II. Forecast of Electric Power Demand

II. A. Overview of the Load Forecasting Process

Long-term forecasts of sales, net energy for load (NEL), and peak loads are typically developed on an annual basis for resource planning work at FPL. New long-term forecasts were developed by FPL in late 2013 that replaced the previous long-term load forecasts that were used by FPL during 2013 in much of its resource planning work and which were presented in FPL's 2013 Site Plan. These new load forecasts are utilized throughout FPL's 2014 Site Plan. These forecasts are a key input to the models used to develop FPL's integrated resource plan.

The following pages describe how forecasts are developed for each component of the long-term forecast: sales, NEL, and peak loads. Consistent with past forecasts, the primary drivers to develop these forecasts include economic conditions and weather.

The projections for the national and Florida economies are obtained from the consulting firm IHS Global Insight. Population projections are obtained from the Florida Legislature's Office of Economic and Demographic Research (EDR). These projections are developed in conjunction with the Bureau of Economic and Business Research (BEBR) of the University of Florida. These inputs are quantified and qualified using statistical models in terms of their impact on the future demand for electricity.

Weather is always a key factor that affects FPL's energy sales and peak demand. Three sets of weather variables are developed and used in FPL's forecasting models:

1. Cooling degree-hours based on 72^o F, winter heating degree-days based on 66^o F, and heating degree-days based on 45^o F are used to forecast energy sales.
2. The maximum temperature on the peak day, along with the build-up of cooling degree-hours prior to the peak, is used to forecast Summer peaks.
3. The minimum and average temperatures on the peak day, along with the build-up of heating degree-hours based on 66^o F, one and two days prior to the peak, are used to forecast Winter peaks.

The cooling degree-hours and winter heating degree-days are used to capture the changes in the electric usage of weather-sensitive appliances such as air conditioners and electric space heaters. Heating degree-days based on 45^o F are used to capture heating load resulting from sustained periods of unusually cold weather not fully captured by heating degree-days based on 66^o F. A composite hourly temperature profile is derived using hourly temperatures across FPL's service territory. Miami, Ft. Myers, Daytona Beach, and West Palm Beach are the locations from which temperatures are obtained. In developing the composite hourly profile, these regional temperatures are weighted by regional energy sales. The resulting composite temperature is used to derive projected cooling and heating degree-hours and heating degree-days. Similarly, composite temperature and hourly profiles of temperatures are used to calculate the weather variables used in the Summer and Winter peak models.

II. B. Comparison of FPL's Current and Previous Load Forecasts

While reflecting some fluctuations by year, FPL's current load forecast is generally in line with the load forecast presented in its 2013 Site Plan. There are four primary factors that are driving the current load forecast: projected population growth, the continued recovery of the Florida economy, energy efficiency codes and standards, and the additional load expected as a result of the acquisition of the City of Vero Beach electric utility.

In early 2013, FPL came to an agreement with the City of Vero Beach to purchase the City's electric system. This agreement was approved by the City voters on March 12, 2013. Beginning in January 2015, NEL, customers, and peaks for Vero Beach are included in FPL's forecasts and are reflected in FPL's 2014 Site Plan.

The customer forecast is based on recent population projections as well as the actual levels of customer growth experienced historically and the additional customers expected as a result of the acquisition of Vero Beach. Population projections are derived from the EDR's July 2013 Demographic Estimating Conference. This forecast is generally consistent with previous forecasts indicating a gradual rebound in Florida's population growth. Net migration into Florida fell to a record low in 2009 during the height of the recession. Florida has since experienced an improvement in net migration which now accounts for a majority of the population growth. However, population growth rates have remained modest by historical standards. Moderately higher rates of population growth are projected from 2014 until 2018 when the projected rate of population growth gradually begins to decelerate. Consistent with past population projections, the rates of population growth in the later years of the forecast are below the rates historically experienced in Florida.

Effective January 2015, FPL is expected to begin providing electric service to more than 34,000 customers formerly served by the City of Vero Beach. Reflecting this increase, the current forecast shows an increase in customer growth in 2015. Thereafter, customer growth is expected to mirror the overall level of population growth in the state. By 2019, the total number of customers served by FPL is expected to exceed five million. Between 2013 and 2023 the total number of customers is projected to increase at an annual rate of 1.4%, the same increase projected in the 2013 Site Plan.

The economic projections incorporated into FPL's load forecast are provided by IHS Global Insight, a leading economic forecasting firm. IHS Global Insight projects a continued recovery in the Florida economy with relatively healthy increases in employment and income levels between 2014 and 2020. Particularly robust growth is projected for the tourism and healthcare industries. Consistent with past projections, economic growth in the later years of the forecast is expected to moderate slightly.

Estimates of savings from energy efficiency codes and standards are developed by ITRON, a leading expert in this area. Included in these estimates are savings from federal and state energy efficiency codes and standards, including the 2005 National Energy Policy Act, the 2007 Energy Independence and Security Act, and the savings occurring from the use of compact fluorescent bulbs[2]. The impact of these savings began in 2005 and their cumulative impact on the Summer peak is expected to reach 3,477 MW by 2023, the equivalent of approximately a 12% reduction in what the forecasted Summer peak load for 2023 would have been without these codes and standards. The cumulative impact from these savings on NEL is expected to reach 9,991 GWH over the same period while the cumulative impact on the Winter peak is expected to be 1,689 MW by 2023. This represents a decrease of approximately 7% in the forecasted NEL for 2023 and a 4% reduction in forecasted Winter peak load for 2023.

Consistent with the forecast presented in FPL's 2013 Site Plan, the total growth projected for the ten-year reporting period of this document is significant. The Summer peak is projected to increase to 26,528 MW by 2023, an increase of 4,952 MW over the 2013 actual Summer peak. Likewise, NEL is projected to reach 132,357 GWH in 2023, an increase of 20,702 GWH from the actual 2013 value.

II.C. Long-Term Sales Forecasts

Long-term forecasts of electricity sales were developed for the major revenue classes and are adjusted to match the NEL forecast. The results of these sales forecasts for the years 2014 - 2023 are presented in Schedules 2.1 - 2.3 which appear at the end of this chapter. Econometric models are developed for each revenue class using the statistical software package MetrixND. The methodologies used to develop energy sales forecasts for each jurisdictional revenue class and NEL forecast are outlined below.

[2] Note that in addition to the fact that these energy efficiency codes and standards lower the forecasted load (as described later in this chapter), these standards also lower the potential for efficiency gains that would otherwise be available through utility DSM programs.

1. Residential Sales

Residential electric usage per customer is estimated by using an econometric model. Residential sales are a function of the following variables: cooling degree-hours, winter heating degree-days, lagged cooling degree-hours, lagged winter heating degree-days, retail gasoline prices, and Florida real per capita income weighted by the percent of the population employed. The impact of weather is captured by the cooling degree-hours, heating degree-days, and the one month lag of these variables. The impact energy prices have on electricity consumption is captured through retail gasoline prices. As energy prices rise, less disposable income is available for all goods and services, electricity included. To capture economic conditions, the model includes a composite variable based on Florida real per capita income and the percent of the state's population that is employed. Residential energy sales are forecasted by multiplying the forecasted residential use per customer by the number of residential customers forecasted.

2. Commercial Sales

The commercial sales forecast is also developed using an econometric model. Commercial sales are a function of the following variables: Florida real per capita income weighted by the percent of the population employed, cooling degree-hours, heating degree-hours, lagged cooling degree-hours, a variable designed to reflect the impact of empty homes, dummy variables for the month of December and for the specific months of January 2007, November 2005, and March 2013, and an autoregressive term. Cooling degree-hours, heating degree-hours, and the one month lag of cooling degree-hours are used to capture weather-sensitive load in the commercial sector.

3. Industrial Sales

The industrial class is comprised of three distinct groups: very small accounts (those with less than 20 kW of demand), medium accounts (those with 21 kW to 499 kW of demand), and large accounts (those with demands of 500 kW or higher). As such, the forecast is developed using a separate econometric model for each group of industrial customers. The small industrial sales model utilizes the following variables: cooling degree-hours, heating degree-hours, dummy variables for the specific months of November 2005 and August 2004, and two autoregressive terms. The medium industrial sales model utilizes the following variables: cooling degree-hours, Florida real per capita income weighted by the percent of the population employed, dummy variables for the specific months of February 2005 and 2006 and November 2005, and three autoregressive terms,. The large industrial sales model utilizes the following variables: cooling degree-hours, Florida real per capita income weighted by the percent of the population employed, the Consumer Price Index, and dummy variables for the specific months of October 2004 and 2005, November 2004, and September 2005.

4. Railroad and Railways Sales and Street and Highway Sales

This class consists solely of Miami-Dade County's Metrorail system. The projections for railroad and railways sales are based on a historical moving average.

The forecast for street and highway sales is developed by first developing a trended use per customer value, then multiplying this value by the number of forecasted customers.

5. Other Public Authority Sales

This class consists of a sports field rate schedule, which is closed to new customers, and one government account. The forecast for this class is based on its historical usage characteristics.

6. Total Sales to Ultimate Customer

Sales forecasts by revenue class are summed to produce a total sales forecast.

7. Sales for Resale

Sales for resale (wholesale) customers are composed of municipalities and/or electric co-operatives. These customers differ from jurisdictional customers in that they are not the ultimate users of the electricity they buy. Instead, they resell this electricity to their own customers. Currently there are five customers in this class: the Florida Keys Electric Cooperative; Lee County Electric Cooperative; Wauchula; Winter Park; and Blountstown. In addition, FPL will begin making sales to Seminole Electric Cooperative in June 2014 under a long term agreement[3].

Beginning in May 2011, FPL began providing service to the Florida Keys Electric Cooperative under a long-term full requirements contract. Previously FPL was serving the Florida Keys under a partial requirements contract. The sales to Florida Keys Electric Cooperative are based on customer-supplied information and historical coincidence factors.

Lee County has contracted with FPL for FPL to supply a portion of their load through 2013, then to begin serving their entire load beginning in 2014. This contract began in January 2010. Lee County provides a forecast of their sales by delivery point which is used to derive their sales forecast.

FPL's sales to Wauchula began in October 2011 and will continue through December 2016.

[3] FPL continues to evaluate the possibility of serving the electrical loads of other entities at the time the 2014 Site Plan is being prepared. Because these possibilities are still being evaluated, the load forecast presented in this Site Plan does not include these potential loads.

Sales to Winter Park began in January 2014 and will continue through December 2016.

Blountstown became an FPL wholesale customer in May 2012. FPL's contract with Blountstown expires in April 2017.

A new contract with Seminole Electric Cooperative is included in the forecast which includes delivery of 200 MW beginning in June 2014 and continuing through May 2021.

II.D. Net Energy for Load (NEL)

An econometric model is developed to produce a NEL per customer forecast. The inputs to the model include Florida real per capita income weighted by the percent of the population employed, and a proxy for energy prices. The model also includes several weather variables including cooling degree-hours and heating degree-days by calendar month, and heating degree-days based on 45^o F. In addition, the model also includes variables for energy efficiency codes and standards and a variable designed to capture the impact of empty homes. Dummy variables are included for the specific months of May 2004, and November 2005. There is also an autoregressive term in the model.

The energy efficiency variable is included to capture the impacts from major codes and standards, including those associated with the 2005 National Energy Policy Act, the 2007 Energy Independence and Security Act, and the savings occurring from the use of compact fluorescent bulbs. The estimated impact from these codes and standards is inclusive of engineering estimates and any resulting behavioral changes. The impact of these savings began in 2005 and their cumulative impact on NEL is expected to reach 9,991 GWH by 2023. This represents a 7.0% reduction in what the forecasted NEL for 2023 would have been absence these codes and standards. On an incremental basis, net of the reduction already experienced through 2013, the reduction in 2023 is expected to reach 6,075 GWH.

The decline in the number of empty homes resulting from the current housing recovery has affected use per customer and is captured in a separate variable. The forecast was also adjusted for additional load estimated from hybrid vehicles, beginning in 2013, which resulted in an increase of approximately 1,587 GWH by the end of the ten-year reporting period. The forecast was also adjusted for the incremental load resulting from FPL's economic development riders which began in 2013, and this incremental load is projected to grow to 537 GWH before leveling off in 2018. An additional adjustment to the NEL forecast was made to reflect the acquisition of the Vero Beach electric system. The Vero Beach acquisition is projected to add 793 GWH by 2023.

The NEL forecast is developed by first multiplying the NEL per customer forecast by the total number of customers forecasted (excluding the customers formerly served by Vero Beach) and then adjusting the forecasted results for the expected incremental load resulting from hybrid vehicles, new wholesale contracts, the Vero Beach acquisition, and FPL's economic development riders. Once the NEL forecast is obtained, total billed sales are computed using a historical ratio of sales to NEL. The sales by class forecasts previously discussed are then adjusted to match the total billed sales. The forecasted NEL values for 2014 - 2023 are presented in Schedule 3.3 that appears at the end of this chapter.

II.E. System Peak Forecasts

The rate of absolute growth in FPL system peak load has been a function of the size of the customer base, varying weather conditions, projected economic conditions, changing patterns of customer behavior, and more efficient appliances and lighting. FPL developed the peak forecast models to capture these behavioral relationships. In addition, FPL's peak forecast also reflects changes in load expected as a result of the acquisition of Vero Beach, changes in wholesale contracts, and the expected number of hybrid vehicles.

The savings from energy efficiency codes and standards incorporated into the peak forecast include the impacts from the 2005 National Energy Policy Act, the 2007 Energy Independence and Security Act, and the use of compact fluorescent light bulbs. The impact from these energy efficiency standards began in 2005 and their cumulative impact on the Summer peak is expected to reach 3,477 MW by 2023. This reduction is inclusive of engineering estimates and any resulting behavioral changes. The cumulative 2023 impact from these energy efficiency codes and standards effectively reduces FPL's Summer peak for that year by 11.6%. On an incremental basis, net of the reduction already experienced through 2013, the impact on the Summer peak from these energy efficiency codes and standards is expected to reach 1,997 MW in 2023. By 2023, the Winter peak is expected to be reduced by 1,689 MW as result of the cumulative impact from these energy efficiency standards since 2005. On an incremental basis, net of the reduction already experienced through 2013, the impact on the Winter peak from these energy efficiency standards is expected to reach 1,065 MW in 2023.

The forecast was also adjusted for additional load estimated from hybrid vehicles which results in an expected increase of approximately 443 MW in the Summer and 221 MW in the Winter by the end of the ten-year reporting period and for the acquisition of the Vero Beach electric system. The Vero Beach acquisition will add 169 MW to the Summer peak, and 179 MW to the Winter peak, forecast by the end of the ten-year reporting period.

The forecasting methodology of Summer, Winter, and monthly system peaks is discussed below. The forecasted values for Summer and Winter peak loads for the years 2014 – 2023 are presented at the end of this chapter in Schedules 3.1 and 3.2, and in Chapter III in Schedules 7.1 and 7.2.

1. System Summer Peak

The Summer peak forecast is developed using an econometric model. The variables included in the model are the price of gasoline, lagged one month, Florida real household disposable income, cooling degree-hours two days prior to the peak day, the maximum temperature on the day of the peak, a variable for energy efficiency standards, and a moving average term. The model is based on the Summer peak contribution per customer which is multiplied by total customers (excluding the customers that have been served by Vero Beach), and adjusted to account for incremental loads resulting from hybrid vehicles, new wholesale contracts, the Vero Beach acquisition, and FPL's economic development riders to derive FPL's system Summer peak.

2. System Winter Peak

Like the system Summer peak model, this model is also an econometric model. The model consists of three weather-related variables: the average temperature on the peak day, heating degree-hours for the prior day squared, and heating degree-hours two days prior to the peak day. The model also includes two dummy variables; one for Winter peaks occurring on weekends and one for winter peaks with minimum temperature below 40.5 degrees. Also included in the model are a variable for housing starts per capita, and an autoregressive term. The forecasted results are adjusted for the impact of energy efficiency standards. The model is based on the Winter peak contribution per customer which is multiplied by total customers (excluding the customers that have been served by Vero Beach), and then adjusted for the expected incremental loads resulting from hybrid vehicles, new wholesale contracts, the Vero Beach acquisition, and FPL's economic development riders.

3. Monthly Peak Forecasts

The forecasting process for monthly peaks consists of the following steps:

a. The forecasted annual summer peak is assumed to occur in the month of August. The month of August has historically accounted for more annual summer peaks than any other month.

b. The forecasted annual winter peak is assumed to occur in the month of January. The month of January has historically accounted for more annual winter peaks than any other month.

c. The remaining monthly peaks are forecasted based on the historical relationship between the monthly peaks and the annual summer peak.

II.F. The Hourly Load Forecast

Forecasted values for system hourly load for the period 2014 - 2023 are produced using a System Load Forecasting “shaper” program. This model uses years of historical FPL hourly system load data to develop load shapes for weekdays, weekend days, and holidays. The model generates a projection of hourly load values based on these load shapes and the forecast of monthly peaks and energy.

II.G. Uncertainty

In order to address uncertainty in the forecasts of aggregate peak demand and NEL, FPL first evaluates the assumptions underlying the forecasts. FPL takes a series of steps in evaluating the input variables, including comparing projections from different sources, identifying outliers in the series, and assessing the series’ consistency with past forecasts. As needed, FPL reviews additional factors which may affect the input variables.

Uncertainty is also addressed in the modeling process. Generally, econometric models are used to forecast the aggregate peak demand and NEL. During the modeling process, the relevant statistics (goodness of fit, F-statistic, P-values, mean absolute deviation (MAD), mean absolute percentage error (MAPE), etc.) are scrutinized to ensure that the models adequately explain historical variation. Once a forecast is developed, it is compared with past forecasts. Deviations from past forecasts are examined in light of changes in input assumptions to ensure that the drivers underlying the forecast are well understood. Finally, forecasts of aggregate peak demand and NEL are compared with the actual values as these become available. An ongoing process of variance analyses is performed. To the extent that the variance analysis identifies large unexplained deviations between the forecast and actual values, revisions to the econometric model may be considered.

The inherent uncertainty in load forecasting is addressed in different ways in regard to FPL’s overall resource planning and operational planning work. In regard to FPL’s resource planning work, FPL’s utilization of a 20% total reserve margin criterion, and a 10% generation-only reserve margin criterion, are designed to maintain reliable electric service to FPL's customers in light of forecasting (and other) uncertainty. In addition, banded forecasts of the projected Summer peak and net energy for load are produced based on an analysis of past forecasting variances. In regard to operational planning, a banded forecast for the projected Summer and Winter peak days is developed based on the historical weather variations. These bands are then used to develop similar bands for the monthly peaks.

II.H. DSM

The effects of FPL's DSM energy efficiency programs implementation through August 2013 are assumed to be imbedded in the actual usage data for forecasting purposes. The impacts of incremental energy efficiency that FPL plans to implement in the future, plus the cumulative and projected incremental impacts of FPL's load management programs, are accounted for as "line item reductions" to the forecasts as part of the IRP process as shown in Chapter III in Schedules 7.1 and 7.2. After making these adjustments to the load forecasts, the resulting "firm" load forecast is then used in FPL's IRP work.