Demand Forecasts

Demand forecasting is a means of estimating the amount of energy that customers will use in the future. These forecasts project the "load" that the system will need to provide. Demand forecasts are one of two key determinants used to identify resource need. The second is an assessment of the Company's existing resources. "Resource need" is the gap between the two. The chapter is divided into three sections.

PSE performs a 20-year forecast of energy sales, customer counts, and peak demand each year. We use this forecast principally for planning long-term resource and delivery systems. Variations of the forecast may also be used to make annual revenue forecasts and operational plans. The 20-year horizon makes it possible to anticipate needs and develop timely responses. Annual updates provide for timely forecast revisions based on the most current information.

I. Methodology

The econometric method PSE employs to produce forecasts of energy demand uses historical data to explain changes in energy sales per customer and customer counts. Notable determinants include: regional and national economic growth, demographic changes, weather, prices, seasonality, and other customer usage and behavior factors. Known near-term load additions or deletions are also included.

The model is specified on electricity and/or gas as inputs into the production of various economic activities. For the residential sector, customer uses include space heating, water heating, lighting, cooking, refrigeration, dish washing, laundry washing, and various other plug loads. For the commercial and industrial sectors, energy applications include heating, venting, and air conditioning (HVAC), lighting, computers, and other production processes.

Peak load forecasts are also developed by the application of econometric equations that relate observed monthly peak loads to weather-sensitive delivered sales for both residential and nonresidential sectors; deviations of actual peak hour temperature from normal peak temperature for the month; day of the week effects; and unique weather events such as a cold snap or El Nino.

A detailed discussion of the methodology used to produce the annual energy and hourly electric forecasts appears in the Load Forecasting Models Appendix.

Customers are divided into classes and service levels that use energy for certain specific purposes to forecast energy sales and customer counts:

- Electric customer classes include residential, commercial, industrial, streetlights, and resale.
- Gas customer classes include firm (residential, commercial, industrial, commercial large volume, and industrial large volume), interruptible (commercial and industrial interruptible), and transportation (commercial firm, commercial interruptible, industrial firm and industrial interruptible).

To forecast peak load:

- Electric peak loads are calculated on an hourly basis, and projected for a winter normal and extreme peak design temperatures (normal: 23° F; extreme: January 15° F, February 15° F, November 17° F, and December 13° F). These extreme peak design temperatures were established based on a one in 20 year return period (5% exceedence probability) developed from extreme value distributions of the 30 year historical minimum temperatures during the on-peak hours.

- Gas peak loads are calculated on a daily basis using a 52-heating degree as the design day temperature to represent its relevant peak. This planning standard is expected to meet or exceed 98% of historic peak day temperatures, and is described more fully in the Load Forecasting Models Appendix.

II. Key Assumptions

Economic activity and fuel prices have a significant effect on energy demand. Higher employment leads to greater energy demand by businesses and increases in the retail customer counts. Retail energy prices influence the type of fuel used to operate appliances, the amount used, and the choice of appliance efficiency levels in the long run. PSE used the following key assumptions about economic activity and fuel prices for the forecasts presented in this IRP.

A. Economic Growth

The Puget Sound area is a major commercial and manufacturing center in the Pacific Northwest with strong links to national and state economies. These links create jobs not only for directly affected industries, but also indirectly for supporting industries through multiplier effects. Accordingly, the performance of the national and state economies impacts PSE's service territory economy. PSE uses information and data generated by Global Insight, a global research firm specializing in economic analysis, as a resource for the U.S. macroeconomic assumptions.

National Economic Outlook

Global Insight's Third Quarter 2006, The US Economy: 30-Year Focus predicts that the nation's gross domestic product (GDP) will grow at an average rate of 2.8% per year over the next 25 years with only mild variations (trend growth). It projects that robust growth in equipment spending and advances in technology will result in higher productivity and efficiencies, even though the percentage of employed Americans will decline as the population ages. These national economic forecasts are summarized in Figure 4-1 below.

Figure 4-1
National U.S. Economic Outlook

	2006	2007	2010	2015	2020	2025	AARG*
Gross Domestic Product (in billions)	$ 11,417.0	$ 11,692.7	$ 12,822.4	$ 14,684.7	$ 16,949.9	$ 19,461.9	2.8%
Employment (in millions)	135.3	136.8	142.2	146.9	153.6	161.4	0.9%
Population (in millions)	299.6	302.3	310.3	323.7	337.1	350.8	0.8%

*AARG: average annual rate of growth

Global Insight's report anticipates near-term economic growth will be moderated by the Federal Reserve Board's interest rate policy to keep inflation low. Increases in consumption and business fixed investment are expected to offset slower employment growth, keeping U.S. economic growth steady over the long run. Real oil prices are also expected to decline near term, but to eventually rise because of rising costs to find, produce, process and distribute product in an environment in which new material is increasingly scarce. The forecast assumes a decline in the value of the dollar relative to other currencies, raising U.S. exports but increasing the cost of imported goods and services.

Regional Economic Outlook

During the next two decades, PSE expects employment in our service area to grow at an annual rate of 1.4% to 1.5%, compared to the 20-year historical rate of 2.5%. Factors contributing to the slower long-term growth in employment include slower national employment growth and an expectation that The Boeing Company's more efficient production processes will not generate the historical employment highs of 2000. Despite the slower rate of growth, we project local employers will create more than 600,000 jobs between 2006 and 2025, and the inflow of more than 800,000 new residents will increase the population of our service territory to about 4.5 million.

Between 2001 and 2003, the region experienced one of its worst recessions in the last 20 years, with employment declining in 2002 by about 2%. Employment boomed after that—particularly in the service sector—with the resurgence of Boeing in 2004, increased nonresidential construction, and higher exports due to a weaker dollar. This expansion is expected to continue in 2007 and 2008 though at a slower rate, led by increased hiring at Boeing (to ramp up production) and at Microsoft (for research and development). Most long-term employment growth is expected to come in the service sectors, including business services and computer industries, with variations by county. Smaller counties such as Island and Jefferson are expected to experience higher growth rates than King County, even though King will experience the highest absolute number of new jobs created. Figure 4-2 summarizes projected employment and population growth for PSE's service territory.

Figure 4-2
Economic Growth Assumptions for PSE Service Area

(in thousands)	2006	2007	2010	2015	2020	2025	AARG
Electric Service Area							
Employment	1,811.2	1,851.5	1,951.8	2,117.1	2,237.6	2,380.4	1.4%
Population	3,507.3	3,563.9	3,693.7	3,922.9	4,132.5	4,317.8	1.1%
Gas Service Area							
Employment	1,815.9	1,862.3	1,974.5	2,148.2	2,271.7	2,422.7	1.5%
Population	3,559.1	3,620.0	3,767.0	4,010.9	4,228.8	4,427.5	1.2%

B. Energy Prices

Retail energy prices—what customers pay—are included in the demand forecasts because they affect the efficiency level of newly acquired appliances, their frequency and level of use, and the type of energy source used to power them. The load forecast is an input into the resource planning process. Hence, the energy price forecasts draw on earlier information derived from internal and external sources.

Electricity

PSE projects that nominal retail electric rates will grow between 3.2% and 3.4% per year over the next 20 years. Near term, this forecast assumes rate increases resulting from our General Rate Cases and from Power Cost Only Rate Cases. To project long-term retail rates, we began with Global Insight's forecast of electric rates for the state and adjusted them to provide starting points in line with PSE's near-term forecast of retail rates.

PSE assumes that long-term real electricity prices (i.e., nominal prices adjusted for inflation) will be flat or will grow only moderately over time. This is due to competitive pressures resulting in moderating nominal costs, additional capacity in regions lacking sufficient energy supply, lower coal prices, and an increase in the efficiency of new generation technologies. Global Insight predicts that most new generation will come from gas-fired facilities, with small amounts from coal and wind. As the region increasingly relies on gas for new generation, marginal electric prices throughout the region will become similar while average electric price differentials across the region will gradually narrow.

Natural Gas

We expect the rise in nominal retail gas rates to equal the long-term rate of inflation: 1.8% to 2.1% per year over the next 20 years. In real terms, this means gas retail rates would remain virtually unchanged. Two components make up gas retail rates: the cost of gas and the cost of distribution, known as the distribution margin. The near-term forecast includes PSE's purchased gas adjustment of October 2006, and an increase due to a General Rate Case in 2007. Forecasted gas costs reflect Kiodex prices for 2006 to 2011, and Global Insight projections after that. The distribution margin is based on PSE's projection for the near term and Global Insight's for the longer term.

Figure 4-3 below summarizes electric and gas rate forecasts over the next 20 years.

Figure 4-3
Retail Rate Forecasts for Electric and Gas

(nominal)	2006	2007	2010	2015	2020	2025	AARG
Residential							
Electric, cent/kwh	7.19	8.31	9.41	10.48	11.63	13.05	3.2%
Natural Gas, $/therm	1.32	1.47	1.43	1.52	1.72	1.96	2.1%
Commercial							
Electric, cent/kwh	7.73	8.36	9.39	10.64	12.22	14.10	3.2%
Natural Gas, $/therm	1.23	1.36	1.30	1.37	1.55	1.77	2.0%
Industrial							
Electric, cent/kwh	7.28	7.88	8.86	10.03	11.68	13.66	3.4%
Natural Gas, $/therm	1.16	1.27	1.18	1.24	1.41	1.61	1.8%

C. Other Assumptions

Weather

The billed sales forecast is based on normal weather defined as the average weather using the last 30 years, ending in 2005.

Loss Factors

Based on current analysis, the electric loss factor was increased to 6.7% from 6.6%. The gas loss factor remains at 0.8% of total sales.

Major Accounts

Two major corporations in PSE's service area plan to add facilities starting in 2007 that will eventually increase consumption by 37 aMW. Completion of a planned water treatment plant in 2010 will add 14 aMW of consumption. A major residential development in Kittitas County is expected to add approximately 500 residential customers in the next few years.

III. Electric and Gas Demand Forecasts

Demand forecasts starting in 2008 serve as the basis for establishing system requirements in this resource plan. The charts and tables below incorporate existing demand-side resources (energy efficiency and conservation) prior to 2008, but do not include anticipated additional demand-side resources thereafter.

PSE analyzes several scenarios in order to capture the range of possible economic futures. Three scenarios were used to develop these forecasts. These scenarios are:

- The Base Case forecast assumes that the U.S. economy grows smoothly over time, with no major shocks or disruptions, at a rate of 2.8%.
- The High Case forecast assumes a faster GDP growth rate of 3.3%, a low inflation rate, and high productivity growth.
- The Low Case Forecast assumes a slower GDP growth rate of 2.3%, high inflation rates, and low productivity. It also assumes significant cutbacks in Boeing and Microsoft employment due to increased competition and regulations.
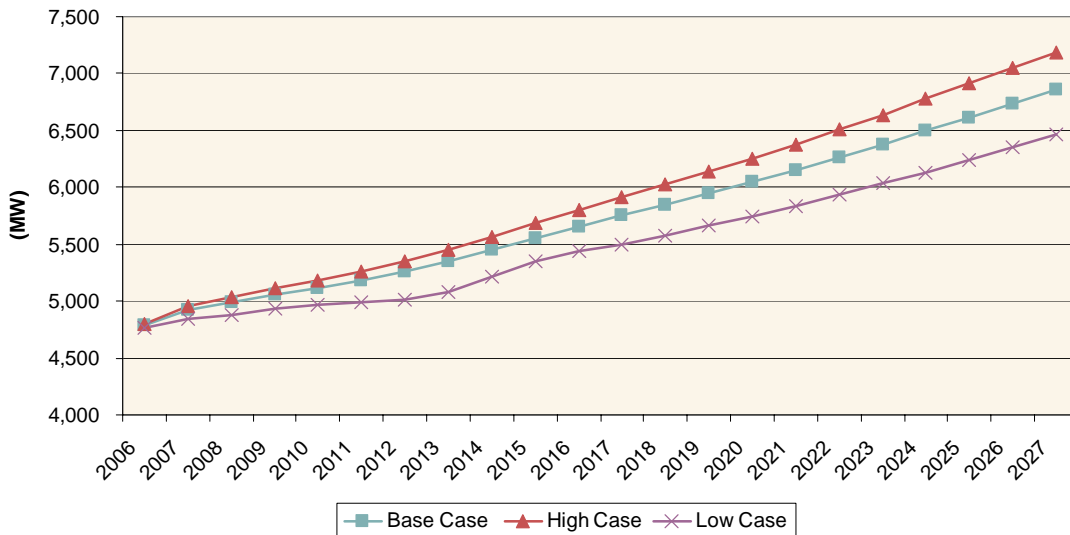
A. Electric Forecast

Figures 4-4 and 4-5 below map electric sales and peak growth forecasts for the Base
Case, High Case, and Low Case over the 20-year planning horizon. The 2005 LCP base
case is shown for comparison purposes. Highlights are discussed on the following pages.

Figure 4-4
Electric Sales Forecasts 2006-2025
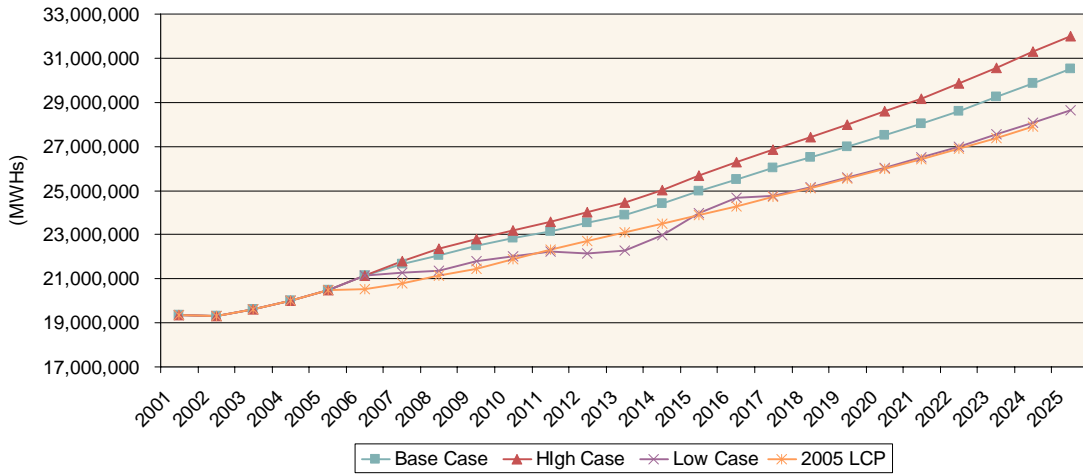
Figure 4-5
Electric Peak (Normal-23°F) Forecast

Electric Forecast Highlights (Base Case)

1. Electric sales are expected to grow at an average annual rate of 2% per year, from 2,412 aMW in 2006, to 3,483 aMW by 2025.

Driven by the area's vibrant economy over the last three years, we expect strong growth in loads to continue through 2007. The rate is then projected to moderate to 1.5% between 2008 and 2014 due to the moderate economic growth, before returning to slightly above 2% per year growth for the remainder of the period.

2. Commercial sales are expected to grow faster than residential sales, increasing from 49% of total sales in 2006 to 52% of total sales in 2025.

Billed sales related to nonmanufacturing employment are expected to grow the fastest in the future, while industrial sales are expected to continue to decline gradually as they have for the past decade (with the exception of 2001) due to declining manufacturing employment.

Slower growth in residential sales is caused by several factors: a projected increase in the rate of construction of multifamily housing, which uses less energy compared to single-family housing; the use of more efficient appliances; and the expectation that new single-family homes are likely to use gas for space and water heating. Residential retail energy price levels are higher, but grow at a slightly slower rate. All these are expected to produce declines in average residential use per customer of close to 1% per year in the forecast period. Residential sales as a percentage of total sales are projected to decline from 50% in 2006 to 47% in 2025.

3. The number of electric customers is predicted to grow at an average rate of 2% per year, reaching 1,500,647 by 2025.

Even though commercial customer growth rates are higher, the residential sector is expected to account for the majority of customer growth in absolute numbers. Currently, residential customers account for 88% of PSE's total customer base. Taking into account the increasing share of multifamily units over the next 20 years, we expect that percentage to decline by only a small amount.

4. Peak hourly loads for electric are expected to grow by 1.7% per year over the next 20 years to 6,616 MW from 4,792 MW, slower than the growth in billed energy.

Peak load growth is projected to grow more slowly than total energy use because residential sales (which place the most upward pressure on peak load events) are growing more slowly than commercial and industrial sales.

In general, compared to the forecast in the 2005 Least Cost Plan, the new forecast of energy load is higher by about 175 aMW by 2020, and grows at a slightly faster pace primarily due to higher customer growth and a slightly slower decline in residential use per customer than anticipated in 2005.

The following tables summarize electric demand forecast results.

Figure 4-6
Electric Sales Forecast Scenarios in aMW

	2006	2007	2010	2015	2020	2025	AARG
Scenarios							
Base Case	2,412	2,472	2,605	2,852	3,140	3,483	2.0%
High Case	2,412	2,486	2,649	2,929	3,262	3,654	2.2%
Low Case	2,412	2,430	2,515	2,736	2,972	3,268	1.6%
LCP 2005	2,345	2,375	2,499	2,727	2,966	N/A	1.7%

Figure 4-7
Electric Sales Forecasts by Class in aMW (Base Case)

	2006	2007	2010	2015	2020	2025	AARG
Base Case							
Total	2,412	2,472	2,605	2,852	3,140	3,483	2.0%
Residential	1,224	1,234	1,272	1,383	1,510	1,645	1.6%
Commercial	1,018	1,069	1,162	1,306	1,467	1,677	2.7%
Industrial	157	156	157	147	144	141	-0.6%
Others	12	13	14	16	18	20	2.6%

Figure 4-8
Electric Customer Count Forecast by Class (Base Case)

	2006	2007	2010	2015	2020	2025	AARG
Total	1,039,523	1,061,336	1,126,112	1,242,398	1,367,252	1,500,647	2.0%
Residential	918,109	936,970	992,445	1,091,598	1,197,430	1,309,252	1.9%
Commercial	114,840	117,652	126,583	142,996	161,148	181,670	2.4%
Industrial	3,800	3,803	3,775	3,735	3,704	3,670	-0.2%
Others	2,774	2,911	3,309	4,069	4,970	6,055	4.2%

Figure 4-9
Electric Peak Forecast (Base Case)

|	2006	2007	2010	2015	2020	2025	AARG
Normal Peaks	4,792	4,924	5,116	5,557	6,047	6,616	1.7%
Extreme Peaks	5,228	5,376	5,590	6,081	6,624	7,256	1.7%
2005 LCP	4,719	4,751	4,945	5,307	5,687	N/A	1.3%

Figure 4-10
Residential Normalized Electric Use per Customer in MWh,
2007 compared to 2005 (Base Case)

|	2006	2007	2010	2015	2020	2025	AARG
LCP 2005	11.068	10.824	10.331	9.905	9.745	N/A	-0.9%
LCP 2007	11.782	11.620	11.088	10.668	10.545	10.537	-0.8%

B. Gas Forecasts

Figures 4-11 and 4-12 below map the gas Base Case, High Case, and Low Case sales and peak day forecasts over the 20-year planning horizon. The 2005 LCP base case is shown for comparison purposes. Highlights are discussed on the following pages.

Figure 4-11
Gas Sales Forecast Scenarios, 2006-2025
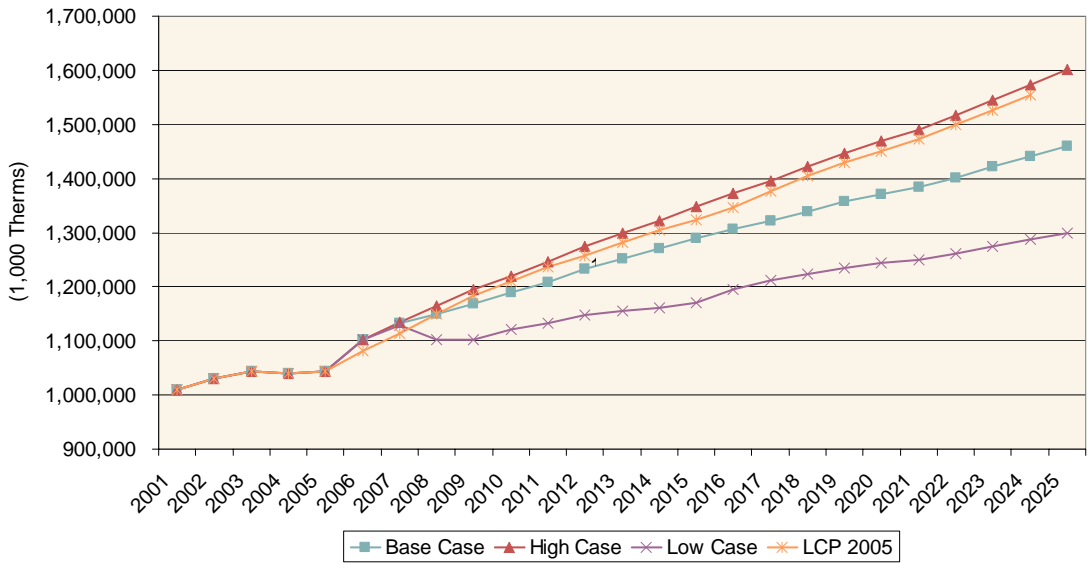
Figure 4-12
Gas Peak Day Forecast Scenarios, 2006-2025
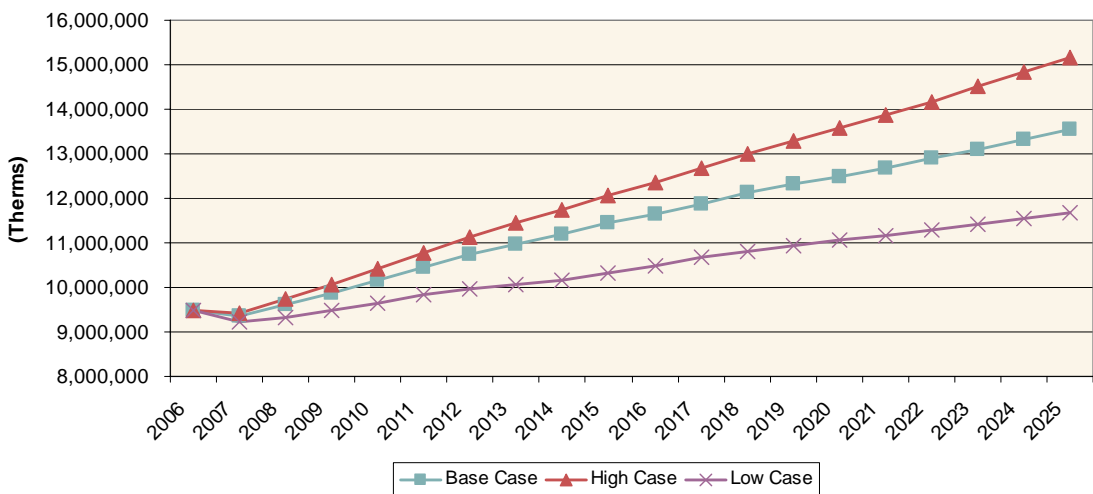
Gas Forecast Highlights (Base Case)

1. Natural gas sales are expected to grow at an average rate of 1.5% per year over the next 20 years, to 1.46 billion therms from 1.1 billion therms in 2006 by 2025.

We expect a slightly faster growth rate in gas billed sales in the near term—over the next six years—as nominal gas prices remain flat or slightly lower; however, nominal gas price increases are expected to approximate the rate of inflation over the long term, which will slow the growth in sales for the remainder of the 20-year period.

While overall volume will increase, some sectors (industrial, interruptibles, and transportation) are expected to decline slightly, continuing a 10-year trend of slowing manufacturing employment and increasing retail prices. A slight decline in residential use per customer due to more efficient equipments and a projected increase in multifamily housing is offset by a steady increase in the number of customers.

2. Gas customer count is expected to increase at a rate of 2.2% per year in the next 20 years, reaching 1,085,323 by 2025.

This forecast reflects slower population growth (hence slower demand for housing) and a declining pool of potential conversion customers compared to the historical growth rate of about 3.3%.

Residential accounts are expected to increase at a rate of 2.2% per year over the next 20 years, and to represent 92% of our total customer base in 2025, as they do today.

While the number of potential conversion customers is expected to decline, this is expected to be offset by increasing penetration of gas into multifamily buildings (townhomes and condominiums) and new single-family homes.

Commercial sector accounts are expected to grow at an average annual rate of approximately 2.4% per year during the next two decades, and to continue to account for 7% of the overall customer base. New restrictions on the use of alternative fuels (especially oil) will contribute to a gradual decline in the growth rate of interruptible customers. We expect many of our current interruptible

customers, especially those with smaller loads, will become all-firm customers or arrange for various combinations of firm, interruptible, and transportation services.

3. Peak-day firm gas requirements are expected to increase at an average rate of 1.9% per year over the next 20 years, from 9.4 million therms in 2006 to 13.5 million therms in 2025.

Gas peak-day growth rates are slightly higher than those for total billed sales because faster sales growth is predicted for the weather-sensitive residential sector for the first six years due to flat or slightly declining gas retail prices. The primary drivers of peak growth across all sectors are an expanding customer base and changes in use per customer. Rising base loads are contributing to peak demand because gas is increasingly being used for purposes other than heating (such as cooking, clothes drying, and fireplaces). This effect is slightly offset by higher appliance efficiencies, and by the increasing use of gas in multifamily housing, where per-customer use is lower.

The residential sector accounts for about 65% of the peak daily requirement; the commercial and industrial sectors account for 29% and 5%, respectively. Large-volume commercial and industrial customers are included in this forecast.

Compared to the gas peak day forecast produced in the 2005 Least Cost Plan, this forecast is higher for 2006, but slightly lower for later years due to higher projected retail prices.

The tables below summarize gas demand forecast results.

Figure 4-13
Gas Sales Forecast Scenarios

(in 1,000 therms)	2006	2007	2010	2015	2020	2025	AARG
Scenarios							
Base Case	1,102,835	1,133,454	1,188,846	1,290,536	1,371,050	1,460,106	1.5%
High Case	1,102,835	1,135,062	1,219,629	1,348,440	1,469,549	1,600,890	2.0%
Low Case	1,102,835	1,129,240	1,121,378	1,171,337	1,243,269	1,298,237	0.9%
LCP 2005	1,082,177	1,114,361	1,210,170	1,323,327	1,450,690	N/A	2.1%

Figure 4-14
Gas Sales Forecast by Class (Base Case)

(in 1,000 therms)	2006	2007	2010	2015	2020	2025	AARG
Total	1,102,835	1,133,454	1,188,846	1,290,536	1,371,050	1,460,106	1.5%
Residential	549,310	566,288	611,994	687,195	745,248	794,037	2.0%
Commercial	235,083	242,279	266,432	307,884	349,135	395,172	2.8%
Industrial	38,257	38,179	37,997	38,027	36,632	34,833	-0.5%
Interruptibles	74,058	87,098	71,884	62,117	49,836	43,812	-2.7%
Transportation	206,128	199,610	200,539	195,312	190,199	192,252	-0.4%

Figure 4-15
Gas Customer Count Forecasts by Class (Base Case)

	2006	2007	2010	2015	2020	2025	AARG
Total	715,116	736,368	797,710	902,039	999,675	1,085,323	2.2%
Residential	659,789	679,749	737,213	834,553	924,706	1,001,876	2.2%
Commercial	52,117	53,465	57,508	64,717	72,382	81,033	2.4%
Industrial	2,635	2,605	2,507	2,360	2,239	2,117	-1.1%
Interruptibles	452	429	362	289	229	178	-4.8%
Transportation	123	120	120	120	119	119	-0.2%

Figure 4-16
Gas Peak Day Forecast (Base Case)

(in 1,000 therms)	2006	2007	2010	2015	2020	2025	AARG
Total	9,482,914	9,363,205	10,164,268	11,444,406	12,499,946	13,535,248	1.9%
Residential	6,585,518	6,478,443	7,024,722	7,876,459	8,525,412	9,094,739	1.7%
Commercial	2,473,475	2,469,148	2,717,079	3,133,401	3,545,296	4,017,290	2.6%
Industrial	348,058	340,708	341,153	342,991	329,238	314,937	-0.5%
Losses	75,863	74,906	81,314	91,555	100,000	108,282	1.9%
LCP 2005	9,217,189	9,504,752	10,529,014	11,716,765	12,922,646	N/A	2.4%