Ameren ILLINOIS

July 11, 2018

Illinois Power Agency ("IPA")
Anthony Star - Director
160 N. LaSalle
Suite C-504
Chicago, Illinois 60601
VIA EMAIL

Dear Mr. Star:

June 2019 through May 2024 Forecasts

Energy and Capacity

In the attached files and as described below, Ameren Illinois Company ("AIC") provides forecast scenarios for customers who take supply from AIC fixed price tariffs:

Expected Forecast
High Forecast
Low Forecast

In each of the forecast scenario files, AIC has included the existing hedges for energy and capacity and a calculation of the hedging position based on the IPA strategy associated with the prior plan. AIC has provided this data and calculations solely to ensure the IPA has all of the pertinent information it needs in preparing its next procurement plan. These calculations do not imply any recommendation from AIC and all calculations should be independently verified by the IPA or its consultant.

1) AIC Expected Energy 2019 through 2024 Final.xlsx

The before switching forecast (eligible retail load including distribution losses) is filtered by expected switching to create the after switching forecast. Approximately 59% of residential load has switched away from AIC fixed price tariffs. Although the impact of municipal aggregation referenda has been substantial in recent years, our expected forecast assumes no additional aggregation referenda in the near term. However, our forecast acknowledges that the vast majority of municipals have renewed with alternative suppliers as prior contracts previously expired. Regarding switching other than municipal aggregation, uncertainty in our future tariff price as compared to the price offered by alternative suppliers provides no compelling evidence that customers will migrate away from our tariff nor return to our tariff. The result is that we continue to forecast flat switching across the planning horizon.

The expected forecast suggests existing energy hedges account for the following:

Plan Year	Hedge Percentage
2019	38%
2020	17%
2021	9%

2) AIC High Energy 2019 through 2024 Final.xlsx

The before switching forecast (eligible retail load including distribution losses) is based on a high growth scenario which is then filtered by a low switching scenario to calculate an after switching forecast which is higher than the expected case. The low switching scenario assumes that the AIC fixed price tariff will become more attractive relative to ARES options and thus a more substantial amount of customers that previously left the AIC fixed price tariff under municipal aggregation will return as existing aggregation contracts expire. The result of the low switching scenario is a forecast where fixed price load eventually returns to levels in proximity to those seen before municipal aggregation.

The high forecast suggests existing energy hedges account for the following:

Plan Year	Hedge Percentage
2019	27%
2020	11%
2021	5%

3) AIC Low Energy 2019 through 2024 Final.xlsx

The before switching forecast (eligible retail load including distribution losses) is based on a low growth scenario which is then filtered by a high switching scenario to calculate an after switching forecast which is lower than the expected case. The high switching scenario assumes that additional municipal aggregation referenda will occur in the planning horizon and that switching outside of municipal aggregation will also continue. The result of the high switching scenario is a forecast where little eligible retail load remains at the end of the planning horizon.

The high forecast suggests existing energy hedges account for the following (not including the impact of any partial curtailment of long term renewable contracts that may occur under this scenario):

Plan Year	Hedge Percentage
2019	52%
2020	28%
2021	19%

4) AIC Capacity 2019 through 2024 Final.xlsx (includes expected, high and low scenarios)

Ameren Illinois has existing bilateral purchases only for the 2019 Planning year which results in the following hedge percentages.

2019 Plan Year	Hedge Ratio
Expected	15%
High	11%
Low	20%

Forecasting Methodology

5) AIC Forecasting Methodology.doc

This file provides a description of the methodology used by Ameren Illinois in preparing its forecasts for the IPA. The document was included as an Appendix in past procurement plans.

Updated Forecast for October 2018 through May 2019

1) AIC Expected Energy October 2018 through May 2019 Final.xlsx

The approved IPA plan has a requirement to provide an updated forecast for the period October 2018 through May 2019 for use in determining the balance of year energy procurement quantities during the September 2018 solicitation. We have provided this updated forecast in a separate file relative to the forecasts for the period June 2019 through May 2024. The resulting balance of year forecast shows an approximate 5% reduction in load change relative to our March 2018 forecast. Residual energy quantities are provided for the IPA's information; however these quantities should be independently confirmed by the IPA or its consultant.

Summary

The advent of municipal aggregation has created considerable uncertainty to the forecasting process and this will continue through this planning horizon. AIC believes the forecasts attached and described in this letter represent reasonable estimates, however, we caution that actual results could vary considerably.

Please let us know if you have questions or wish to discuss any of the files. For matters pertaining to Power Supply, I can be reached at 314-613-9463 or jrange@ameren.com and Rich McCartney can be reached at 314-613-9181 or rmccartney@ameren.com.

Sincerely,

Justin Range
Power Supply Consultant

cc: Mario Bohorquez, Brian Granahan - IPA
R. McCartney, J. Grubbs, Ray Saunders – AIC
Torsten Clausen - ICC Staff
Katherine Gottshall, Vince Musco – Bates White

Ameren Illinois Company ("AIC")
Load Forecast for the period June 1, 2019 – May 31, 2024

Purpose and Summary

The creation of the load forecast is an essential step in the development of the IPA procurement plan for AIC. 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, 2019 – May 31, 2024 load forecast use 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 Analytics. 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 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:

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

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

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

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,

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

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, 2009 is used as a base year for normalizing the index. The ratio is equal to 1 in 2009. In other years, it will be greater than 1 if equipment saturation levels are above their 2009 level. This will be counteracted by higher efficiency levels, which will drive the index downward. The weights are defined as follows.

$$Weight^{Type} = (Energy^{Type}_{09} / HH_{09}) \times HeatShare^{Type}_{09}$$

(5)

$(Energy_{09}{}^{Type}/HH_{09})$ is the unit energy consumption of each end-use in 2009 according to EIA data adjusted for each service territory. $HeatShare_{09}{}^{Type}$ is the saturation levels for each heating end-use in 2009 multiplied by a structural index with base year 2009, which is a function of surface area and building shell efficiency.

$$HeatShare_{09}{}^{Type} = Saturation_{09}{}^{Type} \text{ x } Structural\ Index_{09} \qquad (6)$$

where

$$Structural\ Index_{y} = (Building\ Shell\ Efficiency_{y} \text{ x } Surface\ Area_{y}) / (Building\ Shell\ Efficiency_{09} \text{ x } Surface\ Area_{09}) \qquad (7)$$

where

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

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:

$$HeatUse_{y,m} = \left(\frac{BDays_{y,m}}{AvgBDays}\right) x \left(\frac{WgtHDD_{y,m}}{HDD_{09,7}}\right) x \left(\frac{Income_{y,m}}{Income_{09,7}}\right)^{0.20} x \left(\frac{HHSize_{y,m}}{HHSize_{09,7}}\right)^{0.25} x \left(\frac{ElecPrice_{y,m}}{ElecPrice_{09,7}}\right) x \left(\frac{GasPrice_{y,m}}{GasPrice_{09,7}}\right)$$

(9)

where $Price_{y,m}$ is the average residential real price of electricity in year (y) and month (m), $Price_{09}$ is the average residential real price of electricity in 2009, $HHIncome_{y,m}$ is the average real income per household in a year (y) and month (m), $HHIncome_{09}$ is the average real income per household in 2009, $HHSize_{y,m}$ is the average household size in a year (y) and month (m), $HHSize_{09}$ is the average household size in 2009, $HDD_{y,m}$ is the revenue month heating degree days in year (y) and month (m), and HDD_{09} is the annual heating degree days for 2009.

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:

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

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 2017 was collected.

Daily Peak Model

Methodology:

Using the hourly input data from 2014 to 2016, 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 2014 was taken as a reference calendar year. The actual load for 2014 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).

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 2006-2015. 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 2014 is used as the reference year. We call it the 'Planning Calendar'. Once we have the normal peak and energy load forecast for 2014, using the unitized load approach discussed above, the normal hourly loads are constructed. This profile shape is extended to the future time periods (2017 to 2025 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 2017 to 2026. 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 2017 to 2028.

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 2017 to 2025.

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-2014 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 April 2018). AIC then reviewed these trends and made adjustments using data associated with municipal aggregation contract expiration dates as well as qualitative judgment. The end result is a forecast characterized by flat switching for the balance of the planning horizon. 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. In addition, AIC has also developed additional switching scenarios that address high and low switching scenarios for this planning period.

Residential

As of June 1, 2018, there were 45 Alternative Retail Electric Suppliers (ARES) certified by the ICC and registered with Ameren. 34 ARES are certified by the ICC to supply both residential and non-residential load and 11 ARES are certified by the ICC to supply only non-residential load (including 5 that are Subpart E ARES). Residential switching has remained relatively flat over the last year and as of May 1, 2018, about 59% of residential usage of AIC was supplied by ARES (a small amount of RTP is included in this calculation since the IPA procurement plan pertains to utility fixed price load). AIC expects the amount of load supplied by ARES to remain flat across the planning horizon. Our expectation is driven in part by the vast majority of municipal aggregation contracts which were renewed after their recent expiration. In addition, our current plan year tariff price listed on pluginillinois.org suggests our price is similar to comparable ARES prices for individual customers.

In addition to the ARES options, residential customers may opt for real time pricing through a program administered for AIC by Elevate Energy. Since program inception in 2007 through 2013, participation in the program increased steadily. However, the impact of higher prices caused by the polar vortex resulted in a modest amount of customers leaving the program in search of fixed price options with Ameren Illinois or ARES. As of May 1, 2018, the real time pricing program accounts for approximately 1.6% of residential load.

AIC estimates that the combination of residential switching to ARES and real time pricing will be about 59% 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, the fate of municipal aggregation initiatives going forward, customer response and perhaps most importantly, 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. Our expected forecast predicts a flat trend across the planning horizon. A more aggressive return to utility supply was included in our low switching scenario. Conversely, should the future AIC tariff price exceed what ARES can provide, a higher switching scenario is also possible and this scenario is illustrated by our high switching scenario. The resulting difference between the expected, high and low switching scenarios is substantial and while this is not an ideal situation for planning purposes, AIC believes it properly reflects the significant uncertainty over the planning horizon. 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 March 2019 (this is consistent with the protocol recommended and approved in prior IPA procurement plans). The IPA may wish to utilize this updated forecast for its final procurement quantities in the spring of 2019.

0-149 kW Non-Residential

This customer class has seen approximately 70% load switching since January 1, 2007 and switching has been relatively flat over the last year. Future switching patterns are difficult to predict due to uncertain market conditions. Similar to the residential class, we predict flat switching across the planning horizon. However, similar to the high and low scenarios for residential, alternative scenarios for small commercial are reflective of considerable uncertainty.

AIC estimates that switching in this class will be about 70% 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

Effective May 1, 2014, all customers in this class are fully competitive and must receive supply from either ARES or AIC real time pricing.

Given this development, AIC assumes that none of this load is included in the eligible retail forecast (100% switching).

400-999 kW Non-Residential

This customer class is competitive and AIC therefore assumes none of this load is included in the eligible retail forecast (100% switching).

1,000 kW and Greater Non-Residential

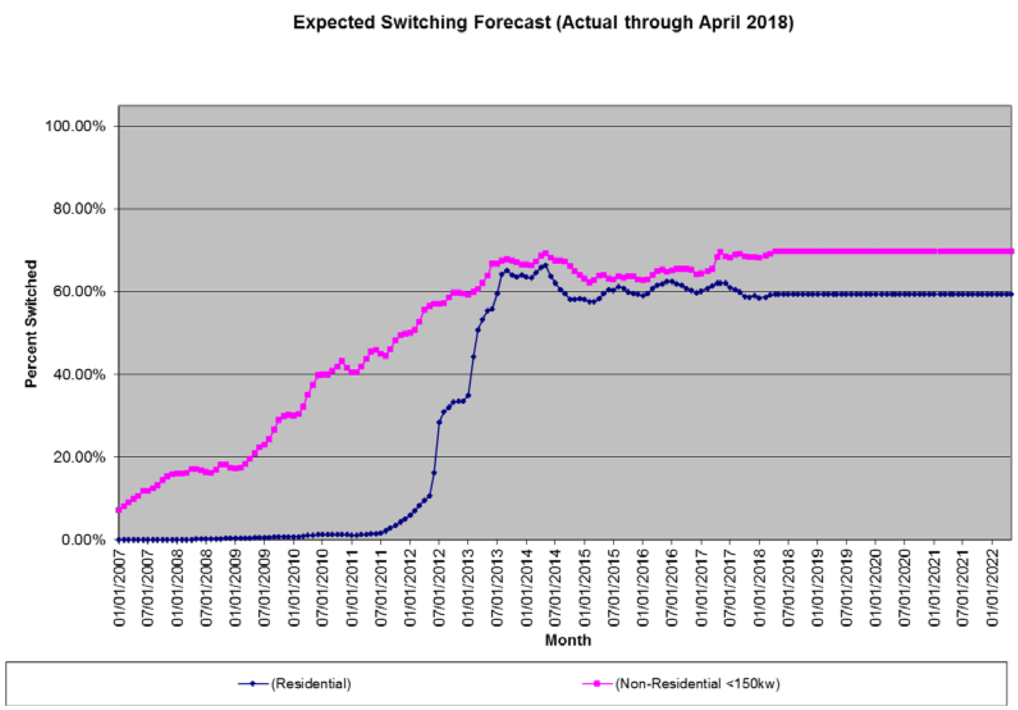
This customer class is competitive and AIC therefore assumes none of this load is included in the eligible retail forecast (100% switching).

Street Lighting

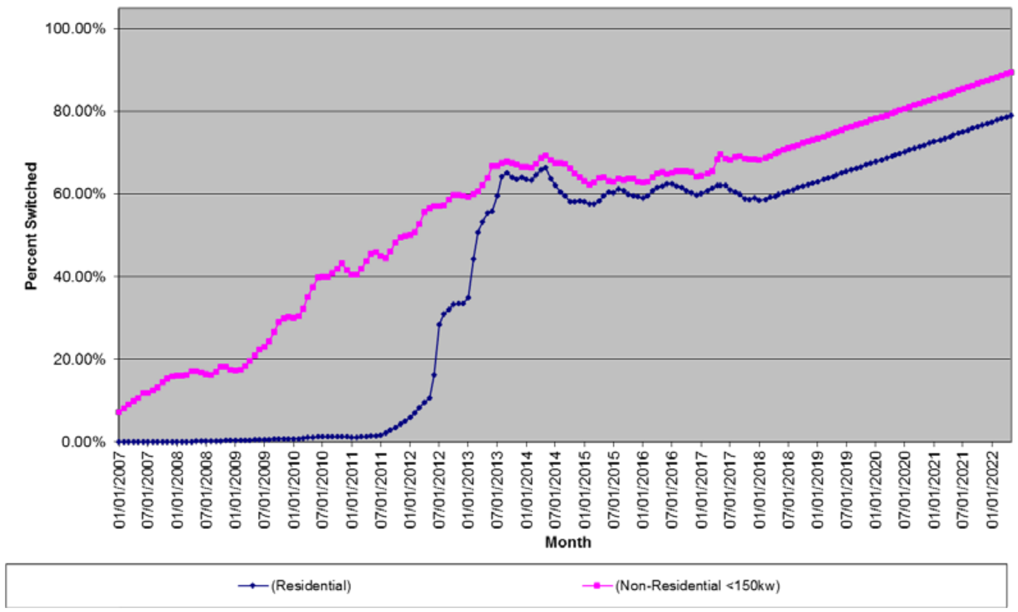
Although a small part of the overall load, AIC estimated the quantity of switching for this class as well. Under the expected scenario, load switching for this class was held flat throughout the planning horizon and is estimated to be approximately 44% at the end of the five year period. Similar to forecasts for residential and small commercial, the low and high switching scenarios reflect uncertainty relative to the expected case.

Switching Patterns

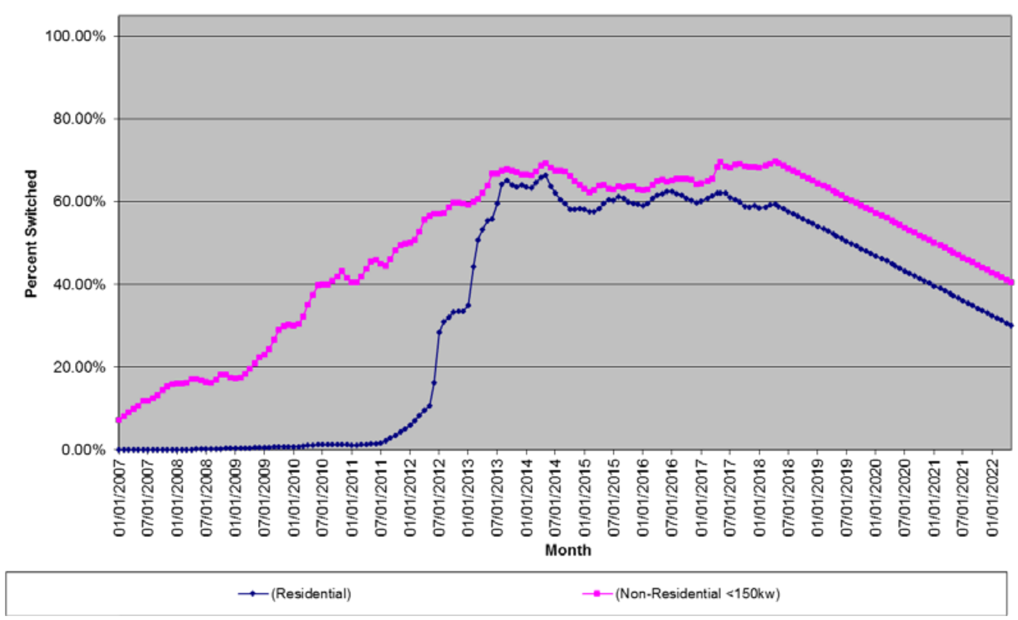
The AIC expected, low and high switching scenarios for residential and small commercial through May 31, 2024 are included in the graphs below (update graphs):



High Switching Forecast (Actual through April 2018)



Low Switching Forecast (Actual through April 2018)



Known or Projected Changes to Future Loads

Known or projected changes to future loads include:

1) Customer switching estimates as previously discussed.

Growth Forecasts by Customer Class

For the residential electric customer class, Ameren Illinois currently projects a 5-year Compound Annual Growth rate of -0.8%. Commercial growth rates for Ameren Illinois are projected to be 0.6% due to expansion plans for a few large customers. Industrial growth rates for Ameren Illinois are projected to be 0.2%.

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

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 8.4%. These values should be unchanged for the balance of the 2018 calendar year, but it is likely that these values will be updated by MISO prior to any 2019 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.