ATTACHMENT A

WAIVER REQUESTS RELATED TO
LOAD ANALYSIS AND FORECASTING
4 CSR 240-22.030

I. BACKGROUND

As part of the long-term forecast filing, AmerenUE is required to satisfy very specific rules as outlined in the Missouri Electric Utility Resource Planning 4CSR-240-22.030 Load Analysis and Forecasting rule. This rule was established in 1993 when end-use forecasting was generally regarded as the best approach for generating long-term forecasts. Since that time, the long-term forecast methodology at AmerenUE has evolved to a less data intensive statistical modeling approach called a Statistically Adjusted End-Use (SAE) model. AmerenUE proposes to continue to use the SAE modeling methodology, which has become the industry standard forecasting approach, for the upcoming 2008 IRP filing.

Transition from End-Use to SAE-Based Models

The end-use framework builds up an annual energy forecast from individual end-use forecasts. This often entails forecasting demand for over a dozen end-uses for multiple market segments. This may include three to four residential sectors (e.g., single-family, multi-family, and mobile homes) and eight to twelve commercial segments (e.g., office, retail, hospitals, and grocery stores). The estimation process involves constructing detail appliance characteristic data for each end-use and market segment where characteristic data includes:

- End-use base-year annual usage (existing and new construction)
- Appliance age distribution
- Average efficiency for each age segment
- Appliance costs
- Appliance size
- Fuel availability
- New appliance options and associated efficiency
- Thermal shell characteristics both new and existing homes and buildings

An end-use forecast is generated by forecasting energy requirements by sector and end-use then aggregating the results to a total class energy forecast. The process requires forecasting the number of appliances, change in operating costs, changes in size, change in efficiency, and change in stock utilization.

For many years, Itron (formerly Regional Economic Research, Inc.) maintained and implemented the EPRI end-use models REEPS (Residential), COMMEND (commercial), and INFORM (industrial). Through the early 1990's these models represented the best of practice in long-term energy forecasting.

The popularity of the end-use models for long-term energy forecasts declined through the 1990's and into the current period largely as a result of the high cost of implementing and maintaining end-use models. Data development and modeling work often cost several hundred thousand dollars every three to four years. It was not unusual for a utility to have large forecast staffs that could allocate a full man-year to maintaining an individual end-use model. Cost pressures and staffing reductions required utilities to implement a less costly approach for generating long-term energy forecasts. To this end, Itron developed the SAE model in response to forecasters' request for an approach that still captures end-use saturation and efficiency trends but is less costly to maintain and is easier to use.

The SAE modeling methodology currently represents the best of practice for long-term forecasting and has been successfully used and approved in numerous regulatory filings before state public utilities commissions that include Florida, Ohio, New York, Pennsylvania, Vermont, Colorado..

SAE Modeling Approach

To provide context for the waiver requests an overview of the proposed forecasting methodology is presented below.

Estimating Class Energy Requirements

Residential sales will be based on an estimated Statistically Adjusted End-Use (SAE) model specification. An SAE modeling approach entails constructing end-use variables that include end-use saturation and efficiency trends as well as economic, price, and weather impacts. The SAE specification allows us to directly capture the impact of improving end-use efficiency and end-use saturation trends on class sales. The process entails constructing end-use variables (i.e., XHeat, XCool, and XOther) and using these variables in estimated average use regression models as shown below:

$$AvgUse_m = a + b_1 \times XHeat_m + b_2 \times XCool_m + b_3 \times XOther_m + \varepsilon_m$$

The objective is to construct generalized end-use variables that approximate monthly end-use kWh requirements. The constructed end-use variables have two components – an index variable that captures change in end-use saturation, stock efficiency, and improvements in thermal shell integrity (e.g., *HeatIndex*), and a variable that reflects short-term utilization of this stock (e.g., *HeatUse*). The end-use variable (e.g., *XHeat*) is constructed as the product of these two components. XHeat, for example, is calculated as:

$$XHeat_{y,m} = HeatIndex_y \times HeatUse_{y,m}$$

where:

$$HeatUse_{y,m} = \left(\frac{HDD_{y,m}}{HDD_{01}}\right) \times \left(\frac{HHSize_y}{HHSize_{01}}\right)^{0.20} \times \left(\frac{Income_y}{Income_{01}}\right)^{0.20} \times \left(\frac{\text{Pr}\,ice_{y,m}}{\text{Pr}\,ice_{01}}\right)^{-0.15}$$

The economic and price drivers are incorporated into the HeatUse variable. By construction, the $HeatUse_{y,m}$ variable is close to one in the base year (2001). This index value changes through time and across months in response to changes in weather conditions, prices, household size, and household income. The heat index (HeatIndex) is a variable that captures heating end-use efficiency and saturation trends, thermal shell improvement trends, and housing

square footage trends. The index is constructed from the EIA annual end-use residential forecast for the West North Central census region.

The heat index (HeatIndex) and heat use variable (HeatUse) are combined to generate the monthly heating variable XHeat. Figure 1 in the Attachment shows the calculated XHeat variable for the residential heating customer class.

The constructed XHeat variable is an estimate of monthly heating requirement (kWh). Similar variables are constructed for cooling (*XCool*) and other end-uses (*XOther*). Figure 2 and Figure 3 show XCool and XOther. The monthly variation in the XOther variable is driven by variation in the number of billing days, lighting requirements, and electricity usage for water heating.

The end-use variables are used to estimate an average use model for residential class. The end-use variables are statistically adjusted to fit actual observed average kWh usage – thus the name Statistically Adjusted End-Use Model.

Figure 4 shows actual and predicted average use for a residential SAE average use model.

In general, the SAE models perform extremely well with an Adjusted R^2 above 0.95 and average absolute percent errors (MAPE) of less than three percent. One of the benefits of the SAE model is that it has proven to be accurate for short-term monthly forecasts for financial planning as well as provide reasonable long-term forecasts for capacity planning purposes.

The SAE model specification will also be used for developing commercial sales forecasts for the small general service and large general service rate classes. For these classes, the general approach is to construct total monthly sales models where the end-use variables reflect class total end-use energy requirements. Figure 5 shows a commercial SAE-based sales forecast. The commercial SAE models also generally perform well with an adjusted R^2 above 0.9 and MAPE's of less than three percent.

Using the set of estimated model coefficients, it's possible to provide end-use sales estimates for the primary end-uses – cooling, heating, and all other uses. Figure 6 shows the end-use decomposition for the residential sector.

Forecasting System Hourly Load and Peak Demand

Hourly load and system peak demand will be based on a load build-up forecasting model. The build-up approach entails combining customer class energy forecasts with class hourly load profiles; this generates an 8760 hourly load forecast for each major customer class. For residential sector, the availability of reasonable end-use hourly load data for heating, cooling, and other use allows us to construct hourly load forecasts for these end-use classifications and aggregate up to a total residential hourly load forecast. Representative hourly load profiles for residential heating, cooling and other use have been developed by Itron for Missouri. Hourly load profiles are based on building simulation models using Saint Louis weather conditions. Figure 7 shows resulting residential hourly load forecast.

The class hourly load forecasts are aggregated to yield a system hourly load forecast. From the hourly load forecast we can then extract annual and monthly system peak and class coincident peak demands. Figure 8 shows the add-up of class hourly loads to a system hourly load forecast.

The primary benefit of the build-up modeling approach is that it allows us to capture the impact differences of end-use sales growth (in the residential sector) and class energy growth has on system hourly load and system peak as the contribution to system peak can be quite different across sectors.

Load Analysis Data Requirements

4 CSR 240-22.050(4) requires an estimate of the technical potential for energy savings and demand reductions for measures passing an initial cost-effectiveness screen. AmerenUE and its Demand Side Management (DSM) consultant, ICF International (ICF), have proposed a waiver of this requirement, given that such an estimate plays no role in the subsequent analysis

of DSM programs. The rule does not require an estimate of either economic or achievable DSM potential. However, AmerenUE and ICF have proposed to prepare an estimate of achievable potential for DSM based on the DSM programs that are to be considered in the integration analysis. This analysis of achievable potential does not require that historical or forecasted energy use and demand be disaggregated by end use and, therefore, detailed end-use data are not needed for DSM analysis for 2008 filing.

The analysis of achievable potential will require end use load shapes. However, ICF has explained that these shapes can be obtained from other sources and does not need end-use information from AmerenUE's Load Analysis group. Non-weather-sensitive load shapes will be obtained from ITRON. Weather-sensitive load shapes will be developed using DOE-2 building energy simulation modeling of prototypical buildings and weather data for the AmerenUE service territory.

AmerenUE's 2008 IRP implementation plan will outline its DSM Process and data needs for the next three years (2008-2011).

In summary, AmerenUE is requesting several waivers from the forecast rules due to the change in forecast methodology (end-use model to SAE modeling approach) as these rules relate to end-use forecasting, and waivers related to some of the load analysis rules as these requirements are not needed to support the current DSM planning activity as explained above.

II. WAIVER REQUESTS

(1) 4 CSR 240-22.030 (1)(D) 1

Current Requirement:
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, whichever is longer.

Proposed Alternative:
AmerenUE will develop actual and weather-normalized monthly class and system energy usage and actual hourly net system loads that will give sufficient degrees of freedom in forecast models.

Rationale:
Consistent rate class level sales data is not available back to January 1982. Consistent rate class sales data is available back to January 1995. This represents more than ten years of monthly sales data – more than enough data to estimate rigorous forecast models. Sales data back to January 1995 will be used.

Actual hourly net system load data specific to AmerenUE's current service territory is available back to 2001; hourly system data going back to 1982 is available but will not be used in forecasting or DSM analysis as it includes Metro East (Illinois) and wholesale loads, which cannot be reasonably separated. AmerenUE system hourly load data from January 2001 through December 2006 will be used.

The weather normalization methodology of energy has significantly changed over the last twenty years. As a result any available historical weather normalized system and class energy is inconsistent across time. As an alternative, AmerenUE will provide historical monthly weather normal energy estimates for the last ten years based on the most current weather response models and normal weather conditions. As part of the weather-normalization process, AmerenUE will explore both use of daily weather response functions and monthly rate class models. Models and resulting estimates will be provided.

(2) 4 CSR 240-22.030 (1) (D) 2

Current Requirement:
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.

Proposed Alternative:
Estimated actual and weather-normalized class and system monthly demands at the time of the system peak and weather normalized hourly system loads for the most recent three years or for the period of time used as the basis of the utility's forecast of these loads, whichever is longer.

Rationale:
Historical monthly class coincident demands (actual and weather normalized) back to 1990 are not available. As an alternative, AmerenUE has major class estimates of coincident monthly peak demand for actual and normal weather conditions back to July 2003, as prior to that load research sample included Metro East. The rules were written

in 1993 implying the need for three years of such data. Estimates will be based on the class and system hourly profile models using data beginning July 2003.

(3) 4 CSR 240-22.030 (3)

Current Requirement:
Analysis of Use Per Unit. For each major class, the utility shall analyze historical use per unit by end use.

Proposed Alternative:
Analysis of Use Per Unit. For each major class, AmerenUE will analyze historical use per unit.

Rationale:
AmerenUE does not have an accurate means of disaggregating sales data by end-use and that data are not required for forecasting or DSM analysis for the 2008 filing. Historical data for use per customer will be provided and if there are any significant changes in trends, the reasons will be noted.

For more detailed explanation, please refer to Section 1.

(4) 4 CSR 240-22.030 (3) (A) 1

Current Requirement:
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.

Proposed Alternative:
For residential, commercial SGS and commercial LGS classes, 'heating, cooling, and other' uses will be estimated.

Rationale:
Aggregate end-use usage will be estimated using SAE models for heating, cooling, and other uses for the residential, commercial SGS and commercial LGS classes. AmerenUE does not have an accurate means of further disaggregating "other use" to end-uses like lighting, water heating, or refrigeration. Process equipment load is generally associated with the industrial sector. The available data does not support constructing SAE models for the industrial and other classes. As a result end-use estimates including process equipment load will not be available for these classes.

For more detailed explanation, please refer to Section 1.

(5) 4 CSR 240-22.030 (3) (A) 2

Current Requirement:
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.

Proposed Alternative:
AmerenUE is requesting a complete waiver from the requirement of section 4 CSR 240-22.030 (3) (A) 2.

Rationale:
Utility-specific survey information will not be available at the time of the 2008 filing. For this forecast AmerenUE will utilize the Missouri Statewide Residential Lighting and Appliance Saturation and Efficiency Study that was completed by RLW Analytics in 2006 and end-use data for the West North Central census region developed by the Energy Information Administration. AmerenUE will evaluate implementing utility-specific residential and commercial surveys going forward on a three-year basis. To control costs, AmerenUE will explore the possibility of conducting joint surveys with other Missouri utilities and assess the viability of jointly funding additional state-wide studies.

(6) 4 CSR 240-22.030 (3) (A) 4

Current Requirement:
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.

Proposed Alternative:
AmerenUE is requesting a complete waiver from the requirement of section 4 CSR 240-22.030 (3) (A) 4.

Rationale:
AmerenUE is not using a bottom-up end-use forecasting approach as envisioned by the rule and the data that would support such methodology are not collected; therefore there is no foundation to comply with this rule. Total sales data for each rate and revenue class are available, and for residential and smaller commercial classes, using the SAE methodology, heating, cooling loads will be determined and the remaining sales will be designated as "other" class.

For more detailed explanation, please refer to Section 1.

(7) 4 CSR 240-22.030 (3) (B) 1

Current Requirement:
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.

Proposed Alternative:
AmerenUE is requesting a complete waiver from the requirement of section 4 CSR 240-22.030 (3) (B) 1.

Rationale:
Same as (3) (A) 2 above. Utility-specific survey information will not be available at the time of the 2008 filing. For this forecast AmerenUE will utilize the Missouri Statewide Residential Lighting and Appliance Saturation and Efficiency Study conducted by RLW Analytics and end-use data for the West North Central census region developed by the Energy Information Administration. AmerenUE will evaluate implementing utility-specific residential and commercial surveys going forward on a three-year basis. To control costs, AmerenUE will explore the possibility of conducting joint surveys with other Missouri utilities and assess the viability of jointly funding additional state-wide appliance saturation studies.

(8) 4 CSR 240-22.030 (3) (B) 2

Current Requirement:
Estimate of end-use energy and demand. For each end use, the utility shall estimate end-use monthly energies and demands at time of the monthly system peaks and shall calibrate these energies and demands to equal the weather-normalized monthly energies and demands at the time of monthly peaks for each major class for the most recently available data.

Proposed Alternative:
AmerenUE will estimate major class actual and weather normalized monthly energies and demands at the time of the monthly system peaks for the most recently available data. Where information is available for a major class, AmerenUE will disaggregate the monthly energies and demands at the time of monthly system peaks into heating, cooling and other uses.

Rationale:
Monthly end-use sales and coincident demands are not available. As part of the modeling process, however, AmerenUE will provide monthly energy and system coincident demand estimates for the primary rate and revenue classes. . Data will be provided for actual weather and normal weather conditions. Detail end-use data is not available for residential, commercial, industrial, and other sectors. However, using the SAE modeling approach, monthly energies for residential, commercial SGS and commercial LGS will be estimated by heating, cooling and other uses. Also, residential class demands at the time of monthly system peaks will be broken into heating, cooling and other uses.

For more detailed explanation, please refer to Section 1.

(9) 4 CSR 240-22.030 (4) (A)

Current Requirement:
Load profiles for each day type shall be developed for each end use, for each major class and for the net system load.

Proposed Alternative:
Load profiles for each day type shall be developed for each major class and for the net system load. Where information is available for a major class, load profiles for heating, cooling and other uses will also be estimated.

Rationale:
Detail end-use profile data is not available for any of the classes; only heating, cooling and other use profiles for residential class are available. AmerenUE will provide load profiles as specified for the major classes, the net system load and aggregate residential end-use load estimates for heating, cooling, and other uses. For more detailed explanation, please refer to Section 1.

(10) 4 CSR 240-22.030 (4) (B)

Current Requirement:
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 and the estimated major class load profiles shall be calibrated to sum to the net system load profiles.

Proposed Alternative:
For each day type, the estimated major class load profiles shall be calibrated to sum to the net system load profiles. Where information is available and heating, cooling and other

uses are estimated for a major class, these profiles will be calibrated to sum to the estimated major class load profiles.

Rationale:
Detail end-use profile data is not available for any of the classes; only heating, cooling and other use profiles for residential class are available. Aggregate residential end-use profiles for heating, cooling, and other use will be calibrated to the residential hourly load profile, and major class profiles will be calibrated to net system hourly loads.
For more detailed explanation, please refer to Section 1.

(11) 4 CSR 240-22.030 (5) (B) 2.A

Current Requirement:
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 other relevant economic and demographic factors.

Proposed Alternative:
The forecasts of the driver variables used in the utility's sales and customer forecast models shall be specified. AmerenUE will perform the residential analysis on a use per unit and the non-residential analyses on a total monthly class kWh basis. AmerenUE will document how the forecast has taken into account the effects of real prices of electricity, real prices of competitive energy sources, real incomes and other relevant economic and demographic factors.

Rationale:
Commercial and industrial customer class sales will be forecasted on a total sales basis as these classes are not as homogenous and using average use models (per unit models) would not improve the forecast. Analyses will be provided on a monthly class kWh basis for the non-residential rate and revenue classes. Residential analysis will be provided on a use per customer basis. Monthly historical sales data and forecast results for all classes will be reported on both a total kWh basis and use per customer basis. AmerenUE will document how the forecast has taken into account the effects of real prices of electricity, real prices of competitive energy sources, real incomes and other relevant economic and demographic factors.

(12) 4 CSR 240-22.030 (5) (B) 2.B

Current Requirement:
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.

Proposed Alternative:
For each major class, the utility shall forecast both monthly energy use and demands at time of the summer and winter system peaks. Where information is available for a major class, the utility shall provide forecasts of the monthly energy and demand at the time of summer and winter system peaks by heating, cooling and other uses.

Rationale:
SAE forecast models do not provide a means of extracting end-use forecasts. For those sectors where SAE is utilized (residential and small commercial customer classes) the SAE model specifications will allow AmerenUE to provide aggregate heating, cooling, and total "other use" sales forecasts. No end-use sales forecasts will be generated in the larger commercial, industrial, wholesales, or "other" customer classes. Heating, cooling and other use coincident demand forecasts will be provided for the residential sector and major class coincident peak demands for the commercial, industrial, wholesale, and "other" customer classes.

For more detailed explanation, please refer to Section 1.

(13) 4 CSR 240-22.030 (6)

Current Requirement:
The utility shall analyze the sensitivity of the component 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.

Proposed Alternative:
AmerenUE is requesting a complete waiver from the requirement of section 4 CSR 240-22.030 (6).

Rationale:
AmerenUE seeks a waiver from this requirement because its purpose is to provide a basis for the high and low load forecasts under (7), but this use would be made unnecessary under waiver request (7) below. The sensitivity analysis described in section (6) would be replaced by the development of a subjective probability distribution over load forecasts in the development of the probability tree of scenarios.

(14) 4 CSR 240-22.030 (7)

Current Requirement:
Based on the sensitivity analysis described in section (6), the utility shall produce at least two 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.

Proposed Alternative:
Based on the range of load forecasts that are reflected in the probability tree of scenarios, AmerenUE will select 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 in a manner that is consistent with their subjective probabilities as part of the probability tree. These forecasts and associated subjective probabilities shall be consistent with inputs to the strategic risk analysis required by 4 CSR 240-22.070."

Rationale:
This change will ensure that the uncertainty in load forecasts used in 4 CSR 240-22.030 will be completely consistent with the uncertainties on this same variable that will be used in the risk analysis and strategy selection steps of 4 CSR 240-22.070.

(15) 4 CSR 240-22.030 (8) (B) 2

Current Requirement:
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.

Proposed Alternative:
The plots for the forecast period shall show each major class coincident demands per unit and total class coincident demands for the base-case forecast. Where heating, cooling and other uses are estimated for any major class, the utility shall provide the total and per unit coincident demands for the base-case forecast by these aggregate end-uses.

Rationale:
Detail end-use forecasts are not available as part of the proposed load modeling approach. AmerenUE will provide major class coincident demand forecasts on a total and per unit (customer) basis. Ameren will also provide residential heating, cooling, and "other use" coincident peak demand on a total and per customer basis.

For more detailed explanation, please refer to Section 1.

(16) 4 CSR 240-22.030 (8) (C)

Current Requirement:
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.

Proposed Alternative:
For the forecast of energy and peak demands, AmerenUE will provide a summary of the range of load forecasts that are reflected in the probability tree of scenarios and the subjective probabilities that are assigned to each of the load forecast cases based on their probabilities as part of the probability tree.

Rationale:
Since AmerenUE seeks a waiver from 4 CSR 240-22.030 (6) above, it proposes to replace the reporting for 4 CSR 240-22.030 (6) with reporting the range of load forecasts that are reflected in the probability tree of scenarios and the subjective probabilities.

(17) 4 CSR 240-22.030 (8) (E) 1

Current Requirement:
The plots shall show each end-use component of the hourly load profile.

Proposed Alternative:
Where heating, cooling and other uses are estimated for a major class, the plots shall show these aggregate end use components of the hourly load profile.

Rationale:
The proposed forecast methodology will not allow AmerenUE to generate detail end-use hourly loads. Load Analysis staff will however, be able to provide hourly residential end-use load profiles for heating, cooling, and “other uses”. End-use load profiles defined at this level will be provided as part of the forecast documentation.

For more detailed explanation, please refer to Section 1.

ATTACHMENT

Figure 1: XHeat (kWh)

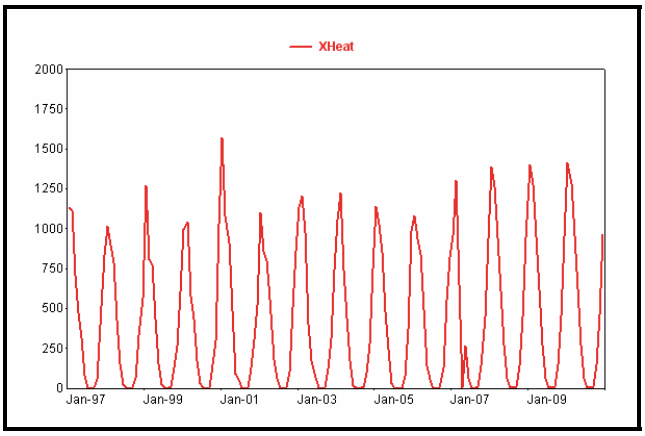

Figure 2: XCool (kWh)

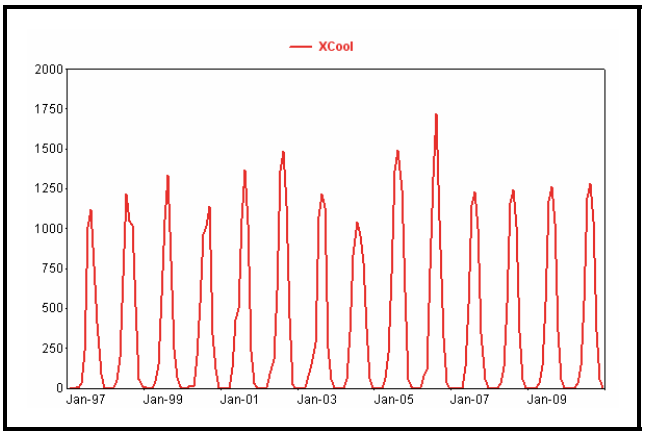

Figure 3: XOther (kWh)

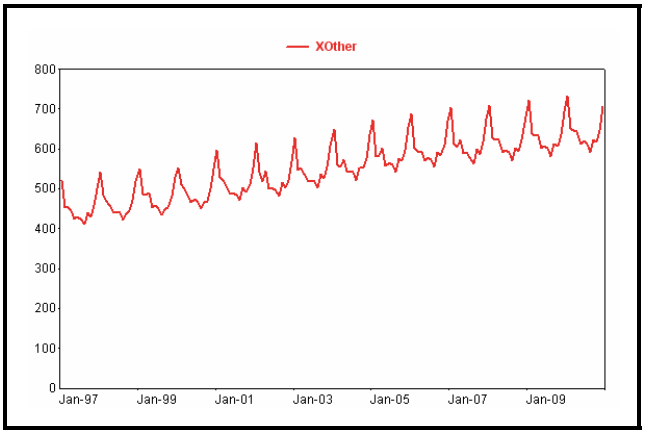

Figure 4: Residential Average Use Forecast (kWh)

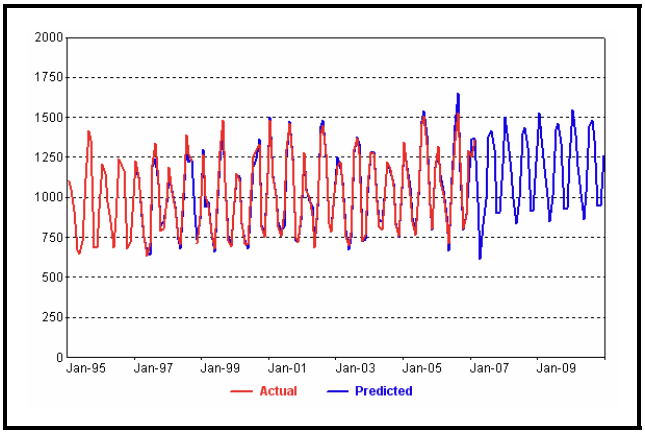

Figure 5: Commercial SAE Forecast Model (MWh)

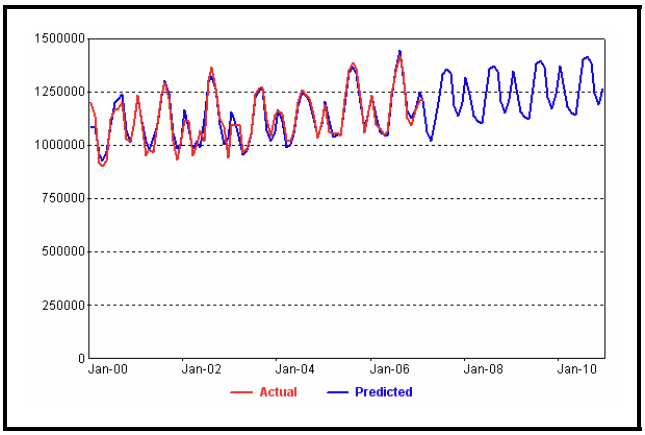

Figure 6: Residential Average End-Use Sales Forecasts (kWh)

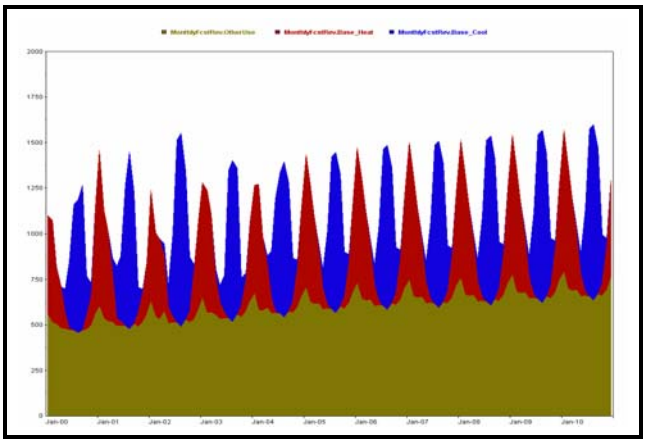

Figure 7: Residential Hourly Load Forecast (Summer Week)

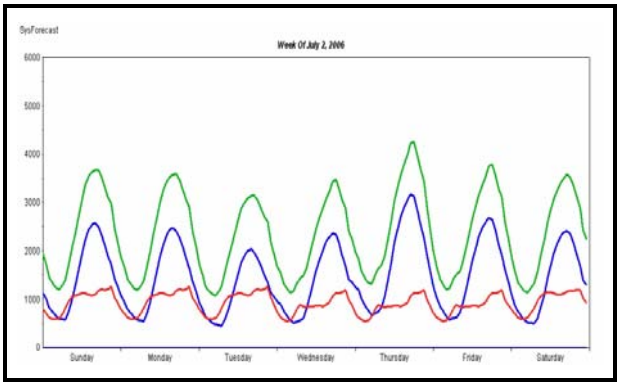

Figure 8: System Hourly Load Build-Up Forecast