2015 MISO Independent Load Forecast

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Executive Summary

This report represents the second in a series of independent 10-year load forecasts the State Utility Forecasting Group (SUFG) has prepared for the Midcontinent Independent System Operator (MISO). These forecasts project annual MISO regional energy demand for the ten MISO local resource zones (LRZs), regional winter and summer seasonal peak loads and MISO system-wide annual energy and peak demands. This forecast does not attempt to replicate the forecasts that are produced by MISO's load-serving entities (LSEs). It would not be appropriate to infer a load forecast for an individual LSE from this forecast.

Econometric models were developed for each state to project annual retail sales of electricity. Forecasts of metered load at the LRZ level were developed by allocating the portion of each state's sales to the appropriate LRZ and adjusting for estimated distribution system losses. LRZ seasonal peak demand projections were developed using conversion factors, which translated annual energy into peak demand based on historical observations assuming normal weather conditions. The LRZ peak demand forecasts are on a non-coincident basis. MISO system level projections were developed from the LRZ forecasts. For the seasonal MISO peak demands, coincidence factors were used. Energy efficiency, demand response, and distributed generation (EE/DR/DG) adjustments were made at the LRZ level based on a study of those factors performed by Applied Energy Group for MISO. Results are provided with and without the adjustments.

The state econometric models were developed using publicly available information for electricity sales, prices for electricity and natural gas, personal income, population, employment, gross state product, and cooling and heating degree days. Economic and population projections acquired from IHS Global Insight (IHS) and price projections developed by SUFG were used to produce projections of future retail sales. Weather variables were held constant at their 30-year normal values. Table ES-1 provides the compound annual growth rates (CAGR) for the state energy forecasts.

Table ES-1 State Retail Sales (without EE/DR/DG Adjustment) Growth Rates (2016-2025)

State	CAGR
Arkansas	1.00
Illinois	0.63
Indiana	1.29
Iowa	1.60
Kentucky	1.09
Louisiana	1.87
Michigan	0.88
Minnesota	1.67
Mississippi	1.76
Missouri	1.18
Montana	1.82
North Dakota	1.08
South Dakota	2.02
Texas	1.91
Wisconsin	1.49

LRZ level energy forecasts were developed by allocating the state energy forecasts to the individual LRZs on a proportional basis. EE/DR/DG adjustments were made at the LRZ level. Additionally, losses associated with the distribution system were added to produce a forecast at the metered load level. Table ES-2 provides the growth rates for the LRZ energy forecasts without and with the EE/DR/DG adjustment.

Table ES-2 LRZ Metered Load Growth Rates (2016-2025)

LRZ	CAGR (without EE/DR/DG adjustment)	CAGR (with EE/DR/DG adjustment)
1	1.63	1.46
2	1.45	1.32
3	1.56	1.10
4	0.63	0.27
5	0.97	0.57
6	1.18	0.96
7	0.88	0.66
8	1.00	0.84
9	1.88	1.80
10	1.76	1.68

LRZ summer and winter non-coincident peak demand projections were developed using conversion factors that are based on normal weather conditions and are determined from historical relationships between average hourly load for the year, summer and winter peak levels for the year, and weather conditions at the time of the peak demand. Since these conversion factors are held constant for the forecast period, the LRZ peak demand projections without the EE/DR/DG adjustment have the same growth rates as the energy projections in Table ES-2.[1] The compound annual growth rates of the LRZ non-coincident peak demand projections with the EE/DR/DG adjustment are shown in Table ES-3.

Table ES-3 LRZ Non-coincident Peak Demand (with EE/DR/DG adjustment) Growth Rates (2016-2025)

LRZ	CAGR (with EE/DR/DG adjustment on non-coincident peak)	CAGR (with EE/DR/DG adjustment on non-coincident peak)
	Summer	Winter
1	1.30	1.24
2	1.25	1.19
3	0.85	0.67
4	0.15	0.02
5	0.45	0.34
6	0.80	0.76
7	0.55	0.41
8	0.60	0.52
9	1.72	1.71
10	1.65	1.63

MISO system-wide energy and peak demand projections were developed from the LRZ-level projections. Since each LRZ does not experience its peak demand at the same time as the others (or as the entire MISO system), the MISO coincident peak demand is less than the arithmetic sum of the individual LSE non-coincident peak demands. The MISO system coincident peak demand is determined by applying coincidence factors to the

[1] It should be noted that if customer sectors grow at different rates, the assumption that energy and peak demand will grow at the same rate is unlikely to hold true. However, there has been very little long-term change in the relationship between energy and peak demand in the MISO region, with weather variations having a much larger impact.

individual LRZ non-coincident peak demands and summing. These coincidence factors represent the ratio of the LRZ's load at the time of the overall MISO system peak to the LRZ's non-coincident peak. Separate coincidence factors were developed for the summer and winter peaks. Since coincidence is not a factor for annual energy, the MISO energy projections are found from the simple sum of the individual LSEs. Table ES-4 provides the compound average growth rates for the MISO energy and peak demand forecasts on a gross and net basis.

Table ES-4. MISO Energy and Seasonal Peak Demand Growth Rates (2016-2025)

MISO-System	Gross CAGR (without EE/DR/DG adjustment)	Net CAGR (with EE/DR/DG adjustment)
Energy	1.33	1.12
Summer Peak Demand	1.30	0.97
Winter Peak Demand	1.32	0.91

Additionally, alternate 90/10 (High/Low) forecasts were developed. Table ES-5 provides the compound annual growth rates for net (with the EE/DR/DG adjustment) energy and seasonal peaks.

Table ES-5: Net MISO System Growth Rates for Alternate Forecasts (2016-2025)

	Base	High	Low
Energy	1.12	1.56	0.58
Summer Peak	0.97	1.44	0.39
Winter Peak	0.91	1.40	0.31

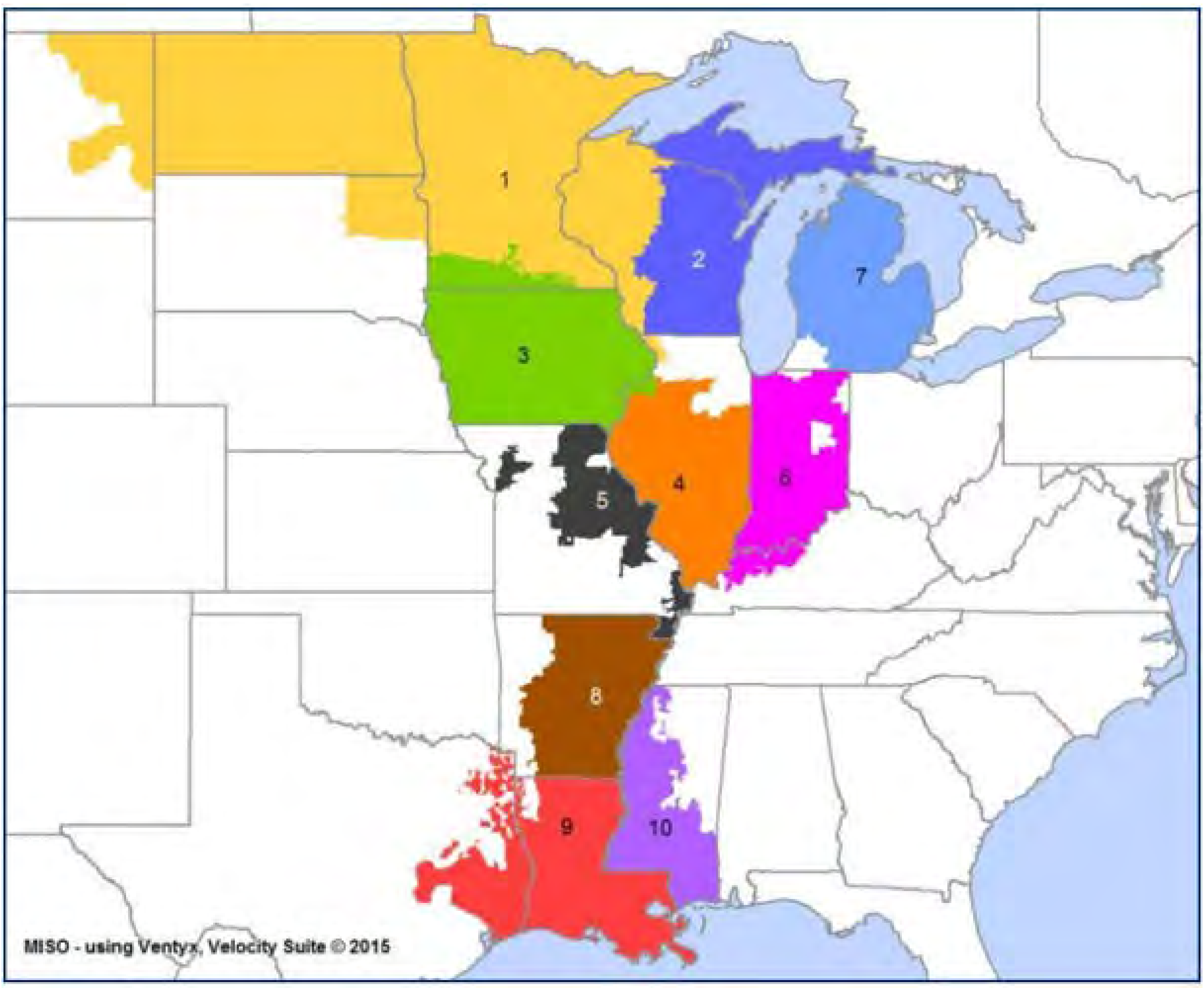
1 Introduction

This report represents the second in a series of independent 10-year load forecasts the State Utility Forecasting Group (SUFG) has prepared for the Midcontinent Independent System Operator (MISO). These forecasts project annual MISO regional energy demand for the ten MISO local resource zones (LRZs), regional winter and summer seasonal peak loads and MISO system-wide annual energy and peak demands. This forecast does not attempt to replicate the forecasts that are produced by MISO's load-serving entities (LSEs). It would not be appropriate to infer a load forecast for an individual LSE from this forecast.

1.1 OVERVIEW

MISO's market footprint consists of a number of individual Local Balancing Authorities (LBAs). It covers all or parts of 15 states and is divided into 10 LRZs. Figure 1 displays MISO's market footprint at the LRZ level.

Figure 1: MISO 2015 Planning Year LRZ Map



Source: MISO, 2015

Econometric models were developed for each state to project annual retail sales of electricity. Forecasts of metered load at the LRZ level were developed by allocating the portion of each state's sales to the appropriate

LRZ and adjusting for estimated distribution system losses. LRZ seasonal peak demand projections were developed using conversion factors, which translated annual energy into peak demand based on historical observations assuming normal weather conditions. The LRZ peak demand forecasts are on a non-coincident basis. MISO system level projections were developed from the LRZ forecasts. For the seasonal MISO peak demands, coincidence factors were used. Energy efficiency, demand response, and distributed generation (EE/DR/DG) adjustments were made at the LRZ level based on a study of those factors performed by Applied Energy Group for MISO. Results are provided with and without the adjustments.

1.2 REPORT STRUCTURE

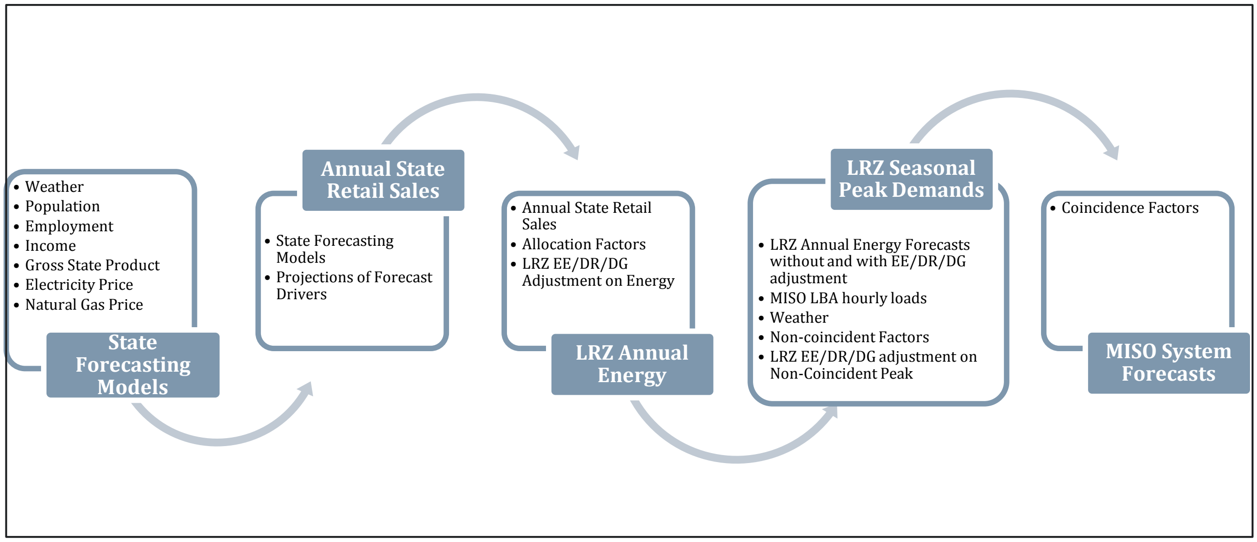
In this report, Chapter 2 explains the forecasting methodology at a high level and provides the data sources. Chapter 3 covers the econometric forecasting models developed for each state and the resulting forecasts of annual statewide retail sales. Chapter 4 explains the process for allocating the state energy forecasts to LRZ-level forecasts and provides those forecasts without and with EE/DR/DG adjustments. The methodology and results for determining LRZ-level seasonal peak demands are in Chapter 5. The MISO system-wide results are incorporated in Chapter 6. Appendices are provided that include the state econometric models, peak demand models and alternate higher and lower projections.

2 Forecasting Methodology

2.1 OVERVIEW

This study employed a multi-step approach to forecast annual energy and seasonal peak demand at the MISO LRZ and system-wide levels. Econometric models were built for each state to forecast retail sales for a 10-year period. These statewide energy forecasts were used to construct annual energy forecasts at the LRZ level, while accounting for the fraction of statewide load that is a part of each LRZ. The LRZ annual energy forecasts were used, in turn, to develop seasonal non-coincident peak demand projections for each LRZ. The LRZ coincident peak projections were used to create the MISO system-wide peak demand projections. The overall process flow chart is illustrated in Figure 2 below. It shows the five major steps in the process and the key inputs at each step.

Figure 2: Process Flow Chart



2.2 STATEWIDE ANNUAL ELECTRIC ENERGY FORECASTS

Econometric models of retail electricity sales were developed for each state using statewide historical data to determine the appropriate drivers of electricity consumption and the statistical relationship between those drivers and energy consumption. SUFG developed numerous possible model specifications for each state and selected models that had a good fit (significant t-statistics, high R-squared, and a significant F-statistic), that passed the statistical tests (heteroskedasticity and serial correlation), and had a set of drivers that included at least one driver that was tied to overall growth in the state (such as population, employment, or GSP). The model formulations for each state are provided in APPENDIX A.

2.3 RETAIL SALES VS. METERED LOAD VS. RESOURCE NEEDS

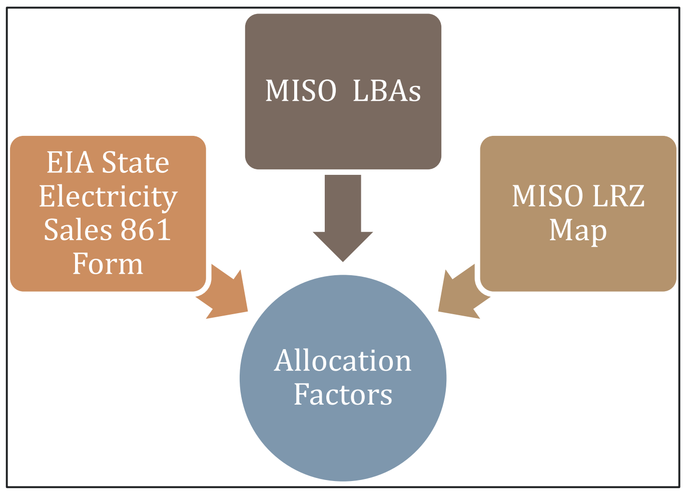
The state-level forecasts represent annual (calendar year) retail sales (electricity usage at the customer locations). This is driven by data availability, since statewide historical sales are available from the U.S. Department of Energy's Energy Information Administration (EIA). The LRZ-level forecasts are at the metered level (in essence, loads at the substations where the transmission network operated by MISO connects to the local distribution systems). The difference between the two is caused by losses between the substations and customers.[2] Thus, an adjustment was made to convert retail sales forecasts to metered loads. This was accomplished by comparing historical EIA sales data for the utilities in an LRZ to historical metered data at the LBA level provided by MISO.

While the LRZ and MISO system projections (both energy and peak demand) are at the metered level, when determining resource needs from the peak demand projections, it may be more appropriate to include the losses associated with the transmission system between the generators and the substations,[3] since sufficient resources will be needed to provide for loads and all system losses. The annual energy forecasts at the state-level are for retail sales. For the LRZ-level forecasts, metered loads are provided. The MISO system-wide coincident peak demands have not been converted to the resource need level because SUFG has not acquired the necessary data for LRZs 9 and 10. Thus, the MISO system-wide projections are at the metered load level.

2.4 LRZ ENERGY FORECASTS

The LRZ annual energy forecasts were produced after the individual state annual forecasts were developed. This was done by allocating the fraction of each state's load to the appropriate LBA within that state (herein referred to as the load fraction) and summing across the various LBAs within each LRZ (Figure 3). Since not all regions within a state experience load growth at the same rate, the load fraction of each state may change over time. The historical load fractions of each state were calculated and used to estimate the future allocation factors. Additional adjustments also have been made to account for LBAs that operate in more than one state. In these cases, the market share of the LBA's load in each state within its service territory has been calculated in order to determine its load fraction for that state. In addition, the distribution losses of each LRZ were incorporated. A comparison between the MISO annual metered loads and retail sales was made to estimate the distribution losses. The MISO system-wide energy forecast was obtained by summing the LRZ annual energy forecasts.

Figure 3: Structure and Logic Diagram for Allocation Factors



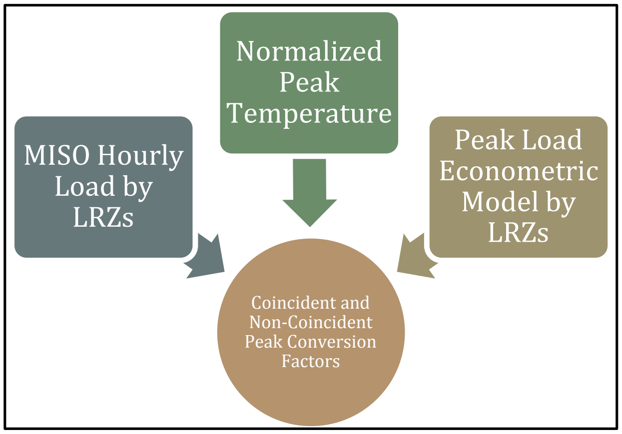
In addition, EE/DR/DG adjustments to the LRZ energy forecasts were made based on a study of those factors performed by Applied Energy Group for MISO. Both adjusted and non-adjusted projections are provided at the LRZ level.

[2] These losses occur mainly in the distribution system of the load serving entities and may include some low voltage transmission lines that are not under MISO operation. They are referred to as distribution losses herein.

[3] These are referred to here as transmission losses, even though they exclude those low voltage transmission losses that are included in distribution losses (see previous footnote).

2.5 LRZ NON-COINCIDENT PEAK DEMAND FORECASTS

Figure 4: Structure and Logic Diagram for Peak Conversion Factors



The non-coincident peak demand forecasts were estimated based on load factors calculated using historical hourly load data of each LRZ provided by MISO. The structure and logic diagram in Figure 4 illustrates the resources employed in estimating the peak conversion factors. Peak load conversion factors were used to translate annual electricity sales forecasts at the LRZ level to summer and winter non-coincident peak demands. These conversion factors were determined from historical relationships between average hourly load for the year, summer/winter peak levels for the year, and weather conditions at the time of the peak demand.

2.6 MISO-LEVEL FORECASTS

The non-coincident LRZ peak demand projections were converted to MISO-level coincident peak demands using historical average coincidence factors. The coincidence factor for each LRZ is determined at the time of the MISO system-wide peak demand using the LRZ's demand at the time of the MISO-wide (coincident) peak demand and at the time of the LRZ's individual (non-coincident) peak demand. The coincidence factor is generally a number slightly less than 1. The MISO system-wide peak demand forecast was obtained by summing the adjusted LRZ peak demands. Since coincidence is not an issue with annual energy, the MISO system-wide annual energy forecast is the arithmetic sum of the LRZ annual energy forecasts.

2.7 DATA SOURCES

Historical annual energy sales data by state are available from EIA. Historical population data for each state were obtained from IHS Global Insight (IHS). Historical macroeconomic data, such as personal income, gross domestic product and employment data, are available on a state-by-state basis from the IHS. Actual heating and cooling degree days on a 65 degree Fahrenheit basis for all 15 states were acquired monthly and annually from the National Oceanic and Atmospheric Administration's (NOAA) National Climate Data Center (NCDC). Hourly temperature records were acquired from Midwest Regional Climate Center (MRCC). Table 1 summarizes the sources of data used in this study.

Table 1: Data sources

Data	Content	Source for Historical Data	Data Used in Projection
Electricity sales	GWh, annual retail electricity sales by state, 1990-2013	EIA	N/A
Electricity prices	Cents/KWh, nominal	EIA*	EIA Annual Energy Outlook
Natural gas prices	$/million Btu, nominal	EIA*	EIA Annual Energy Outlook
Real personal income	Thousands of 2009 dollars, 1970-2014	IHS*	IHS Global Insight
Population	Number of people, population by state, 1990-2013; Number of people, population by county, 1990-2013	IHS	IHS Global Insight
Manufacturing employment	Number of jobs, 1990-2014	IHS	IHS Global Insight
Non-manufacturing employment	Number of jobs, 1990-2014	IHS	IHS Global Insight
Non-farm employment	Number of jobs, 1990-2014	IHS	IHS Global Insight
Gross state product	Millions of chained 2009 dollars, 1990-2014	IHS	IHS Global Insight
Cooling degree days (CDD)	Summations of monthly cooling degree days base 65°F, 1970-2014	NOAA	NOAA 30-year normal
Heating degree days (HDD)	Summations of monthly heating degree days base 65°F, 1970-2014	NOAA	NOAA 30-year normal
Hourly Temperature	Historical hourly temperature of selected weather stations, 1997-2014	MRCC	Normalized Temperature for Seasonal Peak Analysis

** Original data was in nominal dollars. SUFG converted it to real 2009 dollars using state level CPI from IHS Global Insight.*

2.8 MODELING REFINEMENTS

For this year, SUFG undertook a number of model refinements, which were chosen by MISO stakeholders. These include improving the modeling of EE/DR/DG, incorporating multiple weather stations in the state econometric models, developing confidence intervals that capture uncertainty around the macroeconomic variables, incorporating more information in the conversion of annual energy forecasts to peak demand forecasts, and incorporating a new LRZ (LRZ 10).

2.8.1 EE/DR/DG Adjustments

Last year, energy efficiency adjustments were done at the individual state level and were based on various state goals and mandates. This year, the economic potential for energy efficiency, demand response, and distributed generation from the Applied Energy Group study were input to the EGEAS model. The amount selected by EGEAS was used for the adjustment.

2.8.2 Multiple Weather Stations

Since the values for annual CDD and HDD at different weather stations are highly correlated, SUFG was unable to develop reasonable state econometric models with more than one weather station. Thus, in order to better capture the relationship between weather and electricity demand, virtual weather stations were developed.

The virtual weather station for a state uses population-weighted average CDD and HDD from two or more weather stations in that state. Table 2 lists the weather stations used to develop each state's virtual weather station.

Table 2: Weather Stations for State Econometric Models

State	State	Station 1	Station 2	Station 3	Station 4
AR	Arkansas	North Little Rock Airport	Harrison Boone Co Airport		
IA	Iowa	Waterloo Municipal Airport	Des Moines International Airport		
IL	Illinois	Springfield Abraham Lincoln Capital Airport	Carbondale Sewage Plant	Chicago O'Hare International Airport	
IN	Indiana	Evansville Regional Airport	South Bend Michiana Regional Airport	Indianapolis International Airport	
KY	Kentucky	Paducah Barkley Regional Airport	Lexington Bluegrass Airport		
LA	Louisiana	New Orleans International Airport	Shreveport Regional Airport		
MI	Michigan	Grand Rapids Gerald R Ford International Airport	Munising	Detroit City Airport	
MN	Minnesota	Minneapolis St Paul International Airport	Duluth International Airport		
MO	Missouri	St Louis Lambert International Airport	Kansas City International Airport	Springfield Regional Airport	
MS	Mississippi	Jackson International Airport	Tupelo Regional Airport	Hattiesburg	
MT	Montana	Billings International Airport	Missoula International Airport		
ND	North Dakota	Bismarck Municipal Airport	Fargo Hector International Airport		
SD	South Dakota	Rapid City Regional Airport	Sioux Falls Foss Field		
TX	Texas	Houston William P Hobby Airport	Lubbock International Airport	San Antonio International Airport	Dallas Airport
WI	Wisconsin	Green Bay Austin International Airport	Milwaukee Mitchell International Airport	Madison Dane Co Regional Airport	

2.8.3 Energy to Peak Conversion

Last year, SUFG developed linear models of the relationship between temperature and load for hours with the highest winter and summer loads. This relied on a few sets of data points during each year. This year, a multiple regression approach was developed that used a significantly larger amount of available data. See Section 5.1 for more detailed information on the updated energy to peak conversion process.

2.8.4 Forecast Bands

In the 2014 MISO Independent Load Forecast, SUFG used statistical bands of the state econometric model to determine low and high forecasts of load. In essence, this assumes that there is no uncertainty in the projections of the model drivers that are treated as exogenous and that all uncertainty stems from the error in the estimated state models.

In the current forecast, SUFG takes into consideration uncertainties in the forecast drivers when estimating confidence intervals of forecast load. However, the approach is not the traditional one because IHS Global Insight does not provide confidence intervals for the projections of the model drivers. To overcome this, SUFG directly estimated the variances of the forecast drivers.

First, autoregressive models for the drivers other than cooling degree days (CDD) and heating degree days (HDD) in each state model are constructed. The reason the weather variables are not included is because the forecast is on a normal weather basis so there is no variation in the degree days over the forecast period. The autoregressive models are then estimated as a system using seemingly unrelated regression (SUR) based on historical data. By using SUR, it is assumed that uncertainties in the model drivers (other than CDD and HDD) are correlated within a state. (Note that a separate SUR analysis was performed for each state.) Second, the estimated simple autoregressive models are used to obtain forecast mean, lower bound and upper bound (based on a 90% confidence level) for each forecast period and each driver. Third, high and low projections for the model drivers are derived using the bounds from the autoregressive models and the mean from the IHS projections. That is, the difference between the high and mean from the autoregressive model is added to the IHS forecast to get the upper bound of IHS driver forecast and the difference between the mean and the low from the autoregressive model is subtracted from the IHS forecast to get the lower bound of IHS driver forecast for every forecast period. Thus, the auto-regressive driver models are only used to construct the confidence intervals for the forecast drivers, not the forecasts. The forecasts are still taken from IHS Global Insight. Finally, the new 90/10 forecasts of the drivers are used in the state econometric models to determine the high and low load forecasts. For each forecast period, the high for each IHS driver which has a positive coefficient in the state model and the low for the IHS driver which has a negative coefficient in the state model are combined with the estimated relationships to get the high forecast. Similarly, the low for each driver with a positive coefficient in the state model and the high for the driver with a negative coefficient in the state model are used to create the low forecast.

2.8.5 LRZ 10

Using updated data, SUFG developed LRZ-level forecasts that incorporate the new LRZ 10, as well as the new footprint for LRZ 9.

3 Statewide Annual Energy Forecasts

SUFG developed 15 econometric models of annual retail electricity sales for each of the MISO states.[4] The models are based on historical values for a variety of explanatory variables (or drivers), using Eviews, a statistical analysis program. The candidate variables and their data sources are provided in Table 3.

Table 3: Dependent and Explanatory Variables

Variables	Eviews Name	Data Source
Dependent variable:		
Electricity sales	ELECTRICITY_SALES	EIA
Explanatory variables:		
Electricity prices	REAL_ELECTRICITY_PRICE	EIA*
Natural gas prices	REAL_NATURAL_GAS_PRICE	EIA*
Real personal income	REAL_INCOME	IHS Global Insight*
Population	POPULATION	IHS Global Insight
Manufacturing employment	MANUFACTURING_EMP	IHS Global Insight
Non-manufacturing employment	NON_MANUFACTURING_EMP	IHS Global Insight
Non-farm employment	NON_FARM_EMP	IHS Global Insight
Gross state product	REAL_GSP	IHS Global Insight
Cooling degree days	CDD	NOAA/NCDC
Heating degree days	HDD	NOAA/NCDC

** Original data was in nominal dollars. SUFG converted it to real 2009 dollars using state level CPI from IHS Global Insight.*

Each state's electricity sales forecast was determined using projections of values for the applicable drivers for that state. Table 4 provides compound average growth rates for the explanatory variables over the forecast period (2016-2025). Empty cells in the table do not mean the growth rates are zero rather that the corresponding variable is not included in that state's model. Cooling degree days and heating degree days are held constant at their 30-year normal values per NOAA. The projections provided in Table 4 are from a macroeconomic forecast by IHS Global Insight, except the GSP forecast for Louisiana, the electricity price forecasts and the natural gas price forecasts. The approach used for the three exceptions will be explained in the following paragraphs.

[4] The Kentucky econometric model uses a load adjustment for the removal of a large load. The process is described subsequently.

Table 4: Explanatory Variable Compound Annual Growth Rates for the 2016-2025 Period (%)

Variables	AR	IL	IN	IA	KY	LA	MI	MN	MS	MO	MT	ND	SD	TX	WI
REAL_ELECTRICITY_PRICE	1.05	1.29	1.29	-0.03	-0.14	1.06	1.29	-0.03	-0.14	-0.01	0.56	-0.03	-0.01	1.06	1.29
REAL_NATURAL_GAS_PRICE			2.40	2.95	2.35			2.62			3.06	2.85	3.05	3.97	2.11
REAL_INCOME								2.64	2.56						
POPULATION					0.49					0.50			0.81		
REAL_INCOME/ POPULATION				1.94			1.80				2.01				
REAL_GSP	2.36	2.02	2.05	2.36		4.75	1.67		1.96					3.27	2.14
NON_MANUFACTURING_EMP										0.73		0.70			
MANUFACTURING_EMP											0.07				

The GSP forecast for Louisiana from IHS Global Insight was not used for the state's electricity sales forecast. Rather, the GSP forecast for the manufacturing sector of Louisiana was applied to drive the growth of GSP for future periods, which later was used for electricity sales projection. The reason for using this alternative approach is that IHS Global Insight forecasts modest growth in overall GSP (2.03%), largely due to lower expected oil and natural gas production caused by low market prices. Therefore, the growth in overall GSP does not well reflect the robust growth in the manufacturing industry (5.17%), which includes the petrochemical industry, a major sector of electricity consumption. The adopted method is more likely to capture the shift in the state from a non-electric intensive industry (drilling) to an electric intensive one.

Electricity price forecasts by state were obtained from IHS Global Insight for the SUFG's 2014 MISO Independent Load Forecast. However, for the 2015 MISO Independent Load Forecast, the IHS Global Insight no longer provides this information. Therefore, EIA's electricity price forecasts by census region were used to drive state electricity price forecasts. Annual electricity price forecasts by sector (residential, commercial, industrial and transportation) for the period of 2013 to 2025 were obtained from the EIA's Annual Energy Outlook 2015 (AEO 2015)[5] for the five census regions to which MISO states belong. The five census regions are East North Central (ENC), West North Central (WNC), East South Central (ESC), West South Central (WSC) and Mountain. Then state-specific electricity consumption shares by sector were applied to the corresponding regional electricity price forecasts by sector to calculate annual consumption-weighted average electricity prices for the period of 2013 to 2025 for each state. State-specific electricity consumption shares by sector were calculated based on annual retail sales of electricity by sector for each state[6] for the period from 2003 to 2014. In the case that consumption shares by sector are relatively stable over time based on historic data, they were averaged across the period of 2003 to 2014 and then were served as sectoral shares used for estimating the consumption-weighted average electricity prices. If apparent changes in sectoral shares were observed over time based on historic data, the averages across the most recent five years (2010 to 2014) were used. Annual consumption-weighted average electricity prices for each state estimated from EIA data drive the projection of electricity price by state.

Natural gas price forecasts by state were obtained from IHS Global Insight for the SUFG's 2014 MISO Independent Load Forecast. Since IHS Global Insight does not provide the data anymore, a methodology similar

[5] Data retrieved on Apt 22nd, 2015 from: http://www.eia.gov/beta/aeo/#/?id=3-AEO2015&cases=ref2015&region=1-4.

[6] Data retrieved on May 20th, 2015 from: http://www.eia.gov/electricity/data/browser/#/topic/5?agg=0,1&geo=vvvvvvvvvvvvo&endsec=vg&freq=M&start=200101&end=201402&ctype=linechart&ltype=pin&pin=&rse=0&maptype=0.

to the one used to forecast electricity price for the 2015 MISO Independent Load Forecast was applied to natural gas price forecasting. Annual natural gas price forecasts by sector (residential, commercial, and industrial) for the period of 2013 to 2025 were obtained from the EIA's Annual Energy Outlook 2015 (AEO 2015)[7] for the five census regions which MISO states belong to. Then state-specific natural gas consumption shares by sector were applied to the corresponding regional natural gas price forecasts by sector to calculate annual consumption-weighted average natural gas prices for the period of 2013 to 2025 for each state. State-specific natural gas consumption shares by sector were estimated based on annual natural gas delivered to consumers by sector and state[8] for the period from 1997 to 2014. In the case that consumption shares by sector are relatively stable over time based on historic data, they were averaged across the period of 1997 to 2014 and then were served as sectoral shares used for estimating the consumption-weighted average natural gas prices. If apparent changes in sectoral shares were observed over time based on historic data, the averages across the period of 2010 to 2014 were used. Annual consumption-weighted average natural gas prices for each state estimated from EIA data drive the projection of natural gas price by state.

For the state of Kentucky, SUFG observed a dramatic drop in electricity sales in 2013. This was caused by the closure of the Paducah Gaseous Diffusion Plant (PGDP) in mid-2013, which represents a 3 GW load on the Tennessee Valley Authority (TVA) system and accounts for more than 10% of the state's retail sales. With this large drop in load, SUFG could not fit an econometric model for the state. Therefore, the 2013 historical load was adjusted up to what it would have been with the PGDP operated at its full capacity. SUFG then developed the econometric model with the adjusted electricity load and used the econometric model to produce the load forecast. The PGDP load was subtracted from the forecast load at the final step.

Table 5 and Figures 5 through 19 provide the gross (or prior to any EE/DR/DG adjustments) state-level forecasts. The retail sales for the year 2014 are not actual observed values since EIA had not published those numbers at the time this report was written. Therefore, the state econometric models were used to "forecast" those values (as well as the 2015 numbers) to provide continuity between the historical data and the forecast period (2016 to 2025). SUFG will incorporate the 2014 actual values in the econometric model formulations for next year's process.

Figure 5 to Figure 19 illustrate the projections for each state.

[7] Data retrieved on Apr 22nd, 2015 from: http://www.eia.gov/beta/aeo/#/?id=3-AEO2015&cases=ref2015&region=1-4.

[8] Data retrieved on Apr 21st, 2015 from: http://www.eia.gov/dnav/ng/ng_cons_sum_a_epg0_vcs_mmcf_a.htm.

STATEWIDE ANNUAL ENERGY FORECASTS

Table 5: Gross State Energy Forecasts (Annual Retail Sales in GWh)[9]

Year	AR	IL	IN	IA	KY	LA	MI	MN
1990	27365	111577	73982	29437	61097	63826	82367	47167
1991	28440	116869	77034	30781	64194	64704	84519	48755
1992	28451	112521	76977	30208	67068	65098	83840	47412
1993	31663	117786	81931	32104	68149	67756	87589	49211
1994	32619	121490	83808	33039	72485	70132	91160	51155
1995	34671	126231	87006	34301	74548	72827	94701	53959
1996	36137	125990	88901	34999	77019	75269	96302	54942
1997	36858	126953	89147	36148	76836	75886	97391	55674
1998	39315	131697	92059	37318	75850	77716	100506	56744
1999	39789	132682	96735	38034	79098	78267	103981	57399
2000	41611	134697	97775	39088	78316	80690	104772	59782
2001	41732	136034	97734	39444	79975	74693	102409	60687
2002	42450	138447	101429	40898	87267	79261	104714	62162
2003	43108	136248	100468	41207	85220	77769	108877	63087
2004	43672	139254	103094	40903	86521	79737	106606	63340
2005	46165	144986	106549	42757	89351	77389	110445	66019
2006	46636	142448	105664	43337	88743	77468	108018	66770
2007	47055	146055	109420	45270	92404	79567	109297	68231
2008	46135	144620	106981	45488	93428	78722	105781	68792
2009	43173	136688	99312	43641	88809	78670	98121	64004
2010	48194	144761	105994	45445	93569	85080	103649	67800
2011	47928	142886	105818	45655	89538	86369	105054	68533
2012	46860	143540	105173	45709	89048	84731	104818	67989
2013	46686	141790	105553	46774	84764	85808	103041	68625
2014	48373	144437	107384	45934	79942	86326	104735	68181
2015	49016	145439	108542	47025	79026	87905	106425	68835
2016	49434	146669	110042	47675	79893	90520	107311	70022
2017	49917	147577	111480	48340	80558	92021	108651	71357
2018	50468	148439	113014	49228	81383	93834	109254	72436
2019	51280	149698	114733	50054	82431	96031	110077	73572
2020	51932	150908	116453	50895	83572	98003	111629	74878
2021	52330	151832	117928	51689	84642	99732	112667	76217
2022	52697	152653	119215	52532	85591	101411	113127	77553
2023	53101	153374	120594	53349	86446	103042	114012	78804
2024	53592	154234	122023	54167	87273	105061	115053	80022
2025	54058	155133	123492	54983	88089	106923	116165	81286
Compound Annual Growth Rates (%)								
1990-2013	2.35	1.05	1.56	2.03	1.43	1.30	0.98	1.64
2014-2025	1.02	0.65	1.28	1.65	0.89	1.96	0.95	1.61
2016-2025	1.00	0.63	1.29	1.60	1.09	1.87	0.88	1.67

[9] The gross forecast is prior to EE/DR/DG adjustments.

STATEWIDE ANNUAL ENERGY FORECASTS

Table 5: Gross State Energy Forecasts (Annual Retail Sales in GWh) – continued

Year	MS	MO	MT	ND	SD	TX	WI
1990	32127	53925	13125	7014	6334	237415	49198
1991	33019	56514	13407	7255	6685	240352	51032
1992	33241	54411	13096	7128	6494	239431	50925
1993	34749	58622	12929	7432	6905	250084	53156
1994	36627	59693	13184	7681	7174	258180	55412
1995	37868	62259	13419	7883	7414	263279	57967
1996	39622	64843	13820	8314	7736	278450	58744
1997	40089	65711	11917	8282	7773	286704	60094
1998	42510	69010	14145	8220	7824	304705	62061
1999	43980	69045	13282	9112	7922	301844	63547
2000	45336	72643	14580	9413	8283	318263	65146
2001	44287	73213	11447	9810	8627	318044	65218
2002	45452	75001	12831	10219	8937	320846	66999
2003	45544	74270	12825	10461	9080	322686	67241
2004	46033	74054	12957	10516	9214	320615	67976
2005	45901	80940	13479	10840	9811	334258	70336
2006	46936	82015	13815	11245	10056	342724	69821
2007	48153	85533	15532	11906	10603	343829	71301
2008	47721	84382	15326	12416	10974	347059	70122
2009	46049	79687	14326	12649	11010	345296	66286
2010	49687	86085	13423	12956	11356	358458	68752
2011	49338	84255	13788	13737	11680	376065	68612
2012	48388	82435	13863	14717	11734	365467	68820
2013	48783	83424	14045	16033	12213	379716	69124
2014	49784	84883	14967	17100	12275	388016	69959
2015	49829	85449	15081	17637	12551	396660	71127
2016	50723	86862	14955	18020	12980	406075	72209
2017	51587	87873	15180	18321	13286	412072	73346
2018	52727	88763	15692	18612	13485	418876	74527
2019	53830	89793	15968	18903	13744	428672	75922
2020	54844	91071	16207	19196	14105	439011	77219
2021	55723	92263	16449	19377	14434	448430	78285
2022	56592	93442	16744	19524	14741	457271	79295
2023	57499	94558	17050	19678	15012	465522	80360
2024	58416	95626	17350	19798	15284	473611	81444
2025	59342	96508	17585	19850	15539	481279	82522
Compound Annual Growth Rates (%)							
1990-2013	1.83	1.92	0.29	3.66	2.90	2.06	1.49
2014-2025	1.61	1.17	1.48	1.36	2.17	1.98	1.51
2016-2025	1.76	1.18	1.82	1.08	2.02	1.91	1.49

STATEWIDE ANNUAL ENERGY FORECASTS

Figure 5: Gross Arkansas Energy Forecast (Annual Retail Sales in GWh)

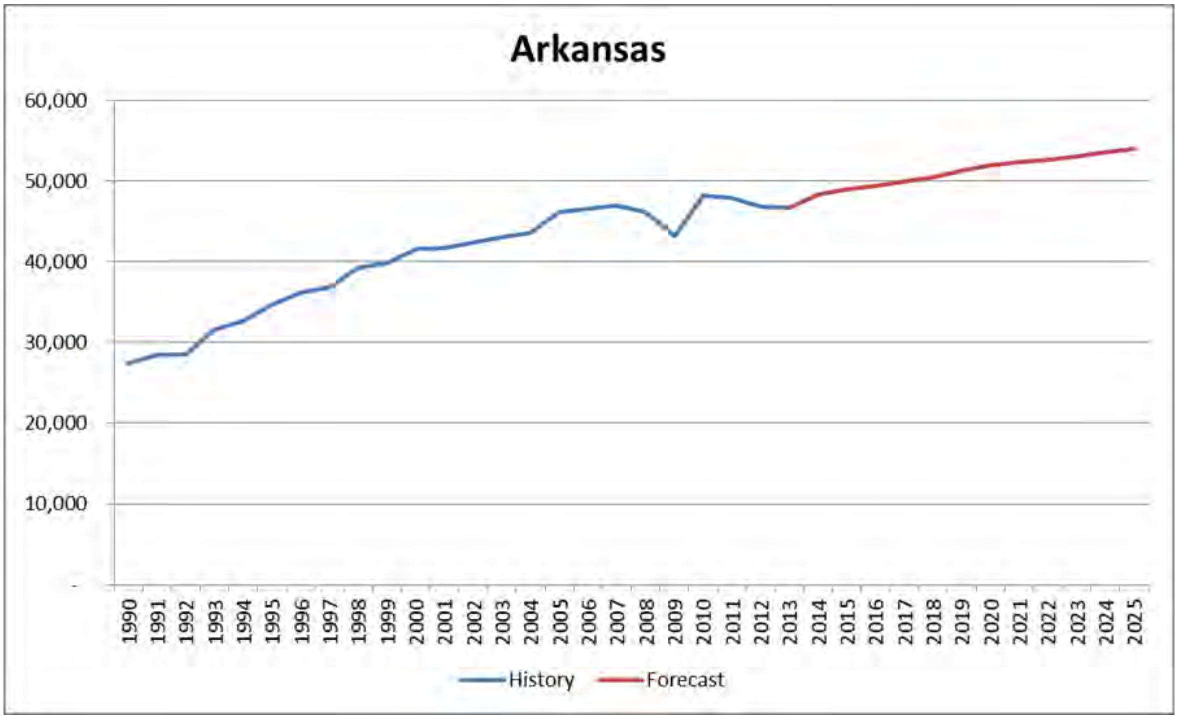
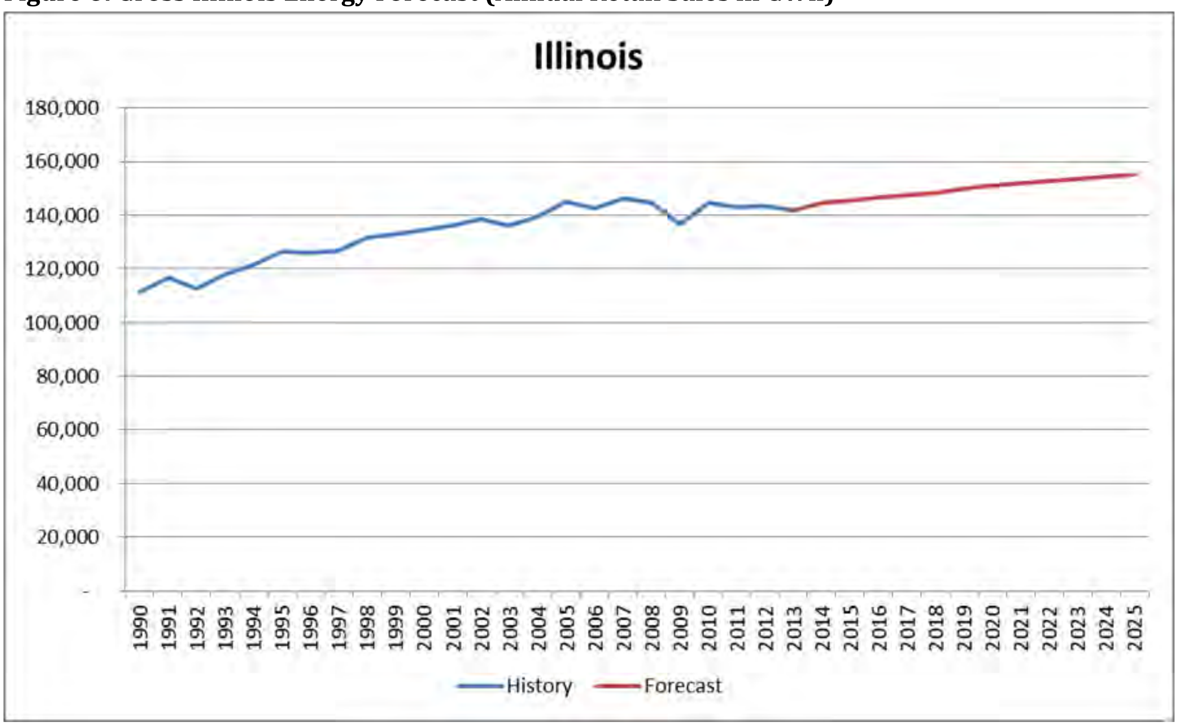


Figure 6: Gross Illinois Energy Forecast (Annual Retail Sales in GWh)



STATEWIDE ANNUAL ENERGY FORECASTS

Figure 7: Gross Indiana Energy Forecast (Annual Retail Sales in GWh)

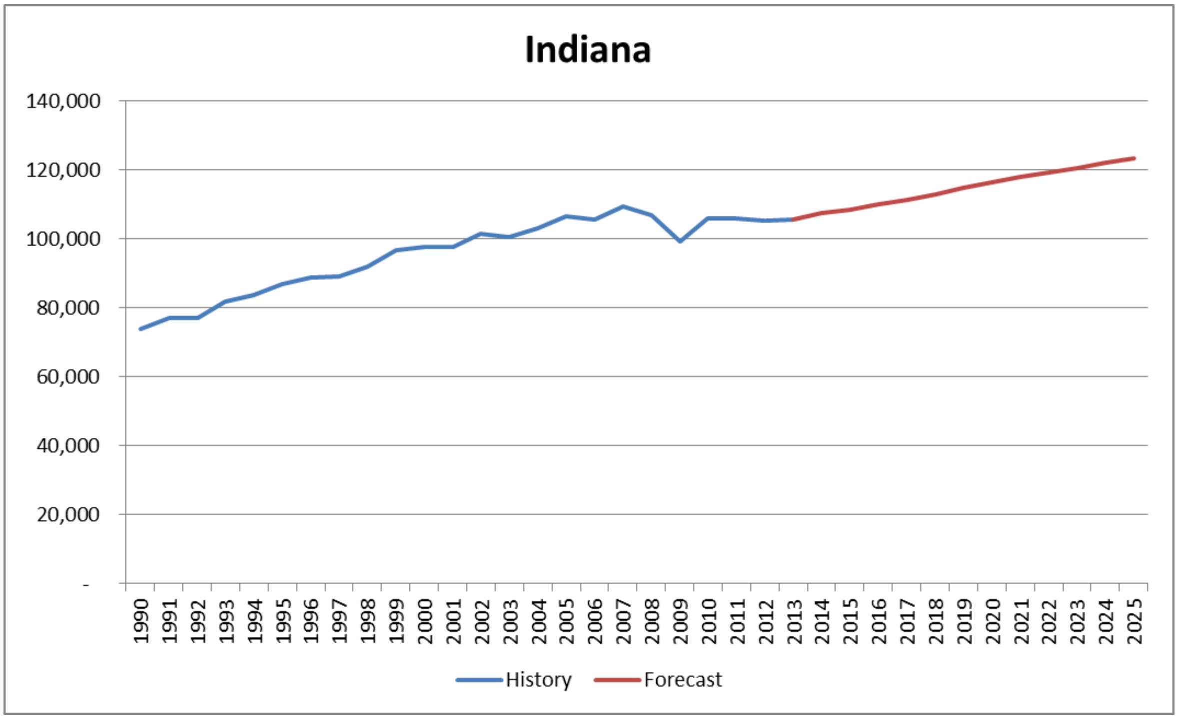
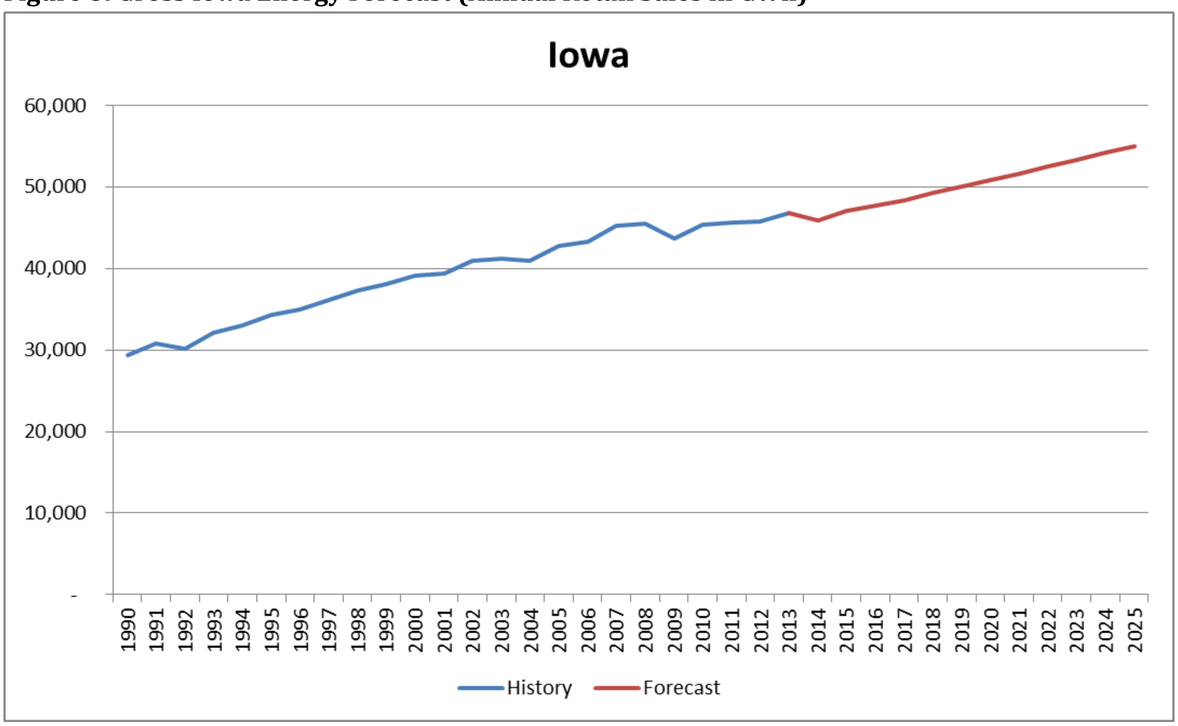


Figure 8: Gross Iowa Energy Forecast (Annual Retail Sales in GWh)



STATEWIDE ANNUAL ENERGY FORECASTS

Figure 9: Gross Kentucky Energy Forecast (Annual Retail Sales in GWh)

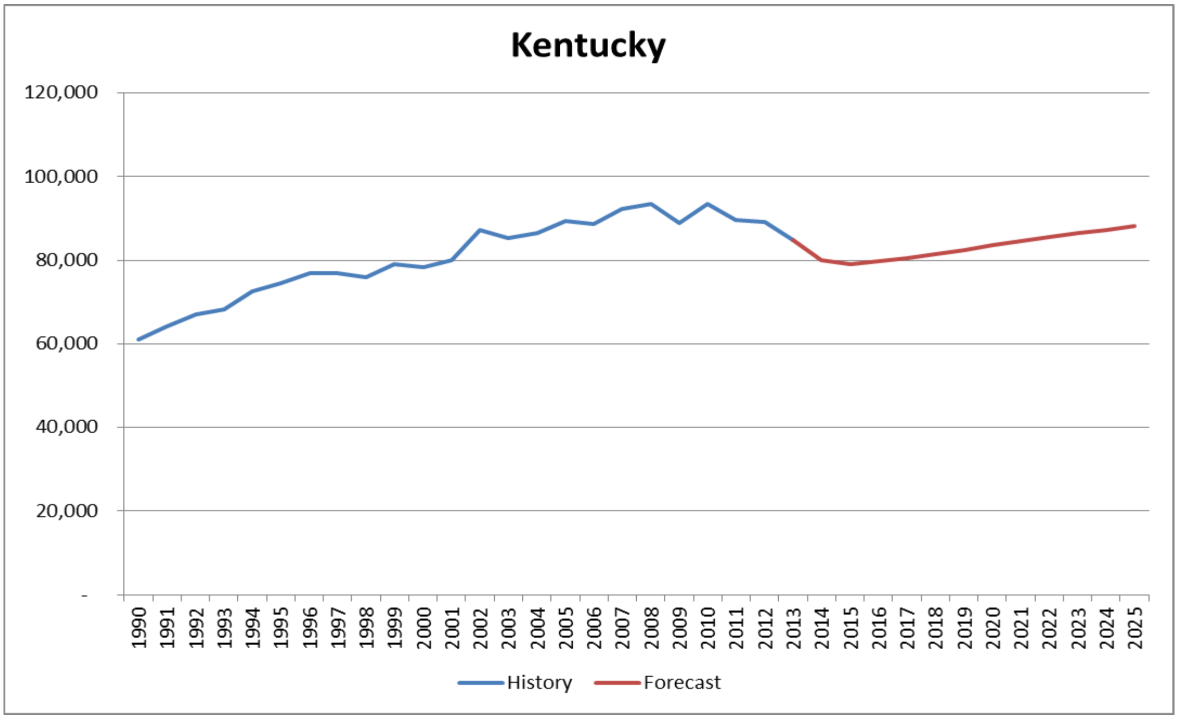
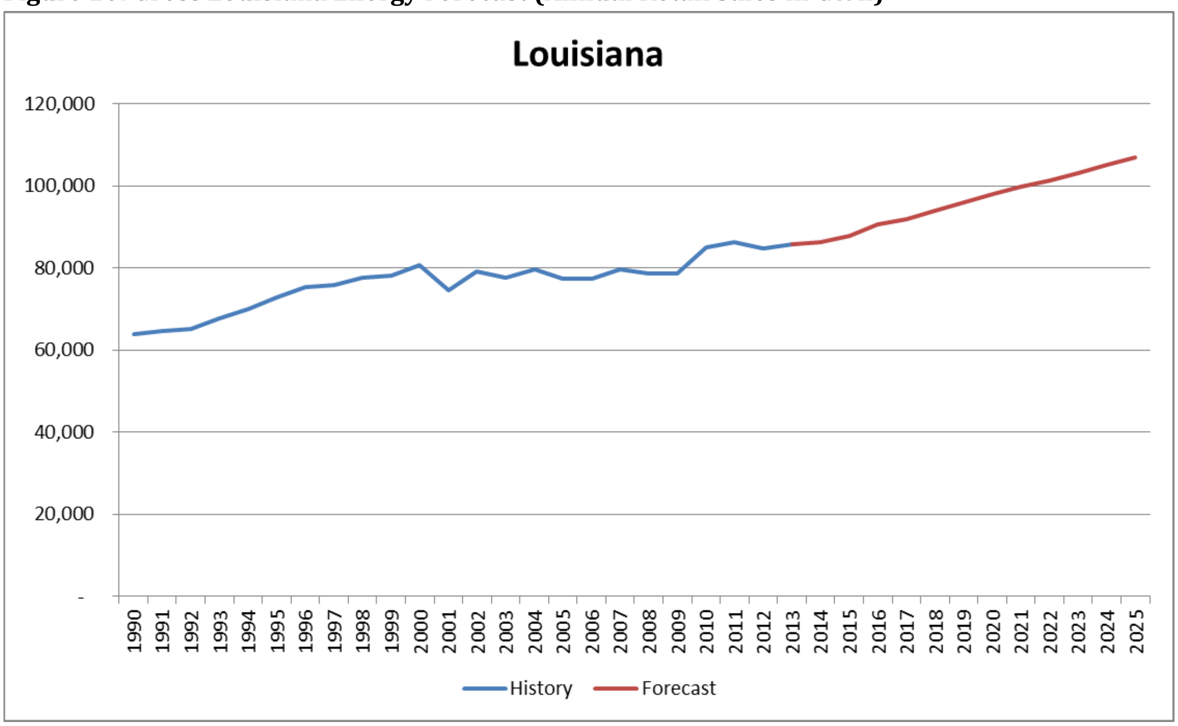


Figure 10: Gross Louisiana Energy Forecast (Annual Retail Sales in GWh)



STATEWIDE ANNUAL ENERGY FORECASTS

Figure 11: Gross Michigan Energy Forecast (Annual Retail Sales in GWh)

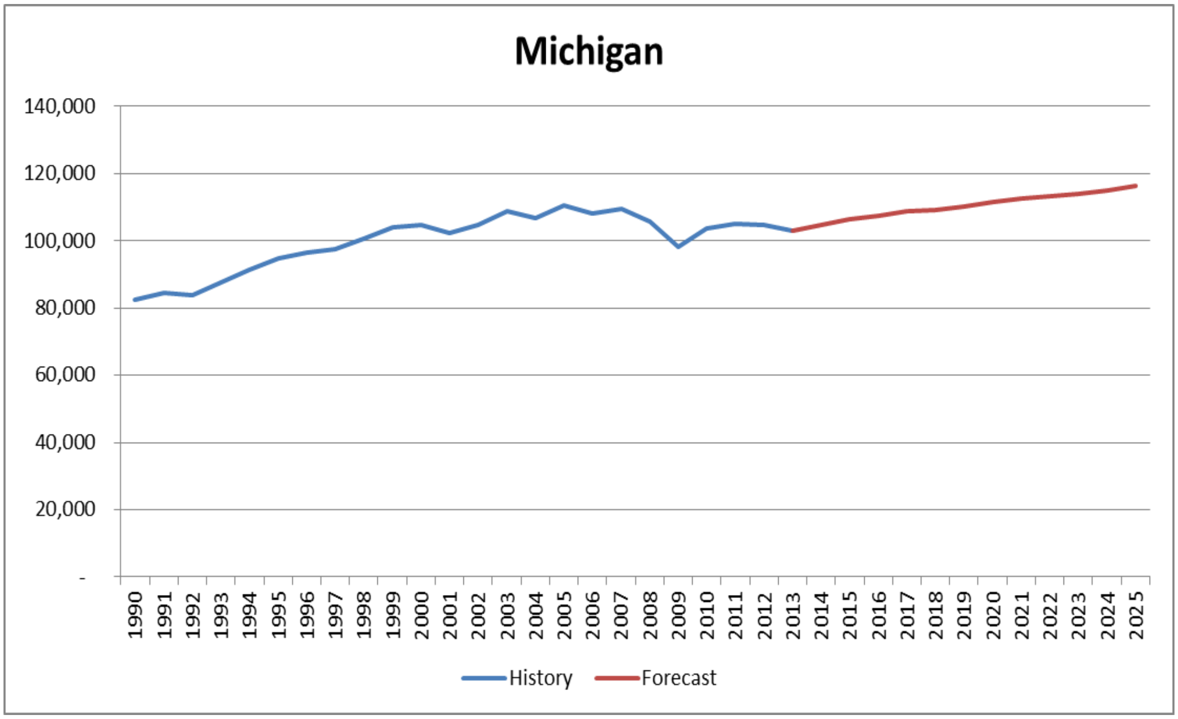


Figure 12: Gross Minnesota Energy Forecast (Annual Retail Sales in GWh)

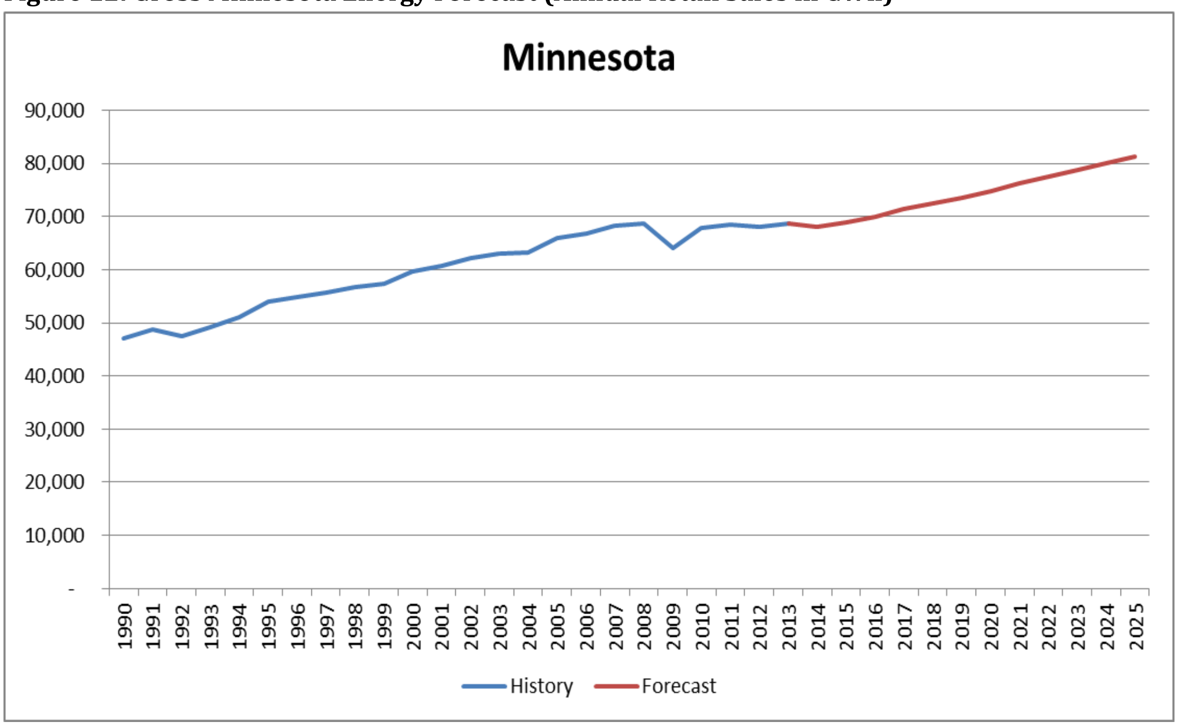


Figure 13: Gross Mississippi Energy Forecast (Annual Retail Sales in GWh)

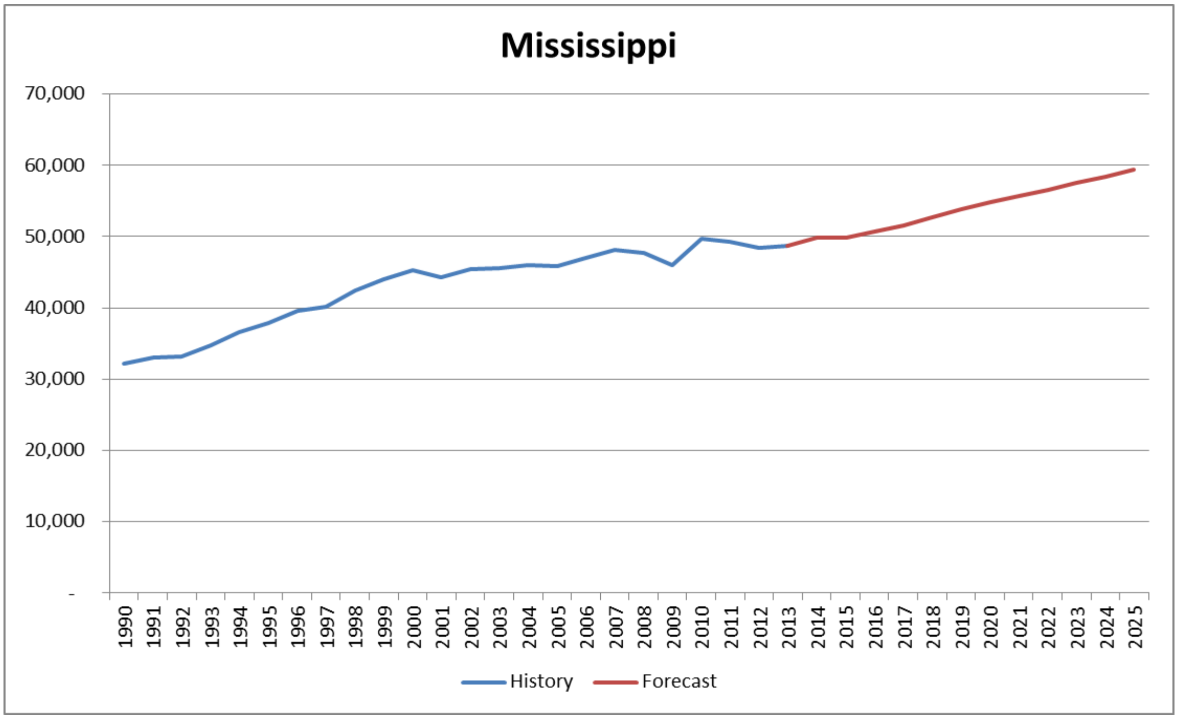
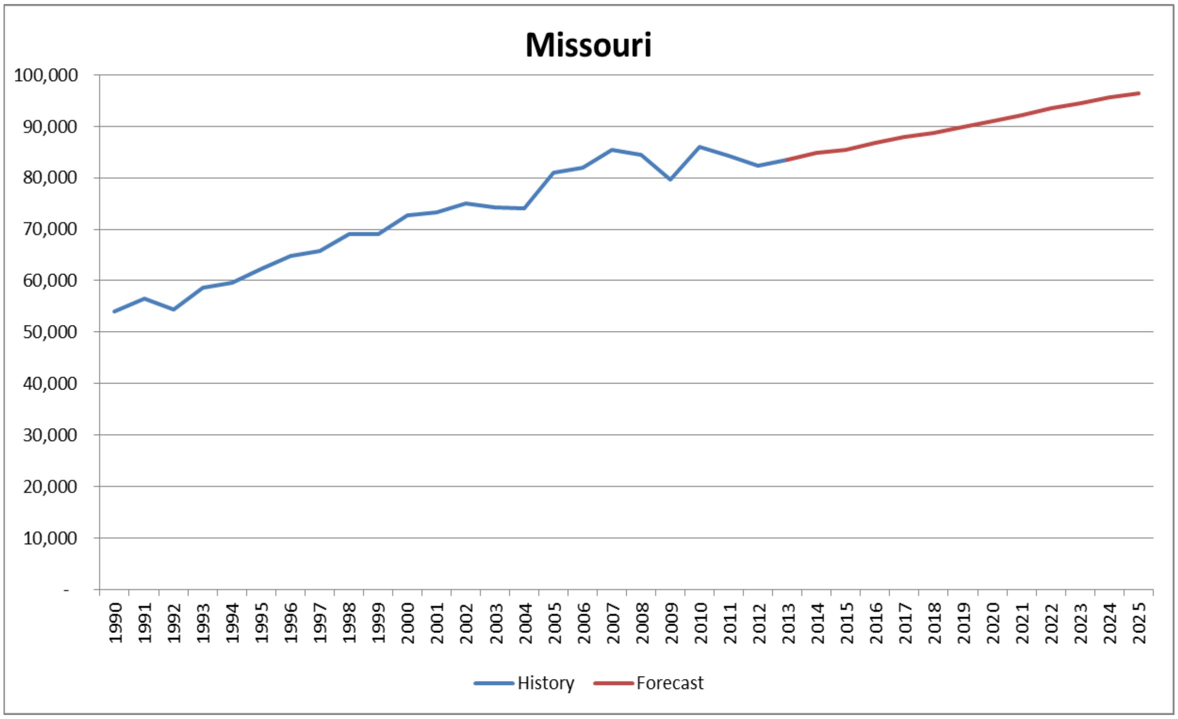


Figure 14: Gross Missouri Energy Forecast (Annual Retail Sales in GWh)



STATEWIDE ANNUAL ENERGY FORECASTS

Figure 15: Gross Montana Energy Forecast (Annual Retail Sales in GWh)

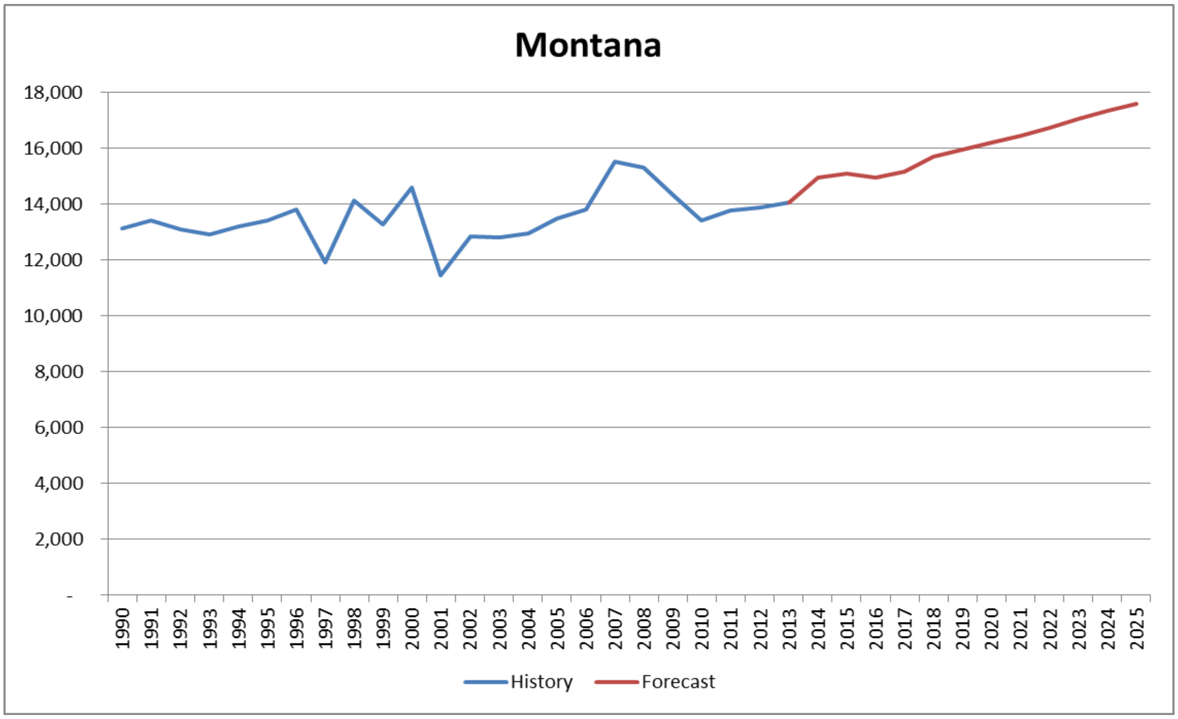
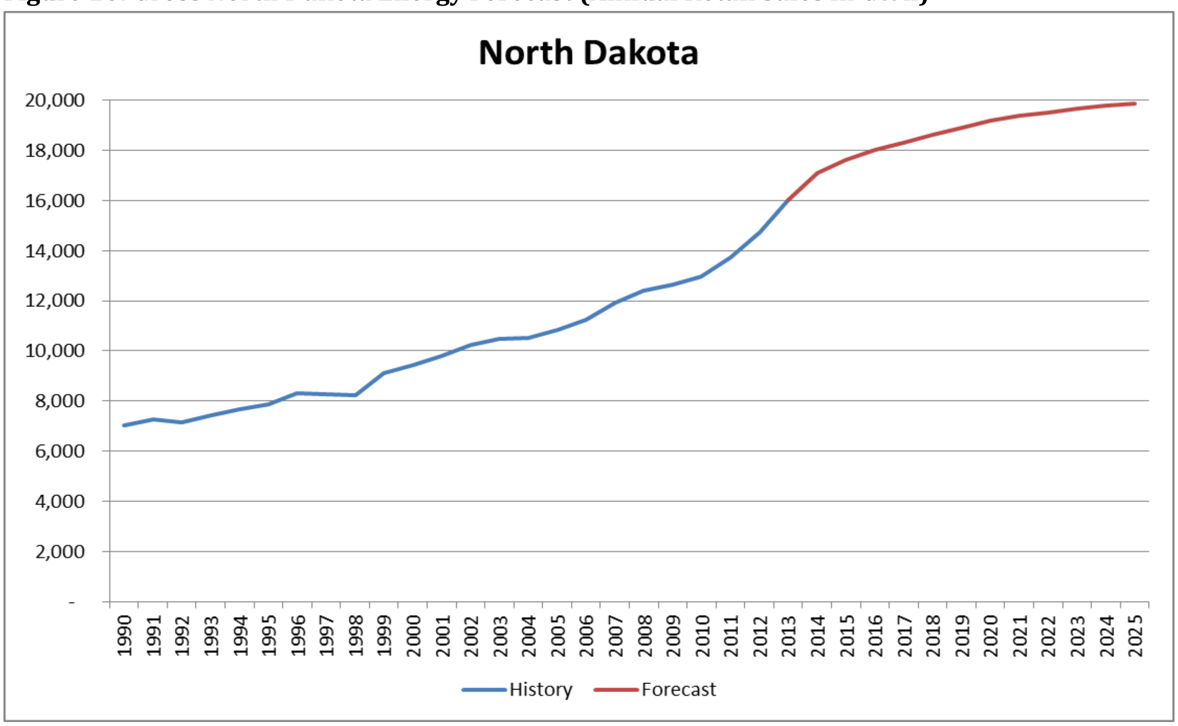


Figure 16: Gross North Dakota Energy Forecast (Annual Retail Sales in GWh)



STATEWIDE ANNUAL ENERGY FORECASTS

Figure 17: Gross South Dakota Energy Forecast (Annual Retail Sales in GWh)

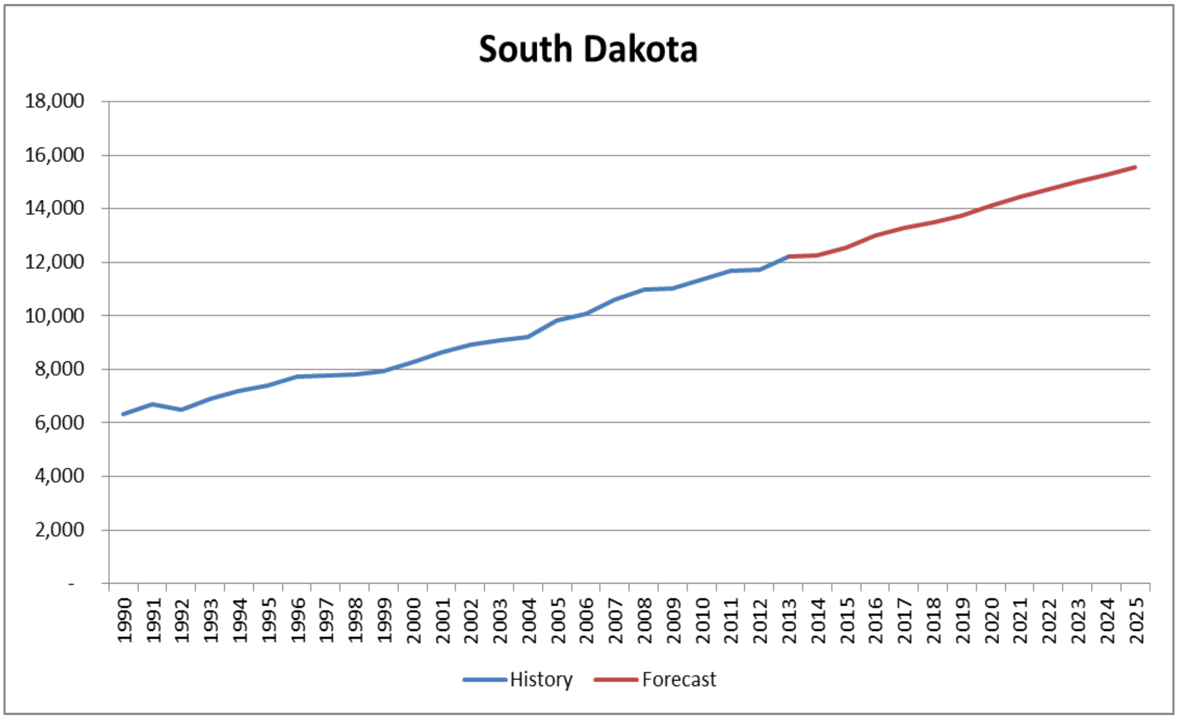
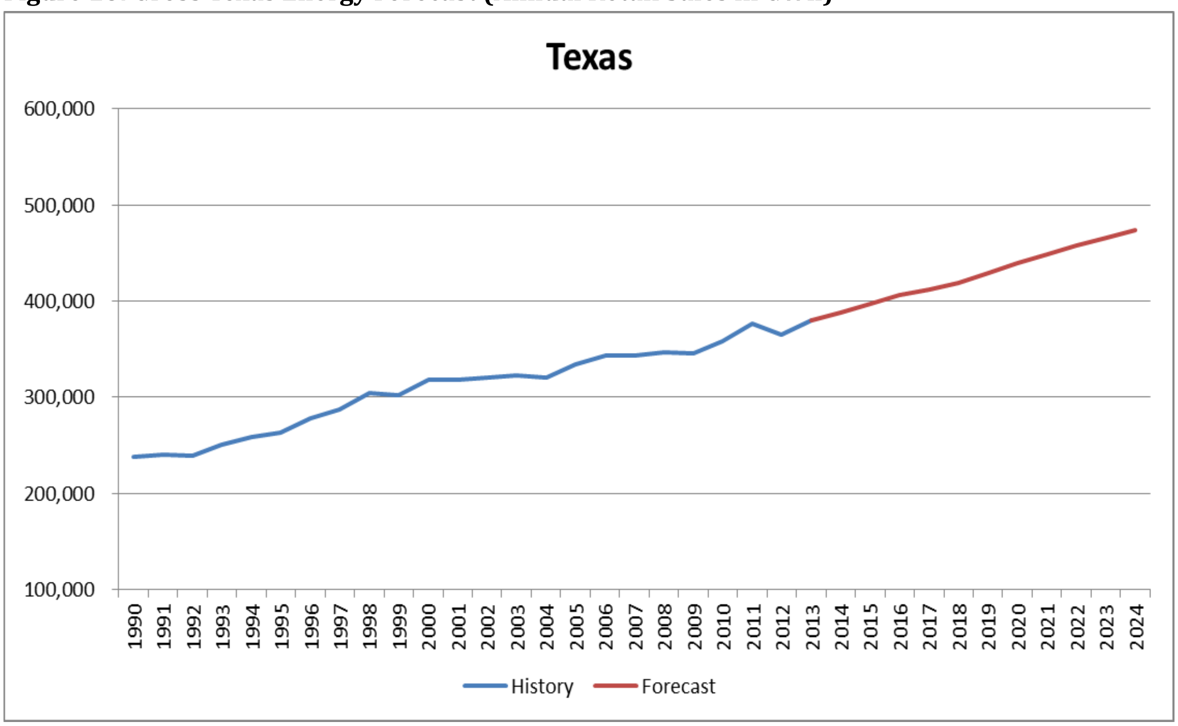
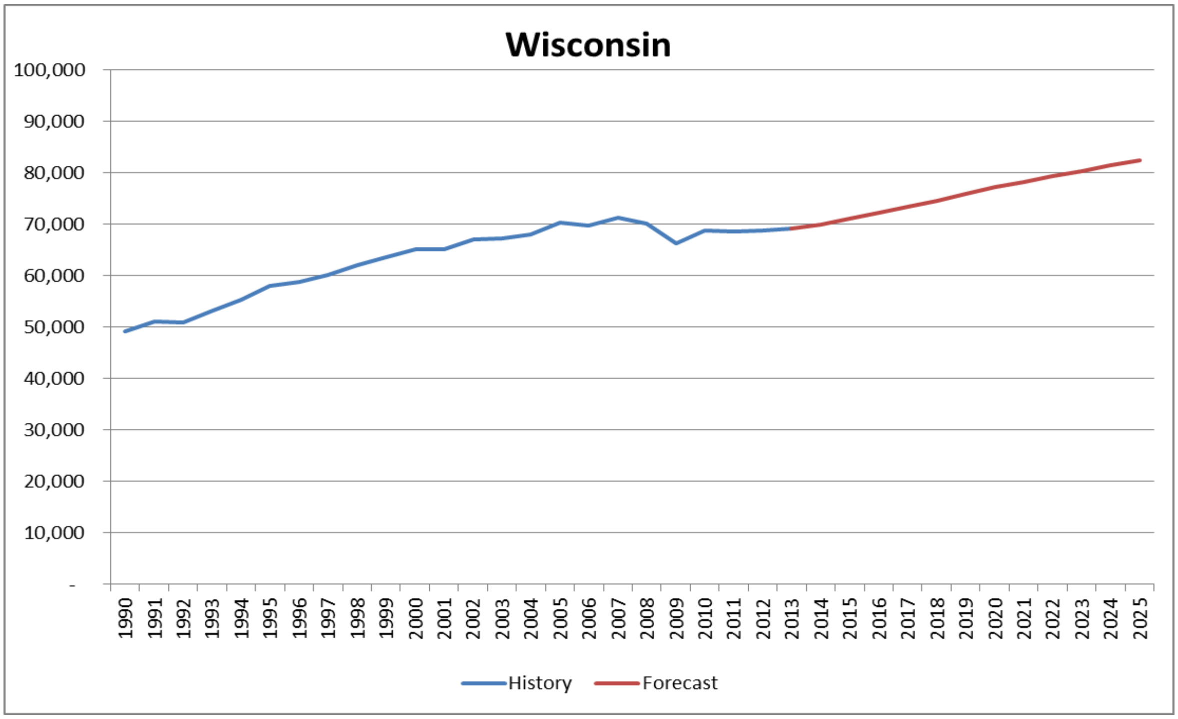


Figure 18: Gross Texas Energy Forecast (Annual Retail Sales in GWh)



STATEWIDE ANNUAL ENERGY FORECASTS

Figure 19: Gross Wisconsin Energy Forecast (Annual Retail Sales in GWh)



4 MISO Regional Energy Forecasts

4.1 ALLOCATION FACTORS

Allocation factors were used to convert annual electricity sales forecasts from the state level econometric forecasts to the MISO LRZ level. The shares of electricity sales within the MISO market footprint were calculated from sales of the LBAs. EIA form 861's historical annual electricity sales data from 2009 to 2013 were used to estimate the annual MISO load fraction at the state level. For most states, the MISO load fraction at either the state or the LRZ level showed the same pattern with less than a 1% absolute change annually.

4.1.1 MISO Local Resource Zone

MISO's market footprint covers all or parts of 17 states and is divided into 10 LRZs[10]. Figure 1 in Chapter 1 displays MISO's market footprint at the LRZ level. Table 6 lists MISO local balancing authorities' names and acronyms for each LRZ.

[10] A very small amount of load in Oklahoma and Tennessee is served by MISO LBAs in LRZ 8. Rather than develop individual state econometric models for those states, these loads are assumed to grow at the LRZ rate.

Table 6: MISO Local Balancing Authorities, 2014

BA Acronym	Local Balancing Authority (MISO)	LRZ
DPC	Dairy Land Power Cooperative	1
GRE	Great River Energy	1
MDU	Montana-Dakota Utilities	1
MP	Minnesota Power	1
NSP	Northern States Power (Xcel Energy)	1
OTP	Otter Tail Power	1
SMP	Southern Minnesota Municipal Association	1
ALTE	Alliant Energy – East	2
MGE	Madison Gas & Electric	2
UPPC	Upper Peninsula Power Company	2
WEC	Wisconsin Electric Power Company	2
WPS	Wisconsin Public Service	2
ALTW	Alliant Energy - West	3
MEC	MidAmerican Electric Company	3
MPW	Muscatine Power & Water	3
AMIL	Ameren - Illinois	4
CWLP	City Water Light & Power	4
SIPC	Southern Illinois Power Cooperative	4
AMMO	Ameren - Missouri	5
CWLD	Columbia Water & Light District	5
BREC	Big Rivers Electric Cooperative	6
DUK(IN)	Duke Energy - Indiana	6
HE	Hoosier Energy	6
IPL	Indianapolis Power & Light	6
NIPSCO	Northern Indiana Public Service Company	6
SIGE	Southern Indian Gas & Electric	6
CONS	Consumers Energy	7
DECO	Detroit Edison (DTE Energy)	7
EAI	Entergy – Arkansas	8
CLEC	Cleco	9
EES	Entergy - LA, TX	9
EES	Entergy - LA, TX	9
LAFA	Lafayette Utilities	9
LAGN	Louisiana Generation (NRG)	9
LEPA	Louisiana Energy & Power Authority	9
SME	South Mississippi Electric Power Association	10
EES	Entergy - MS	10

Table 7 summarizes the historical MISO load fractions at the state level for 2009 to 2013. The category "MISO Sales" includes all electricity sales from either MISO utilities or utilities listing a MISO LBA as the local balancing authority. At the request of MISO staff and due to concerns over providing utility-specific information in states that only have a single MISO utility, the states of Indiana and Kentucky are combined (IN+KY). Similarly, North Dakota and Montana have been combined (ND+MT).

Table 7: MISO Load Fraction at State Level, 2013 (MWh)

State	MISO Sales	Non-MISO Sales	MISO State Level Load Fraction					
			2009	2010	2011	2012	2013	Average
AR	32,890,064	13,792,970	70.0%	70.6%	70.4%	70.5%	70.5%	70.4%
IA	43,448,249	3,357,246	92.0%	92.9%	93.0%	93.2%	92.9%	92.8%
IL	49,053,065	92,751,823	34.0%	34.5%	34.8%	33.9%	34.6%	34.4%
IN+KY	95,018,157	95,233,074	47.4%	47.5%	48.5%	48.8%	49.9%	48.4%
LA	79,114,071	6,693,861	91.8%	91.8%	91.7%	92.1%	92.2%	91.9%
MI	99,020,444	4,017,861	95.3%	96.0%	96.2%	96.2%	96.1%	96.0%
MN	67,786,837	857,266	98.7%	98.7%	98.7%	98.8%	98.8%	98.7%
MO	41,300,853	42,106,104	48.9%	49.7%	49.5%	50.3%	49.5%	49.6%
MS	21,817,785	26,964,205	45.6%	45.9%	45.2%	44.8%	44.7%	45.2%
ND+MT	11,268,669	18,809,472	36.0%	37.3%	37.9%	36.8%	37.5%	37.1%
SD	3,091,272	9,118,527	26.5%	26.9%	26.1%	26.0%	25.3%	26.2%
TX	21,738,016	357,079,238	5.5%	5.7%	5.5%	6.0%	5.7%	5.7%
WI	69,124,043	0	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Source: Electric power sales, revenue, and energy efficiency 861 detailed data files, U.S. Energy Information Administration, calculated by SUFG.

In the 2014 study, SUFG identified a number of utilities that did not have an LBA assignment in the EIA 861 data. Sales from those utilities with unknown LBAs were grouped as "Non-MISO" sales. In order to better represent the MISO's market footprint, at the beginning of 2015, SUFG worked with MISO staff to update the missing information. Therefore, with updated information regarding MISO zoning boundaries and updated LBA assignments, SUFG re-estimated the allocation factors from 2009 to 2012, plus one newly added year, 2013. Table 8 lists utilities that were treated as "Non-MISO" sales in the 2014 study and are now included in the MISO footprint for the 2015 study. Additionally, the LBA listed in the EIA data changed for some utilities from 2012 to 2013 (Table 9). Finally, some LRZ assignments were changed because they were incorrect in the 2014 MISO Independent Load Forecast (Table 10).

Table 8: Electricity Sales Categorized as MISO Sales (previously listed as Non-MISO)

State	Utility Name	2012 Sales (MWh)
AR	City of Hope	280,429
AR	Riceland Foods Inc.	33,463
IA	City of Graettinger	9,162
IL	University of Illinois	17,552
IN	Portside Energy Corp.	288,491
MI	EQ-Waste-Energy Services Inc.	450
MI	Midland Cogeneration Venture	444,323
MI	Alpena Power Co.	338,060
MI	Michigan State University	855
MN	Melrose Public Utilities	102,749
MN	Koda Energy LLC	37,010
MN	Franklin Heating Station	157,795
MN	City of Warroad	51,626
MN	Cleveland Cliffs Inc.	643,755
MN	Olmsted County Public Works	5,398
MS	Dixie Electric Power Assn	791,976
ND	Dakota Valley Elec Coop Inc.	561,023
ND	Northern Plains Electric Coop	404,277
SD	City of Flandreau	27,482
TX	E I DuPont De Nemours & Co	363,135
TX	SRW Cogeneration LP	2,126,331
WI	City of Medford	123,157

Table 9: Utilities Switched LBA between 2012 and 2013 (EIA 861 Form)

State	Utility	Sales (MWh)	LBA in 2014 Study	LBA in 2015 Study	LRZ
SD	City of Volga	47,664	MISO	WAUE	1
IN	Tipmont Rural Elec Member Corp	475,814	MISO	PJM	6
IN	City of Washington	169,350	MISO	PJM	6

Source: Electric power sales, revenue, and energy efficiency 861 detailed data files, U.S. Energy Information Administration

Table 10: List of MISO Utilities with Revised LRZ Based on MISO Inputs

State & Utility	Sales (MWh)	LRZ Classification in 2014 Study	2014 Grouping Notes	LRZ Classification in 2015 Study
MN				
Federated Rural Electric Assn	305,504	1	Located at the LRZ 1 according to LRZ map illustration	3
Nobles Cooperative Electric	153,442	1		3
TX				
Southwest Arkansas E C C	21,986	9	Used Entergy As BA in 2012	8
WI				
City of Bangor	26,201	2	Located at the LRZ 2 according to LRZ map illustration	1
City of Medford	123,157	2		1
City of New Richmond	90,690	2		1
City of River Falls	116,168	2		1
City of Westby	22,677	2		1
Dahlberg Light & Power Co.	96,948	2		1
Superior Water and Light Co.	682,951	2		1
Whitehall Electric Utility	35,642	2		1

Source: Utilities that re-assigned LRZ based on inputs from MISO

Figure 20 illustrates the percentage of total electricity sales from MISO associated utilities at the state level for 2009 to 2013. The numbers above the bars represent the five-year average MISO load fraction at the state level.

Figure 20: State-Level MISO Load Fraction, 2009 to 2013

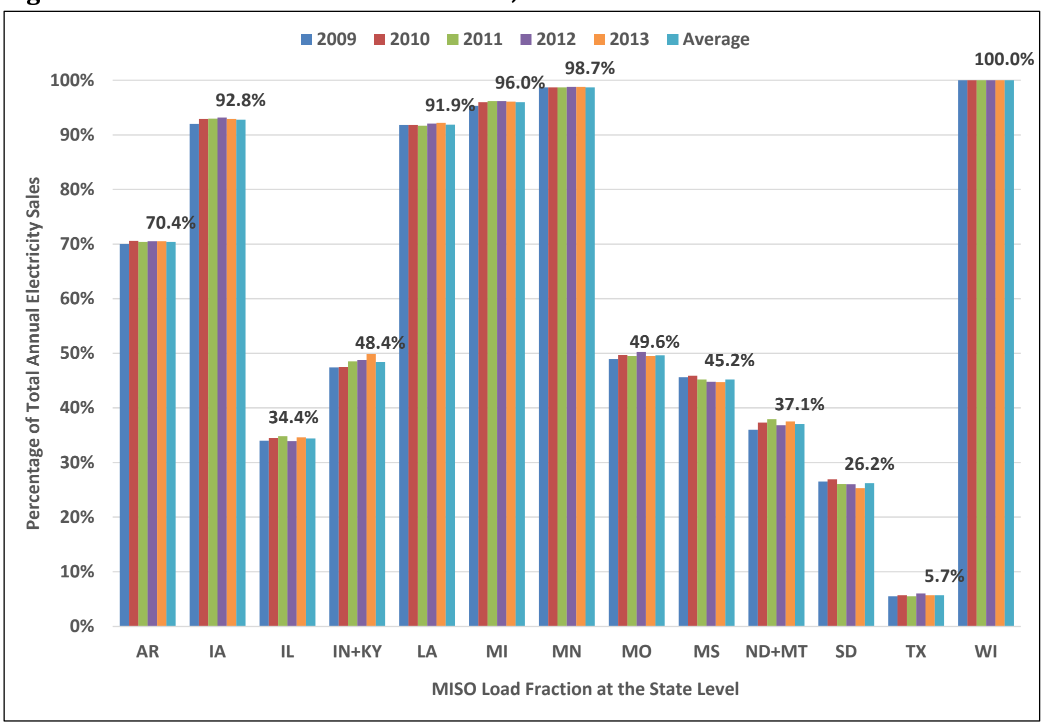


Table 11 shows the average percentage of annual electricity sales at the state level that was located in each MISO LRZ. The last row "Non-MISO" lists the average percentage of electricity sales from non-MISO utilities at the state level.

Table 11: MISO Load Fraction Formula at LRZ Level (Average Percentage of State-Level Electricity Sales from 2009 to 2013)

LRZ	AR	IA[11]	IL	IN+KY	LA	MI[12]	MN	MO[13]	MS	ND+MT	SD	TX[14]	WI[15]
1		1.8%	0.0002%			0.1%	96.8%			37.1%	24.3%		16.7%
2						4.9%							83.3%
3		91.1%	1.4%				2.0%				1.8%		
4			32.9%										
5								49.3%					
6				48.4%									
7						90.9%							
8	70.4%							0.2%				0.01%	
9					91.9%							5.7%	
10									45.2%				
Non-MISO	**29.6%**	**7.2%**	**65.6%**	**51.6%**	**8.1%**	**4.0%**	**1.3%**	**50.4%**	**54.8%**	**62.9%**	**73.8%**	**94.3%**	**0.0%**

Source: Electric power sales, revenue, and energy efficiency Form 861 detailed data files, U.S. Energy Information Administration, calculated by SUFG.

Table 12 summarizes the percentage of MISO electricity sales in each state for 2009 to 2013 and the four-year average by LRZ. For most states, the percentage of electricity sales from MISO utilities was quite stable during this period. Figure 21 to Figure 30 display MISO state level load fraction by LRZ from 2009 to 2013.

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[11] Part of utilities in Iowa such as Heartland Power Coop, Hawkeye Tri-County EL Coop Inc. etc. used Dairy Land Power Cooperative as their balancing authority. Dairy Land Power Cooperative is a local balancing authority in MISO market footprint Zone 1. Therefore, electricity sales from those utilities are considered MISO sales in LRZ 1.

[12] Northern States Power Company provides electricity to customers in the Upper Peninsula of Michigan. As it is categorized as MISO LRZ 1 utility, its sales to Michigan are considered MISO sales in LRZ 1.

[13] Some utilities in Missouri adjacent to Arkansas used Entergy as their balancing authority, such as City of West Plains and Clay County Electric Coop Corp. Therefore, those sales were classified as MISO sales in LRZ 8 instead of LRZ 5.

[14] Southwest Arkansas ECC sells electricity to Texas using Entergy as its balancing agency. Since it is located at Arkansas, it is grouped as a LRZ 8 utilities. Therefore, its sales in Texas is also treated as zone 8 sales.

[15] Northern States Power Company and Dairy Land Power Cooperative provide electricity to customers in western Wisconsin. Therefore, their sales are considered MISO sales in LRZ 1.

Table 12: State Level MISO Load Fraction by MISO LRZs, 2009 to 2013

LRZ	State	State Level MISO Load Fraction					
		Average	2009	2010	2011	2012	2013
1	IA	1.8%	1.8%	1.8%	1.8%	1.7%	1.8%
	IL	0.0002%	0.0002%	0.0002%	0.0002%	0.0002%	0.0002%
	MI	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
	MN	96.8%	96.6%	96.7%	96.8%	96.9%	96.9%
	ND+MT	37.1%	36.0%	37.3%	37.9%	36.7%	37.5%
	SD	24.3%	24.6%	25.0%	24.3%	24.2%	23.5%
	WI	16.7%	16.8%	16.6%	16.9%	16.2%	17.0%
2	MI	4.9%	4.3%	5.2%	5.3%	4.9%	4.9%
	WI	83.3%	83.2%	83.4%	83.1%	83.8%	83.0%
3	IA	91.1%	90.3%	91.1%	91.3%	91.5%	91.1%
	IL	1.4%	1.4%	1.4%	1.4%	1.4%	1.4%
	MN	2.0%	2.1%	2.0%	2.0%	1.9%	1.9%
	SD	1.8%	1.8%	1.9%	1.8%	1.8%	1.8%
4	IL	32.9%	32.6%	33.1%	33.4%	32.5%	33.2%
5	MO	49.3%	48.6%	49.4%	49.2%	50.1%	49.3%
6	IN+KY	48.4%	47.3%	47.5%	48.5%	48.6%	49.9%
7	MI	90.9%	90.8%	90.7%	90.8%	91.2%	91.0%
8	AR	70.4%	70.0%	70.6%	70.4%	70.5%	70.5%
	MO	0.2%	0.3%	0.3%	0.2%	0.2%	0.2%
	TX	0.006%	0.006%	0.006%	0.006%	0.006%	0.006%
9	LA	91.9%	91.8%	91.8%	91.7%	92.1%	92.2%
	TX	5.7%	5.5%	5.7%	5.5%	6.0%	5.7%
10	MS	45.2%	45.6%	45.9%	45.2%	44.8%	44.7%

Source: Electric power sales, revenue, and energy efficiency Form 861 detailed data files, U.S. Energy Information Administration, calculated by SUFG.

Figure 21: MISO State-Level Load Fractions at LRZ 1

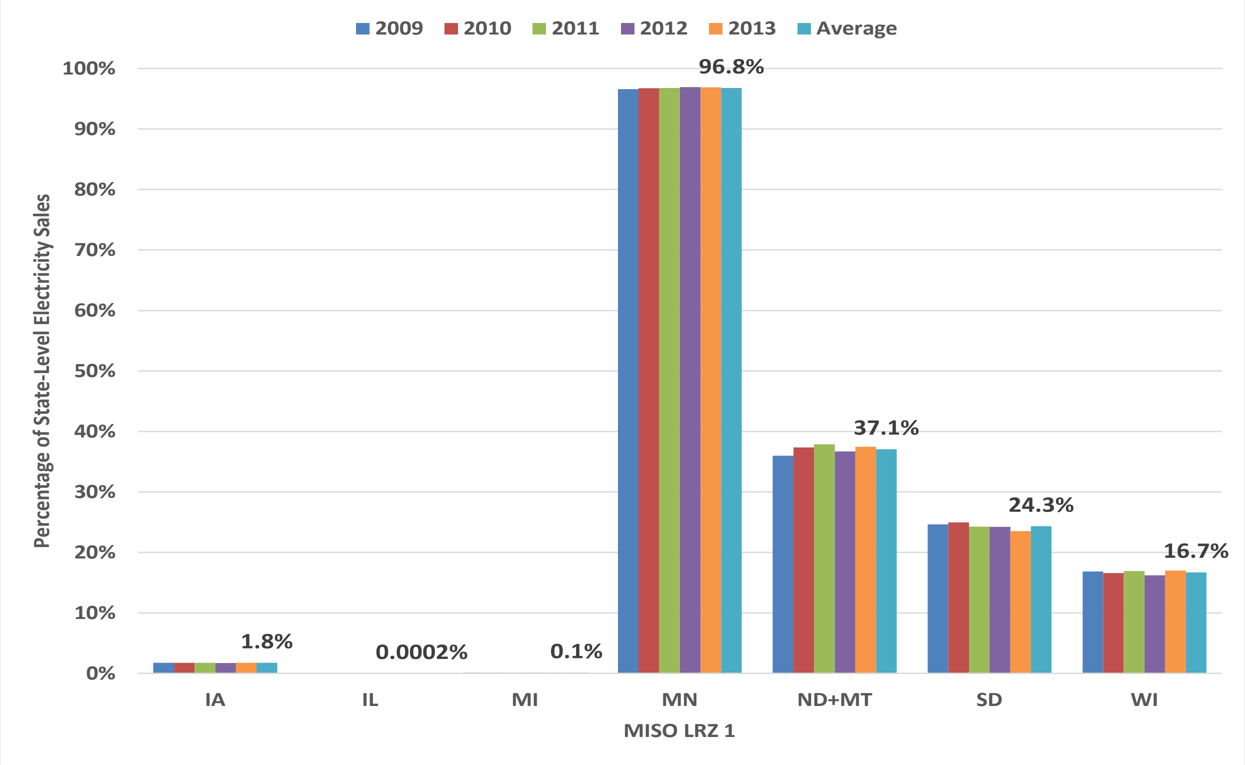


Figure 22: MISO State-Level Load Fractions at LRZ 2

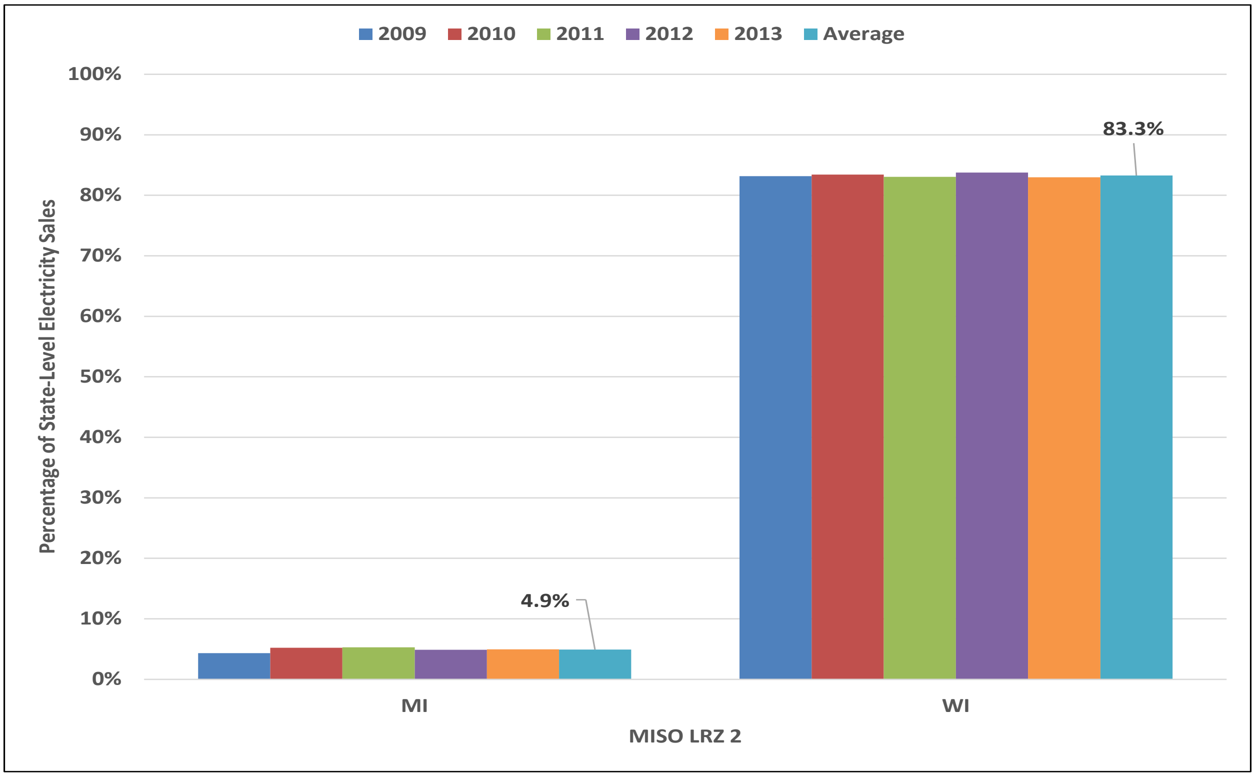


Figure 23: MISO State-Level Load Fractions at LRZ 3

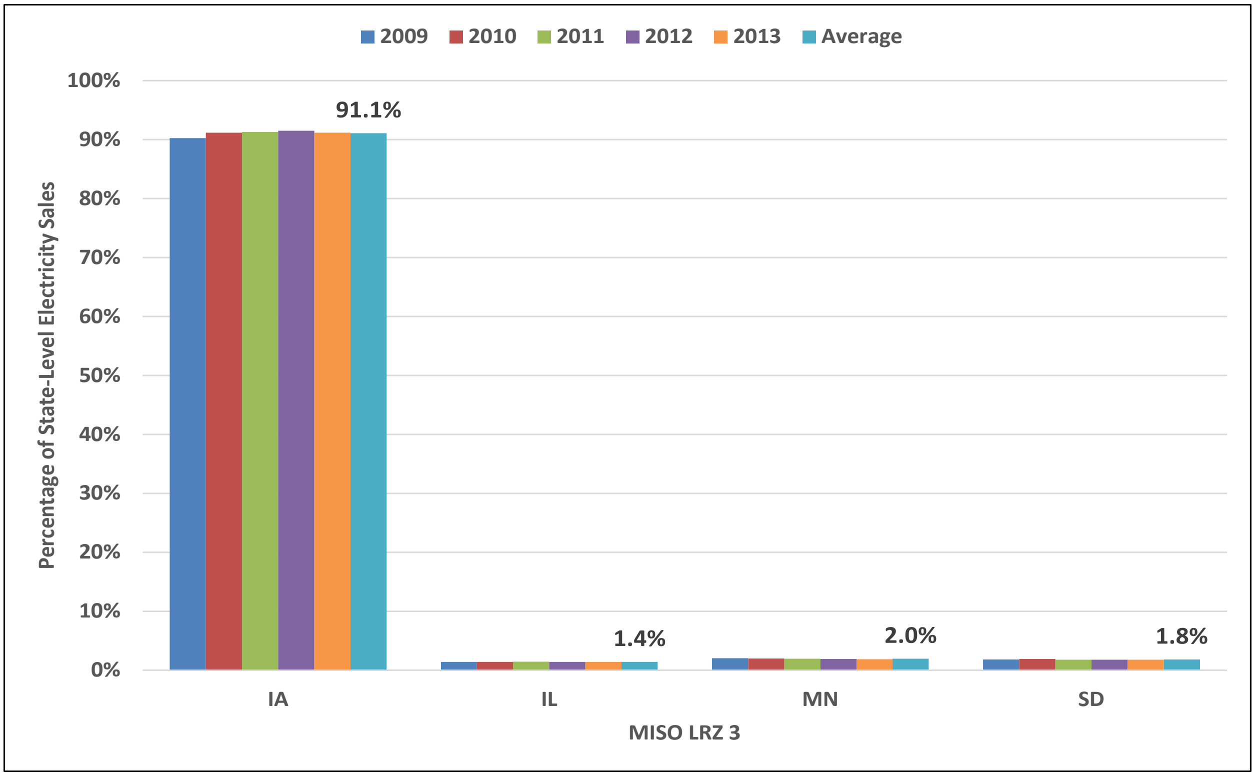


Figure 24: MISO State-Level Load Fractions at LRZ 4

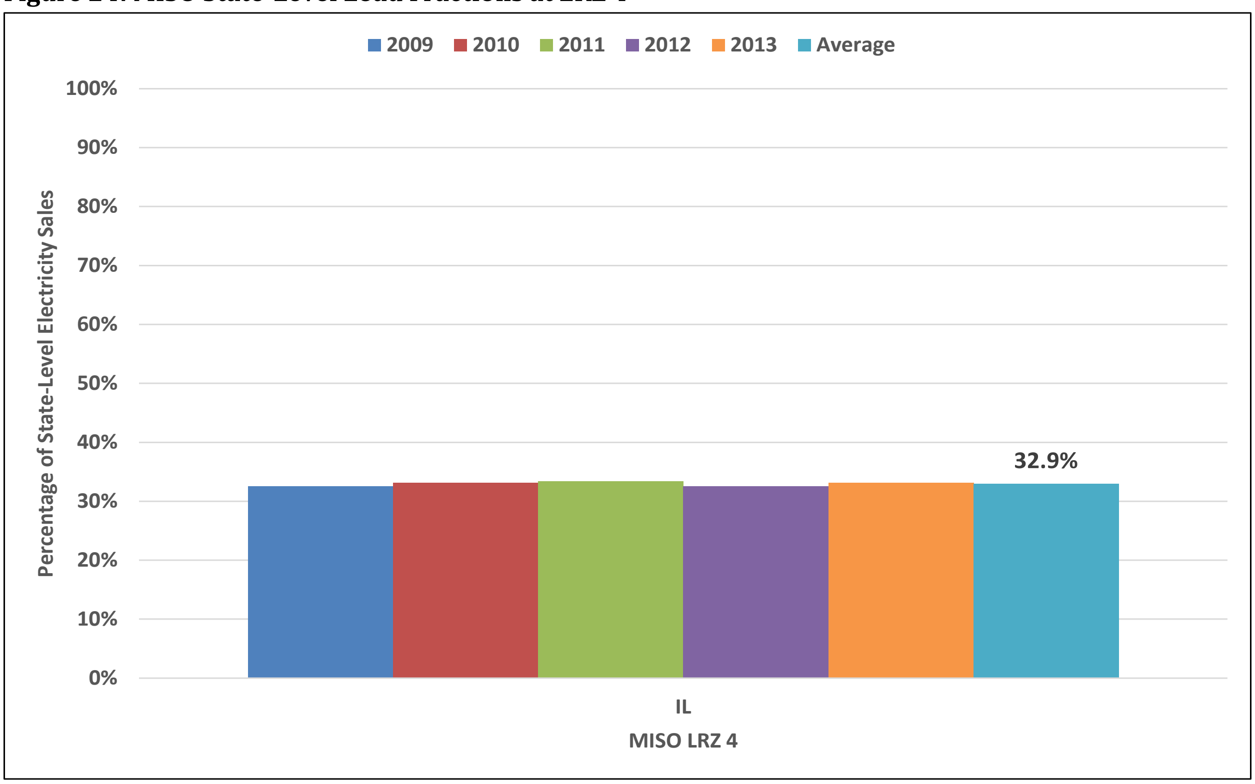


Figure 25: MISO State-Level Load Fractions at LRZ 5

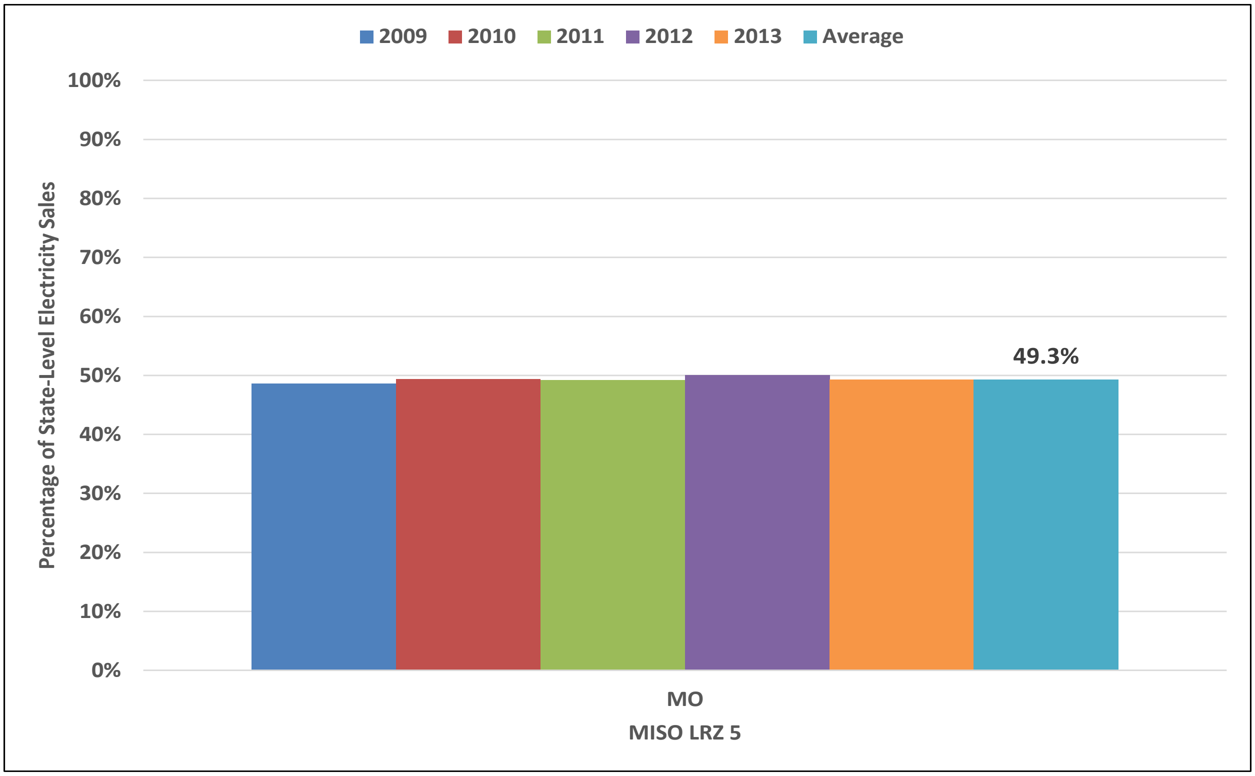


Figure 26: MISO State-Level Load Fractions at LRZ 6

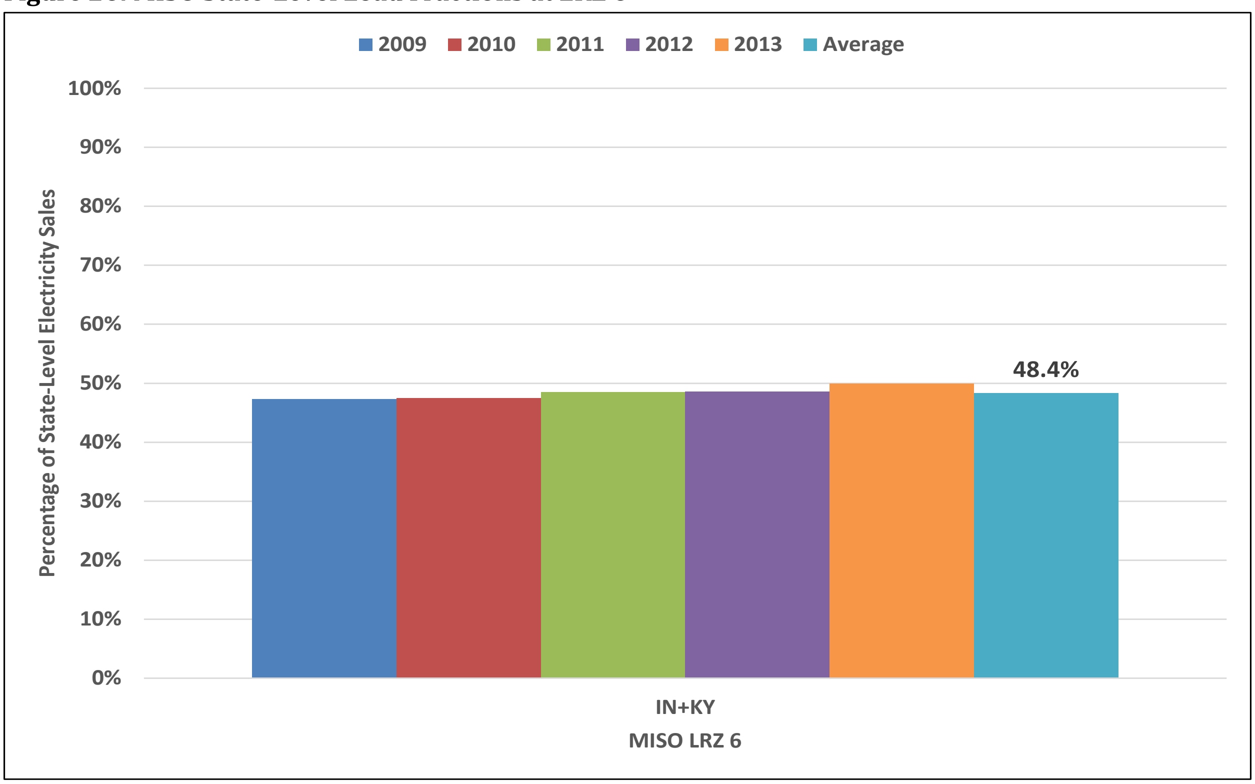


Figure 27: MISO State-Level Load Fractions at LRZ 7

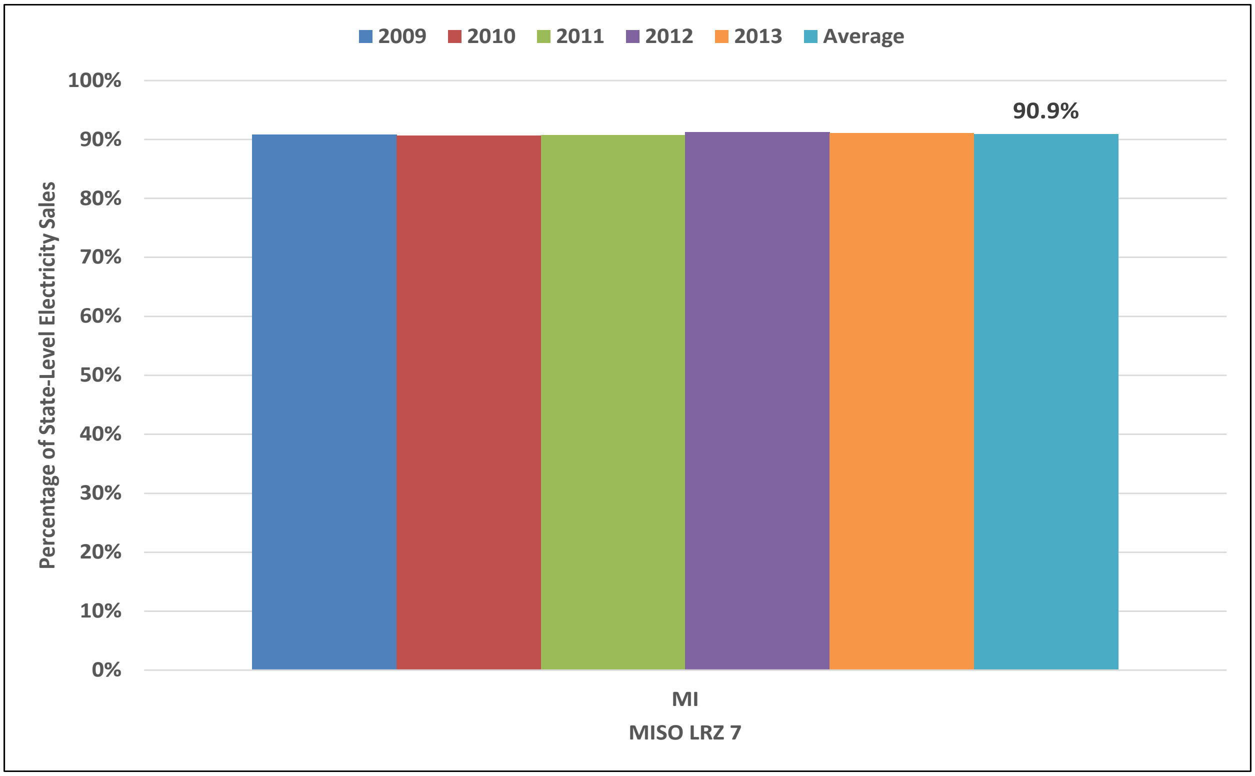


Figure 28: MISO State-Level Load Fractions at LRZ 8

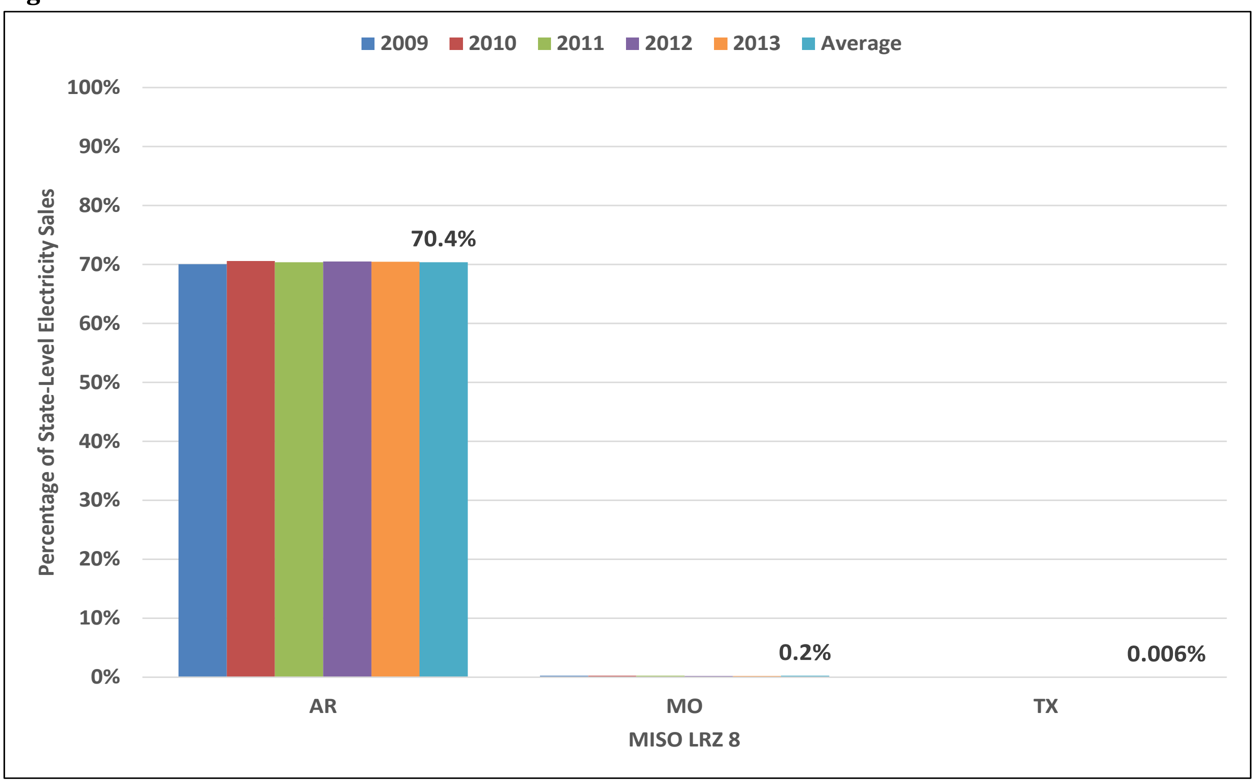


Figure 29: MISO State-Level Load Fractions at LRZ 9

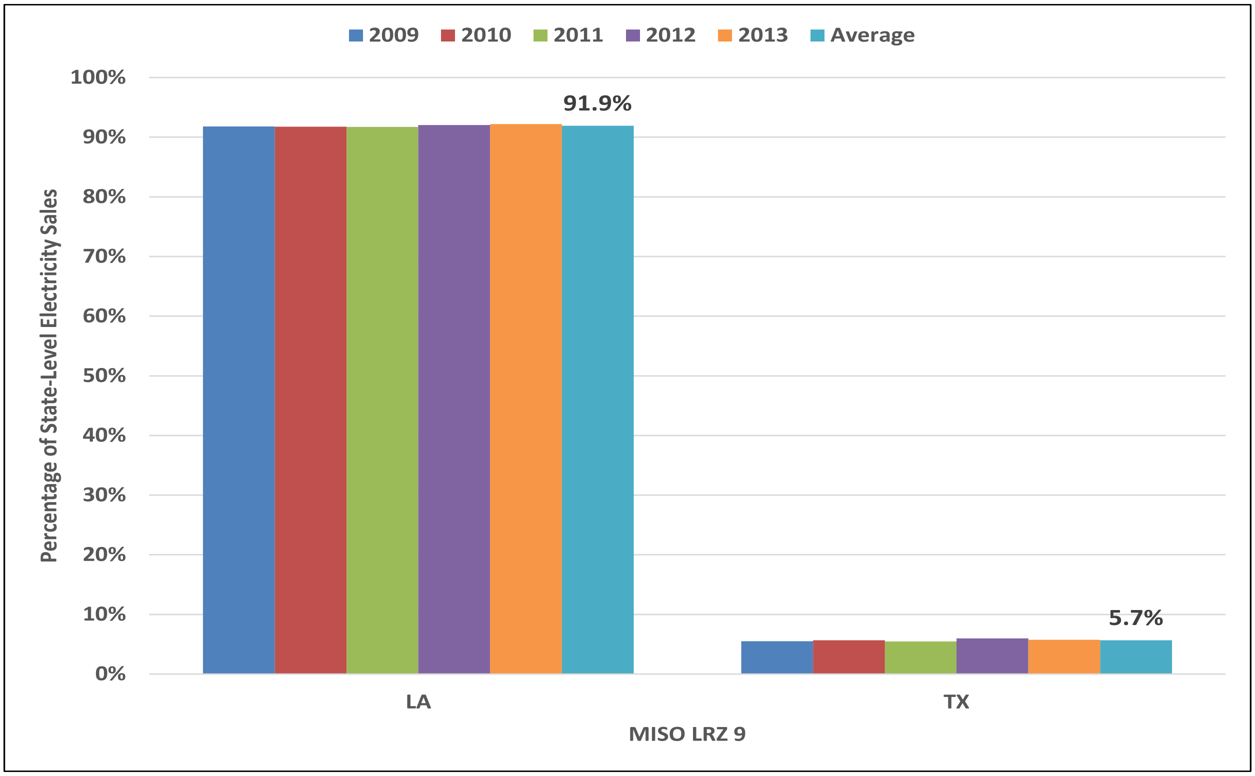
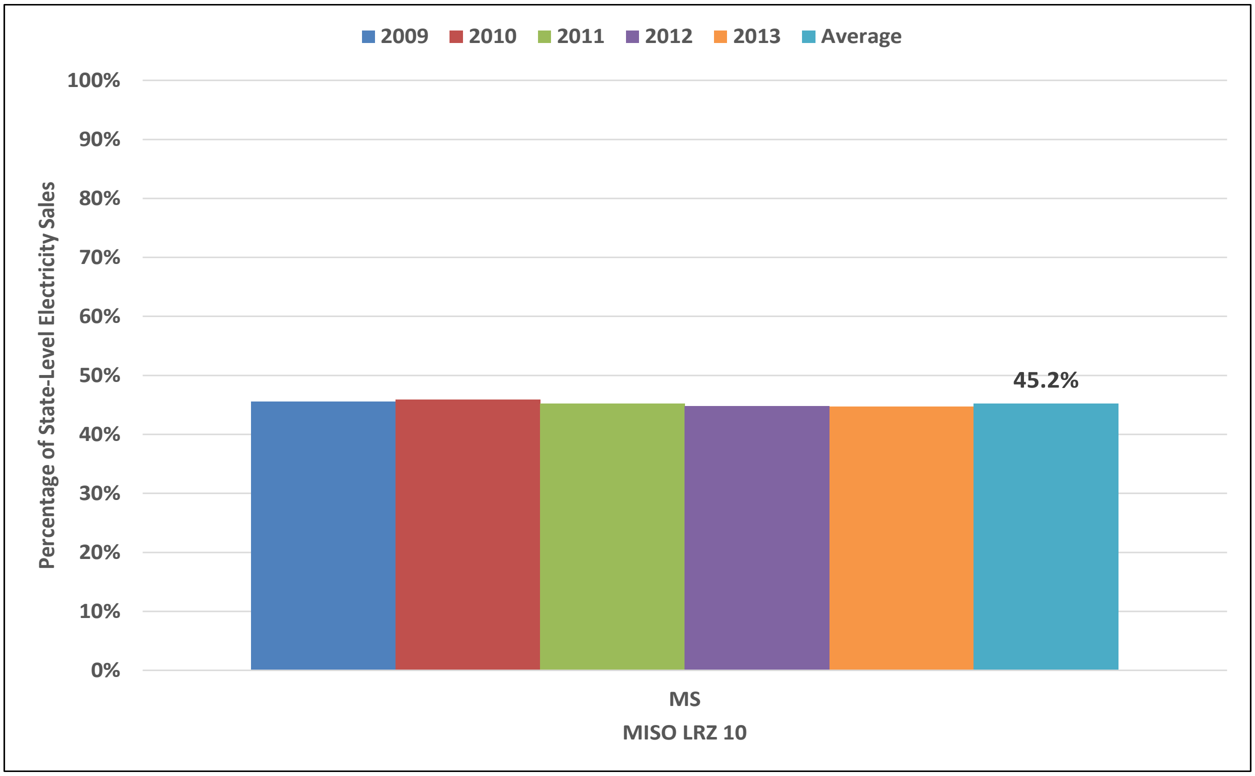


Figure 30: MISO State-Level Load Fractions at LRZ 10



4.1.2 MISO Future Allocation Factors

In determining the future allocation factors, a number of elements were considered. These include the stability of the historical market shares, any distinct upward or downward trend in the historical market shares, and information regarding expected growth for sub-state areas where those areas are particularly indicative of either the MISO or the non-MISO portion of the state. For example, most of the MISO portion of Missouri is in or near the St. Louis metropolitan area. Since the economic drivers for the St. Louis area are weaker than those for the entire state of Missouri, the share of electricity sales in the MISO portion is expected to decrease. A similar analysis was performed in Illinois using the Chicago metropolitan area. Table 13 provides the allocation factors for each LRZ. The allocation factors were then applied to the state load forecasts to obtain LRZ-level forecasts of annual calendar-year energy sales. These were then converted to metered load forecasts by applying the historical estimated distribution losses. Figure 31 to Figure 42 provide historical market shares and future allocation factors for various states.

Table 13: Allocation Factors to Convert State Sales to LRZ Sales

MISO LRZ	State	Allocation Factor	
		Basis	Result
1	IA	Historical average	Constant at 1.76%
	IL	Historical average	Constant at 0.0002%
	MI	Historical average	Constant at 0.14%
	MN	Historical average	Constant at 96.78%
	ND+MT	Historical average	Constant at 37.08%
	SD	Historical average	Constant at 24.33%
	WI	Historical average	Constant at 16.72%
2	MI	Historical average	Constant at 4.93%
	WI	Historical average	Constant at 83.28%
3	IA	Historical average	Constant at 91.06%
	IL	Historical average	Constant at 1.42%
	MN	Historical average	Constant at 1.96%
	SD	Historical average	Constant at 1.82%
4	IL	Chicago vs. state growth	Constant at 32.94%
5	MO	St. Louis vs. state growth	Declining from 49.31% to 48.21%
6	IN+KY	Historical average	Constant at 51.26%
7	MI	Historical average	Constant at 90.89%
8	AR	Historical average	Constant at 70.39%
	MO	Historical average	Constant at 0.25%
	TX	Historical average	Constant at 0.0061%
9	LA	Historical average	Constant at 91.92%
	TX	Historical average	Constant at 5.67%
10	MS	Historical average	Constant at 45.24%

Figure 31: MISO Allocation Factors—IA

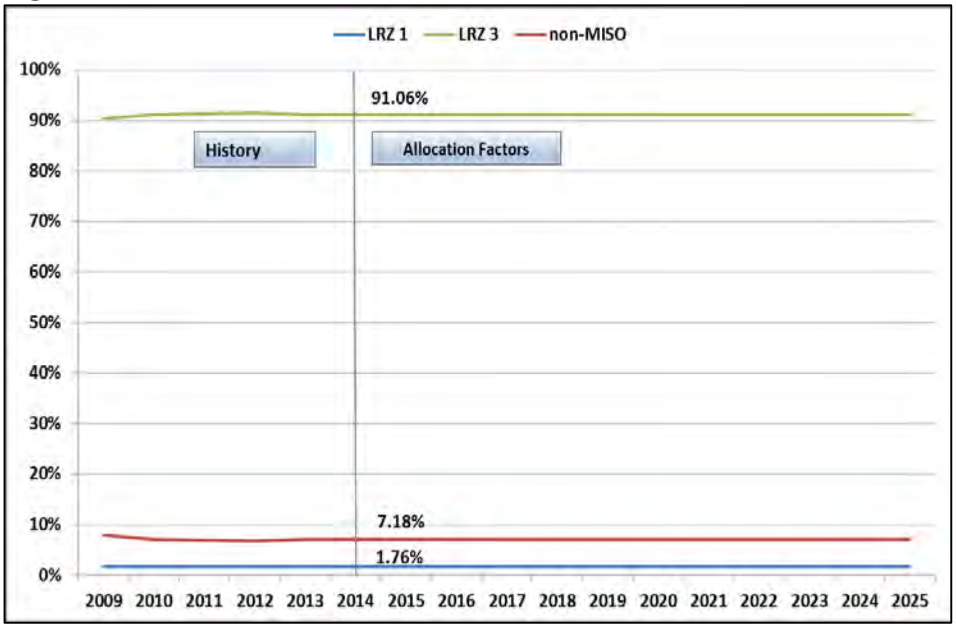


Figure 31 shows the historical MISO market share and future allocation factors for Iowa. Historical values for LRZ 1 are in the range of 1.73% to 1.78%. The allocation factor is held at the average of the historical values (1.76%). For LRZ 3, the 2009 value (90.25%) is lower than the others, which have little variation. The allocation factor is held constant at the average of the historical values (91.06%).

Figure 32: MISO Allocation Factors—IL

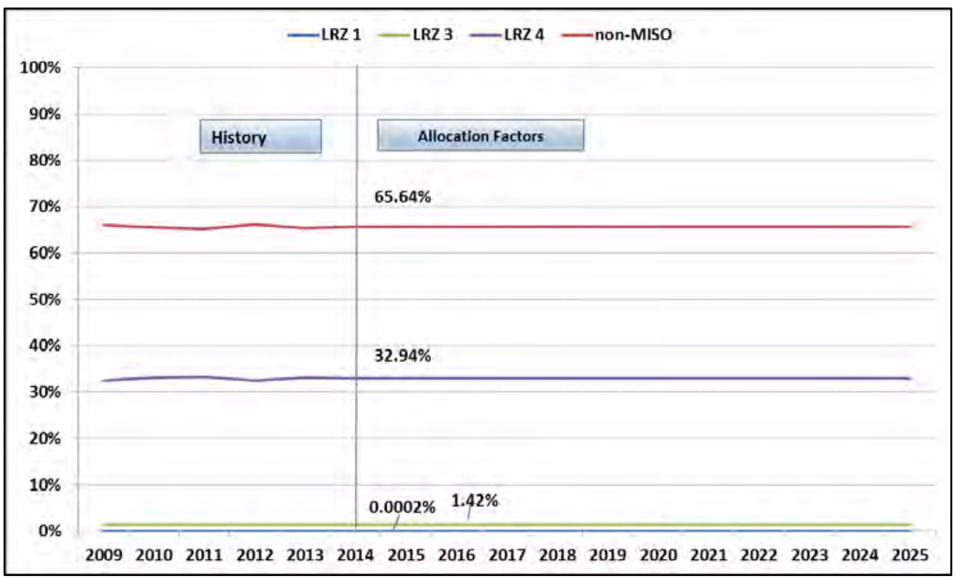


Figure 32 shows the historical MISO market share and future allocation factors for Illinois. Based on the projections of the values for the model drivers for the state of Illinois and for the Chicago metropolitan statistical area, the non-MISO region is projected to grow at a similar rate to the MISO region. The allocation factors for LRZ 4 (32.94%) are held constant at the averages of the historical values. For LRZ 1 and LRZ 3, very small variations are observed in their historical values. They are held constant at the averages of their historical values (0.0002% and 1.42% respectively).

Figure 33: MISO Allocation Factors—IN+KY

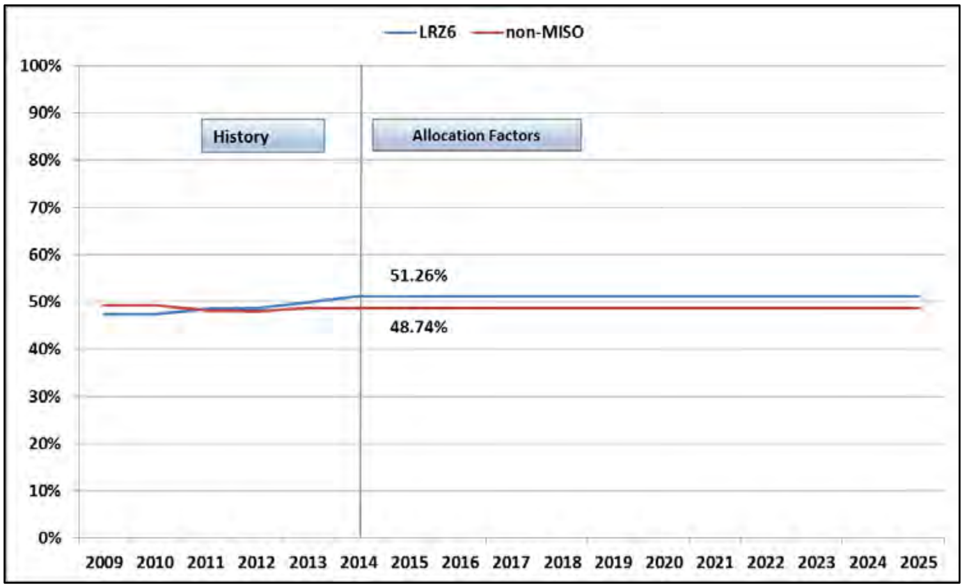


Figure 33 shows the combined historical MISO market share in Indiana and Kentucky and the future allocation factors. The historical share in the MISO footprint has risen throughout the observations (from 47.35% to 49.94% as shown in the graph). Adjustments of historical allocation factors are made in order to factor in the closure of Paducah Gaseous Diffusion Plant (PGDP) before determining the allocation factor for the future. The future allocation factor is held constant (51.26%) at the average of adjusted historical allocation factors.

Figure 34: MISO Allocation Factors—LA

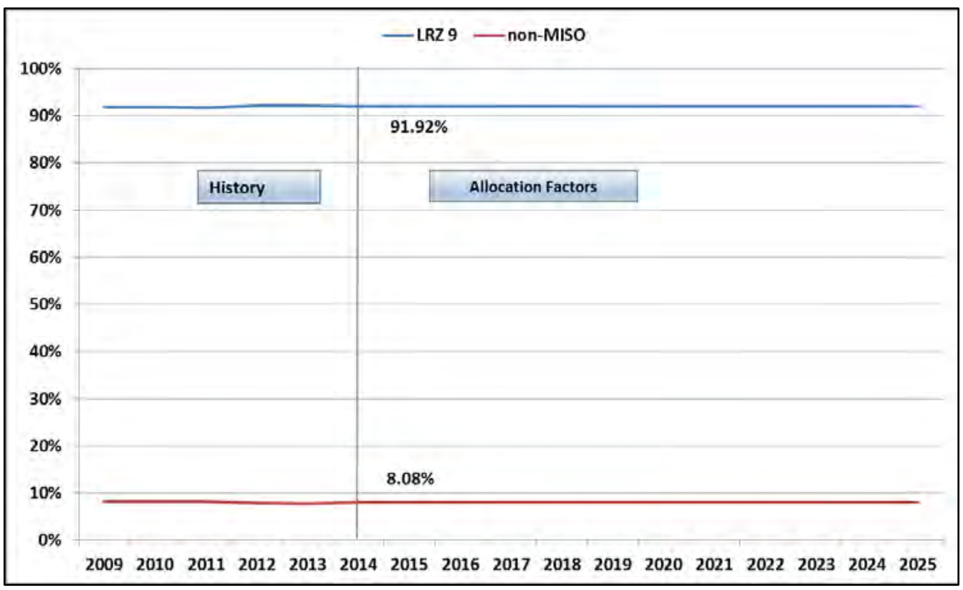


Figure 34 shows the historical MISO market share and future allocation factors for Louisiana. Very small variations are observed in the historical shares. The allocation factor is held at the average of the historical values (91.92%).

Figure 35: MISO Allocation Factors—MI

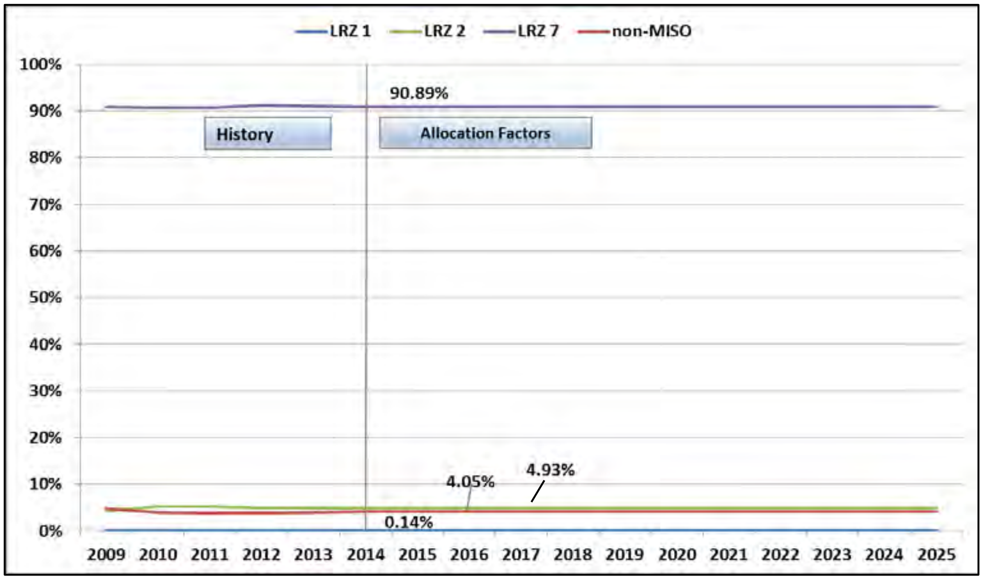


Figure 35 shows the historical MISO market share and future allocation factors for Michigan. LRZ 1 has very little variation in historical shares and is held constant at the average of the historical values (0.14%). LRZ 2 has historical shares ranging from 4.32% to 5.28%. The allocation factor is held constant at the historical average (4.93%). The variation in LRZ 7 has been low (between 90.65% and 91.19%). The allocation factor is held at the average of the historical values (90.89%).

Figure 36: MISO Allocation Factors—MN

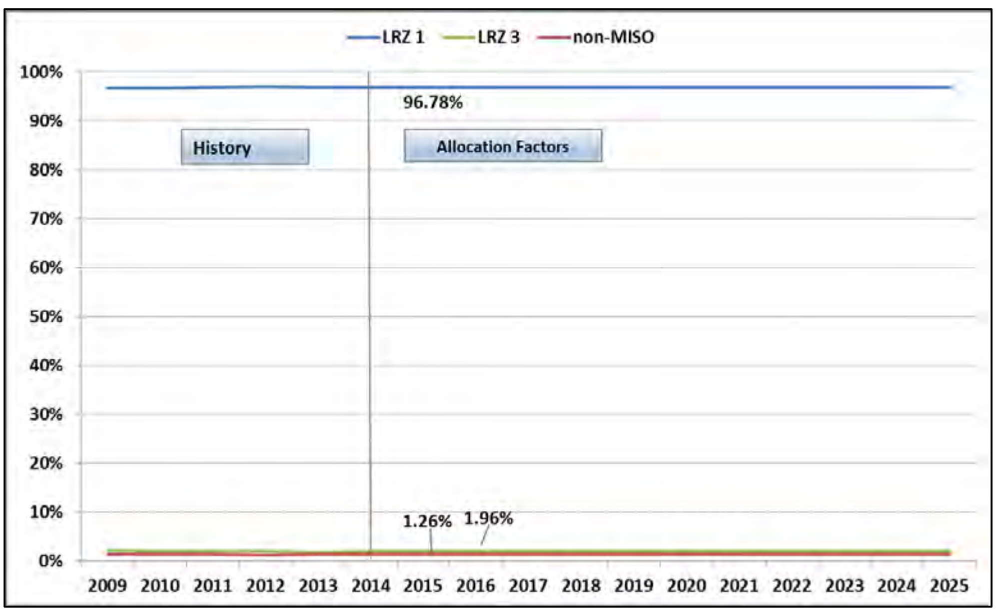


Figure 36 shows the historical MISO market share and future allocation factors for Minnesota. The variation in LRZ 1 has been very low (between 96.60% and 96.93%). The allocation factor is held at the average of the historical values (96.78%). The variation in LRZ 3 has also been low (between 1.86% and 2.06%). The allocation factor is held at the average of the historical values (1.96%).

Figure 37: MISO Allocation Factors—MO

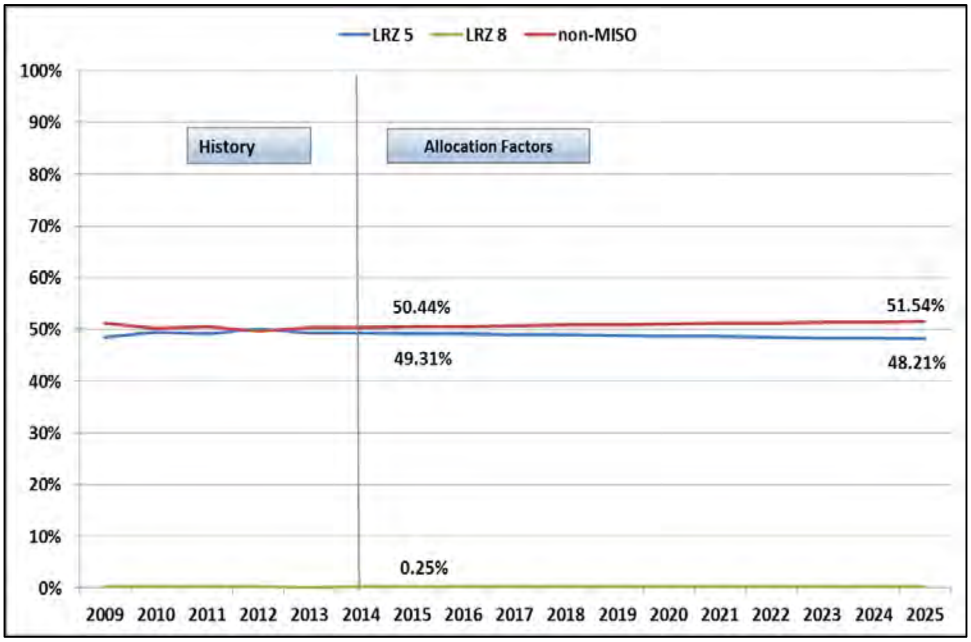


Figure 37 shows the historical MISO market share and future allocation factors for Missouri. Based on the projections of the values for the model drivers for the state of Missouri and for the St. Louis metropolitan statistical area, the non-MISO region is projected to grow faster than the MISO region. The allocation factor for LRZ 5 declines from 49.31% in 2014 (the average of historical values) to 48.21% in 2025 to reflect the declining share of statewide sales in the MISO footprint. The variation in the historical share of LRZ 8 is low. The allocation factor is held at the average of the historical values (0.25%).

Figure 38: MISO Allocation Factors—MS

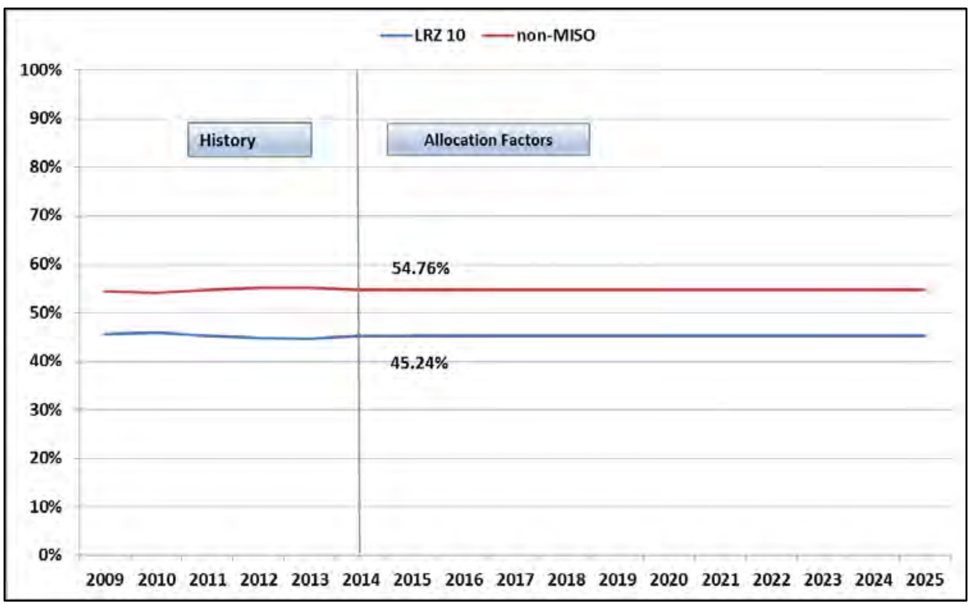


Figure 38 shows the historical MISO market share and future allocation factors for Mississippi. While there is some variation in the historical share (between 44.73% and 45.89%), there is no consistent pattern of growth or shrinkage. The allocation factor is held at the average of the historical values (45.24%).

Figure 39: MISO Allocation Factors—ND+MT

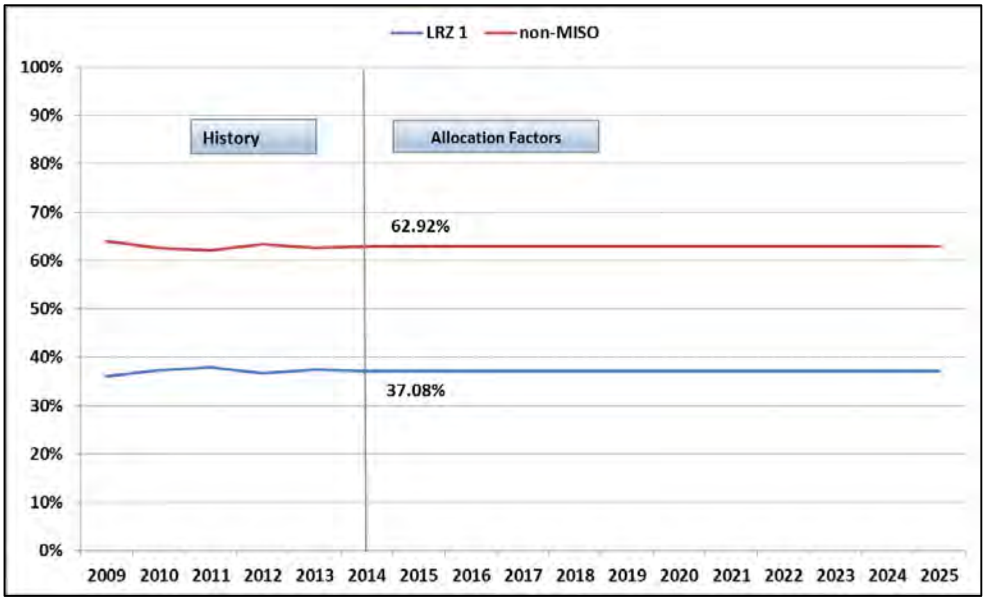


Figure 39 shows the combined historical MISO market share in North Dakota and Montana and the future allocation factors. The historical shares range from 35.99% to 37.90%, without a clear trend of growing or shrinking. The allocation factor is held constant at the average of the historical values (37.08%).

Figure 40: MISO Allocation Factors—SD

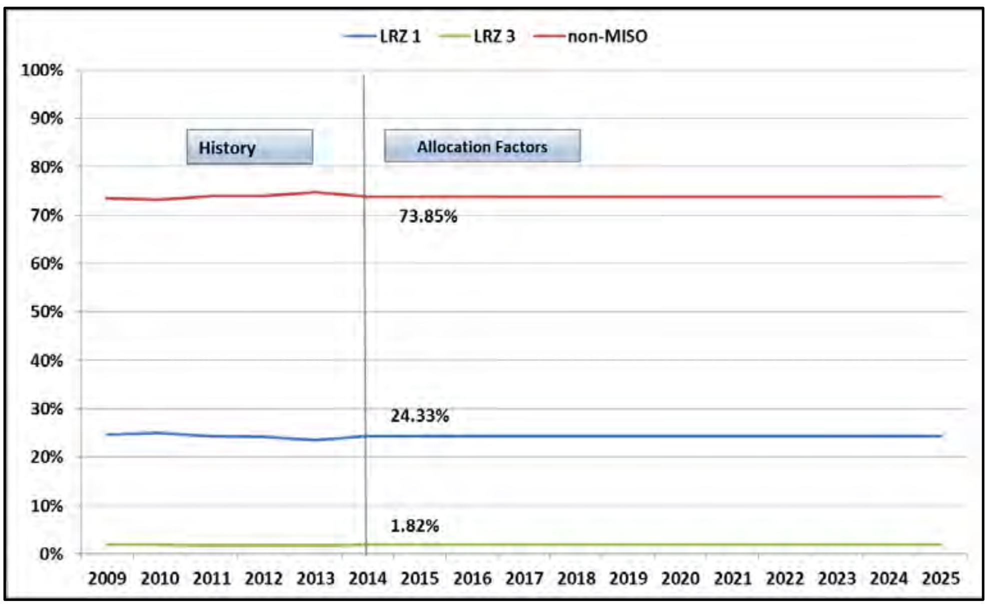


Figure 40 shows the historical MISO market share and future allocation factors for South Dakota. The variation in the historical share of LRZ 1 is moderate (between 23.51% and 24.97%). The allocation factor is held at the average of the historical values (24.33%). The variation in the historical share of LRZ 3 is low (between 1.77% and 1.90%). The allocation factor is held at the average of the historical values (1.82%).

Figure 41: MISO Allocation Factors—TX

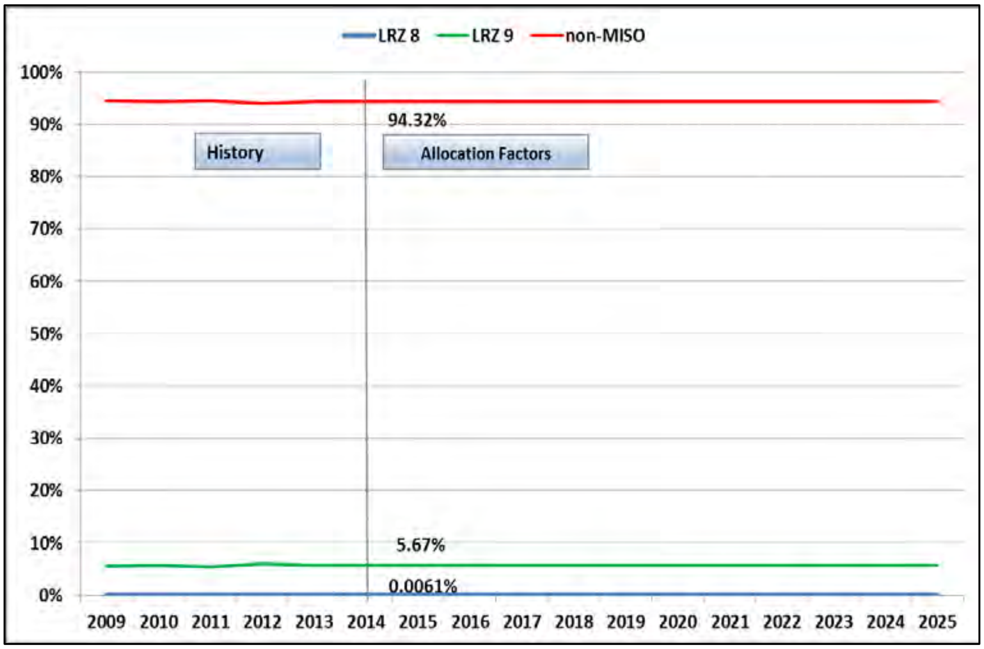


Figure 41 shows the historical MISO market share and future allocation factors for Texas. The variation has been very low for LRZ 8 (between 0.0058% and 0.0065%). The allocation factor is held constant at the average of historical values (0.0061%). For LRZ 9, historical shares fluctuated in the range of 5.46% to 5.98%. The allocation factor is held constant at its historical average (5.67%).

Figure 42: MISO Allocation Factors—WI

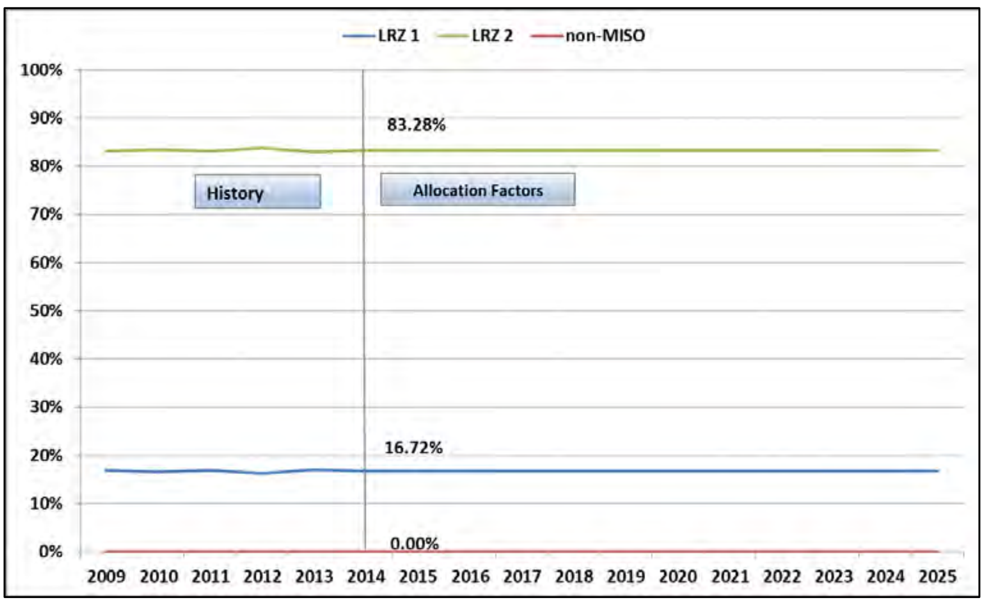


Figure 42 shows the historical MISO market share and future allocation factors for Wisconsin. The variation in the historical share of LRZ 1 is moderate (between 16.23% and 17.02%). The allocation factor is held at the average of the historical values (16.72%). The variation in the historical share of LRZ 2 is also moderate (between 82.98% and 83.77%). The allocation factor is held at the average of the historical values (83.28%).

4.2 ANNUAL ENERGY FORECASTS

Table 14 provides the gross LRZ annual metered load projections and Table 15 provides the net LRZ annual metered load projections (with EE/DR/DG adjustment). Please note that 2014 data shown in the following tables are actuals. Thus, they are the same on both the gross and net bases.

Table 14: Gross LRZ Energy Forecasts (Annual Metered Load in GWh)

Year	LRZ1	LRZ2	LRZ3	LRZ4	LRZ5	LRZ6	LRZ7	LRZ8	LRZ9	LRZ10
2014	99,623	65,113	47,437	50,332	43,298	101,811	100,152	37,160	110,905	21,999
2015	99,938	67,058	47,432	51,069	44,176	104,846	102,860	37,949	108,487	22,917
2016	101,565	68,040	48,086	51,501	44,815	106,134	103,717	38,275	111,573	23,329
2017	103,429	69,094	48,749	51,820	45,245	107,278	105,012	38,650	113,379	23,726
2018	105,123	70,148	49,613	52,123	45,610	108,561	105,595	39,076	115,534	24,250
2019	106,834	71,398	50,426	52,565	46,044	110,067	106,390	39,704	118,239	24,758
2020	108,716	72,600	51,258	52,989	46,604	111,623	107,890	40,209	120,758	25,224
2021	110,539	73,578	52,042	53,314	47,117	113,008	108,894	40,520	122,988	25,628
2022	112,351	74,476	52,871	53,602	47,621	114,224	109,338	40,805	125,136	26,028
2023	114,083	75,443	53,671	53,855	48,091	115,440	110,193	41,120	127,202	26,445
2024	115,769	76,436	54,473	54,157	48,533	116,667	111,200	41,501	129,633	26,867
2025	117,445	77,426	55,274	54,473	48,880	117,911	112,274	41,862	131,887	27,293
Annual Growth Rates（%）										
2014-2015	0.32	2.99	-0.01	1.46	2.03	2.98	2.70	2.12	-2.18	4.18
2015-2016	1.63	1.47	1.38	0.85	1.45	1.23	0.83	0.86	2.84	1.79
2016-2017	1.84	1.55	1.38	0.62	0.96	1.08	1.25	0.98	1.62	1.70
2017-2018	1.64	1.52	1.77	0.58	0.81	1.20	0.55	1.10	1.90	2.21
2018-2019	1.63	1.78	1.64	0.85	0.95	1.39	0.75	1.61	2.34	2.09
2019-2020	1.76	1.68	1.65	0.81	1.22	1.41	1.41	1.27	2.13	1.88
2020-2021	1.68	1.35	1.53	0.61	1.10	1.24	0.93	0.77	1.85	1.60
2021-2022	1.64	1.22	1.59	0.54	1.07	1.08	0.41	0.71	1.75	1.56
2022-2023	1.54	1.30	1.51	0.47	0.99	1.06	0.78	0.77	1.65	1.60
2023-2024	1.48	1.32	1.49	0.56	0.92	1.06	0.91	0.93	1.91	1.59
2024-2025	1.45	1.30	1.47	0.58	0.71	1.07	0.97	0.87	1.74	1.59
Compound Annual Growth Rates (%)										
2014-2019	1.41	1.86	1.23	0.87	1.24	1.57	1.22	1.33	1.29	2.39
2014-2025	1.51	1.59	1.40	0.72	1.11	1.34	1.04	1.09	1.59	1.98
2016-2025	1.63	1.45	1.56	0.63	0.97	1.18	0.88	1.00	1.88	1.76

Table 15: Net LRZ Energy Forecasts with EE/DR/DG adjustment (Annual Metered Load in GWh)

Year	LRZ1	LRZ2	LRZ3	LRZ4	LRZ5	LRZ6	LRZ7	LRZ8	LRZ9	LRZ10
2014	99,623	65,113	47,437	50,332	43,298	101,811	100,152	37,160	110,905	21,999
2015	99,710	66,772	47,140	50,777	43,920	104,521	102,387	37,857	108,434	22,894
2016	101,203	67,619	47,558	51,017	44,358	105,579	103,005	38,128	111,466	23,287
2017	102,920	68,544	47,982	51,143	44,588	106,486	104,060	38,446	113,211	23,665
2018	104,454	69,471	48,602	51,253	44,755	107,526	104,398	38,813	115,294	24,170
2019	105,991	70,598	49,169	51,501	44,990	108,780	104,943	39,380	117,914	24,657
2020	107,683	71,683	49,752	51,734	45,354	110,079	106,190	39,822	120,339	25,102
2021	109,310	72,554	50,283	51,866	45,672	111,202	106,938	40,066	122,467	25,485
2022	110,915	73,351	50,855	51,962	45,983	112,150	107,124	40,284	124,501	25,863
2023	112,428	74,221	51,394	52,024	46,261	113,091	107,719	40,528	126,445	26,258
2024	113,885	75,120	51,931	52,135	46,512	114,036	108,460	40,836	128,742	26,657
2025	115,331	76,057	52,468	52,280	46,694	115,011	109,295	41,123	130,858	27,065
Annual Growth Rates（%）										
2014-2015	0.09	2.55	-0.63	0.88	1.44	2.66	2.23	1.88	-2.23	4.07
2015-2016	1.50	1.27	0.89	0.47	1.00	1.01	0.60	0.72	2.80	1.72
2016-2017	1.70	1.37	0.89	0.25	0.52	0.86	1.02	0.83	1.57	1.62
2017-2018	1.49	1.35	1.29	0.22	0.37	0.98	0.32	0.96	1.84	2.13
2018-2019	1.47	1.62	1.17	0.48	0.53	1.17	0.52	1.46	2.27	2.01
2019-2020	1.60	1.54	1.18	0.45	0.81	1.19	1.19	1.12	2.06	1.81
2020-2021	1.51	1.21	1.07	0.26	0.70	1.02	0.70	0.61	1.77	1.53
2021-2022	1.47	1.10	1.14	0.19	0.68	0.85	0.17	0.54	1.66	1.48
2022-2023	1.36	1.19	1.06	0.12	0.60	0.84	0.55	0.61	1.56	1.53
2023-2024	1.30	1.21	1.04	0.21	0.54	0.84	0.69	0.76	1.82	1.52
2024-2025	1.27	1.25	1.03	0.28	0.39	0.86	0.77	0.70	1.64	1.53
Compound Annual Growth Rates (%)										
2014-2019	1.25	1.63	0.72	0.46	0.77	1.33	0.94	1.17	1.23	2.31
2014-2025	1.34	1.42	0.92	0.35	0.69	1.11	0.80	0.93	1.52	1.90
2016-2025	1.46	1.32	1.10	0.27	0.57	0.96	0.66	0.84	1.80	1.68

5 MISO Regional Non-Coincident Peak Demand Forecasts

5.1 PEAK LOAD CONVERSION FACTORS

Peak load conversion factors were used to translate annual electricity sales forecasts at the MISO LRZ level to summer and winter non-coincident peak demands. These conversion factors are based on normal weather conditions at the time of peak demand and are determined from historical relationships between average hourly load for the year, summer/winter peak levels for the year, and weather conditions at the time of the peak demand.

The process involves three steps: (1) determine the relationship between the peak demand (normalized to the average demand level for the year) and temperature[16] using historical data, (2) estimate the "normal" weather conditions at the time the peak demand occurs, and (3) determine the relationship between peak demand and average demand under normal weather conditions.

5.1.1 Load Data and Selected Weather Stations

The zonal hourly load data was obtained from MISO and contains 43,824 hourly observations of LRZ-level loads from January 1, 2010 to December 31, 2014. These data points represent the MISO footprint at the time the data was collected. In the 2014 MISO Independent Load Forecast, there were only 9 zones. In 2015, MISO split Mississippi from LRZ 9 and assigned it as LRZ 10.

Actual hourly weather data from 1997 to 2014 was obtained from the Midwest Regional Climate Center. For each LRZ, one centrally located weather station was selected within the load centers of the particular LRZ. Table 16 lists the selected weather stations for each LRZ. Note that the weather station for LRZ 9 was changed from Alexandria in the 2014 MISO Independent Load Forecast to one that is more centrally located for the changed footprint.

Table 16: Selected Weather Stations for LRZs

LRZ	City	Station WBAN ID	Station Call Sign
1	Minneapolis-St. Paul, MN	14922	KMSP
2	Milwaukee, WI	14839	KMKE
3	Des Moines, IA	14933	KDSM
4	Springfield, IL	93822	KSPI
5	St. Louis, MO	13994	KSTL
6	Indianapolis, IN	93819	KIND
7	Lansing, MI	53841	KFFT
8	Little Rock, AR	13963	KLIT
9	Lake Charles, LA	03937	KLCH
10	Jackson, MS	03940	KJAN

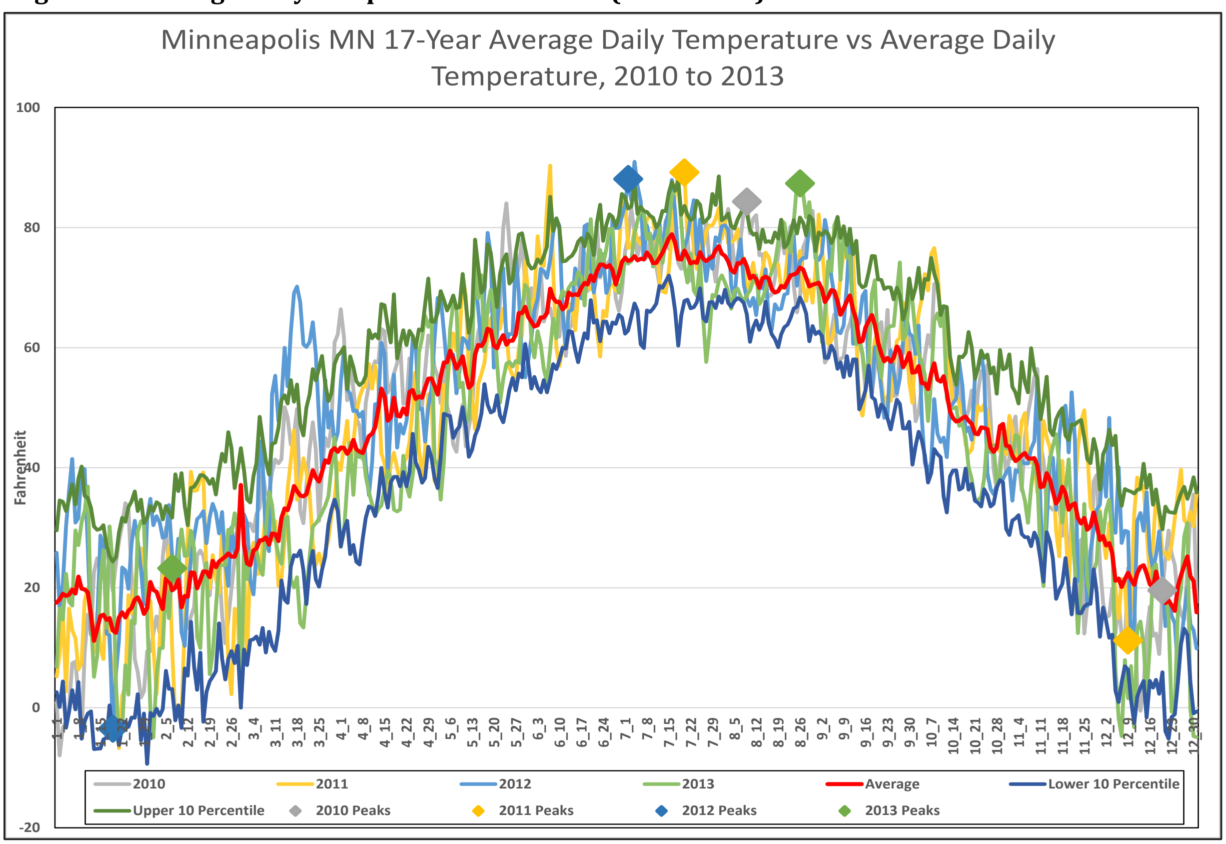
[16] While heat index was considered as a substitute for temperature for summer peaks, it was found to be less indicative of peak demand occurrences than ambient temperature was.

5.1.2 Relationship between Peak Demand and Temperature

There are a number of factors affecting hourly load demand, such as humidity, wind speed, and temperature. Of all the weather related factors, temperature is the most important one to determine when the timing and magnitude of the peak. A closer look at the historical relationships between hourly loads and hourly temperatures shows that temperature has an enormous impact on annual electricity demand, peak zonal winter and summer hourly loads and when the peaks occur.

The likelihood of a peak occurrence increases as the weather gets colder in the winter or hotter in the summer. The peak may or may not occur at the hour when the temperature is coldest or hottest. It often occurs on the day when the average daily temperature is the year's coldest or hottest. Using LRZ 1 as an example, Figure 43 shows the historical relationships between hourly peaks and average daily temperatures. The red line represents the average of historical average daily temperature values across years using the 17 years of hourly temperature records of Minneapolis, MN from 1997 to 2013. The dark blue line represents the average daily temperature at the lower 10th percentile and the dark green line represents the upper 10th percentile. The other four lines represent average daily temperature for each year from 2010 to 2013. The diamonds represent actual summer and winter peaks recorded in 2010 to 2013. The curves representing recorded average daily temperatures of year 2010 to 2013 in that chart show the volatility of weather over years. Summer peaks usually occur when the average daily temperature is above the upper 10th percentile value of the hottest days of a year. Winter peaks are less consistent. The chart indicates that the peaks usually happen at extreme temperatures instead of normal temperature, especially for summer peaks.

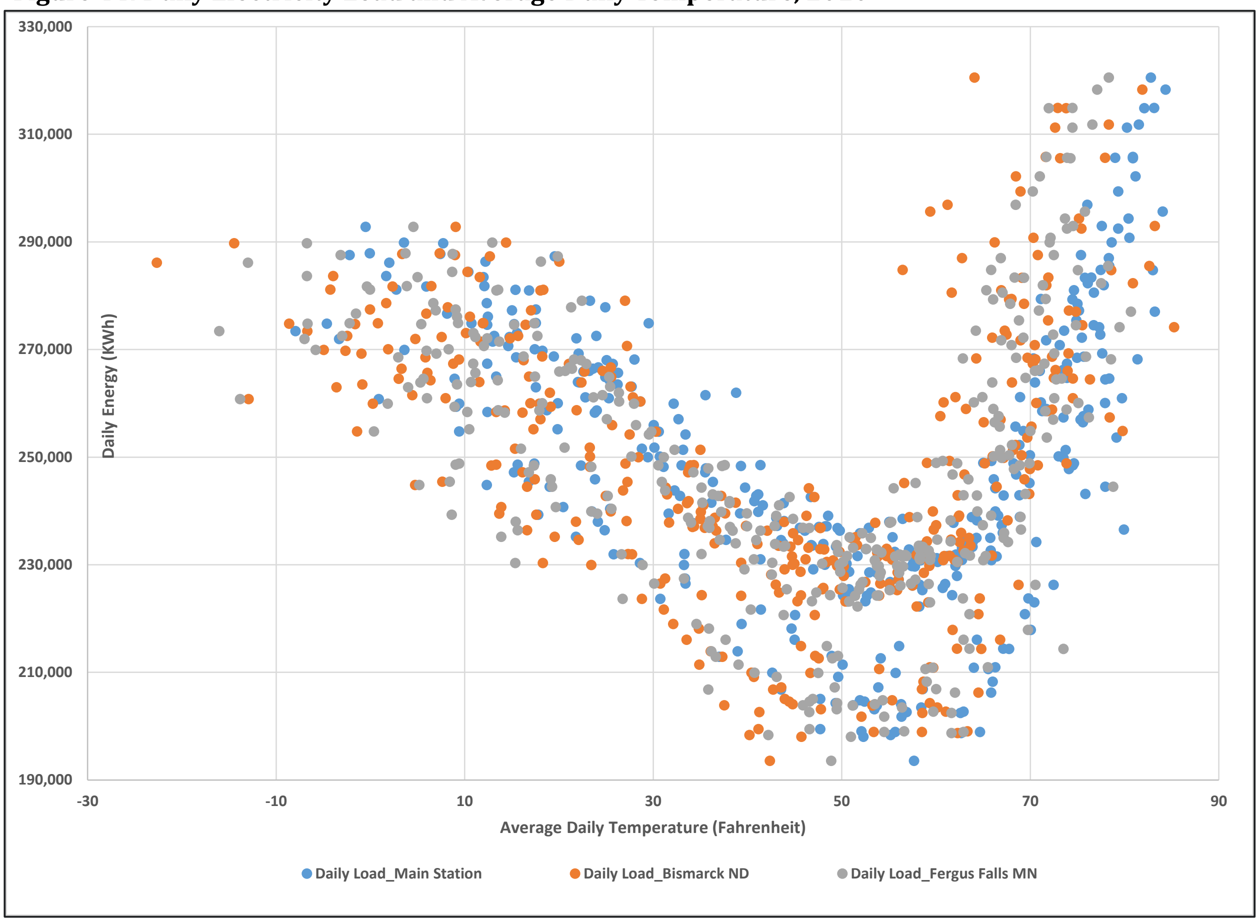
Figure 43: Average Daily Temperature and Peaks (Fahrenheit)



An investigation of historical MISO zonal load data and zonal weather patterns shows that the relationship between temperature and electricity usage is nonlinear. Figure 44 illustrates the daily electricity load of LRZ 1 vs. the average daily temperature. The dots represent the daily electricity load of LRZ 1 versus the average daily temperature of selected weather stations. Three distinct regions are apparent in the figure. For days with colder temperatures (generally below 50 degrees), load increases as temperature decreases. For warmer days (above 65 degrees), load increases as temperature increases. Load is relatively insensitive to temperature in the center region since the need for spacing heating or air conditioning is minimized. In addition, the load is more sensitive to temperature in the summer than winter as the load increases more quickly as summer temperature rises. It can also be observed that when the temperature is extremely cold or hot, the daily load is less responsive to temperature changes because the heating/cooling end uses are already being nearly fully utilized.

During the period of 2010 to 2014, all the peaks of the 10 LRZs occurred on weekdays. Summer peaks usually happened in the late afternoon to early evening while winter peaks occurred either in the morning or in the evening.

Figure 44: Daily Electricity Load and Average Daily Temperature, 2010



5.1.3 Multiple Linear Regression

Multiple linear regression (MLR) analyses were used to estimate the relationship of peak load and temperature quantitatively. In this study, several MLR models were developed such as classical models with seasonal dummy variables, autoregressive models and models with moving average of hourly temperatures. After comparing the fitted results with actual peaks and other statistics for each LRZ, a model that could provide best peak prediction was selected for each LRZ respectively.

5.1.4 Sample Selection

There are 43,824 hourly load records for each zone from 2010 to 2014. More than half of those records are either insensitive to the changes of temperature or occur during times when peak demand do not occur, namely weekend and holiday loads and hourly loads between 9 PM and 6 AM. Thus, SUFG decided to only pick up those records that are sensitive to temperature changes for regression analysis. For each LRZ, the hourly loads were ranked and the top 5,000 hourly loads were selected. Then, loads that occur outside of the summer and winter seasons were removed. The remaining loads and corresponding temperature information were then used in the regression analysis for each LRZ.

5.1.5 Variables and Models

The regression models capture the impact of weather on peak demand through a load factor approach, which compares the level of average demand to the level of peak demand. Load factor is found by dividing the average hourly load over a given period of time (usually one year) by the highest level of demand during that time period. For purposes of this study, SUFG used a slightly modified version of the traditional load factor, which is referred to herein as the Daily Peak Load Factor. The Daily Peak Load Factor is the ratio of the average load over the whole period to the peak demand for a particular day in the period. This is done to capture the impact on demand of hourly and daily temperature relative to the normal levels of demand.

Numerous possible model specifications for each zone were developed, with final models selected based on key statistics and the ability to predict peaks in comparison with historical values. Appendix B provides the regression models for each LRZ. There are slight differences in model specifications across LRZs.

As Figure 43 showed earlier, peak demand often occurs at temperature extremes that are outside of the average for a given time of year. Thus, it is necessary to look at what typical temperature conditions are when the peak demand occurs instead of the average conditions for a given day or month. However, determining the typical conditions can be problematic, especially when there is limited amount of peak observations. These data limitations can cause one or two unusual years to bias the results. Examples include the mild summers of 2013 and 2014, as well as the Polar Vortex of January 2014.

Table 17 presents the historical zonal peak load factors and associated temperatures from 2010 to 2014. For summer peaks, the impact on peak loads of the mild summers can be seen in 2013 and 2014. Multiple summer peaks occurred in September (marked in red font). For winter peaks, note that the 2014 zonal load factors are much lower than other years (marked in blue font). The recorded hourly temperature when the peak occurred is generally much colder than previous years. Using just these observations would bias the normal peak conditions calculations to be cooler in both summer and winter.

Table 17: Historical Summer and Winter Peak Load Factors and Temperatures, 2010-2014 (Fahrenheit)

LRZ	Year	Summer Peak					Winter Peak				
		Peak Time	Temp	Avg Temp	T Max	Load Factor	Peak Time	Temp	Avg Temp	T Max	Load Factor
1	2010	8/9/2010 15:00	93	84	94	65%	12/20/2010 18:00	23	20	26	77%
	2011	7/20/2011 16:00	95	89	96	63%	2/7/2011 19:00	3	11	24	78%
	2012	7/2/2012 14:00	98	88	99	61%	1/19/2012 8:00	-10	-3	6	78%
	2013	8/26/2013 14:00	96	87	96	63%	12/9/2013 19:00	-2	4	12	76%
	2014	7/21/2014 15:00	91	82	91	67%	**1/22/2014 19:00**	**-3**	**2**	**7**	**75%**
2	2010	8/12/2010 15:00	87	81	88	60%	12/13/2010 18:00	11	12	16	77%
	2011	7/20/2011 16:00	97	87	98	56%	2/9/2011 19:00	4	6	13	81%
	2012	7/16/2012 15:00	96	87	97	56%	1/19/2012 19:00	3	9	25	80%
	2013	8/27/2013 15:00	94	84	94	59%	12/11/2013 18:00	4	10	17	77%
	2014	7/22/2014 16:00	87	79	89	63%	**1/6/2014 18:00**	**-12**	**-11**	**-6**	**74%**
3	2010	8/12/2010 15:00	93	86	94	61%	12/13/2010 18:00	9	8	15	77%
	2011	7/19/2011 17:00	95	89	98	59%	2/8/2011 19:00	2	-1	13	77%
	2012	7/25/2012 16:00	105	91	106	58%	1/12/2012 19:00	14	14	18	79%
	2013	**9/9/2013 16:00**	**97**	**86**	**101**	**60%**	12/11/2013 18:00	4	9	24	74%
	2014	**9/4/2014 16:00**	**91**	**84**	**93**	**65%**	**1/6/2014 19:00**	**-4**	**-7**	**-1**	**74%**
4	2010	8/3/2010 16:00	94	85	95	59%	12/13/2010 19:00	9	9	16	74%
	2011	7/21/2011 16:00	97	88	98	56%	2/10/2011 8:00	5	12	24	77%
	2012	7/25/2012 16:00	101	91	103	55%	1/12/2012 19:00	15	19	32	77%
	2013	8/30/2013 15:00	93	83	94	60%	12/11/2013 20:00	7	18	27	76%
	2014	8/25/2014 15:00	96	85	96	60%	**1/6/2014 18:00**	**-10**	**-9**	**-4**	**70%**
5	2010	8/3/2010 16:00	100	92	102	57%	1/7/2010 19:00	11	15	26	69%
	2011	8/2/2011 16:00	101	92	102	55%	2/10/2011 8:00	13	21	32	70%
	2012	7/25/2012 16:00	106	96	107	53%	1/12/2012 19:00	17	21	35	72%
	2013	8/30/2013 15:00	99	90	100	59%	2/1/2013 8:00	13	20	30	72%
	2014	8/25/2014 16:00	95	89	98	58%	**1/6/2014 19:00**	**-3**	**-3**	**1**	**64%**
6	2010	8/10/2010 15:00	95	87	96	63%	12/15/2010 7:00	5	14	23	73%
	2011	7/20/2011 14:00	98	88	98	63%	2/10/2011 7:00	8	12	22	73%
	2012	7/25/2012 16:00	99	88	102	63%	1/13/2012 10:00	16	17	19	78%
	2013	7/18/2013 15:00	91	84	93	65%	12/12/2013 7:00	2	12	20	74%
	2014	**9/5/2014 15:00**	**88**	**79**	**89**	**68%**	**1/24/2014 8:00**	**-4**	**8**	**22**	**69%**
7	2010	7/7/2010 15:00	91	82	92	56%	12/13/2010 18:00	10	12	15	77%
	2011	7/21/2011 14:00	95	85	96	52%	12/8/2011 18:00	31	30	35	82%
	2012	7/17/2012 15:00	98	87	98	51%	1/19/2012 18:00	9	17	27	82%
	2013	7/17/2013 14:00	92	84	93	53%	12/12/2013 18:00	16	13	21	78%
	2014	**9/5/2014 15:00**	**86**	**77**	**88**	**59%**	**1/24/2014 8:00**	**2**	**-1**	**7**	**69%**
8	2010	8/2/2010 15:00	103	89	104	58%	1/8/2010 7:00	13	20	26	67%
	2011	8/3/2011 14:00	111	96	113	53%	1/13/2011 7:00	17	23	31	69%
	2012	7/30/2012 14:00	111	95	111	55%	1/12/2012 20:00	30	35	48	76%
	2013	7/9/2013 16:00	96	87	96	59%	1/15/2013 7:00	26	29	32	72%
	2014	8/25/2014 13:00	96	85	96	60%	**1/24/2014 8:00**	**17**	**25**	**38**	**62%**
9	2010	8/2/2010 16:00	95	88	104	63%	1/11/2010 8:00	33	36	51	67%
	2011	8/18/2011 16:00	94	88	105	62%	1/13/2011 8:00	31	35	42	69%
	2012	6/26/2012 16:00	96	88	103	62%	1/13/2012 8:00	41	42	49	78%
	2013	8/7/2013 16:00	91	86	97	62%	12/16/2013 8:00	44	43	61	76%
	2014	8/22/2014 16:00	90	84	93	66%	**1/7/2014 7:00**	**22**	**29**	**38**	**66%**
10	2010	8/2/2010 14:00	104	89	104	56%	1/11/2010 7:00	20	31	47	65%
	2011	8/3/2011 14:00	87	89	98	52%	1/13/2011 7:00	23	27	39	66%
	2012	7/30/2012 16:00	90	89	98	52%	1/13/2012 7:00	29	35	46	72%
	2013	8/8/2013 16:00	96	87	97	55%	12/13/2013 7:00	36	42	54	71%
	2014	8/6/2014 16:00	94	83	95	58%	**1/7/2014 7:00**	**15**	**21**	**31**	**59%**

In order to better estimate typical temperature conditions on peak, historical weather data was used going back to 1997. Extreme hourly temperatures that occurred during times when demand does not historically peak were excluded from the analysis. These include weekends, holidays and off-peak hours. The potential peak hours were determined by using the highest load hours during the years for which hourly loads were available. While there is some variation across LRZs, peak hours generally occur in the morning and evening in the winter and the afternoon and evening in the summer. The elimination of off-peak hours was especially important for the winter analysis, since many of the coldest temperatures occurred in the middle of the night.

After eliminating off-peak times, the remaining hours were ranked according to hottest temperatures in summer (and lowest temperatures in winter). For years where the hourly loads were known, the actual temperature on peak was compared to the list of highest (lowest) temperatures. Thus, it was determined whether the summer peak occurred on the hottest hour, the second hottest hour, and so forth. A similar determination was performed for the winter peak. More often than not, the peak demand did not occur on the hour with the most extreme temperature and occasionally, the peak occurred on an hour which ranked outside of the top ten or twenty extreme hours.

Next, the average of the ranked extreme temperatures was calculated for two separate time periods: 1997-2014 (which included all weather data) and 2010-2014 (the years for which the hour at which the peak demand occurred was known). This facilitated a comparison of the extremity of the temperatures over the smaller period to the larger period which indicated whether the shorter period was generally warmer or colder than the longer period. The next step was to calculate the average of the actual temperatures at the time of peak for the years that these were known. Finally, this average was adjusted if the 1997-2013 period was warmer or colder than the known period. Table 18 lists the summer and winter temperatures used as normal peak temperatures for each LRZ.

Table 18: Typical Peak Weather Temperatures (Fahrenheit)

Normalized Peak Temps	Winter			Summer		
	Hourly Temp	Average Daily Temp	Daily Max Temp	Hourly Temp	Average Daily Temp	Daily Max Temp
LRZ 1	-2.7	5.0	14.5	93.9	85.0	93.9
LRZ 2	-2.8	-1.1	6.4	89.3	82.7	92.0
LRZ 3	5.3	4.6	14.7	91.1	85.4	96.3
LRZ 4	4.9	10.3	19.4	94.2	84.7	94.7
LRZ 5	10.1	14.9	24.8	98.4	90.1	100.0
LRZ 6	5.2	12.7	22.6	91.3	82.8	92.0
LRZ 7	12.6	12.5	20.9	91.1	81.5	92.1
LRZ 8	18.5	24.1	32.6	99.5	88.3	101.1
LRZ 9	35.8	39.5	52.0	93.1	86.6	98.5
LRZ 10	25.2	33.6	45.2	95.6	86.7	98.9

5.1.6 Regression Results

By inputting actual observed peak weather conditions into the finalized peak conversion models, a series of fitted peak load factors for each zone was obtained for the period of 2010 to 2014. A comparison between the fitted peaks and actual peaks was made and found that the models under forecast the actual peaks in most instances. This is because the econometric model forecasts the mean value for a given temperature. However, most actual peak demands occur on the tail (away from the mean) of the distribution of load levels at a given temperature. Therefore, an adjustment was made to try to capture how far out on the distribution the peaks occur. For each LRZ, a calculation was made to determine the number of standard deviations of fitted peaks from actual peaks. This was used to determine the adjustment to be used in determining the energy to peak demand conversion in the forecast. Figure 45 illustrates the three important elements in deciding zonal summer and winter load factors for this study. Appendix B provides a comparison among the actual historical peaks, the unadjusted peak demands from the model, and the adjusted peak demands.

Figure 45: Zonal Peak Load Factor Calculation

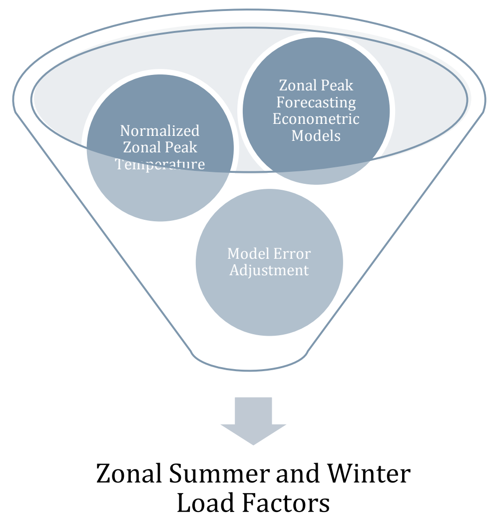


Table 19 lists the adjusted seasonal peak load factors under typical peak weather conditions. For each zone, the load factor in the winter is higher than in the summer. It means the winter peak is less than the summer peak load.

Table 19: Adjusted Peak Load Factors under Typical Peak Temperatures

LRZ	Adjusted Peak Load Factors under Typical Weather Conditions	
	Summer	Winter
1	64.9%	75.2%
2	59.0%	74.9%
3	61.1%	75.6%
4	58.6%	74.2%
5	57.4%	68.9%
6	66.3%	72.9%
7	55.8%	77.7%
8	58.0%	69.1%
9	65.1%	72.1%
10	54.6%	67.1%

These load factors are the ratios of annual average hourly load over summer (or winter) peak demand under normal weather. The reciprocals of the peak load factors are the peak demand conversion factors in Table 20. For comparison purpose, the conversion factors used for the 2014 report are also included in the table. The summer peak conversion factors are relatively less than the 2014 version while the winter conversion factors are slightly higher. There are multiple factors that may contribute to the changes, such as methodology change and normalized peak weather conditions. Also, the addition of the mild summer and extremely cold winter in 2014 affect the results.

Multiplying the average hour load for a given year of the forecast by the conversion factor would yield the peak hourly demand. An example of the calculation follows:

Suppose the forecast annual energy for a given year in LRZ 1 is 100 million MWh. The average hourly load is found by dividing the annual energy by the number of hours in the year.

$$\frac{100{,}000{,}000\ MWh}{8{,}760\ hr} = 11{,}416\ MW$$

The summer and winter peak demands are found by multiplying the average hourly load by the appropriate conversion factor.

$$11{,}416\ MW * 1.541 = 17{,}592\ MW\ (summer)$$

$$11{,}416\ MW * 1.329 = 15{,}172\ MW\ (winter)$$

Table 20: Peak Demand Conversion Factors

LRZ	2015 Version		2014 Version	
	Summer	Winter	Summer	Winter
1	1.541	1.329	1.568	1.282
2	1.695	1.336	1.672	1.267
3	1.635	1.323	1.638	1.275
4	1.707	1.348	1.717	1.303
5	1.741	1.451	1.749	1.405
6	1.508	1.372	1.542	1.340
7	1.792	1.286	1.826	1.245
8	1.726	1.448	1.739	1.412
9	1.536	1.388	1.634	1.363
10	1.831	1.489		

5.2 NON-COINCIDENT PEAK DEMANDS

The LRZ-level non-coincident summer and winter peak demands were calculated by applying the energy-to-peak conversion factors developed earlier to the LRZ annual energy projections. These values represent the projected peak demands for the summer and winter season under normal weather conditions. Usually, the non-coincident peak of each LRZ does not occur at the same time when the MISO reaches system-wide peak. EE/DR/DG adjustments were made directly on non-coincident peak projections. Table 21 to Table 24 provide gross and net (without and with EE/DR/DG adjustment) non-coincident peak demand projections for summer and winter. Please note that 2014 data are historical. Figure 46 to Figure 55 provide the same information graphically.

LRZ PEAK DEMAND FORECASTS

Table 21: Summer Non-coincident Peak Demand Using Gross Forecast (Metered Load in MW)

Year	LRZ1	LRZ2	LRZ3	LRZ4	LRZ5	LRZ6	LRZ7	LRZ8	LRZ9	LRZ10
2014	17,018	11,730	8,283	9,563	8,487	17,170	19,293	7,058	19,173	4,297
2015	17,578	12,975	8,862	9,948	8,786	18,052	21,043	7,469	19,024	4,791
2016	17,865	13,165	8,984	10,033	8,913	18,274	21,218	7,533	19,565	4,877
2017	18,193	13,369	9,108	10,095	8,998	18,471	21,483	7,607	19,881	4,961
2018	18,490	13,572	9,269	10,154	9,071	18,692	21,603	7,691	20,259	5,070
2019	18,791	13,814	9,421	10,240	9,157	18,951	21,765	7,814	20,734	5,176
2020	19,122	14,047	9,577	10,323	9,268	19,219	22,072	7,914	21,175	5,274
2021	19,443	14,236	9,723	10,386	9,370	19,458	22,277	7,975	21,566	5,358
2022	19,762	14,410	9,878	10,442	9,471	19,667	22,368	8,031	21,943	5,442
2023	20,066	14,597	10,027	10,491	9,564	19,876	22,543	8,093	22,305	5,529
2024	20,363	14,789	10,177	10,550	9,652	20,088	22,749	8,168	22,732	5,617
2025	20,658	14,981	10,327	10,612	9,721	20,302	22,969	8,239	23,127	5,706
Annual Growth Rates (%)										
2014-2015	3.29	10.61	6.99	4.03	3.52	5.14	9.07	5.83	-0.78	11.51
2015-2016	1.63	1.47	1.38	0.85	1.45	1.23	0.83	0.86	2.84	1.79
2016-2017	1.84	1.55	1.38	0.62	0.96	1.08	1.25	0.98	1.62	1.70
2017-2018	1.64	1.52	1.77	0.58	0.81	1.20	0.55	1.10	1.90	2.21
2018-2019	1.63	1.78	1.64	0.85	0.95	1.39	0.75	1.61	2.34	2.09
2019-2020	1.76	1.68	1.65	0.81	1.22	1.41	1.41	1.27	2.13	1.88
2020-2021	1.68	1.35	1.53	0.61	1.10	1.24	0.93	0.77	1.85	1.60
2021-2022	1.64	1.22	1.59	0.54	1.07	1.08	0.41	0.71	1.75	1.56
2022-2023	1.54	1.30	1.51	0.47	0.99	1.06	0.78	0.77	1.65	1.60
2023-2024	1.48	1.32	1.49	0.56	0.92	1.06	0.91	0.93	1.91	1.59
2024-2025	1.45	1.30	1.47	0.58	0.71	1.07	0.97	0.87	1.74	1.59
Compound Annual Growth Rates (%)										
2014-2019	2.00	3.33	2.61	1.38	1.53	1.99	2.44	2.06	1.58	3.79
2014-2025	1.78	2.25	2.03	0.95	1.24	1.53	1.60	1.42	1.72	2.61
2016-2025	1.63	1.45	1.56	0.63	0.97	1.18	0.88	1.00	1.88	1.76

Table 22: Winter Non-coincident Peak Demand Using Gross Forecast (Metered Load in MW)

Year	LRZ1	LRZ2	LRZ3	LRZ4	LRZ5	LRZ6	LRZ7	LRZ8	LRZ9	LRZ10
2014	15,140	10,113	7,349	8,262	7,782	16,873	14,832	6,870	19,302	4,277
2015	15,171	10,220	7,162	7,857	7,319	16,418	15,112	6,269	17,177	3,899
2016	15,418	10,370	7,261	7,923	7,425	16,620	15,238	6,323	17,665	3,969
2017	15,701	10,531	7,361	7,972	7,496	16,799	15,428	6,385	17,951	4,036
2018	15,958	10,691	7,492	8,019	7,557	17,000	15,514	6,455	18,292	4,126
2019	16,218	10,882	7,614	8,087	7,629	17,236	15,631	6,559	18,721	4,212
2020	16,503	11,065	7,740	8,152	7,722	17,479	15,851	6,643	19,119	4,291
2021	16,780	11,214	7,858	8,202	7,806	17,696	15,998	6,694	19,473	4,360
2022	17,055	11,351	7,983	8,247	7,890	17,887	16,064	6,741	19,813	4,428
2023	17,318	11,498	8,104	8,286	7,968	18,077	16,189	6,793	20,140	4,499
2024	17,574	11,650	8,225	8,332	8,041	18,269	16,337	6,856	20,525	4,571
2025	17,828	11,801	8,346	8,381	8,098	18,464	16,495	6,916	20,882	4,643
Annual Growth Rates (%)										
2014-2015	0.20	1.06	-2.54	-4.90	-5.95	-2.70	1.89	-8.74	-11.01	-8.84
2015-2016	1.63	1.47	1.38	0.85	1.45	1.23	0.83	0.86	2.84	1.79
2016-2017	1.84	1.55	1.38	0.62	0.96	1.08	1.25	0.98	1.62	1.70
2017-2018	1.64	1.52	1.77	0.58	0.81	1.20	0.55	1.10	1.90	2.21
2018-2019	1.63	1.78	1.64	0.85	0.95	1.39	0.75	1.61	2.34	2.09
2019-2020	1.76	1.68	1.65	0.81	1.22	1.41	1.41	1.27	2.13	1.88
2020-2021	1.68	1.35	1.53	0.61	1.10	1.24	0.93	0.77	1.85	1.60
2021-2022	1.64	1.22	1.59	0.54	1.07	1.08	0.41	0.71	1.75	1.56
2022-2023	1.54	1.30	1.51	0.47	0.99	1.06	0.78	0.77	1.65	1.60
2023-2024	1.48	1.32	1.49	0.56	0.92	1.06	0.91	0.93	1.91	1.59
2024-2025	1.45	1.30	1.47	0.58	0.71	1.07	0.97	0.87	1.74	1.59
Compound Annual Growth Rates (%)										
2014-2019	1.38	1.48	0.71	-0.43	-0.40	0.43	1.05	-0.92	-0.61	-0.31
2014-2025	1.50	1.41	1.16	0.13	0.36	0.82	0.97	0.06	0.72	0.75
2016-2025	1.63	1.45	1.56	0.63	0.97	1.18	0.88	1.00	1.88	1.76

LRZ PEAK DEMAND FORECASTS

Table 23: Summer Non-coincident Peak Demand with EE/DR/DG Adjustments (Metered Load in MW)

Year	LRZ1	LRZ2	LRZ3	LRZ4	LRZ5	LRZ6	LRZ7	LRZ8	LRZ9	LRZ10
2014	17,018	11,730	8,283	9,563	8,487	17,170	19,293	7,058	19,173	4,297
2015	16,443	11,882	8,465	9,744	8,728	17,573	19,639	6,965	18,779	4,786
2016	16,660	12,017	8,519	9,781	8,807	17,726	19,739	6,995	19,285	4,867
2017	16,919	12,176	8,573	9,794	8,843	17,853	19,929	7,036	19,572	4,946
2018	17,145	12,335	8,664	9,805	8,866	18,001	19,970	7,087	19,915	5,050
2019	17,368	12,532	8,744	9,842	8,903	18,184	20,052	7,177	20,351	5,150
2020	17,611	12,719	8,826	9,876	8,964	18,374	20,277	7,243	20,750	5,242
2021	17,851	12,864	8,899	9,890	9,016	18,533	20,398	7,269	21,105	5,320
2022	18,086	12,994	8,979	9,896	9,066	18,660	20,404	7,289	21,443	5,397
2023	18,304	13,137	9,052	9,895	9,109	18,785	20,492	7,314	21,763	5,478
2024	18,511	13,284	9,124	9,904	9,147	18,909	20,610	7,352	22,145	5,559
2025	18,714	13,436	9,195	9,918	9,168	19,036	20,743	7,385	22,493	5,642
Annual Growth Rates (%)										
2014-2015	-3.38	1.29	2.20	1.89	2.84	2.35	1.79	-1.31	-2.06	11.39
2015-2016	1.32	1.14	0.64	0.38	0.90	0.87	0.51	0.43	2.70	1.70
2016-2017	1.55	1.32	0.63	0.14	0.41	0.71	0.96	0.59	1.48	1.60
2017-2018	1.34	1.31	1.05	0.11	0.26	0.83	0.21	0.72	1.76	2.11
2018-2019	1.30	1.59	0.92	0.38	0.41	1.02	0.41	1.28	2.19	1.99
2019-2020	1.40	1.50	0.95	0.34	0.69	1.05	1.12	0.91	1.96	1.78
2020-2021	1.36	1.14	0.82	0.14	0.58	0.86	0.60	0.36	1.71	1.50
2021-2022	1.32	1.01	0.89	0.07	0.56	0.69	0.03	0.28	1.60	1.45
2022-2023	1.20	1.10	0.81	-0.01	0.47	0.67	0.43	0.34	1.50	1.49
2023-2024	1.13	1.12	0.80	0.09	0.41	0.66	0.57	0.51	1.75	1.48
2024-2025	1.10	1.14	0.78	0.14	0.23	0.67	0.65	0.45	1.57	1.48
Compound Annual Growth Rates (%)										
2014-2019	0.41	1.33	1.09	0.58	0.96	1.15	0.77	0.34	1.20	3.69
2014-2025	0.87	1.24	0.95	0.33	0.70	0.94	0.66	0.41	1.46	2.51
2016-2025	1.30	1.25	0.85	0.15	0.45	0.80	0.55	0.60	1.72	1.65

Table 24: Winter Non-coincident Peak Demand with EE/DR/DG Adjustments (Metered Load in MW)

Year	LRZ1	LRZ2	LRZ3	LRZ4	LRZ5	LRZ6	LRZ7	LRZ8	LRZ9	LRZ10
2014	15,140	10,113	7,349	8,262	7,782	16,873	14,832	6,870	19,302	4,277
2015	14,035	9,127	6,766	7,652	7,262	15,939	13,708	5,765	16,932	3,894
2016	14,213	9,223	6,796	7,671	7,319	16,072	13,759	5,785	17,386	3,959
2017	14,427	9,338	6,826	7,672	7,341	16,181	13,874	5,814	17,641	4,021
2018	14,612	9,454	6,886	7,670	7,352	16,309	13,881	5,851	17,948	4,105
2019	14,794	9,599	6,937	7,689	7,374	16,469	13,917	5,922	18,338	4,186
2020	14,992	9,737	6,990	7,706	7,417	16,634	14,056	5,972	18,694	4,259
2021	15,188	9,842	7,034	7,706	7,452	16,772	14,119	5,988	19,011	4,322
2022	15,379	9,935	7,084	7,701	7,485	16,880	14,099	5,999	19,312	4,384
2023	15,555	10,038	7,129	7,690	7,513	16,986	14,138	6,014	19,598	4,448
2024	15,722	10,145	7,172	7,686	7,536	17,091	14,198	6,039	19,938	4,513
2025	15,884	10,256	7,215	7,687	7,545	17,198	14,270	6,061	20,248	4,579
Annual Growth Rates (%)										
2014-2015	-7.30	-9.75	-7.94	-7.38	-6.68	-5.54	-7.58	-16.08	-12.28	-8.96
2015-2016	1.26	1.04	0.45	0.25	0.78	0.83	0.37	0.34	2.68	1.67
2016-2017	1.51	1.25	0.44	0.01	0.30	0.68	0.83	0.50	1.47	1.58
2017-2018	1.29	1.24	0.87	-0.02	0.15	0.79	0.05	0.64	1.74	2.09
2018-2019	1.25	1.54	0.74	0.25	0.30	0.98	0.26	1.21	2.17	1.97
2019-2020	1.33	1.44	0.76	0.21	0.58	1.01	0.99	0.84	1.94	1.75
2020-2021	1.31	1.07	0.64	0.01	0.47	0.82	0.45	0.27	1.70	1.47
2021-2022	1.26	0.95	0.71	-0.07	0.45	0.64	-0.14	0.19	1.58	1.43
2022-2023	1.14	1.04	0.63	-0.14	0.37	0.63	0.28	0.25	1.48	1.47
2023-2024	1.07	1.06	0.61	-0.05	0.30	0.62	0.42	0.42	1.74	1.46
2024-2025	1.03	1.09	0.59	0.01	0.13	0.63	0.50	0.36	1.55	1.46
Compound Annual Growth Rates (%)										
2014-2019	-0.46	-1.04	-1.15	-1.43	-1.07	-0.48	-1.26	-2.93	-1.02	-0.43
2014-2025	0.44	0.13	-0.17	-0.65	-0.28	0.17	-0.35	-1.13	0.44	0.62
2016-2025	1.24	1.19	0.67	0.02	0.34	0.76	0.41	0.52	1.71	1.63

LRZ PEAK DEMAND FORECASTS

Figure 46: Net and Gross LRZ 1 Summer and Winter Non-coincident Peak Demand (MW)

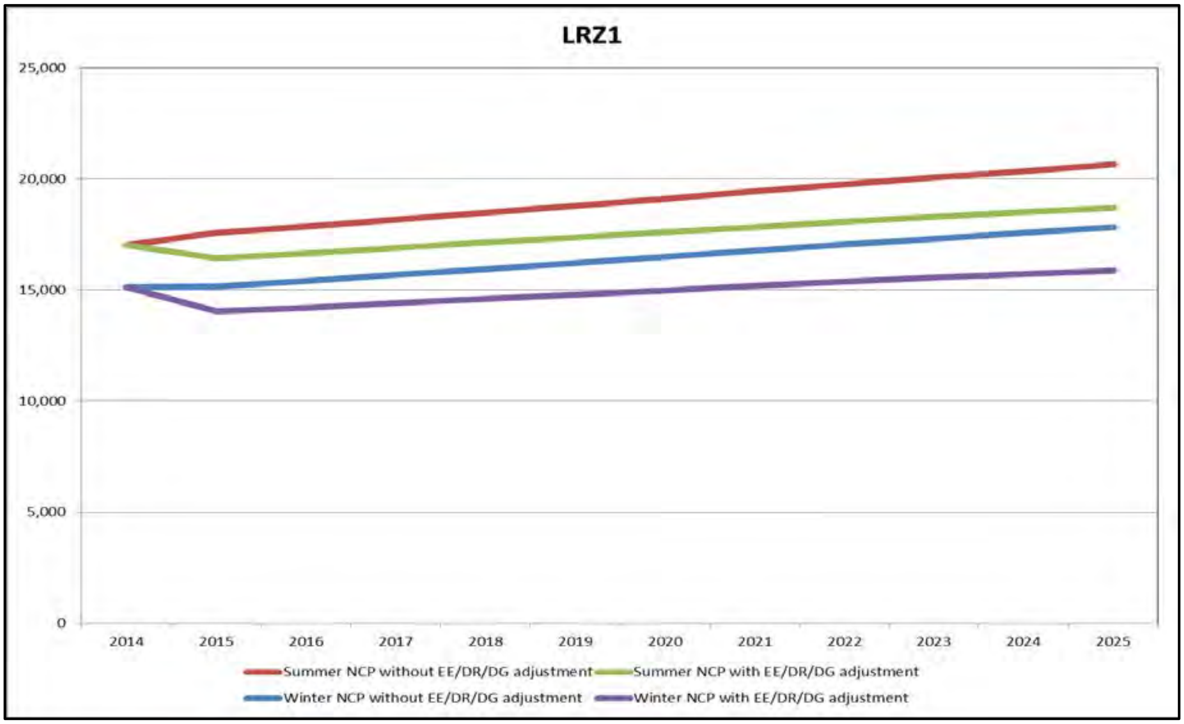
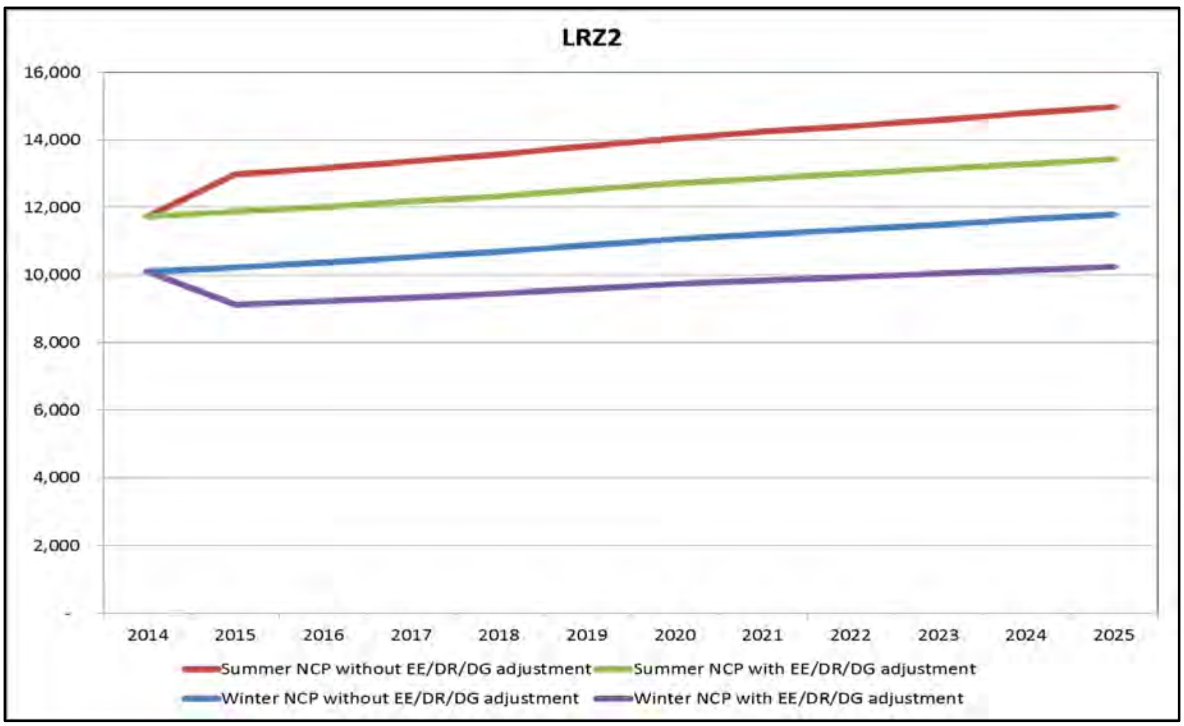


Figure 47: Net and Gross LRZ 2 Summer and Winter Non-coincident Peak Demand (MW)



LRZ PEAK DEMAND FORECASTS

Figure 48: Net and Gross LRZ 3 Summer and Winter Non-coincident Peak Demand (MW)

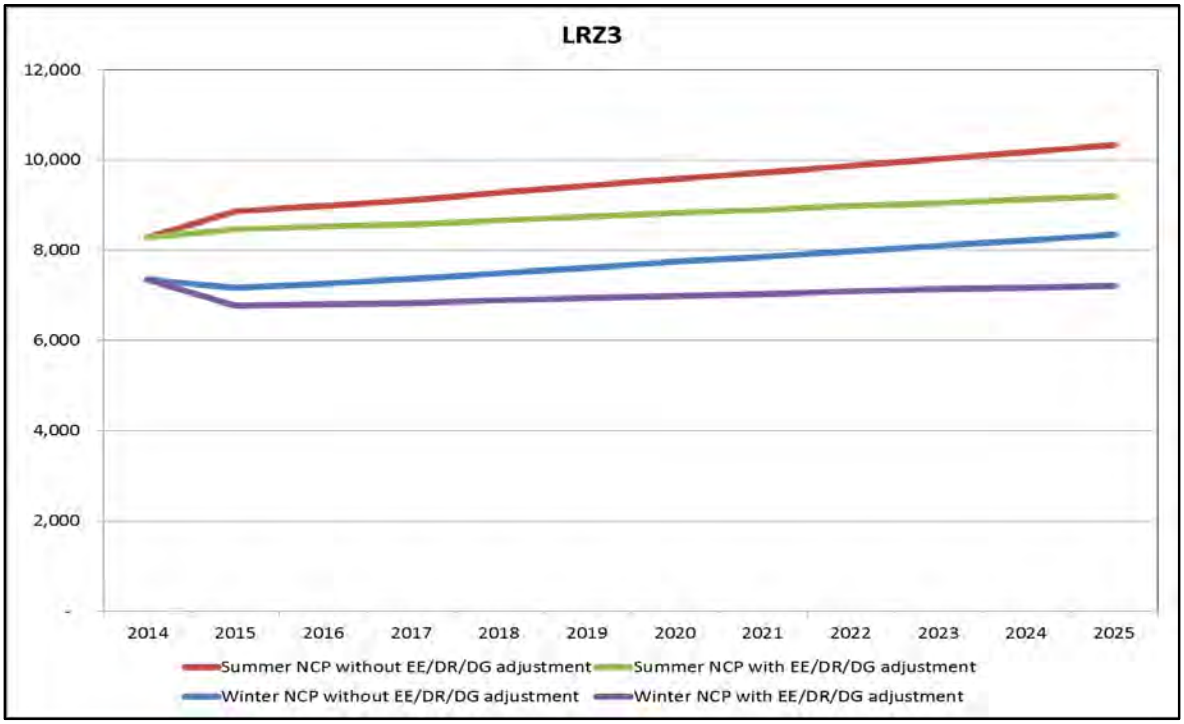


Figure 49: Net and Gross LRZ 4 Summer and Winter Non-coincident Peak Demand (MW)

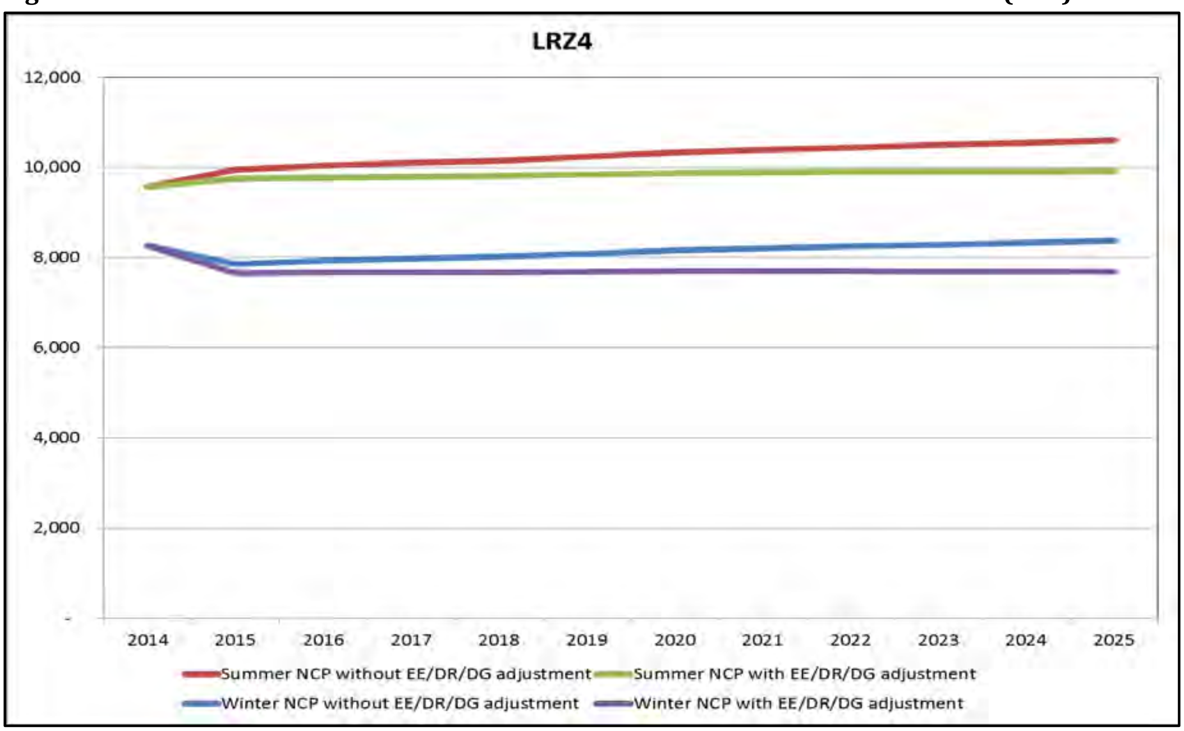


Figure 50: Net and Gross LRZ 5 Summer and Winter Non-coincident Peak Demand (MW)

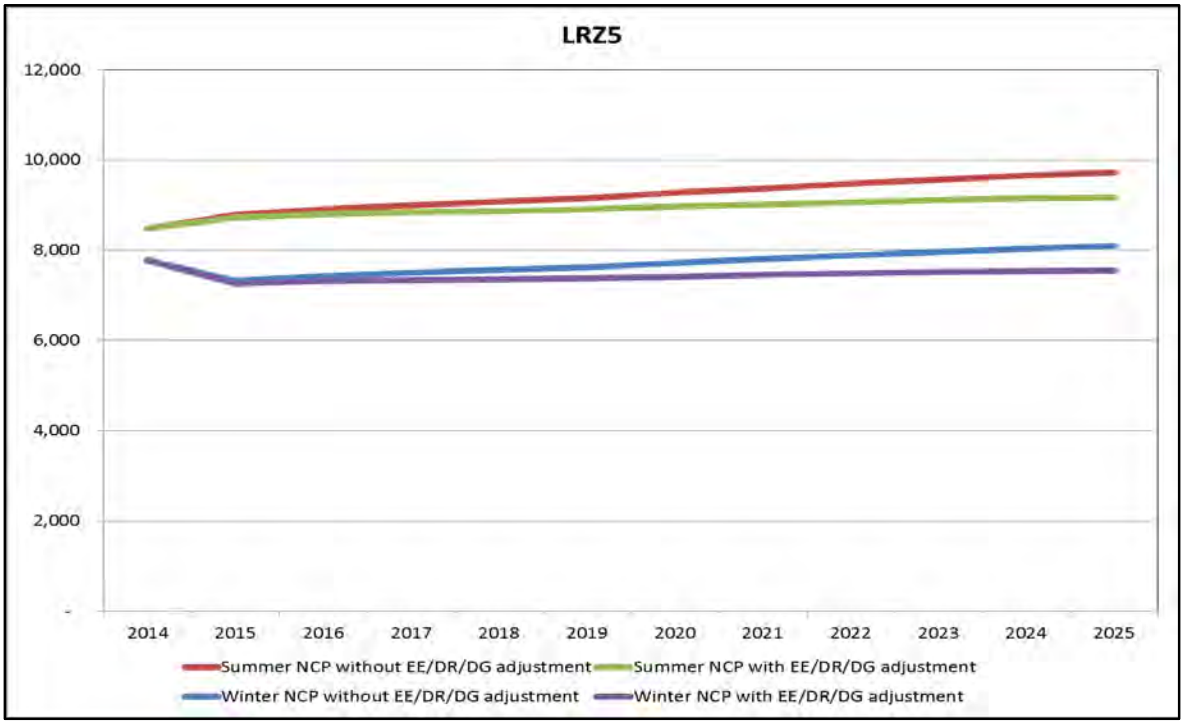
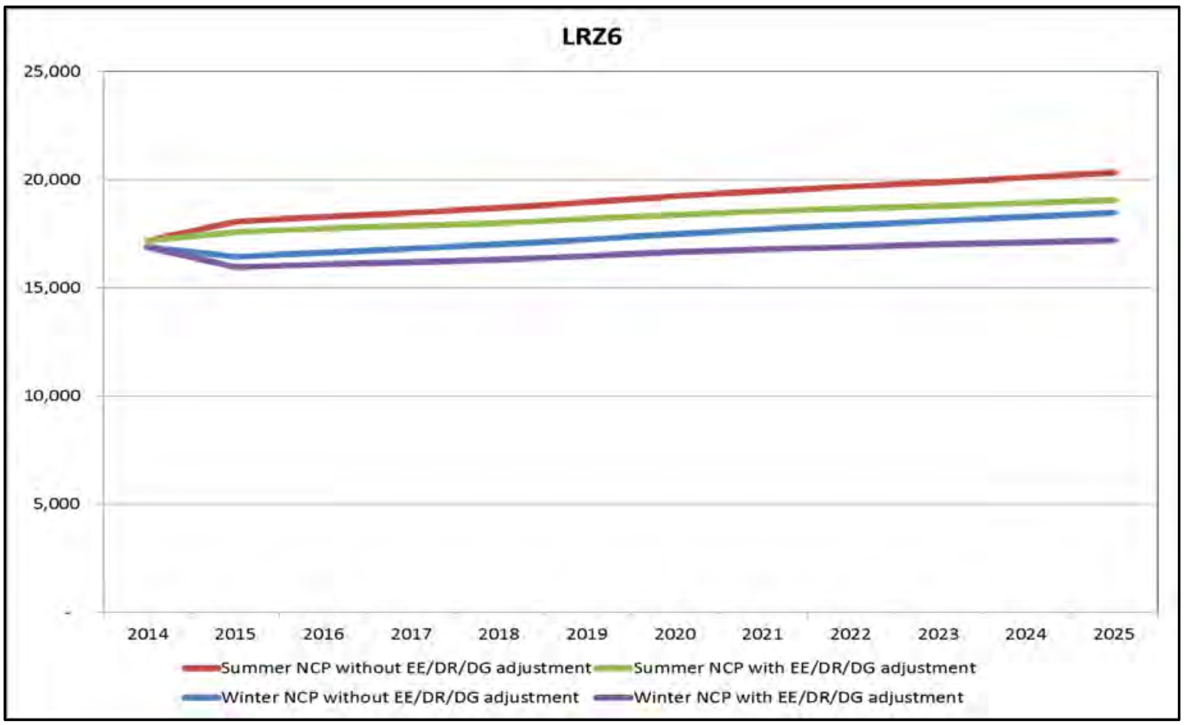


Figure 51: Net and Gross LRZ 6 Summer and Winter Non-coincident Peak Demand (MW)



LRZ PEAK DEMAND FORECASTS

Figure 52: Net and Gross LRZ 7 Summer and Winter Non-coincident Peak Demand (MW)

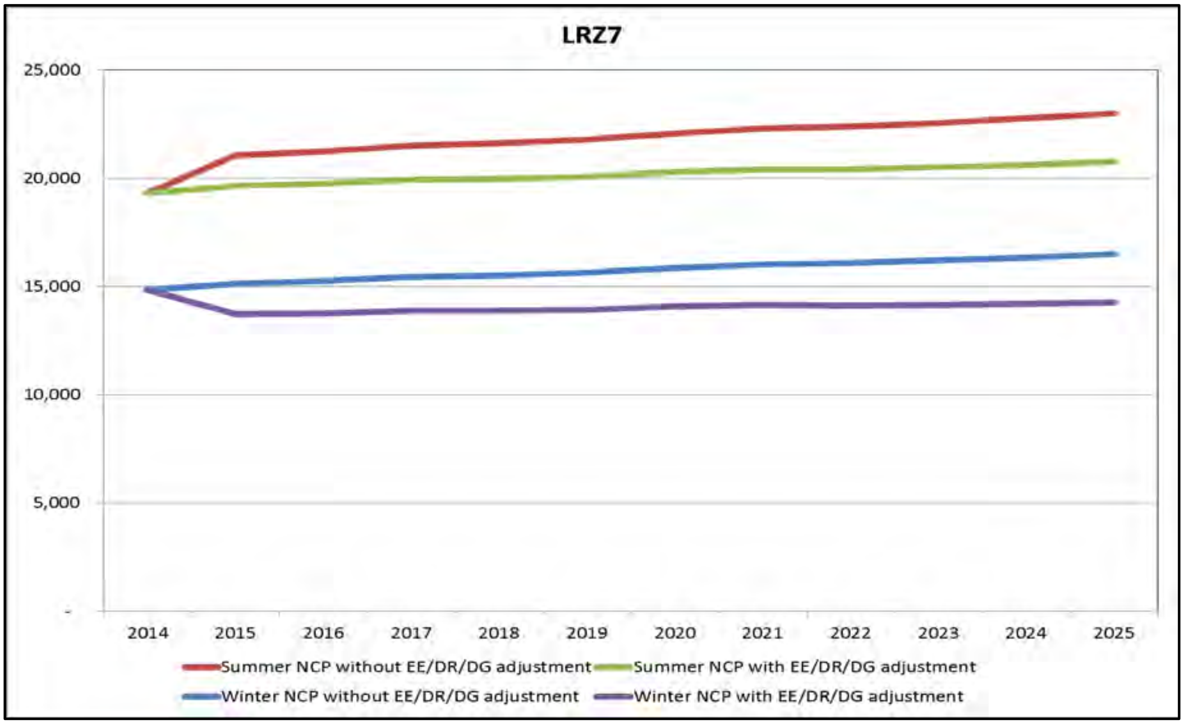
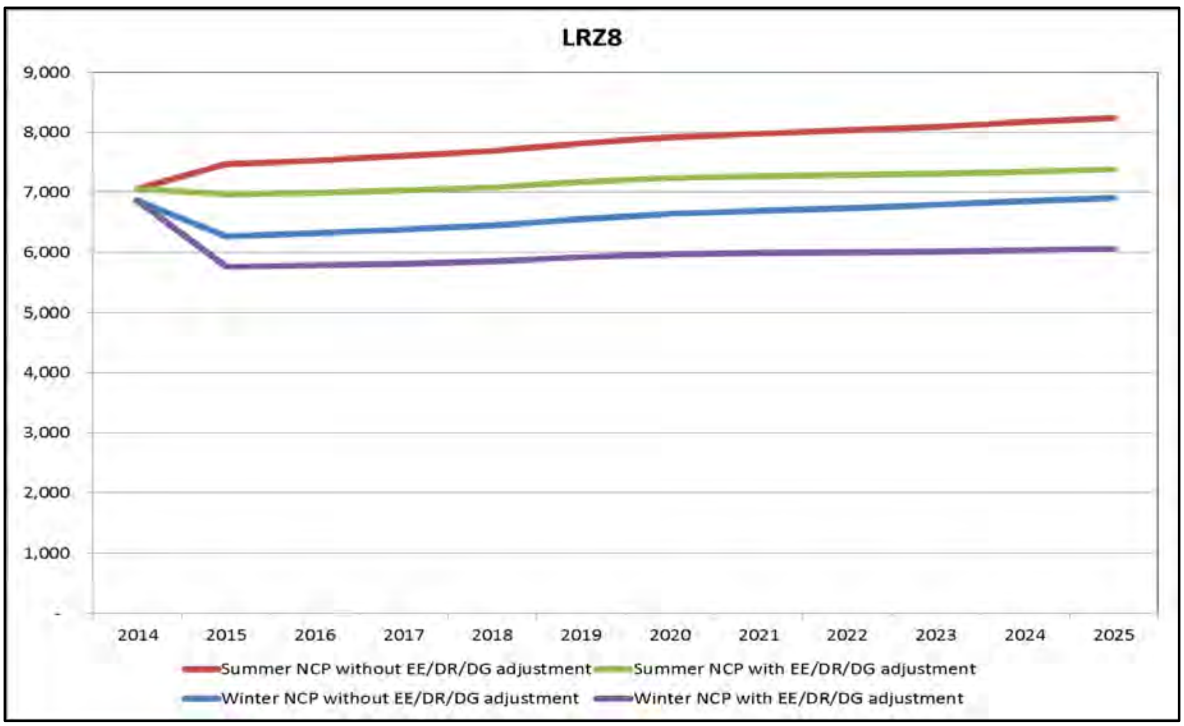


Figure 53: Net and Gross LRZ 8 Summer and Winter Non-coincident Peak Demand (MW)



LRZ PEAK DEMAND FORECASTS

Figure 54: Net and Gross LRZ 9 Summer and Winter Non-coincident Peak Demand (MW)

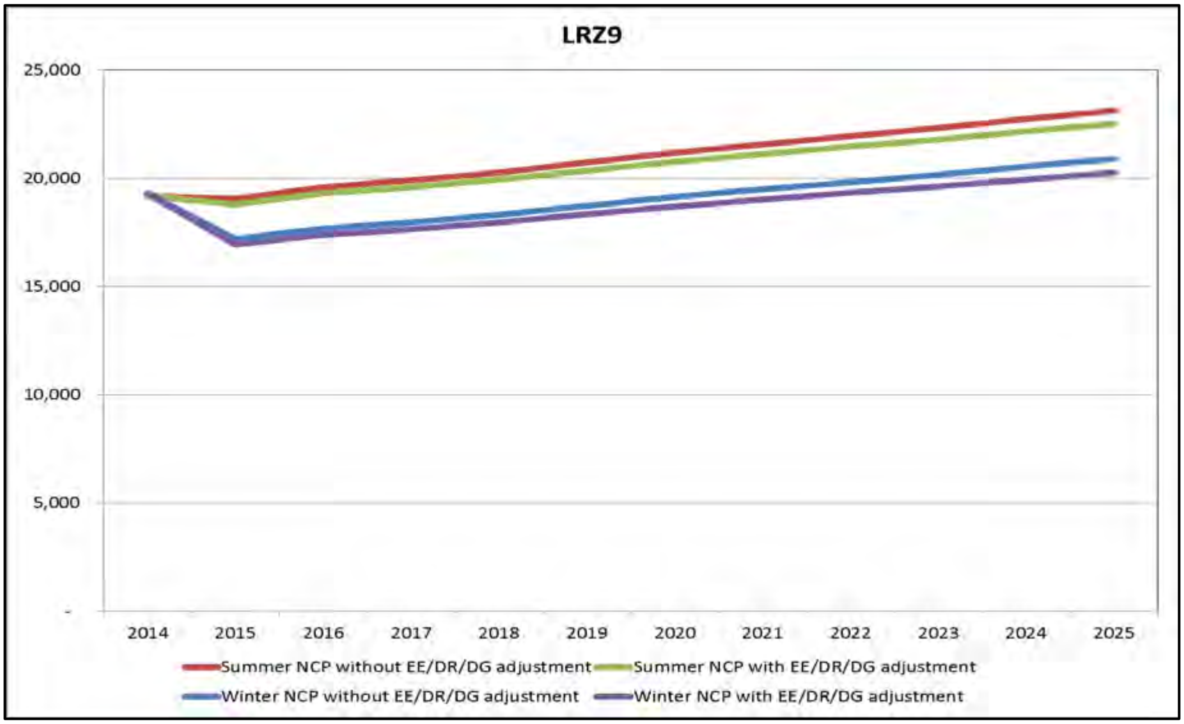
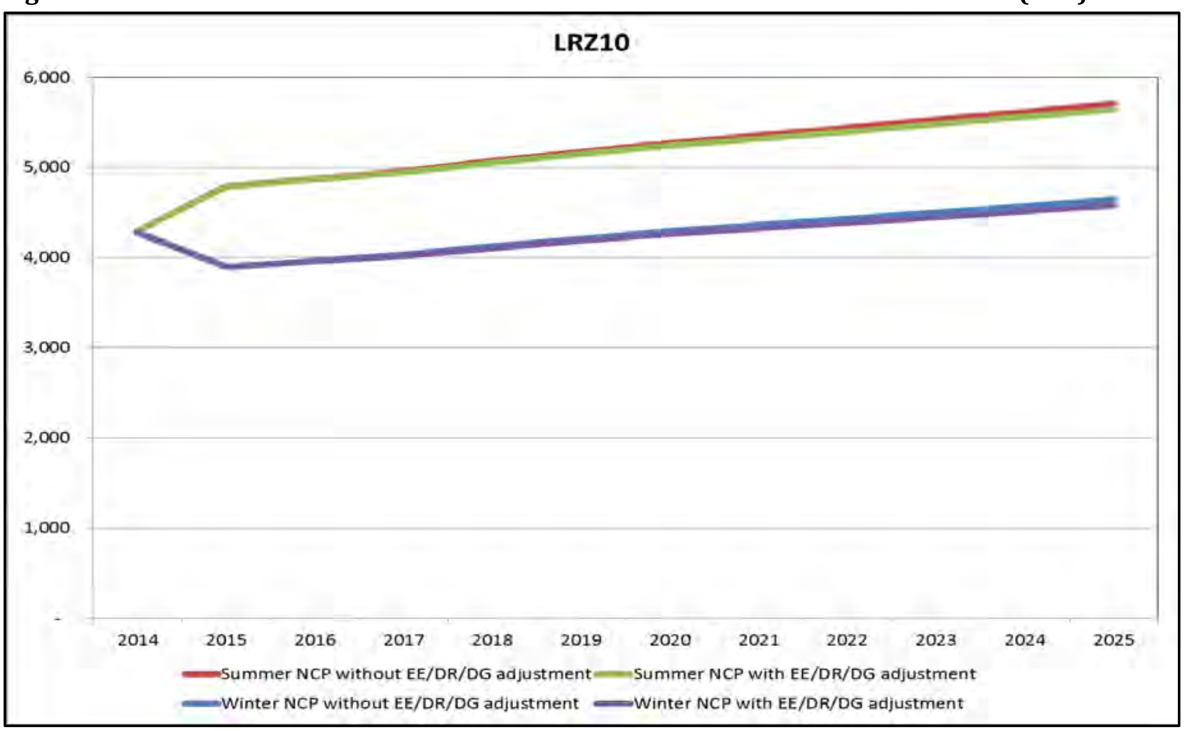


Figure 55: Net and Gross LRZ 10 Summer and Winter Non-coincident Peak Demand (MW)



6 MISO System-Wide Forecasts

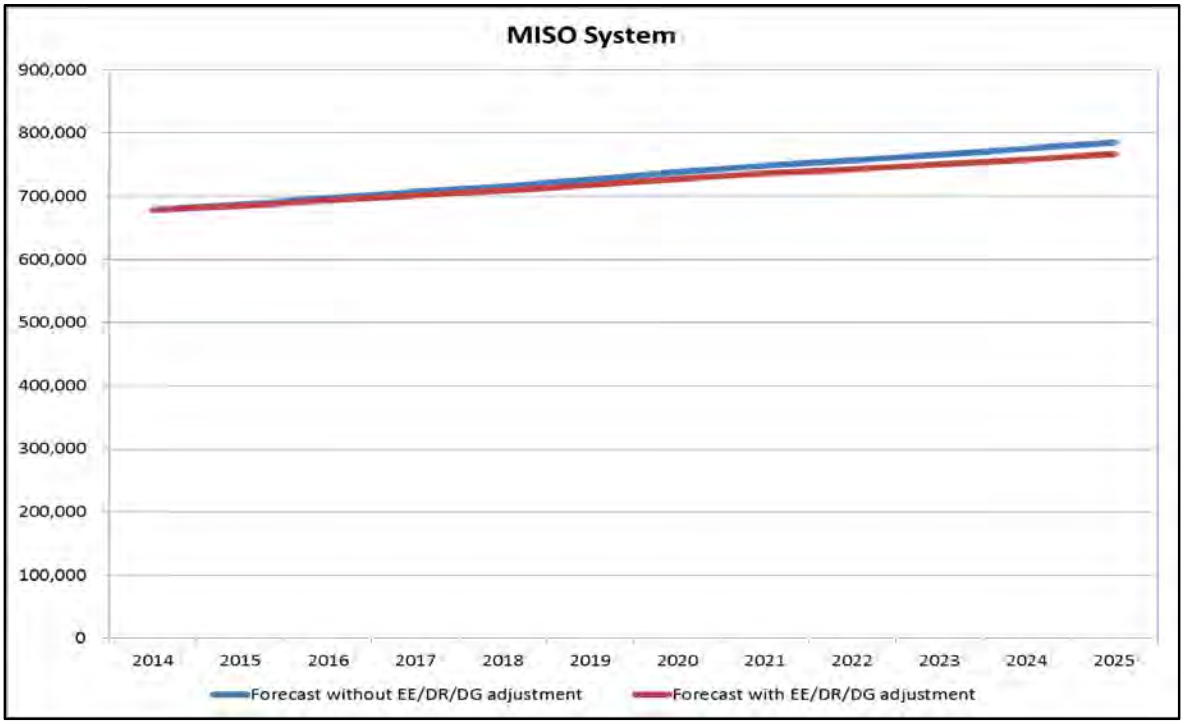
6.1 MISO SYSTEM ENERGY FORECAST

The MISO system energy forecast is found by summing the individual LRZ energy forecasts. Table 25 and Figure 56 provide the MISO-level energy forecast. Note: the forecasts are for the specified calendar year, not the MISO planning year.

Table 25: Gross and Net MISO System Energy (Annual Metered Load in GWh)

Year	MISO energy without EE/DR/DG adjustment	MISO energy with EE/DR/DG adjustment
2014	677,830	677,830
2015	686,732	684,413
2016	697,034	693,221
2017	706,381	701,045
2018	715,632	708,736
2019	726,424	717,923
2020	737,872	727,738
2021	747,627	735,843
2022	756,452	742,988
2023	765,542	750,368
2024	775,235	758,314
2025	784,725	766,181
Annual Growth Rates（%）		
2014-2015	1.31	0.97
2015-2016	1.50	1.29
2016-2017	1.34	1.13
2017-2018	1.31	1.10
2018-2019	1.51	1.30
2019-2020	1.58	1.37
2020-2021	1.32	1.11
2021-2022	1.18	0.97
2022-2023	1.20	0.99
2023-2024	1.27	1.06
2024-2025	1.22	1.04
Compound Annual Growth Rates (%)		
2014-2019	1.39	1.16
2014-2025	1.34	1.12
2016-2025	1.33	1.12

Figure 56: Gross and Net MISO System Energy Forecast (Metered Load in GWh)



6.2 MISO SYSTEM COINCIDENT PEAK DEMAND FORECAST

Not all LRZs experience their peak demand levels at the same time. This load diversity means that the MISO system peak demand level is less than the arithmetic sum of the LRZ non-coincident peak demands. The MISO system coincident peak demand is determined by applying coincidence factors to the individual LRZ non-coincident peak demands and summing. These coincidence factors represent the ratio of the LRZ's load at the time of the overall MISO system peak to the LRZ's non-coincident peak. Coincidence factors were calculated from hourly loads over the 2010 to 2014 timeframe. Table 26 and Table 27 list the summer and winter coincidence factors. Note that when the coincidence factor equals 1, it means the peak for that zone coincided with the MISO system peak.

Table 26: MISO Coincidence Factors—Winter

LRZ	Winter Coincidence Factor					
	Average	2010	2011	2012	2013	2014
1	0.989	0.992	0.994	0.962	1.000	0.994
2	0.982	0.993	0.976	0.963	0.990	0.989
3	0.989	0.996	0.971	1.000	0.979	1.000
4	0.994	1.000	1.000	1.000	0.980	0.992
5	0.985	0.962	1.000	1.000	0.964	1.000
6	0.975	0.975	0.993	0.992	0.928	0.988
7	0.957	0.988	0.958	0.938	0.959	0.944
8	0.949	0.889	0.929	0.995	0.954	0.981
9	0.910	0.830	0.949	0.894	0.900	0.979
10	0.918	0.917	0.889	0.940	0.852	0.993

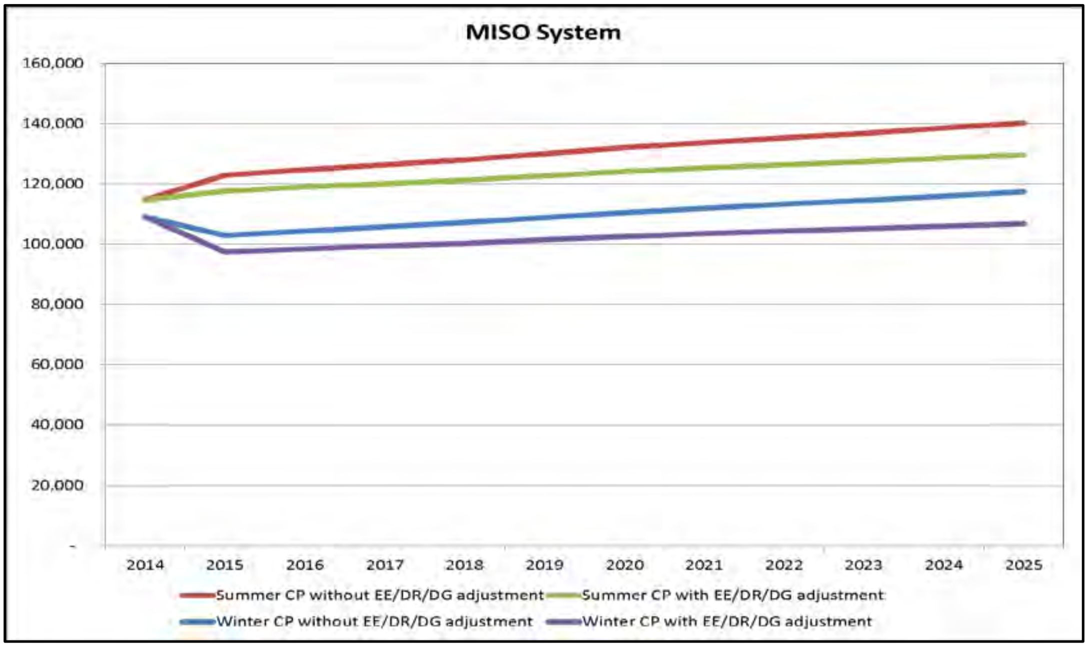
Table 27: MISO Coincidence Factors—Summer

LRZ	Summer Coincidence Factor					
	Average	2010	2011	2012	2013	2014
1	0.956	0.968	1.000	0.945	0.973	0.896
2	0.983	0.948	1.000	0.969	0.999	1.000
3	0.975	0.952	0.986	0.974	0.969	0.992
4	0.961	1.000	0.988	0.945	0.988	0.885
5	0.958	1.000	0.971	0.949	0.963	0.907
6	0.979	0.962	0.991	0.973	1.000	0.970
7	0.974	0.913	0.961	1.000	0.999	0.998
8	0.928	0.964	0.936	0.929	0.936	0.875
9	0.917	0.982	0.909	0.911	0.862	0.920
10	0.876	0.952	0.901	0.896	0.785	0.845

Table 28: Gross and Net MISO System Coincident Peak Demand (Metered Load in MW)

Year	MISO Summer CP without EE/DR/DG adjustment	MISO Summer CP with EE/DR/DG adjustment	MISO Winter CP without EE/DR/DG adjustment	MISO Winter CP with EE/DR/DG adjustment
2014	114,709	114,709	108,920	108,920
2015	122,933	117,601	102,782	97,417
2016	124,734	118,914	104,319	98,461
2017	126,393	120,096	105,712	99,372
2018	128,015	121,228	107,096	100,261
2019	129,909	122,615	108,709	101,361
2020	131,936	124,116	110,416	102,536
2021	133,653	125,314	111,872	103,468
2022	135,193	126,324	113,194	104,253
2023	136,793	127,381	114,551	105,062
2024	138,497	128,529	115,996	105,945
2025	140,169	129,652	117,409	106,803
Annual Growth Rates (%)				
2014-2015	7.17	2.52	-5.64	-10.56
2015-2016	1.47	1.12	1.49	1.07
2016-2017	1.33	0.99	1.34	0.93
2017-2018	1.28	0.94	1.31	0.89
2018-2019	1.48	1.14	1.51	1.10
2019-2020	1.56	1.22	1.57	1.16
2020-2021	1.30	0.97	1.32	0.91
2021-2022	1.15	0.81	1.18	0.76
2022-2023	1.18	0.84	1.20	0.78
2023-2024	1.25	0.90	1.26	0.84
2024-2025	1.21	0.87	1.22	0.81
Compound Annual Growth Rates (%)				
2014-2019	2.52	1.34	-0.04	-1.43
2014-2025	1.84	1.12	0.68	-0.18
2016-2025	1.30	0.97	1.32	0.91

Figure 57: Gross and Net MISO System Coincident Peak Demand (Metered Load in MW)



6.3 MISO SYSTEM HIGH AND LOW FORECASTS

Using the methodology described in Chapter 2, alternate 90/10 (High/Low) forecasts were developed. Figure 58 shows the MISO system net energy forecasts and Table 29 provides the growth rates for net energy and seasonal peaks. Appendix C contains more information on the high and low forecasts.

Figure 58: Net MISO System Energy for Alternate Forecasts (Annual Metered Load in GWh)

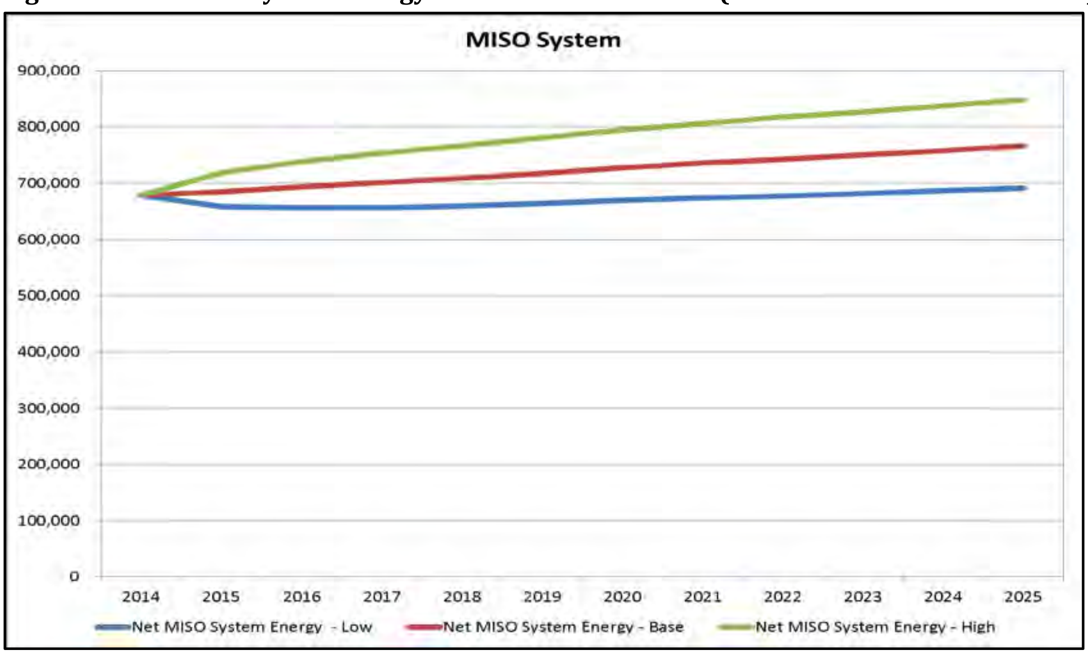


Table 29: Net MISO System Compound Annual Growth Rates for Alternate Forecasts (2016-2025)

	Base	High	Low
Energy	1.12	1.56	0.58
Summer Peak	0.97	1.44	0.39
Winter Peak	0.91	1.40	0.31

APPENDIX A State Electric Energy Forecasting Models

Arkansas

Dependent Variable: ELECTRICITY_SALES
Method: Least Squares
Sample: 1990 2013
Included observations: 24

Variable	Coefficient	Std. Error	t-Statistic	Prob.	Elasticity at 2013 (weather at means)
C	26579.63	3339.833	7.958372	0.0000	
@MOVAV(REAL_ELECTRICITY_PRICE,3)	-2057.705	178.8651	-11.50423	0.0000	-0.3197
REAL_GSP	0.222283	0.013761	16.15294	0.0000	0.5511
CDD	3.240904	0.595194	5.445123	0.0000	0.1464
HDD	1.305267	0.447506	2.916756	0.0088	0.1118

R-squared	0.992661	Mean dependent var	40279.71
Adjusted R-squared	0.991117	S.D. dependent var	6719.508
S.E. of regression	633.3275	Durbin-Watson stat	1.473360
F-statistic	642.5209		
Prob(F-statistic)	0.000000		

Illinois

Dependent Variable: ELECTRICITY_SALES
Method: Least Squares
Sample: 1990 2013
Included observations: 24

Variable	Coefficient	Std. Error	t-Statistic	Prob.	Elasticity at 2013 (weather at means)
C	85631.92	16794.60	5.098778	0.0001	
@MOVAV(REAL_ELECTRICITY_PRICE,5)	-2398.837	659.2909	-3.638511	0.0017	-0.1363
REAL_GSP	0.081879	0.015590	5.252025	0.0000	0.3877
CDD	10.99190	1.417119	7.756509	0.0000	0.0804
HDD	2.005417	0.667445	3.004618	0.0073	0.0887

R-squared	0.989730	Mean dependent var	133177.1
Adjusted R-squared	0.987568	S.D. dependent var	10840.50
S.E. of regression	1208.690	Durbin-Watson stat	1.927055
F-statistic	457.7760		
Prob(F-statistic)	0.000000		

Indiana

Dependent Variable: ELECTRICITY_SALES
Method: Least Squares
Sample: 1990 2013
Included observations: 24

Variable	Coefficient	Std. Error	t-Statistic	Prob.	Elasticity at 2013 (weather at means)
C	33718.69	4263.215	7.909217	0.0000	
@MOVAV(REAL_ELECTRICITY_PRICE,3)	-2072.168	269.1211	-7.699760	0.0000	-0.1575
@MOVAV(REAL_NATURAL_GAS_PRICE,3)	528.2982	122.5911	4.309434	0.0004	0.0332
REAL_GSP	0.236684	0.006259	37.81729	0.0000	0.6597
CDD	5.945190	0.873182	6.808652	0.0000	0.0657
HDD	1.581184	0.459513	3.440997	0.0029	0.0900

R-squared	0.996051	Mean dependent var	95772.67
Adjusted R-squared	0.994954	S.D. dependent var	10914.61
S.E. of regression	775.3028	Durbin-Watson stat	2.111233
F-statistic	908.0568		
Prob(F-statistic)	0.000000		

Iowa

Dependent Variable: ELECTRICITY_SALES
Method: Least Squares
Sample: 1990 2013
Included observations: 24

Variable	Coefficient	Std. Error	t-Statistic	Prob.	Elasticity at 2013 (weather at means)
C	18943.27	3132.870	6.046618	0.0000	
REAL_ELECTRICITY_PRICE	-1593.057	231.4430	-6.883151	0.0000	-0.2519
REAL_NATURAL_GAS_PRICE (-2)	226.2321	73.97976	3.058028	0.0071	0.0292
REAL_INCOME/POPULATION	434.4074	106.1228	4.093442	0.0008	0.3869
REAL_GSP	0.089356	0.029014	3.079787	0.0068	0.2875
CDD	2.766519	0.616787	4.485372	0.0003	0.0648
HDD	0.471215	0.206361	2.283448	0.0355	0.0794

R-squared	0.995080	Mean dependent var	39249.38
Adjusted R-squared	0.993343	S.D. dependent var	5545.565
S.E. of regression	452.4621	Durbin-Watson stat	1.865698
F-statistic	573.0092		
Prob(F-statistic)	0.000000		

Kentucky

Dependent Variable: ELECTRICITY_SALES
Method: Least Squares
Sample: 1994 2013
Included observations: 20

Variable	Coefficient	Std. Error	t-Statistic	Prob.	Elasticity at 2013 (weather at means)
C	-77897.63	12101.31	-6.437125	0.0000	
@MOVAV(REAL_ELECTRICITY_PRICE,3)	-1584.538	826.3808	-1.917443	0.0758	-0.1212
@MOVAV(REAL_NATURAL_GAS_PRICE,3)	896.4493	232.8831	3.849354	0.0018	0.0617
POPULATION	0.034166	0.003304	10.33949	0.0000	1.6352
CDD	4.638003	1.828520	2.536479	0.0237	0.0723
HDD	3.759639	1.174261	3.201706	0.0064	0.1968

R-squared	0.967353	Mean dependent var	84499.31
Adjusted R-squared	0.955694	S.D. dependent var	6956.077
S.E. of regression	1464.184	Durbin-Watson stat	1.809730
F-statistic	82.96713		
Prob(F-statistic)	0.000000		

Louisiana

Dependent Variable: ELECTRICITY_SALES
Method: Least Squares
Sample: 1990 2013
Included observations: 24

Variable	Coefficient	Std. Error	t-Statistic	Prob.	Elasticity at 2013 (weather at means)
C	59374.89	8871.980	6.692406	0.0000	
@MOVAV(REAL_ELECTRICITY_PRICE,3)	-3588.096	532.2390	-6.741512	0.0000	-0.3074
REAL_GSP	0.141978	0.020493	6.928105	0.0000	0.3673
CDD	4.906066	1.772056	2.768573	0.0122	0.1871
HDD	3.945677	1.488811	2.650220	0.0158	0.0776

R-squared	0.960884	Mean dependent var	76559.79
Adjusted R-squared	0.952649	S.D. dependent var	6438.349
S.E. of regression	1401.006	Durbin-Watson stat	1.781461
F-statistic	116.6830		
Prob(F-statistic)	0.000000		

Michigan

Dependent Variable: ELECTRICITY_SALES
Method: Least Squares
Sample: 1990 2013
Included observations: 24

Variable	Coefficient	Std. Error	t-Statistic	Prob.	Elasticity at 2013 (weather at means)
C	43803.67	11496.61	3.810139	0.0013	
REAL_ELECTRICITY_PRICE(-2)	-2280.165	507.2398	-4.495241	0.0003	-0.2277
REAL_INCOME/POPULATION	1337.749	232.2243	5.760591	0.0000	0.4722
REAL_GSP	0.047346	0.021274	2.225522	0.0391	0.1876
CDD	5.586437	1.504317	3.713604	0.0016	0.0450
HDD	1.560792	0.638137	2.445855	0.0250	0.0966

R-squared	0.984279	Mean dependent var	99914.92
Adjusted R-squared	0.979912	S.D. dependent var	8469.197
S.E. of regression	1200.363	Durbin-Watson stat	1.789823
F-statistic	225.3902		
Prob(F-statistic)	0.000000		

Minnesota

Dependent Variable: ELECTRICITY_SALES
Method: Least Squares
Sample: 1992 2013
Included observations: 22

Variable	Coefficient	Std. Error	t-Statistic	Prob.	Elasticity at 2013 (weather at means)
C	20576.21	3699.593	5.561749	0.0000	
@MOVAV(REAL_ELECTRICITY_PRICE,4)	-748.8661	314.4687	-2.381369	0.0300	-0.0940
@MOVAV(REAL_NATURAL_GAS_PRICE,4)	569.7097	135.0755	4.217714	0.0007	0.0501
REAL_INCOME	0.000150	8.53E-06	17.64468	0.0000	0.5243
CDD	7.083996	1.320929	5.362889	0.0001	0.0752
HDD	1.041439	0.307265	3.389388	0.0037	0.1353

R-squared	0.991567	Mean dependent var	61014.41
Adjusted R-squared	0.988932	S.D. dependent var	6794.611
S.E. of regression	714.8173	Durbin-Watson stat	1.818049
F-statistic	376.2795		
Prob(F-statistic)	0.000000		

Mississippi

Dependent Variable: ELECTRICITY_SALES
Method: Least Squares
Sample: 1993 2013
Included observations: 21

Variable	Coefficient	Std. Error	t-Statistic	Prob.	Elasticity at 2013 (weather at means)
C	16105.32	5072.862	3.174800	0.0063	
@MOVAV(REAL_ELECTRICITY_PRICE,2)	-1692.783	255.4988	-6.625405	0.0000	-0.2898
REAL_INCOME(-1)	0.000183	5.93E-05	3.090968	0.0075	0.3545
REAL_GSP	0.201376	0.088016	2.287936	0.0371	0.4003
CDD	3.296009	0.704433	4.678954	0.0003	0.1667
HDD	1.437900	0.644115	2.232366	0.0413	0.0800

R-squared	0.985573	Mean dependent var	44431.10
Adjusted R-squared	0.980764	S.D. dependent var	4308.771
S.E. of regression	597.6077	Durbin-Watson stat	2.064809
F-statistic	204.9383		
Prob(F-statistic)	0.000000		

Missouri

Dependent Variable: ELECTRICITY_SALES
Method: Least Squares
Sample: 1998 2013
Included observations: 16

Variable	Coefficient	Std. Error	t-Statistic	Prob.	Elasticity at 2013 (weather at means)
C	-99007.54	14626.41	-6.769094	0.0000	
@MOVAV(REAL_ELECTRICITY_PRICE,5)	-2484.731	542.1817	-4.582839	0.0010	-0.2474
POPULATION	0.016488	0.001841	8.954426	0.0000	1.1952
NON_MANUFACTURING_EMP	0.031252	0.006514	4.797392	0.0007	0.9279
CDD	8.479600	1.019905	8.314105	0.0000	0.1655
HDD	2.500053	0.594768	4.203408	0.0018	0.1457

R-squared	0.989047	Mean dependent var	7849.50
Adjusted R-squared	0.983570	S.D. dependent var	5920.461
S.E. of regression	758.8787	Durbin-Watson stat	1.898750
F-statistic	180.5944		
Prob(F-statistic)	0.000000		

Montana

Dependent Variable: ELECTRICITY_SALES
Method: Least Squares
Sample: 1996 2013
Included observations: 18

Variable	Coefficient	Std. Error	t-Statistic	Prob.	Elasticity at 2013 (weather at means)
C	2739.967	3772.436	0.726313	0.4828	
REAL_ELECTRICITY_PRICE	-2014.651	232.0327	-8.682616	0.0000	-1.1398
@MOVAV(REAL_NATURAL_GAS_PRICE,5)	544.5881	84.63668	6.434422	0.0000	0.2836
REAL_INCOME/POPULATION	298.7459	58.71022	5.088483	0.0004	0.7796
MANUFACTURING_EMP	0.271165	0.071228	3.806996	0.0029	0.3527
CDD	1.976617	0.801431	2.466360	0.0313	0.0674
HDD	0.765575	0.228727	3.347118	0.0065	0.4035

R-squared	0.949994	Mean dependent var	13633.39
Adjusted R-squared	0.922717	S.D. dependent var	1031.667
S.E. of regression	286.8011	Durbin-Watson stat	1.934246
F-statistic	34.82859		
Prob(F-statistic)	0.000002		

North Dakota

Dependent Variable: ELECTRICITY_SALES
Method: Least Squares
Sample: 1995 2013
Included observations: 19

Variable	Coefficient	Std. Error	t-Statistic	Prob.	Elasticity at 2013 (weather at means)
C	-6463.323	1198.565	-5.392552	0.0001	
@MOVAV(REAL_ELECTRICITY_PRICE,2)	-677.6237	124.5469	-5.440713	0.0001	-0.3024
@MOVAV(REAL_NATURAL_GAS_PRICE,3)	149.1068	34.44355	4.329019	0.0007	0.0441
NON_MANUFACTURING_EMP	0.056434	0.001209	46.68167	0.0000	1.4743
HDD	0.317828	0.069226	4.591136	0.0004	0.2508

R-squared	0.995151	Mean dependent var	10985.74
Adjusted R-squared	0.993766	S.D. dependent var	2318.660
S.E. of regression	183.0709	Durbin-Watson stat	1.845949
F-statistic	718.3514		
Prob(F-statistic)	0.000000		

South Dakota

Dependent Variable: ELECTRICITY_SALES
Method: Least Squares
Sample: 1995 2013
Included observations: 19

Variable	Coefficient	Std. Error	t-Statistic	Prob.	Elasticity at 2013 (weather at means)
C	-19443.84	1233.943	-15.75749	0.0000	
REAL_ELECTRICITY_PRICE(-2)	-475.7095	76.51588	-6.217134	0.0000	-0.3146
REAL_NATURAL_GAS_PRICE(-2)	63.92909	22.23205	2.875538	0.0130	0.0304
POPULATION	0.038971	0.001050	37.10305	0.0000	2.7003
CDD	0.504849	0.162773	3.101555	0.0084	0.0384
HDD	0.200510	0.053482	3.749132	0.0024	0.1547

R-squared	0.997501	Mean dependent var	9591.947
Adjusted R-squared	0.996540	S.D. dependent var	1581.594
S.E. of regression	93.02632	Durbin-Watson stat	1.851350
F-statistic	1037.993		
Prob(F-statistic)	0.000000		

Texas

Dependent Variable: ELECTRICITY_SALES
Method: Least Squares
Sample: 1996 2013
Included observations: 18

Variable	Coefficient	Std. Error	t-Statistic	Prob.	Elasticity at 2013 (weather at means)
C	86031.22	18049.69	4.766353	0.0005	
REAL_ELECTRICITY_PRICE(-2)	-4120.164	1670.959	-2.465748	0.0297	-0.0856
REAL_NATURAL_GAS_PRICE(-2)	2697.458	932.0740	2.894038	0.0135	0.0383
REAL_GSP	0.145399	0.007357	19.76215	0.0000	0.5313
CDD	26.16797	5.234784	4.998864	0.0003	0.2416
HDD	17.80360	5.172099	3.442239	0.0049	0.0992

R-squared	0.987684	Mean dependent var	331390.5
Adjusted R-squared	0.982553	S.D. dependent var	28690.53
S.E. of regression	3789.660	Durbin-Watson stat	1.968183
F-statistic	192.4748		
Prob(F-statistic)	0.000000		

Wisconsin

Dependent Variable: ELECTRICITY_SALES
Method: Least Squares
Sample: 1990 2013
Included observations: 24

Variable	Coefficient	Std. Error	t-Statistic	Prob.	Elasticity at 2013 (weather at means)
C	20061.26	2202.430	9.108695	0.0000	
@MOVAV(REAL_ELECTRICITY_PRICE,3)	-1208.035	110.0411	-10.97804	0.0000	-0.1687
REAL_NATURAL_GAS_PRICE	249.2321	65.61098	3.798634	0.0013	0.0240
REAL_GSP	0.196129	0.003549	55.26382	0.0000	0.7494
CDD	4.206383	0.688373	6.110612	0.0000	0.0405
HDD	0.681842	0.245735	2.774705	0.0125	0.0761

R-squared	0.996456	Mean dependent var	63245.42
Adjusted R-squared	0.995472	S.D. dependent var	6980.190
S.E. of regression	469.7064	Durbin-Watson stat	1.550660
F-statistic	1012.273		
Prob(F-statistic)	0.000000		

APPENDIX B Peak Demand Models

Regression Models

LRZ	Model Specification
1	$C + Summer + Month + Month^2 + Weekday + Weekday^2 + Summer * Avg\ Temp + Winter * Avg\ Temp + Summer * Avg\ Temp^2 + Temp * Hour$
2	$C + Summer + Month^2 + Weekday + Weekday^2 + Summer * Avg\ Temp + Winter * Avg\ Temp + Summer * Avg\ Temp^2$
3	$C + Summer + Weekday + Weekday^2 + Summer * Avg\ Temp + Winter * Avg\ Temp + Summer * Avg\ Temp^2 + Temp * Hour + Month * Temp$
4	$C + Summer + Weekday + Weekday^2 + Summer * Avg\ Temp + Winter * Avg\ Temp + Summer * Avg\ Temp^2 + Temp * Month$
5	$C + Summer + Weekday + Weekday^2 + Summer * Avg\ Temp + Winter * Avg\ Temp + Summer * Avg\ Temp^2 + Temp * Month$
6	$C + Summer + Weekday + Weekday^2 + Summer * Avg\ Temp + Winter * Avg\ Temp + Summer * Avg\ Temp^2 + Temp$
7	$C + Summer + Month + Weekday + Weekday^2 + Summer * Avg\ Temp + Winter * Avg\ Temp + Summer * Avg\ Temp^2$
8	$C + Summer + Weekday + Weekday^2 + Summer * Avg\ Temp + Winter * Avg\ Temp + Summer * Avg\ Temp^2 + Temp + T\ Max$
9	$C + Summer + Weekday + Weekday^2 + Summer * Avg\ Temp + Winter * Avg\ Temp + Summer * Avg\ Temp^2 + T\ Max + Hour$
10	$C + Summer + Weekday + Weekday^2 + Avg\ Temp + Winter * Avg\ Temp^2 + T\ Max + Temp + Hour$

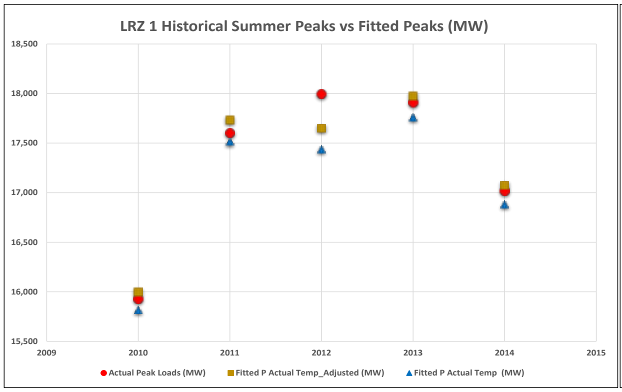
The followings are variable names and definitions:

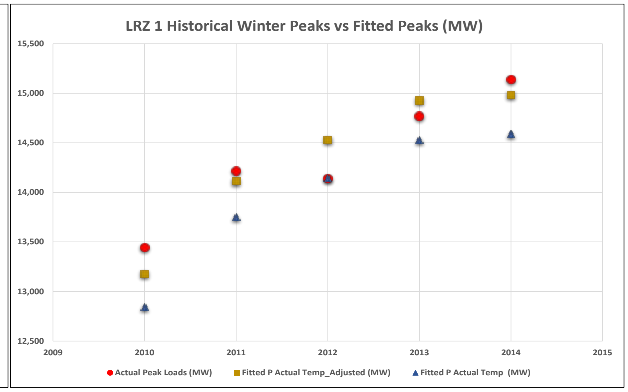
- Summer: the value is 1 for summer records, otherwise it is 0;
- Winter: the value is 1 for winter records, otherwise it is 0;
- Temp: hourly temperature observed;
- Avg Temp: average temperature of a particular day;
- T Max: high temperature of a particular day;
- Month: class variable, 12 months a year;
- Weekday: class variable, 7 days a week;
- Hour: class variable, 24 hours a day;
- Daily Peak Load Factor: dependent variable.

The following figures show the comparison of historical peak loads versus fitted peak loads. The red dots represent actual peak loads, the blue triangles indicate the unadjusted fitted peaks from the model with actual peak weather conditions, and the gold squares show the adjusted predicted peaks. In most instances, the adjustments make the model outputs closer to actual peaks. It is worth noting that some observations associated with the Polar Vortex or with summer peaks that occurred in September were treated as outliers.

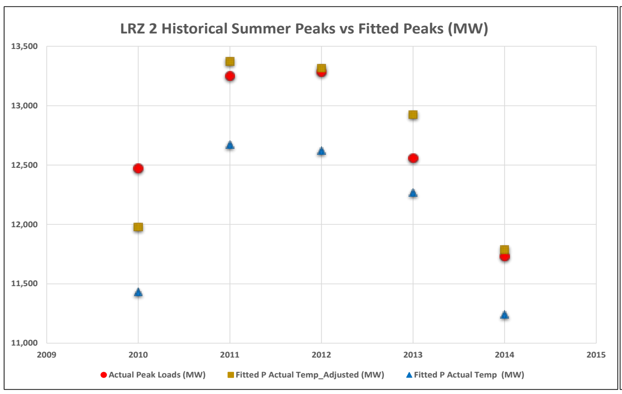
PEAK DEMAND MODELS

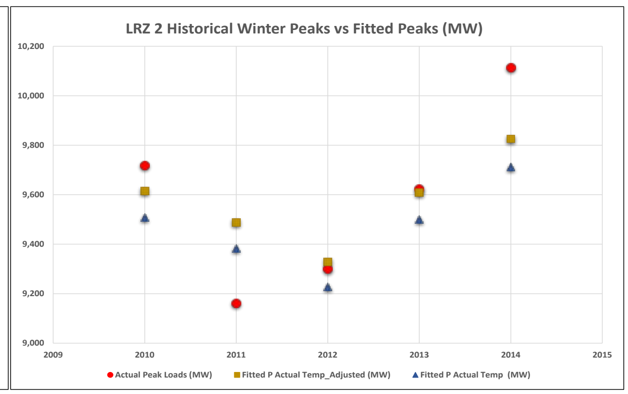
Actual Peak Loads vs. Fitted Peak Loads for LRZ 1



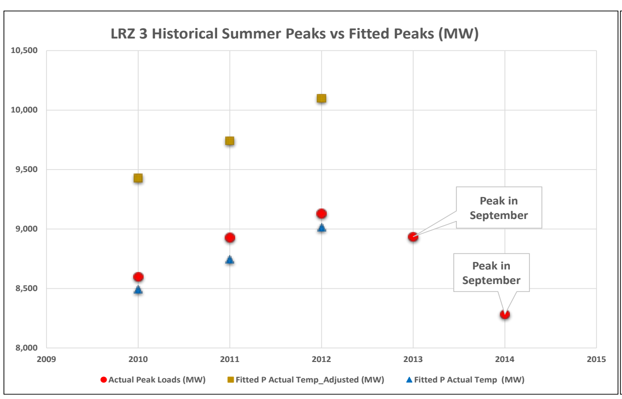


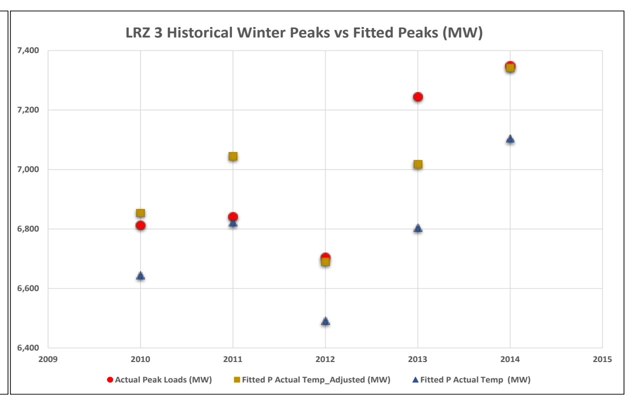
Actual Peak Loads vs. Fitted Peak Loads for LRZ 2





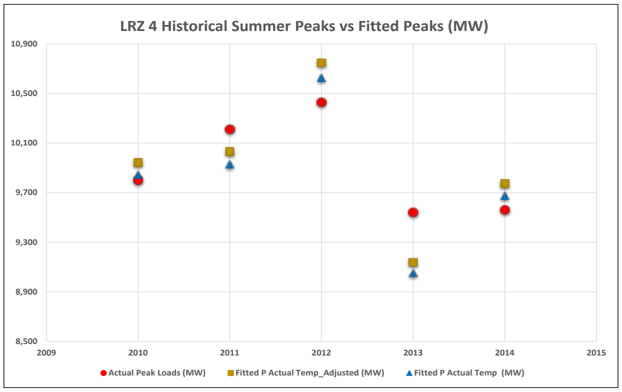
Actual Peak Loads vs. Fitted Peak Loads for LRZ 3

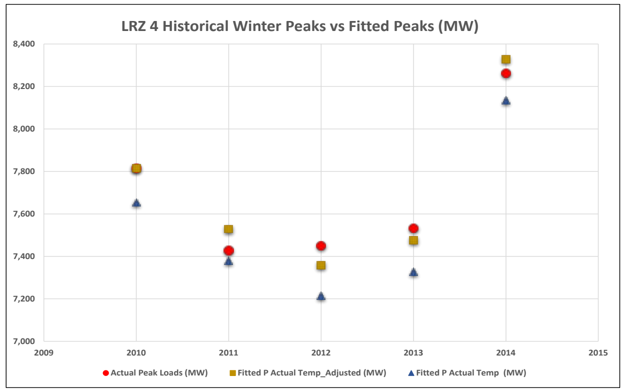




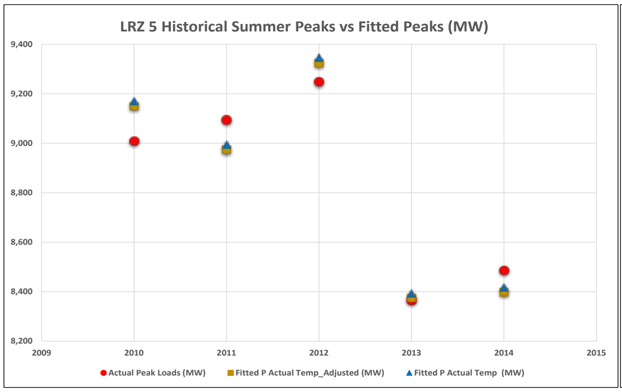
PEAK DEMAND MODELS

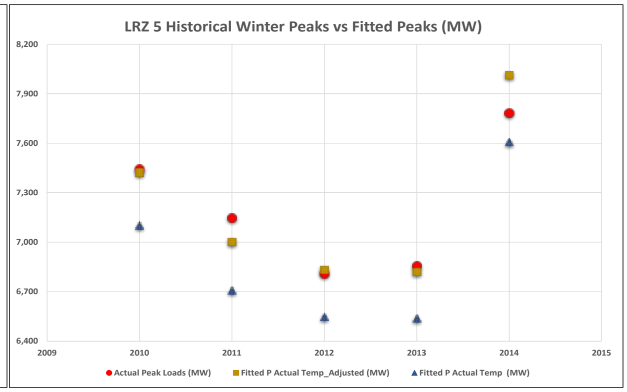
Actual Peak Loads vs. Fitted Peak Loads for LRZ 4



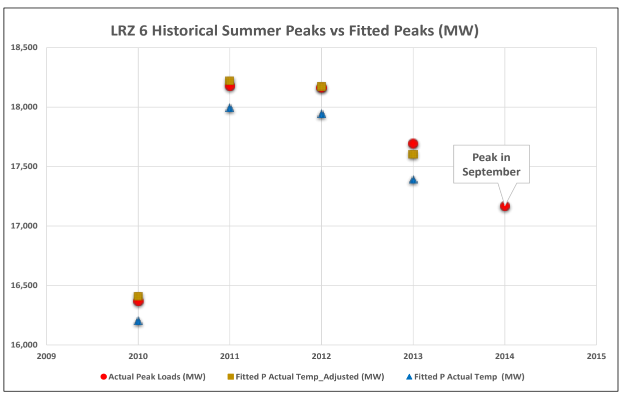


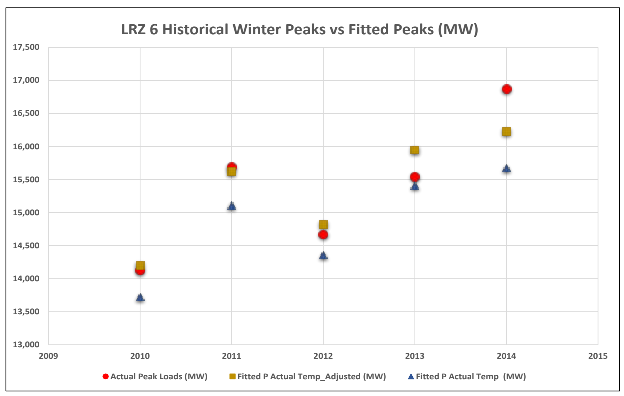
Actual Peak Loads vs. Fitted Peak Loads for LRZ 5





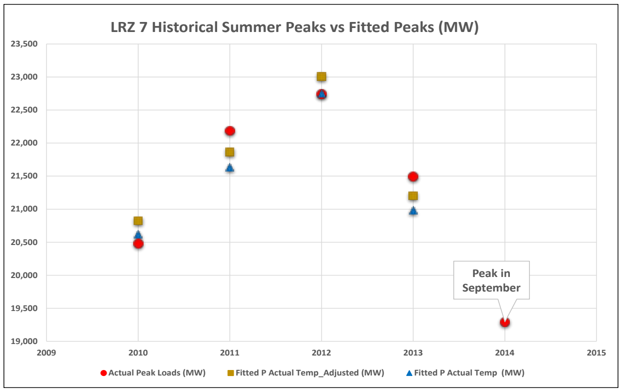
Actual Peak Loads vs. Fitted Peak Loads for LRZ 6

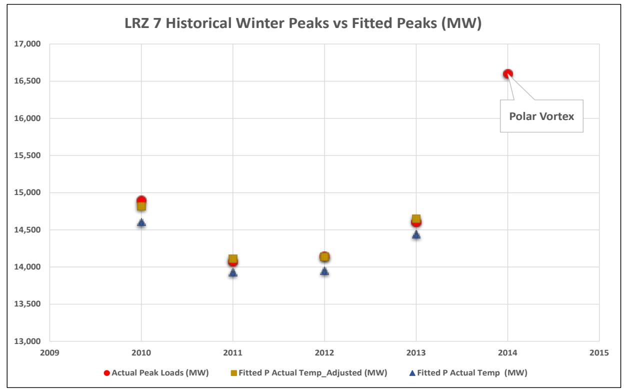




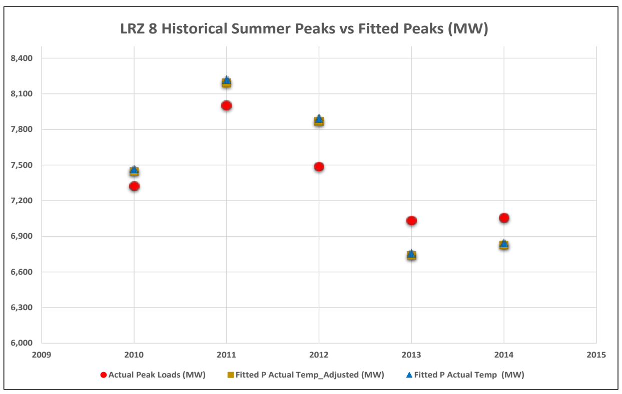
PEAK DEMAND MODELS

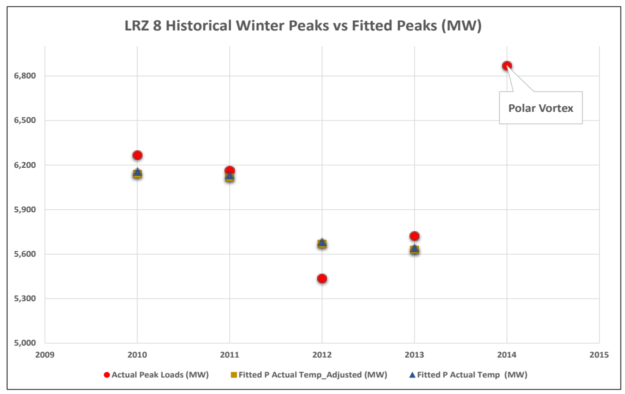
Actual Peak Loads vs. Fitted Peak Loads for LRZ 7



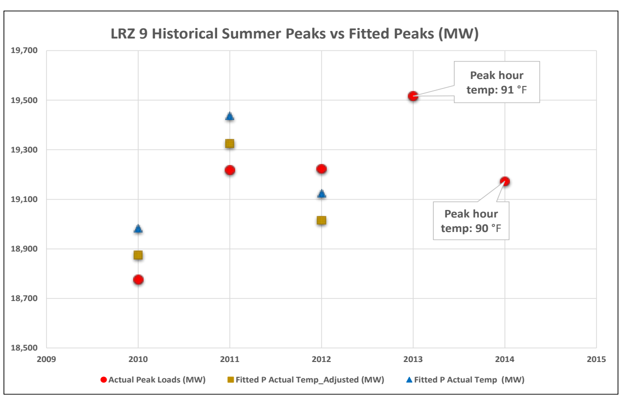


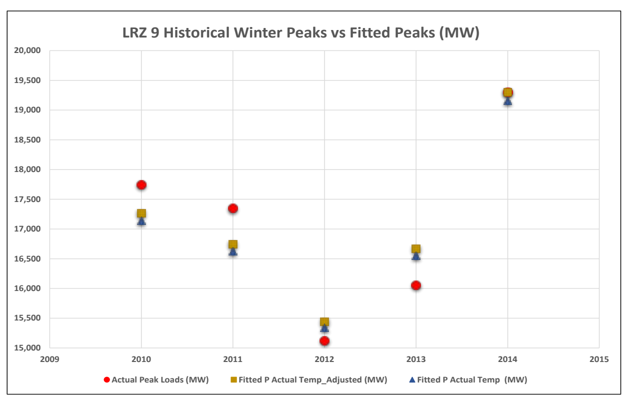
Actual Peak Loads vs. Fitted Peak Loads for LRZ 8





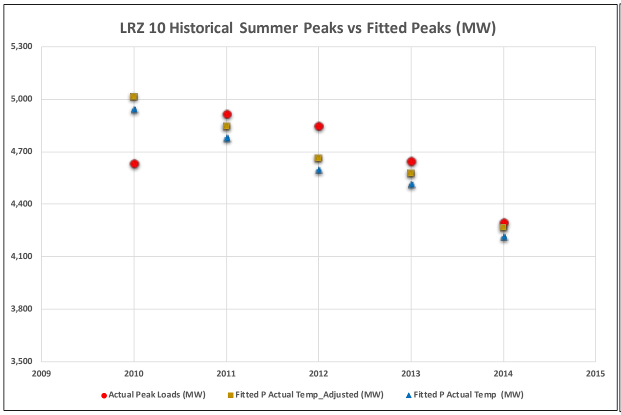
Actual Peak Loads vs. Fitted Peak Loads for LRZ 9

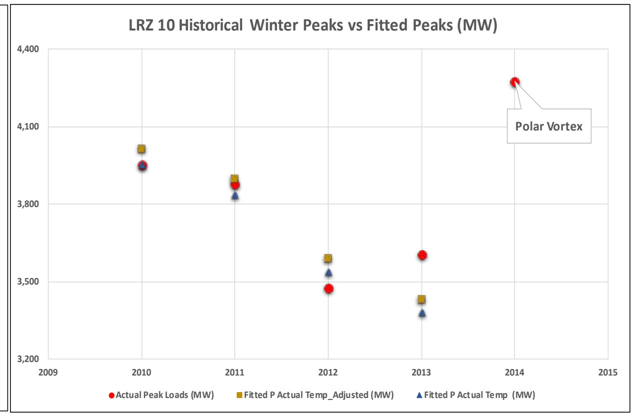




- *Note: The hourly temperatures of 2013 and 2014 summer peaks happened at unusually cool temperatures which were out of the top 20 highest annual hourly temperature. The peak hourly temperatures of previous years were 95, 94, and 96 Fahrenheit respectively.*

Actual Peak Loads vs. Fitted Peak Loads for LRZ 10





APPENDIX C High and Low Forecasts

Gross State Energy Forecasts (Annual Retail Sales in GWh)—High

Year	AR	IL	IN	IA	KY	LA	MI	MN
1990	27,365	111,577	73,982	29,437	61,097	63,826	82,367	47,167
1991	28,440	116,869	77,034	30,781	64,194	64,704	84,519	48,755
1992	28,451	112,521	76,977	30,208	67,068	65,098	83,840	47,412
1993	31,663	117,786	81,931	32,104	68,149	67,756	87,589	49,211
1994	32,619	121,490	83,808	33,039	72,485	70,132	91,160	51,155
1995	34,671	126,231	87,006	34,301	74,548	72,827	94,701	53,959
1996	36,137	125,990	88,901	34,999	77,019	75,269	96,302	54,942
1997	36,858	126,953	89,147	36,148	76,836	75,886	97,391	55,674
1998	39,315	131,697	92,059	37,318	75,850	77,716	100,506	56,744
1999	39,789	132,682	96,735	38,034	79,098	78,267	103,981	57,399
2000	41,611	134,697	97,775	39,088	78,316	80,690	104,772	59,782
2001	41,732	136,034	97,734	39,444	79,975	74,693	102,409	60,687
2002	42,450	138,447	101,429	40,898	87,267	79,261	104,714	62,162
2003	43,108	136,248	100,468	41,207	85,220	77,769	108,877	63,087
2004	43,672	139,254	103,094	40,903	86,521	79,737	106,606	63,340
2005	46,165	144,986	106,549	42,757	89,351	77,389	110,445	66,019
2006	46,636	142,448	105,664	43,337	88,743	77,468	108,018	66,770
2007	47,055	146,055	109,420	45,270	92,404	79,567	109,297	68,231
2008	46,135	144,620	106,981	45,488	93,428	78,722	105,781	68,792
2009	43,173	136,688	99,312	43,641	88,809	78,670	98,121	64,004
2010	48,194	144,761	105,994	45,445	93,569	85,080	103,649	67,800
2011	47,928	142,886	105,818	45,655	89,538	86,369	105,054	68,533
2012	46,860	143,540	105,173	45,709	89,048	84,731	104,818	67,989
2013	46,686	141,790	105,553	46,774	91,961	85,808	103,041	68,625
2014	49,363	150,968	110,932	47,493	93,533	88,773	108,381	69,604
2015	50,693	152,854	114,686	49,149	93,979	92,333	110,775	71,227
2016	51,781	154,788	117,969	50,684	96,453	96,871	113,347	73,403
2017	52,629	156,161	120,736	51,872	98,028	99,052	115,925	75,784
2018	53,453	157,476	123,527	53,202	99,617	101,270	116,937	77,740
2019	54,480	159,051	126,530	54,436	101,298	103,777	118,552	79,403
2020	55,297	160,428	129,069	55,614	103,052	106,083	121,140	81,303
2021	55,846	161,556	131,233	56,732	104,598	108,036	122,078	83,251
2022	56,315	162,499	133,219	57,908	105,982	109,937	123,754	84,952
2023	56,824	163,195	135,412	58,966	107,195	112,163	124,496	86,688
2024	57,400	164,176	137,545	60,062	108,399	114,416	126,038	88,370
2025	57,942	164,962	139,560	61,168	109,610	116,533	127,468	90,088
Compound Annual Growth Rates (%)								
1990-2013	2.35	1.05	1.56	2.03	1.79	1.30	0.98	1.64
2014-2025	1.47	0.81	2.11	2.33	1.45	2.50	1.49	2.37
2016-2025	1.26	0.71	1.89	2.11	1.43	2.07	1.31	2.30

Gross State Energy Forecasts (Annual Retail Sales in GWh)—High - continued

Year	MS	MO	MT	ND	SD	TX	WI
1990	32,127	53,925	13,125	7,014	6,334	237,415	49,198
1991	33,019	56,514	13,407	7,255	6,685	240,352	51,032
1992	33,241	54,411	13,096	7,128	6,494	239,431	50,925
1993	34,749	58,622	12,929	7,432	6,905	250,084	53,156
1994	36,627	59,693	13,184	7,681	7,174	258,180	55,412
1995	37,868	62,259	13,419	7,883	7,414	263,279	57,967
1996	39,622	64,843	13,820	8,314	7,736	278,450	58,744
1997	40,089	65,711	11,917	8,282	7,773	286,704	60,094
1998	42,510	69,010	14,145	8,220	7,824	304,705	62,061
1999	43,980	69,045	13,282	9,112	7,922	301,844	63,547
2000	45,336	72,643	14,580	9,413	8,283	318,263	65,146
2001	44,287	73,213	11,447	9,810	8,627	318,044	65,218
2002	45,452	75,001	12,831	10,219	8,937	320,846	66,999
2003	45,544	74,270	12,825	10,461	9,080	322,686	67,241
2004	46,033	74,054	12,957	10,516	9,214	320,615	67,976
2005	45,901	80,940	13,479	10,840	9,811	334,258	70,336
2006	46,936	82,015	13,815	11,245	10,056	342,724	69,821
2007	48,153	85,533	15,532	11,906	10,603	343,829	71,301
2008	47,721	84,382	15,326	12,416	10,974	347,059	70,122
2009	46,049	79,687	14,326	12,649	11,010	345,296	66,286
2010	49,687	86,085	13,423	12,956	11,356	358,458	68,752
2011	49,338	84,255	13,788	13,737	11,680	376,065	68,612
2012	48,388	82,435	13,863	14,717	11,734	365,467	68,820
2013	48,783	83,424	14,045	16,033	12,213	379,716	69,124
2014	51,096	86,911	17,502	17,794	12,370	393,560	71,792
2015	52,600	88,522	18,514	18,871	12,689	404,644	73,826
2016	53,997	90,821	19,249	19,722	13,414	428,532	75,720
2017	55,368	92,772	20,165	20,372	13,798	436,732	77,427
2018	56,752	94,500	21,488	21,042	14,065	445,798	79,100
2019	58,158	96,189	22,240	21,690	14,363	457,509	81,376
2020	59,417	98,071	23,048	22,363	14,776	469,588	82,622
2021	60,540	99,782	23,606	22,949	15,139	480,269	83,902
2022	61,602	101,481	24,261	23,496	15,478	490,624	86,276
2023	62,761	103,074	24,969	24,100	15,789	500,632	86,542
2024	63,891	104,617	25,549	24,757	16,102	510,111	87,937
2025	64,997	106,000	26,062	25,398	16,403	519,005	89,477
Compound Annual Growth Rates (%)							
1990-2013	1.83	1.92	0.29	3.66	2.90	2.06	1.49
2014-2025	2.21	1.82	3.69	3.29	2.60	2.55	2.02
2016-2025	2.08	1.73	3.42	2.85	2.26	2.15	1.87

HIGH AND LOW FORECASTS

Gross LRZ Energy Forecasts (Annual Metered Load in GWh) —High

Year	LRZ1	LRZ2	LRZ3	LRZ4	LRZ5	LRZ6	LRZ7	LRZ8	LRZ9	LRZ10
2014	99,623	65,113	47,437	50,332	43,298	101,811	100,152	37,160	110,905	21,999
2015	104,765	69,618	49,564	53,673	45,765	113,527	107,065	39,247	113,237	24,192
2016	108,162	71,391	51,076	54,352	46,858	116,659	109,551	40,092	119,041	24,834
2017	111,633	73,002	52,255	54,834	47,767	119,021	112,042	40,750	121,636	25,465
2018	114,801	74,502	53,554	55,296	48,557	121,405	113,020	41,389	124,316	26,102
2019	117,552	76,556	54,763	55,849	49,324	123,953	114,582	42,184	127,434	26,748
2020	120,425	77,768	55,924	56,333	50,187	126,288	117,083	42,818	130,379	27,327
2021	123,204	78,924	57,025	56,729	50,957	128,307	117,990	43,245	132,901	27,844
2022	125,943	81,067	58,172	57,060	51,718	130,141	119,609	43,612	135,353	28,332
2023	128,378	81,335	59,207	57,304	52,422	131,993	120,326	44,008	138,098	28,865
2024	130,929	82,622	60,279	57,648	53,096	133,809	121,816	44,455	140,837	29,385
2025	133,508	84,030	61,358	57,924	53,687	135,564	123,198	44,877	143,411	29,893
Annual Growth Rates（%）										
2014-2015	5.16	6.92	4.48	6.64	5.70	11.51	6.90	5.62	2.10	9.97
2015-2016	3.24	2.55	3.05	1.26	2.39	2.76	2.32	2.15	5.12	2.66
2016-2017	3.21	2.26	2.31	0.89	1.94	2.03	2.27	1.64	2.18	2.54
2017-2018	2.84	2.06	2.49	0.84	1.65	2.00	0.87	1.57	2.20	2.50
2018-2019	2.40	2.76	2.26	1.00	1.58	2.10	1.38	1.92	2.51	2.48
2019-2020	2.44	1.58	2.12	0.87	1.75	1.88	2.18	1.50	2.31	2.17
2020-2021	2.31	1.49	1.97	0.70	1.54	1.60	0.77	1.00	1.93	1.89
2021-2022	2.22	2.71	2.01	0.58	1.49	1.43	1.37	0.85	1.84	1.75
2022-2023	1.93	0.33	1.78	0.43	1.36	1.42	0.60	0.91	2.03	1.88
2023-2024	1.99	1.58	1.81	0.60	1.29	1.38	1.24	1.02	1.98	1.80
2024-2025	1.97	1.70	1.79	0.48	1.11	1.31	1.13	0.95	1.83	1.73
Compound Annual Growth Rates (%)										
2014-2019	3.37	3.29	2.91	2.10	2.64	4.01	2.73	2.57	2.82	3.99
2014-2025	2.70	2.35	2.37	1.29	1.97	2.64	1.90	1.73	2.36	2.83
2016-2025	2.37	1.83	2.06	0.71	1.52	1.68	1.31	1.26	2.09	2.08

HIGH AND LOW FORECASTS

Net LRZ Energy Forecasts (Annual Metered Load in GWh) —High

Year	LRZ1	LRZ2	LRZ3	LRZ4	LRZ5	LRZ6	LRZ7	LRZ8	LRZ9	LRZ10
2014	99,623	65,113	47,437	50,332	43,298	101,811	100,152	37,160	110,905	21,999
2015	104,538	69,333	49,272	53,381	45,509	113,202	106,591	39,156	113,184	24,169
2016	107,800	70,970	50,548	53,868	46,401	116,104	108,839	39,945	118,934	24,793
2017	111,124	72,451	51,487	54,157	47,110	118,230	111,091	40,546	121,468	25,404
2018	114,133	73,826	52,544	54,426	47,702	120,369	111,824	41,126	124,076	26,021
2019	116,709	75,756	53,506	54,786	48,270	122,666	113,134	41,860	127,110	26,647
2020	119,392	76,851	54,417	55,077	48,936	124,745	115,383	42,430	129,961	27,206
2021	121,975	77,900	55,266	55,280	49,512	126,501	116,034	42,791	132,380	27,701
2022	124,507	79,941	56,156	55,419	50,080	128,067	117,396	43,090	134,719	28,167
2023	126,723	80,113	56,930	55,473	50,592	129,644	117,852	43,416	137,341	28,678
2024	129,045	81,306	57,737	55,626	51,076	131,177	119,077	43,790	139,947	29,176
2025	131,394	82,660	58,552	55,731	51,502	132,664	120,219	44,138	142,381	29,665
Annual Growth Rates（%）										
2014-2015	4.93	6.48	3.87	6.06	5.11	11.19	6.43	5.37	2.06	9.86
2015-2016	3.12	2.36	2.59	0.91	1.96	2.56	2.11	2.02	5.08	2.58
2016-2017	3.08	2.09	1.86	0.54	1.53	1.83	2.07	1.50	2.13	2.47
2017-2018	2.71	1.90	2.05	0.50	1.26	1.81	0.66	1.43	2.15	2.43
2018-2019	2.26	2.62	1.83	0.66	1.19	1.91	1.17	1.78	2.45	2.41
2019-2020	2.30	1.44	1.70	0.53	1.38	1.69	1.99	1.36	2.24	2.10
2020-2021	2.16	1.37	1.56	0.37	1.18	1.41	0.56	0.85	1.86	1.82
2021-2022	2.08	2.62	1.61	0.25	1.15	1.24	1.17	0.70	1.77	1.68
2022-2023	1.78	0.21	1.38	0.10	1.02	1.23	0.39	0.76	1.95	1.81
2023-2024	1.83	1.49	1.42	0.28	0.96	1.18	1.04	0.86	1.90	1.73
2024-2025	1.82	1.67	1.41	0.19	0.83	1.13	0.96	0.79	1.74	1.68
Compound Annual Growth Rates (%)										
2014-2019	3.22	3.07	2.44	1.71	2.20	3.80	2.47	2.41	2.77	3.91
2014-2025	2.55	2.19	1.93	0.93	1.59	2.44	1.67	1.58	2.30	2.76
2016-2025	2.22	1.71	1.65	0.38	1.17	1.49	1.11	1.12	2.02	2.01

Gross Summer Non-coincident Peak Demand (Metered Load in MW) —High

Year	LRZ1	LRZ2	LRZ3	LRZ4	LRZ5	LRZ6	LRZ7	LRZ8	LRZ9	LRZ10
2014	17,018	11,730	8,283	9,563	8,487	17,170	19,293	7,058	19,173	4,297
2015	18,428	13,470	9,260	10,456	9,102	19,547	21,903	7,725	19,857	5,058
2016	19,025	13,813	9,543	10,588	9,319	20,086	22,412	7,891	20,874	5,192
2017	19,636	14,125	9,763	10,682	9,500	20,493	22,922	8,020	21,329	5,324
2018	20,193	14,415	10,006	10,772	9,657	20,903	23,122	8,146	21,799	5,457
2019	20,677	14,812	10,232	10,880	9,809	21,342	23,441	8,303	22,346	5,592
2020	21,182	15,047	10,448	10,974	9,981	21,744	23,953	8,427	22,862	5,713
2021	21,671	15,271	10,654	11,051	10,134	22,092	24,138	8,511	23,305	5,821
2022	22,153	15,685	10,868	11,115	10,286	22,408	24,470	8,584	23,735	5,924
2023	22,581	15,737	11,062	11,163	10,425	22,727	24,616	8,662	24,216	6,035
2024	23,030	15,986	11,262	11,230	10,560	23,039	24,921	8,750	24,696	6,144
2025	23,483	16,258	11,464	11,284	10,677	23,341	25,204	8,833	25,148	6,250
Annual Growth Rate (%)										
2014-2015	8.28	14.83	11.80	9.34	7.24	13.84	13.53	9.45	3.57	17.71
2015-2016	3.24	2.55	3.05	1.26	2.39	2.76	2.32	2.15	5.12	2.66
2016-2017	3.21	2.26	2.31	0.89	1.94	2.03	2.27	1.64	2.18	2.54
2017-2018	2.84	2.06	2.49	0.84	1.65	2.00	0.87	1.57	2.20	2.50
2018-2019	2.40	2.76	2.26	1.00	1.58	2.10	1.38	1.92	2.51	2.48
2019-2020	2.44	1.58	2.12	0.87	1.75	1.88	2.18	1.50	2.31	2.17
2020-2021	2.31	1.49	1.97	0.70	1.54	1.60	0.77	1.00	1.93	1.89
2021-2022	2.22	2.71	2.01	0.58	1.49	1.43	1.37	0.85	1.84	1.75
2022-2023	1.93	0.33	1.78	0.43	1.36	1.42	0.60	0.91	2.03	1.88
2023-2024	1.99	1.58	1.81	0.60	1.29	1.38	1.24	1.02	1.98	1.80
2024-2025	1.97	1.70	1.79	0.48	1.11	1.31	1.13	0.95	1.83	1.73
Compound Annual Growth Rates (%)										
2014-2019	3.97	4.78	4.32	2.61	2.94	4.45	3.97	3.30	3.11	5.41
2014-2025	2.97	3.01	3.00	1.52	2.11	2.83	2.46	2.06	2.50	3.46
2016-2025	2.37	1.83	2.06	0.71	1.52	1.68	1.31	1.26	2.09	2.08

HIGH AND LOW FORECASTS

Gross Winter Non-coincident Peak Demand (Metered Load in MW) —High

Year	LRZ1	LRZ2	LRZ3	LRZ4	LRZ5	LRZ6	LRZ7	LRZ8	LRZ9	LRZ10
2014	15,140	10,113	7,349	8,262	7,782	16,873	14,832	6,870	19,302	4,277
2015	15,904	10,611	7,484	8,257	7,582	17,777	15,730	6,484	17,929	4,116
2016	16,419	10,881	7,712	8,362	7,764	18,268	16,095	6,623	18,848	4,225
2017	16,946	11,126	7,890	8,436	7,914	18,638	16,461	6,732	19,258	4,332
2018	17,427	11,355	8,087	8,507	8,045	19,011	16,605	6,838	19,683	4,441
2019	17,845	11,668	8,269	8,592	8,172	19,410	16,834	6,969	20,176	4,551
2020	18,281	11,853	8,444	8,667	8,315	19,776	17,202	7,074	20,643	4,649
2021	18,703	12,029	8,611	8,728	8,443	20,092	17,335	7,144	21,042	4,737
2022	19,118	12,355	8,784	8,778	8,569	20,379	17,573	7,205	21,430	4,820
2023	19,488	12,396	8,940	8,816	8,685	20,669	17,678	7,270	21,865	4,911
2024	19,875	12,592	9,102	8,869	8,797	20,953	17,897	7,344	22,299	4,999
2025	20,267	12,807	9,265	8,912	8,895	21,228	18,100	7,414	22,706	5,086
Annual Growth Rate (%)										
2014-2015	5.04	4.92	1.84	-0.05	-2.56	5.36	6.05	-5.62	-7.11	-3.77
2015-2016	3.24	2.55	3.05	1.26	2.39	2.76	2.32	2.15	5.12	2.66
2016-2017	3.21	2.26	2.31	0.89	1.94	2.03	2.27	1.64	2.18	2.54
2017-2018	2.84	2.06	2.49	0.84	1.65	2.00	0.87	1.57	2.20	2.50
2018-2019	2.40	2.76	2.26	1.00	1.58	2.10	1.38	1.92	2.51	2.48
2019-2020	2.44	1.58	2.12	0.87	1.75	1.88	2.18	1.50	2.31	2.17
2020-2021	2.31	1.49	1.97	0.70	1.54	1.60	0.77	1.00	1.93	1.89
2021-2022	2.22	2.71	2.01	0.58	1.49	1.43	1.37	0.85	1.84	1.75
2022-2023	1.93	0.33	1.78	0.43	1.36	1.42	0.60	0.91	2.03	1.88
2023-2024	1.99	1.58	1.81	0.60	1.29	1.38	1.24	1.02	1.98	1.80
2024-2025	1.97	1.70	1.79	0.48	1.11	1.31	1.13	0.95	1.83	1.73
Compound Annual Growth Rates (%)										
2014-2019	3.34	2.90	2.39	0.79	0.98	2.84	2.56	0.29	0.89	1.25
2014-2025	2.69	2.17	2.13	0.69	1.22	2.11	1.83	0.69	1.49	1.59
2016-2025	2.37	1.83	2.06	0.71	1.52	1.68	1.31	1.26	2.09	2.08

HIGH AND LOW FORECASTS

Net Summer Non-coincident Peak Demand (Metered Load in MW) —High

Year	LRZ1	LRZ2	LRZ3	LRZ4	LRZ5	LRZ6	LRZ7	LRZ8	LRZ9	LRZ10
2014	17,018	11,730	8,283	9,563	8,487	17,170	19,293	7,058	19,173	4,297
2015	17,292	12,377	8,864	10,251	9,044	19,068	20,499	7,221	19,612	5,053
2016	17,820	12,666	9,078	10,336	9,213	19,538	20,933	7,353	20,595	5,182
2017	18,362	12,932	9,228	10,382	9,344	19,875	21,367	7,449	21,020	5,309
2018	18,847	13,178	9,400	10,423	9,452	20,212	21,489	7,542	21,455	5,437
2019	19,253	13,530	9,554	10,482	9,555	20,575	21,728	7,666	21,963	5,566
2020	19,670	13,719	9,698	10,527	9,677	20,900	22,157	7,756	22,437	5,682
2021	20,079	13,898	9,830	10,555	9,780	21,167	22,259	7,806	22,843	5,783
2022	20,477	14,269	9,969	10,570	9,881	21,401	22,505	7,842	23,234	5,879
2023	20,818	14,277	10,086	10,567	9,971	21,635	22,565	7,883	23,674	5,984
2024	21,177	14,481	10,209	10,584	10,054	21,861	22,782	7,933	24,110	6,086
2025	21,539	14,714	10,332	10,590	10,124	22,076	22,978	7,978	24,514	6,185
Annual Growth Rate (%)										
2014-2015	1.61	5.52	7.01	7.20	6.57	11.05	6.25	2.31	2.29	17.59
2015-2016	3.05	2.33	2.42	0.83	1.86	2.47	2.12	1.82	5.01	2.56
2016-2017	3.04	2.10	1.65	0.44	1.43	1.72	2.07	1.32	2.06	2.45
2017-2018	2.65	1.90	1.86	0.40	1.15	1.70	0.57	1.24	2.07	2.41
2018-2019	2.15	2.67	1.64	0.56	1.09	1.80	1.11	1.64	2.37	2.38
2019-2020	2.17	1.40	1.51	0.43	1.27	1.58	1.98	1.19	2.16	2.07
2020-2021	2.08	1.31	1.36	0.26	1.07	1.28	0.46	0.63	1.81	1.79
2021-2022	1.98	2.67	1.42	0.14	1.03	1.10	1.11	0.46	1.71	1.65
2022-2023	1.67	0.05	1.17	-0.02	0.91	1.09	0.27	0.52	1.89	1.78
2023-2024	1.72	1.43	1.22	0.16	0.84	1.04	0.96	0.64	1.84	1.70
2024-2025	1.71	1.60	1.21	0.06	0.70	0.99	0.86	0.57	1.68	1.64
Compound Annual Growth Rates (%)										
2014-2019	2.50	2.90	2.90	1.85	2.40	3.68	2.41	1.67	2.75	5.31
2014-2025	2.16	2.08	2.03	0.93	1.62	2.31	1.60	1.12	2.26	3.37
2016-2025	2.13	1.68	1.45	0.27	1.05	1.37	1.04	0.91	1.95	1.99

Net Winter Non-coincident Peak Demand (Metered Load in MW)—High

Year	LRZ1	LRZ2	LRZ3	LRZ4	LRZ5	LRZ6	LRZ7	LRZ8	LRZ9	LRZ10
2014	15,140	10,113	7,349	8,262	7,782	16,873	14,832	6,870	19,302	4,277
2015	14,768	9,518	7,088	8,053	7,525	17,298	14,325	5,980	17,684	4,110
2016	15,214	9,733	7,248	8,110	7,657	17,720	14,616	6,085	18,568	4,215
2017	15,672	9,934	7,356	8,136	7,759	18,019	14,906	6,161	18,949	4,317
2018	16,082	10,118	7,481	8,158	7,840	18,320	14,972	6,233	19,339	4,420
2019	16,421	10,385	7,592	8,195	7,918	18,643	15,121	6,332	19,794	4,525
2020	16,769	10,525	7,694	8,220	8,011	18,931	15,406	6,403	20,217	4,617
2021	17,110	10,657	7,787	8,231	8,088	19,167	15,456	6,438	20,581	4,699
2022	17,443	10,939	7,885	8,233	8,164	19,372	15,608	6,463	20,930	4,776
2023	17,725	10,936	7,965	8,220	8,230	19,578	15,627	6,491	21,323	4,860
2024	18,023	11,088	8,049	8,223	8,292	19,775	15,758	6,528	21,712	4,941
2025	18,323	11,262	8,133	8,217	8,342	19,963	15,874	6,559	22,072	5,021
Annual Growth Rate (%)										
2014-2015	-2.46	-5.89	-3.56	-2.53	-3.30	2.52	-3.41	-12.96	-8.38	-3.89
2015-2016	3.02	2.27	2.26	0.71	1.76	2.44	2.03	1.76	5.00	2.54
2016-2017	3.01	2.06	1.49	0.32	1.33	1.69	1.99	1.25	2.05	2.43
2017-2018	2.61	1.85	1.70	0.28	1.05	1.67	0.44	1.17	2.06	2.38
2018-2019	2.11	2.65	1.48	0.44	0.99	1.76	0.99	1.58	2.35	2.36
2019-2020	2.12	1.34	1.35	0.31	1.17	1.54	1.89	1.12	2.14	2.05
2020-2021	2.04	1.25	1.20	0.14	0.97	1.25	0.32	0.56	1.80	1.77
2021-2022	1.94	2.65	1.26	0.01	0.94	1.07	0.99	0.38	1.70	1.63
2022-2023	1.62	-0.03	1.01	-0.15	0.81	1.06	0.12	0.44	1.88	1.76
2023-2024	1.68	1.39	1.06	0.03	0.74	1.01	0.84	0.56	1.82	1.68
2024-2025	1.66	1.57	1.05	-0.07	0.61	0.95	0.74	0.48	1.66	1.62
Compound Annual Growth Rates (%)										
2014-2019	1.64	0.53	0.65	-0.16	0.35	2.02	0.39	-1.62	0.50	1.13
2014-2025	1.75	0.98	0.93	-0.05	0.63	1.54	0.62	-0.42	1.23	1.47
2016-2025	2.09	1.63	1.29	0.15	0.96	1.33	0.92	0.84	1.94	1.96

HIGH AND LOW FORECASTS

Gross and Net MISO System Energy (Annual Metered Load in GWh) —High

Year	MISO energy without EE/DR/DG adjustment	MISO energy with EE/DR/DG adjustment
2014	677,830	677,830
2015	720,653	718,334
2016	742,015	738,202
2017	758,405	753,068
2018	772,942	766,046
2019	788,945	780,445
2020	804,531	794,397
2021	817,125	805,341
2022	831,006	817,542
2023	841,936	826,762
2024	854,877	837,957
2025	867,451	848,907
Annual Growth Rates（%）		
2014-2015	6.32	5.98
2015-2016	2.96	2.77
2016-2017	2.21	2.01
2017-2018	1.92	1.72
2018-2019	2.07	1.88
2019-2020	1.98	1.79
2020-2021	1.57	1.38
2021-2022	1.70	1.52
2022-2023	1.32	1.13
2023-2024	1.54	1.35
2024-2025	1.47	1.31
Compound Annual Growth Rates (%)		
2014-2019	3.08	2.86
2014-2025	2.27	2.07
2016-2025	1.75	1.56

HIGH AND LOW FORECASTS

Gross and Net MISO System Coincident Peak Demand (Metered Load in MW) —High

Year	MISO Summer CP without EE/DR/DG adjustment	MISO Summer CP with EE/DR/DG adjustment	MISO Winter CP without EE/DR/DG adjustment	MISO Winter CP with EE/DR/DG adjustment
2014	114,709	114,709	108,920	108,920
2015	128,946	123,614	107,870	102,505
2016	132,694	126,875	111,050	105,192
2017	135,610	129,314	113,497	107,157
2018	138,163	131,377	115,678	108,843
2019	140,992	133,699	118,073	110,725
2020	143,760	135,940	120,396	112,515
2021	145,968	137,629	122,284	113,879
2022	148,435	139,566	124,356	115,416
2023	150,330	140,918	125,993	116,504
2024	152,613	142,645	127,925	117,874
2025	154,831	144,314	129,801	119,195
Annual Growth Rates (%)				
2014-2015	12.41	7.76	-0.96	-5.89
2015-2016	2.91	2.64	2.95	2.62
2016-2017	2.20	1.92	2.20	1.87
2017-2018	1.88	1.60	1.92	1.57
2018-2019	2.05	1.77	2.07	1.73
2019-2020	1.96	1.68	1.97	1.62
2020-2021	1.54	1.24	1.57	1.21
2021-2022	1.69	1.41	1.70	1.35
2022-2023	1.28	0.97	1.32	0.94
2023-2024	1.52	1.23	1.53	1.18
2024-2025	1.45	1.17	1.47	1.12
Compound Annual Growth Rates (%)				
2014-2019	4.21	3.11	1.63	0.33
2014-2025	2.76	2.11	1.61	0.82
2016-2025	1.73	1.44	1.75	1.40

HIGH AND LOW FORECASTS

Gross State Energy Forecasts (Annual Retail Sales in GWh) —Low

Year	AR	IL	IN	IA	KY	LA	MI	MN
1990	27,365	111,577	73,982	29,437	61,097	63,826	82,367	47,167
1991	28,440	116,869	77,034	30,781	64,194	64,704	84,519	48,755
1992	28,451	112,521	76,977	30,208	67,068	65,098	83,840	47,412
1993	31,663	117,786	81,931	32,104	68,149	67,756	87,589	49,211
1994	32,619	121,490	83,808	33,039	72,485	70,132	91,160	51,155
1995	34,671	126,231	87,006	34,301	74,548	72,827	94,701	53,959
1996	36,137	125,990	88,901	34,999	77,019	75,269	96,302	54,942
1997	36,858	126,953	89,147	36,148	76,836	75,886	97,391	55,674
1998	39,315	131,697	92,059	37,318	75,850	77,716	100,506	56,744
1999	39,789	132,682	96,735	38,034	79,098	78,267	103,981	57,399
2000	41,611	134,697	97,775	39,088	78,316	80,690	104,772	59,782
2001	41,732	136,034	97,734	39,444	79,975	74,693	102,409	60,687
2002	42,450	138,447	101,429	40,898	87,267	79,261	104,714	62,162
2003	43,108	136,248	100,468	41,207	85,220	77,769	108,877	63,087
2004	43,672	139,254	103,094	40,903	86,521	79,737	106,606	63,340
2005	46,165	144,986	106,549	42,757	89,351	77,389	110,445	66,019
2006	46,636	142,448	105,664	43,337	88,743	77,468	108,018	66,770
2007	47,055	146,055	109,420	45,270	92,404	79,567	109,297	68,231
2008	46,135	144,620	106,981	45,488	93,428	78,722	105,781	68,792
2009	43,173	136,688	99,312	43,641	88,809	78,670	98,121	64,004
2010	48,194	144,761	105,994	45,445	93,569	85,080	103,649	67,800
2011	47,928	142,886	105,818	45,655	89,538	86,369	105,054	68,533
2012	46,860	143,540	105,173	45,709	89,048	84,731	104,818	67,989
2013	46,686	141,790	105,553	46,774	91,961	85,808	103,041	68,625
2014	47,377	137,786	103,782	44,370	91,056	83,828	101,055	66,545
2015	47,341	138,010	102,756	44,858	88,782	83,416	102,039	66,214
2016	47,092	138,310	102,208	44,676	88,063	84,075	101,258	66,415
2017	47,205	136,847	102,241	44,812	87,796	84,167	101,682	66,701
2018	47,483	139,136	102,660	45,236	87,829	86,355	101,471	67,019
2019	48,078	140,405	103,286	45,636	88,193	88,157	101,705	67,514
2020	48,555	141,475	103,957	46,163	88,724	89,911	102,592	68,251
2021	48,818	142,055	104,385	46,588	89,383	91,332	103,229	69,028
2022	49,065	142,937	104,891	47,135	89,876	92,791	103,099	69,804
2023	49,374	143,504	105,382	47,641	90,283	94,098	103,422	70,574
2024	49,777	144,489	106,093	48,167	90,687	95,955	103,932	71,288
2025	50,161	145,324	106,929	48,634	91,162	97,560	104,706	72,080
Compound Annual Growth Rates (%)								
1990-2013	2.35	1.05	1.56	2.03	1.79	1.30	0.98	1.64
2014-2025	0.52	0.49	0.27	0.84	0.01	1.39	0.32	0.73
2016-2025	0.70	0.55	0.50	0.95	0.39	1.67	0.37	0.91

Gross State Energy Forecasts (Annual Retail Sales in GWh) —Low – continued

Year	MS	MO	MT	ND	SD	TX	WI
1990	32,127	53,925	13,125	7,014	6,334	237,415	49,198
1991	33,019	56,514	13,407	7,255	6,685	240,352	51,032
1992	33,241	54,411	13,096	7,128	6,494	239,431	50,925
1993	34,749	58,622	12,929	7,432	6,905	250,084	53,156
1994	36,627	59,693	13,184	7,681	7,174	258,180	55,412
1995	37,868	62,259	13,419	7,883	7,414	263,279	57,967
1996	39,622	64,843	13,820	8,314	7,736	278,450	58,744
1997	40,089	65,711	11,917	8,282	7,773	286,704	60,094
1998	42,510	69,010	14,145	8,220	7,824	304,705	62,061
1999	43,980	69,045	13,282	9,112	7,922	301,844	63,547
2000	45,336	72,643	14,580	9,413	8,283	318,263	65,146
2001	44,287	73,213	11,447	9,810	8,627	318,044	65,218
2002	45,452	75,001	12,831	10,219	8,937	320,846	66,999
2003	45,544	74,270	12,825	10,461	9,080	322,686	67,241
2004	46,033	74,054	12,957	10,516	9,214	320,615	67,976
2005	45,901	80,940	13,479	10,840	9,811	334,258	70,336
2006	46,936	82,015	13,815	11,245	10,056	342,724	69,821
2007	48,153	85,533	15,532	11,906	10,603	343,829	71,301
2008	47,721	84,382	15,326	12,416	10,974	347,059	70,122
2009	46,049	79,687	14,326	12,649	11,010	345,296	66,286
2010	49,687	86,085	13,423	12,956	11,356	358,458	68,752
2011	49,338	84,255	13,788	13,737	11,680	376,065	68,612
2012	48,388	82,435	13,863	14,717	11,734	365,467	68,820
2013	48,783	83,424	14,045	16,033	12,213	379,716	69,124
2014	48,543	82,855	12,438	16,393	12,179	382,448	68,145
2015	48,099	82,364	11,600	16,399	12,410	388,706	68,407
2016	48,365	82,861	10,759	16,307	12,542	384,808	68,670
2017	48,897	82,999	10,193	16,243	12,775	387,340	69,253
2018	49,649	83,083	9,713	16,162	12,914	391,933	70,003
2019	50,494	83,363	9,445	16,085	13,122	399,749	71,005
2020	51,244	83,908	9,183	16,000	13,440	408,593	71,966
2021	51,853	84,553	9,305	15,756	13,727	416,489	72,748
2022	52,491	85,196	9,006	15,449	13,995	423,783	73,404
2023	53,256	85,953	9,031	15,137	14,228	430,385	74,260
2024	54,057	86,599	9,142	14,709	14,447	436,580	75,018
2025	54,817	87,048	8,993	14,152	14,665	442,868	75,882
Compound Annual Growth Rates (%)							
1990-2013	1.83	1.92	0.29	3.66	2.90	2.06	1.49
2014-2025	1.11	0.45	-2.91	-1.33	1.70	1.34	0.98
2016-2025	1.40	0.55	-1.97	-1.56	1.75	1.57	1.12

Gross LRZ Energy Forecasts (Annual Metered Load in GWh) —Low

Year	LRZ1	LRZ2	LRZ3	LRZ4	LRZ5	LRZ6	LRZ7	LRZ8	LRZ9	LRZ10
2014	99,623	65,113	47,437	50,332	43,298	101,811	100,152	37,160	110,905	21,999
2015	94,849	64,477	45,255	48,461	42,581	104,209	98,621	36,652	103,680	22,122
2016	94,765	64,665	45,096	48,566	42,751	103,519	97,867	36,462	104,083	22,244
2017	94,977	65,192	45,212	48,052	42,735	103,392	98,277	36,549	104,323	22,489
2018	95,258	65,830	45,648	48,856	42,691	103,638	98,072	36,764	106,709	22,834
2019	95,866	66,710	46,052	49,302	42,747	104,176	98,299	37,223	108,915	23,223
2020	96,746	67,588	46,578	49,677	42,939	104,830	99,156	37,591	111,134	23,568
2021	97,713	68,298	47,002	49,881	43,180	105,422	99,772	37,796	112,977	23,848
2022	98,463	68,859	47,544	50,191	43,419	105,966	99,645	37,988	114,819	24,142
2023	99,359	69,618	48,042	50,390	43,714	106,454	99,958	38,228	116,475	24,494
2024	100,164	70,300	48,563	50,736	43,952	107,061	100,451	38,540	118,636	24,862
2025	100,915	71,088	49,030	51,029	44,088	107,774	101,199	38,837	120,560	25,211
Annual Growth Rates（%）										
2014-2015	-4.79	-0.98	-4.60	-3.72	-1.66	2.36	-1.53	-1.37	-6.51	0.56
2015-2016	-0.09	0.29	-0.35	0.22	0.40	-0.66	-0.77	-0.52	0.39	0.55
2016-2017	0.22	0.81	0.26	-1.06	-0.04	-0.12	0.42	0.24	0.23	1.10
2017-2018	0.30	0.98	0.96	1.67	-0.10	0.24	-0.21	0.59	2.29	1.54
2018-2019	0.64	1.34	0.89	0.91	0.13	0.52	0.23	1.25	2.07	1.70
2019-2020	0.92	1.31	1.14	0.76	0.45	0.63	0.87	0.99	2.04	1.49
2020-2021	1.00	1.05	0.91	0.41	0.56	0.56	0.62	0.54	1.66	1.19
2021-2022	0.77	0.82	1.15	0.62	0.55	0.52	-0.13	0.51	1.63	1.23
2022-2023	0.91	1.10	1.05	0.40	0.68	0.46	0.31	0.63	1.44	1.46
2023-2024	0.81	0.98	1.08	0.69	0.54	0.57	0.49	0.82	1.86	1.50
2024-2025	0.75	1.12	0.96	0.58	0.31	0.67	0.74	0.77	1.62	1.41
Compound Annual Growth Rates (%)										
2014-2019	-0.77	0.49	-0.59	-0.41	-0.26	0.46	-0.37	0.03	-0.36	1.09
2014-2025	0.12	0.80	0.30	0.13	0.16	0.52	0.09	0.40	0.76	1.25
2016-2025	0.70	1.06	0.93	0.55	0.34	0.45	0.37	0.70	1.65	1.40

HIGH AND LOW FORECASTS

Net LRZ Energy Forecasts (Annual Metered Load in GWh) —Low

Year	LRZ1	LRZ2	LRZ3	LRZ4	LRZ5	LRZ6	LRZ7	LRZ8	LRZ9	LRZ10
2014	99,623	65,113	47,437	50,332	43,298	101,811	100,152	37,160	110,905	21,999
2015	94,622	64,192	44,963	48,169	42,325	103,884	98,147	36,560	103,627	22,099
2016	94,403	64,244	44,569	48,082	42,294	102,964	97,155	36,315	103,977	22,203
2017	94,468	64,641	44,444	47,375	42,079	102,600	97,325	36,345	104,155	22,428
2018	94,589	65,154	44,637	47,986	41,836	102,602	96,875	36,501	106,469	22,754
2019	95,024	65,911	44,795	48,238	41,693	102,890	96,852	36,898	108,590	23,122
2020	95,713	66,670	45,071	48,421	41,688	103,287	97,456	37,203	110,716	23,446
2021	96,485	67,274	45,243	48,433	41,735	103,616	97,816	37,342	112,456	23,706
2022	97,027	67,734	45,528	48,551	41,781	103,892	97,432	37,466	114,185	23,977
2023	97,704	68,395	45,766	48,558	41,884	104,105	97,484	37,636	115,718	24,307
2024	98,280	68,984	46,021	48,713	41,931	104,429	97,711	37,875	117,746	24,653
2025	98,801	69,718	46,224	48,835	41,903	104,874	98,220	38,098	119,531	24,983
Annual Growth Rates（%）										
2014-2015	-5.02	-1.41	-5.22	-4.30	-2.25	2.04	-2.00	-1.61	-6.56	0.45
2015-2016	-0.23	0.08	-0.88	-0.18	-0.07	-0.89	-1.01	-0.67	0.34	0.47
2016-2017	0.07	0.62	-0.28	-1.47	-0.51	-0.35	0.17	0.08	0.17	1.02
2017-2018	0.13	0.79	0.43	1.29	-0.58	0.00	-0.46	0.43	2.22	1.45
2018-2019	0.46	1.16	0.35	0.53	-0.34	0.28	-0.02	1.09	1.99	1.62
2019-2020	0.73	1.15	0.62	0.38	-0.01	0.39	0.62	0.83	1.96	1.40
2020-2021	0.81	0.91	0.38	0.02	0.11	0.32	0.37	0.37	1.57	1.11
2021-2022	0.56	0.68	0.63	0.24	0.11	0.27	-0.39	0.33	1.54	1.15
2022-2023	0.70	0.98	0.52	0.02	0.25	0.21	0.05	0.45	1.34	1.37
2023-2024	0.59	0.86	0.56	0.32	0.11	0.31	0.23	0.63	1.75	1.42
2024-2025	0.53	1.06	0.44	0.25	-0.07	0.43	0.52	0.59	1.52	1.34
Compound Annual Growth Rates (%)										
2014-2019	-0.94	0.24	-1.14	-0.85	-0.75	0.21	-0.67	-0.14	-0.42	1.00
2014-2025	-0.08	0.62	-0.24	-0.27	-0.30	0.27	-0.18	0.23	0.68	1.16
2016-2025	0.51	0.91	0.41	0.17	-0.10	0.20	0.12	0.53	1.56	1.32

HIGH AND LOW FORECASTS

Gross Summer Non-coincident Peak Demand (Metered Load in MW) —Low

Year	LRZ1	LRZ2	LRZ3	LRZ4	LRZ5	LRZ6	LRZ7	LRZ8	LRZ9	LRZ10
2014	17,018	11,730	8,283	9,563	8,487	17,170	19,293	7,058	19,173	4,297
2015	16,683	12,475	8,455	9,440	8,468	17,943	20,176	7,214	18,181	4,625
2016	16,669	12,512	8,426	9,461	8,502	17,824	20,021	7,176	18,251	4,651
2017	16,706	12,614	8,447	9,361	8,499	17,802	20,105	7,194	18,293	4,702
2018	16,755	12,737	8,528	9,517	8,490	17,844	20,063	7,236	18,712	4,774
2019	16,862	12,907	8,604	9,604	8,501	17,937	20,110	7,326	19,099	4,855
2020	17,017	13,077	8,702	9,677	8,540	18,050	20,285	7,399	19,488	4,927
2021	17,187	13,215	8,782	9,717	8,587	18,152	20,411	7,439	19,811	4,986
2022	17,319	13,323	8,883	9,777	8,635	18,245	20,385	7,477	20,134	5,047
2023	17,477	13,470	8,976	9,816	8,694	18,329	20,449	7,524	20,424	5,121
2024	17,618	13,602	9,073	9,884	8,741	18,434	20,550	7,585	20,803	5,198
2025	17,750	13,754	9,160	9,941	8,768	18,557	20,703	7,644	21,141	5,271
Annual Growth Rate (%)										
2014-2015	-1.97	6.35	2.08	-1.28	-0.22	4.50	4.58	2.21	-5.18	7.64
2015-2016	-0.09	0.29	-0.35	0.22	0.40	-0.66	-0.77	-0.52	0.39	0.55
2016-2017	0.22	0.81	0.26	-1.06	-0.04	-0.12	0.42	0.24	0.23	1.10
2017-2018	0.30	0.98	0.96	1.67	-0.10	0.24	-0.21	0.59	2.29	1.54
2018-2019	0.64	1.34	0.89	0.91	0.13	0.52	0.23	1.25	2.07	1.70
2019-2020	0.92	1.31	1.14	0.76	0.45	0.63	0.87	0.99	2.04	1.49
2020-2021	1.00	1.05	0.91	0.41	0.56	0.56	0.62	0.54	1.66	1.19
2021-2022	0.77	0.82	1.15	0.62	0.55	0.52	-0.13	0.51	1.63	1.23
2022-2023	0.91	1.10	1.05	0.40	0.68	0.46	0.31	0.63	1.44	1.46
2023-2024	0.81	0.98	1.08	0.69	0.54	0.57	0.49	0.82	1.86	1.50
2024-2025	0.75	1.12	0.96	0.58	0.31	0.67	0.74	0.77	1.62	1.41
Compound Annual Growth Rates (%)										
2014-2019	-0.18	1.93	0.76	0.09	0.03	0.88	0.83	0.75	-0.08	2.47
2014-2025	0.38	1.46	0.92	0.35	0.30	0.71	0.64	0.73	0.89	1.87
2016-2025	0.70	1.06	0.93	0.55	0.34	0.45	0.37	0.70	1.65	1.40

Gross Winter Non-coincident Peak Demand (Metered Load in MW) —Low

Year	LRZ1	LRZ2	LRZ3	LRZ4	LRZ5	LRZ6	LRZ7	LRZ8	LRZ9	LRZ10
2014	15,140	10,113	7,349	8,262	7,782	16,873	14,832	6,870	19,302	4,277
2015	14,398	9,827	6,833	7,456	7,055	16,318	14,489	6,055	16,416	3,763
2016	14,386	9,856	6,810	7,472	7,083	16,210	14,378	6,024	16,479	3,784
2017	14,418	9,936	6,827	7,393	7,080	16,190	14,439	6,038	16,517	3,826
2018	14,460	10,033	6,893	7,516	7,073	16,229	14,409	6,073	16,895	3,885
2019	14,553	10,167	6,954	7,585	7,082	16,313	14,442	6,149	17,244	3,951
2020	14,686	10,301	7,033	7,643	7,114	16,416	14,568	6,210	17,596	4,010
2021	14,833	10,409	7,097	7,674	7,154	16,508	14,658	6,244	17,888	4,057
2022	14,947	10,495	7,179	7,722	7,194	16,593	14,640	6,276	18,179	4,107
2023	15,083	10,610	7,254	7,752	7,243	16,670	14,686	6,315	18,441	4,167
2024	15,205	10,714	7,333	7,806	7,282	16,765	14,758	6,367	18,784	4,230
2025	15,319	10,835	7,404	7,851	7,305	16,877	14,868	6,416	19,088	4,289
Annual Growth Rate (%)										
2014-2015	-4.90	-2.83	-7.02	-9.76	-9.34	-3.29	-2.31	-11.86	-14.95	-12.01
2015-2016	-0.09	0.29	-0.35	0.22	0.40	-0.66	-0.77	-0.52	0.39	0.55
2016-2017	0.22	0.81	0.26	-1.06	-0.04	-0.12	0.42	0.24	0.23	1.10
2017-2018	0.30	0.98	0.96	1.67	-0.10	0.24	-0.21	0.59	2.29	1.54
2018-2019	0.64	1.34	0.89	0.91	0.13	0.52	0.23	1.25	2.07	1.70
2019-2020	0.92	1.31	1.14	0.76	0.45	0.63	0.87	0.99	2.04	1.49
2020-2021	1.00	1.05	0.91	0.41	0.56	0.56	0.62	0.54	1.66	1.19
2021-2022	0.77	0.82	1.15	0.62	0.55	0.52	-0.13	0.51	1.63	1.23
2022-2023	0.91	1.10	1.05	0.40	0.68	0.46	0.31	0.63	1.44	1.46
2023-2024	0.81	0.98	1.08	0.69	0.54	0.57	0.49	0.82	1.86	1.50
2024-2025	0.75	1.12	0.96	0.58	0.31	0.67	0.74	0.77	1.62	1.41
Compound Annual Growth Rates (%)										
2014-2019	-0.79	0.11	-1.10	-1.70	-1.87	-0.67	-0.53	-2.19	-2.23	-1.57
2014-2025	0.11	0.63	0.07	-0.46	-0.57	0.00	0.02	-0.62	-0.10	0.03
2016-2025	0.70	1.06	0.93	0.55	0.34	0.45	0.37	0.70	1.65	1.40

Net Summer Non-coincident Peak Demand (Metered Load in MW) —Low

Year	LRZ1	LRZ2	LRZ3	LRZ4	LRZ5	LRZ6	LRZ7	LRZ8	LRZ9	LRZ10
2014	17,018	11,730	8,283	9,563	8,487	17,170	19,293	7,058	19,173	4,297
2015	15,548	11,382	8,059	9,236	8,411	17,464	18,772	6,710	17,936	4,620
2016	15,463	11,364	7,961	9,209	8,396	17,276	18,542	6,638	17,972	4,641
2017	15,432	11,421	7,912	9,061	8,344	17,184	18,551	6,623	17,984	4,687
2018	15,410	11,500	7,923	9,169	8,286	17,153	18,431	6,632	18,368	4,754
2019	15,439	11,625	7,927	9,207	8,247	17,170	18,397	6,689	18,716	4,829
2020	15,506	11,749	7,952	9,231	8,235	17,205	18,490	6,728	19,062	4,896
2021	15,595	11,842	7,958	9,221	8,233	17,227	18,532	6,733	19,349	4,948
2022	15,643	11,907	7,984	9,231	8,230	17,238	18,421	6,735	19,634	5,003
2023	15,714	12,010	8,001	9,220	8,239	17,238	18,398	6,745	19,882	5,070
2024	15,766	12,097	8,020	9,237	8,235	17,255	18,411	6,769	20,217	5,140
2025	15,806	12,210	8,029	9,247	8,215	17,291	18,478	6,789	20,507	5,206
Annual Growth Rate (%)										
2014-2015	-8.64	-2.96	-2.71	-3.42	-0.89	1.71	-2.70	-4.93	-6.45	7.51
2015-2016	-0.54	-0.16	-1.21	-0.29	-0.18	-1.07	-1.22	-1.07	0.20	0.45
2016-2017	-0.20	0.50	-0.61	-1.61	-0.62	-0.54	0.05	-0.23	0.06	0.99
2017-2018	-0.14	0.69	0.13	1.19	-0.70	-0.18	-0.65	0.14	2.14	1.43
2018-2019	0.19	1.09	0.05	0.41	-0.47	0.10	-0.19	0.87	1.90	1.59
2019-2020	0.43	1.07	0.32	0.26	-0.14	0.20	0.51	0.58	1.85	1.37
2020-2021	0.58	0.79	0.07	-0.11	-0.02	0.13	0.23	0.08	1.51	1.07
2021-2022	0.31	0.55	0.33	0.12	-0.03	0.07	-0.60	0.03	1.47	1.11
2022-2023	0.45	0.86	0.21	-0.12	0.10	0.00	-0.12	0.15	1.27	1.34
2023-2024	0.33	0.73	0.25	0.19	-0.04	0.10	0.07	0.35	1.68	1.38
2024-2025	0.26	0.93	0.11	0.10	-0.25	0.21	0.36	0.30	1.44	1.29
Compound Annual Growth Rates (%)										
2014-2019	-1.93	-0.18	-0.88	-0.76	-0.57	0.00	-0.95	-1.07	-0.48	2.36
2014-2025	-0.67	0.36	-0.28	-0.31	-0.30	0.06	-0.39	-0.35	0.61	1.76
2016-2025	0.24	0.80	0.09	0.05	-0.24	0.01	-0.04	0.25	1.48	1.29

HIGH AND LOW FORECASTS

Net Winter Non-coincident Peak Demand (Metered Load in MW) —Low

Year	LRZ1	LRZ2	LRZ3	LRZ4	LRZ5	LRZ6	LRZ7	LRZ8	LRZ9	LRZ10
2014	15,140	10,113	7,349	8,262	7,782	16,873	14,832	6,870	19,302	4,277
2015	13,263	8,734	6,437	7,251	6,998	15,839	13,085	5,551	16,171	3,758
2016	13,180	8,708	6,345	7,220	6,977	15,662	12,899	5,485	16,200	3,774
2017	13,144	8,743	6,292	7,092	6,925	15,572	12,884	5,467	16,208	3,811
2018	13,115	8,796	6,287	7,168	6,868	15,538	12,776	5,469	16,551	3,864
2019	13,130	8,885	6,276	7,187	6,828	15,546	12,729	5,512	16,862	3,925
2020	13,175	8,973	6,283	7,196	6,810	15,571	12,772	5,539	17,170	3,978
2021	13,241	9,037	6,273	7,178	6,800	15,584	12,779	5,538	17,426	4,019
2022	13,271	9,079	6,280	7,176	6,789	15,587	12,675	5,534	17,679	4,063
2023	13,320	9,150	6,279	7,156	6,788	15,578	12,635	5,537	17,899	4,116
2024	13,353	9,210	6,280	7,159	6,777	15,586	12,619	5,550	18,197	4,172
2025	13,375	9,290	6,272	7,157	6,752	15,611	12,642	5,561	18,454	4,225
Annual Growth Rate (%)										
2014-2015	-12.40	-13.63	-12.41	-12.23	-10.08	-6.13	-11.78	-19.20	-16.22	-12.13
2015-2016	-0.62	-0.30	-1.43	-0.43	-0.30	-1.12	-1.42	-1.19	0.18	0.43
2016-2017	-0.28	0.40	-0.83	-1.76	-0.74	-0.58	-0.12	-0.33	0.05	0.97
2017-2018	-0.22	0.60	-0.08	1.06	-0.82	-0.22	-0.84	0.04	2.12	1.40
2018-2019	0.11	1.01	-0.17	0.27	-0.59	0.06	-0.37	0.78	1.88	1.56
2019-2020	0.35	1.00	0.11	0.12	-0.27	0.16	0.34	0.49	1.83	1.35
2020-2021	0.50	0.71	-0.15	-0.25	-0.15	0.08	0.05	-0.02	1.49	1.05
2021-2022	0.23	0.46	0.11	-0.03	-0.16	0.02	-0.81	-0.07	1.45	1.08
2022-2023	0.37	0.79	-0.02	-0.27	-0.02	-0.05	-0.32	0.05	1.25	1.31
2023-2024	0.24	0.65	0.02	0.04	-0.17	0.05	-0.13	0.25	1.66	1.35
2024-2025	0.17	0.87	-0.13	-0.04	-0.37	0.16	0.19	0.20	1.42	1.27
Compound Annual Growth Rates (%)										
2014-2019	-2.81	-2.56	-3.11	-2.75	-2.58	-1.62	-3.01	-4.31	-2.67	-1.70
2014-2025	-1.12	-0.77	-1.43	-1.30	-1.28	-0.70	-1.44	-1.90	-0.41	-0.11
2016-2025	0.16	0.72	-0.13	-0.10	-0.36	-0.04	-0.22	0.15	1.46	1.26

HIGH AND LOW FORECASTS

Gross and Net MISO System Energy (Annual Metered Load in GWh) —Low

Year	MISO energy without EE/DR/DG adjustment	MISO energy with EE/DR/DG adjustment
2014	677,830	677,830
2015	660,907	658,588
2016	660,019	656,206
2017	661,198	655,862
2018	666,300	659,403
2019	672,514	664,013
2020	679,808	669,673
2021	685,889	674,105
2022	691,037	677,573
2023	696,732	681,558
2024	703,265	686,345
2025	709,732	691,188
Annual Growth Rates（%）		
2014-2015	-2.50	-2.84
2015-2016	-0.13	-0.36
2016-2017	0.18	-0.05
2017-2018	0.77	0.54
2018-2019	0.93	0.70
2019-2020	1.08	0.85
2020-2021	0.89	0.66
2021-2022	0.75	0.51
2022-2023	0.82	0.59
2023-2024	0.94	0.70
2024-2025	0.92	0.71
Compound Annual Growth Rates (%)		
2014-2019	-0.16	-0.41
2014-2025	0.42	0.18
2016-2025	0.81	0.58

HIGH AND LOW FORECASTS

Gross and Net MISO System Coincident Peak Demand (Metered Load in MW) —Low

Year	MISO Summer CP without EE/DR/DG adjustment	MISO Summer CP with EE/DR/DG adjustment	MISO Winter CP without EE/DR/DG adjustment	MISO Winter CP with EE/DR/DG adjustment
2014	114,709	114,709	108,920	108,920
2015	118,289	112,957	98,934	93,569
2016	118,120	112,301	98,806	92,948
2017	118,337	112,041	98,977	92,637
2018	119,214	112,428	99,736	92,900
2019	120,297	113,004	100,661	93,313
2020	121,583	113,763	101,744	93,863
2021	122,650	114,311	102,647	94,243
2022	123,537	114,667	103,418	94,478
2023	124,535	115,123	104,269	94,780
2024	125,677	115,710	105,241	95,190
2025	126,816	116,300	106,201	95,595
		Annual Growth Rates (%)		
2014-2015	3.12	-1.53	-9.17	-14.09
2015-2016	-0.14	-0.58	-0.13	-0.66
2016-2017	0.18	-0.23	0.17	-0.33
2017-2018	0.74	0.35	0.77	0.28
2018-2019	0.91	0.51	0.93	0.44
2019-2020	1.07	0.67	1.08	0.59
2020-2021	0.88	0.48	0.89	0.40
2021-2022	0.72	0.31	0.75	0.25
2022-2023	0.81	0.40	0.82	0.32
2023-2024	0.92	0.51	0.93	0.43
2024-2025	0.91	0.51	0.91	0.43
		Compound Annual Growth Rates (%)		
2014-2019	0.96	-0.30	-1.56	-3.05
2014-2025	0.92	0.13	-0.23	-1.18
2016-2025	0.79	0.39	0.81	0.31