8.2 Power Demand

This section provides a high-level overview of the 2007 ERCOT Long-Term Demand and Energy Forecast (Reference 8.2-1) and all of the tables, figures, and data are taken from the Forecast. The methodology is briefly described, highlighting the major aspects involved in producing the forecast, including the data input used in the process. An historical perspective of the load growth in the ERCOT region is provided, and final results of the forecast peak demands and energy consumption are presented in a graphical form and summarized in table. A discussion of the major drivers of peak demands and energy consumption is included, along with the uncertainties associated with the forecast, and the differences from last year's forecast. A more detailed explanation of the econometric forecasting methodology used by ERCOT is described in Appendix 3 of Reference 8.2-1.

8.2.1 Historical Trends

Figure 8.2-1 provides the average hourly load and the annual system peak hour load from 1997 to 2006. The average hourly load growth is almost constant.

The historical annual peak demand for 1997-2006 is included in Figure 8.2-2 and the historical energy consumption for the same period is included in Figure 8.2-3.

Table 8.2-1 provides the historical annual growth percentage of the average hourly load, peak demand, and energy consumption for the period of 1998-2006. Figure 8.2-4 provides the three annual growth percentages graphically.

8.2.2 ERCOT Forecast of Long-Term Demand and Energy

The long-term load forecast covers a period from 1 to 15 years using a process and tools developed internally by ERCOT. The forecast is used for (Reference 8.2-2):

- Annual budget development (energy)
- System planning studies
- Resource adequacy assessments
  - Annual Capacity, Demand, and Reserves Report
  - Seasonal and long-term assessments
- Weekly forecast for outage coordination
- Statement of Opportunities Report
- PUCT/NERC/DOE/FERC reporting

Methodology

The econometric forecasting basics center on a regression analysis, i.e., the development of an equation or set of equations that describes the historical load as a function of independent variables. The regression analysis is used to calculate the appropriate coefficients for each variable and to choose the best equations describing historical patterns (Reference 8.2-2). The forecasting process is shown in Figure 8.2-5. Refer to Appendix 3 of Reference 8.2-1 for a detailed description of the model and methodology.

The long-term forecast was produced with a set of econometric models that use weather, and economic and demographic data, to capture and project the long-term trends from the past five years of historical data. Each of these factors is discussed below.

Weather

Weather drives most of the variation in electric demand in the short-run. Because weather also affects the variation in the electric demand in the long-run, long-term forecasting uses historical average weather profiles to indicate the future variation in weather. There are eight defined weather zones in ERCOT. The largest metropolitan statistical areas are located in the North Central, South Central, and Coastal zones:

- North Central (Dallas-Ft. Worth)
- South Central (Austin-San Antonio)
- Coastal (Houston)

Twelve years of weather data were available from WeatherBank for 20 ERCOT weather stations. These weather stations were used to develop weighted hourly weather profiles for each of the eight weather zones. These data were used in the load shape models. Monthly cooling degree days and heating degree days were used in the monthly energy models.

A representative hourly load shape by weather zone is forecast using an average weather profile of temperatures, cooling degree hours, and heating degree hours obtained from historical data. Seasonal daily, weekly, monthly, and yearly load variations and holiday events were considered, in addition to various interactions, such as weather, weekends, and weekdays. This hourly load shape only describes the hourly load fluctuations within the year and in itself does not reflect the long-term trend.

The long-term trend was provided by the energy consumption forecast. The monthly energy consumption forecast models by weather zones used cooling degree days and heating degree days to project the monthly energy for the next nineteen years (2007-2025).

One measure of the uncertainty associated with extreme weather impacts on the peak demand can be obtained by using a more extreme weather profile to obtain the forecasts. ERCOT developed weather profiles that rank at the 90th percentiles of all the temperatures in its hourly temperature database and did the same to develop profiles with the 10th percentile of all temperatures. Strictly speaking these are not confidence bands in the statistical sense, but this term has commonly been used to refer to the results. A more appropriate term would be to use

scenarios associated with the 90th percentile temperature distribution or 90th percentile scenario forecasts. ERCOT has also run Monte Carlo simulations to assess the impact of extreme temperatures on the peak demands. Subsection 8.2.3 provided the results of the analysis for both normal and extreme weather patterns.

Economic and Demographic Data

Economic and demographic changes can affect the characteristics of electrical demand in the medium- to the long-run. Economic and demographic data at the county level were obtained on a monthly basis from Moody's Economy.com. The data were used as input to the monthly energy consumption models.

The regional economic outlook for Texas is projected to outperform the U.S. as a whole. Three of its major metropolitan areas, Houston, Dallas, and Austin, which are among the top 50 in the U.S., are leading the South. Employment growth in Texas shows a stronger performance for the Dallas-Forth Worth area and the Austin-San Antonio area. The Houston area is expanding, but is expected to lose some momentum due to a slowdown in the energy industry.

Some of the indicators that were used in the forecast are economic and demographic drivers such as real per capita personal income, population, employment in the financial services, non-farm employment, and total employed. These are presented in Figures 8.2-6 through 8.2-10. As discussed in Subsection 8.4.1, actions to reduce the demand for power (i. e., demand-side management or conservation) are taken into account in determining the reserve margin.

8.2.3 Results of ERCOT Long-Term Demand and Energy Forecast

The forecast energy consumption for 2007-2017 using the normal weather scenario is included in Figure 8.2-3. Figure 8.2-11 provides the forecast average hourly load for 2007-2017 using the normal weather scenario.

Figure 8.2-12 shows the forecast peak demand scenarios for 2007-2017 using the extreme weather profiles described above. The red dashed line on the top is a plot of the system peak demand forecast using temperatures above 90% of the historical temperatures (90th percentile) experienced during the last twelve years. This extreme forecast is referred to in the figure as the High Hourly Forecast 90-10. The middle line is the normal weather scenario (Base 50-50). The Low Hourly Forecast 10-90 refers to the forecast obtained by using temperatures above 10% of all temperatures during the last twelve years.

The historical peak demand for 2002-2006 and the forecast peak demand for 2007-2015 for the eight weather zones are shown in Table 8.2-2. The forecasts for the three major zones (North Central, South Central, and Coastal) show a stable and strong growth. The forecasts for the smaller zones show an average or below-average trend in growth.

A summary of the long-term forecast model results for 2007-2025 peak demand and energy consumption is provided in Table 8.2-3. Table 8.2-4 provides the forecast growth percentages for average hourly load, peak demand, and energy consumption. Figure 8.2-4 provides the three annual growth percentages graphically.

Difference between the 2006 and 2007 Forecasts

In the long-term, the 2007 forecast is very similar to the 2006 forecast for the same period. The energy forecast from 2007 to 2015 is 0.06% higher than the 2006 forecast. A one-time adjustment due to economic revisions and other factors, such as Hurricane Katrina, contributed to the growth from the actual energy consumption in 2006 to the forecast for 2007. One of the key factors driving the long-term higher energy consumption is an improvement in the outlook of the overall health of the economy as captured by economic indicators such as the real per capita personal income, population, and various employment measures including non-farm employment and total employment. If income is growing at a faster rate than population, the average person expects to enjoy an overall higher standard of living. A higher standard of living generally translates into an improvement in comfort, which in many cases directly translates into increases in electricity consumption.

The energy consumption forecast scenarios show a rather slight degree of variability between the 90-10 high weather forecasts and the median (50-50) base case. The same holds true for the 10-90 low weather forecast scenario.

Figure 8.2-13 shows the difference between the two forecasts of peak demand for the period of 2007-2015.

Accuracy of the Long-Term Forecast

A comparison of the historical actual and forecast peak demand (Figure 8.2-14) and a comparison of the historical actual and forecast energy consumption (Figure 8.2-15) show that since 1999 ERCOT long-term forecasts have been within ± 5% of the actuals. Since 2003 the accuracy of the energy consumption forecast has been very close to ± 1% (Reference 8.2-2).

8.2.4 References

8.2-1 "2007 ERCOT Planning Long-Term Hourly Peak Demand and Energy Forecast - May 8, 2007" available at http://www.ercot.com/news/presentations/2007/2007_ERCOT_Planning_Long_Term_Hourly_Demand_Energy_Forecast_.pdf, accessed on July 13, 2007.

8.2-2 "Long Term Demand and Energy Forecasting – Planning," available at www.ercot.com/meetings/other/keywords/2007/0124-LoadForecast/KDonohoo_ERCOTLongTermDemandEnergForecastingPlanning01242007.ppt, accessed on June 2, 2007.

Table 8.2-1 Historical Annual Growth of Average Hourly Load, Peak Demand, and Energy Consumption, 1998-2006

Year	Average Load (MW)	Load Growth (MW)	Load Growth (%)	Peak Demand (MW)	Peak Growth (MW)	Peak Growth (%)	Energy Consumption (TWh)	Energy Growth (TWh)	Energy Growth (%)
1998	30,475	1,986	6.97%	53,691	3,326	6.60%	270	16	6.30%
1999	30,336	-139	-0.46%	54,980	1,289	2.40%	269	-1	-0.37%
2000	32,488	2,152	7.09%	57,981	3,001	5.46%	289	20	7.43%
2001	31,623	-865	-2.66%	55,214	-2,767	-4.77%	278	-11	-3.81%
2002	32,052	429	1.36%	56,086	872	1.58%	281	3	1.08%
2003	32,533	481	1.50%	60,037	3,951	7.04%	285	4	1.42%
2004	32,917	384	1.18%	58,506	-1,531	-2.55%	289	4	1.40%
2005	34,161	1,244	3.78%	60,214	1,708	2.92%	299	10	3.46%
2006	34,899	738	2.16%	62,339	2,125	3.53%	306	7	2.34%

Compiled from Reference 8.2-1

Table 8.2-2 Yearly Coincident Peak Demands by Weather Zone (MW)

Year	NORTH	NORTH CENTRAL	EAST	FAR WEST	WEST	SOUTH CENTRAL	COAST	SOUTH	SYSTEM LOAD
Historical									
2002	1,904	20,527	2,175	1,830	1,595	9,492	14,578	3,985	56,086
2003	2,070	22,303	2,319	1,805	1,675	10,016	15,823	4,025	60,037
2004	2,047	20,749	2,265	1,658	1,562	9,619	16,611	3,996	58,506
2005	2,080	21,975	2,351	1,661	1,542	10,162	16,282	4,159	60,214
2006	2,361	22,687	2,432	1,598	1,612	10,718	16,739	4,191	62,339
Forecast									
2007	2,086	23,782	2,251	1,412	1,638	11,329	17,174	4,123	63,794
2008	2,117	24,059	2,363	1,415	1,683	11,708	17,631	4,158	65,135
2009	2,145	24,472	2,323	1,429	1,725	12,075	18,112	4,227	66,508
2010	2,183	24,914	2,353	1,435	1,770	12,475	18,554	4,271	67,955
2011	2,229	25,365	2,382	1,441	1,820	12,901	19,002	4,317	69,456
2012	2,263	25,743	2,402	1,442	1,863	13,292	19,377	4,351	70,733
2013	2,325	26,267	2,517	1,448	1,914	13,725	19,794	4,405	72,394
2014	2,377	26,788	2,462	1,509	1,964	14,111	20,312	4,474	73,998
2015	2,447	27,360	2,484	1,461	2,022	14,570	20,727	4,525	75,596

Compiled from Reference 8.2-1

Table 8.2-3 2007 ERCOT Long-Term Forecast Model Results

Year	Forecast Energy Consumption (MWh)	Historical Energy Consumption (MWh)	Peak (MW)
Historical			
2002	281,930,582	280,772,959	56,086
2003	284,207,211	284,983,916	60,037
2004	287,569,872	289,140,984	58,506
2005	300,553,020	299,253,971	60,214
2006	305,552,884	305,687,145	62,339
Forecast			
2007	313,027,658		63,794
2008	319,688,988		65,135
2009	325,408,664		66,508
2010	332,578,515		67,955
2011	340,089,254		69,456
2012	347,087,436		70,733
2013	354,122,426		72,394
2014	361,232,831		73,998
2015	369,322,241		75,596
2016	377,330,064		77,024
2017	384,606,172		78,694
2018	391,597,067		80,161
2019	398,301,224		81,622
2020	404,587,586		82,871
2021	411,162,342		84,363
2022	417,594,564		85,681
2023	423,892,847		87,015
2024	430,373,659		88,180
2025	436,287,512		89,883

Compiled from Reference 8.2-1

Table 8.2-4 Forecast Annual Growth of Average Hourly Load, Peak Demand, and Energy Consumption, 2007-2017

Year	Average Load (MW)	Load Growth (MW)	Load Growth (%)	Peak Demand (MW)	Peak Growth (MW)	Peak Growth (%)	Energy Consumption (TWh)	Energy Growth (TWh)	Energy Growth (%)
2007	35,734	835	2.39%	63,794	1,455	2.33%	313	7	2.29%
2008	36,395	661	1.85%	65,135	1,341	2.10%	320	7	2.24%
2009	37,147	752	2.07%	66,508	1,373	2.11%	325	5	1.56%
2010	37,966	819	2.20%	67,955	1,447	2.18%	333	8	2.46%
2011	38,823	857	2.26%	69,456	1,501	2.21%	340	7	2.10%
2012	39,513	690	1.78%	70,733	1,277	1.84%	347	7	2.06%
2013	40,425	912	2.31%	72,394	1,661	2.35%	354	7	2.02%
2014	41,237	812	2.01%	73,998	1,604	2.22%	361	7	1.98%
2015	42,159	922	2.24%	75,596	1,598	2.16%	369	8	2.22%
2016	42,957	798	1.89%	77,024	1,428	1.89%	377	8	2.17%
2017	43,905	948	2.21%	78,694	1,670	2.17%	385	8	2.12%

Compiled from Reference 8.2-1

Figure 8.2-1 Historical Average Load and System Peak Load

Compiled from Reference 8.2-1

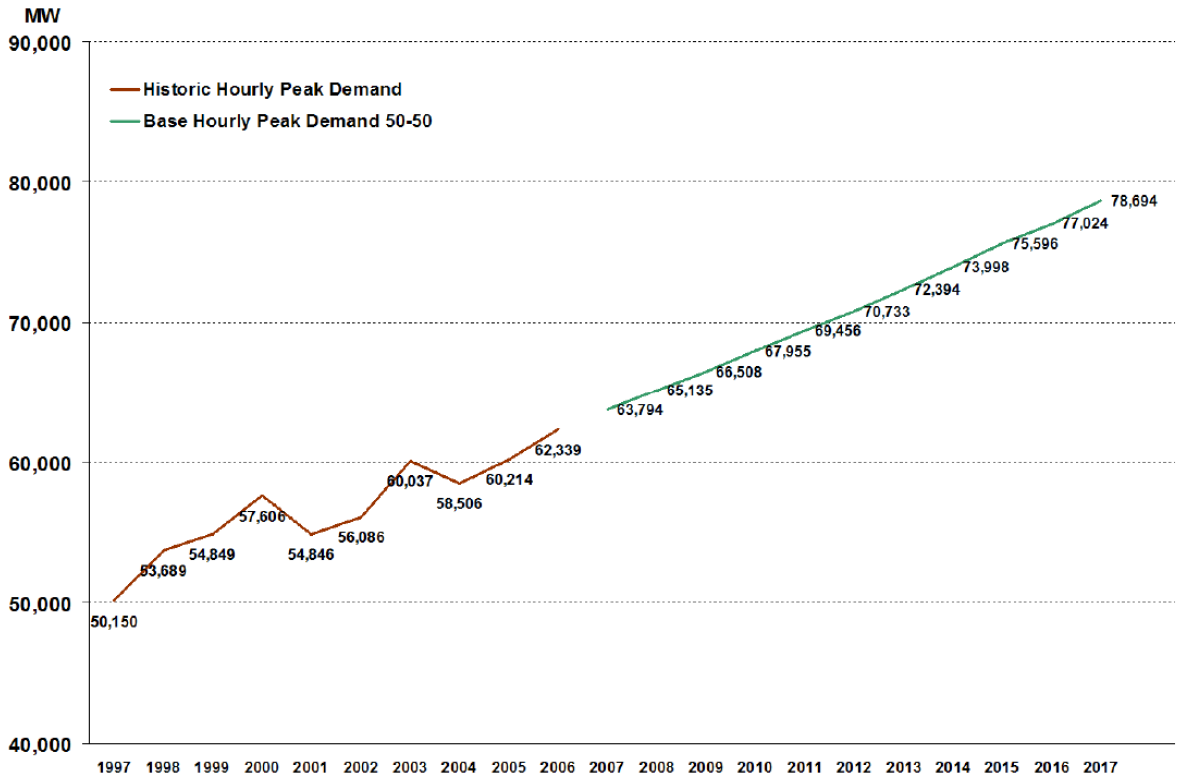
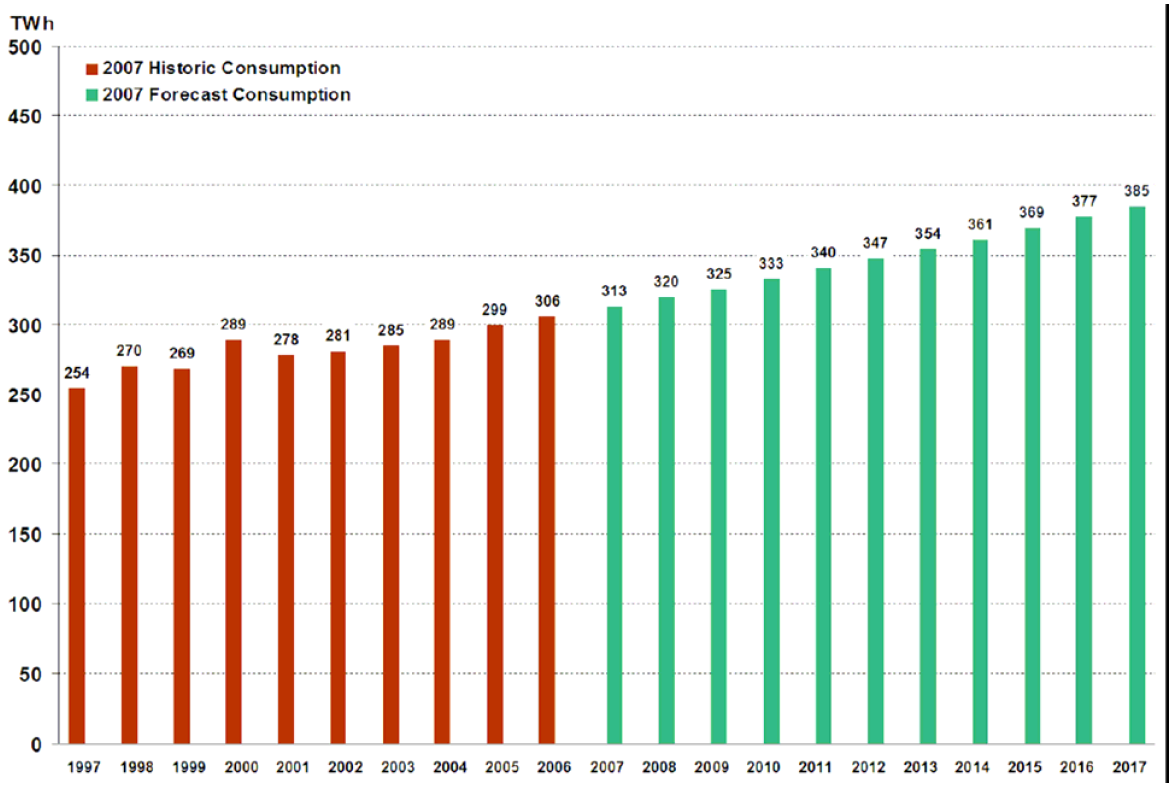


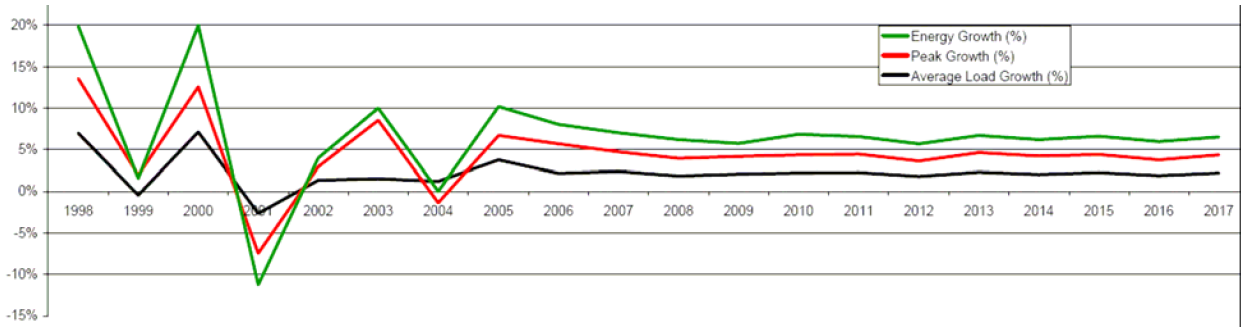
Figure 8.2-2 Historical and Forecast Hourly Peak Demands

Reference 8.2-1



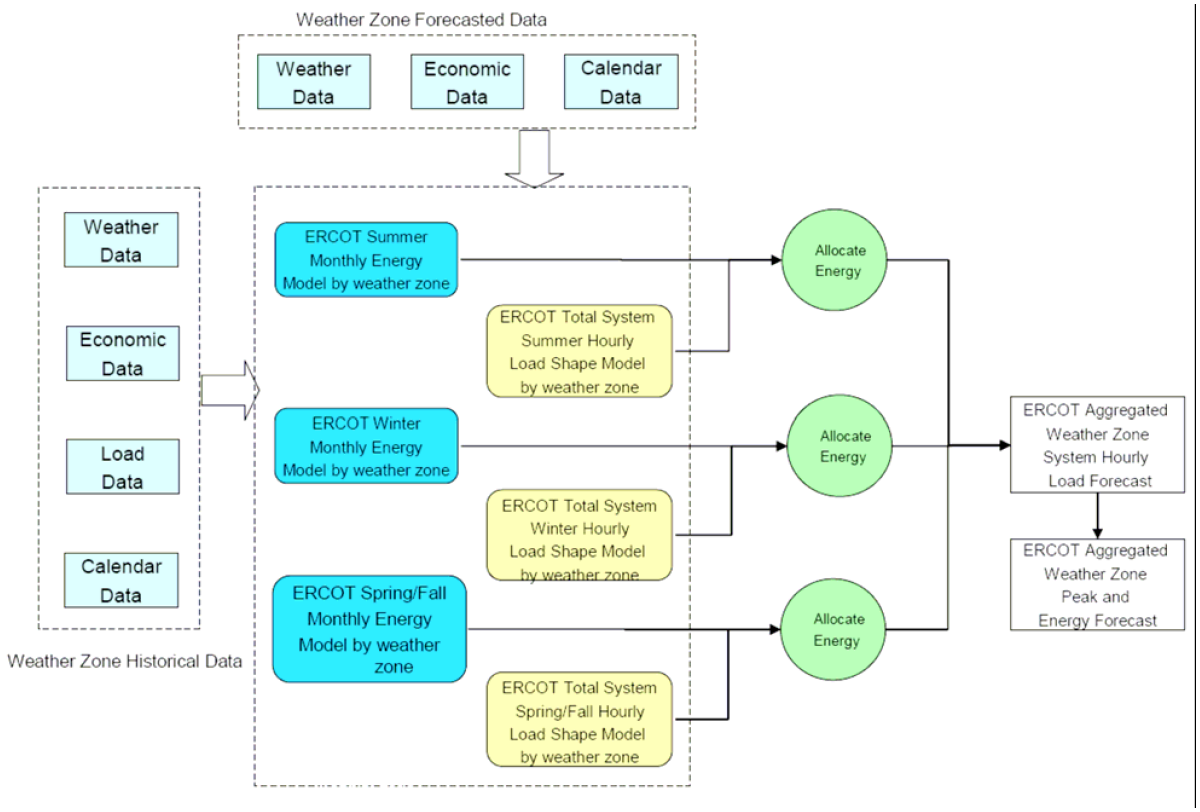
Reference 8.2-1

Figure 8.2-3 Historical and Forecast Energy Consumption



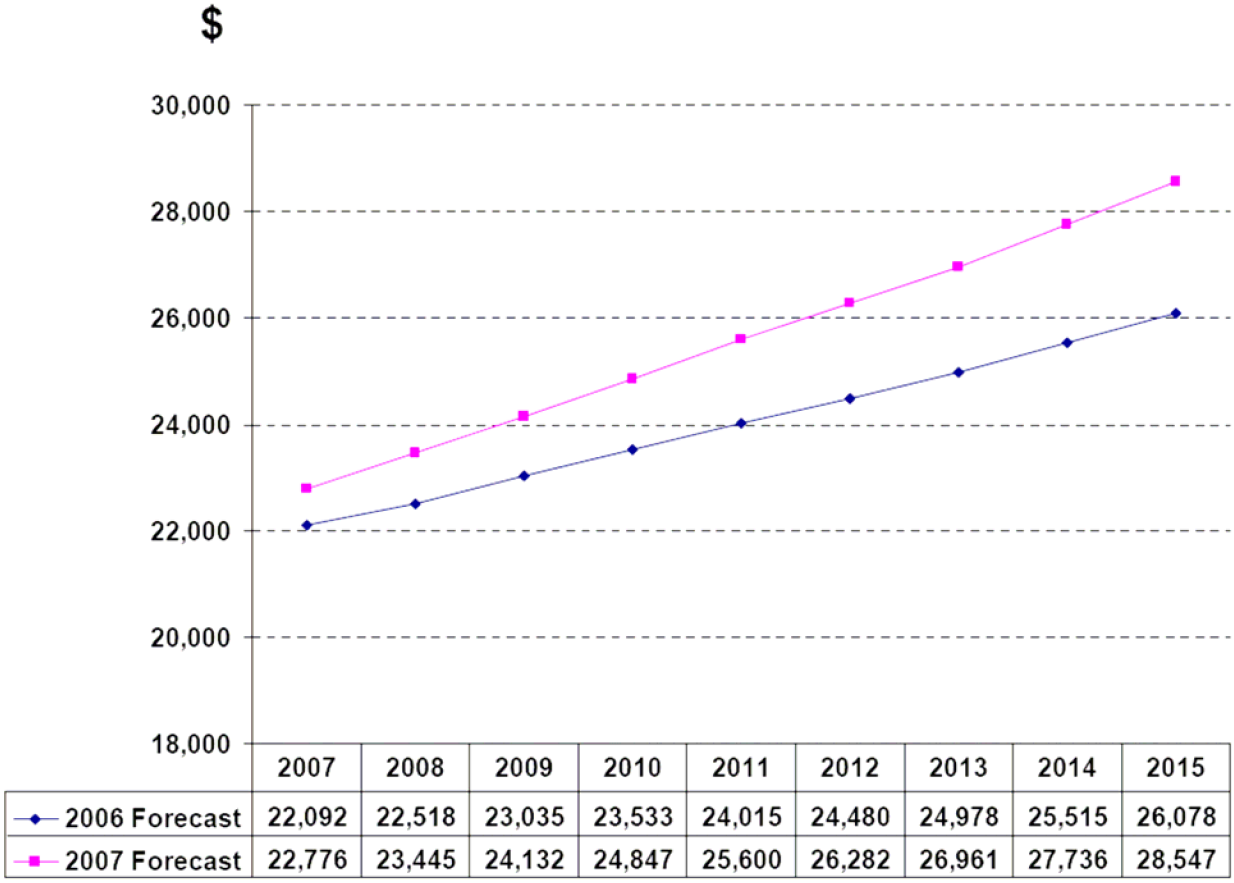
Compiled from Reference 8.2-1

Figure 8.2-4 Annual Percentage Growth of Average Hourly Load, Peak Demand, and Energy Consumption



Reference 8.2-1

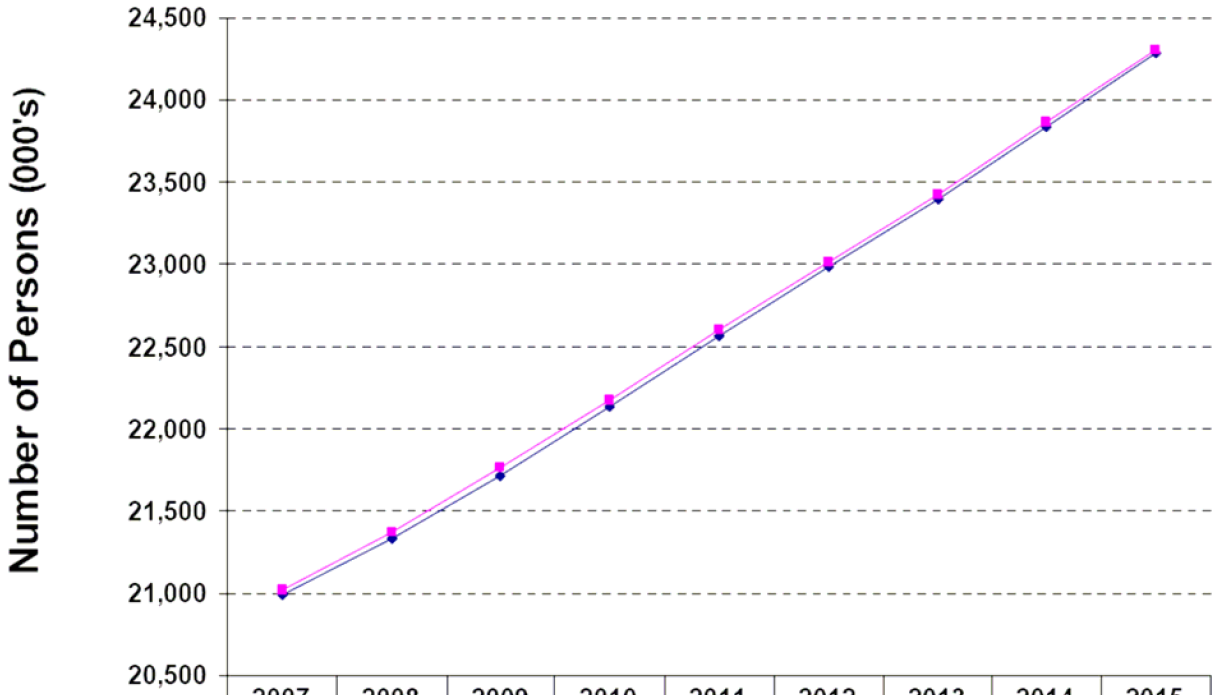
Figure 8.2-5 ERCOT Long-Term Forecasting Process



	2007	2008	2009	2010	2011	2012	2013	2014	2015
2006 Forecast	22,092	22,518	23,035	23,533	24,015	24,480	24,978	25,515	26,078
2007 Forecast	22,776	23,445	24,132	24,847	25,600	26,282	26,961	27,736	28,547

Reference 8.2-1

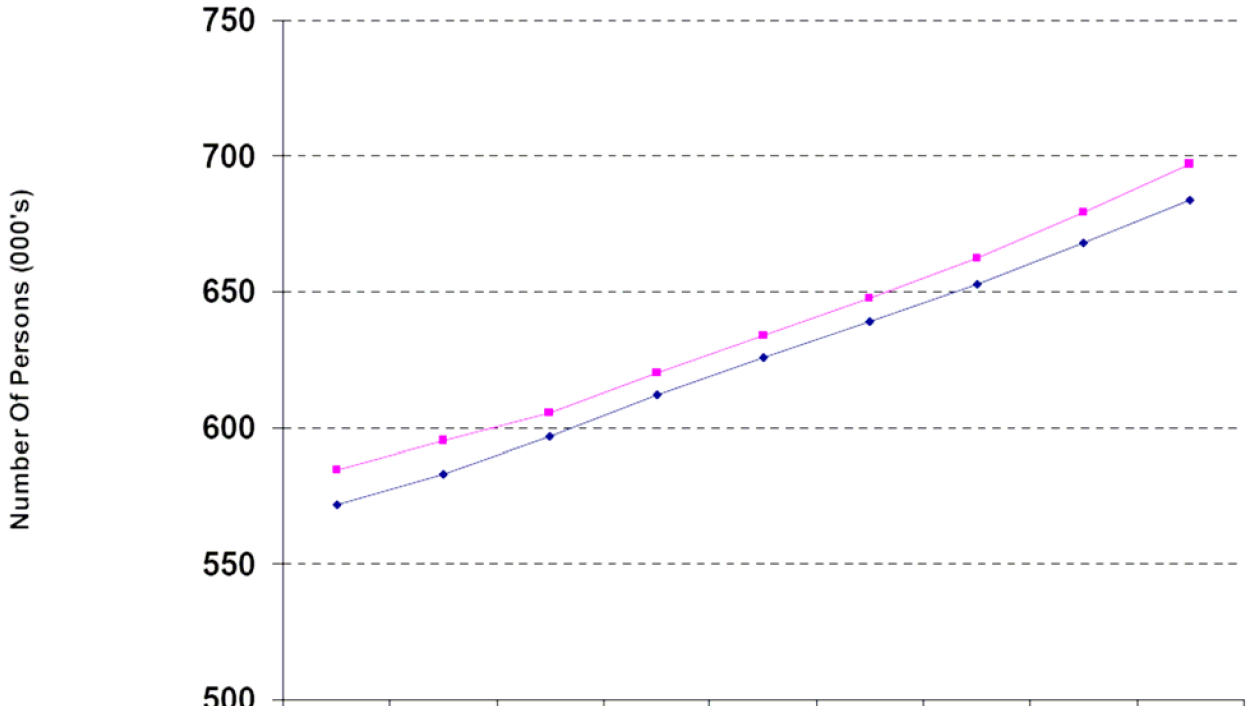
Figure 8.2-6 Real Personal Per-Capita Income



	2007	2008	2009	2010	2011	2012	2013	2014	2015
2006 Forecast	20,986	21,327	21,713	22,137	22,566	22,981	23,398	23,837	24,282
2007 Forecast	21,015	21,372	21,759	22,175	22,602	23,011	23,425	23,862	24,309

Reference 8.2-1

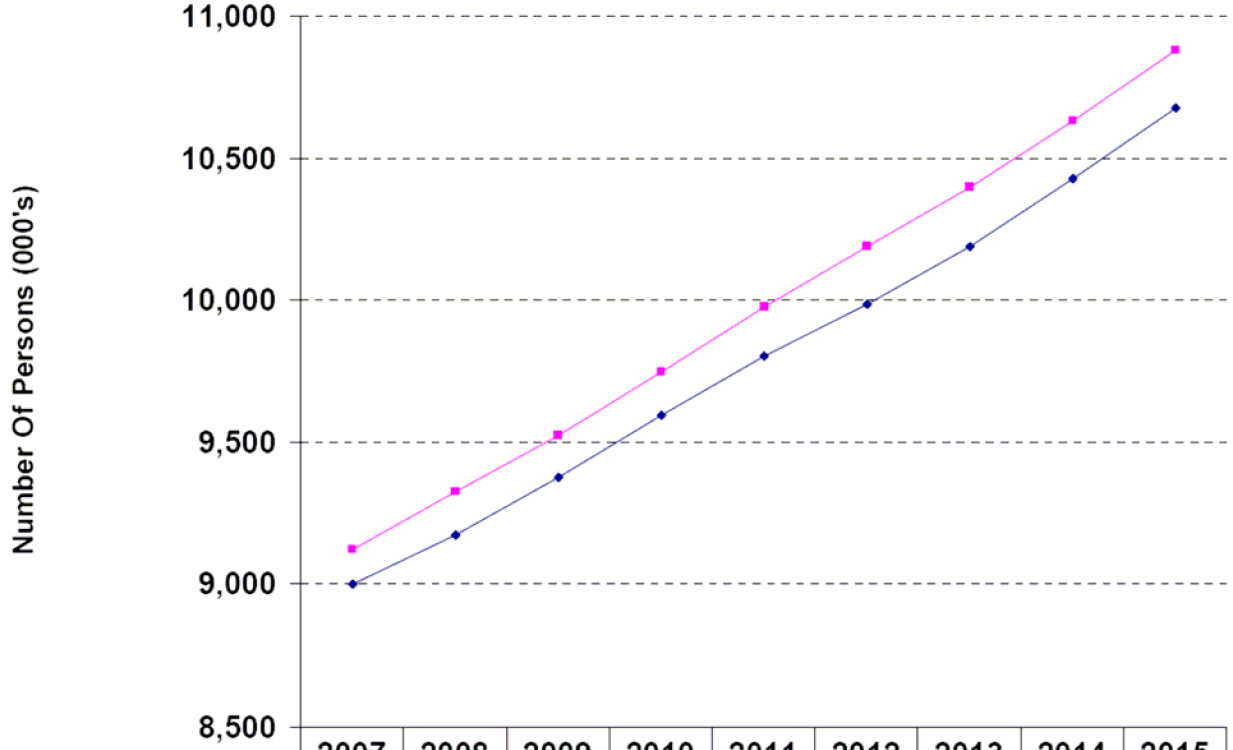
Figure 8.2-7 Population in the ERCOT Region



	2007	2008	2009	2010	2011	2012	2013	2014	2015
2006 Forecast	572	583	597	612	626	639	653	668	684
2007 Forecast	584	595	605	620	634	648	662	679	697

Reference 8.2-1

Figure 8.2-8 Employment in Financial Services



	2007	2008	2009	2010	2011	2012	2013	2014	2015
2006 Forecast	9,003	9,173	9,377	9,597	9,801	9,983	10,191	10,429	10,675
2007 Forecast	9,123	9,328	9,526	9,749	9,975	10,187	10,399	10,628	10,877

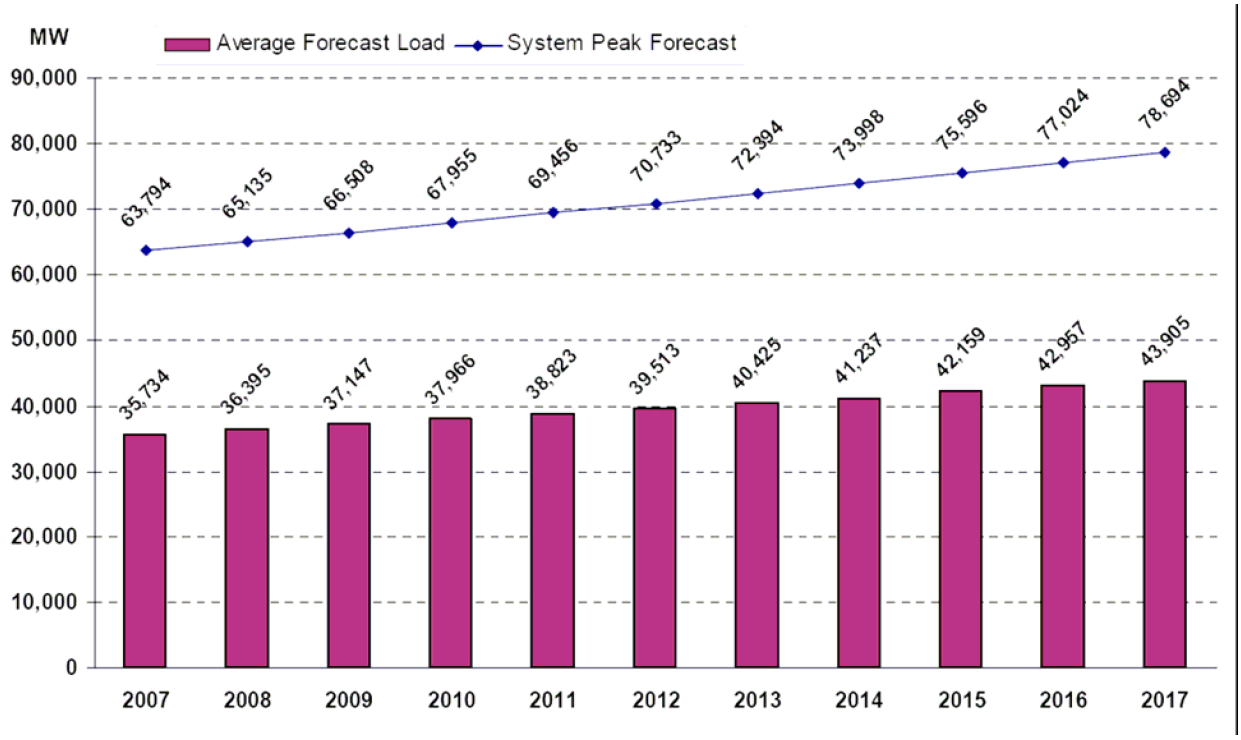
Reference 8.2-1

Figure 8.2-9 Total Non-Farm Employment

	2007	2008	2009	2010	2011	2012	2013	2014	2015
2006 Forecast	9,975	10,158	10,370	10,633	10,875	11,089	11,333	11,617	11,911
2007 Forecast	9,985	10,160	10,338	10,577	10,818	11,044	11,271	11,522	11,797

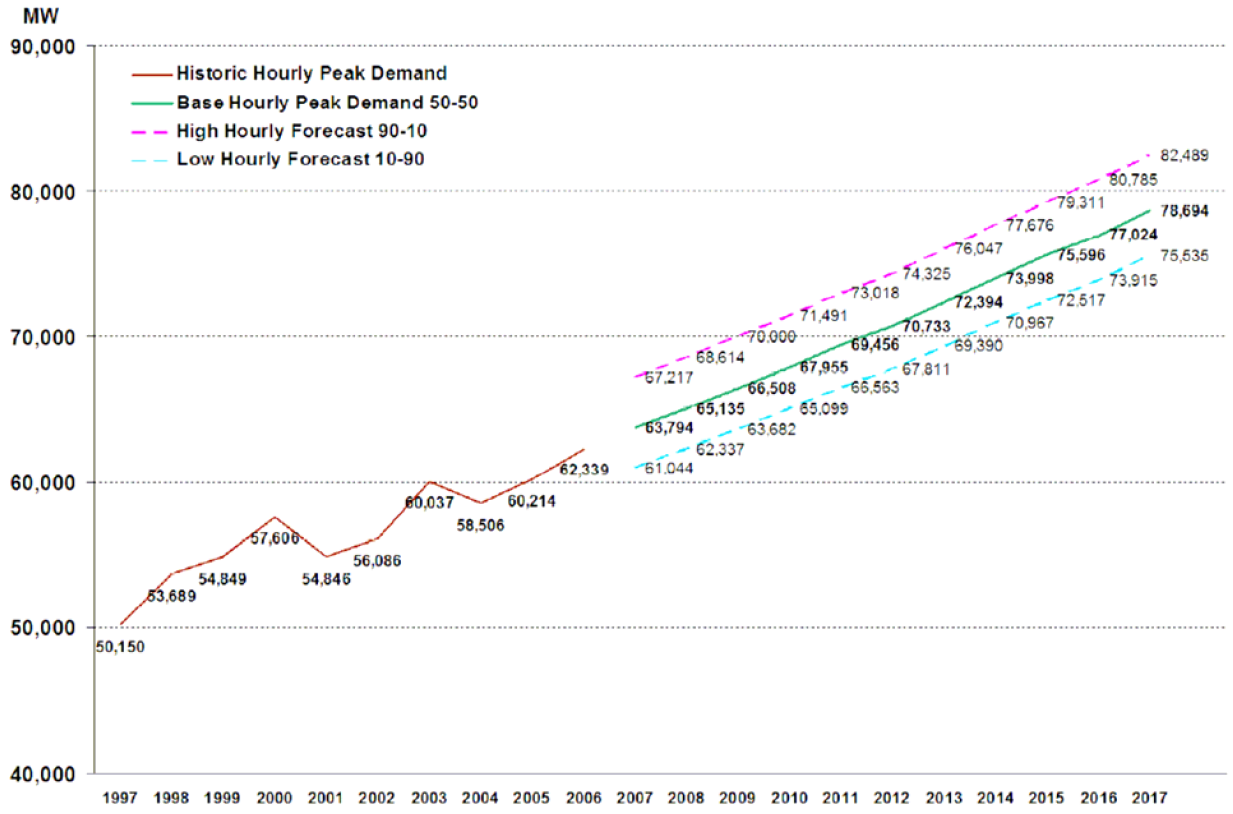
Reference 8.2-1

Figure 8.2-10 Total Persons Employed



Reference 8.2-1

Figure 8.2-11 Forecast Average Load versus Forecast System Peak

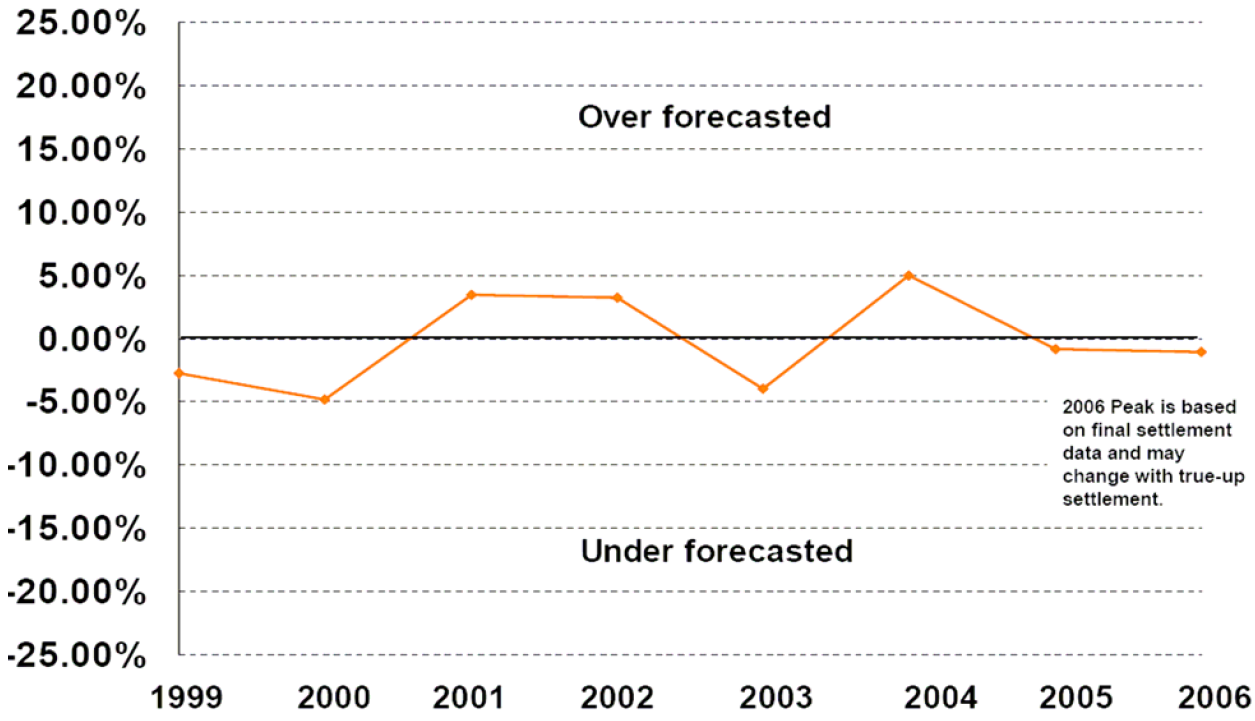


Reference 8.2-1

Figure 8.2-12 Historical and Forecast Hourly Peak Demand

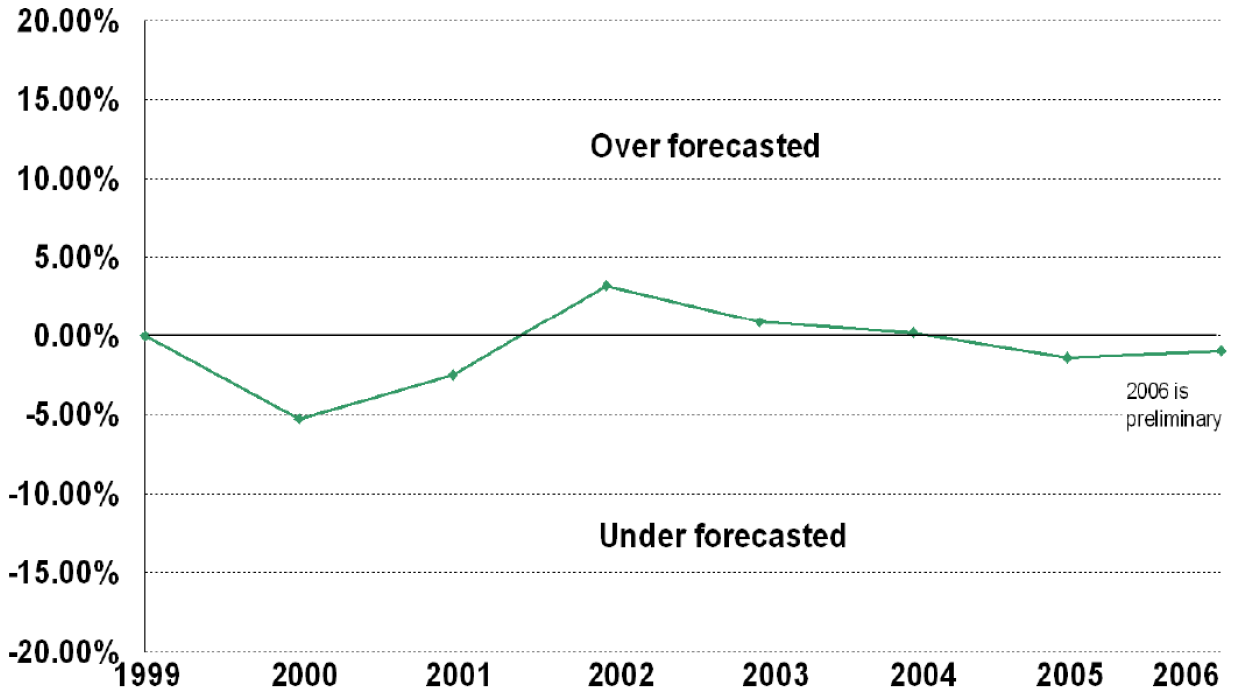
Reference 8.2-1

Figure 8.2-13 Comparison of 2006 and 2007 Peak Demand Forecast



Reference 8.2-2

Figure 8.2-14 Historical Accuracy of Peak Demand Forecasts



Reference 8.2-2

Figure 8.2-15 Historical Accuracy of Energy Consumption Forecasts