

Appendix A. Peak Demand and Annual Consumption Forecast 7610.0320 – Subparts 1, 2, 3, 4 and 5

Forecast Methodology

Overall Methodological Framework

Xcel Energy prepares its forecast by major customer class and jurisdiction, using a variety of statistical and econometric techniques. The NSP System serves five jurisdictions. Minnesota, North Dakota and South Dakota are served by Northern States Power Company. Wisconsin and Michigan are served by Northern States Power Company, a Wisconsin corporation (NSPW). The overall methodological framework is “model oriented”. The NSP and NSPW Systems operate as an integrated system. The forecast is referred to as the 2010 IRP Forecast (August 2010).

Specific Analytical Techniques

1. Econometric Analysis. Xcel Energy uses econometric analysis to develop jurisdictional MWh sales forecasts at the customer meter for the following sectors:
 - a. Residential without Space Heating;
 - b. Residential with Space Heating;
 - c. Small Commercial and Industrial;
 - d. Large Commercial and Industrial.Xcel Energy also uses econometric analysis to develop the total system MW demand forecast.
2. Trend analysis is used for the “Other” sectors, which includes Public Street and Highway Lighting, Other Sales to Public Authorities, Interdepartmental sales, and Municipals (firm Wholesale).
3. Loss Factor Methodology. Loss factors by jurisdiction are used to convert the sales forecasts into system energy requirements (at the generator).
4. Judgment. Judgment is inherent to the development of any forecast. Whenever possible, Xcel Energy uses quantitative models to structure its judgment in the forecasting process.

The sales forecasts are estimates of MWh levels measured at the customer meter. They do not include line or other losses. The various jurisdictional class forecasts are summed to yield the total system sales forecast. Native energy requirements are measured at the generator and include line and other

losses. Xcel Energy creates native energy requirements based on the sales forecasts. A system loss factor for each jurisdiction, developed based on average historical losses, is applied to the jurisdictional sales forecast to calculate total losses. The sum of the jurisdictional MWh sales and losses equals native energy requirements. The native energy requirements, along with peak producing weather and binary variables, are then used as independent variables within an econometric model to forecast MW peak demand for the Xcel Energy North System.

Models Used

1. Residential Econometric Models. Sales to the residential sectors represent 28.2% of its total NSP System electric sales in 2009. Residential sales are divided into with space heating and without space heating customer classes for each jurisdiction. Ordinary Least Squares models using historical data are developed for each residential sector. A variety of independent variables are used in the models, including:
 - Number of customers;
 - Gross Metro Product for respective jurisdiction;
 - Actual heating and temperature humidity index (THI) degree days;
 - Number of monthly billing days.
2. Small Commercial and Industrial Econometric Models. The small commercial and industrial sector represents 42.2% of NSP System electric sales in 2009. The models are ordinary least squares regressions using historical data. The models include a combination of variables, including the following:
 - Number of small commercial and industrial customers;
 - Gross Metro Product for respective jurisdiction;
 - Employment for respective jurisdiction;
 - Actual heating and temperature humidity index (THI) degree days;
3. Large Commercial and Industrial Econometric Models. Sales to the large commercial and industrial sector represent 25.9 % of NSP System electric sales in 2009. The models are OLS regressions using historical data and a combination of variables, including the following:
 - Industrial Production for respective jurisdiction;
 - Employment for respective jurisdiction;
 - Number of monthly billing days;
 - Indicator variables such as CI reclassification.

4. Others. Sales to the “Others” sector represent 0.7 % of NSP System electric sales in 2009. This sector includes Public Street and Highway Lighting (PSHL), Sales to Public Authorities (OSPA) and Interdepartmental (IDS) sales. Because this class represents a very small portion of the total sales, trend analysis is used and very little growth is forecast.
5. Municipals. Sales to the Municipal utility sector represent 3.0 % of NSP System electric sales in 2009. The municipal class is forecast using separate trend analysis at the individual customer level for NSP and NSPW. The forecast of these municipal customers only includes firm wholesale customer usage.
6. Peak Demand Model. An econometric model is developed to forecast base peak demand for the entire planning period. The model includes a combination of variables, including the following:
 - Weather normalized native energy requirements
 - Peak producing weather by month
 - Binary variables

Methodology Strengths and Weaknesses

The strength of the process Xcel Energy uses for this forecast is the richness of the information obtained during the analysis. Xcel Energy’s econometric forecasting models are based on sound economic and statistical theory. Historical modeling and forecast drivers are based on economic and demographic variables that are easily measured and analyzed. The use of models by class and jurisdiction gives greater insight into how the NSP System is growing, thereby providing better information for decisions to be made in the areas of generation, transmission, marketing, conservation, and load management.

With respect to accuracy, forecasts of this duration are inherently uncertain. Planners and decision makers must be keenly aware of the inherent risk that accompanies long-term forecasts. They must also develop plans that are robust over a wide range of future outcomes.

Data Definitions

The following is a list of definitions of the variables considered in Xcel Energy’s econometric models.

Jurisdiction Abbreviations

M or MN	State of Minnesota
N or ND	State of North Dakota
S or SD	State of South Dakota
W or WI	State of Wisconsin
Mi or MI	State of Michigan

Monthly MWh Sales Series

SLSReswo(Juris)	Residential without space heating for given jurisdiction
SLSResSH(Juris)	Residential with space heating for given jurisdiction
SLSSmCI(Juris)	Small commercial and industrial for given jurisdiction
SLSLgCI(Juris)	Large commercial and industrial for given jurisdiction

Monthly Customer Series

CustReswo(Juris)	Residential without space heating for given jurisdiction
CustResSH(Juris)	Residential with space heating for given jurisdiction
CustSmCI(Juris)	Small commercial and industrial for given jurisdiction
CustLgCI(Juris)	Large commercial and industrial for given jurisdiction

Monthly Economic and Demographic Series

(Juris)HH	Number of Households in given jurisdiction
GMP(MSA)	Gross Metro Product for given metropolitan statistical area
GSP(State)	Gross State Product for given state
EE_(Juris)	Total Employment in given jurisdiction
EEGOV_(Juris)	Total Government Employment in given jurisdiction
IPMFG_(Juris)	Industrial Production Index - manufacturing in given jurisdiction
IPSB0004_US	Industrial Production – United States
CYPNR_(Juris)	Real per capita Personal Income in given jurisdiction

(Juris)TotRes_RAP Real Average Price for electric sales to residential customers

Monthly Data Variables used in Demand Model

THI12(Month)Cust Temperature Humidity Index @12:00 noon on the peak day multiplied by total retail customers

THI12_LAG1(Month)Cust Temperature Humidity Index @12:00 noon on the day before the peak day multiplied by total retail customers.

THI15(Month)Cust Temperature Humidity Index @15:00 (3:00 PM) on the peak day multiplied by total retail customers

HDD(Season) Normal Heating Degree Days on the day of the Peak multiplied by a binary variable for the season (winter - Wtr, shoulder month - sh)

AvgTemp_Cust Average Temperature on the peak day multiplied by total retail customers

DaysOver90(Month) cumulative days over 90 for the calendar year as of the monthly peak day

WNActEnergy_LpYrAdj_12MoSum 12 month rolling sum of the weather normalized net energy requirements adjusted to remove the effect of leap years

MfgSlowdown An index based on Industrial (Manufacturing) Production and Manufacturing Employment

Monthly Weather Variables

H65_bill (Juris)(Month) HDD base 65 for given jurisdiction and month

T65_bill(Juris)(Month) THI DD base 65 for given jurisdiction and month

Other Monthly Variables

BillDaysCellnet21 Billing Month Days

Monthly Binary Variables

Jan Binary variable for the month of January

Feb Binary variable for the month of February

Mar Binary variable for the month of March

Apr	Binary variable for the month of April
May	Binary variable for the month of May
Jun	Binary variable for the month of June
Jul	Binary variable for the month of July
Aug	Binary variable for the month of August
Sep	Binary variable for the month of September
Oct	Binary variable for the month of October
Nov	Binary variable for the month of November
Dec	Binary variable for the month of December

Xcel Energy uses internal and external data to create its MWh sales and MW peak demand forecast.

Historical MWh sales are taken from Xcel Energy’s internal company records, fed by its billing system. Historical coincident net peak demand data is obtained through company records. The load management estimate is added to the net peak demand to derive the base peak demand.

Through 2007 weather data (dry bulb temperature and dew points) were collected from a respected local meteorologist (Mr. Frank Watson) for the Minneapolis/St. Paul, Fargo, Sioux Falls, and Eau Claire areas. Beginning in 2008 weather data has been collected from weatherunderground.com for the same locations. The heating degree-days and THI degree-days are calculated internally based on this weather data.

Economic and demographic data is obtained from the Bureau of Labor Statistics, U.S. Department of Commerce, and the Bureau of Economic Analysis. Typically they are accessed from Global Insight, Inc. data banks, and reflect the most recent values of those series at the time of modeling.

Demand-Side Management Programs

The regression model results for the residential and commercial and industrial classes are reduced to account for the expected incremental impacts of demand-side management (“DSM”) programs. A monthly forecast of the impact of new DSM programs (excluding Saver’s Switch) is developed by Xcel Energy’s DSM Regulatory Strategy and Planning Department. The impacts are converted by class from calendar month energy to billing month sales volumes. The resulting sales volumes are used to reduce the class level sales forecasts that result from the regression modeling process. Impacts from all program

installations through 2009 are assumed to be imbedded in the historical data, so only new program installations are included in the DSM adjustment.

An additional adjustment was made to the current forecast to account for new federally mandated efficiency standards for business cooling. This new standard supplants DSM programs the Company previously had in place, which reduces the amount of Business DSM. However, the standards have not been in place long enough to be reflected in actual sales data used in the development of the forecast. The solution to this problem was to adjust forecasted Commercial/Industrial sales downward to incorporate the effect of the new standards.

The Company's Saver's Switch program results in short-term interruptions of service designed to reduce system capacity requirements rather than permanent reductions in energy use, so it is not considered here.

Overview of Probability Distributions

Xcel Energy uses a straightforward extension of the peak demand econometric model to assess risk around the expected value of the peak demand by conducting a Monte Carlo simulation on the main drivers of the peak model (weather and native energy requirements). For the Monte Carlo energy probability distribution model, the main drivers are weather and Minnesota Households (HH_MN).

The Monte Carlo stochastic simulation of peak demand (MW) or (energy (MWh)) involves taking 10,000 random draws from the weather probability distributions as well as 10,000 draws from the 12-month sum of energy probability distribution (or HH_MN probability distribution), which, in turn, produces 10,000 forecasts of peak demand (or energy), and thus generates a probability distribution around the mean peak demand (or mean energy).

For example, if the econometric model forecasts that the mean peak demand for 2022 is 10,586 MW, then using the same econometric model, the Monte Carlo simulation method forecasts that there is a 90% probability that the 2022 peak demand will be less than 11,911 MW, or alternatively, a 10% chance that the peak will be less than 9,240 MW.

In summary, the Monte Carlo stochastic simulation method adequately captures the effect of extreme weather on monthly peak demand and monthly

energy usage, while preserving the expected value or mean forecast of peak demand and energy.

Data Adjustments and Assumptions

1. Weather Adjustments. Xcel Energy adjusts the monthly weather data to reflect billing schedules. Therefore, the monthly weather data corresponds exactly with the billing month schedule.
2. Economic Adjustments. All price data and related economic series are deflated to 2000 constant dollars.

Assumptions and Special Information

The data used in Xcel Energy's forecasting process has already been discussed in a general way. Descriptions and citations of sources for the data sets have been mentioned within this documentation under different sections.

Xcel Energy believes that its process is a reasonable and workable one to use as a guide for its future energy and load requirements. The underlying assumptions used to prepare Xcel Energy's median forecast are as follows:

1. Demographic Assumption. Population or household projections are essential in the development of the long-range forecast. The forecasts of customers are derived from population and household projections provided by Global Insight, Inc., and reviewed by Xcel Energy staff. Xcel Energy customer growth mirrors demographic growth over the forecast period.
2. Weather Assumption. Xcel Energy assumes "normal" weather in the forecast horizon. Normal weather is defined as the average weather pattern over the 20-year period from 1990-2009. The variability of weather is an important source of uncertainty. Xcel Energy's energy and peak demand forecasts are based on the assumption that the normal weather conditions will prevail in the forecast horizon. Weather-related demand uncertainties are not treated explicitly in this forecast.
3. Loss Factor Assumptions. The loss factors are important to convert the sales forecast to energy requirements. Xcel Energy uses a historical average loss factor for each jurisdiction, and assumes it will not change in the future.

Forecast Coordination

Xcel Energy reports its energy and peak demand forecasts to the Midwest ISO (MISO). MISO then combines the forecasts of all its member utilities. Xcel Energy also reports its forecast to the Public Service Commission of Wisconsin as part of its Strategic Energy Assessment (SEA) process. In this process, the Wisconsin portion of the total Xcel Energy system load is combined with other Wisconsin electric utilities to form a statewide Wisconsin forecast.