	4,586,324
2004	1,703,858	1,417,307	1,085,380	108,058	305,711	4,620,314
2005	1,881,441	1,485,034	1,106,700	112,919	328,803	4,914,897
2006	1,898,846	1,547,077	1,145,490	112,727	337,658	5,041,798
2007	**	**	**	**	**	**
2008	**	**	**	**	**	**
2009	**	**	**	**	**	**
2010	**	**	**	**	**	**
2011	**	**	**	**	**	**
2012	**	**	**	**	**	**
2013	**	**	**	**	**	**
2014	**	**	**	**	**	**
2015	**	**	**	**	**	**
2016	**	**	**	**	**	**
2017	**	**	**	**	**	**
2018	**	**	**	**	**	**
2019	**	**	**	**	**	**
2020	**	**	**	**	**	**
2021	**	**	**	**	**	**
2022	**	**	**	**	**	**
2023	**	**	**	**	**	**
2024	**	**	**	**	**	**
2025	**	**	**	**	**	**
2026	**	**	**	**	**	**

*Historical data not weather normalized.

The projections for loads by major class for the summer and winter peak days for 2007 (first year of the planning horizon), 2011 (fifth year of the planning horizon), 2016 (tenth year of the planning horizon), and 2026 (twentieth year of the planning horizon) are shown in Figures 3-10. Note that the 2007 loads are projected, not actual. The load by hour by revenue class was derived by allocating the total energy load to each class. Subclasses were not used in the forecasting as Empire has no data by subclass. Tables 4 through 11 contain the data reflected in Figures 3-10.

Figure 3
2007 Winter Peak Day - First Forecast Year
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Table 4
2007 Projected Winter Peak Day Loads (MW)
****Highly Confidential in its Entirety****

Figure 4
2007 Summer Peak Day - First Forecast Year
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Table 5
2007 Projected Summer Peak Day Loads (MW)
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Figure 5
2011 Winter Peak Day - Fifth Forecast Year
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Table 6
2011 Winter Peak Day Loads (MW)
****Highly Confidential in its Entirety****

Figure 6
2011 Summer Peak Day - Fifth Forecast Year
****Highly Confidential in its Entirety****

Table 7
2011 Summer Peak Day Loads (MW)
****Highly Confidential in its Entirety****

Figure 7
2016 Winter Peak Day - Tenth Forecast Year
****Highly Confidential in its Entirety****

Table 8
2016 Winter Peak Day Loads (MW)
****Highly Confidential in its Entirety****

Figure 8
2016 Summer Peak Day - Tenth Forecast Year
****Highly Confidential in its Entirety****

Table 9
2016 Summer Peak Day Loads (MW)
****Highly Confidential in its Entirety****

Figure 9
2026 Winter Peak Day - Twentieth Forecast Year
****Highly Confidential in its Entirety****

Table 10
2026 Winter Peak Day Loads (MW)
****Highly Confidential in its Entirety****

Figure 10
2026 Summer Peak Day - Twentieth Forecast Year
****Highly Confidential in its Entirety****

Table 11
2026 Summer Peak Day Loads (MW)
****Highly Confidential in its Entirety****

2.2 High and Low Analysis

The development of the high and low load forecasts began with an identification of the key driver variables. This included an analysis of customer growth and related economic growth variables. The number of customers over the historical period of 1973 – 2006, a total of 34 years, was examined and categorized. The average growth rate was about 2.0%. The maximum growth rate in any year was 3.8% (during years of heavy growth in the Branson, Missouri area); the minimum growth rate was 0.9%. A set of high and low economic drivers were used. These economic drivers yielded a high load forecast with an average customer growth of about **____** and a low load forecast with an average customer growth of about **____**. This corresponded very closely to the historical customer growth analysis. When the history of actual customer growth is viewed in three 10-year periods, the compound growth rates were 1.7%, 1.8% and 2.5%.

Analysis of 34 years of historical data showed growth rates of less than 1.8% occurred about 38% of the time, growth in the range of 1.9 to 2.2% occurred 50% of the time, and growth was greater than 2.2% about 12% of the time. These probabilities of occurrence were assigned to the low (38%), base (50%) and high (12%) load forecasts.[1] The peak demand forecasts for the low, base, and high load forecasts are shown in Table 12. The peak demands for each of the three forecasts as compared to the actual historical load and the weather-normalized historical load are shown in Figure 11. The data of the historical and weather-normalized peaks are contained in Table 13.

Figure 11

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Annual On-System Peak Data

[1] Empire's 2006 10-K states: "We expect our annual electric customer growth to range from approximately 1.6% to 1.9% over the next several years, although our electric customer growth for the twelve months ended December 31, 2006 was 2.1%. . . The primary drivers of electric sales growth are customer growth and general economic conditions.

Table 12
Peak Demand Forecast Comparison
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Table 13
Historical and Weather-Normalized Peak Loads (MW)

Year	Historical Peak	Weather-Normalized Peak
1980	518	485
1981	506	502
1982	505	511
1983	536	526
1984	524	542
1985	543	563
1986	612	584
1987	610	606
1988	624	625
1989	638	645
1990	668	667
1991	678	684
1992	680	709
1993	739	745
1994	741	790
1995	815	834
1996	842	865
1997	876	891
1998	916	914
1999	979	940
2000	993	962
2001	1,001	985
2002	987	1,004
2003	1,045	1,027
2004	1,014	1,051
2005	1,087	1,080
2006	1,159	1,113

The annual energy forecasts for the low, base, and high load forecasts are shown in Table 14. The annual energy projections for each of the three forecasts as compared to the actual historical energy and the weather-normalized energy are shown in Figure 12. The data for the historical and weather-normalized annual energy are contained in Table 15.

Table 14
Annual Energy Forecast Comparison
****Highly Confidential in its Entirety****

Figure 12
****Highly Confidential in its Entirety****

Annual Net System Input Data

Table 15
Historical and Weather-Normalized Annual Energy (MWh)

Year	Historical Annual Energy	Weather-Normalized Energy
1980	2,392,227	2,263,521
1981	2,300,145	2,346,020
1982	2,334,300	2,388,915
1983	2,450,833	2,464,735
1984	2,497,672	2,546,858
1985	2,614,848	2,650,147
1986	2,576,653	2,751,460
1987	2,727,506	2,861,474
1988	2,883,278	2,957,895
1989	2,936,071	3,057,562
1990	3,029,425	3,163,908
1991	3,208,554	3,251,299
1992	3,151,977	3,373,119
1993	3,552,901	3,554,344
1994	3,720,515	3,778,088
1995	3,937,177	3,994,260
1996	4,204,598	4,146,512
1997	4,250,155	4,275,576
1998	4,471,314	4,391,846
1999	4,473,229	4,519,122
2000	4,794,585	4,627,443
2001	4,800,756	4,745,359
2002	4,917,875	4,836,136
2003	4,950,161	4,952,124
2004	4,972,159	5,071,426
2005	5,293,643	5,213,779
2006	5,328,662	5,379,977

3.0 Load Forecast Methodology Overview

The forecast for Empire's peak demand and energy throughout the planning horizon was developed individually by jurisdiction by rate class with an econometric model. Additionally, a system level peak and net system input (energy) forecast was developed to check and support the multiple rate class forecasts. Eleven years (1996-2006) of historical sales and weather data were used. A description of the software model used in preparing this forecast, *MetrixND*, is provided in Appendix A. The load impacts of implemented demand-side management (DSM) programs are incorporated in the base load forecast, but load impacts of new DSM programs proposed by this IRP are not.

3.1 Historical Data Base

The historical data used for modeling were derived by summing the monthly billing data (energy) by rate class by jurisdiction. The rate classes for which these data are available are shown on Table 16.

Table 16
Rate Classes By Jurisdiction Contained in Historical Data Base

Arkansas	Kansas	Missouri	Oklahoma
RG – Residential	RG – Residential	RG – Residential	RG – Residential
CB – Commercial	CB – Commercial	CB – Commercial	CB – Commercial
GP – General Power	GP – General Power	GP – General Power	GP – General Power
LS – Special Lighting	SH – Small Heating	LP – Large Power	TEB – Total Electric Building
PL – Private Lighting	TEB – Total Electric Building	SH – Small Heating	LS – Special Lighting
SPL – Municipal Street Lighting	PT - Transmission	TEB – Total Electric Building	PL – Private Lighting
PT - Transmission	PL – Private Lighting	LS – Special Lighting	SPL – Municipal Street Lighting
	LS – Special Lighting	PRAX - Praxair	PT - Transmission
	SPL – Municipal Street Lighting	SPL – Municipal Street Lighting	
		PFM – Feed Mill/Grain Elevator	
		PL – Private Lighting	
		MS – Miscellaneous	

3.2 Weather Normalization

Weather normalization is the process of determining what historical electricity usage (consumption) would have been if normal weather conditions had existed. The process involves using a mathematical model to adjust the actual monthly energy usage for a rate class based on statistical analysis and normal weather conditions.

Empire used regression analysis techniques to determine weather-normalized peak demands and energies for its historical load. A regression equation was developed independently for each of net system input (NSI) and annual peaks. The regression

equation for NSI used actual values for annual customer numbers, cooling degree days (CDD), and heating degree days (HDD) as the independent variables. The regression equation for the peak demands used actual values for annual customer numbers and the three-day weighted average temperature of the peak day and the two days prior to the peak day. The weighting assigned 70% to the peak day, 20% to the day before the peak day, and 10% to the day before that. Coefficients were developed for the regression equations that suitably forecast the actual system NSI and peak loads as historically experienced for Empire using actual weather data.

The technique for weather normalization of NSI was to substitute actual HDD and CDD with normal CDD and HDD as reported by the National Oceanographic and Atmospheric Administration (NOAA) at the Springfield, Missouri airport. The technique for weather normalization of the annual peaks was to substitute the average three-day temperature over the peak day and two previous days as determined from the entire 1973-2006 period.

The results for weather-normalized NSI and annual peaks are shown in Figures 13 and 14. The tabular data can be found in Tables 13 and 15.

Figure 13

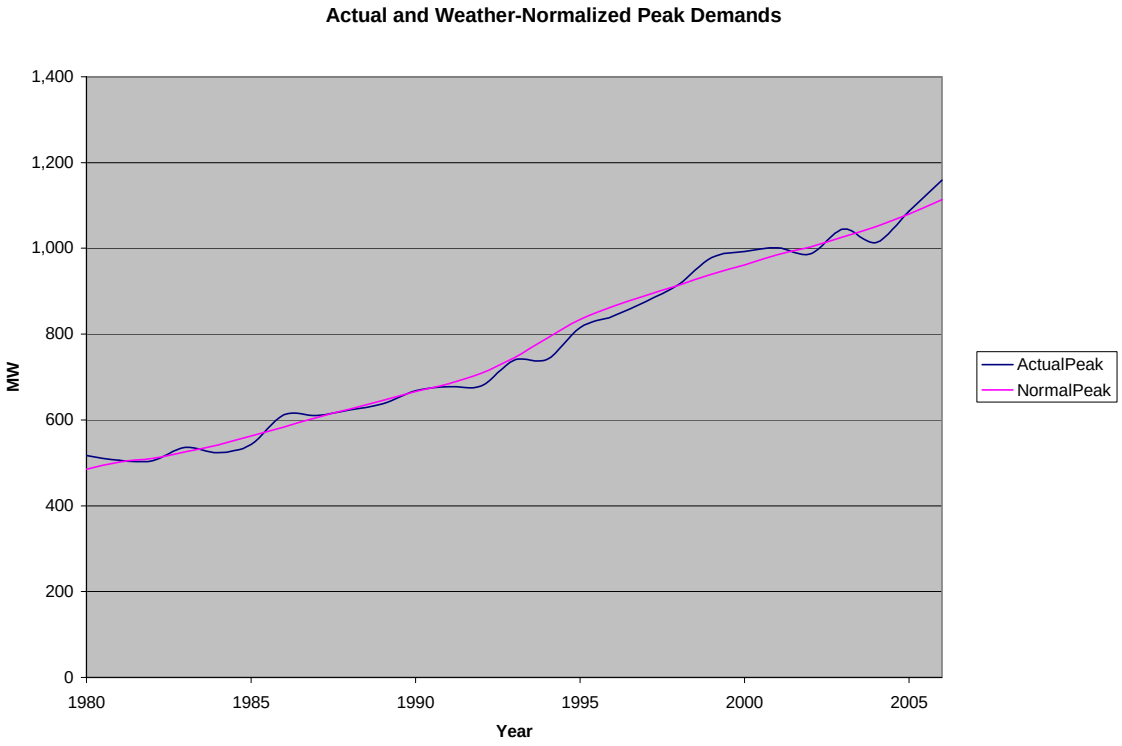
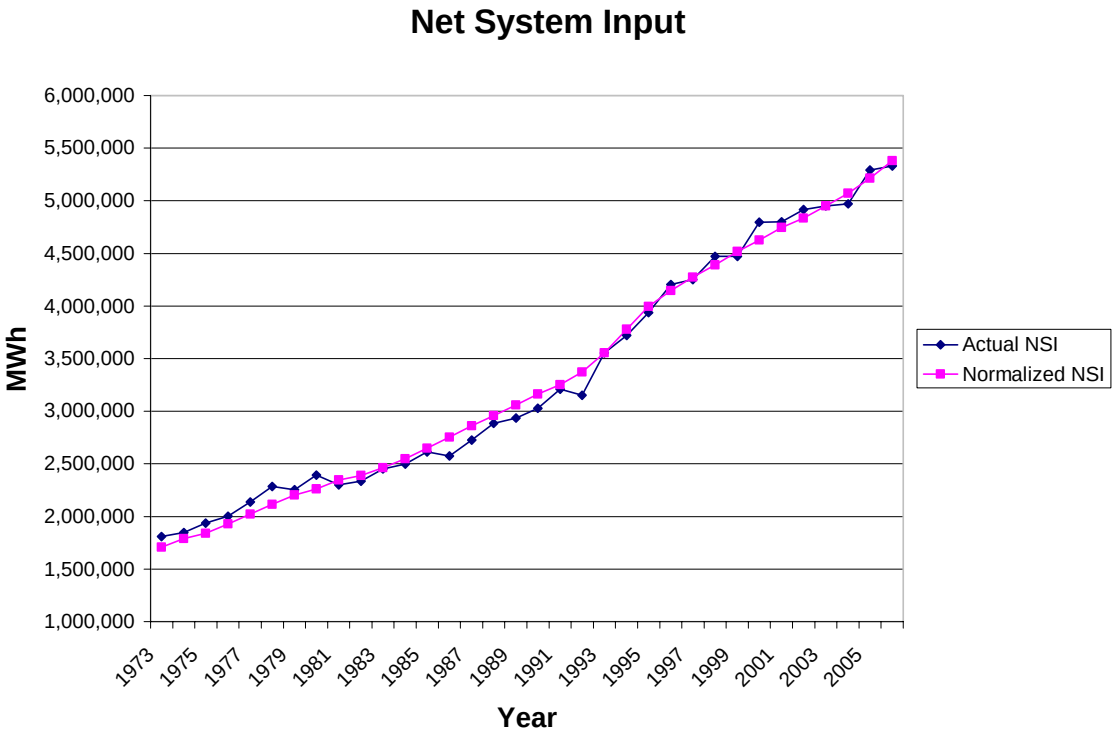


Figure 14



3.3 Forecast Methodology Summary

Empire performed both "bottom up" forecasting (at the rate class level) and "top down" forecasting (net system input level). Consistency checks were performed to ensure that the bottom up methodology was deriving the same magnitude of forecast as the top down. Subclasses were not used as Empire does not have data by subclass.

The pricing plans were forecast individually by jurisdiction using historical sales and weather, monthly binaries, weather splines, and economic variables. System energy, peak demands, customer count, and sales were forecast with linear regression analysis employing the "least squares" method to determine a best fit line through a set of historical observations. The forecasts for a few of the smaller pricing plans used a moving average technique called "exponential smoothing". All of these methods fall into the category of statistical modeling, not end-use modeling. Empire has requested variances from the rule's requirements for end-use modeling.

3.4 Economic Drivers

The pool of economic drivers used in the forecast are: Retail Sales, Population, Gross Regional Product, Employment, Households, Mean Household Income 06, and Wealth. Data for each of these drivers on a county-by-county basis were obtained by Empire from Woods & Poole Economics. Each of the drivers is described in more detail below.

Retail Sales. Data for retail sales are derived from the Census of Retail Trade (U. S. Department of Commerce, Bureau of the Census) and the U. S. Department of Commerce, Bureau of Economic Analysis. These sales are counted on an establishment basis and are classified by kind of business according to the principal lines of commodities sold or the usual trade designation. The specific kinds of businesses include building materials and hardware, general merchandise stores, food stores, automobile dealers, gasoline service stations, apparel and accessories, furniture and home furnishings stores, eating and drinking places, drug stores, and miscellaneous retail sales.

Population. The population numbers are derived from data from the U. S. Department of Commerce, Bureau of the Census including the 2000 Census. Population as of July 1 of a year includes civilian population; military population except personnel stationed overseas; college residents; institutional populations – prison inmates and residents of mental institutions, nursing homes, and hospitals; and estimates of undocumented aliens.

Gross Regional Product (GRP). The gross regional product on a county-by-county basis are derived from historical data for United States total, region and states from the U. S. Department of Commerce, Bureau of Economic Analysis.

Employment. Employment data are a complete measure of the full- and part-time jobs by place of work derived from the U. S. Department of Commerce, Bureau of Economic Analysis data. Employment data include data from establishment surveys, farm and non-farm proprietors, private household employment, and miscellaneous employment.

Households. Households data are derived from the U. S. Department of Commerce, Bureau of the Census. Households are defined as occupied housing units including a house, an apartment, a group of rooms, or a single room occupied as separate living quarters. Group quarters include such living arrangements as prisons, homes for the aged, rooming houses, college dormitories, and military barracks.

Mean Household Income 06. Mean household income is defined as total personal income less estimated income of group quarters population divided by the number of households.

Wealth. Wealth is relative total personal income per capita weighted by the source of income. Sources of income include earned income (80%), dividends/interest/rent (10%), and transfers (10%).

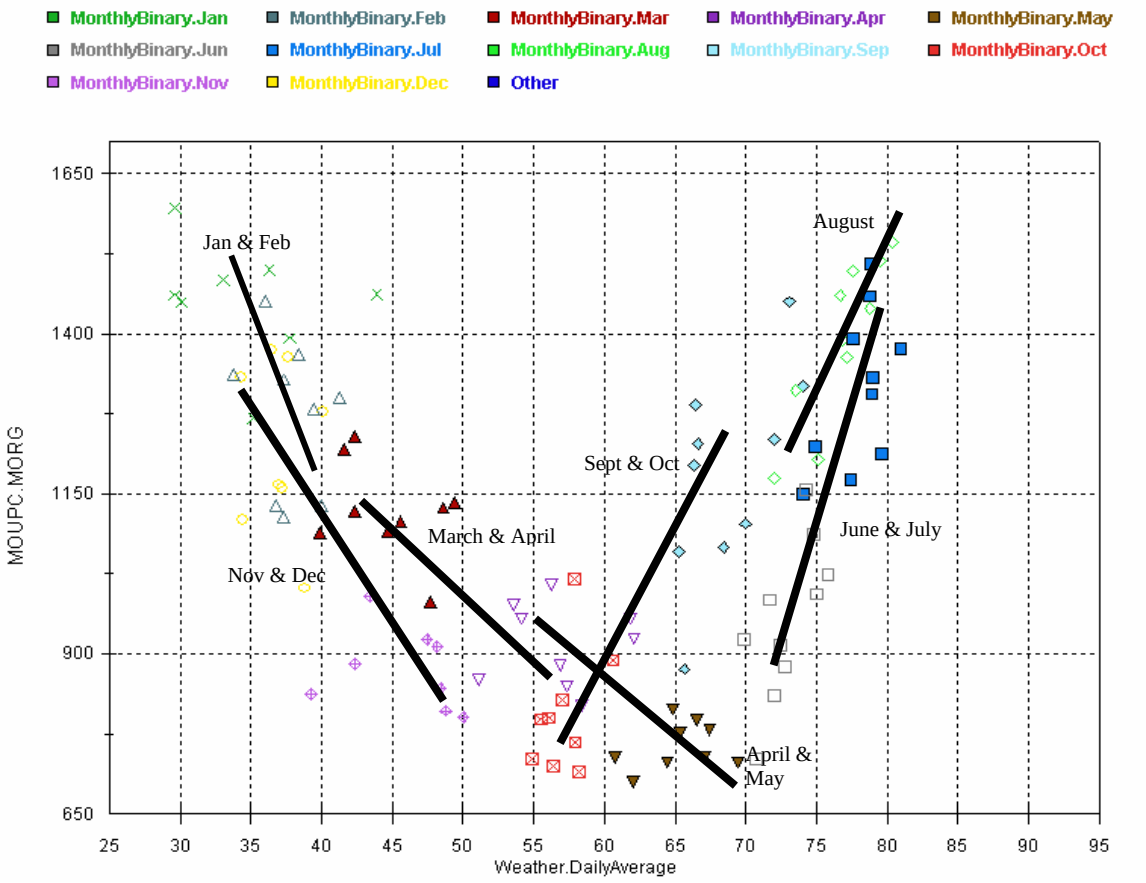
Residential and Commercial Use-Per-Customer (UPC) were forecast with customer count, economic variables, and weather data. Remaining Pricing Plans were forecast using customer growth, economic drivers, and weather.

3.5 Incorporating Weather

The weather splines were created using the Use-Per Customer (UPC) data for Missouri RG from 1996 to present and daily average temperature. The scatter plot shown as

Figure 15 illustrates the relationship of consumption and weather based on the monthly binaries that were created. From this scatter plot, similar months were paired to provide more data points and avoid staccato-like regression binaries. The monthly binaries were then combined to make joint binaries based upon a "best-fit" line from the scatter plot. These joint binaries or splines were then assigned different degree day bases. Summer months were assigned degree days based upon a 70°F base. This base was predicated upon the scatter plot illustration of consumption response to temperature. The winter months were assigned degree days based upon a 50°F base. The shoulder months used the standard 65°F base. The weather splines provided the flexibility for the regression equations to react to weather more accurately.

Figure 15
Weather Splines



3.6 Mapping of Rate Classes to Revenue Classes

An understanding of how the rate classes map to Empire's revenue classes is important in developing the load forecast. This mapping is provided in Table 17. Residential is almost entirely comprised (99.62%) of RG – Residential, RG – Residential Water Heater, and RH – Residential Total Electric. The most significant categories for Commercial include GP – General Power, TEB – Total Electric Building, CB – Commercial, LP – Large Power, and SH – Small Heating which all together comprise 99.20% of the

revenue class. The industrial class is primarily comprised of CB – Commercial, GP – General Power, LP – Large Power, and PFM – Feed Mill/Grain Elevators which together total 99.58% of this revenue class.

Table 17
Rate Class Mapped to Revenue Class by Jurisdiction

	Arkansas	Kansas	Missouri	Oklahoma
Residential	RG – Residential RG – Residential Water Heater RH – Residential Total Electric PL – Private Lighting	RG – Residential RG – Residential Water Heating RH – Residential Total Electric PL – Private Lighting	MS – Miscellaneous PL – Private Lighting RG – Residential RG – Residential Water Heating RH – Residential Total Electric SH – Small Heating	RG – Residential RG – Residential Water Heater RH – Residential Total Electric PL – Private Lighting
Commercial	CB – Commercial GP – General Power LS – Special Lighting PL – Private Lighting RG - Residential	CB – Commercial GP – General Power LS – Special Lighting PL – Private Lighting RG – Residential SH – Small Heating TEB – Total Electric Building	CB – Commercial GP – General Power LS – Special Lighting PL – Private Lighting RG – Residential SH – Small Heating TEB – Total Electric Building LP – Large Power MS – Miscellaneous	CB – Commercial GP – General Power LS – Special Lighting PL – Private Lighting RG - Residential TEB – Total Electric Building
Other Industrial	CB – Commercial GP – General Power PL – Private Lighting PT - Transmission	CB – Commercial GP – General Power LS – Special Lighting PT – Transmission SH – Small Heating TEB – Total Electric Building	LP – Large Power PFM – Feed Mill/Grain Elevator CB – Commercial GP – General Power PT – Transmission TEB – Total Electric Building	CB – Commercial GP – General Power PL – Private Lighting PT – Transmission TEB – Total Electric Building
Other Retail	CB – Commercial LS – Special Lighting PL – Private Lighting SPL – Municipal Street Lighting GP – General Power RG – Residential Water Heating	CB – Commercial LS – Special Lighting PL – Private Lighting SPL – Municipal Street Lighting GP – General Power SH – Small Heating TEB – Total Electric Building	SC – Praxair Transmission Oil Pipe GP – General Power Oil Pipe LP – Large Power CB – Commercial GP – General Power LS – Special Lighting MS - Miscellaneous PL – Private Lighting RG – Residential Water Heating SPL – Municipal Street Lighting SH – Small Heating TEB – Total Electric Bldg	Oil Pipe GP – General Power CB – Commercial LS – Special Lighting PL – Private Lighting SPL – Municipal Street Lighting TEB – Total Electric Building GP – General Power
On-System Wholesale		Chetopa	Monett Mount Vernon Lockwood	

4.0 Residential

The residential forecast reflects an average annual energy growth rate of approximately **____** from 2007 to 2026 as shown in Table 18 and displayed on Figure 16.

Table 18
Residential Revenue Class Forecast
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Figure 16
****Highly Confidential in its Entirety****

Residential

A comparison of the peak demands projected for the residential class in each of the low, base and high forecasts is provided on Figure 17.

Figure 17
Highly Confidential in its Entirety*

Residential Demand

The forecast for the residential class is based on econometric modeling for each rate class. The first step in determining the residential forecast was mapping of rate classes to the residential revenue class. This mapping is shown by jurisdiction in Table 19.

Table 19
Residential Rate Class Mapping

Arkansas	Kansas	Missouri	Oklahoma
RG – Residential RG – Residential Water Heater RH – Residential Total Electric PL – Private Lighting	RG – Residential RG – Residential Water Heating RH – Residential Total Electric PL – Private Lighting	MS – Miscellaneous PL – Private Lighting RG – Residential RG – Residential Water Heating RH – Residential Total Electric SH – Small Heating	RG – Residential RG – Residential Water Heater RH – Residential Total Electric PL – Private Lighting

For the total company, the residential rate class has the components shown in Table 20.

Table 20
Components of Residential Rate Class

Rate Class	% of Residential Rate Class
RG – Residential	96.07
RH – Residential Total Electric	2.60
RG – Residential Water Heating	0.95
PL – Private Lighting	0.37
SH – Small Heating	0
MS – Miscellaneous	0

A separate statistical model within *MetrixND* was developed for each rate class for each jurisdiction using the economic drivers described previously in conjunction with weather information.[2] For some rate classes, a projected customer count was forecast as well as a projected use per customer. The two (customer count and use per customer) were then multiplied together to get the resulting energy forecast for the rate class. An example regression equation, use per customer in the RG rate class in Missouri, is shown in Table 21. Driver variables included heating and cooling degree days and households. This particular regression had an R^2 of 0.915 and a Mean Absolute Percentage of Error (MAPE) of 5.17%.

[2] All of the residential rates, RG and RH, were combined for purposes of regression analysis and forecasting.

Table 21
Regression Analysis Results for Missouri RG – Use per Customer

Variable	Coefficient	StdErr	T-Stat
CONST	-110.941	218.344	-0.508
MonthlyBinary.Jan	49.269	54.443	0.905
MonthlyBinary.Feb	-115.299	58.656	-1.966
MonthlyBinary.Mar	-94.173	54.001	-1.744
MonthlyBinary.Apr	-104.428	82.984	-1.258
MonthlyBinary.May	-67.994	105.926	-0.642
MonthlyBinary.Jun	89.580	126.775	0.707
MonthlyBinary.Jul	266.001	147.184	1.807
MonthlyBinary.Aug	291.321	158.116	1.842
MonthlyBinary.Sep	292.943	147.291	1.989
MonthlyBinary.Oct	56.425	106.528	0.530
MonthlyBinary.Nov	-45.784	64.045	-0.715
MonthlyBinary.Dec	0.000	0.000	0.000
MonthlyWeather.HDegreeDays	0.426	0.120	3.542
MonthlyWeather.HDegreeDaysLag1	0.592	0.104	5.671
MonthlyWeather.CDegreedays	0.973	0.192	5.070
MonthlyWeather.CDegreeDaysLag1	0.489	0.202	2.426
MOEconomics.Households	13.315	3.037	4.385

The validity of the regression equation developed for the RG rate class is demonstrated in Figure 18. The actual sales values are compared to the sales predicted by the regression equation in the *MetrixND* software product. Regression analysis was then used to develop the forecast of the number of customers reflected in Figure 19, the use per customer as shown in Figure 20, and the forecast for the RG class as shown in Figure 21. (Note: gaps occur in Figures 19, 20 and 21 due to data issues when Empire converted billing systems.)

Figure 18

Historical RG Actual vs RG MetrixND Predicted

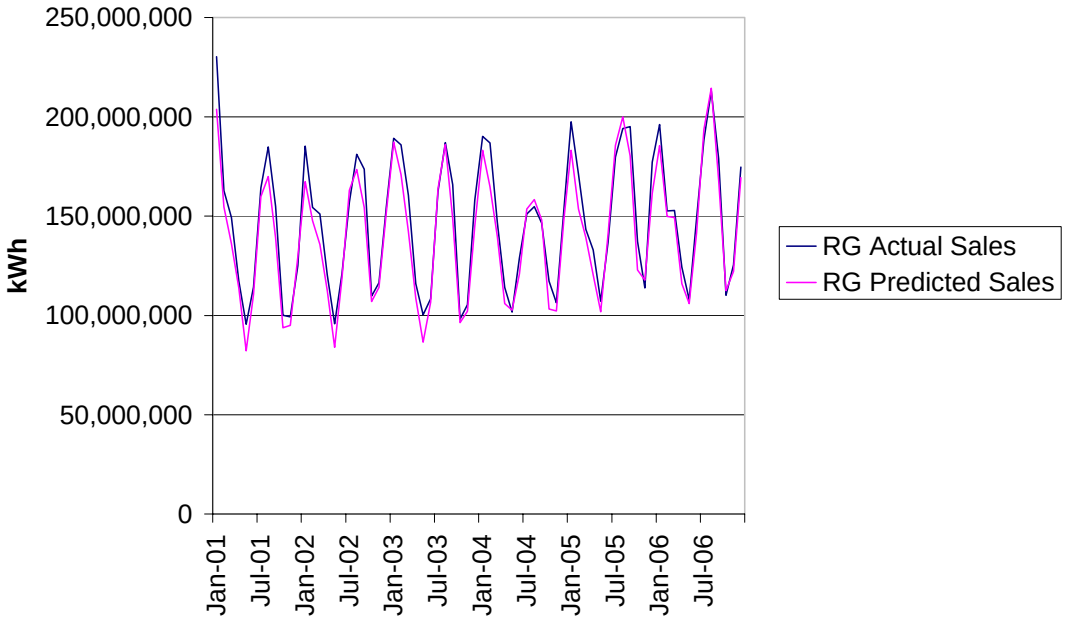


Figure 19
****Highly Confidential in its Entirety****

Actual RG Customers and Forecasted Customers

Figure 20
****Highly Confidential in its Entirety****

RG UPC Actual and Forecast

Figure 21
****Highly Confidential in its Entirety****

RG Actual with Forecast

The driver variables for each rate class by jurisdiction which were factored into the development of the residential rates is shown in Table 22. Econometric modeling was used for each rate class in each jurisdiction.

Table 22
Driver Variables in the Residential Rate Classes

Arkansas	Kansas	Missouri	Oklahoma
RG (Use Per Customer) – Heating (HDD) and Cooling Degree Days (CDD), GRP RG (Customer Count) - Population	RG (Use Per Customer) – HDD and CDD, GRP RG (Customer Count) - Employment	RG (Use Per Customer) – HDD and CDD, Households RG (Customer Count) – Retail Sales	RG (Use Per Customer) – HDD and CDD, Households RG (Customer Count) – Personal Income, Population
PL – Population	PL – GRP	MS (Customer Count) – Retail Sales	PL – Retail Sales
		PL – HDD and CDD, Retail Sales	
		SH (Use Per Customer) – Customer Count, HDD and CDD SH (Customer Count) – GRP, Population, Mean Household Income, Retail Sales, Weather, Wages and Salaries, Personal Income, Income Cap, Earnings	

5.0 Commercial

The commercial forecast reflects an average annual energy growth rate of approximately **____** from 2007 to 2026 as shown in Table 23 and Figure 22.

Table 23
****Highly Confidential it its Entirety****
Commercial Revenue Class Forecast

Figure 22
****Highly Confidential in its Entirety****

Commercial

A comparison of the peak demands projected for the commercial class in each of the low, base and high forecasts is provided on Figure 23.

Figure 23
****Highly Confidential in its Entirety****

Commercial Demand

The forecast for the commercial class is based on econometric modeling for each rate class. The first step in determining the commercial forecast was mapping of rate classes to the commercial revenue class. This mapping is shown by jurisdiction in Table 24.

Table 24
Commercial Rate Class Mapping

Arkansas	Kansas	Missouri	Oklahoma
CB – Commercial GP – General Power LS – Special Lighting PL – Private Lighting RG - Residential	CB – Commercial GP – General Power LS – Special Lighting PL – Private Lighting RG – Residential SH – Small Heating TEB – Total Electric Building	CB – Commercial GP – General Power LS – Special Lighting PL – Private Lighting RG – Residential SH – Small Heating TEB – Total Electric Building CP – Cogeneration LP – Large Power MS - Miscellaneous	CB – Commercial GP – General Power LS – Special Lighting PL – Private Lighting RG - Residential TEB – Total Electric Building

For the total company, the commercial rate class has the components shown in Table 25.

Table 25
Components of Commercial Rate Class

Rate Class	% of Commercial Rate Class
GP – General Power	38.69
TEB – Total Electric Building	23.01
CB – Commercial	22.96
LP – Large Power	8.17
SH – Small Heating	6.37
PL – Private Lighting	0.77
LS – Special Lighting	0.03
RG – Residential	0.01
MS – Miscellaneous	0.01

A separate statistical model within *MetrixND* was developed for each rate class for each jurisdiction using the economic drivers described previously in conjunction with weather information. For some rate classes, a projected customer count was forecast as well as a projected use per customer. The two (customer count and use per customer) were then multiplied together to get the resulting energy forecast for the rate class. An example regression equation, use per customer in the CB rate class in Missouri, is shown in Table 26. Driver variables included heating and cooling degree days and mean household income. This particular regression had an R^2 of 0.578 and a Mean Absolute Percentage of Error (MAPE) of 8.38%.

Table 26
Regression Analysis Results for Missouri CB – Use per Customer

Variable	Coefficient	StdErr	T-Stat
CONST	856.948	955.028	0.897
MonthlyWeather.HDegreeDays	0.217	0.476	0.457
MonthlyWeather.HDegreeDaysLag1	0.269	0.464	0.581
MonthlyWeather.CDegreedays	0.542	0.661	0.820
MonthlyWeather.CDegreeDaysLag1	1.366	0.667	2.049
MonthlyBinary.Jan	-56.921	202.491	-0.281
MonthlyBinary.Feb	-103.906	225.112	-0.462
MonthlyBinary.Mar	-120.161	231.269	-0.520
MonthlyBinary.Apr	-76.118	343.057	-0.222
MonthlyBinary.May	-31.510	429.043	-0.073
MonthlyBinary.Jun	156.355	514.209	0.304
MonthlyBinary.Jul	-162.204	587.928	-0.276
MonthlyBinary.Aug	32.081	622.823	0.052
MonthlyBinary.Sep	-148.291	585.235	-0.253
MonthlyBinary.Oct	-92.140	434.316	-0.212
MonthlyBinary.Nov	-98.406	256.895	-0.383
MonthlyBinary.Dec	0.000	0.000	0.000
MOEconomics.Meanhouseholdincome06	0.003	0.006	0.509

The regression analysis results for the projections of the number of customers, use per customer, and the total CB energy sales are shown in Figures 24, 25 and 26. (Note: gaps occur in Figures 24, 25, and 26 due to data issues when Empire converted billing systems.)

Figure 24
****Highly Confidential in its Entirety****

Actual CB Customers and Forecasted Customers

Figure 25
****Highly Confidential in its Entirety****

CB UPC Actual and Forecast

Figure 26
****Highly Confidential in its Entirety****

CB Actual with Forecast

The driver variables for each rate class by jurisdiction which was factored into the development of the commercial rates is shown in Table 27. Econometric modeling was used for each rate class in each jurisdiction.

Table 27
Driver Variables in the Commercial Rate Classes

Arkansas	Kansas	Missouri	Oklahoma
CB (Use Per Customer) – HDD, CDD, Households CB (Customer Count) – Retail Sales	CB (Use Per Customer) – HDD, CDD, Employment CB (Customer Count) - GRP	CB (Use Per Customer) – HDD, CDD, Mean Household Income CB (Customer Count) – Retail Sales	CB (Use Per Customer) – HDD, CDD, Employment CB (Customer Count) – Retail Sales
GP – Exponential Smoothing	GP – HDD, CDD, Employment, Wealth	GP – HDD, CDD, GRP	GP – Exponential Smoothing
LS – Population	LS - none	LS – Customer Count	LS – none
PL – Population	PL – GRP	PL – HDD, CDD, Retail Sales	PL – Retail Sales
RG (Use Per Customer) – HDD, CDD, GRP RG (Customer Count) - Population	RG (Use Per Customer) – HDD, CDD, GRP RG (Customer Count) - Employment	RG (Use Per Customer) – HDD, CDD, Households RG (Customer Count) – Retail Sales	RG (Use Per Customer) – HDD, CDD, Households RG (Customer Count) – Personal Income, Population
	SH (Use Per Customer) – HDD, CDD SH (Customer Count) - Population	SH (Use Per Customer) – HDD, CDD, Customer Count SH (Customer Count) – GRP, Population, Mean Household Income, Retail Sales, Weather Index, Wages & Salaries, Personal Income, Income Cap, Earnings	TEB – HDD, CDD, Weather
	TEB – HDD, CDD, Employment	TEB – Customer Count, Retail Sales	
		LP – Population, HDD, CDD LP (Customer Count) – HDD, CDD	
		MS – Customer Count MS (Customer Count) – Retail Sales	

6.0 Industrial

The industrial forecast reflects an average annual energy growth rate of approximately **____** from 2007 to 2026 as shown in Table 28 and Figure 27.

Table 28
****Highly Confidential in its Entirety****
Industrial Revenue Class Forecast

Figure 27
****Highly Confidential in its Entirety****

Industrial

A comparison of the peak demands projected for the industrial class in each of the low, base and high forecasts is provided on Figure 28
.

Figure 28
****Highly Confidential in its Entirety****

Industrial Demand

The forecast for the industrial class is based on econometric modeling for each rate class. The first step in determining the industrial forecast was mapping of rate classes to the industrial revenue class. This mapping is shown by jurisdiction in Table 29.

Table 29
Industrial Rate Class Mapping

Arkansas	Kansas	Missouri	Oklahoma
CB – Commercial GP – General Power PL – Private Lighting PT - Transmission	CB – Commercial GP – General Power LS – Special Lighting PT – Transmission SH – Small Heating TEB – Total Electric Building	LP – Large Power PFM – Feed Mill/Grain Elevator CB – Commercial GP – General Power PT – Transmission TEB – Total Electric Building	CB – Commercial GP – General Power PL – Private Lighting PT – Transmission TEB – Total Electric Building

For the total company, the industrial rate class has the components shown in Table 30.

Table 30
Components of Industrial Rate Class

Rate Class	% of Commercial Rate Class
CB – Commercial	57.62
GP – General Power	25.60
LP – Large Power	15.21
PFM – Feed Mill/GrainElevator	1.15
PL – Private Lighting	0.25
PT – Transmission	0.06
SH – Small Heating	0.06
TEB – Total Electric Building	0.06

A separate statistical model within *MetrixND* was developed for each rate class for each jurisdiction using the economic drivers described previously in conjunction with weather information. For some rate classes, a projected customer count was forecast as well as a projected use per customer. The two (customer count and use per customer) were then multiplied together to get the resulting energy forecast for the rate class. An example regression equation, customer count for the GP rate class in Missouri, is shown in Table 31. Driver variables included heating and cooling degree days and mean household income. This particular regression had an R^2 of 0.984 and a Mean Absolute Percentage of Error (MAPE) of 1.16%.

Table 31
Regression Analysis Results for Missouri GP – Customer Count

Variable	Coefficient	StdErr	T-Stat
CONST	-18979.228	2477.628	-7.660
MonthlyBinary.Jan	-3.213	12.101	-0.265
MonthlyBinary.Feb	-2.631	12.084	-0.218
MonthlyBinary.Mar	-6.141	12.069	-0.509
MonthlyBinary.Apr	-8.378	12.056	-0.695
MonthlyBinary.May	-13.796	12.044	-1.145
MonthlyBinary.Jun	-9.851	12.034	-0.819
MonthlyBinary.Jul	-6.725	12.025	-0.559
MonthlyBinary.Aug	-2.598	12.018	-0.216
MonthlyBinary.Sep	-6.380	12.012	-0.531
MonthlyBinary.Oct	-6.617	12.008	-0.551
MonthlyBinary.Nov	29.782	12.006	2.481
MonthlyBinary.Dec	0.000	0.000	0.000
Mo_Econ_Table.Mo_Pop	4.430	6.461	0.686
Mo_Econ_Table.Mo_WealthIndex	4.010	2.934	1.367
Mo_Econ_Table.Mo_Wages_N_Salaries	-2.645	0.422	-6.265
Mo_Econ_Table.Mo_Personal_Income	0.322	0.157	2.042
Mo_Econ_Table.Income_Cap_2006	-0.085	0.030	-2.790
Mo_Econ_Table.Mo_Earnings	1.154	0.150	7.671
Mo_Econ_Table.Mo_MeanHouseIncome06	0.033	0.012	2.820
Mo_Econ_Table.Mo_GRP	-0.306	0.203	-1.509
Mo_Econ_Table.Mo_Employment	56.595	6.815	8.304
Mo_Econ_Table.Mo_Total_Retail_Sales	-0.174	0.100	-1.736
Mo_Econ_Table.Mo_County_Weights	0.000	0.000	0.000

The driver variables for each rate class by jurisdiction which was factored into the development of the industrial rates are shown in Table 32. The regression analysis results for the projections of the number of customers and use per customer are shown in Figures 29 and 30.

Figure 29
****Highly Confidential in its Entirety****
GP UPC Actual and Forecast

Figure 30
****Highly Confidential in its Entirety****
GP Customer Count – Actual and Forecast

Table 32
Driver Variables in the Industrial Rate Classes

Arkansas	Kansas	Missouri	Oklahoma
CB (Use Per Customer) – HDD, CDD, Households CB (Customer Count) – Retail Sales	CB (Use Per Customer) – HDD, CDD, Employment CB (Customer Count) - GRP	LP – Population, HDD, CDD LP (Customer Count) – HDD, CDD	CB (Use Per Customer) – HDD, CDD, Employment CB (Customer Count) – Retail Sales
GP – Exponential Smoothing	GP – HDD, CDD, Employment, Wealth	PFM – HDD, CDD	GP – Exponential Smoothing
PL – Population	LS - none	CB (Use Per Customer) – HDD, CDD, Mean Household Income CB (Customer Count) – Retail Sales	PL – Retail Sales
PT – HDD, CDD, Population, GRP	PT – HDD, CDD, GRP	GP – HDD, CDD, GRP	PT –Exponential Smoothing
	SH (Use Per Customer) – HDD, CDD SH (Customer Count) - Population	PT – HDD, CDD, Population	TEB – HDD, CDD, Weather
	TEB – HDD, CDD, Employment	TEB – Customer Count, Retail Sales	

7.0 Other

The other category in Empire's load forecast includes Street and Highway Lighting, Public Authority, and Interdepartmental. These revenue classes are comprised of portions of the rate classes shown in Table 33.

Table 33
Rate Classes for Other Categories

Street & Highway Lighting	Public Authority	Interdepartmental
SPL – Municipal Street Lighting	GP – General Power	GP – General Power
CB – Commercial	CB – Commercial	CB – Commercial
MS – Miscellaneous	TEB – Total Electric Building	PL – Private Lighting
LS – Special Lighting	SH – Small Heating	
GP – General Power	LS – Special Lighting	
PL – Private Lighting	RG – Residential	
RG - Residential	PL – Private Lighting	

The forecast for these revenue classes is shown on Table 34.

Table 34
****Highly Confidential in its Entirety****
Energy Forecasts for Other Categories (MWh)

8.0 On-System Wholesale

The on-system wholesale class consists of the cities of Monett, Missouri; Mount Vernon, Missouri; Chetopa, Kansas; and Lockwood, Missouri. The sum of the loads for these cities is shown in Table 35.

Table 35
****Highly Confidential in its Entirety****
On-System Wholesale Load Forecast

A separate statistical model was developed for each city using the economic drivers described previously in conjunction with weather information. An example regression equation, for Monett, is shown in Table 36. Driver variables included heating and cooling degree days and retail sales. This particular regression had an R^2 of 0.788 and a MAPE of 4.78.

Table 36
Regression Analysis Results for Monett, Missouri

Variable	Coefficient	StdErr	T-Stat
CONST	13658422.742	1069648.697	12.769
MonthlyBinary.Jan	476883.118	392363.354	1.215
MonthlyBinary.Feb	-1412355.146	415465.892	-3.399
MonthlyBinary.Mar	-488884.615	480893.429	-1.017
MonthlyBinary.Apr	-1396107.507	718145.884	-1.944
MonthlyBinary.May	-1147965.786	884048.435	-1.299
MonthlyBinary.Jun	-2118519.028	1028567.027	-2.060
MonthlyBinary.Jul	-2269601.512	1172086.749	-1.936
MonthlyBinary.Aug	-2087248.299	1156029.697	-1.806
MonthlyBinary.Sep	-1789513.381	948172.054	-1.887
MonthlyBinary.Oct	-799735.232	758441.219	-1.054
MonthlyBinary.Nov	-1167994.240	498013.526	-2.345
MonthlyBinary.Dec	0.000	0.000	0.000
MonthlyWeather.HDegreeDays	503.265	1008.654	0.499
MonthlyWeather.CDegreedays	15754.712	1816.578	8.673
MOEconomics.RetailSales	2047.109	349.857	5.851

The driver variables for on-system wholesale customer are shown in Table 37.

Table 37
Driver Variables for On-System Wholesale Customers

On-System Wholesale Customer	Driver Variables
Chetopa, Kansas	HDD, CDD, Personal Income
Monett, Missouri	HDD, CDD, Retail Sales
Mount Vernon, Missouri	HDD, CDD, Employment
Lockwood, Missouri	HDD, CDD, Number of Households

Abbreviations

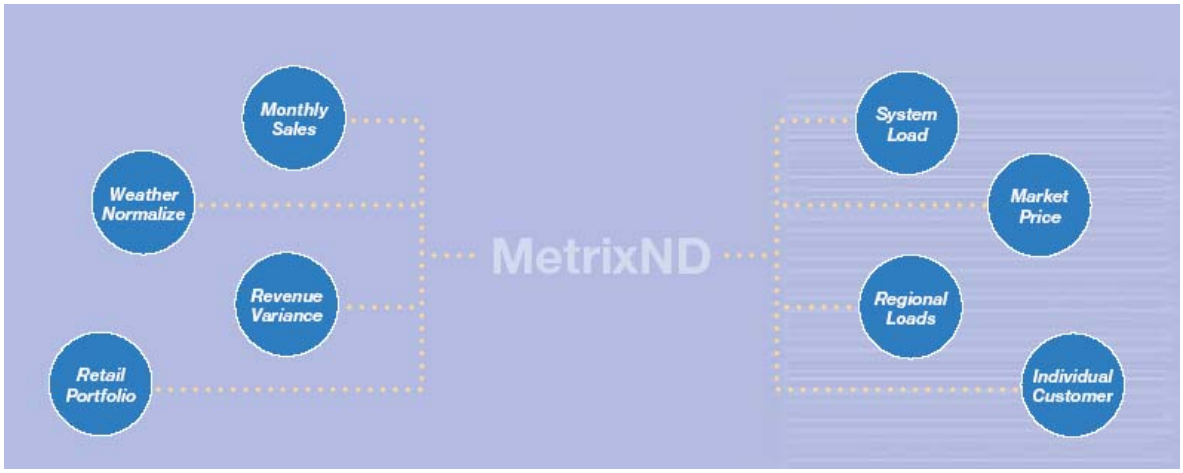
CB – Commercial rate class
CDD – Cooling degree days
CP – Cogeneration rate class
DSM – Demand-side management
GP – General power rate class
GRP – Gross Regional Product
HDD – Heating degree days
IRP – Integrated Resource Plan
KCP&L – Kansas City Power & Light
kV – kilovolt
kW – kilowatt
kWh – kilowatthour
LP – Large power rate class
LS – Special Lighting rate class
MAD – Mean Absolute Deviation
MAPE – Mean Absolute Percentage of Error
MPSC – Missouri Public Service Commission
MS – Miscellaneous rate class
MW – Megawatt
MWh – Megawatthour
NOAA – National Oceanographic and Atmospheric Administration
NSI – Net System Input
PFM – Feed mills and grain elevators rate class
PL – Private lighting rate class
PT- Transmission rate class
RG – Residential rate class
RH – Residential rate class
SH – Small heating rate class
SPL – Municipal street lighting rate class
TEB – Total electric building rate class
UPC – Use per customer

Appendix A

MetrixND

MetrixND, a product of Itron, is an energy forecasting tool designed to take advantage of advanced Microsoft Windows® capabilities. The model is equipped with an intuitive user interface and drag-and-drop architecture that streamlines the development of forecasting variables and models. The model's forecasting techniques include neural networks, multivariate regression, ARIMA and exponential smoothing.

Figure A-1
MetrixND



MetrixND facilitates the ability of utility personnel to:

- Use existing sources of meter and other data for more accurate forecasts. *MetrixND* works with Excel® spreadsheets and a variety of databases, including Microsoft Access®, SQL Server®, ORACLE®, MV-90, and MV-Star.
- Model all data frequencies: sub-hourly, hourly, daily, weekly, monthly, quarterly and annual data.
- Display all aspects of the forecasts with effective, easy-to-produce graphics.
- Create analysis variables on the fly using spreadsheet-like formulas to try different things instead of having to learn a programming language.
- Model hourly loads and calibrate automatically to forecasts of daily energy and peak demand.
- Compare alternative model specifications by selecting from competing models quickly and efficiently.
- Improve their understanding of historical outcomes by dragging and dropping alternative forecast drivers into their models to view the impact on their forecast.
- Improve their forecast by including a time series model of the residuals.
- Customize forecasting models by writing powerful macros using Microsoft Visual Basic® for Applications

MetrixND is a flexible modeling tool, widely used by the top energy forecasters at leading utilities and energy providers throughout the world. *MetrixND* puts the power of the most advanced modeling techniques at one's fingertips, enabling the development of accurate forecasts and their application to business decisions with confidence. These techniques, which can be used independently or in combination, include:

Exponential Smoothing
Ideal for projecting customer growth trends that support monthly sales and peak forecasting applications.

ARIMA
For seasoned time series professionals who want to visualize how historical data patterns extend into the future.

Regression
The workhorse of the energy forecasting professional the fastest way to build multi-variate models.

Neural Networks
Essential for short-term forecasting where modeling the nonlinear response between loads and weather matters the most.

Appendix B. Additional Figures

Figure B-1
****Highly Confidential in its Entirety****

Annual Summer NSI

Figure B-2
****Highly Confidential in its Entirety****

Annual Non-Summer NSI

Figure B-3
****Highly Confidential in its Entirety****

Annual Winter Peaks

Figure B-4
****Highly Confidential in its Entirety****

Residential June-September

Figure B-5
****Highly Confidential in its Entirety****

Commercial June-September

Figure B-6
****Highly Confidential in its Entirety****

Industrial June-September

Figure B-7
****Highly Confidential in its Entirety****

Residential Non-Summer

Figure B-8
****Highly Confidential in its Entirety****

Commercial Non-Summer

Figure B-9
****Highly Confidential in its Entirety****

Industrial Non-Summer

Appendix C – Supporting Data

Table C-1 Residential Peak Demands (MW)
** Highly Confidential in its Entirety**
Base Forecast

Low Forecast

High Forecast

Table C-2. RG - Historical versus MetrixND Predicted

Year	Month	RG Actual (kWh)	MetrixND Predicted (kWh)
2001	1	230,343,324	203,770,951
2001	2	162,875,415	154,671,286
2001	3	149,346,756	136,023,521
2001	4	117,474,061	113,827,473
2001	5	95,645,552	82,251,935
2001	6	114,194,280	110,486,881
2001	7	164,246,190	159,860,064
2001	8	184,841,111	170,042,621
2001	9	155,092,473	139,068,496
2001	10	100,039,876	93,852,269
2001	11	99,319,396	95,038,947
2001	12	125,134,263	129,714,810
2002	1	185,210,844	167,473,399
2002	2	154,381,492	147,725,625
2002	3	151,016,775	135,735,007
2002	4	120,395,019	112,437,477
2002	5	95,779,099	84,078,571
2002	6	121,205,409	118,821,774
2002	7	156,880,727	163,025,899
2002	8	181,128,548	173,580,801
2002	9	173,622,491	154,407,082
2002	10	109,814,109	106,976,767
2002	11	116,373,074	114,158,087
2002	12	154,666,278	151,864,855
2003	1	189,134,499	187,302,705
2003	2	185,815,441	170,851,311
2003	3	160,462,781	142,181,911
2003	4	115,974,166	108,699,735
2003	5	100,248,612	86,464,173
2003	6	108,465,038	106,625,875
2003	7	162,543,253	163,934,367
2003	8	186,983,530	186,012,736
2003	9	165,814,103	148,682,525
2003	10	98,123,548	96,467,372
2003	11	105,362,379	102,131,648
2003	12	158,135,487	145,192,539
2004	1	190,127,311	183,195,639
2004	2	186,770,784	164,913,064
2004	3	146,777,750	139,599,046
2004	4	114,040,677	105,992,816
2004	5	101,774,656	102,722,509
2004	6	129,060,381	120,892,149
2004	7	151,125,782	153,575,938
2004	8	154,884,099	158,331,810
2004	9	146,595,934	148,091,953
2004	10	117,239,803	103,292,050
2004	11	106,396,013	102,358,655
2004	12	152,401,666	147,727,267
2005	1	197,446,380	183,210,707
2005	2	171,060,078	153,665,755
2005	3	143,315,831	139,180,253
2005	4	133,023,052	120,280,000
2005	5	107,276,486	101,948,674
2005	6	136,974,024	141,030,917
2005	7	179,757,496	185,775,217
2005	8	194,104,927	199,949,059
2005	9	195,159,714	180,445,003
2005	10	137,364,378	122,951,252
2005	11	113,880,382	117,789,764
2005	12	177,249,663	161,524,176
2006	1	196,021,489	185,506,916
2006	2	152,560,472	149,974,983
2006	3	152,763,823	149,377,461
2006	4	124,331,057	115,970,342
2006	5	107,980,081	106,017,733
2006	6	148,611,079	141,473,568
2006	7	188,345,648	193,817,288
2006	8	213,080,819	214,403,670
2006	9	179,029,177	168,234,688
2006	10	110,224,959	112,576,088
2006	11	125,406,476	122,123,993
2006	12	174,758,411	169,339,975

Table C-3. Actual and Forecast RG Customers

Year	Month	Actual	Year	Month	Actual /Forecast	Year	Month	Forecast	Year	Month	Forecast	Year	Month	Forecast	Year	Month	Forecast
1996	1	113,871	2002	1	126,718												
1996	2	114,145	2002	2	126,970												
1996	3	114,330	2002	3	126,858												
1996	4	114,362	2002	4	126,700												
1996	5	114,370	2002	5	126,742												
1996	6	114,421	2002	6	126,894												
1996	7	114,674	2002	7	127,158												
1996	8	114,988	2002	8	127,426												
1996	9	115,122	2002	9	127,433												
1996	10	115,375	2002	10	127,906												
1996	11	115,749	2002	11	128,411												
1996	12	116,189	2002	12	128,770												
1997	1	116,395	2003	1	129,042												
1997	2	116,490	2003	2	129,083												
1997	3	116,436	2003	3	128,985												
1997	4	116,417	2003	4	129,079												
1997	5	116,517	2003	5	128,934												
1997	6	116,737	2003	6	129,055												
1997	7	116,946	2003	7	129,202												
1997	8	117,090	2003	8	129,698												
1997	9	117,199	2003	9	129,812												
1997	10	117,406	2003	10	129,965												
1997	11	117,737	2003	11	130,653												
1997	12	118,055	2003	12	131,070												
1998	1	118,162	2004	1	131,271												
1998	2	118,235	2004	2	131,396												
1998	3	118,482	2004	3	131,296												
1998	4	118,419	2004	4	131,226												
1998	5	118,547	2004	5	131,343												
1998	6	118,663	2004	6	131,574												
1998	7	118,921	2004	7	131,817												
1998	8	119,053	2004	8	132,050												
1998	9	119,284	2004	9	132,539												
1998	10	119,502	2004	10	132,480												
1998	11		2004	11	132,860												
1998	12	120,173	2004	12	133,327												
1999	1	120,402	2005	1	133,456												
1999	2	120,642	2005	2	133,679												
1999	3	120,735	2005	3	133,650												
1999	4	120,808	2005	4	133,726												
1999	5	120,706	2005	5	134,064												
1999	6	120,950	2005	6	134,155												
1999	7	121,235	2005	7	134,380												
1999	8	121,566	2005	8	134,673												
1999	9	121,716	2005	9	134,958												
1999	10	121,897	2005	10	135,221												
1999	11		2005	11	135,747												
1999	12		2005	12	136,097												
2000	1		2006	1	136,337												
2000	2		2006	2	136,627												
2000	3		2006	3	136,767												
2000	4		2006	4	136,607												
2000	5		2006	5	136,690												
2000	6		2006	6	137,214												
2000	7		2006	7	137,322												
2000	8		2006	8	137,882												
2000	9		2006	9	138,037												
2000	10		2006	10	138,285												
2000	11		2006	11	138,743												
2000	12		2006	12	139,039												
2001	1	125,097															
2001	2	125,193															
2001	3	125,381															
2001	4	125,265															
2001	5	125,248															
2001	6	125,241															
2001	7	125,648															
2001	8	125,754															
2001	9	125,775															
2001	10	125,947															
2001	11	126,352															
2001	12	126,643															

Table C-4. Actual and Forecast RG UPC

Year	Month	Actual	Year	Month	Actual /Forecast	Year	Month	Forecast	Year	Month	Forecast	Year	Month	Forecast	Year	Month	Forecast
1996	1	1,387	2002	1	1,329												
1996	2	1,185	2002	2	1,172												
1996	3	1,047	2002	3	1,075												
1996	4	886	2002	4	889												
1996	5	713	2002	5	664												
1996	6	865	2002	6	938												
1996	7	1,112	2002	7	1,285												
1996	8	1,177	2002	8	1,367												
1996	9	1,003	2002	9	1,214												
1996	10	679	2002	10	840												
1996	11	818	2002	11	896												
1996	12	1,157	2002	12	1,190												**
1997	1	1,352	2003	1	1,466												
1997	2	1,192	2003	2	1,336												
1997	3	930	2003	3	1,109												
1997	4	799	2003	4	846												
1997	5	708	2003	5	672												
1997	6	826	2003	6	828												
1997	7	1,178	2003	7	1,270												
1997	8	1,186	2003	8	1,439												
1997	9	1,008	2003	9	1,148												
1997	10	740	2003	10	743												
1997	11	833	2003	11	786												
1997	12	1,155	2003	12	1,115												
1998	1	1,308	2004	1	1,404												
1998	2	1,059	2004	2	1,262												
1998	3	1,020	2004	3	1,066												
1998	4	872	2004	4	808												
1998	5	742	2004	5	781												
1998	6	944	2004	6	918												
1998	7	1,295	2004	7	1,163												
1998	8	1,321	2004	8	1,197												
1998	9	1,216	2004	9	1,117												
1998	10		2004	10	778												
1998	11		2004	11	769												
1998	12		2004	12	1,107												
1999	1		2005	1	1,371												
1999	2		2005	2	1,147												
1999	3		2005	3	1,038												
1999	4		2005	4	896												
1999	5		2005	5	758												
1999	6	845	2005	6	1,047												
1999	7	1,270	2005	7	1,377												
1999	8	1,353	2005	8	1,480												
1999	9	1,112	2005	9	1,334												
1999	10	736	2005	10	907												
1999	11		2005	11	868												
1999	12		2005	12	1,188												
2000	1		2006	1	1,362												
2000	2		2006	2	1,100												
2000	3		2006	3	1,094												
2000	4		2006	4	848												
2000	5		2006	5	774												
2000	6		2006	6	1,032												
2000	7		2006	7	1,411												
2000	8		2006	8	1,559												
2000	9		2006	9	1,221												
2000	10		2006	10	816												
2000	11		2006	11	884												
2000	12		2006	12	1,223												
2001	1	1,627	**														
2001	2	1,234															
2001	3	1,085															
2001	4	907															
2001	5	655															
2001	6	880															
2001	7	1,273															
2001	8	1,353															
2001	9	1,106															
2001	10	746															
2001	11	755															
2001	12	1,030															

Table C-5. Actual and Forecast RG Rate Class

Year	Month	Actual	Year	Month	Actual /Forecast	Year	Month	Forecast	Year	Month	Forecast	Year	Month	Forecast	Year	Month	Forecast
1996	1	159,987,467	2002	1	185,210,844												
1996	2	150,877,658	2002	2	154,381,492												
1996	3	121,228,104	2002	3	151,016,775												
1996	4	108,577,772	2002	4	120,395,019												
1996	5	82,941,017	2002	5	95,779,099												
1996	6	100,180,212	2002	6	121,205,409												
1996	7	140,381,309	2002	7	156,880,727												
1996	8	139,445,109	2002	8	181,128,548												
1996	9	122,234,712	2002	9	173,622,491												
1996	10	83,152,714	2002	10	109,814,109												
1996	11	94,494,764	2002	11	116,373,074												
1996	12	130,767,284	2002	12	154,666,278												**
1997	1	165,110,562	2003	1	189,134,499												
1997	2	145,035,300	2003	2	185,815,441												
1997	3	111,459,422	2003	3	160,462,781												
1997	4	98,006,389	2003	4	115,974,166												
1997	5		2003	5	100,248,612												
1997	6	85,293,981	2003	6	108,465,038												
1997	7	137,385,035	2003	7	162,543,253												
1997	8	153,704,676	2003	8	186,983,530												
1997	9	125,559,816	2003	9	165,814,103												
1997	10	96,812,980	2003	10	98,123,548												
1997	11	101,387,607	2003	11	105,362,379												
1997	12	127,998,475	2003	12	158,135,487												
1998	1		2004	1	190,127,311												
1998	2	130,482,884	2004	2	186,770,784												
1998	3	129,294,603	2004	3	146,777,750												
1998	4	110,956,891	2004	4	114,040,677												
1998	5	85,743,349	2004	5	101,774,656												
1998	6	117,343,192	2004	6	129,060,381												
1998	7	174,455,943	2004	7	151,125,782												
1998	8	165,852,658	2004	8	154,884,099												
1998	9	157,704,884	2004	9	146,595,934												
1998	10	107,884,266	2004	10	117,239,803												
1998	11	89,322,233	2004	11	106,396,013												
1998	12	111,313,772	2004	12	152,401,666												
1999	1	183,868,557	2005	1	197,446,380												
1999	2	125,984,552	2005	2	171,060,078												
1999	3	123,216,654	2005	3	143,315,831												
1999	4	108,036,984	2005	4	133,023,052												
1999	5	84,158,863	2005	5	107,276,486												
1999	6	100,592,068	2005	6	136,974,024												
1999	7	146,897,252	2005	7	179,757,496												
1999	8	181,785,717	2005	8	194,104,927												
1999	9	146,962,142	2005	9	195,159,714												
1999	10	92,542,744	2005	10	137,364,378												
1999	11		2005	11	113,880,382												
1999	12		2005	12	177,249,663												
2000	1		2006	1	196,021,489												
2000	2		2006	2	152,560,472												
2000	3		2006	3	152,763,823												
2000	4		2006	4	124,331,057												
2000	5		2006	5	107,980,081												
2000	6		2006	6	148,611,079												
2000	7		2006	7	188,345,648												
2000	8		2006	8	213,080,819												
2000	9		2006	9	179,029,177												
2000	10		2006	10	110,224,959												
2000	11		2006	11	125,406,476												
2000	12		2006	12	174,758,411												
2001	1	230,343,324	**														
2001	2	162,875,415															
2001	3	149,346,756															
2001	4	117,474,061															
2001	5	95,645,552															
2001	6	114,194,280															
2001	7	164,246,190															
2001	8	184,841,111															
2001	9	155,092,473															
2001	10	100,039,876															
2001	11	99,319,396															
2001	12	125,134,263															

Table C-6 Commercial Peak Demands (MW)
Highly Confidential in its Entirety
Base Forecast

Low Forecast

High Forecast

Table C-7. Actual and Forecast CB Customers

Year	Month	Actual	Year	Month	Actual /Forecast	Year	Month	Forecast	Year	Month	Forecast	Year	Month	Forecast	Year	Month	Forecast
1996	1	16,792	2002	1	19,300												
1996	2	16,810	2002	2	19,278												
1996	3	16,818	2002	3	19,266												
1996	4	16,906	2002	4	19,287												
1996	5	16,939	2002	5	19,322												
1996	6	16,970	2002	6	19,405												
1996	7	17,063	2002	7	19,367												
1996	8	17,052	2002	8	19,412												
1996	9	17,073	2002	9	19,439												
1996	10	17,146	2002	10	19,453												
1996	11	17,193	2002	11	19,463												
1996	12	17,224	2002	12	19,485												**
1997	1	17,292	2003	1	19,513												
1997	2	17,309	2003	2	19,557												
1997	3	17,337	2003	3	19,605												
1997	4	17,343	2003	4	19,586												
1997	5		2003	5	19,508												
1997	6	17,424	2003	6	19,553												
1997	7	17,443	2003	7	19,496												
1997	8	17,458	2003	8	19,511												
1997	9	17,455	2003	9	19,493												
1997	10	17,483	2003	10	19,481												
1997	11	17,462	2003	11	19,517												
1997	12	17,509	2003	12	19,558												
1998	1		2004	1	19,526												
1998	2	17,602	2004	2	19,541												
1998	3	17,622	2004	3	19,574												
1998	4	17,669	2004	4	19,614												
1998	5	17,676	2004	5	19,671												
1998	6	17,720	2004	6	19,752												
1998	7	17,738	2004	7	19,732												
1998	8	17,777	2004	8	19,720												
1998	9	17,769	2004	9	19,765												
1998	10	17,784	2004	10	19,786												
1998	11	17,782	2004	11	19,756												
1998	12	17,794	2004	12	19,807												
1999	1	17,793	2005	1	19,800												
1999	2	17,833	2005	2	19,799												
1999	3	17,902	2005	3	19,780												
1999	4	17,964	2005	4	19,803												
1999	5	17,962	2005	5	19,786												
1999	6	18,018	2005	6	19,875												
1999	7	18,085	2005	7	19,830												
1999	8	18,096	2005	8	19,862												
1999	9	18,098	2005	9	19,870												
1999	10	18,161	2005	10	19,853												
1999	11		2005	11	19,866												
1999	12		2005	12	19,879												
2000	1		2006	1	19,885												
2000	2		2006	2	19,889												
2000	3		2006	3	19,899												
2000	4		2006	4	19,918												
2000	5		2006	5	19,972												
2000	6		2006	6	20,093												
2000	7		2006	7	20,060												
2000	8		2006	8	20,018												
2000	9		2006	9	20,050												
2000	10		2006	10	20,085												
2000	11		2006	11	20,123												
2000	12		2006	12	20,114												
2001	1	18,986	**														
2001	2	19,003															
2001	3	19,069															
2001	4	19,065															
2001	5	19,116															
2001	6	19,231															
2001	7	19,181															
2001	8	19,227															
2001	9	19,230															
2001	10	19,278															
2001	11	19,324															
2001	12	19,312															

Table C-8. Actual and Forecast CB UPC

Year	Month	Actual	Year	Month	Actual /Forecast	Year	Month	Forecast	Year	Month	Forecast	Year	Month	Forecast	Year	Month	Forecast
1996	1	1,630	2002	1	1,689												
1996	2	1,487	2002	2	1,522												
1996	3	1,410	2002	3	1,468												
1996	4	1,358	2002	4	1,363												
1996	5	1,298	2002	5	1,352												
1996	6	1,550	2002	6	1,613												
1996	7	1,840	2002	7	1,834												
1996	8	1,873	2002	8	2,022												
1996	9	1,754	2002	9	1,951												
1996	10	1,348	2002	10	1,428												
1996	11	1,266	2002	11	1,306												
1996	12	1,409	2002	12	1,455												**
1997	1	1,609	2003	1	1,609												
1997	2	1,482	2003	2	1,594												
1997	3	1,291	2003	3	1,450												
1997	4	1,271	2003	4	1,276												
1997	5		2003	5	1,326												
1997	6	1,345	2003	6	1,375												
1997	7	1,828	2003	7	957												
1997	8	1,991	2003	8	1,947												
1997	9	1,741	2003	9	1,816												
1997	10	1,482	2003	10	1,300												
1997	11	1,283	2003	11	1,252												
1997	12	1,373	2003	12	1,445												
1998	1		2004	1	1,626												
1998	2	1,383	2004	2	1,581												
1998	3	1,379	2004	3	1,408												
1998	4	1,388	2004	4	1,300												
1998	5	1,261	2004	5	1,274												
1998	6	1,603	2004	6	1,586												
1998	7	2,073	2004	7	1,725												
1998	8	2,034	2004	8	1,784												
1998	9	2,031	2004	9	1,675												
1998	10	1,483	2004	10	1,508												
1998	11	1,238	2004	11	1,284												
1998	12	1,337	2004	12	1,412												
1999	1	1,688	2005	1	1,654												
1999	2	1,387	2005	2	1,475												
1999	3	1,346	2005	3	1,341												
1999	4	1,378	2005	4	1,402												
1999	5	1,270	2005	5	1,277												
1999	6	1,485	2005	6	1,626												
1999	7	1,902	2005	7	1,845												
1999	8	2,147	2005	8	1,932												
1999	9	1,927	2005	9	1,998												
1999	10	1,431	2005	10	1,578												
1999	11		2005	11	1,322												
1999	12		2005	12	1,602												
2000	1		2006	1	1,495												
2000	2		2006	2	1,418												
2000	3		2006	3	1,380												
2000	4		2006	4	1,314												
2000	5		2006	5	1,338												
2000	6		2006	6	1,613												
2000	7		2006	7	1,929												
2000	8		2006	8	2,038												
2000	9		2006	9	1,934												
2000	10		2006	10	1,415												
2000	11		2006	11	1,305												
2000	12		2006	12	1,530												
2001	1	1,981	**														
2001	2	1,632															
2001	3	1,521															
2001	4	1,443															
2001	5	1,477															
2001	6	1,616															
2001	7	2,064															
2001	8	2,207															
2001	9	2,057															
2001	10	1,525															
2001	11	1,452															
2001	12	1,531															

Table C-9. Actual and Forecast CB Rate Class

Year	Month	Actual	Year	Month	Actual /Forecast	Year	Month Forecast	Year	Month Forecast	Year	Month Forecast	Year	Month Forecast
1996	1	27,365,836	2002	1	32,591,519								
1996	2	24,991,191	2002	2	29,350,158								
1996	3	23,713,587	2002	3	28,275,205								
1996	4	22,963,094	2002	4	26,279,480								
1996	5	21,986,382	2002	5	26,125,174								
1996	6	26,304,724	2002	6	31,303,755								
1996	7	31,391,161	2002	7	35,511,987								
1996	8	31,940,835	2002	8	39,254,658								
1996	9	29,948,481	2002	9	37,928,936								
1996	10	23,120,672	2002	10	27,775,069								
1996	11	21,772,441	2002	11	25,417,025								
1996	12	24,270,789	2002	12	28,347,854								**
1997	1	27,831,014	2003	1	31,403,453								
1997	2	25,653,972	2003	2	31,174,944								
1997	3	22,388,862	2003	3	28,419,346								
1997	4	22,042,637	2003	4	24,997,859								
1997	5		2003	5	25,871,144								
1997	6	23,439,146	2003	6	26,888,004								
1997	7	31,882,428	2003	7	18,654,080								
1997	8	34,766,149	2003	8	37,996,878								
1997	9	30,393,076	2003	9	35,406,670								
1997	10	25,910,961	2003	10	25,332,854								
1997	11	22,406,812	2003	11	24,426,511								
1997	12	24,044,209	2003	12	28,260,510								
1998	1		2004	1	31,757,616								
1998	2	24,344,302	2004	2	30,894,758								
1998	3	24,308,297	2004	3	27,552,106								
1998	4	24,518,292	2004	4	25,507,309								
1998	5	22,295,786	2004	5	25,067,008								
1998	6	28,400,486	2004	6	31,324,461								
1998	7	36,773,423	2004	7	34,034,946								
1998	8	36,164,733	2004	8	35,170,910								
1998	9	36,085,876	2004	9	33,105,251								
1998	10	26,382,324	2004	10	29,835,385								
1998	11	22,016,427	2004	11	25,360,239								
1998	12	23,787,659	2004	12	27,974,176								
1999	1	30,035,536	2005	1	32,750,963								
1999	2	24,734,952	2005	2	29,195,967								
1999	3	24,093,086	2005	3	26,527,319								
1999	4	24,751,044	2005	4	27,762,373								
1999	5	22,810,711	2005	5	25,260,717								
1999	6	26,748,906	2005	6	32,323,186								
1999	7	34,393,646	2005	7	36,582,491								
1999	8	38,854,882	2005	8	38,369,717								
1999	9	34,873,559	2005	9	39,702,088								
1999	10	25,993,304	2005	10	31,328,944								
1999	11		2005	11	26,265,302								
1999	12		2005	12	31,844,944								
2000	1		2006	1	29,718,751								
2000	2		2006	2	28,211,820								
2000	3		2006	3	27,453,997								
2000	4		2006	4	26,175,076								
2000	5		2006	5	26,722,434								
2000	6		2006	6	32,412,297								
2000	7		2006	7	38,703,631								
2000	8		2006	8	40,788,804								
2000	9		2006	9	38,781,353								
2000	10		2006	10	28,416,024								
2000	11		2006	11	26,252,995								
2000	12		2006	12	30,774,009								
2001	1	37,608,552	**										
2001	2	31,013,216											
2001	3	29,004,693											
2001	4	27,508,861											
2001	5	28,237,974											
2001	6	31,071,007											
2001	7	39,595,960											
2001	8	42,438,458											
2001	9	39,565,616											
2001	10	29,391,726											
2001	11	28,055,811											
2001	12	29,562,409											

Table C-10 Industrial Peak Demands (MW)
Highly Confidential in its Entirety
Base Forecast

Low Forecast

High Forecast

Table C-11. Actual and Forecast GP Customer Count

Date	Historical GP Customers	Forecasted GP Customers
1/1/1996	1,172	
1/1/1997	1,209	
1/1/1998	1,300	
1/1/1999	1,392	
1/1/2000	1,271	
1/1/2001	1,491	
1/1/2002	1,523	
1/1/2003	1,590	
1/1/2004	1,673	
1/1/2005	1,767	
1/1/2006	1,846	
1/1/2007		** **
1/1/2008		** **
1/1/2009		** **
1/1/2010		** **
1/1/2011		** **
1/1/2012		** **
1/1/2013		** **
1/1/2014		** **
1/1/2015		** **
1/1/2016		** **
1/1/2017		** **
1/1/2018		** **
1/1/2019		** **
1/1/2020		** **
1/1/2021		** **
1/1/2022		** **
1/1/2023		** **
1/1/2024		** **
1/1/2025		** **
1/1/2026		** **

Table C-12 GP Actual and Forecast UPC

Date	GP UPC Historical	GP UPC Forecasted
1/1/1996	49,427	
1/1/1997	49,930	
1/1/1998	43,973	
1/1/1999	43,852	
1/1/2000	49,846	
1/1/2001	43,373	
1/1/2002	43,767	
1/1/2003	38,919	
1/1/2004	41,798	
1/1/2005	41,276	
1/1/2006	40,417	
1/1/2007		** **
1/1/2008		** **
1/1/2009		** **
1/1/2010		** **
1/1/2011		** **
1/1/2012		** **
1/1/2013		** **
1/1/2014		** **
1/1/2015		** **
1/1/2016		** **
1/1/2017		** **
1/1/2018		** **
1/1/2019		** **
1/1/2020		** **
1/1/2021		** **
1/1/2022		** **
1/1/2023		** **
1/1/2024		** **
1/1/2025		** **
1/1/2026		** **

Table C-13. Actual, Forecast, and Weather Normalized Summer NSI

Normalized Summer	Actual Summer	Year	Forecasted Summer				
1,563,107	1,484,381	1996					
1,610,644	1,530,490	1997					
1,650,027	1,713,256	1998					
1,681,338	1,687,899	1999					
1,744,508	1,768,545	2000					
1,732,634	1,783,594	2001					
1,760,695	1,824,491	2002					
1806202.5	1,798,453	2003					
1854996.13	1,759,886	2004					
1908998.76	2,007,958	2005					
1962388.66	2,003,178	2006	1,962,389	Jun	Jul	Aug	Sep

**

**

Table C-14 Annual Winter Peaks - Actual, Weather Normalized and Forecast

	Winter Peaks	Peak with DSM Total DSM	Actual Peak	Normalized Peak
1996			773	752.99
1997			841	779.86
1998			700	798.23
1999			831	831.15
2000			794	846.42
2001			941	846.73
2002			891	865.38
2003			987	892.26
2004			945	922.1
2005			913	953.11
2006			1032	984.8
2007	**		1059	1016
2008				
2009				
2010				
2011				
2012				
2013				
2014				
2015				
2016				
2017				
2018				
2019				
2020				
2021				
2022				
2023				
2024				
2025				
2026			**	

*Actual Winter Peak based on peak from Dec-Feb
For 1996, peak would have to occur between Dec95-Feb06

Chart C-15 - Actual, Forecast and Weather Normalized Non-Summer

Normalized Non-Summer	Actual Non-Summer	Year	Forecasted Non-Summer							
2649143.5	2704352	1996								
2743673.9	2703376	1997								
2814866.44	2740306	1998								
2890505.07	2768099	1999								
2993153.21	3007385	2000								
2983442.31	2998161	2001								
3039691.81	3073770	2002								
3132235.12	3144377	2003								
3229220.92	3212273	2004								
3334467.19	3285725	2005								
3441666.86	3336036	2006	3441667	Jan	Feb	Mar	Apr	May	Oct	Nov	Dec

**

**

Chart C-16. Residential June-September (kWh)

Date	Historical Res	Forecasted Res
1/1/1996	503,811,867	
1/1/1997	509,074,693	
1/1/1998	614,455,832	
1/1/1999	588,276,116	
1/1/2000	632,261,805	
1/1/2001	629,835,537	
1/1/2002	659,293,308	
1/1/2003	627,593,184	
1/1/2004	585,818,713	
1/1/2005	718,534,343	
1/1/2006	747,434,083	
1/1/2007		** **
1/1/2008		** **
1/1/2009		** **
1/1/2010		** **
1/1/2011		** **
1/1/2012		** **
1/1/2013		** **
1/1/2014		** **
1/1/2015		** **
1/1/2016		** **
1/1/2017		** **
1/1/2018		** **
1/1/2019		** **
1/1/2020		** **
1/1/2021		** **
1/1/2022		** **
1/1/2023		** **
1/1/2024		** **
1/1/2025		** **
1/1/2026		** **

Chart C-17 Commercial June-September (kWh)

Date	Historical Comm	Forecasted Comm
1996	416,605,998	
1997	438,060,499	
1998	476,774,667	
1999	483,974,253	
2000	491,801,033	
2001	509,312,035	
2002	530,477,593	
2003	512,021,094	
2004	516,894,584	
2005	577,964,761	
2006	608,392,803	
2007		** **
2008		** **
2009		** **
2010		** **
2011		** **
2012		** **
2013		** **
2014		** **
2015		** **
2016		** **
2017		** **
2018		** **
2019		** **
2020		** **
2021		** **
2022		** **
2023		** **
2024		** **
2025		** **
2026		** **

Chart C-18 Industrial June-September (kWh)

Date	Historical Ind	Forecasted Ind
1/1/1996	321,087,192	
1/1/1997	333,145,071	
1/1/1998	343,126,402	
1/1/1999	356,136,151	
1/1/2000	358,310,944	
1/1/2001	355,415,968	
1/1/2002	359,185,811	
1/1/2003	376,954,749	
1/1/2004	387,392,485	
1/1/2005	401,671,106	
1/1/2006	414,691,050	
1/1/2007		** **
1/1/2008		** **
1/1/2009		** **
1/1/2010		** **
1/1/2011		** **
1/1/2012		** **
1/1/2013		** **
1/1/2014		** **
1/1/2015		** **
1/1/2016		** **
1/1/2017		** **
1/1/2018		** **
1/1/2019		** **
1/1/2020		** **
1/1/2021		** **
1/1/2022		** **
1/1/2023		** **
1/1/2024		** **
1/1/2025		** **
1/1/2026		** **

Chart C-19 Residential Non-Summer (kWh)

Year	Historical Res	Forecasted Res
1/1/1996	936,700,164	
1/1/1997	920,712,729	
1/1/1998	934,174,111	
1/1/1999	920,899,720	
1/1/2000	1,032,456,699	
1/1/2001	1,051,249,178	
1/1/2002	1,067,156,131	
1/1/2003	1,100,721,930	
1/1/2004	1,118,039,098	
1/1/2005	1,162,906,275	
1/1/2006	1,151,412,290	
1/1/2007		** **
1/1/2008		** **
1/1/2009		** **
1/1/2010		** **
1/1/2011		** **
1/1/2012		** **
1/1/2013		** **
1/1/2014		** **
1/1/2015		** **
1/1/2016		** **
1/1/2017		** **
1/1/2018		** **
1/1/2019		** **
1/1/2020		** **
1/1/2021		** **
1/1/2022		** **
1/1/2023		** **
1/1/2024		** **
1/1/2025		** **
1/1/2026		** **

Chart C-20 Commercial Non-Summer (kWh)

Year	Historical Comm	Forecasted Comm
1/1/1996	738,273,392	
1/1/1997	733,788,032	
1/1/1998	769,548,562	
1/1/1999	776,623,295	
1/1/2000	841,294,450	
1/1/2001	866,308,201	
1/1/2002	847,687,868	
1/1/2003	874,785,432	
1/1/2004	900,412,362	
1/1/2005	907,069,519	
1/1/2006	938,684,041	
1/1/2007		** **
1/1/2008		** **
1/1/2009		** **
1/1/2010		** **
1/1/2011		** **
1/1/2012		** **
1/1/2013		** **
1/1/2014		** **
1/1/2015		** **
1/1/2016		** **
1/1/2017		** **
1/1/2018		** **
1/1/2019		** **
1/1/2020		** **
1/1/2021		** **
1/1/2022		** **
1/1/2023		** **
1/1/2024		** **
1/1/2025		** **
1/1/2026		** **

Chart C-21 Industrial - Non-Summer (kWh)

Year	Historical Ind	Forecasted Ind
1/1/1996	602,642,402	
1/1/1997	610,141,710	
1/1/1998	617,657,133	
1/1/1999	631,977,641	
1/1/2000	650,973,053	
1/1/2001	649,482,882	
1/1/2002	668,260,542	
1/1/2003	681,775,145	
1/1/2004	697,987,069	
1/1/2005	705,029,119	
1/1/2006	730,799,302	
1/1/2007		** **
1/1/2008		** **
1/1/2009		** **
1/1/2010		** **
1/1/2011		** **
1/1/2012		** **
1/1/2013		** **
1/1/2014		** **
1/1/2015		** **
1/1/2016		** **
1/1/2017		** **
1/1/2018		** **
1/1/2019		** **
1/1/2020		** **
1/1/2021		** **
1/1/2022		** **
1/1/2023		** **
1/1/2024		** **
1/1/2025		** **
1/1/2026		** **