Ameren Illinois Company ("AIC")
Load Forecast for the period June 1, 2014 – May 31, 2019

Purpose and Summary

The creation of the load forecast is an essential step in the development of the AIC procurement plan. The load forecast provides the basis for subsequent analysis resulting in a projected system supply requirement. The load forecast process includes a multi-year historical analysis of loads, analysis of switching trends, and competitive retail markets by customer class, known and projected changes affecting load, customer class specific growth forecasts and an impact analysis of statutory programs related to energy efficiency and renewable energy. The results of this analysis and modeling include a 5 year summary analysis of the projected system supply requirements.

Load Forecast Methodology

The models developed for the June 1, 2014 – May 31, 2019 load forecast use both econometric and the statistically adjusted end use (SAE) approaches. The traditional approach to forecasting monthly sales is to develop an econometric model that relates monthly sales to weather, seasonal variables, and economic conditions. The strength of econometric models is that they are well suited to identify historical trends and to project these trends into the future. In contrast, the strength of the end-use modeling approach is the ability to identify the end use factors that are driving energy use. By incorporating an end-use structure into an econometric model, the statistically adjusted end-use modeling framework exploits the strengths of both approaches. This SAE approach was used for all residential and commercial classes, while traditional econometric models were developed for the industrial and public authority classes. Lighting sales were forecasted by either exponential smoothing models or econometric models. Economic variables were obtained from Moody's Economy.com. Saturation and efficiency data were obtained from EIA. Revenue month weather data was created using billing cycles and weighting daily average temperatures according to the billing cycles. After revenue month sales models were created, the models were simulated with calendar month weather (and calendar month days where applicable) to obtain the calendar month sales forecast.

Since the rate structure changed in 2007 and it was not possible to reclassify the historical data according to the new rates; therefore, modeling was done on each revenue class, i.e., residential, commercial, industrial, public authority and lighting. The next step in the energy forecast was to allocate the sales forecast into the new delivery service rates. DS1 class is equivalent to residential class, and lighting sales are equivalent to DS5. Commercial, industrial and public authority sales were separated into the DS2, DS3A, DS3B and DS4 classes after calculating the shares of each delivery service class within a revenue class.

Residential SAE Model

The SAE modeling framework defines energy use in residential sector (USEy,m) in year (y) and month (m) as the sum of energy used by heating equipment ($Heat_{y,m}$), cooling equipment ($Cool_{y,m}$) and other equipment ($Other_{y,m}$). The equation for this is as follows:

$$\mathrm{Use}_{y,m} = \mathrm{Heat}_{y,m} + \mathrm{Cool}_{y,m} + \mathrm{Other}_{y,m} \qquad (1)$$

Although monthly sales are measured for individual customers, the end-use components are not. Substituting estimates for the end-use elements gives Equation 2,

$$\mathrm{Use}_{y,m} = a + b_1 \times \mathrm{XHeat}_{y,m} + b_2 \times \mathrm{XCool}_{y,m} + b_3 \times \mathrm{XOther}_{y,m} + \varepsilon_{y,m} \qquad (2)$$

where $XHeat_{y,m}$, $XCool_{y,m}$, and $XOther_{y,m}$ are explanatory variables constructed from end-use information, weather data, and market data. As shown below, the equations used to construct these X variables are simplified end-use models, and the X variables are the estimated usage levels for each of the major end use based on these models. The estimated model can then be thought of as a statistically adjusted end-use model, where the estimated slopes are the adjustment factors.

Constructing XHeat- Electric

Energy use by space heating systems depends on heating degree days, heating equipment share levels, heating equipment operating efficiencies, billing days, average household size, household income, and energy price. The heating variable is represented as the product of an annual equipment index and a monthly usage multiplier. That is,

$$\mathrm{XHeat}_{y,m} = \mathrm{HeatIndex}_{y} \times \mathrm{HeatUse}_{y,m} \qquad (3)$$

where $XHeat_{y,m}$ is estimated heating energy use in year (y) and month (m), $HeatIndex_y$ is the annual index of heating equipment, and $HeatUse_{y,m}$ is the monthly usage multiplier.

The HeatIndex is defined as a weighted average across equipment saturation levels normalized by operating efficiency levels. Given a set of fixed weights, the index will change over time with changes in equipment saturations (Sat) and operating efficiencies (Eff). Formally, the equipment index is defined as:

$$HeatIndex_y = StructuralIndex_y \, x \sum_{Type} Weight^{Type} \, x \frac{\left(Sat_y^{Type} \big/ Efficiency_y^{Type} \right)}{\left(Sat_{05}^{Type} \big/ Efficiency_{05}^{Type} \right)} \qquad (4)$$

In the above expression, 2005 is used as a base year for normalizing the index. The ratio is equal to 1 in 2005. In other years, it will be greater than 1 if equipment saturation levels are above their 2005 level. This will be counteracted by higher efficiency levels, which will drive the index downward. The weights are defined as follows.

$$Weight^{Type} = (Energy^{Type}_{05} / HH_{05}) \times HeatShare^{Type}_{05} \quad (5)$$

$(Energy_{05}{}^{Type}/HH_{05})$ is the unit energy consumption of each end-use in 2005 according to EIA data adjusted for each service territory. $HeatShare_{05}{}^{Type}$ is the saturation levels for each heating end-use in 2005 multiplied by a structural index with base year 2005, which is a function of surface area and building shell efficiency.

$$HeatShare_{05}{}^{Type} = Saturation_{05}{}^{Type} \text{ x Structural } Index_{05} \quad (6)$$

where

$$\text{Structural } Index_y = (\text{Building Shell } Efficiency_y \text{ x Surface } Area_y) / (\text{Building Shell } Efficiency_{05} \text{ x Surface } Area_{05}) \quad (7)$$

where

$$\text{Surface Area} = 892 + 1.44 \text{ x House Size} \quad (8)$$

The end-use saturation and efficiency trends are developed from Energy Information Administration (EIA)'s regional projections.

Heating system usage levels are impacted on a monthly basis by several factors, including weather, household size, income levels, prices and billing days. Since the revenue month heating degree days are used in the SAE index, HDD is not used as a separate variable in the model. The estimates for space heating equipment usage levels are computed as follows:

$$HeatUse_{y,m} = \left(\frac{BDays_{y,m}}{AvgBDays}\right) x \left(\frac{WgtHDD_{y,m}}{HDD_{05}}\right) x \left(\frac{Income_{y,m}}{Income_{05}}\right)^{0.20} x \left(\frac{HHSize_{y,m}}{HHSize_{05}}\right)^{0.25} x \left(\frac{ElecPrice_{y,m}}{ElecPrice_{05,7}}\right) x \left(\frac{GasPrice_{y,m}}{GasPrice_{05,7}}\right) \quad (9)$$

where $Price_{y,m}$ is the average residential real price of electricity in year (y) and month (m), $Price_{05}$ is the average residential real price of electricity in 2005, $HHIncome_{y,m}$ is the average real income per household in a year (y) and month (m), $HHIncome_{05}$ is the average real income per household in 2005, $HHSize_{y,m}$ is the average household size in a year (y) and month (m), $HHSize_{05}$ is the average household size in 2005, $HDD_{y,m}$ is the revenue month heating degree days in year (y) and month (m), and HDD_{05} is the annual heating degree days for 2005.

Constructing XCool- Electric

To construct XCool index, the same procedures as in XHeat index are followed; the only difference is that cooling degree days are used instead of heating degree days.

Constructing XOther- Electric

Monthly estimates of non-weather sensitive sales can be derived in a similar fashion to space heating and cooling. Based on end-use concepts, other sales are driven by appliance and equipment saturation levels, appliance efficiency levels, average household size, real income, real prices, and billing days. The explanatory variable for other uses is defined as follows:

$$XOther_{y,m} = OtherIndex_{y} \times OtherUse_{y,m} \quad (10)$$

The methodology for constructing OtherIndex is the same as heating and cooling indices except for the fact that there is no weather variable used in this index.

Peak Forecast

The monthly peak forecast for AIC's eligible customer retail load was performed at the total Ameren Illinois level. Historical hourly data from 2010 to 2011 was collected while the corresponding daily temperatures were used for building the regression models. The daily temperatures are calculated by averaging the daily high and low values. The loads were at transmission level and excluded wholesale load.

Methodology:
Using the hourly input data from 2010 to 2011, a daily peak regression model and a daily energy regression model were constructed. A peak and energy model for every DS class (namely DS1, DS2, DS3A, DS3B, DS4 and DS5) was built. This is because each of these DS classes has a different weather response function. For example, DS1 is the most weather-sensitive class. Year 2010 was taken as a reference calendar year. The actual load for 2010 was weather normalized using the daily peak and energy models, by adopting the Unitized Load Calculation approach. This approach is briefly discussed below.

Unitized Load Calculation:

Using the actual hourly load data estimate the daily peak and daily average load. Calculate the Unitized Hourly Load using the equation shown below:

Daily peak designated as: $PK_t(0)$

Daily energy designated as: $AVG_t(0)$

Unitized Hourly Load:

$$D_{ht}(0) = \frac{MW_{ht}(0) - AVG_t(0)}{PK_t(0) - AVG_t(0)}$$

The same regression coefficients are used to run-through the normal weather for daily peak and energy.

Weather normalized daily peak designated as: $PK_t(0)'$

Weather normalized daily energy designated as: $AVG_t(0)'$

Normalized hourly load:

$$MW_{ht}(0)' = AVG_t(0)' + D_{ht}(0).(PK_t(0)' - AVG_t(0)')$$

Daily Peak Model

Daily peak loads were modeled using regression within the MetrixND software package. Daily peak load was the dependent variable, and the independent variables included temperature based variables, seasonal variables, day-type variables, calendar variables, and energy growth trend variable. Average daily temperature, defined as the arithmetic mean of the day's high and low temperatures, is the basis for all of the weather variable constructions. Temperature splines are then created from the average daily temperature variable to allow load to respond to temperature in a non-linear fashion. These temperature splines are also interacted with seasonal and weekend variables to allow the temperature response of load to change with respect to these variables (i.e. Load will respond more to an 80 degree day in July than in October, and more on a weekday than a weekend).
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The daily peak model also includes independent binary variables representing each day of the week, each month of the year, and major holidays. This captures the change in load that is not due to weather variation, such as load reductions due to industrial customers and businesses that may not operate on weekends.

Statistical tests verify that the models fit the data quite well. The R-Squared statistic, which indicates the amount of variation in the dependent variable (load) that is explained by the model, is around 88% on an average. The Mean Absolute

Percent Error (MAPE) of the models is around 4.5% on an average, indicating that over all of the years of the analysis, the average day has a small absolute error.

Daily Energy Model

The concept for building the daily energy models is the same as that of daily peak, except that the dependent y-variable is the sum of hourly loads. The R-squared statistic is around 90% on an average for the daily energy models. The MAPE is around 4%.

Forecasting Normal Weather Conditions for the Daily Peak Model

AIC defines normal for a weather element as the arithmetic mean of that weather element computed over the 10 year period from 2003-2012. Because daily average temperature is the weather variable of interest for the peak forecast, the daily average temperature for each date must be averaged over the 10 year period. Unfortunately, averaging temperatures by date (i.e. all January 1st values averaged, then all January 2nd values and so on) creates a series of normal temperatures that is relatively smooth (i.e. no extreme values) and therefore devoid of peak load making weather conditions. To ameliorate this situation, a routine known as the "rank and average" method is used. In this method, all 10 years of historical weather data are collected. For each summer and non-summer of each year, the respective degree day data is sorted from the highest value to the lowest. Then the sorted data is averaged across the 10 years, with all of the hottest days in each summer averaged with each other. Likewise, all of the coldest days in each non-summer season are averaged, while the mild days are averaged together.

After the weather has been averaged by the degree day rank, the days are "mapped" back to the actual weather of the reference calendar year, from each year for the historical period. For the forecast period, an average weather shape is used to map the degree days. This way, the "normal" degree days follow a realistic contour. The normal temperature series is run through the daily peak and daily energy forecast models to produce a normal peak load and a normal energy load forecast.

The year 2010 is used as the reference year. We call it the 'Planning Calendar'. Once we have the normal peak and energy load forecast for 2010, using the unitized load approach discussed above, the normal hourly loads are constructed. This profile shape is extended to the future time periods (2013 to 2019 also called the 'Actual Calendar') after applying suitable calendar adjustments. In order to do this, the first step was to simulate the normal weather (from rank and average technique discussed above) from 2013 to 2018. The next step is to replicate the 24-hour profile shape (considered separately for each month) for each day into the forecast period, by considering the peak producing temperature, second peak producing temperature, and so on. Thus we have a profile shape for each day from 2013 to 2018.

Using the peak and energy models, we forecast the normal daily peak and energy loads for the same actual calendar time period. The unitized load formula is then applied to the forecasted values to come up with normal hourly loads for all the years from 2013 to 2019.

Final Forecast Steps

The MetrixLT software is used to apply the hourly shapes developed above under the monthly energy sales forecast. For example, for the month of January-2013 there are 744 hourly values and one energy forecast value. The 744 hourly values are shaped according to the energy value. Suitable loss factors are applied to the shaped values to arrive at final hourly forecast. This is done for each DS class separately. The final hourly system values (and hence the monthly peaks) are obtained by aggregating the values from each DS class.

Switching Trends and Competitive Retail Market Analysis

It is important to note in any discussion of retail switching the inherent difficulty in projecting future activity. AIC necessarily must make some assumption of future switching levels given that 16-111.5(b) of the PUA requires a five year analysis of the projected balance of supply and demand. In making these assumptions, AIC has utilized an extension of existing trends and their best judgment to arrive at the expected values. This was accomplished by first establishing the current trend line utilizing actual switching data by customer class for the post rate freeze period (January 2007 through May 2013). AIC then reviewed these trends and using their qualitative judgment made adjustments such that the end result is a forecast generally characterized by increasing switching, albeit at a rate somewhat slower than prior years given the significant switching that has already occurred and the reduction in AIC supply price compared to prior years. Given the difficulties inherent with projecting switching, it is expected that subsequent switching projections for future planning periods could differ substantially, and thus will impact the projection of AIC power supply requirements for eligible retail customers. Hence, AIC has also developed additional switching scenarios that address high and low switching scenarios.

Residential

As of June 1, 2013, there were thirty three Alternative Retail Electric Suppliers (ARES) certified by the ICC and registered with Ameren. Twenty ARES are certified by the ICC to supply both residential and non-residential load and thirteen ARES are certified by the ICC to supply only non-residential load (including four that are Subpart E ARES). Residential switching has increased over the last twelve month period such that as of June 1, 2013, 53.8% of residential usage of AIC was supplied by ARES (55.4% when RTP is considered). AIC expects the amount of load supplied by ARES will increase this summer as a result of the success of the third round of government aggregation referenda and the resulting successful solicitations for supply. In addition, non-government aggregation switching continues to grow.

Although the AIC supply price for the current plan year has dropped considerably, residential switching could continue to be positively influenced by an increase in the number of ARES willing to supply residential customers, aggressive marketing campaigns, the development of value added products and services and further expansion of government aggregation. It is worth noting that the amount of ARES approved to serve residential customers has increased from fourteen to twenty in the last twelve months. While the difference between market prices and the AIC tariff price appears to be closer relative to prior years as illustrated by the Price to Compare website sponsored by the Office of Retail Market Development, the momentum appears to suggest switching of residential load to ARES should continue, albeit at a slower rate relative to the last eighteen months.

In addition to the ARES options, residential customers may opt for real time pricing through a program administered for AIC by CNT Energy. Since program inception in 2007, participation in the program has been steadily increasing and is now approximately 1.6% of available load.

AIC estimates that the combination of residential switching to ARES and real time pricing will be greater than 79% of energy by the end of the five year planning period. But it should be noted that the variability in this forecast could be considerable and such variability could be driven by the aggressiveness of ARES marketing campaigns, customer acceptance and the headroom between ARES contracts and AIC fixed price tariffs. Due to the nature of a three year procurement cycle, forecasting switching is inherently difficult. During times of declining power prices, AIC's fixed tariff price will tend to be higher than the market rate, but in turn, during times of escalating power prices, one would expect AIC to have a lower tariff price than the current market rate. This could lead to a return of residential customers to the AIC fixed price tariff in the future. While not predicted in our expected switching scenario, AIC has assessed in its low switching scenario the impact of government aggregation load returning to AIC fixed price tariffs after the expiration of current contracts. In addition, AIC has assessed a higher switching scenario where residential switching approaches 100% over the planning horizon. The difference between the expected, high and low switching scenarios is substantial. This is reflective of significant uncertainty over the planning horizon especially as it pertains to the relationship of the AIC fixed tariff price relative to market prices and customer response to the relationship. While AIC believes the expected switching scenario is a reasonable assessment, the high and low switching scenarios could also occur. Therefore, in order to assist the IPA in its hedging efforts, AIC proposes that it monitor switching in the residential class and provide an updated residential switching forecast to the IPA in November 2013 and then again in March 2014 (this is consistent with the protocol recommended and approved in the 2013 IPA procurement plan). Where warranted, the IPA may wish to consider utilizing this updated forecast for its final procurement quantities.

0-149 kW Non-Residential

This customer class has seen approximately 64% load switching since January 1, 2007 up from about 57% a year ago. Future switching patterns are difficult to predict due to uncertain market conditions. However, as long as market prices stay below the AIC tariff price, one could reasonably expect switching to continue its upward trend.

In addition, now that ARES have been successful in gaining significant switching among the larger industrial and commercial customer classes, it is reasonable to assume ARES will focus efforts on the smaller customer classes. Finally, customers in this class also have an option for real time pricing, giving them other alternatives to switch away from the fixed price tariff.

AIC estimates that switching in this class will be in excess of 78% of load by the end of the five year planning period. However, the substantial difference between the expected, low and high switching scenarios previously described in the residential section also applies to this customer class and is reflective of significant uncertainty over the planning horizon.

150-399 kW Non-Residential

This customer class has seen approximately 86% load switching since January 1, 2007 up from about 82% a year ago. The ICC had previously declared that this class of customers is competitive with a transition period that became effective May 1, 2011. This means that customers currently taking fixed price supply from AIC will be allowed to continue until May 1, 2014, unless such customers switch to ARES or real time pricing before then, at which point such customers cannot return to AIC fixed price supply. Any customer that currently takes supply from ARES or from AIC real time pricing will not be able to return to AIC fixed price supply. Effective May 1, 2014, all customers must receive supply from either ARES or AIC real time pricing.

Given this development, AIC estimates that load switching in this class will be 100% by the end of the five year planning period.

400-999 kW Non-Residential

Section 16-113 (f) of the PUA declared this class to be competitive on June 1, 2010. As such, all customers are required to take supply under an ARES or the AIC real time pricing tariff. Therefore, this customer class assumes 100% switching and is therefore no longer considered part of the AIC fixed price load.

1,000 kW and Greater Non-Residential

This customer class is declared competitive and therefore these customers can no longer take the fixed price supply after May 31, 2008 and is therefore not included in the AIC fixed price load.

Street Lighting (DS5)

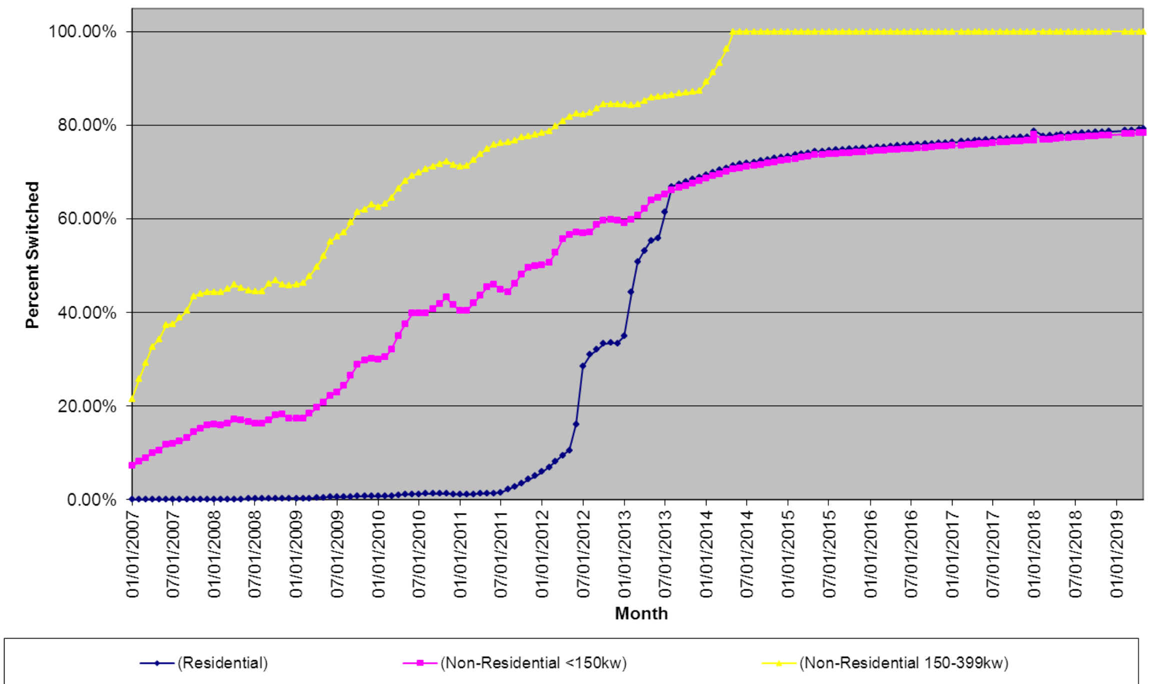
Although a small part of the fixed price load, AIC utilized its customer data system to estimate the quantity of load switching away from the fixed price tariff. This load switching is estimated to be approximately 35% as of June 1, 2013 and is projected to grow to about 51% by the end of the five year period.

Switching Patterns

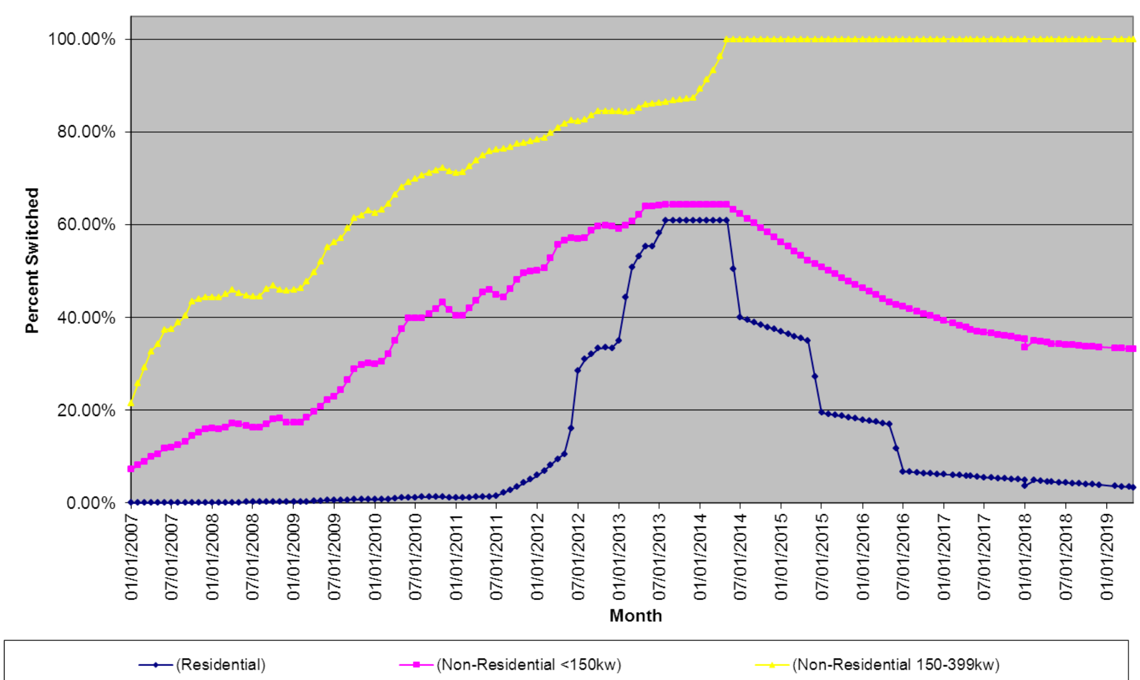
As noted previously, it is reasonable to expect further switching among residential and small commercial customer classes to either real time pricing or ARES. However, uncertainty is amplified since the AIC fixed price tariff has been lowered considerably over the prior period and the future relationship of the AIC tariff to market prices remains uncertain. The significant amount of government aggregation contracts expiring over the planning horizon adds to this complexity.

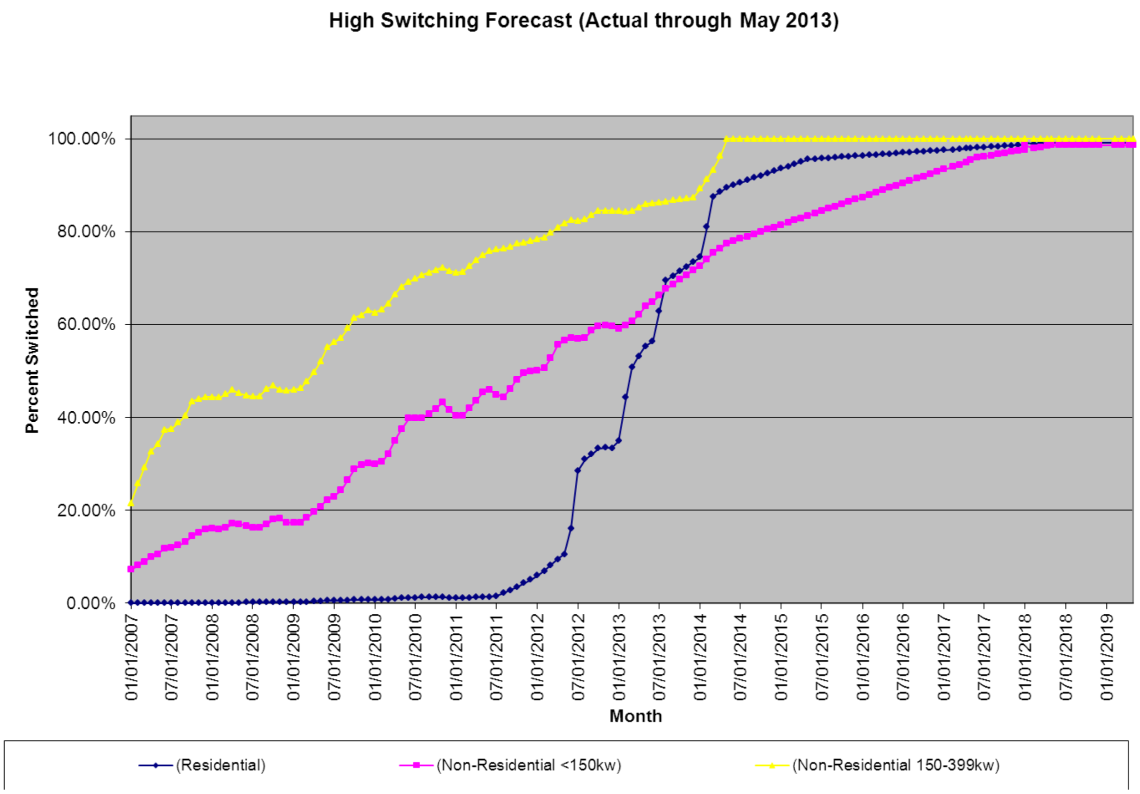
The AIC expected, low and high switching scenarios through May 31, 2019 are included in the graphs below:

Expected Switching Forecast (Actual through May 2013)



Low Switching Forecast (Actual through May 2013)





Known or Projected Changes to Future Loads

Known or projected changes to future loads include:

1) Customer switching estimates as previously discussed.
2) Potential incremental Energy Efficiency initiatives as discussed below.

Growth Forecasts by Customer Class

For the residential electric customer class, Ameren Illinois currently projects a 5-year Compound Annual Growth rate of 0.2%. Commercial growth rates for Ameren Illinois are projected to be 1.2% due to a major DS4 Customer expansion.

Impact of Energy Efficiency on Power Supply Forecast: Existing Energy Efficiency Programs

Please reference the AIC EE IPA submission documents for more detailed information. The impact of *existing* energy efficiency programs is included in the AIC forecasts.

Impact of Energy Efficiency Codes & Appliance Standards

The AIC procurement plan forecast utilizes a statistical adjusted end use (SAE) model approach for the residential and commercial classes. The SAE modeling framework defines energy usage as the sum of energy used for heating equipment, cooling equipment and other equipment. The other end use incorporates the impact of the new lighting standard as well as efficiency improvements across other household appliances.

The models are based on the Energy Information Administration's annual energy outlook. The information from EIA includes the following:

Updated equipment efficiency trends
Updated equipment and appliance saturation trends
Updated structural indices
Updated annual heating, cooling, water heating & Non-HVAC indices

Impact of Energy Efficiency on Power Supply Forecast: Incremental Energy Efficiency Programs

Pleaser reference the report "AIC EE IPA Submission Document 2013 Y7 2013 07 02.doc" in regards to the incremental energy efficiency impact should the IPA decide to pursue expansion of existing programs in its procurement plan. Note that the Power Supply forecasts provided to the IPA do not include the impact of these incremental Energy Efficiency programs with the exception of one scenario which is labeled accordingly.

Capacity Forecast

Effective June 1, 2013, MISO implemented an *annual* capacity construct with zonal differences as compared to the *monthly* capacity construct with no zonal differences previously employed.

The current transmission losses assumed in the AIC forecast are 2.2% and the reserve assumptions are 6.2%. It is likely that these values will be updated by MISO prior to any spring 2014 procurement events. As in past procurement cycles, AIC will provide updated capacity quantities to the IPA once the revised transmission losses and reserves are published.