CALIFORNIA ENERGY COMMISSION

CALIFORNIA ENERGY DEMAND 2010-2020
STAFF DRAFT FORECAST

DRAFT STAFF REPORT

June 2009
CEC-200-2009-012-SD

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Please cite this report as: Kavalec, Chris and Tom Gorin. 2009. *California Energy Demand 2010-2020, Staff Draft Forecast,* California Energy Commission. CEC-200-2009-012SD.

ACKNOWLEDGEMENTS

The staff demand forecast was prepared using the expertise of numerous staff members in the Demand Analysis Office. Andrea Gough supervised data preparation and combined the separate chapters and appendices into a coherent document. Lynn Marshall contributed to the peak forecast and various other aspects of the analysis. Mohsen Abrishami prepared the commercial sector forecast. Bryan Alcorn prepared the industrial forecast. Mark Ciminelli forecasted energy for transportation, communication, and utilities. Ted Dang and Steven Mac prepared the historic energy consumption data. Miguel Garcia-Cerrutti developed and ran the revised Summary Model. Asish Gautam prepared the forecast for self-generation and developed the predictive model for photovoltaic systems. Adrienne Kandel developed the projections of commercial floor space, with contribution from Gary Occhiuzzo. Nahid Movassagh forecasted consumption for the agriculture and water pumping sectors. Don Schultz, Nicholas Fugate, and Mike Jaske developed the energy efficiency program estimates. Glen Sharp prepared the residential sector forecast. Kate Sullivan and Tom Gorin prepared the demographic projections. Mitch Tian prepared the peak demand forecast.

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Abstract

This document presents the California Energy Commission staff draft forecasts for 2010-2020 electricity, peak, and natural gas demand for each utility planning area in California and for California as a whole. The *California Energy Demand 2010-2020 Staff Draft Forecast* supports the analysis and recommendations in the *2007 Integrated Energy Policy Report* and the *2008 Integrated Energy Policy Report Update.* In particular, this document reports on progress made by staff in refining how energy efficiency program impacts are measured and attributed within the forecast.

The energy consumption and peak forecasts presented in the report are lower than the 2008-2018 forecasts previously produced for the *2007 Integrated Energy Policy Report*, primarily because of worsening economic conditions. Compared to the previous forecast, projected electricity consumption is down by almost 10 percent and peak demand is down by more than 8 percent for 2018. Electricity consumption is expected to increase by 0.8 percent per year from 2010-2018, versus the 1.2 percent per year projected for the *2007 Integrated Energy Policy Report.* Peak demand is expected to grow an average of 1.1 percent annually over the same period compared to 1.3 percent in the previous forecast.

Keywords

Electricity demand, consumption, forecast, weather normalization, peak, natural gas, self-generation, conservation, energy efficiency, California Solar Initiative

Executive Summary

Introduction

The *California Energy Demand 2010-2020 Staff Draft Forecast* (*CED 2009*), an Energy Commission staff report, presents forecasts of electricity and end-user natural gas consumption and peak electricity demand for California as a whole and for each major utility planning area within California for 2010-2020. The *CED 2009* supports the analysis and recommendations in the *2007 Integrated Energy Policy Report* (*2007 IEPR*) and the *2008 Integrated Energy Policy Report Update (2008 IEPR)*. In particular, the *CED 2009* reports on progress made by staff in refining how energy efficiency program impacts are measured and attributed within the forecast.

Summary of Changes to Forecast

The previous long run forecast used in the *2007 IEPR*, the *California Energy Demand 2008-2018 Staff Revised Forecast (CED 2007)*, was based on 2006 peak demand and energy. For the current forecast, staff added 2007 energy consumption data to the historic series used for forecasting. The peak demand forecast incorporates recent analysis of 2008 temperatures and peak demand at the planning area level.

In the residential sector, lighting was broken out as a separate end use for the first time to better capture the impacts of residential lighting efficiency programs. In the commercial sector, staff revised its estimates of existing floor space and projected new floor space using updated economic projections and a new econometric methodology. The economic projections used for this forecast lead to a lower level of projected floor space than used in the *CED 2007*. For self-generation, staff refined its methods to track the various technologies and individual programs.

The *CED 2007* assumed constant electricity rates throughout the forecast period. For this forecast, staff developed three rate scenarios for electricity and natural gas rates: high rates, low (constant) rates, and a rate scenario in between the two. The high-rate case assumed that 2020 rates would be approximately 30 percent higher rates than 2010 rates for both electricity and natural gas, while the "mid" case assumed 15 percent and 10 percent higher rates for electricity and natural gas, respectively, over the same period. In the low case, rates remained at 2010 levels through 2020 for both fuel types. Three combinations of electricity and natural gas rates were used as inputs to the models: high rates for each, mid rates for each, and low rates for each.

The increased effort to capture the impacts of energy efficiency programs, along with including expected effects of 2009-2011 utility programs, helped reduce the forecasted energy demand in the investor-owned utility service territories relative to the demand forecasted in *CED 2007*.

Electricity Forecast Results

Table ES-1 compares the *CED 2009* for select years with the *CED 2007* and shows results for one of three electricity rate scenarios used for this forecast: the scenario that assumed no increase in rates from 2010-2020, referred to as the low-rate case. This scenario is most directly comparable to the 2007 forecast, which assumed flat rates throughout the forecast period. Both the energy consumption and peak forecasts are lower than in the previous forecast over the entire forecast period, primarily because of worsening economic conditions. Projected electricity consumption is down by more than 9 percent and peak demand by around 5 percent by 2018 compared to the *CED 2007*. Electricity consumption is projected to grow at a rate of 0.8 percent per year from 2010-2018, versus 1.2 percent per year in the *CED 2007*, while peak demand grows an average of 1.1 percent annually over the same period, compared to 1.3 percent in the previous forecast.

Table ES-1: Comparison of CED 2007 and CED 2009 Statewide Electricity Demand

	Consumption (GWh)			Peak (MW)		
	2007 Forecast	Staff Draft (Low-Rate Case)	Percent Difference Staff Draft/2007 Forecast	2007 Forecast	Staff Draft (Low-Rate Case)	Percent Difference Staff Draft/2007 Forecast
1990	229,868	229,868	0.00%	47,308	47,308	0.00%
2000	265,769	265,769	0.00%	53,669	53,669	0.00%
2007	285,197	282,098	-1. 09%	62,085	62,698	0. 99%
2010	297,062	278,043	-6. 40%	64,760	62,520	-3. 46%
2015	316,575	290,504	-8. 24%	69,302	66,174	-4. 51%
2018	327,085	297,104	-9. 17%	71,889	68,321	-4. 96%
Annual Average Growth Rates						
1990-2000	1. 46%	1. 46%		1. 27%	1. 29%	
2000-2007	1. 01%	0. 94%		2. 10%	2. 24%	
2007-2010	1. 37%	-0. 48%		1. 42%	-0. 09%	
2010-2018	1. 21%	0. 82%		1. 31%	1. 12%	
Historic values are shaded						
GWh=gigawatt-hour						
MW = megawatt						

Source: California Energy Commission, 2009

Lower residential demand is the result of lower projected income growth than the 2007 forecast. Lower projected employment and output growth reduces industrial and commercial demand. The effect of these changes from the previous forecast can clearly be seen in **Figures ES-1** and **ES-2**.

Figure ES-1: Statewide Electricity Consumption (CED 2009, Low-Rate Case)

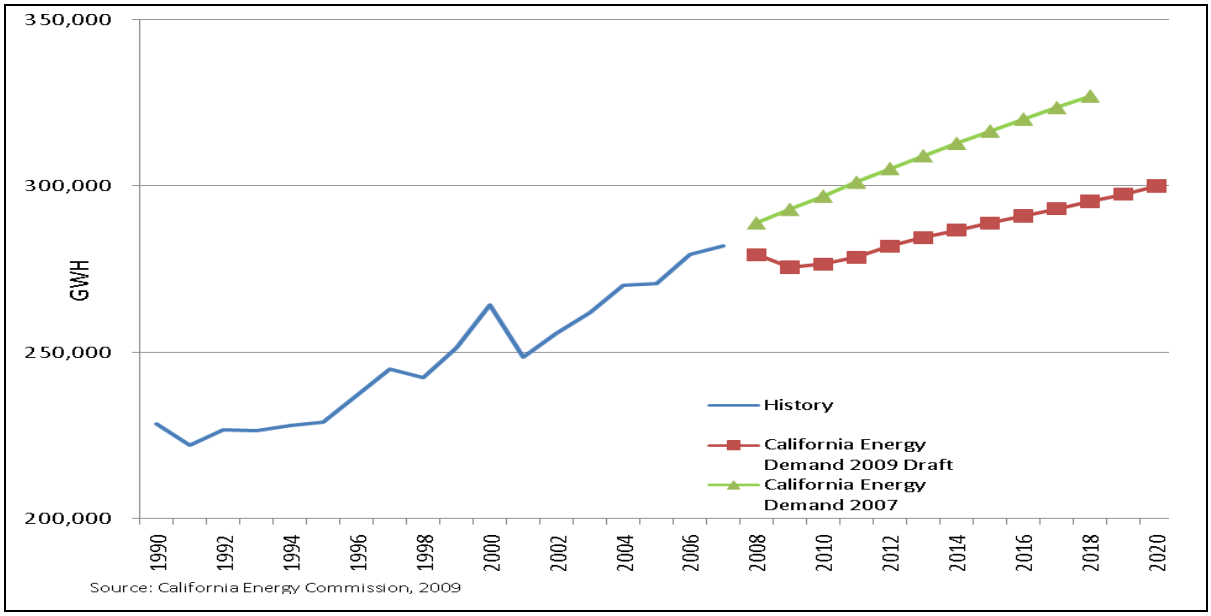
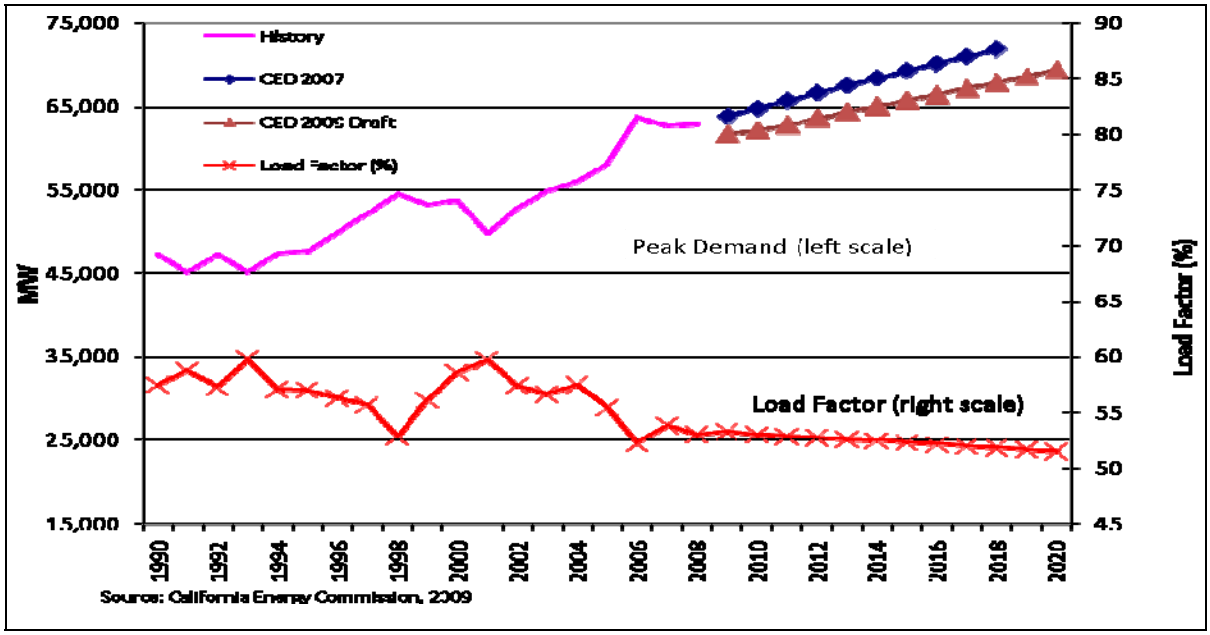


Figure ES-2: Statewide Non-Coincident Peak Demand (CED 2009, Low-Rate Case)



Natural Gas Forecast Results

Table ES-2 compares the statewide *CEC 2009* forecast with the *CED 2007* forecast for selected years. As in the case of electricity, the draft natural gas demand forecast has a lower growth rate than does the previous forecast because of lower income and economic growth, along with lower reported consumption in 2007 compared to the forecast for the same year in the *CED 2007*. Most of this decrease comes from lower floor space projections in the commercial sector. This forecast does not include natural gas used for electric generation.

Table ES-2: Statewide Natural Gas Forecast Comparison

	CED 2007	*CED 2009* (High-Rate Case)	Percent Difference
	(MM Therms)		
1990	12,893	12,893	0.00%
2000	13,913	13,913	0.00%
2007	13,386	13,216	-1.27%
2010	13,616	12,992	-4.59%
2018	14,058	13,236	-5.85%
Historic values are shaded			
	Annual Average Growth Rates		
1990- 2000	0.76%	0.76%	
2000- 2007	-0.55%	-0.73%	
2007- 2010	0.57%	-0.57%	
2010- 2018	0.40%	0.23%	

Source: California Energy Commission, 2009

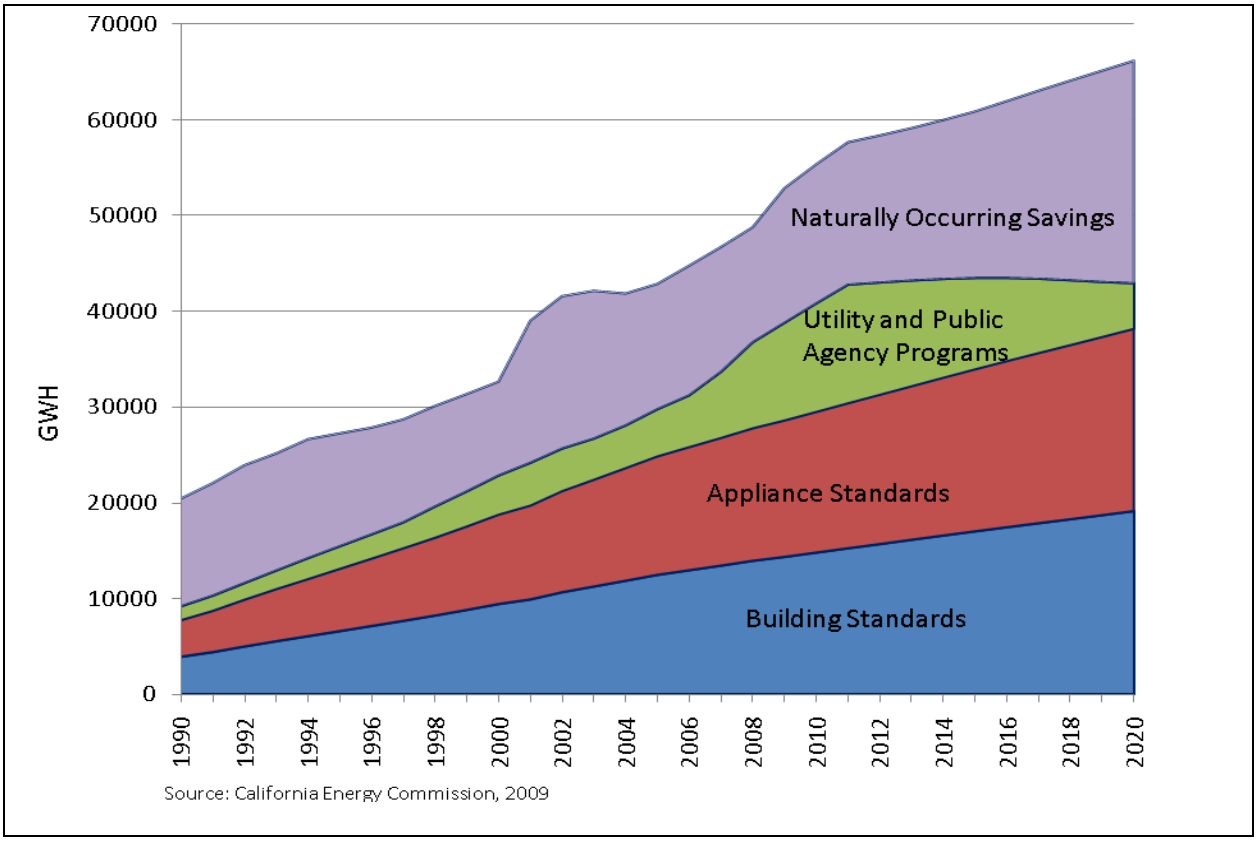
Conservation/Efficiency

With the state's adoption of the first *Energy Action Plan (EAP)* in 2003, energy efficiency became the resource of first choice for meeting the state's future energy needs. Assembly Bill 2021(Levine, Chapter 734, Statutes of 2006) set a statewide goal of reducing total forecasted electricity consumption by 10 percent over the next 10 years. Under AB 2021, the Energy Commission, in consultation with the California Public Utilities Commission (CPUC), is responsible for setting annual statewide efficiency targets in a public process using the most recent investor-owned and publicly owned utility targets. These targets, combined with California's greenhouse gas emission reduction goals, make it essential for the Energy

Commission to properly account for energy efficiency impacts when forecasting future electricity and natural gas demand.

Much time and effort was put into refining the staff's forecasting methods to account for energy efficiency and conservation impacts while preparing this forecast, particularly for utility efficiency programs. **Figure ES-3** shows electricity consumption savings estimates incorporated in the *CED 2009* for building and appliance standards, utility and public agency programs, and "naturally occurring" savings, or savings associated with rate changes and market trends not directly related to programs or standards.

Figure ES- 3: Efficiency/Conservation Consumption Savings by Source



CHAPTER 1: Statewide Forecast Results and Methods

Introduction

The *California Energy Demand 2010-2020 Staff Draft Forecast* (*CED 2009*), an Energy Commission staff report, presents forecasts of electricity and end-user natural gas consumption and peak electricity demand for California as a whole and for each major utility planning area within the state for 2010-2020. The *CED 2009* supports the analysis and recommendations in the *2007 Integrated Energy Policy Report (2007 IEPR)* and *2008 Integrated Energy Policy Report Update (2008 IEPR)*, including electricity and natural gas system assessments as well as analysis of progress towards increased energy efficiency. As a result of major staff effort to improve the measurement and attribution of efficiency impacts within the energy demand forecast, this report provides more detail on the impacts of energy efficiency programs and standards than has been the case in the past.

The Integrated Energy Policy Report Committee will conduct a workshop on June 26, 2009 to receive public comments on the *CED 2009*. Following the workshop, subject to the direction of the Committee, staff may prepare a revised forecast or range of forecasts for adoption by the Energy Commission.

The adopted forecast will be used in a number of applications, including the California Public Utilities Commission (CPUC) 2010 procurement process. The CPUC has identified the Integrated Energy Policy Report process as "the appropriate venue for considering issues of load forecasting, resource assessment, and scenario analyses, to determine the appropriate level and ranges of resource needs for load serving entities in California."[1] The final forecasts will also be an input to California Independent System Operator (California ISO) controlled grid studies and other transmission planning studies and in the *California Gas Report*[2] and electricity supply-demand assessments.

Summary of Changes to Forecast

The previous long run forecast, *California Energy Demand 2008-2018*[3] (*CED 2007*) was based on 2006 peak demand and energy. For the current forecast, staff added 2007 energy consumption data to the historic series used for forecasting. The peak demand forecast incorporates recent analysis of 2008 temperatures and peak demand at the planning area level.

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[1] California Public Utilities Commission. Assigned Commissioner's Ruling On Interaction Between The CPUC Long-Term Planning Process And The California Energy Commission Integrated Energy Policy Report Process, September 9, 2004 Rulemaking 04-04-003.

[2] The California Gas Report is prepared by California electric and gas utilities in compliance with California Public Utilities Commission Decision D.95-01-039.

[3] California Energy Commission. *California Energy Demand 2008–2018 Staff Revised Forecast,* November 2007,. CEC-200-2007-015-SF2.

In the residential sector, lighting was broken out as a separate end use for the first time to better capture the impacts of residential lighting efficiency programs. In the commercial sector, staff revised its estimates of existing floor space and projected new floor space using updated economic projections and a new econometric methodology. The economic projections used for this forecast result in lower projected floor space than was used in *CED 2007*. For self-generation, staff refined its methods to track various technologies and individual programs.

CED 2007 assumed constant electricity rates throughout the forecast period. For this forecast, three price scenarios were developed for electricity and natural gas rates: high rates, low (constant) rates, and a rate scenario in between the two. The high-rate case assumed approximately 30 percent higher rates by 2020 relative to 2010 for both electricity and natural gas, while the middle case assumed 15 percent and 10 percent higher rates for electricity and natural gas, respectively, over the same period. In the low-rate case, rates remained at 2010 levels through 2020. Three combinations of electricity and natural gas rates were input to the models: high rates for each, "mid" rates for each, and low rates for each.

The increased effort to capture the impacts of energy efficiency programs, along with including the expected effects of 2009-2011 utility programs, helped reduce forecasted energy demand in the investor-owned utility (IOU) service territories relative to *CED 2007*. Chapter 8 provides details on staff work related to efficiency program measurement and attribution for this forecast.

Statewide Forecast Results

Table 1-1 compares the *CED 2009* electricity forecast for select years with *CED 2007*, the forecast which was used in the *2007 IEPR*. The table shows results for the low-rate case scenario, which assumed no increase in rates from 2010-2020. This scenario is most directly comparable to the 2007 forecast, which assumed flat rates throughout the forecast period. Both the energy consumption and peak forecasts are lower than in the previous forecast over the entire forecast period, primarily due to worsening economic conditions. Projected electricity consumption is down by more than 9 percent and peak demand by almost 5 percent by 2018 compared to *CED 2007*. Electricity consumption is projected to grow at a rate of 0.8 percent per year from 2010-2018, versus 1.2 percent per year in *CED 2007*, while peak demand grows an average of 1.1 percent annually over the same period, compared to 1.3 percent in the previous forecast.

The historic data used for this forecast differs slightly from *CED 2007* because of revised data submitted by utilities, and because a detailed review of self-generation consumption data found some data had been misclassified.

Table 1-1: Comparison of CED 2007 and CED 2009 Statewide Electricity Demand

	Consumption (GWh)			Peak (MW)		
	2007 Forecast	Staff Draft (Low-Rate Case)	Percent Difference Staff Draft/2007 Forecast	2007 Forecast	Staff Draft (Low-Rate Case)	Percent Difference Staff Draft/2007 Forecast
1990	229,868	229,868	0.00%	47,308	47,308	0.00%
2000	265,769	265,769	0.00%	53,669	53,669	0.00%
2007	285,197	282,098	-1. 09%	62,085	62,698	0. 99%
2010	297,062	278,043	-6. 40%	64,760	62,520	-3. 46%
2015	316,575	290,504	-8. 24%	69,302	66,174	-4. 51%
2018	327,085	297,104	-9. 17%	71,889	68,321	-4. 96%
Annual Average Growth Rates						
1990-2000	1. 46%	1. 46%		1. 27%	1. 29%	
2000-2007	1. 01%	0. 94%		2. 10%	2. 24%	
2007-2010	1. 37%	-0. 48%		1. 42%	-0. 09%	
2010-2018	1. 21%	0. 82%		1. 31%	1. 12%	
Historic values are shaded						
GWh=gigawatt-hour						
MW = megawatt						

Source: California Energy Commission, 2009

Annual Electricity Consumption

The staff draft statewide forecast of electricity consumption, shown in **Figure 1-1**, is lower than in the *CED 2007* forecast over the entire forecast period, beginning with a dip in 2008 and 2009, and thereafter rising at a lower rate than in the previous forecast. By 2018, projected consumption is more than 9 percent lower than the previous forecast. This difference reflects current economic conditions along with a lower rate of economic growth in the longer term. Economic conditions affect the forecast through lower personal income growth, lower employment, lower industrial output, and fewer additions to commercial floor space. Staff estimates that around 65 percent of the change in statewide consumption compared to *CED 2007* is from economic impacts in 2010, increasing to 80 percent by 2018. Economic inputs are discussed later in this chapter. Most of the remaining difference comes from increased efficiency program impacts assumed in this forecast, as discussed in Chapter 8.

Consistent with a much lower total consumption forecast, per capita electricity declines throughout the forecast period, as shown in **Figure 1-2**. By 2018, projected per capita consumption is reduced by more than 600 kWh compared to the previous forecast. This projected trend represents a departure from the past, although the historical data show that per capita consumption dropped from 2006 to 2007.

Figure 1-1: Statewide Annual Electricity Consumption (CED 2009— Low-Rate Case)

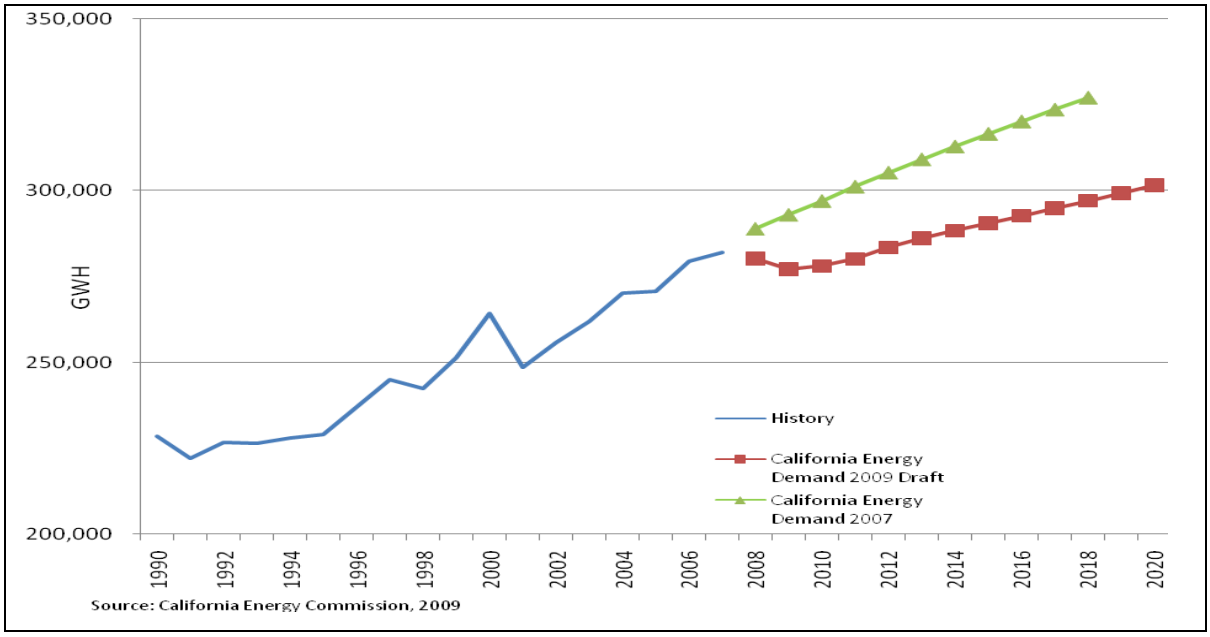


Figure 1-2: Statewide Annual Electricity per Capita (CED 2009— Low-Rate Case)

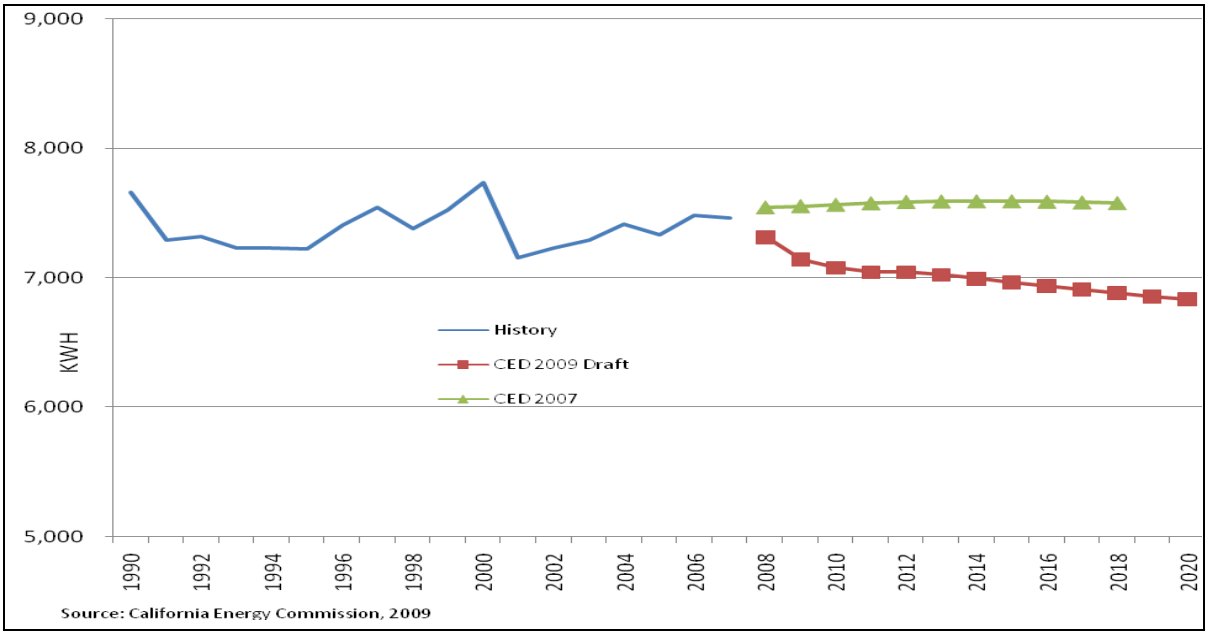


Figure 1-3 shows projected annual consumption by major economic sector, comparing the *CED 2009* low-rate case with *CED 2007*. The largest percentage reductions from *CED 2007* occur in the residential sector (-13.1 percent by 2018) and the commercial sector (-10.8 percent by 2018). In the residential case, the main driver for these reductions compared to the previous forecast is lower personal income per capita, which drops given significantly reduced projected personal income and slightly higher population projections. In the commercial case, reductions result from lower projections of floor space due to decreases in projected employment and commercial sector output. Industrial consumption compared to *CED 2007* decreases by a much lower percentage (-4. 2 percent by 2018), reflecting declines in industrial output projected in both forecasts. The only sector that increases compared to *CED 2007* is agricultural/water pumping (+4. 3 percent in 2018), which results from higher actual consumption in 2007 than the projected 2007 consumption used in the previous forecast.

Figure 1-4 shows projected total electricity consumption for the three rate scenarios. By 2020, under the high-rate scenario (rates 30 percent above those in 2010), projected electricity consumption is down by around 1.8 percent. In the mid-rate case (15 percent higher), projected consumption is reduced by slightly over one percent. The numbers correspond to an overall price elasticity for the models of around six percent.[4] The price response comes from the commercial, residential, and industrial sectors; the agricultural/water pumping and transportation, communications and utility and street lighting sectors are assumed to have a price elasticity of zero. Most of the response stems from the Commercial Model, with a much smaller effect for the Residential and Industrial Models. The estimated price response in the residential and industrial sectors may be conservative—staff plans to reexamine the impact of price on energy demand and consumption for the *2011 IEPR*.

To support sub-regional electricity system analysis, staff disaggregates the planning area forecasts to correspond to control areas and congestion zones. **Table 1-2** shows the forecast of energy required to meet demand by control area and congestion zone. Projections correspond to the mid-rate case; the numbers would be slightly higher or lower by one percent or less for the other scenarios. Compared with 2007, demand is projected to be down in all areas in 2010 with the exception of the Sacramento Municipal Utility District (SMUD) and Imperial Irrigation District (IID) control areas. After 2010, demand is expected to grow the fastest in the SMUD and IID control areas, reflecting strong population growth for SMUD and relatively high expected economic growth for IID. The slowest growth occurs in the Los Angeles Department of Water and Power (LADWP) control area because of relatively low projected economic growth in that area. In the California ISO control area, demand is projected to grow slightly faster in Southern California beyond 2010.

[4] Price elasticity is defined as percentage change in demand divided by percentage change in price and is a measure of how consumers react to a change in price..

Figure 1-3: Statewide Electricity Consumption by Sector (CED 2009— Low-Rate Case)

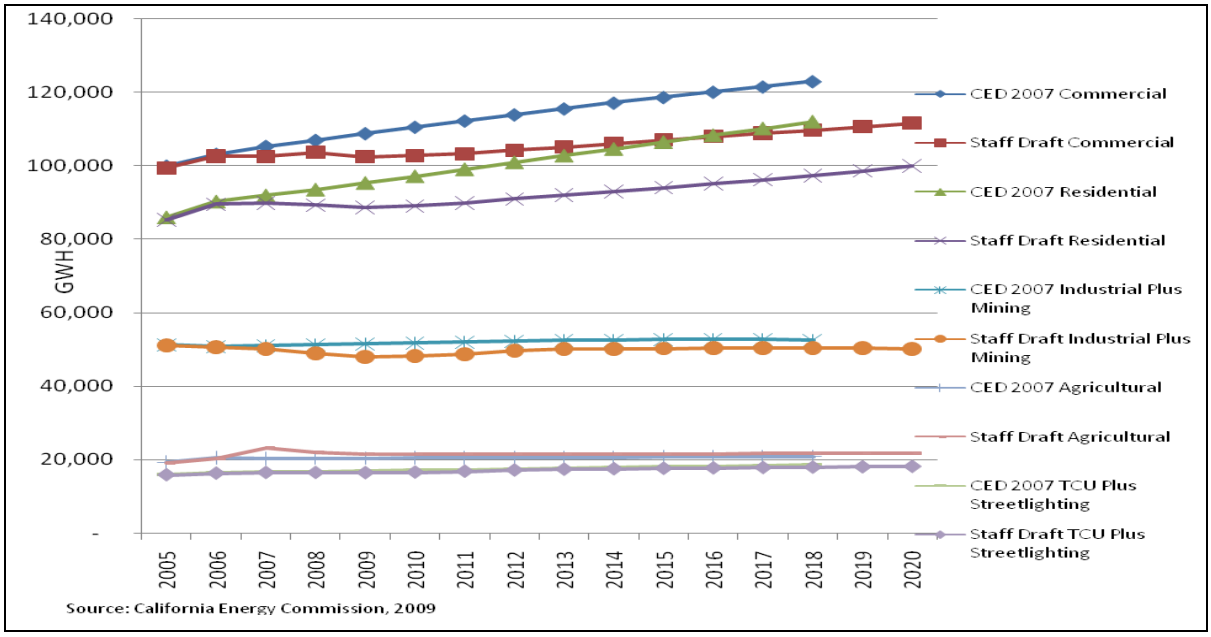


Figure 1-4: Annual Electricity Consumption by Rate Scenario

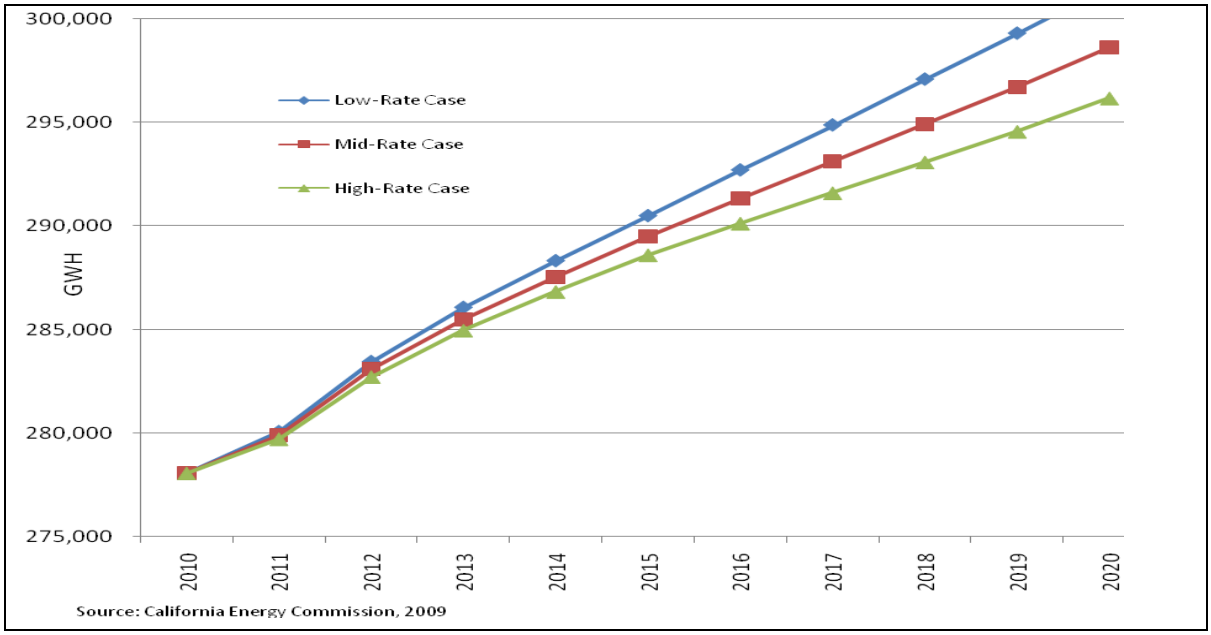


Table 1-2: Control Area Net Energy for Load (GWh)

	North of Path 15	South of Path 15	California ISO Total	SMUD	LADWP	Imperial Irrigation	Turlock Irrigation
2007	107,165	132,924	240,090	18,177	29,984	4,014	2,576
2010	105,218	129,744	234,961	18,260	29,277	4,065	2,521
2015	109,504	134,979	244,482	19,187	29,826	4,464	2,640
2020	112,871	139,791	252,662	19,887	29,967	4,888	2,720
	Annual Growth Rates						
2007-2010	-0. 61%	-0. 80%	-0. 72%	0. 15%	-0. 79%	0. 42%	-0. 72%
2010-2015	0. 80%	0. 79%	0. 80%	1. 00%	0. 37%	1. 89%	0. 92%
2010-2020	0. 70%	0. 75%	0. 73%	0. 85%	0. 23%	1. 86%	0. 76%

Source: California Energy Commission, 2009

Statewide Peak Demand

Figure 1-5 compares the draft forecast of statewide non-coincident[5] peak demand for the low-rate case with the *CED 2007* forecast. As with electricity consumption, current economic conditions have a major impact in the short term while long-term economic projections lead to a lower rate of growth beyond 2010. The projected statewide peak falls by 3.5 percent by 2010, declining further to 5.0 percent by 2018.

Figure 1-5 also shows the load factor for the state as a whole. The load factor represents the relationship between average energy demand and peak: the smaller the load factor, the greater the difference between peak and average hourly demand. The load factor varies with temperature; in extremely hot years (for example, 1998 and 2006) demand is "peakier." The general decline in the load factor over the last twenty years indicates a greater proportion of homes and businesses with central air conditioning. This trend is projected to continue over the forecast period. Energy efficiency measures, such as more efficient lighting, can also contribute to the declining load factor by reducing overall energy use while having an insignificant effect on peak demand.

The forecast of per capita non-coincident peak, shown in **Figure 1-6**, is projected to decrease over the forecast period from 1.64 kilowatts per person in 2008 to 1.58 kilowatts in 2020. As in the forecast for per capita consumption, economic conditions and energy efficiency impacts result in a marked reduction in projected per capita use relative to *CED 2007* at the beginning of the forecast period. Thereafter, the difference between the two forecasts becomes slightly more pronounced, as per capita peak declines slightly in the current forecast while rising in *CED 2007*.

[5] Non-coincident peak refers to the sum of the individual peak demands for each sector in an electrical system. These individual peaks often occur at different hours of the day.

Figure 1-5: Statewide Non-Coincident Peak Demand (Low-Rate Case)

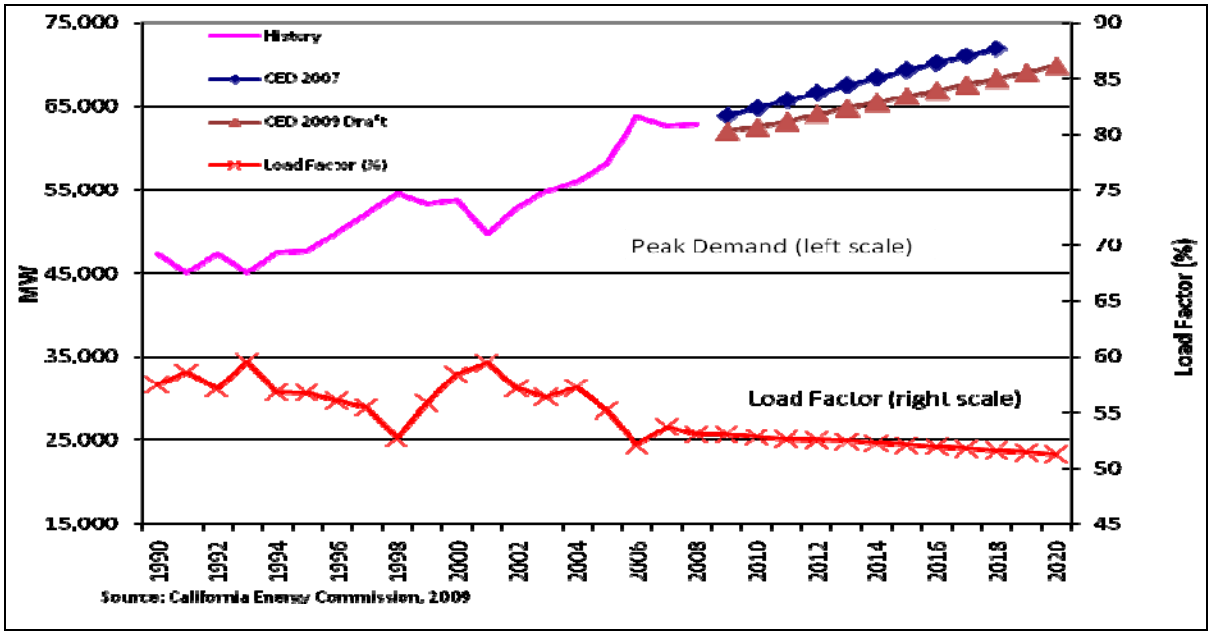


Figure 1-6: Statewide Non-Coincident Peak Demand per Capita (Low-Rate Case)

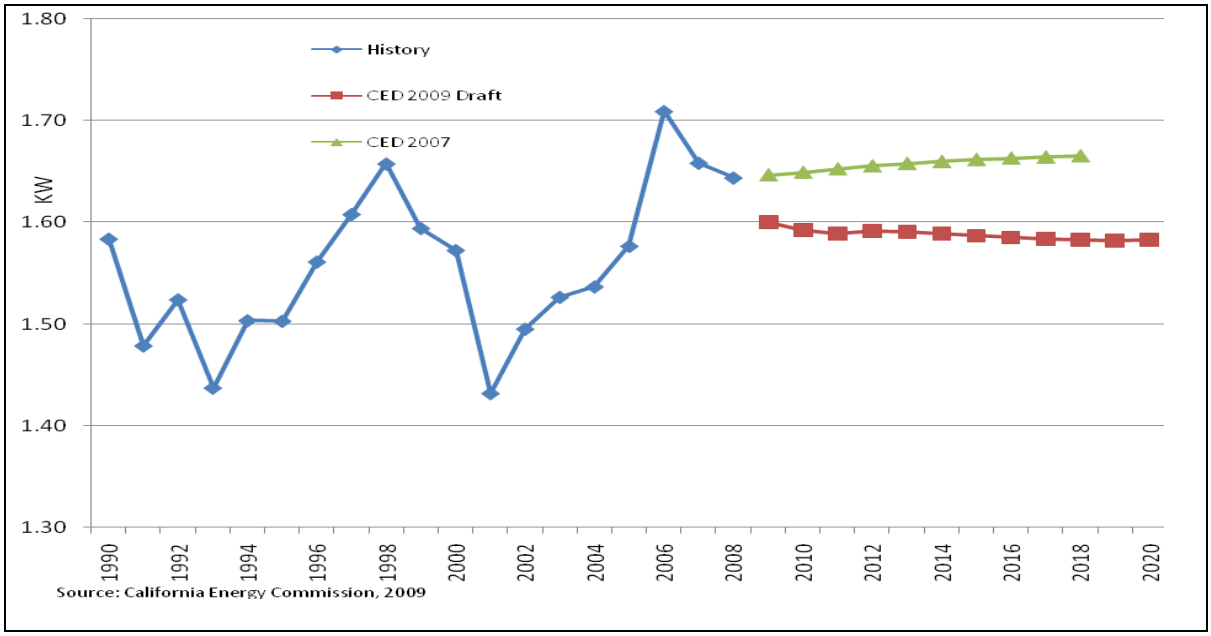


Figure 1-7 shows projected annual non-coincident peak demand for the three rate scenarios. The impact of the different rates on peak demand is similar to their projected effect on consumption. By 2020, under the high-rate scenario, the projected peak is down by around 1.7 percent. In the mid-rate case, projected peak demand is reduced by slightly less than one percent in the same year.

Figure 1-7: Statewide Non-Coincident Peak Demand by Rate Scenario

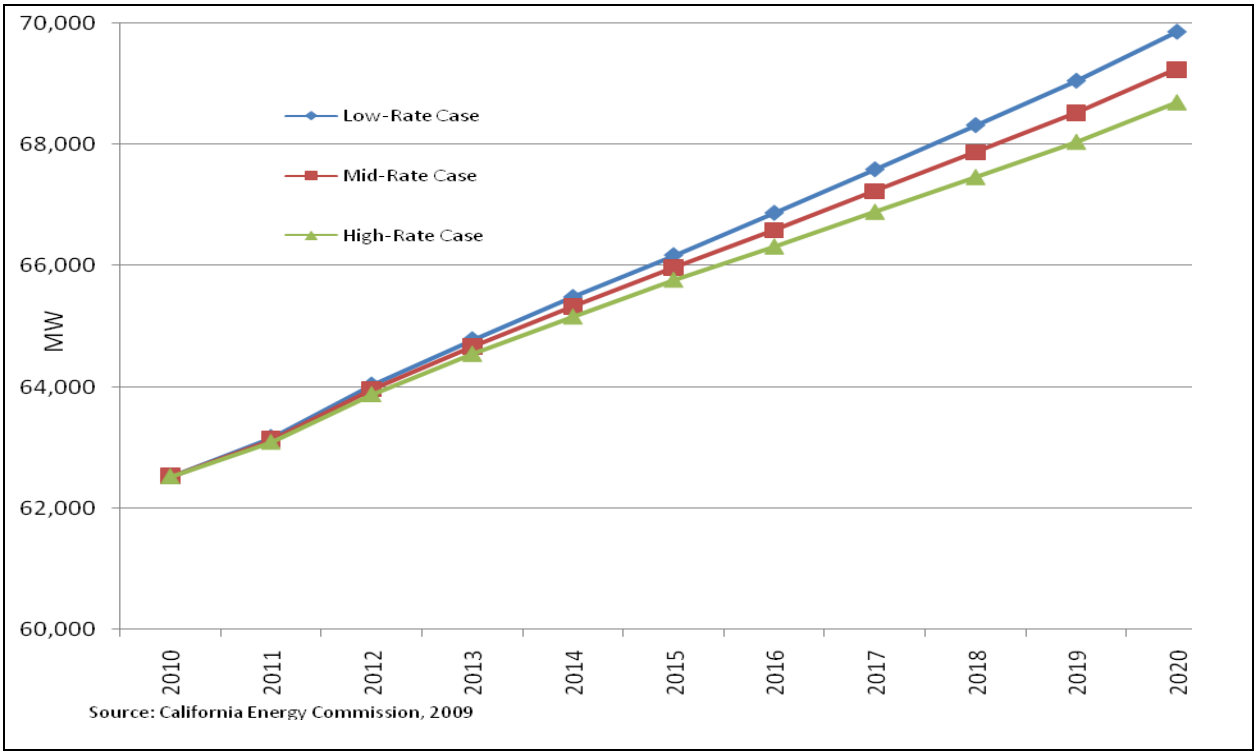


Figure 1-8 shows projected annual peak demand by the major economic sectors. As in the consumption forecast, the largest percentage reductions compared to *CED 2007* occur in the residential and commercial sectors (-5.5 percent and -8.0 percent by 2018, respectively). Projected industrial peak demand declines by around 2.8 percent in 2018 compared to the previous forecast. In all three cases, the drop in peak is less than the drop in consumption, a reflection of smaller reductions in cooling relative to other end uses. Projected agricultural/water pumping peak demand rises by 8.9 percent in 2018 compared to *CED 2007* because of significantly higher reported actual peaks in the final historical years (2007 and 2008) compared to peaks predicted in the previous forecast.

Figure 1-8: Statewide Peak Demand by Sector (Low-Rate Case)

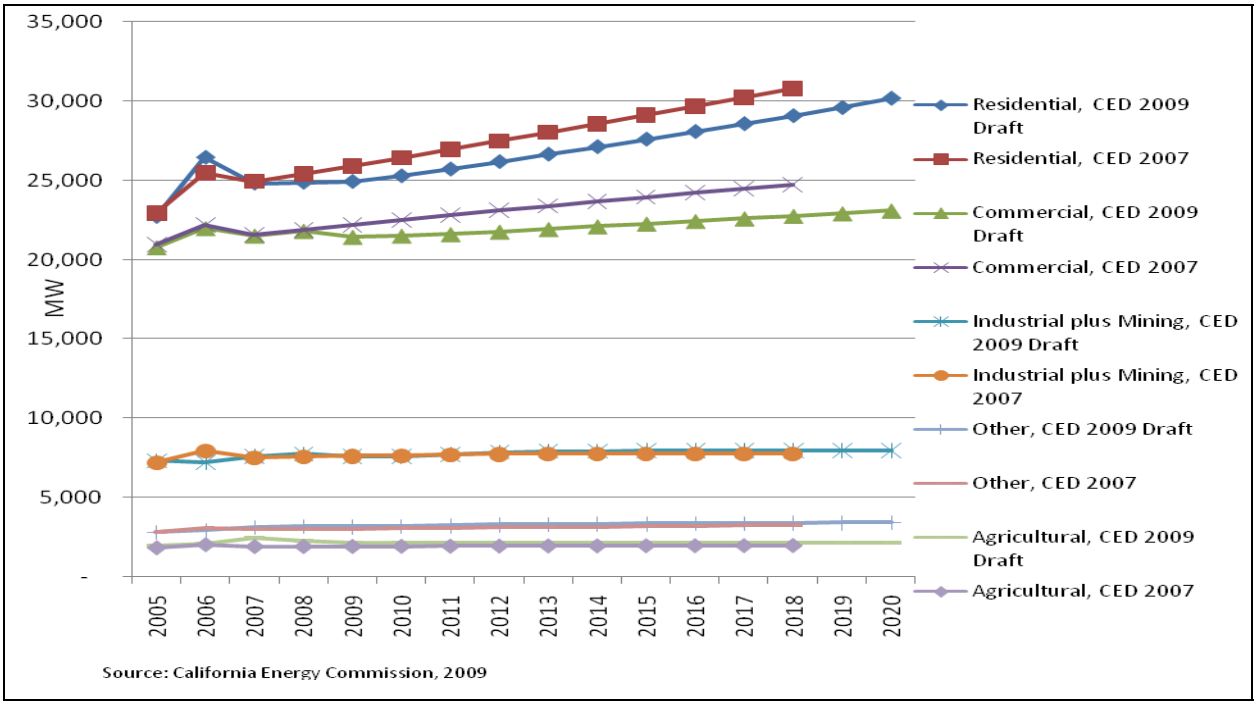


Table 1-3 shows peak demand by control area for the mid-rate scenario; the numbers would be higher or lower by one percent or less for the other scenarios. 2008 is the latest year for which staff had historical data on peaks, so the table begins with this year rather than 2007. Peak demand is up slightly in 2010 compared to 2008 in the Southern California portion of California ISO, IID, and the Turlock Irrigation District, and down in the other control areas. As with net energy, demand in the IID control area grows the fastest and LADWP the slowest beyond 2010, for the same reasons. Growth in peak demand is higher than growth for energy beyond 2010 because the trend toward increased air conditioning use is expected to continue.

Table 1-3: Annual Peak Demand (MW) By Control Area and Congestion Zone

	North of Path 15	South of Path 15	California ISO Coincident* Peak	SMUD	LADWP	Imperial Irrigation	Turlock Irrigation
2008	21,774	27,926	48,512	4,448	6,800	977	610
2010	21,618	27,980	48,412	4,434	6,466	994	615
2015	22,880	29,782	51,403	4,691	6,584	1,088	658
2020	24,051	31,453	54,177	4,917	6,655	1,190	687
	Annual Growth Rates						
2008-2010	-0. 36%	0. 10%	-0. 10%	-0. 16%	-2. 49%	0. 90%	0. 48%
2010-2015	1. 14%	1. 26%	1. 21%	1. 14%	0. 36%	1. 83%	1. 15%
2010-2020	1. 07%	1. 18%	1. 13%	1. 04%	0. 29%	1. 82%	1. 10%

Source: California Energy Commission, 2009

*Staff estimates coincident peak by applying an estimated factor (0. 9761) to non-coincident peak.

Natural Gas Demand Forecast

Table 1-4 compares the *CED 2009* natural gas forecast with the *CED 2007* forecast for selected years. This forecast does not include natural gas used for generating electricity. Staff developed three price scenarios for natural gas rates: high rates, low (constant) rates, and a rate scenario in between the two. The high-rate case assumed approximately 30 percent higher rates by 2020 relative to 2010, while the "mid" case assumed 10 percent higher rates over the same period. In the low case, rates remained at 2010 levels through 2020. For comparisons with the previous forecast, the high-rate case is used because rates in that scenario are most similar to rates used in *CED 2007*.

The draft forecast is lower in the near term (2010) given current economic conditions and because recorded 2007 consumption was lower than what was forecast for 2007 in *CED 2007*. In addition, longer-term growth declines relative to the previous forecast because of lower

projected economic growth for 2010-2018, with 2018 consumption projected to be almost six percent lower than in *CED 2007*.

Overview of Methods and Assumptions

Although the methods to estimate energy efficiency impacts, self-generation, and commercial floor space have been refined and residential lighting is now explicitly modeled, the staff draft forecast uses essentially the same methods as earlier long-term staff demand forecasts. The specific data sources and assumptions used for this forecast and any changes to methodology since *CED 2007* are described here. A more detailed discussion of forecast methods and data sources is available in the *Methods Report*. [6]

Table 1-4: Statewide End-User Natural Gas Consumption

	CED 2007	*CED 2009* (High-Rate Case)	Percent Difference
1990	12,893	12,893	0. 00%
2000	13,913	13,913	0. 00%
2007	13,386	13,216	-1. 27%
2010	13,616	12,992	-4. 59%
2018	14,058	13,236	-5. 85%
Historic values are shaded			
	Annual Average Growth Rates		
1990- 2000	0. 76%	0. 76%	
2000- 2007	-0. 55%	-0. 73%	
2007- 2010	0. 57%	-0. 57%	
2010- 2018	0. 40%	0. 23%	

Source: California Energy Commission, 2009

Models for the major economic sectors produce forecasts of annual energy consumption in each utility planning area. After adjusting for historic weather and usage, the annual consumption forecast is used to forecast annual peak demand.

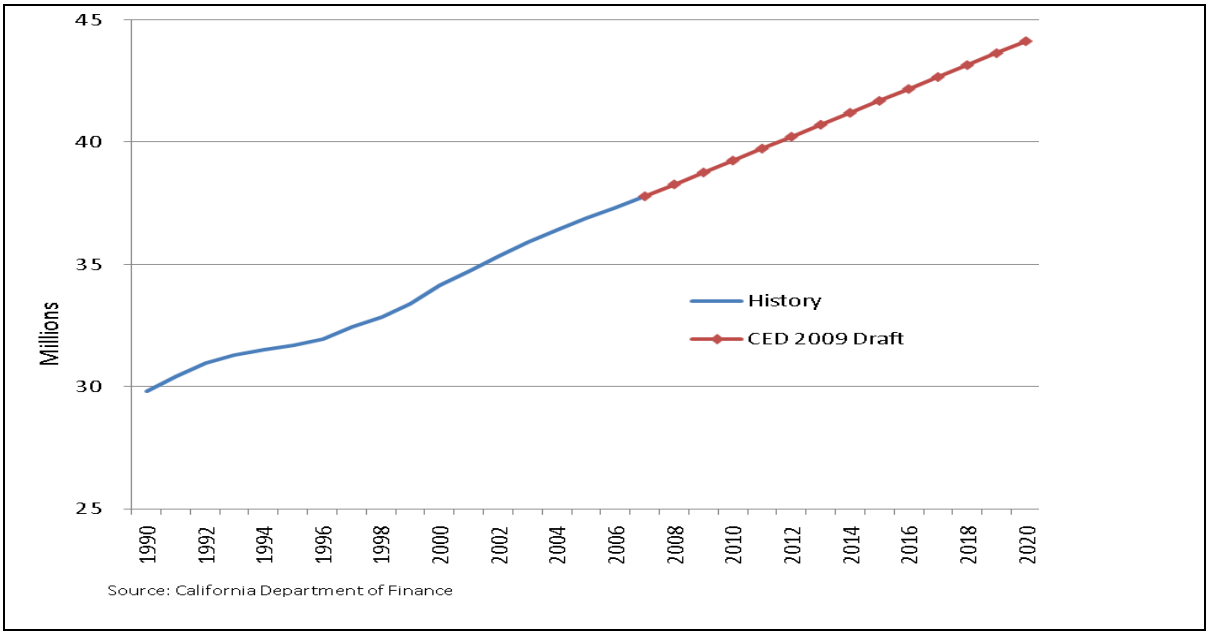
The commercial, residential, and industrial sector energy models are structural models that attempt to explain how energy is used by process and end-use. Structural models are critical to enable forecasts to account for the impacts of mandatory energy efficiency standards and other energy efficiency programs that seek to force or encourage adoption of more efficient technologies by end-users. The forecasts of agricultural and water pumping energy consumption are made using econometric methods, while projections for the street lighting and the transportation, communications, and utility sectors rely on trend analyses.

[6] California Energy Commission, *Energy Demand Forecast Methods Report,* CEC-400-2005-036, June, 2005.

Economic and Demographic Assumptions

Population growth is a key driver for residential energy demand and for commercial growth and demand for water pumping and other services. As in past forecasts, staff used the California Department of Finance's (DOF) most recent long-term population forecast, which has not been updated since the *CED 2007*. **Figure 1-9** shows the historic (through 2007) and forecasted population growth used in the *CED 2009*. Population is projected to grow at about 1.2 percent annually during the forecast period. For comparison, statewide population grew an average of 1.4 percent annually from 1990 to 2007. The declining growth rates over the forecast horizon reflect lower rates of fertility and immigration as the population of California and other regions age. Older age cohorts have a lower tendency to immigrate.[7]

Figure 1-9: Historic and Projected Total Statewide Population



[7] A "cohort" is a generational group as defined in demographics or statistics.

The main difference in reduced energy peak demand and consumption projections compared to the previous forecast comes from the economic outlook provided by Economy.com. The economic forecast reflects short-term economic impacts from the current recession, and also projects lower long-term rates of growth. These effects are indicated in **Figures 1-10** and **1-11**, which compare projected statewide real personal income and total non-agricultural employment projections used in this forecast with those used in *CED 2007*. The short-term impacts are clearly seen in both figures, as is less-favorable long-term growth. Projected average annual growth in personal income between 2010 and 2018 is 2.6 percent, down from 2.7 percent in *CED 2007*. Total employment increases at an annual rate of 0.9 percent over the same period, compared to 1.5 percent in the previous forecast.

Figure 1-10: Statewide Personal Income ($2007)

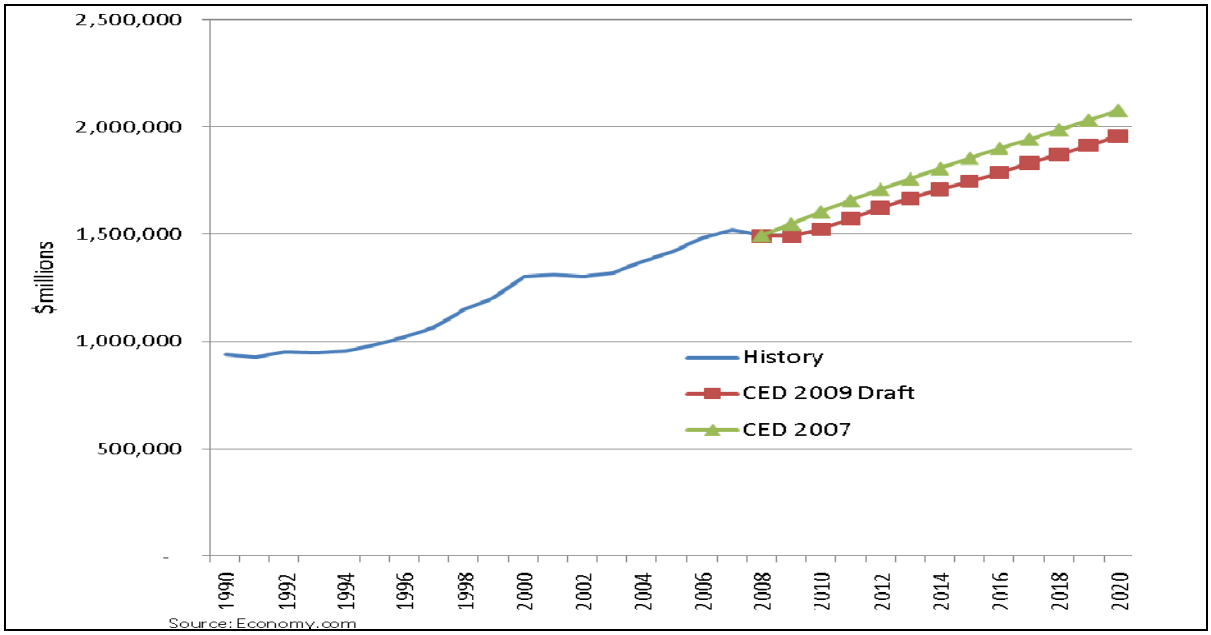
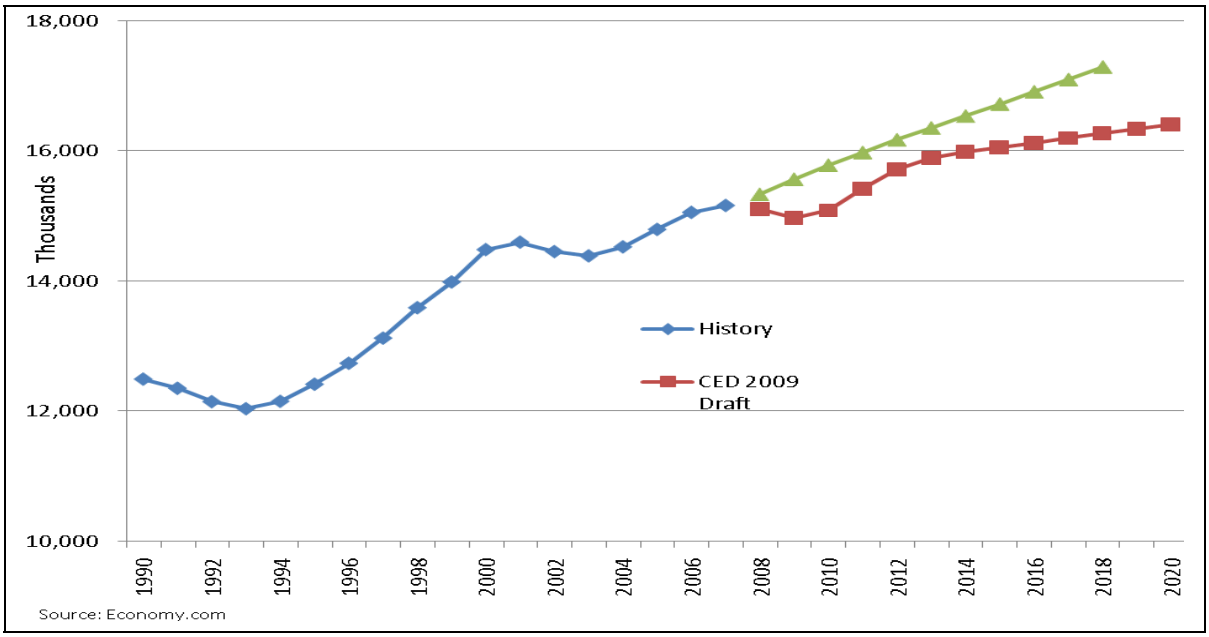


Figure 1-11: Statewide Total Non-Agricultural Employment



Electricity and Natural Gas Rate Projections

Three rate scenarios were developed for both electricity and natural gas rates: high rates, low (constant) rates, and a rate scenario in between the two. Three combinations of electricity and natural gas rates were used as inputs to the models: high rates for each, "mid" rates for each, and low rates for each. In the scenarios with increasing prices, rates were held constant between the last available historic year and 2010, and then allowed to grow until 2020. The high-rate case for electricity assumed 30 percent higher prices by 2020 relative to 2010, while the mid-rate case assumed 15 percent higher prices over the same period. The high-rate case for natural gas had prices 30 percent higher by 2020, matching the increase assumed in staff projections for the *2007 IEPR*,[8] and the mid case assumed 10 percent higher prices by 2020, equal to the rate of increase in the "base case" projections used for the scenario analyses undertaken for the *2007 IEPR*.[9] **Table 1-5** shows the increase in rates assumed over the first five and last five years of the forecast. Electricity rate projections assumed that most of the increase would occur in the last five years.

[8] These projections were not officially adopted for the *2007 IEPR*.

[9] *Scenario Analyses of California's Electricity System: Preliminary Results for the 2007 Integrated Energy Policy Report*, CEC-200-2007-010-SF, June 2007.

Table 1-5: Percentage Growth in Rates by Scenario and Fuel Type

	Electricity		Natural Gas	
Time Period	Mid-Rate Case	High-Rate Case	Mid-Rate Case	High-Rate Case
2010-2015	5. 0%	10. 0%	4. 9%	14. 2%
2015-2020	9. 5%	18. 2%	4. 9%	14. 2%

Source: California Energy Commission, 2009

Residential Lighting

Residential lighting was broken out as a separate end use to better capture the impacts of residential lighting efficiency programs. Functionally, this meant separating lighting from the "miscellaneous" end use in the Residential Model, estimating historic use of lighting per household, and projecting the use through 2020.

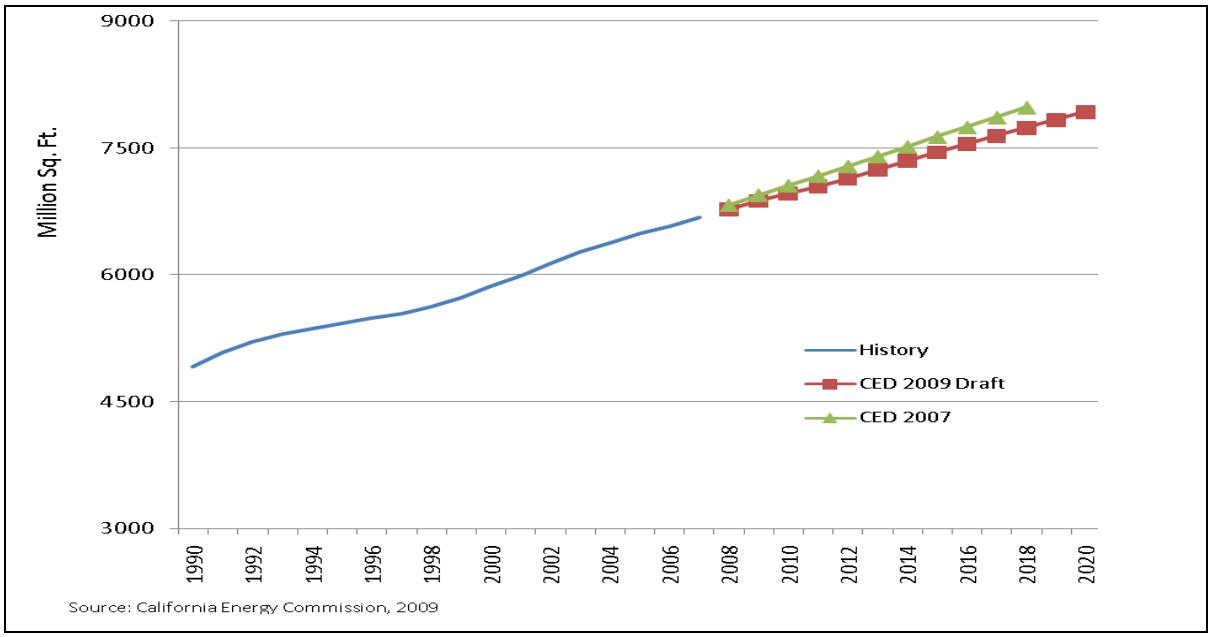
Historic estimates of lighting use per household through 2004 are based on values supplied by the consulting firm Itron along with various lighting studies. For the investor-owned utility (IOU) planning areas, reported energy savings and efficiency program plans were used to provide reductions to average lighting use relative to the 2004 estimates for 2005 – 2011. Details about average lighting input assumptions and the impact of residential lighting programs are provided in the Appendix.

Floor Space Forecast

Energy use in the commercial sector is modeled in terms of energy use per square foot for each of twelve different building types. A forecast of floor space in each county serves as the economic driver of demand trends. For the *CED 2009*, staff revised the econometric method for forecasting growth in floor space used in *CED 2007*. The new method forecasts additions rather than total floor space, using projected additions to create a forecast for total stock. The floor space methodology is further explained in the Appendix.

Figure 1-12 compares the resulting floor space projections used for this forecast with those used in *CED 2007*. Although the two sets of projections were derived from slightly different methodologies, the main reason for the difference in the two series is economic, a reflection of lower projected long-term growth in the commercial sector. Projected average annual growth between 2008 and 2018 is 1.34 percent, down from 1.57 percent in *CED 2007*.

Figure 1-12: Projected Growth in Commercial Floor Space Stock



Conservation/Efficiency Impacts

Energy Commission demand forecasts seek to account for all conservation that is "reasonably expected to occur." Since the 1985 *Electricity Report*, reasonably expected to occur conservation programs have been split into two types: committed and uncommitted. This demand forecast continues that distinction. Committed programs are defined as programs that have been implemented or for which funding has been approved. While conservation "reasonably expected to occur" includes both committed and uncommitted programs, only the effects of committed programs are included in the demand forecast. However, the Energy Commission models include naturally occurring or market-driven energy efficiency. Therefore, the forecasts include some impacts associated with the historic and ongoing levels of programs to the extent they represent impacts associated with replacement of aging building stock and equipment, or installation of new stock and equipment at efficiency levels that comply with current building and appliance standards. Uncommitted effects are thus defined as the incremental impacts of the level of future programs (for example, savings associated with new equipment that exceeds current standards, or early replacement of existing stock), impacts of new programs, and impacts from expansion of current programs.

Chapter 8 gives details regarding the committed energy efficiency impacts projected for this forecast. Staff will also provide a forecast of the impacts of uncommitted programs on energy demand after completing a revised demand forecast in August 2009.

Demand Response

The term "demand response" encompasses a variety of programs, including traditional direct control (interruptible) programs and new price-responsive demand programs. A key distinction is whether the program is dispatchable. Dispatchable programs, such as direct control, interruptible tariffs, or demand bidding programs, have triggering conditions that are not under the control of, and cannot be anticipated by, the customer. Energy or peak load saved from dispatchable programs is treated as a resource, and is therefore not accounted for in the demand forecast. Nondispatchable programs are not activated using a predetermined threshold condition but allow the customer to make the economic choice whether to modify usage in response to ongoing price signals. Impacts from committed nondispatchable programs should be included in the demand forecast.

At this time, all of the existing demand response programs have some form of triggering condition. Although the utility or California ISO may not have direct control, the customer only has the opportunity to participate in the program when the program operator has called an event, either because of high market prices or resource scarcity. Therefore, in this forecast, no demand response impacts are counted on the demand side.

Self-Generation

This forecast accounts for all the major programs designed to promote self-generation, building up from sales of individual systems. Incentive programs include:

- Emerging Renewables Program (ERP) - managed by the Energy Commission
- California Solar Initiative (CSI) - managed by the CPUC
- Self-Generation Incentive Program (SGIP) - managed by the CPUC
- New Solar Homes Partnership (NSHP) - managed by the Energy Commission
- Incentives administered by public utilities such as SMUD, LADWP, Burbank Water and Power, City of Glendale, City of Pasadena, and IID

The forecast also accounts for power plants that report information to the Energy Commission. The principal source of that information is Form CEC-1304, which must be submitted to the Energy Commission by owners of electric power plants located with California or within a control area with end users inside California. Staff only included power plants in the forecast that explicitly listed themselves as operating under cogeneration or self-generation mode.

The general strategy of the ERP, CSI, SGIP, and NSHP programs is to encourage demand for self-generation technologies with financial incentives until the size of the market increases to the point where economies of scale are achieved and capital costs decline. The extent to which consumers see real price declines will depend on the interplay of supplier expectations, the

future level of incentives, and demand as manifested by the number of states or countries offering subsidies.

The ERP and SGIP programs currently fund small wind turbines and fuel cells. Based on the availability of historical data, either a simple trend or the average rate of installations for the two last historical years (2006 and 2007) was used to project future capacity additions. For the CSI program, added future photovoltaic (PV) capacity was projected by taking the average capacity installed between 2007 and 2008. The NSHP projections used the average of the installed and pending PV additions from 2008 and 2009. These values are carried forward until 2016, when both the CSI and NSHP programs are scheduled to end. Capacity additions between 2017 and 2020 are derived by allowing the cumulative installed capacity to grow at the historic rate of electricity consumption for each sector. The difference in cumulative capacity between successive years is assumed to reflect new additions once the programs have ended. Assumptions about PV system performance were derived from the scenario analyses performed for the *2007 IEPR*. [10]

Capacity additions for programs administered by the public utilities were assumed to increase at the same rate as electricity growth by sector. For the large generators reporting under CEC 1304, cumulative capacity was assumed to remain constant at 2007 levels throughout the forecast period. Inspection of historical data revealed no trend upward or downward in installations. Since many of these plants sell electricity back to the grid, the effective plant generating capacity for projecting future onsite generation was derived by weighting overall plant capacity by the ratio of historical total electricity consumed by the plant to the overall electricity generated.

To translate self-generation capacity into effects on system peak demand requires assumptions about load shape, the coincidence of self-generation peak with system peak, and the extent to which self-generation units are operating during peak hours. Staff used the evaluation studies of the SGIP program for these assumptions.[11] For example, the 2004 study found that the load impact at the time of the 2004 California ISO peak was 58 MW out of 103 MW of installed capacity.

Table 1-6 shows the impacts of self-generation, which are projected to reduce peak load by almost 2,600 MW and consumption by more than 12,000 GWh in 2018. Consumption from self-generation is lower than in *CED 2007*, mainly due to historical data updates showing reductions in 2006 and 2007. The growth in consumption from 2007-2010 is higher than that projected in *CED 2007*, reflecting the large number of installations and pending installations in 2008 and 2009. Estimates of peak impacts are slightly higher than in the previous forecast, due to a greater penetration of PV systems, which have more impact during peak periods than other

[10] PV characteristics are described in Appendix E and G of *Scenario Analysis of California's Electricity System: Preliminary Results for the 2007 IEPR*, Draft Staff Report. Publication # CEC-200-2007-010-SD, June 2007.

[11] CPUC Self-Generation Incentive Program Fourth-Year Impact Report Final Report, ITRON, Submitted to Southern California Edison and The Self-Generation Incentive Program Working Group, April 15, 2005.

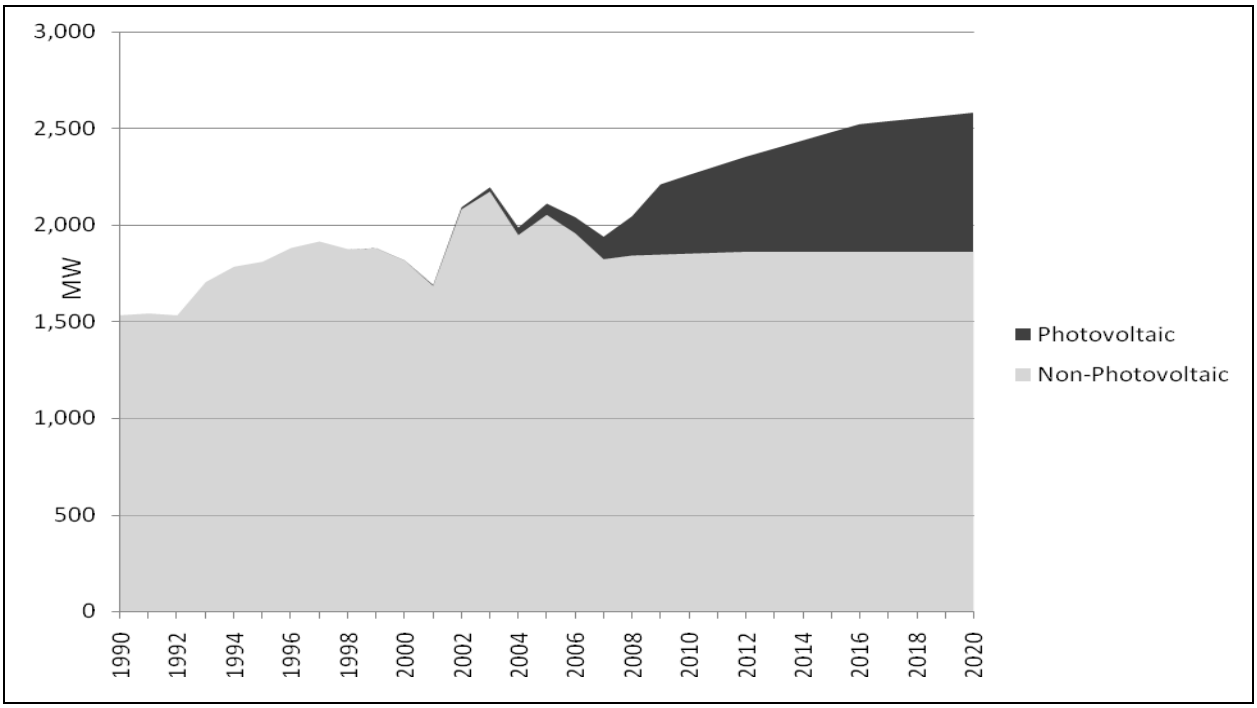
technologies. **Figure 1-13** shows the growing peak impact of PV systems relative to other technologies.

Table 1-6: Self-Generation Forecast

	Consumption (GWh)			Demand at System Peak (MW)		
	CED 2007	Staff Draft	Percent Difference	*CED 2007*	Staff Draft	Percent Difference
1990	9,132	9,132	--	1,488	1,533	3. 02%
2000	10,823	10,823	--	1,767	1,818	2. 89%
2007	11,305	10,153	-10. 19%	1,895	1,940	2. 37%
2010	11,880	11,395	-4. 08%	2,058	2,260	9. 82%
2015	12,839	12,226	-4. 77%	2,329	2,480	6. 48%
2018	13,414	12,455	-7. 15%	2,492	2,552	2. 41%
Annual Average Growth Rates						
1990-2000	1. 71%	1. 71%		1. 73%	1. 72%	
2000-2007	0. 62%	-0. 91%		1. 00%	0. 93%	
2007-2010	1. 67%	3. 92%		2. 79%	5. 22%	
2010-2018	1. 53%	1. 11%		2. 42%	1. 53%	
Historic values are shaded						

Source: California Energy Commission, 2009

Figure 1-13: Peak Impacts of PV and Non-PV Self-Generation



Source: California Energy Commission, 2009

These projections are consistent with current demand but may prove to be conservative. Staff is currently developing predictive models for some of the self-generation technologies based on estimated payback periods and cost-effectiveness, determined by up-front costs, energy rates, and incentive levels. The first model, near completion, is designed to project residential demand for PV systems. This model is based on one used by the Energy Information Administration as part of its National Energy Modeling System. Details of the model are provided in the Appendix. The model is still being tested by staff, but **Table 1-7** provides some preliminary simulation results for the Pacific Gas and Electric planning area that show the relationship between installed capacity in MW, electricity rates, and system price per kilowatt (kW).

The model simulations indicate that demand rises quickly as system price falls below $5,000, with percentage increases largest at lower electricity rates. These results are meant to be illustrative, but they do suggest the potential for significant increases in installed capacity as system prices drop. Currently, systems average a little more than $8,000/kW.[12]

Table 1-7: Residential Photovoltaic System Penetration* in MW by Electricity and System Price

		Electricity Rate (2007 $kWh)							
		$ 0. 08	$0. 10	$0. 12	$0. 14	$0. 16	$0. 18	$0. 20	$0. 22
Photovoltaic System Price (2007 $/kW)	$1,000	277	356	406	575	587	587	959	1076
	$3,000	20	63	104	124	139	176	206	260
	$5,000	4	6	18	48	67	84	98	108
	$7,000	3	3	5	6	18	42	58	72
	$9,000	3	3	3	4	5	6	20	40

Source: California Energy Commission, 2009

*Assumes a discount rate of 3 percent.

Historic Electricity Consumption Estimates

Energy Commission demand forecasting models are organized by sector according to economic activity: commercial, industrial, agricultural, and so on. Each of these models develops a forecast based on sub-activities within the sector (for example, commercial building type or industrial activity). Under the Energy Commission's Quarterly Fuel and Reporting (QFER) regulations, each load serving entity (LSE) is required to file monthly and annual reports that document energy consumption by activity group.

[12] From CSI program data available on PG&E's website: https://pge. Powerclerk. com /CSIProgramData. aspx.

The quality of the QFER data continues to be undermined by LSE data coding errors, lack of adherence to regulations by some LSE's, and failure to provide economic classification for some of the data. However, unclassified consumption has declined significantly in recent years. From a high of almost 20,000 GWh in 2003, unclassified energy use dropped to less than 8,000 GWh in 2007 as economic classification is now provided for direct access customers, per current reporting requirements. Staff allocated unclassified consumption to economic sectors using professional judgment, relying on such factors as apparently unrealistic changes in historic consumption in a given sector.

Demand Forecast Disaggregation

Many uses for demand forecasts require more disaggregation than the planning area forecasts presented in the following chapters. For example, electricity system analysis requires identification of load by congestion zone or load pocket; evaluation of progress towards renewable energy goals requires sales data by individual LSEs; development of energy efficiency goals requires projections of per capita sales by LSEs; and controlled grid studies require forecasts for each LSE, sometimes with geographic subdivisions. The statewide tables following this chapter include forecast disaggregations developed by staff to support some of these applications.

Structure of Report

Chapters 2-6 provide *CED 2009* electricity forecasts for the following planning areas: Pacific Gas and Electric, Southern California Edison, San Diego Gas and Electric, SMUD, and LADWP, in that order. All of the planning areas included in this forecast are described in **Table 1-8**. Chapter 7 provides more statewide results from the end-user natural gas forecast, along with results for the Pacific Gas and Electric, Southern California Gas, and San Diego Gas and Electric distribution areas. Chapter 8 describes recent staff work focused on refining and improving methods to incorporate energy efficiency and conservation savings within the forecast, and presents staff estimates of the impacts resulting from utility efficiency programs, building and appliance standards, and other conservation-related factors.

Table 1-8: Utilities within Forecasting Areas

Planning Area	Utilities Included	
Electric Areas		
Pacific Gas and Electric (PG&E)	PG&E Alameda Biggs Calaveras Gridley Healdsburg Lassen MUD Lodi Lompoc Merced Modesto Palo Alto	Plumas – Sierra Port of Stockton PWRPA Redding Roseville San Francisco Shasta Silicon Valley Tuolumne Turlock Irrigation District Ukiah USBR-CVP
Sacramento Municipal Utility District (SMUD)	SMUD	
Southern California Edison (SCE)	Anaheim Anza Azusa Banning Bear Valley Colton MWD	Ranch Cucamonga Riverside Southern California Edison USBR-Parker Davis Valley Electric Vernon Victorville
Los Angeles Department of Water and Power (LADWP)	LADWP	
San Diego Gas and Electric (SDG&E)	SDG&E	
Cities of Burbank and Glendale (BUGL)	Burbank,Glendale	
Pasadena (PASD)	Pasadena	
Imperial (IID)	Imperial Irrigation District	
Department of Water Resources (DWR)	DWR	
Natural Gas Distribution Areas		
PG&E	PG&E Electric Planning Area, SMUD	
SDG&E	SDG&E	
Southern California Gas Company (SCG)	SCG, Long Beach	
OTHER	Avista Energy, Southwest Gas Corporation	

Source: California Energy Commission, 2009

CHAPTER 2: Pacific Gas and Electric Planning Area

The Pacific Gas and Electric (PG&E) planning area includes:

- PG&E bundled retail customers.[13]
- Customers served by energy service providers (ESPs) using the PG&E distribution system to deliver electricity to end users.
- Customers of publicly owned utilities and irrigation districts in PG&E's transmission system, with the exception of the Sacramento Municipal Utility District (SMUD).[14] SMUD is treated as its own planning area and is discussed in a later chapter.

For purposes of this chapter, the PG&E planning area forecast includes the members of the SMUD control area (Roseville, Redding, and Western Area Power Administration [WAPA]). To support electricity and transmission system analysis, staff uses historic consumption and load data to develop individual forecasts for all medium and large utilities in the planning area. Those results are presented in Forms 1.5a and 1.5b in the Appendix. The results in this chapter are for the entire PG&E transmission planning area.

This chapter is organized as follows. First, forecasted consumption and peak loads for the PG&E planning area are discussed; both total and per capita values are presented. The proposed *CED 2009* values are compared to the adopted *CED 2007* forecast, with differences between the two forecasts explained. The forecasted load factor, jointly determined by the consumption and peak load estimates, is also discussed. Second, the chapter presents sector consumption and peak load forecasts. The residential, commercial, industrial, and "other" sector forecasts are compared to those in *CED 2007* and differences between the two are discussed. Third, the chapter discusses the forecasts self generation and impacts of conservation and efficiency programs.

[13] Bundled customers receive electric generation, transmission, distribution, and related customer service and support functions as a combined service.

[14] The public utilities in the PG&E planning area are Calaveras Public Power Agency; Central Valley Project; Cities of Alameda, Biggs, Gridley, Healdsburg, Lodi, Lompoc, Palo Alto, Redding, Roseville, San Francisco, and Ukiah; Lassen Municipal Utility District; Merced Irrigation District; Modesto Irrigation District; Plumas-Sierra Rural Electric Cooperation; Shasta Dam Area Public Utility District; Silicon Valley Power; Tuolumne County PPA; and Turlock Irrigation District.

Planning Area Results

Table 2-1 compares the *CED 2009* high- and low-rate scenarios and *CED 2007* electricity consumption and peak demand forecasts for selected years.

Table 2-1: PG&E Planning Area Forecast Comparison

Consumption (GWH)					
	CED 2007	CED 2009 Staff Draft Low Rate	CED 2009 Staff Draft High Rate	Percent Difference Staff Low Rate/CED 2007	Percent Difference Staff High Rate/CED 2007
1990	86,803	86,803	86,803	0.00%	0.00%
2000	101,331	101,331	101,331	0.00%	0.00%
2007	106,311	107,529	107,529	1.15%	1.15%
2010	110,503	106,240	106,240	-3.86%	-3.86%
2015	117,806	111,254	110,588	-5.56%	-6.13%
2018	121,873	113,732	112,414	-6.68%	-7.76%
Average Annual Growth Rates					
1990-2000	1.56%	1.56%	1.56%		
2000-2007	0.69%	1.19%	1.19%		
2007-2010	1.30%	-0.40%	-0.40%		
2010-2018	1.23%	0.86%	0.71%		
Peak (MW)					
	CED 2007	CED 2009 Staff Draft Low Rate	CED 2009 Staff Draft High Rate	Percent Difference Staff Low Rate/CED 2007	Percent Difference Staff High Rate/CED 2007
1990	17,055	17,043	17,043	-0.07%	-0.07%
2000	20,716	20,665	20,665	-0.25%	-0.25%
2007	23,114	22,836	22,836	-1.20%	-1.20%
2010	24,050	23,240	23,240	-3.37%	-3.37%
2015	25,760	24,676	24,550	-4.21%	-4.70%
2018	26,754	25,488	25,233	-4.73%	-5.69%
Average Annual Growth Rates					
1990-2000	1.96%	1.95%	1.95%		
2000-2007	2.21%	2.02%	2.02%		
2007-2010	1.33%	0.59%	0.59%		
2010-2018	1.34%	1.16%	1.03%		
Historic values are shaded					

Source: California Energy Commission, 2009

In the PG&E planning area, the *CED 2009* forecasts for both price scenarios are much lower than the *CED 2007* forecast. This is caused by lower economic and demographic forecasts as well as increased projections of savings from efficiency programs. In the near term, both *CED 2009* consumption forecasts are nearly 4 percent lower than the *CED 2007* forecast. By the end of the

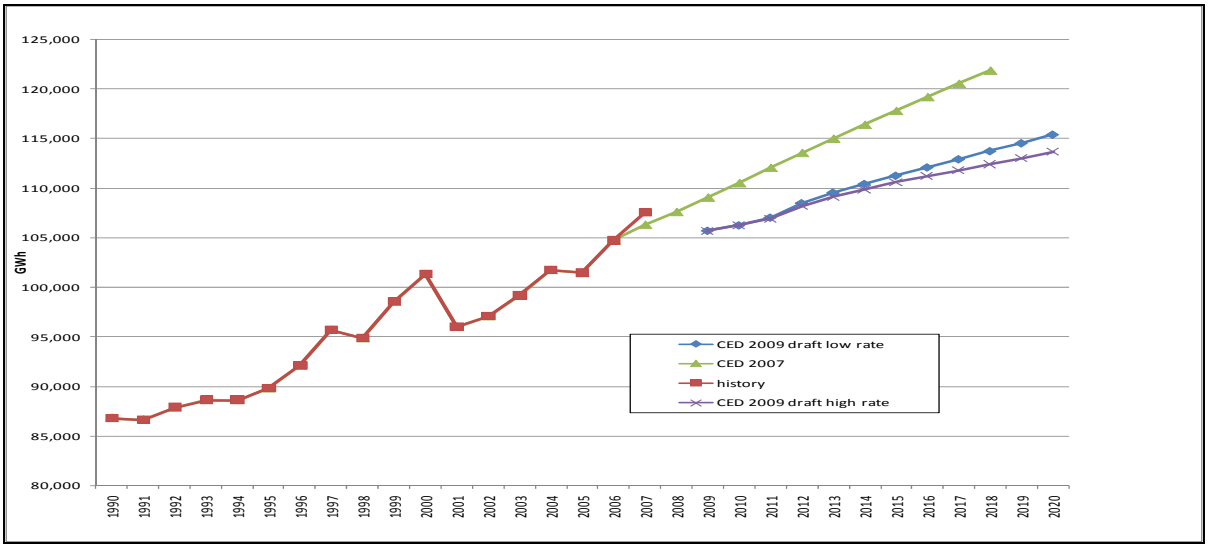
forecast period the *CED 2009* low-rate forecast is 6.7 percent lower than the *CED 2007* forecast while the *CED 2009* high-rate forecast is 7.8 percent lower.

CED 2007 assumed constant electricity rates throughout the forecast period. For this forecast, three price scenarios were developed for electricity rates: high rates, low (constant) rates, and a rate scenario in between the two. The high-rate case assumed approximately 30 percent higher rates by 2020 relative to 2010, while the "mid-rate" case assumed 15 percent higher rates over the same period. In the low-rate case, rates remained at 2010 levels through 2020. Chapter 1 provides more details.

The difference in peak forecasts is not as great with the near term *CED 2009* peak forecast being 3 percent lower than the *CED 2007* forecast in the near term. This difference increases to more than 4.7 percent for the low-rate forecast and about 5.7 percent for the high-rate forecast by the end of the forecast period. The smaller reduction in peak forecasts compared to consumption forecasts is caused by greater reduction in energy uses which have little impact on peak (i.e., residential lighting).

As shown in **Figure 2-1**, the *CED 2009* electricity consumption forecast for the PG&E planning area is lower over the entire forecast period than the adopted *CED 2007* forecast. This result is attributed to lower economic forecasts and increased savings from efficiency programs.

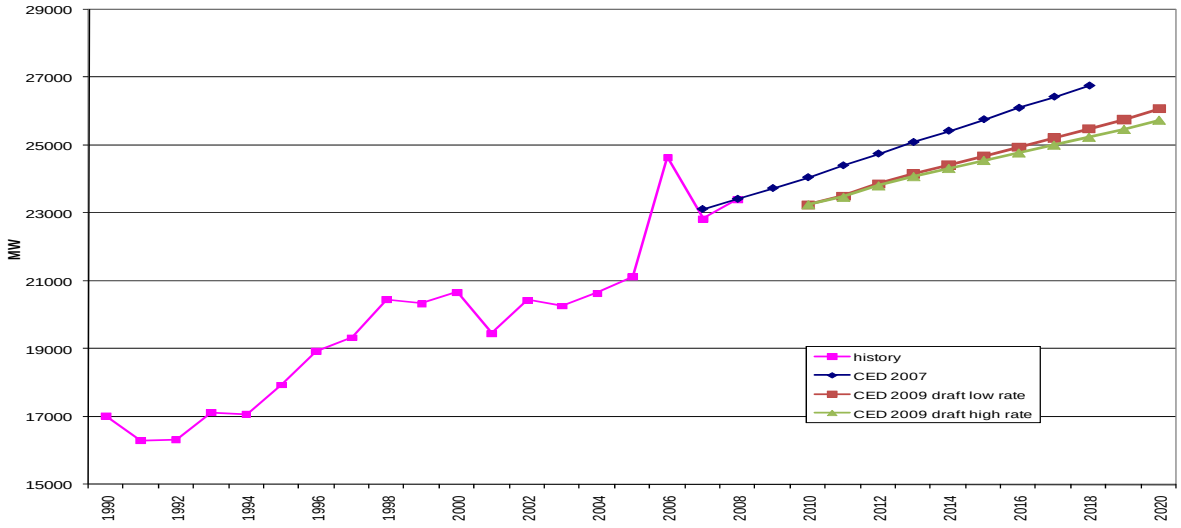
Figure 2-1: PG&E Planning Area Electricity Forecast



Source: California Energy Commission, 2009

The *CED 2009* PG&E planning area peak demand forecasts, shown in **Figure 2-2**, are also lower over the entire forecast period than the *CED 2007* forecast. The decrease in the peak demand forecasts is somewhat less than the corresponding energy forecast because most of the energy reductions come from areas that do not have as large of an impact on peak demand.

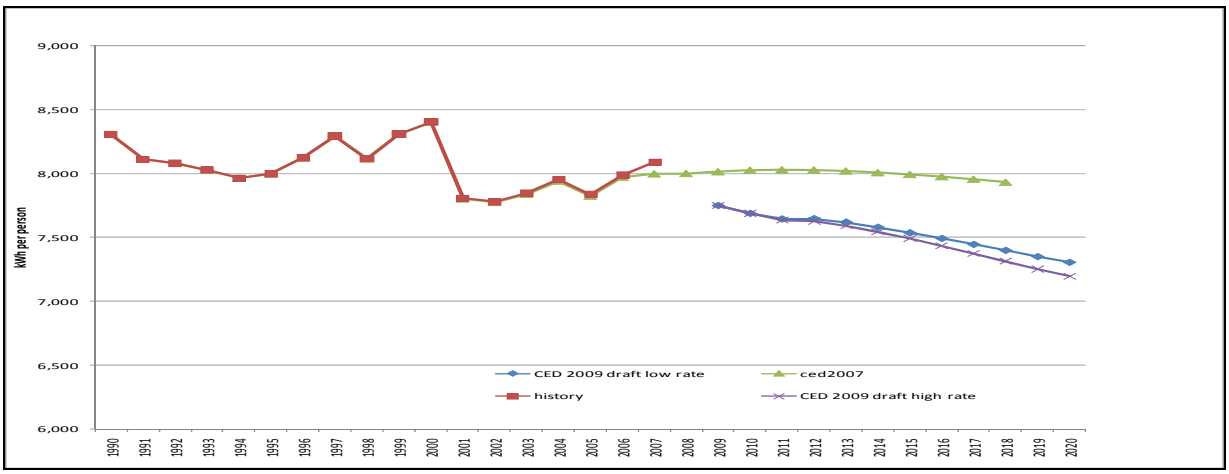
Figure 2-2: PG&E Planning Area Peak



Source: California Energy Commission, 2009

Figure 2-3 compares PG&E planning area per capita electricity consumption in the *CED 2009* and *CED 2007* forecasts. Similar to the consumption forecasts, there is a reduction in near-term levels caused by lower economic and demographic projections as well as near term increases in efficiency program savings. This reduction also continues throughout the forecast period causing a projected decline in per capita electricity use over the entire forecast.

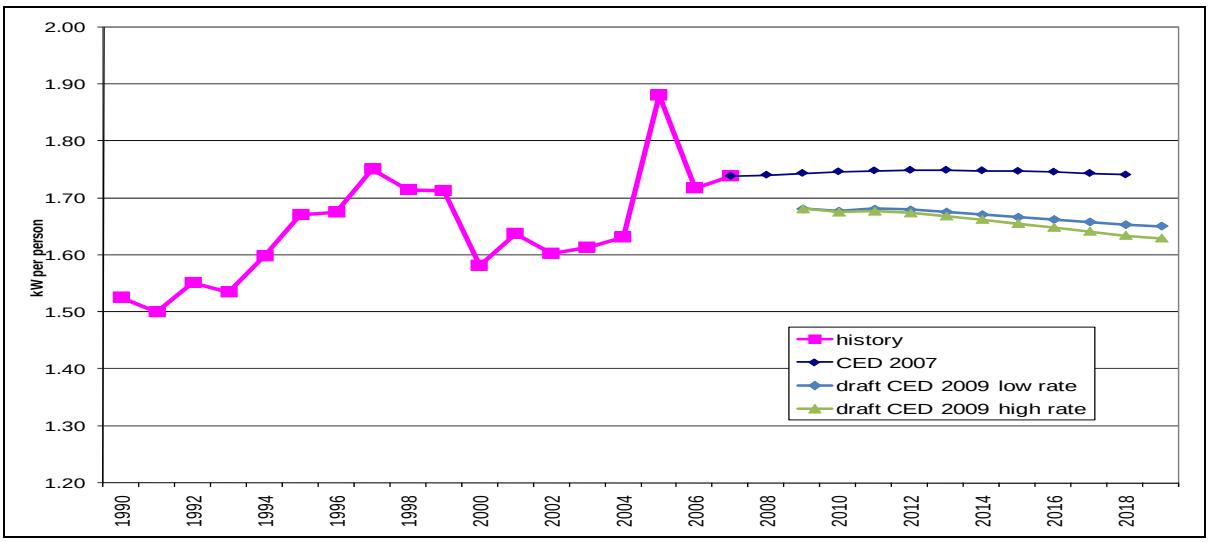
Figure 2-3: PG&E Planning Area Per Capita Electricity Consumption



Source: California Energy Commission, 2009

Per capita peak demand, shown in **Figure 2-4**, declines only slightly over the forecast period. The *CED 2009* projected levels of per capita peak are estimated to be at a level similar to the mid-to late-1990s, prior to the energy crisis.

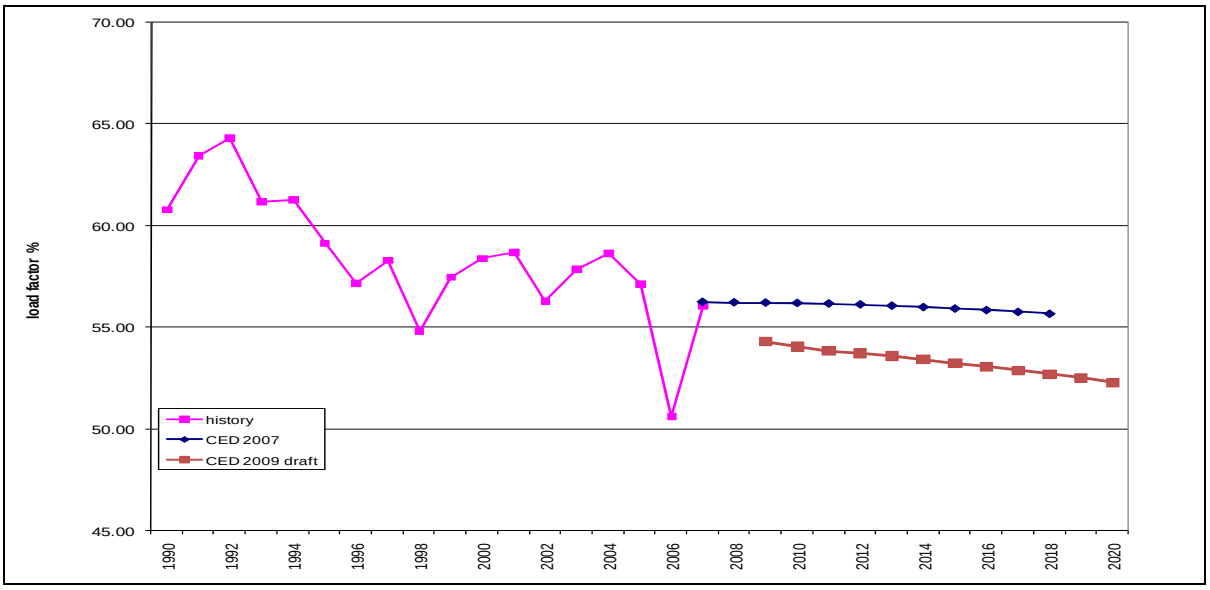
Figure 2-4: PG&E Planning Area per Capita Peak Demand



Source: California Energy Commission, 2009

Figure 2-5 compares the respective implied forecast load factors. The load factor is a measure of the increase in peak demand relative to annual electricity consumption. Lower load factors indicate "a needle peak"; higher load factors indicate a more stable load. Actual data show a long-term downward trend as consumption shifts away from the industrial sector toward residential and commercial use. Further, more population and economic growth in the PG&E planning area is taking place in hotter inland areas, leading to greater saturation of central air conditioning and to a greater use of air conditioning equipment in the cooler Bay Area on the peak day compared to previous historic years. The *CED 2009* projected load factors continue to decline over the forecast period because of greater reductions in the energy consumption forecast compared to the peak forecast.

Figure 2-5: PG&E Planning Area Load Factor



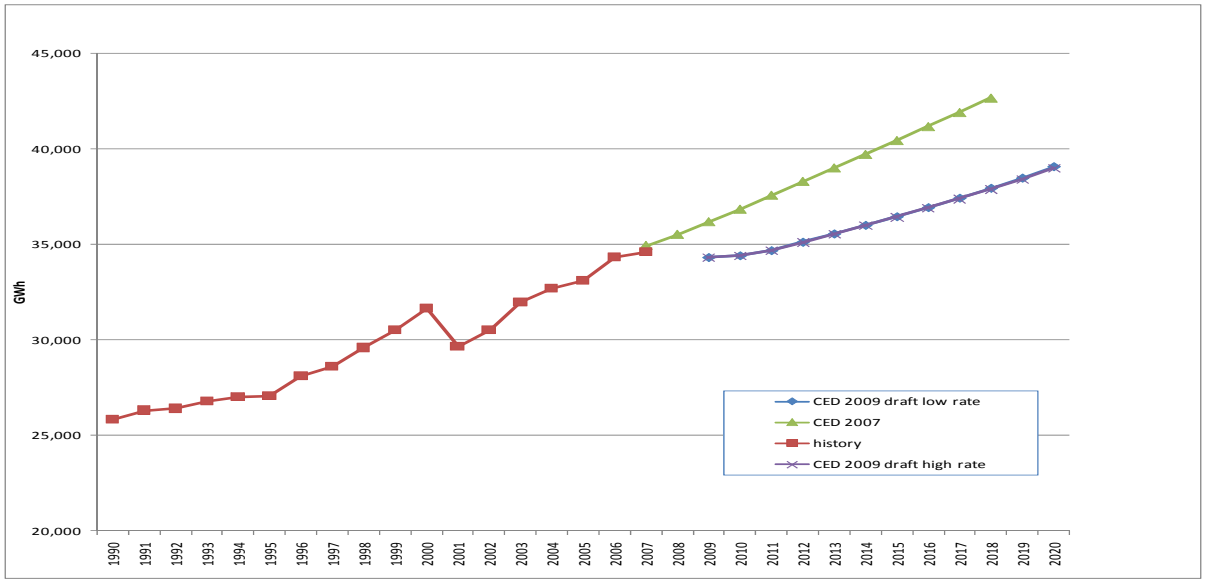
Source: California Energy Commission, 2009

Sector Level Results and Input Assumptions

Residential Sector

Figure 2-6 compares between the *CED 2009* and *CED 2007* PG&E planning area residential forecasts. The *CED 2009* forecast is lower throughout the entire forecast period mainly because of lower projections of personal income and increased savings assumptions from efficiency programs and standards. There is little difference between the low and high-rate cases in the residential forecast because of the relatively inelastic nature of residential consumption.

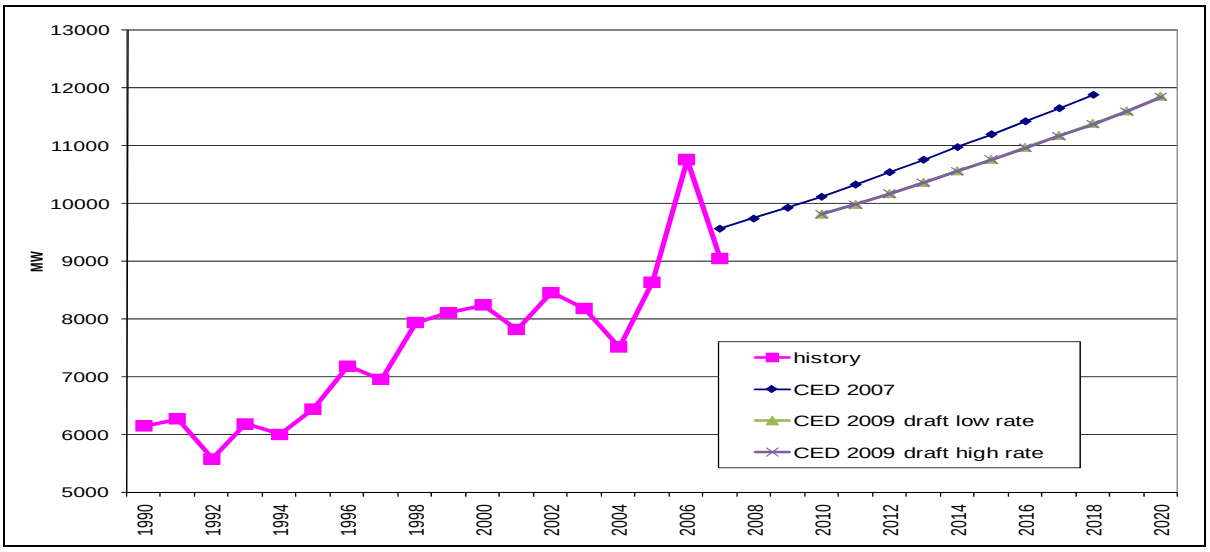
Figure 2-6: PG&E Planning Area Residential Consumption



Source: California Energy Commission, 2009

Figure 2-7 compares the *CED 2009* and *CED 2007* residential peak demand forecasts. As in the electricity consumption forecast, the *CED 2009* residential peak forecast is lower than that for *CED 2007*. The difference between the two peak forecasts is less than the difference in the electricity consumption forecasts because most of the consumption reductions come from measures that are not peak related (i.e., lighting and miscellaneous). Also the savings from 2005 federal air conditioner standards are assumed to have a greater impact on annual electricity consumption than on peak.

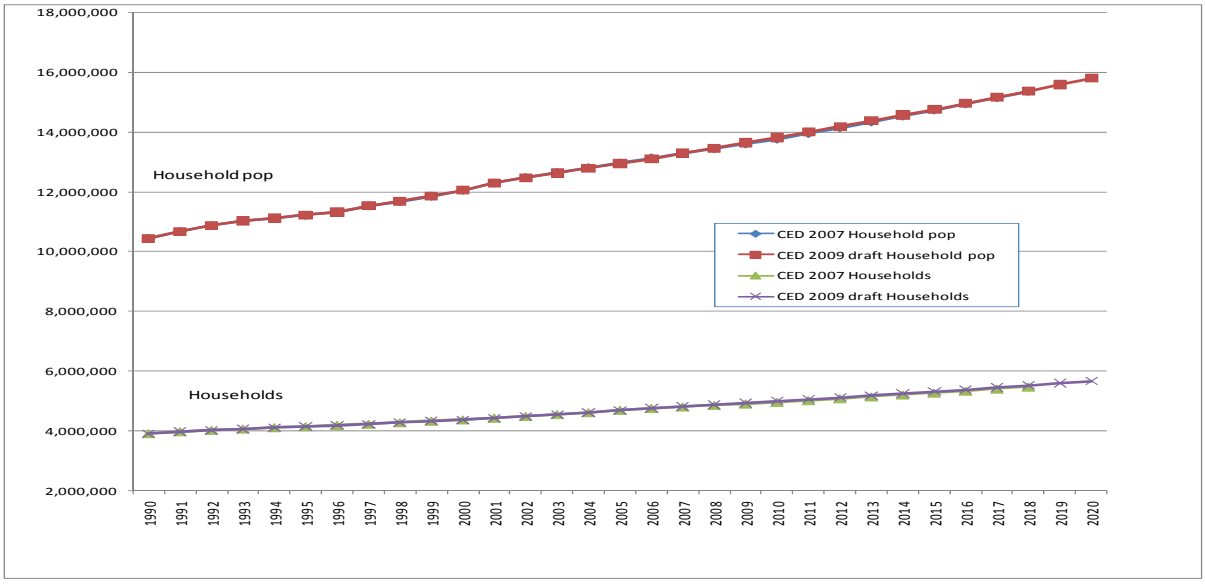
Figure 2-7: PG&E Planning Area Residential Peak



Source: California Energy Commission, 2009

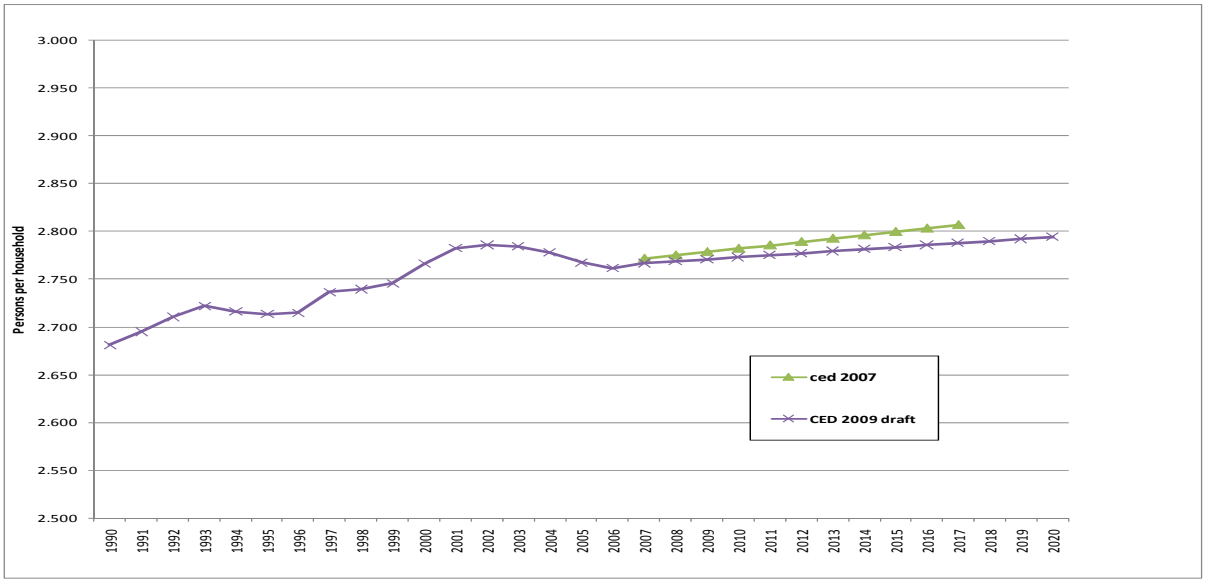
Figures 2-8, 2-9 and **2-10** compare the residential drivers used in the *CED 2009* forecast with those used previously. **Figure 2-8** provides comparisons of household population and total households. The *CED 2009* forecast of total population and households is virtually the same as the previous forecast. There is a slight difference, given the inclusion of 2007 historic population and household estimates at the county level. This served to lower the projection of persons per household slightly as shown in **Figure 2-9**. The California Department of Finance has recently released updated population and household estimates for 2008 which will be included in the staff revised forecast due out later this summer. **Figure 2-10** compares household income (per capita income multiplied by persons per household) between the two forecasts. The *CED 2009* estimate of household income is higher in recent history than the previous forecast but the near term forecast is much lower than that projected in the *CED 2007* forecast. This lower projection continues throughout the entire forecast period.

Figure 2-8: PG&E Planning Area Residential Demographic Projections



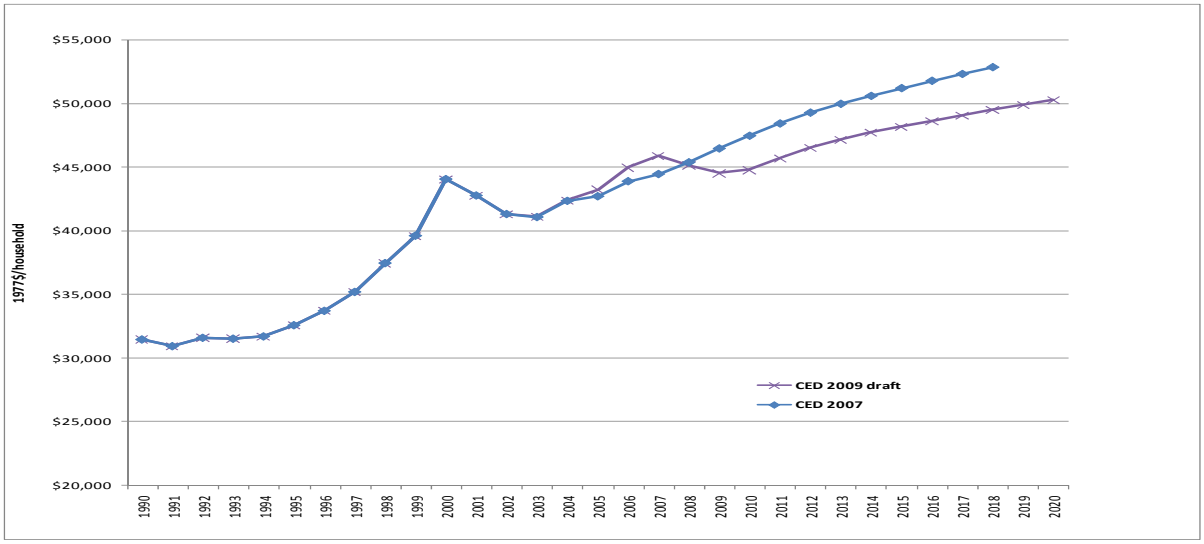
Source: California Energy Commission, 2009

Figure 2-9: PG&E Planning Area Persons per Household Projections



Source: California Energy Commission, 2009

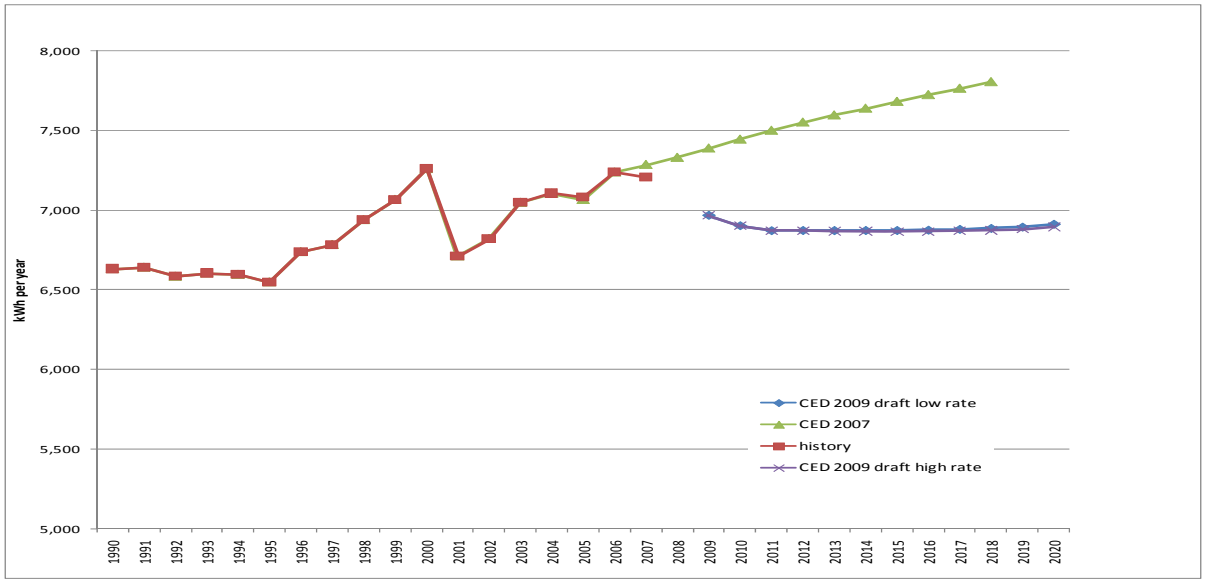
Figure 2-10: PG&E Planning Area Household Income Projections



Source: California Energy Commission, 2009

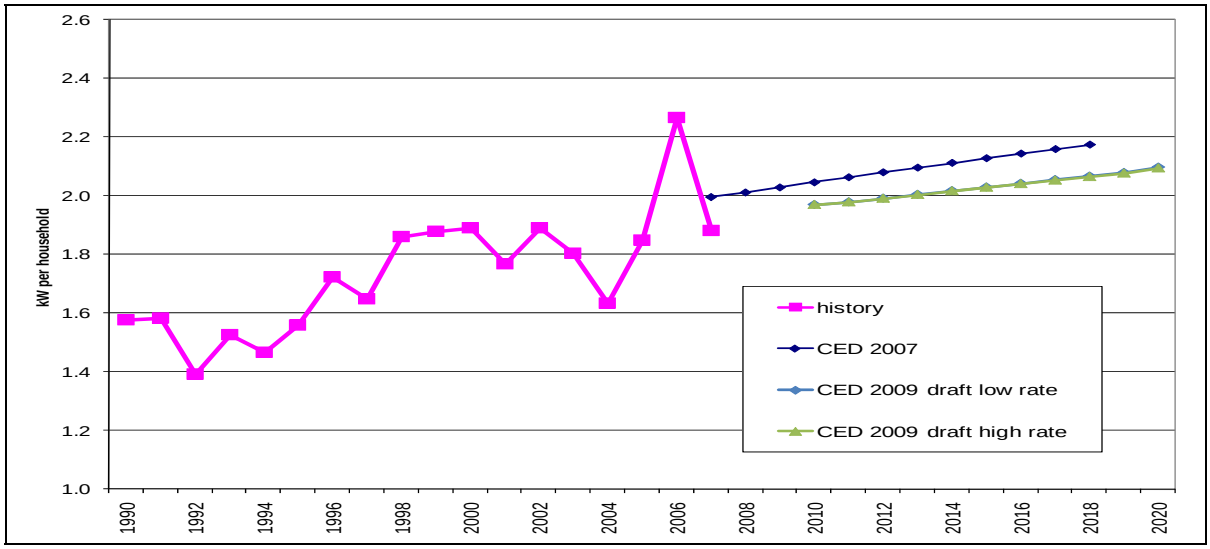
Figures 2-11 and **2-12** compare electricity use per household between the two forecasts. **Figure 2-11** compares annual use per household and **Figure 2-12** compares peak use per household. The *CED 2009* forecast for both annual energy and peak demand is somewhat lower than that projected in *CED 2007*. The decline in use per household in the short term is caused by recent economic conditions and increases in savings from efficiency measures (primarily lighting). This decline tapers off after 2012 and use per household is projected to remain relatively constant after that at the level of mid-1990 household use. The *CED 2009* forecast of peak use per household is projected to increase over the forecast period in a pattern similar to that in the *CED 2007* forecast although at a lower level. The decrease in level is primarily caused by lower economic projections.

Figure 2-11: PG&E Planning Area Use per Household



Source: California Energy Commission, 2009

Figure 2-12: PG&E Planning Area Peak Use per Household



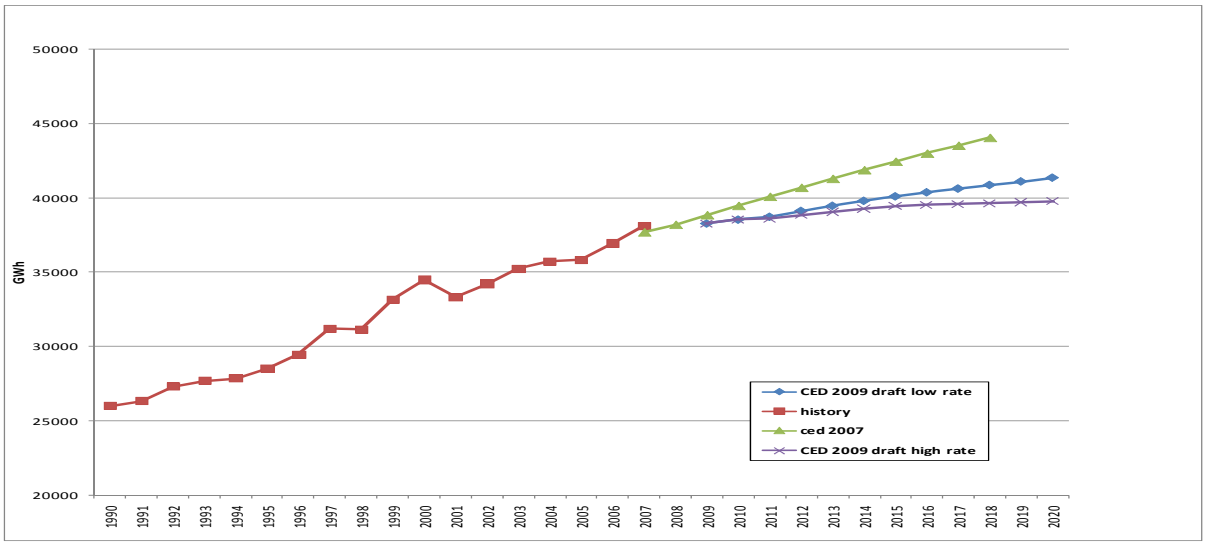
Source: California Energy Commission, 2009

Commercial Building Sector

Figure 2-13 compares the commercial building sector forecasts. Both *CED 2009* forecast price scenarios are lower throughout the entire forecast period than the *CED 2007* forecast. This is primarily caused by a decrease in commercial floor space projections and an increase in the assumptions related to compliance of the recently enacted commercial lighting standards in retrofit applications. The high-rate scenario produces a somewhat lower forecast than the low-rate scenario because of the assumed price elasticity of commercial energy use.

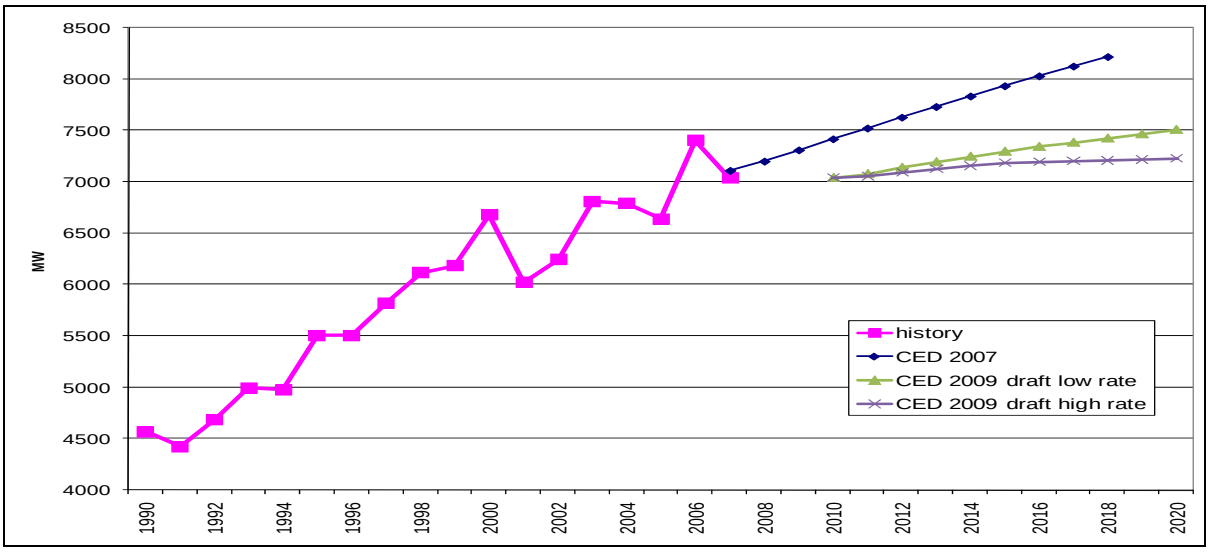
Figure 2-13 compares the commercial peak demand forecasts. Growth in both forecasts is driven primarily by the underlying electricity consumption forecast and exhibits the same pattern. Energy savings from programs and end uses in the commercial sector are assumed to directly translate into peak savings as most commercial use is more uniform over the day in contrast to residential usage patterns.

Figure 2-13: PG&E Planning Area Commercial Consumption



Source: California Energy Commission, 2009

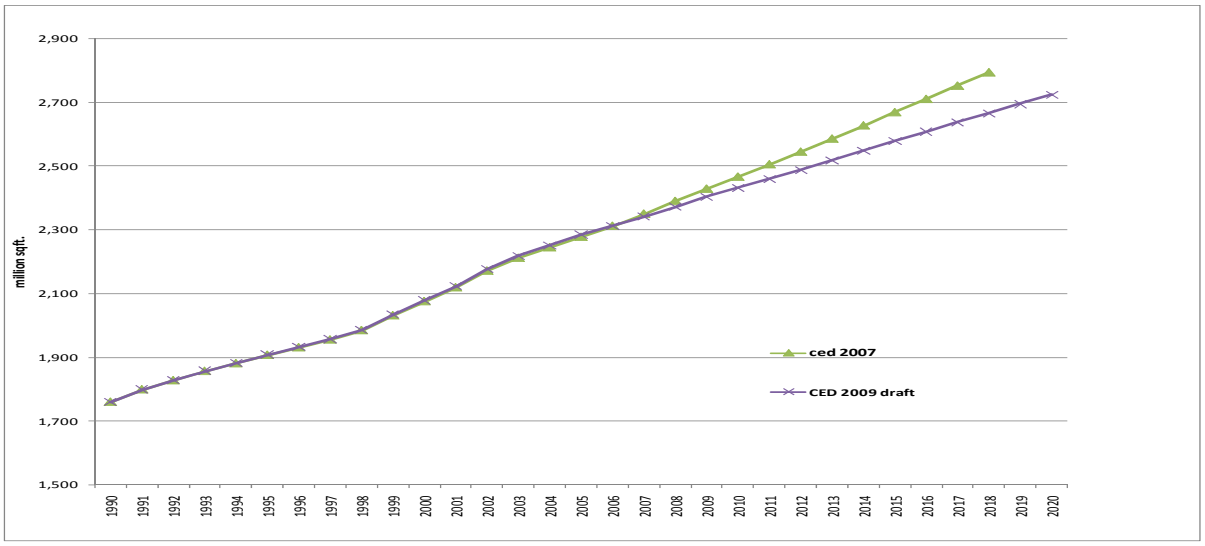
Figure 2-14: PG&E Planning Area Commercial Sector Peak



Source: California Energy Commission, 2009

In staff's commercial building sector forecasting model, floor space by building type, such as retail, offices, and schools, is the key driver. **Figure 2-16** compares total commercial floor space projections and historic estimates used in the two forecasts. The *CED 2009* floor space projections are somewhat lower over the forecast period than those used in the previous forecast. This is because of the lower economic and demographic drivers used in developing the floor space estimates.

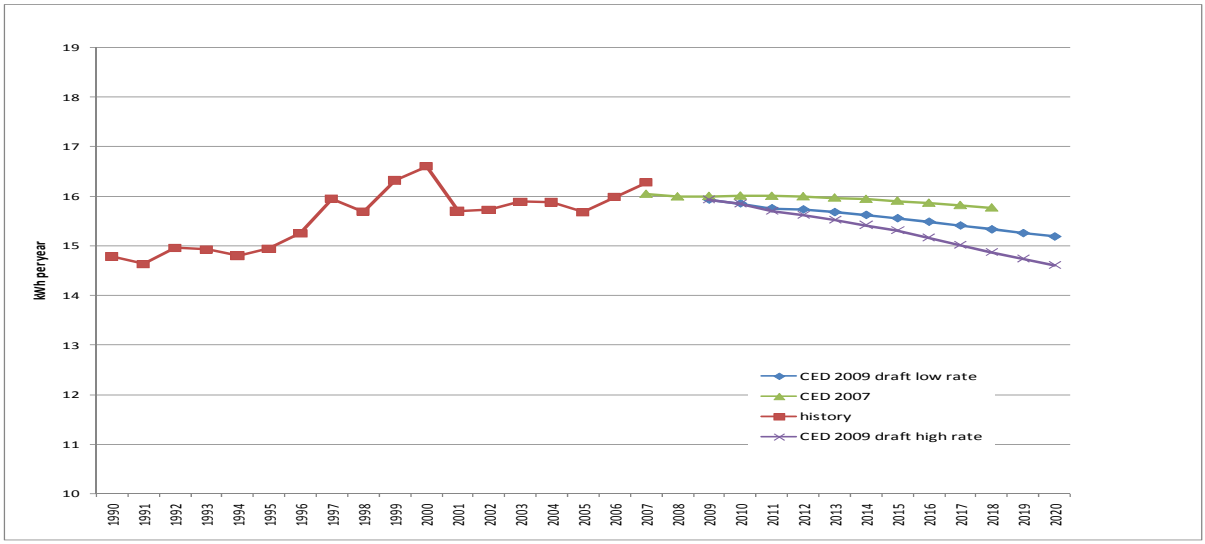
Figure 2-15: PG&E Planning Area Commercial Floor Space



Source: California Energy Commission, 2009

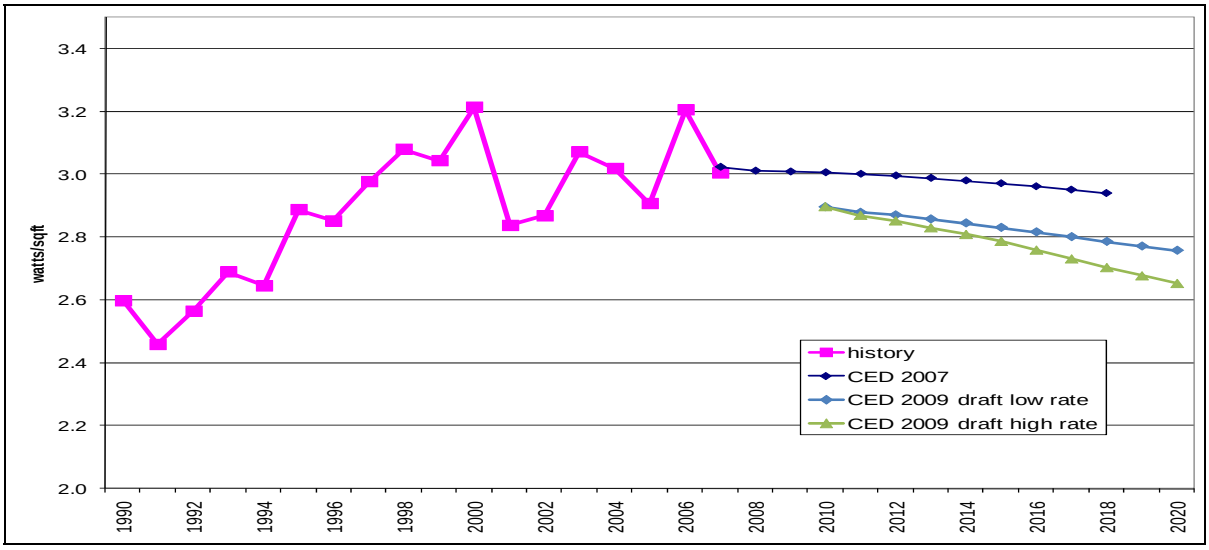
Historic and projected commercial sector annual and peak use per square foot are shown in **Figures 2-16** and **2-17**, respectively. The *CEC 2009* annual use per square foot declines over the forecast period at a faster rate than the *CED 2007* forecast, as does commercial peak use (**Figure 2-17**). Both the energy and peak forecasts decline over the forecast period due to projected impacts of commercial building and appliance standards. By the end of the forecast period both *CED 2009* price scenarios of use per square foot return to levels of the early 1990's. Peak use per square foot follows the same pattern as total consumption per square foot which corresponds to the total commercial energy and peak patterns.

Figure 2-16: PG&E Planning Area Commercial kWh per Square Foot



Source: California Energy Commission, 2009

Figure 2-17: PG&E Planning Area Commercial Sector Peak Watts per Square Foot

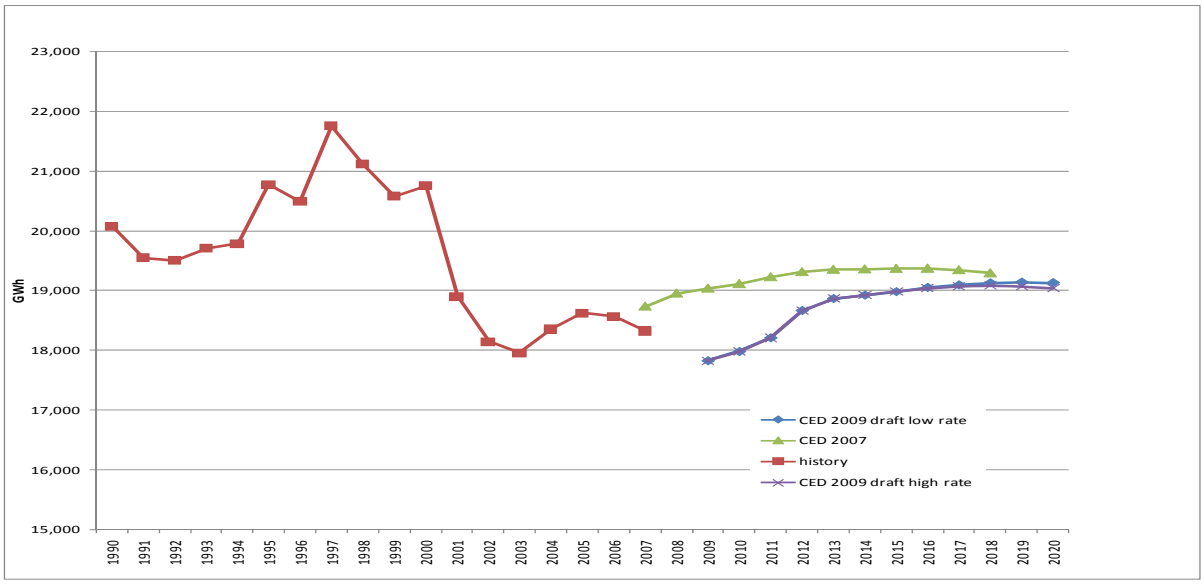


Source: California Energy Commission, 2009

Industrial Sector

Figure 2-18 compares the PG&E planning area industrial sector electricity consumption forecasts. The *CEC 2009* draft industrial consumption forecast is lower in the short term than the *CED 2007* forecast because of recent economic developments. However, the projected growth in the *CED 2009* forecast is higher in the short term than was projected in the *CED 2007* forecast but does not return to the level of the previous forecast. The net result is a somewhat lower *CEC 2009* forecast after 2012. This is caused by lower forecasted industrial economic drivers used in the *CEC 2009* draft forecast. There is little difference in the low and high-rate forecast because of the low price elasticity in the industrial sector.

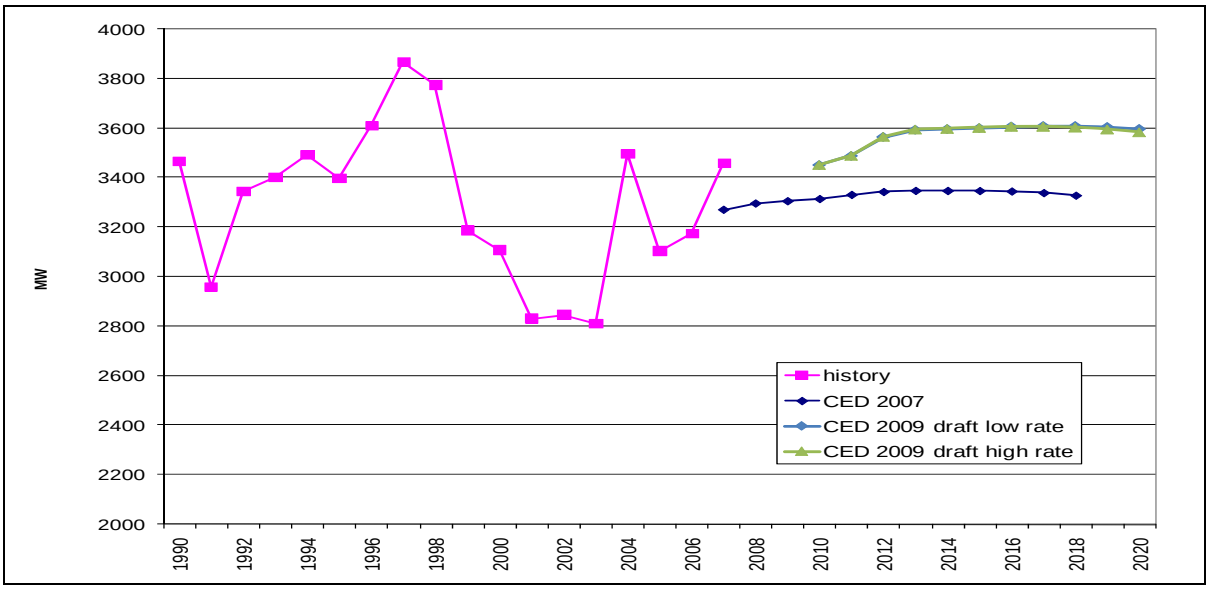
Figure 2-18: PG&E Planning Area Industrial Consumption



Source: California Energy Commission, 2009

Figure 2-19 compares the industrial sector peak forecasts. The *CED 2009* peak is higher due to an increase in the starting point value. The *CED 2009* industrial peak forecast follows the same pattern as the forecast of electricity consumption with an increase in peak through 2012 before flattening out over the remainder of the forecast period.

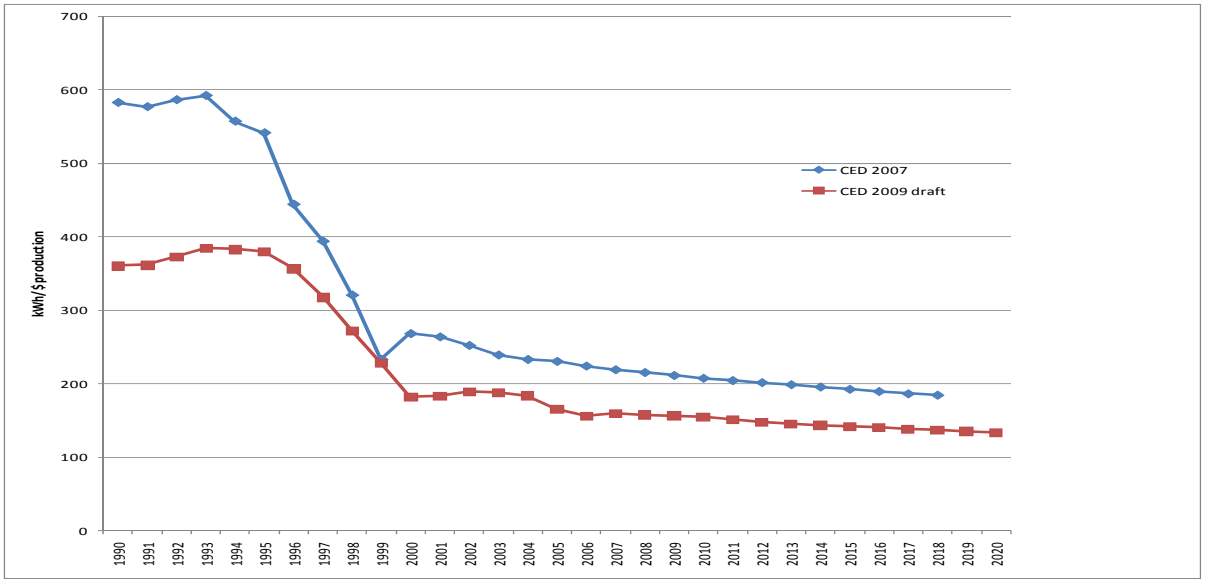
Figure 2-19: PG&E Planning Area Industrial Sector Peak



Source: California Energy Commission, 2009

Figure 2-20 compares electricity use per dollar of industrial production value between the *CED 2009* and *CED 2007* forecasts. Both forecasts exhibit similar patterns caused by increases in productivity in the industrial sector. The decline in use per dollar of production is slightly lower in the *CED 2009* than the previous forecast.

Figure 2-20: PG&E Planning Area Industrial Sector Use per Production Unit

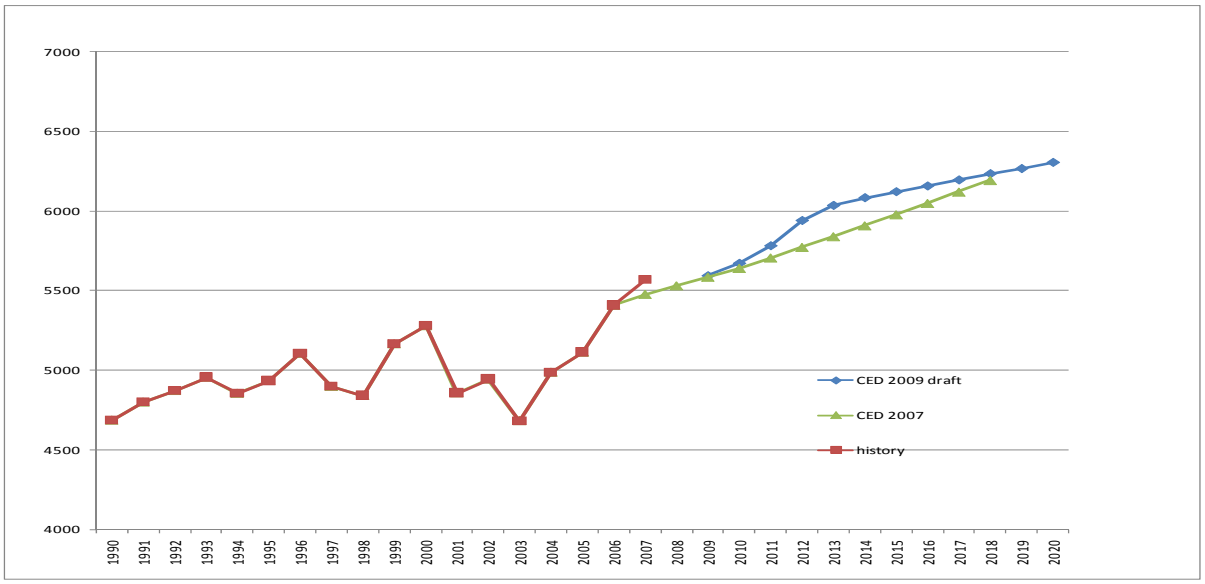


Source: California Energy Commission, 2009

Other Sectors

Figure 2-21 compares the electricity consumption forecasts for the transportation, communication, and utilities sector. The *CED 2009* transportation, communication, and utilities and street lighting forecast is higher than the *CED 2007* forecast given the higher starting point. The higher starting point is a result of assigning previously unclassified consumption to this sector based on more recent QFER filings.

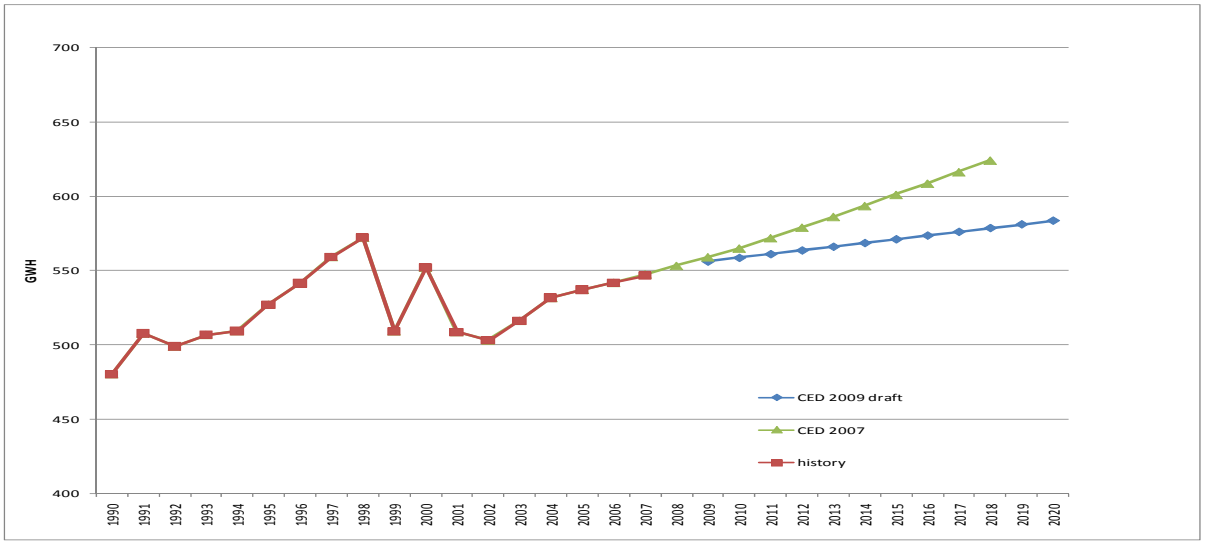
Figure 2-21: PG&E Planning Area Transportation, Communication, and Utilities Sector Electricity Forecast



Source: California Energy Commission, 2009

Figure 2-22 compares the electricity consumption forecasts for the street lighting sectors. The *CED 2009* street lighting forecast is lower than the *CED 2007* forecast because of lower economic projections and increases in lighting efficiency.

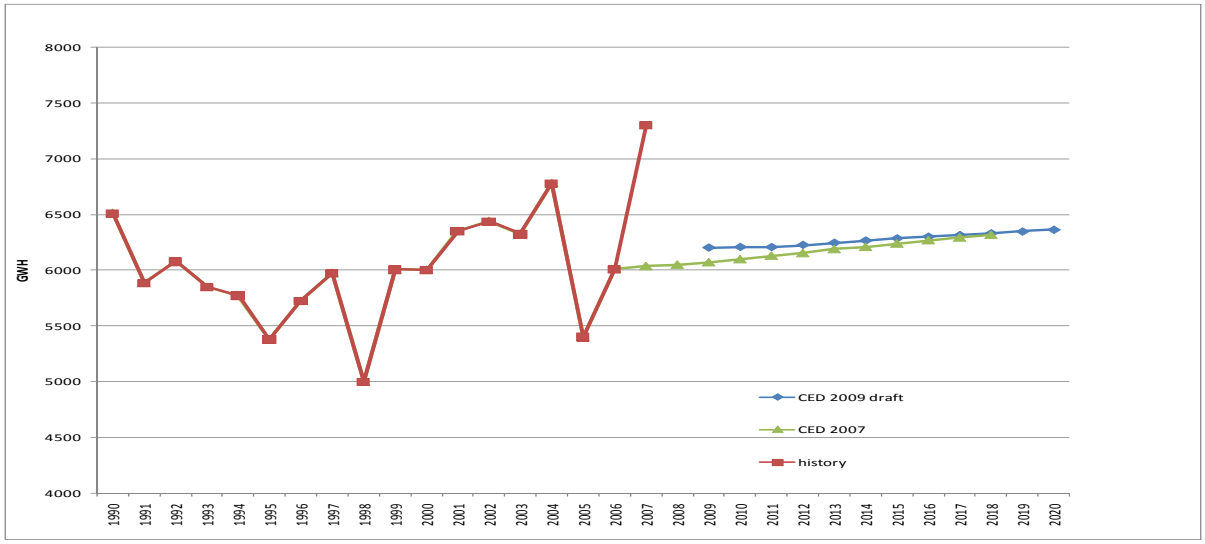
Figure 2-22: PG&E Planning Area Street Lighting Sector Electricity Forecasts



Source: California Energy Commission, 2009

Figure 2-23 compares the electricity consumption forecasts for the agriculture and water pumping sectors. The *CED 2009* agriculture and water pumping forecast is slightly higher than *CED 2007* forecast but is projected to grow at a flatter rate over the forecast period. The result is a forecast that is about the same by the end of the forecast period.

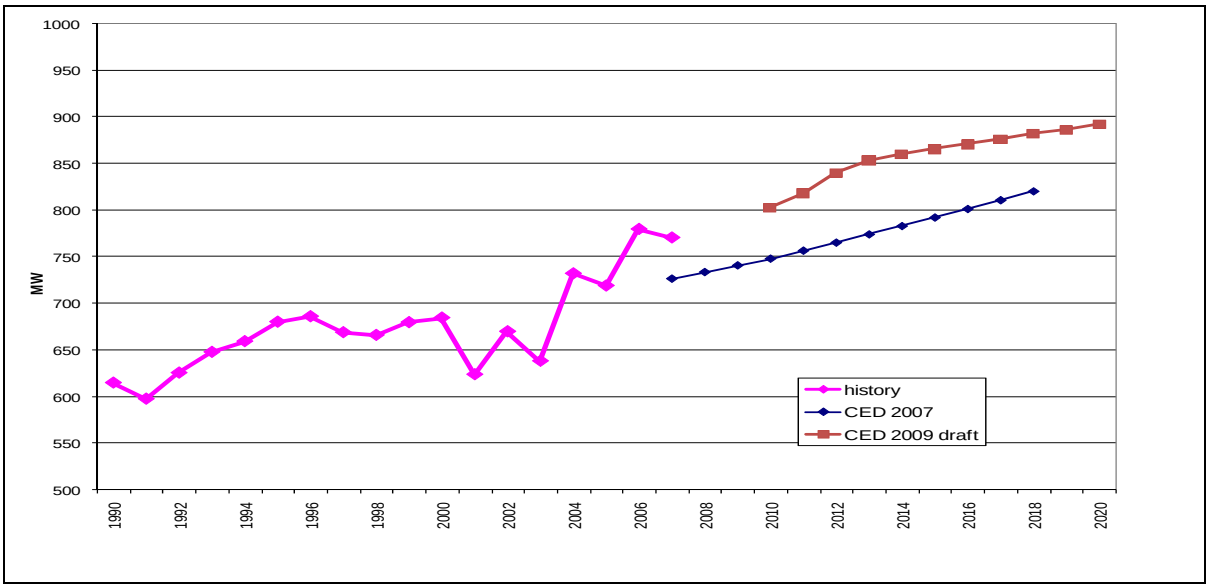
Figure 2-23: PG&E Planning Area Agriculture & Water Pumping Sector Electricity Forecasts



Source: California Energy Commission, 2009

Figure 2-24 provides a comparison between the two forecasts of the combined peak for these sectors. The *CED 2009* forecast is higher over the entire forecast period than the *CED 2007* due to a higher assumed starting point. However, the growth rate of the *CED 2009* forecast is lower than that of the *CED 2007* forecast toward the end of the forecast period.

Figure 2-24: PG&E Planning Area Other Sector Peak

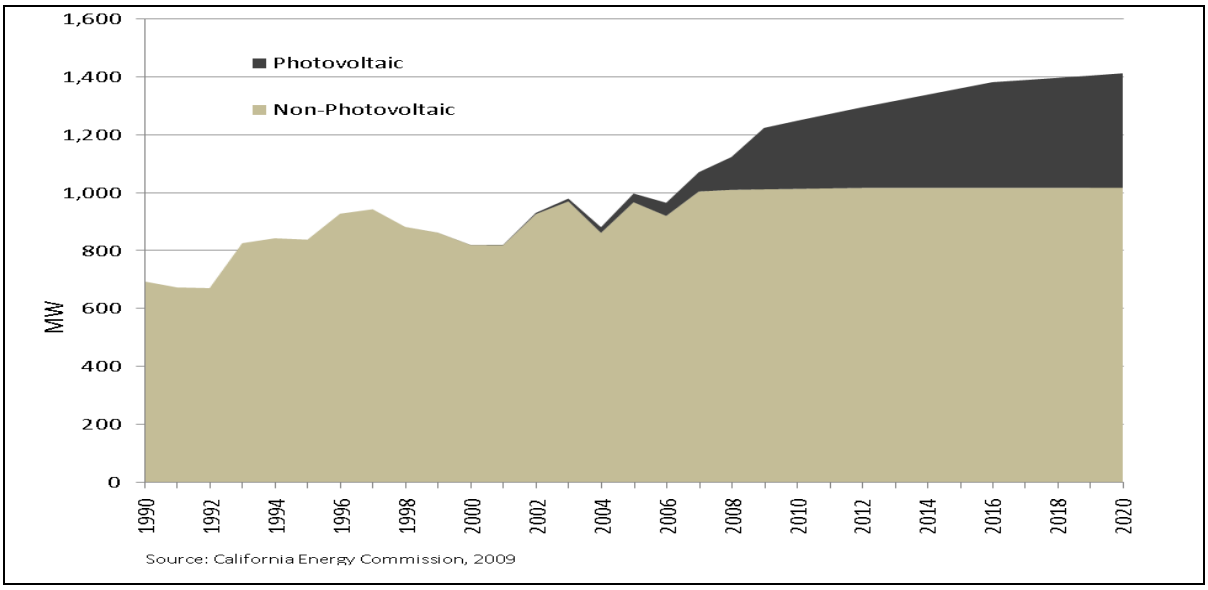


Source: California Energy Commission, 2009

Self-Generation

The peak demand forecast is reduced by self-generation, including the effects of SGIP, CSI, and other programs, as discussed in Chapter 1. The effects of these programs are forecast based on recent trends in installations. **Figure 2-25** shows the staff draft forecast of peak impacts from photovoltaic and non-photovoltaic self-generation. Based on current trends, staff projects about 400 MW of peak reduction from photovoltaic systems by 2020.

Figure 2-25: PG&E Planning Area Self Generation Peak Forecasts



Conservation/Efficiency Impacts

Staff spent a great deal of time refining methods to account for energy efficiency and conservation impacts while preparing this forecast, particularly for utility efficiency programs. **Tables 2-2** and **2-3** show electricity consumption and peak savings estimates for selected years, for building and appliance standards, utility and public agency programs, and "naturally occurring" savings, or savings associated with rate changes and certain market trends not directly related to programs or standards. Savings are measured against a baseline before 1975, so they incorporate more than 30 years of impacts from rate changes and standards. Chapter 8 provides more detail on staff work related to energy efficiency and conservation.

Table 2-2: PG&E Planning Area Electricity Consumption Savings Estimates

	1990	1998	2003	2008	2011	2015	2020
Residential Energy Savings (GWh)							
Building Standards	1010	1830	2354	2689	3002	3463	4079
Appliance Standards	1190	2575	3469	4185	4556	5051	5649
Utility and Public Agency Programs	646	984	997	2298	3646	2912	1152
Naturally Occurring Savings	67	90	106	119	129	513	1901
Total Residential Savings	2912	5479	6925	9291	11334	11939	12781
Commercial Energy Savings (GWh)							
Building Standards	474	806	1290	1730	1949	2280	2707
Appliance Standards	249	571	823	1085	1206	1376	1591
Utility and Public Agency Programs*	168	759	1020	1835	2113	1313	811
Naturally Occurring Savings	6190	6293	9091	6694	7472	7920	8763
Total Commercial Savings	7081	8429	12224	11344	12740	12889	13872
Total Energy Savings	9994	13908	19149	20635	24074	24829	26654

Source: California Energy Commission, 2009

*Commercial programs also include agricultural program savings.

Table 2-3: PG&E Planning Area Electricity Peak Savings Estimates

	1990	1998	2003	2008	2011	2015	2020
Residential Energy Savings (MW)							
Building Standards	240	491	602	759	842	996	1205
Appliance Standards	283	691	888	1181	1277	1452	1669
Utility and Public Agency Programs	154	264	255	648	1022	837	340
Naturally Occurring Savings	16	24	27	34	36	148	562
Total Residential Savings	693	1470	1772	2622	3177	3433	3776
Commercial Energy Savings (MW)							
Building Standards	83	158	249	317	341	398	471
Appliance Standards	44	112	159	199	211	240	277
Utility and Public Agency Programs*	29	149	197	337	370	229	141
Naturally Occurring Savings	1087	1236	1757	1228	1309	1382	1526
Total Commercial Savings	1244	1655	2363	2082	2232	2249	2415
Total Energy Savings	1937	3125	4135	4704	5409	5682	6191

Source: California Energy Commission, 2009

*Commercial programs also include agricultural program savings.

CHAPTER 3: Southern California Edison Planning Area

The Southern California Edison (SCE) planning area includes:

- SCE bundled retail customers.
- Customers served by energy service providers (ESPs) using the SCE distribution system to deliver electricity to end users.
- Customers of the various southern California municipal and irrigation district utilities with the exception of the cities of Los Angeles, Pasadena, Glendale, and Burbank and the Imperial Irrigation District. Also excluded from the SCE planning area are San Diego County and the southern portion of Orange County served by SDG&E.

This chapter is organized as follows. It first presents forecasted consumption and peak loads for the SCE planning area, including both total and per capita values. The *CED 2009* values are compared to the adopted *CED 2007* forecast; differences between the two forecasts are explained. The forecasted load factor, jointly determined by the consumption and peak load estimates, is also discussed. Next, it presents sector consumption and peak load forecasts. The residential, commercial, industrial, and "other" sector forecasts are compared to those in *CED 2007*; again, differences between the two are discussed. Finally, assumptions on prices, self generation and energy efficiency are discussed.

Forecast Results

Table 3-1 compares the *CED 2007* and *CED 2009* forecasts of electricity consumption and peak demand for selected years. The *CED 2009* electricity consumption forecast is 9. 5 percent lower than the *CED 2007* forecast in the short term. This difference grows to over 13 percent by the end of the forecast period for the low-rate scenario and over 14 percent for the high-rate scenario. The lower forecast is caused by much lower short term economic projections in the short term and an increase in the savings assumptions from efficiency programs. The difference in peak forecasts is somewhat less pronounced than the consumption forecast. The *CED 2009* peak forecast is nearly 5 percent lower in the short term than the *CED 2007* forecast. This difference grows to 6.7 percent for the low-rate scenario and 8 percent for the high-rate scenario by the end of the forecast period. The smaller decrease in peak forecast relative to energy forecasts is caused by reductions which are more consumption oriented than peak oriented (for example, residential lighting).

Table 3-1: SCE Planning Area Forecast Comparison

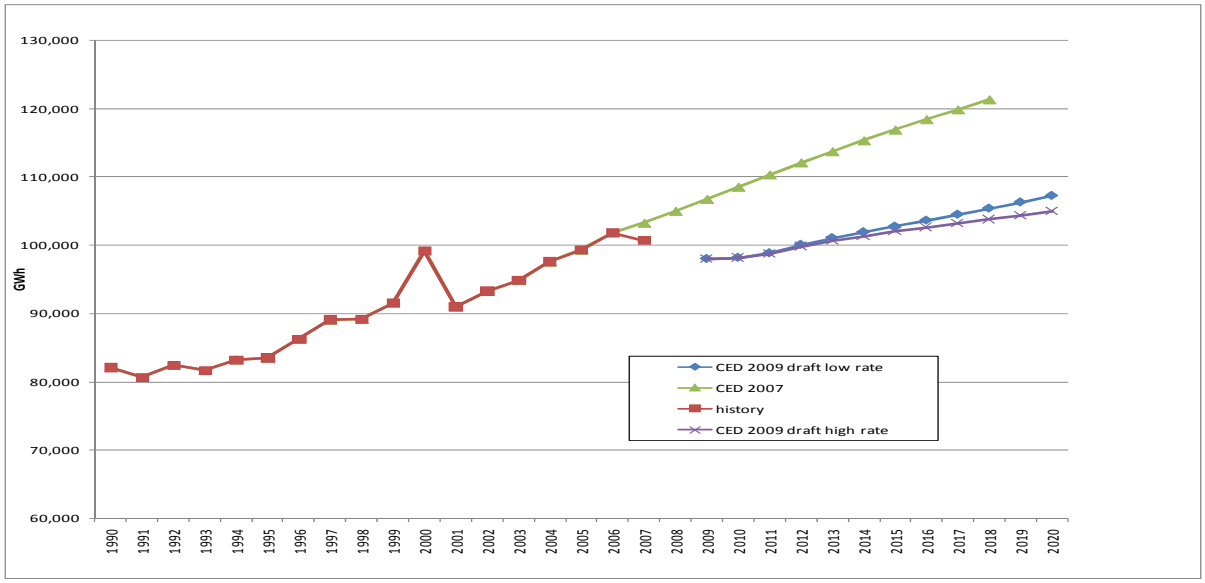
Consumption (GWH)					
	CED 2007	CED 2009 Staff Draft Low Rate	CED 2009 Staff Draft High Rate	Percent Difference Staff Low Rate/CED 2007	Percent Difference Staff High Rate/CED 2007
1990	82,069	82,069	82,069	0.00%	0.00%
2000	99,146	99,146	99,146	0.00%	0.00%
2007	103,214	100,636	100,636	-2.50%	-2.50%
2010	108,503	98,190	98,190	-9.50%	-9.50%
2015	116,872	102,761	102,040	-12.07%	-12.69%
2018	121,298	105,372	103,768	-13.13%	-14.45%
Average Annual Growth Rates					
1990-2000	1.91%	1.91%	1.91%		
2000-2007	0.58%	0.30%	0.30%		
2007-2010	1.68%	-0.82%	-0.82%		
2010-2018	1.40%	0.89%	0.69%		
Peak (MW)					
	CED 2007	CED 2009 Staff Draft Low Rate	CED 2009 Staff Draft High Rate	Percent Difference Staff Low Rate/CED 2007	Percent Difference Staff High Rate/CED 2007
1990	17,635	17,647	17,647	0.07%	0.07%
2000	19,408	19,506	19,506	0.50%	0.50%
2007	22,876	23,111	23,111	1.03%	1.03%
2010	24,082	22,898	22,898	-4.92%	-4.92%
2015	26,013	24,379	24,221	-6.28%	-6.89%
2018	27,112	25,290	24,944	-6.72%	-8.00%
Average Annual Growth Rates					
1990-2000	0.96%	1.01%	1.01%		
2000-2007	3.34%	3.45%	3.45%		
2007-2010	1.73%	-0.31%	-0.31%		
2010-2018	1.49%	1.25%	1.08%		
Historic values are shaded					

Source: California Energy Commission, 2009

As shown in **Figure 3-1**, the *CED 2009* electricity consumption forecast is about 9. 5 percent lower at the beginning of the forecast period (2010) than the *CED 2007* forecast because of the recent economic downturn and an increase in efficiency program savings assumptions.

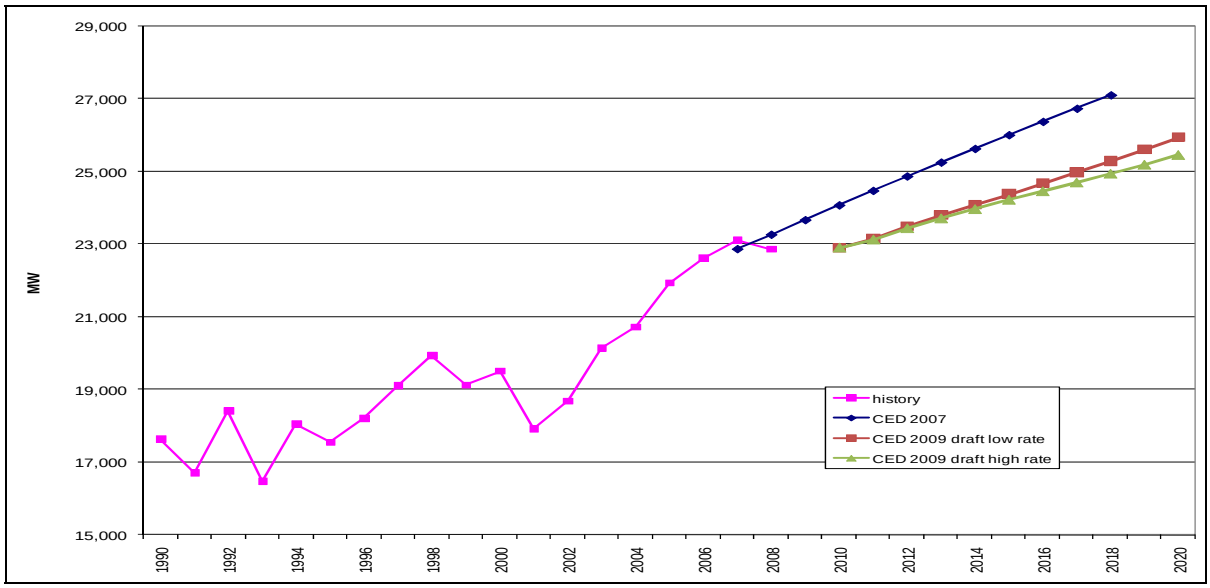
The *CED 2009* SCE planning area peak demand forecast, shown in **Figure 3-2**, is also lower over the entire forecast period compared to the *CED 2007* forecast. This is consistent with the differences seen in the electricity forecasts.

Figure 3-1: SCE Planning Area Electricity Forecast



Source: California Energy Commission, 2009

Figure 3-2: SCE Planning Area Peak

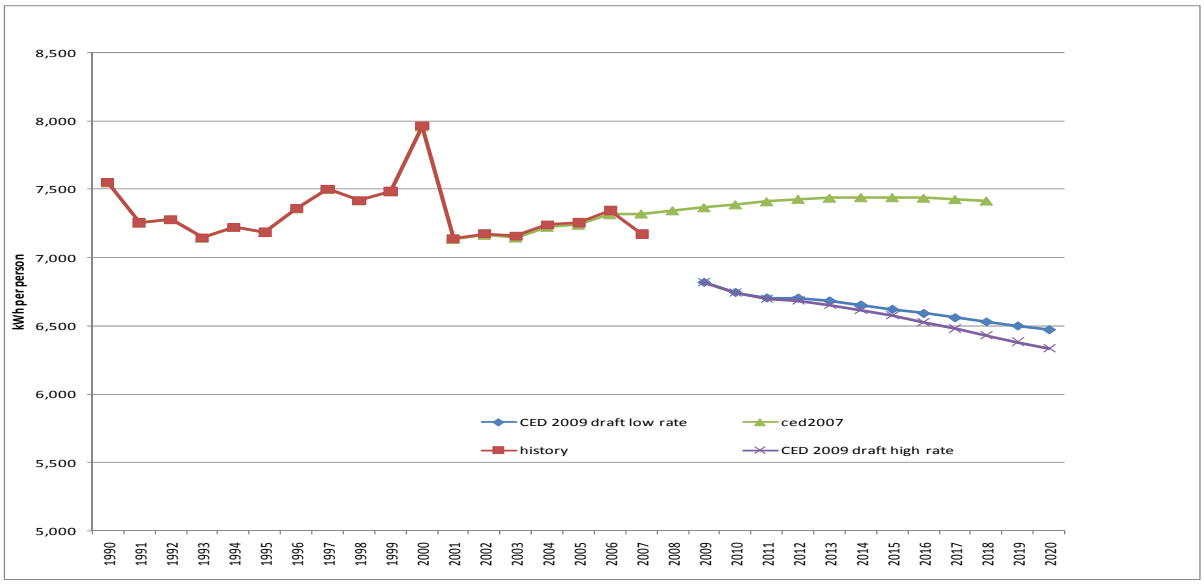


Source: California Energy Commission, 2009

As **Figure 3-3** shows, per capita electricity consumption is lower in the *CED 2009* forecast throughout the entire period than in the *CED 2007* forecast. Per capita consumption in the *CED 2009* forecast starts from a lower value in 2009 and declines over the forecast period for both the high- and low-rate scenarios. Both of the *CED 2009* values remain below levels of per capita electricity consumption witnessed in recent history.

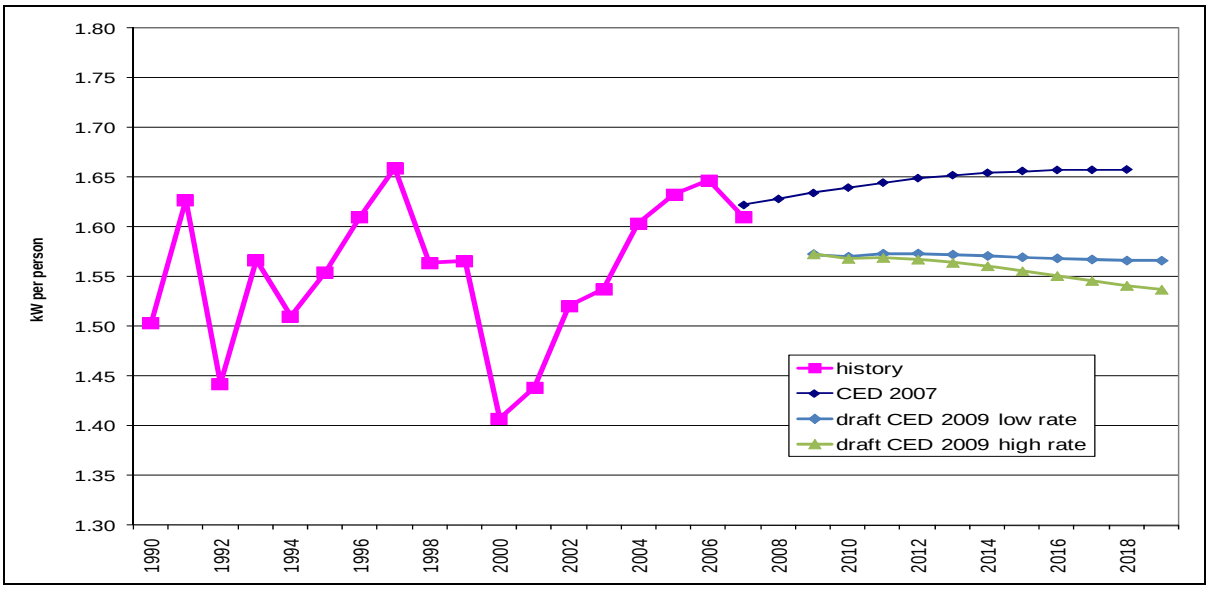
Figure 3-4 compares per capita peak demand. Both *CED 2009* forecast scenarios are also lower than the *CED 2007* forecast. In contrast to the electricity consumption values the per capita peak values still remain in the range of recent historic occurrences.

Figure 3-3: SCE Planning Area per Capita Electricity Consumption



Source: California Energy Commission, 2009

Figure 3-4: SCE Planning Area per Capita Peak Demand

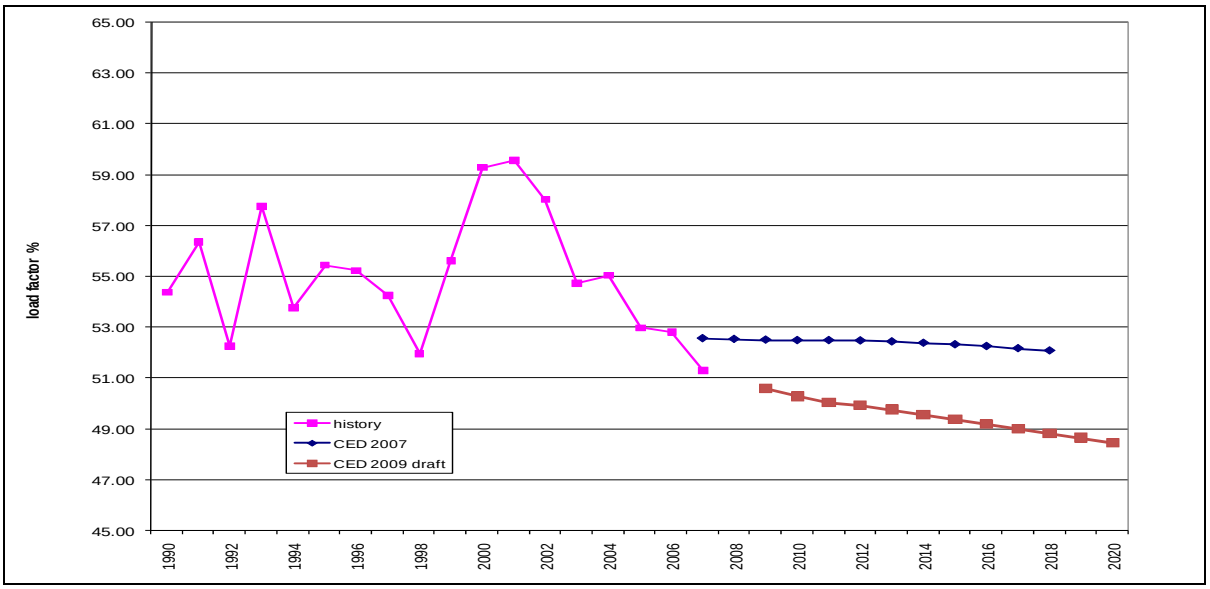


Source: California Energy Commission, 2009

Figure 3-5 compares the load factors for the *CED 2009* and *CED 2007* forecasts. The load factor is a measure of the relative increase in peak demand with respect to annual electricity consumption. Lower load factors indicate a sharper needle peak, and higher load factors indicate a more stable load. Historic variation in load factors is caused in part by variation in annual weather patterns. In southern California, recent peak temperatures before 2006 were lower than the 57-year median value, resulting in higher-than-expected load factors. The 2006 load factor is low because of the higher-than-normal peak conditions experienced last summer. The *CED 2009* projected load factors are on the low end of the range of recent values.

Over the forecast period, the *CED 2009* load factor declines slightly, which is consistent with higher weather-sensitive load growth in relation to baseload energy growth. Consumption in the SCE planning area is shifting toward residential and commercial sectors and away from the industrial sectors. Growth is also increasingly taking place in hotter inland areas leading to greater saturation of central air conditioning and greater use of air conditioning equipment compared to earlier concentrations in cooler coastal areas. Additionally, air conditioning loads are increasing along the coast as more households install air conditioning units for the few days they may be needed each year.

Figure 3-5: SCE Planning Area Load Factor



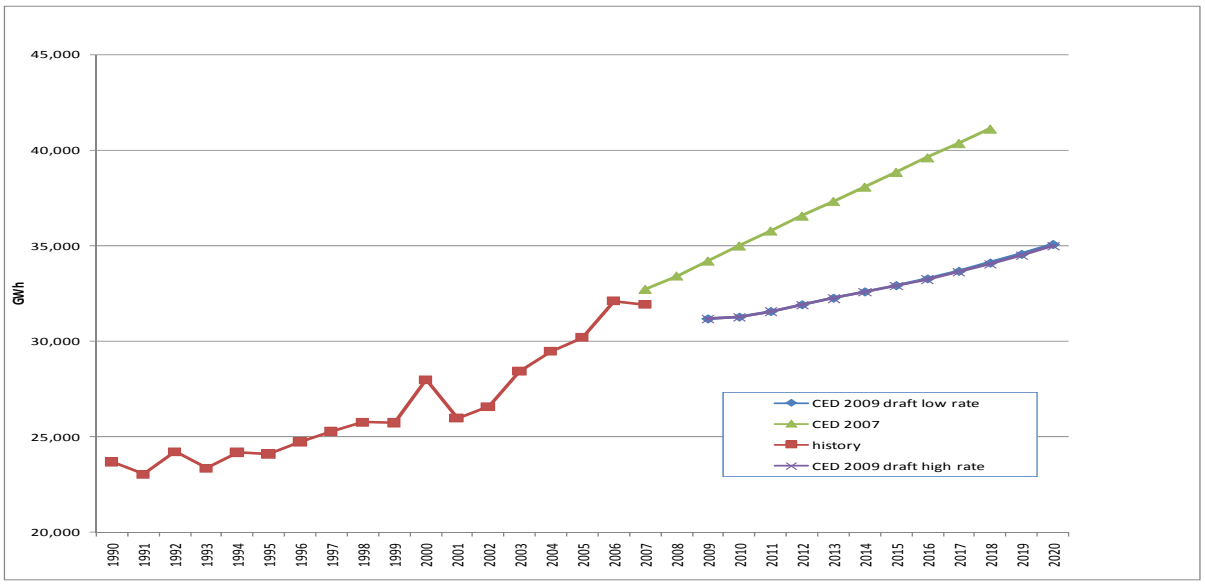
Source: California Energy Commission, 2009

Sector Level Results and Input Assumptions

Residential

Figure 3-6 compares the *CED 2009* and *CED 2007* SCE planning area residential forecasts. Both *CED 2009* forecast scenarios are lower throughout the entire forecast period. This is caused by revised economic and demographic projections and reductions in future use from residential lighting efficiency programs.

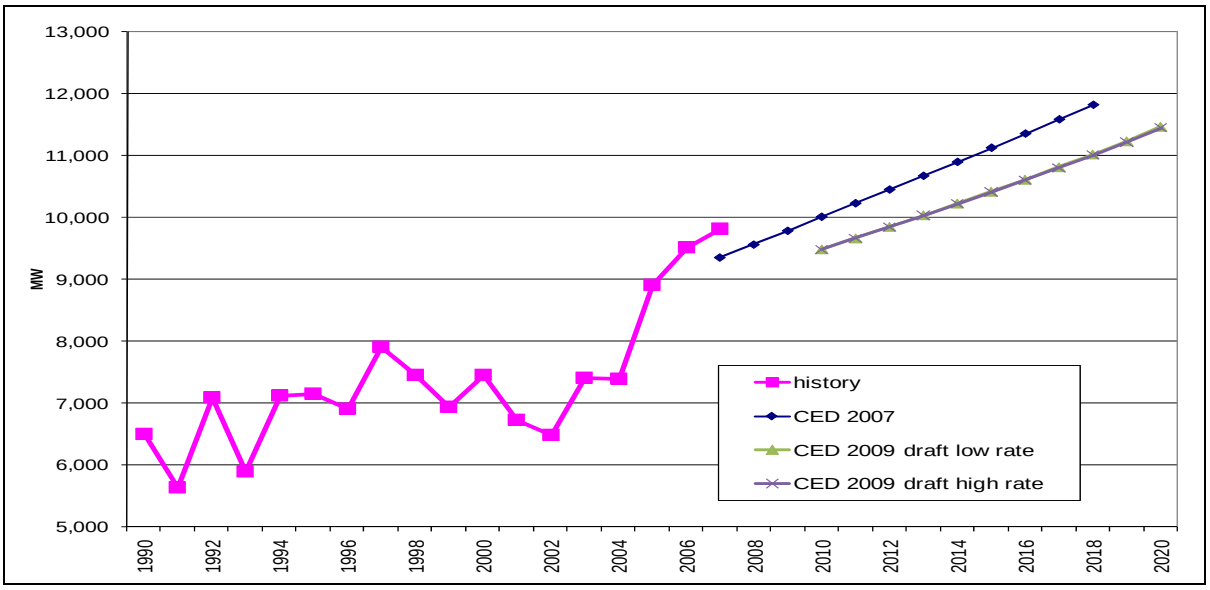
Figure 3-6: SCE Planning Area Residential Consumption



Source: California Energy Commission, 2009

Figure 3-7 compares the *CED 2009* and *CED 2007* residential peak demand forecasts. As is the case for residential consumption, the *CED 2009* residential peak forecast is lower throughout the forecast period than *CED 2007*. The difference between the two peak forecasts is driven primarily by the difference in electricity consumption forecasts.

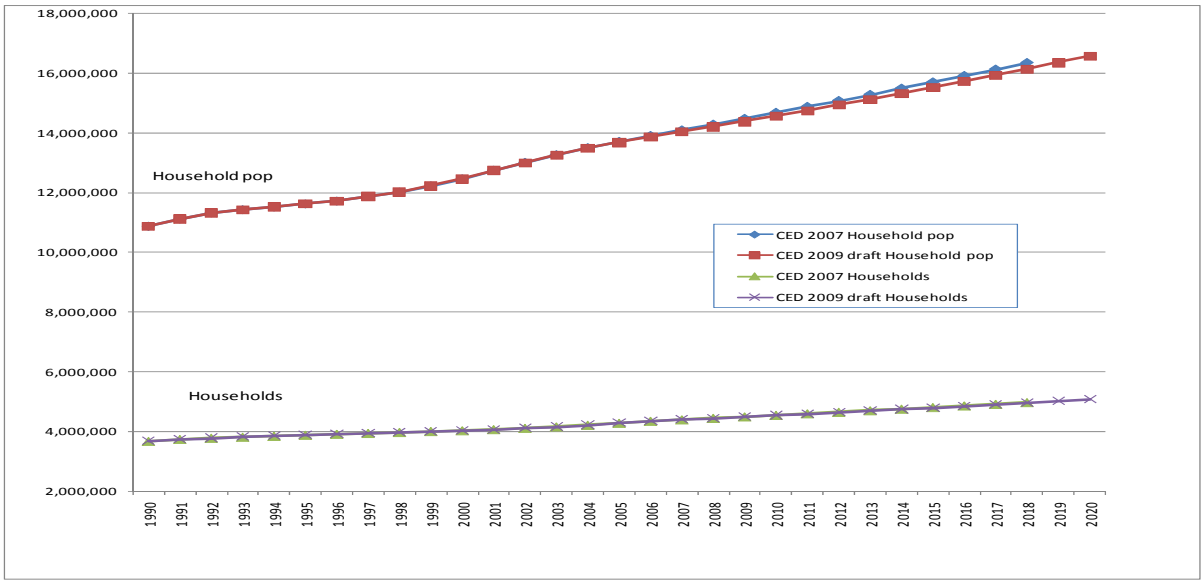
Figure 3-7: SCE Planning Area Residential Peak



Source: California Energy Commission, 2009

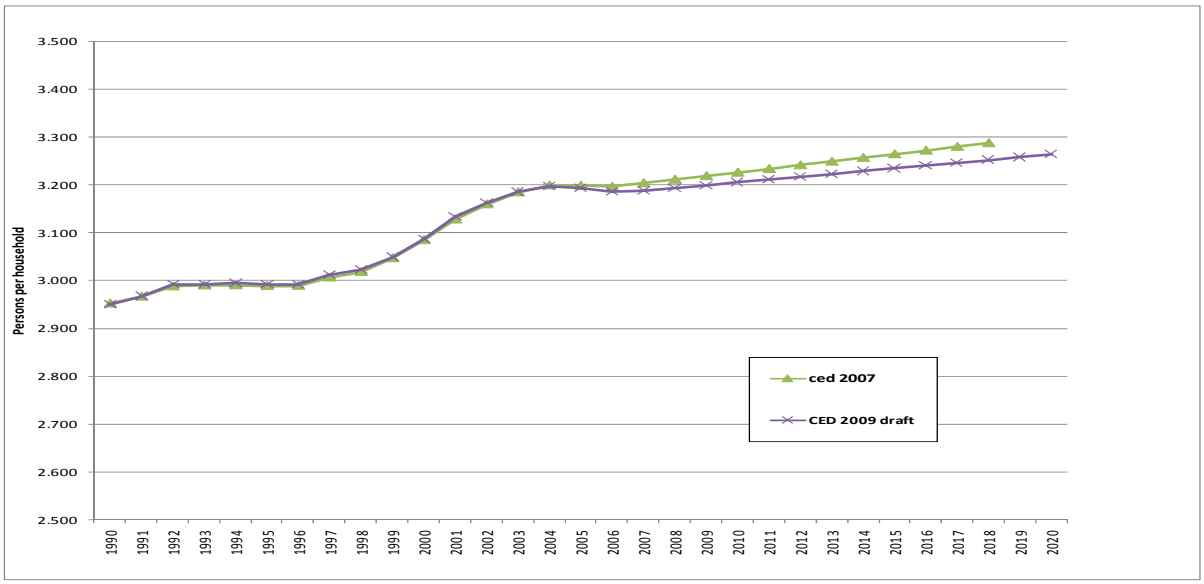
Figures 3-8, 3-9 and **3-10** compare the residential drivers used in the *CED 2009* forecast with the *CED 2007* values. **Figure 3-8** provides comparisons of total population and total household projections. The *CED 2009* forecast of total population is slightly lower as it is based on a revised split of the Los Angeles county population into component planning areas. In addition, incorporation of updated historic estimates leads to a slight downward revision in projected persons per household (**Figure 3-10**). The *CED 2009* persons per household projections incorporate annual Department of Finance E-5A interim updates to county population and household estimates through 2007. The interim estimates indicate that the average number of persons per household in the SCE region has increased at a slightly slower rate than was projected in the *CED 2007* forecast, and this has decreased the current 2007 actual estimate of persons per household. The *CED 2009* projected growth in persons per household per year is assumed to be half of the annual 1990-2007 growth. This is a slightly lower growth rate than was used in the *CED 2007* projection. The net result of these changes is a slightly higher household forecast than was used in the *CED 2007* forecast.

Figure 3-8: SCE Planning Area Residential Demographic Projections



Source: California Energy Commission, 2009

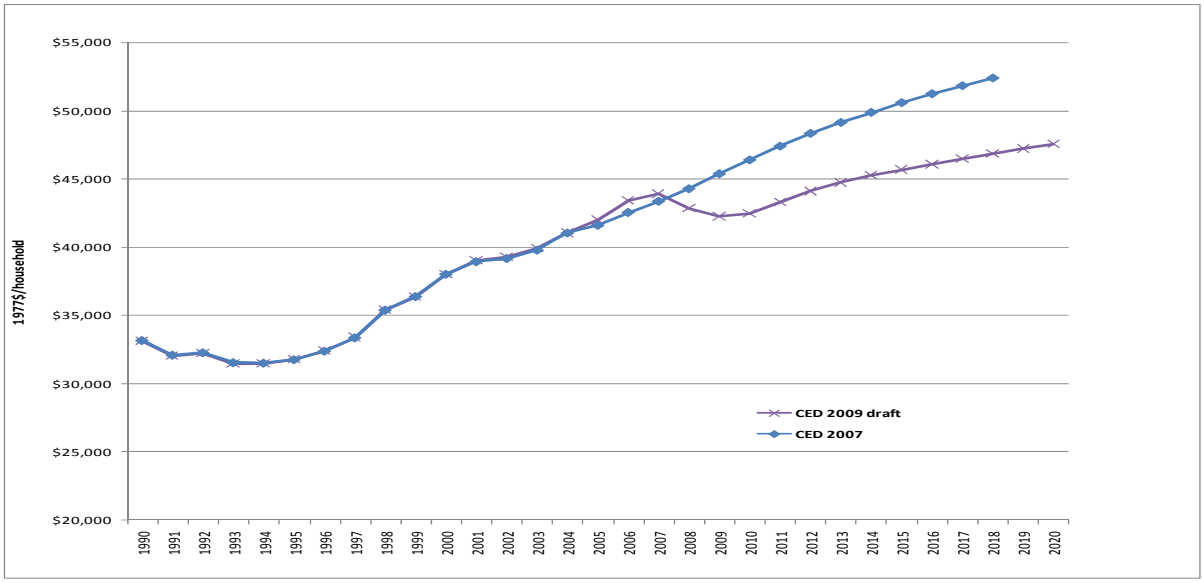
Figure 3-9: SCE Planning Area Persons per Household Projections



Source: California Energy Commission, 2009

Figure 3-10 compares household income between the two forecasts. Household income is derived as the product of per capita income and persons per household. The *CED 2009* projection drops significantly in the near term and then increases at a slower rate than the previous forecast. The lower household income growth serves to reduce forecasted residential consumption over the forecast period.

Figure 3-10: SCE Planning Area Household Income Projections

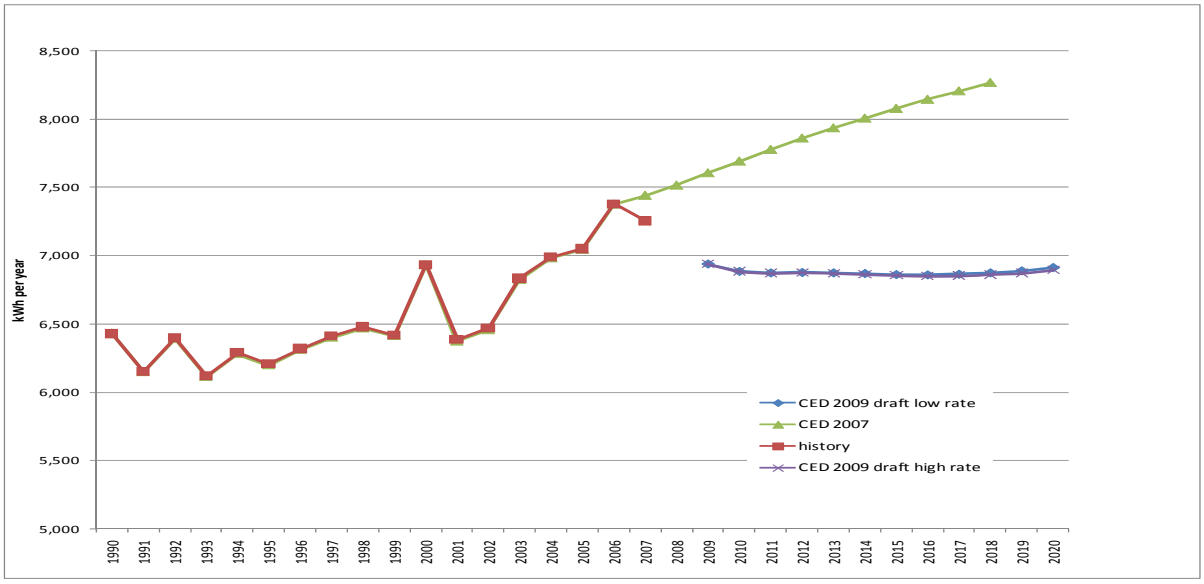


Source: California Energy Commission, 2009

Figure 3-11 is a comparison of annual electricity use per household, and **Figure 3-12** is a comparison of peak demand per household. The *CED 2009* forecast of annual electricity use per household is significantly lower than that projected in *CED 2007*. This is primarily due to lower short-term household income growth projections and incorporation of savings from lighting programs in the *CED 2009* forecast. The new projection of annual residential use per household is projected to remain relatively constant over the forecast period compared to the continued increase seen in the *CED 2007* forecast.

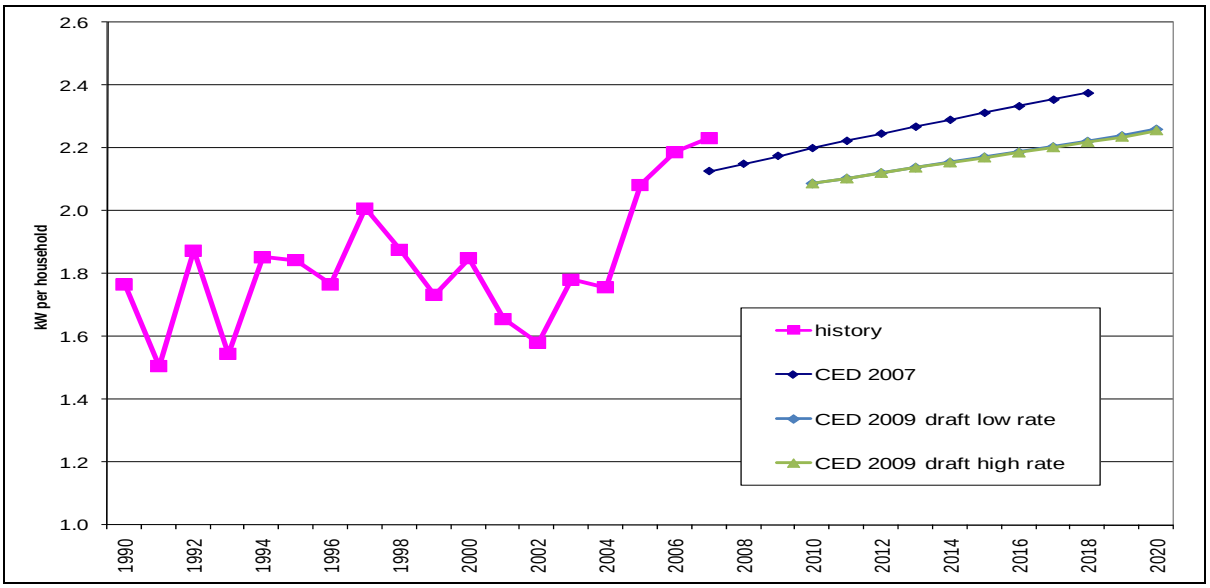
CED 2009 peak use per household, presented in **Figure 3-12**, is also lower than what was projected in *CED 2007*. This is in part driven by the short-term difference in energy forecasts. The mid- to-long term growth in peak is similar to the *CED 2007* forecast because much of the annual electricity savings does not directly translate into peak savings.

Figure 3-11: SCE Planning Area Use per Household



Source: California Energy Commission, 2009

Figure 3-12: SCE Planning Area Peak Use per Household

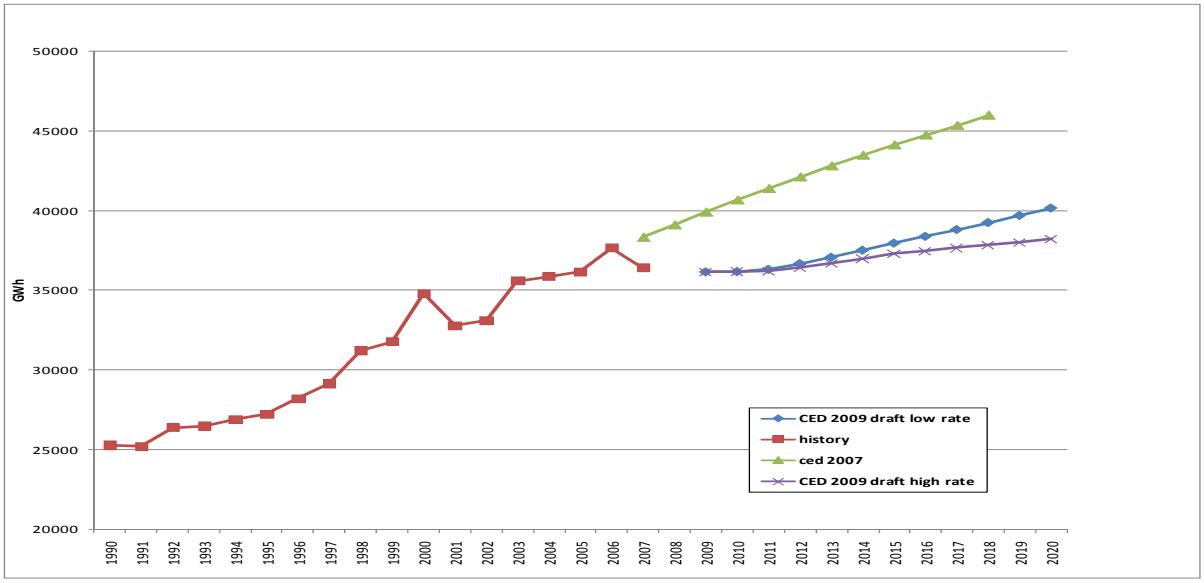


Source: California Energy Commission, 2009

Commercial Building Sector

Figure 3-13 compares the commercial building sector forecasts. The *CED 2009* forecast is lower throughout the entire forecast period. The *CED 2009* forecast's starting value is lower than that projected in *CED 2007*, because of a drop in recent historic values. The *CED 2009* forecast also grows at a slower rate in both scenarios than the *CED 2007* forecast as a result of lower economic and demographic projections. This is caused mainly by revisions in the estimation of commercial square footage in the SCE planning area

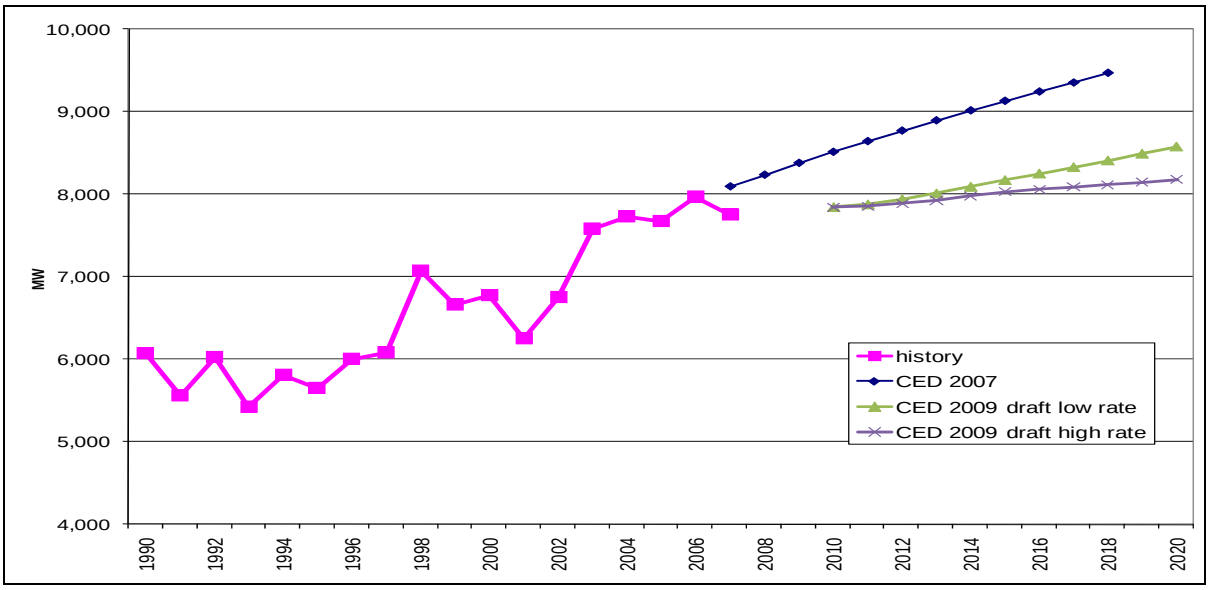
Figure 3-13: SCE Planning Area Commercial Consumption



Source: California Energy Commission, 2009

Figure 3-14 compares the commercial peak demand forecasts. Growth in the commercial peak demand forecasts is driven primarily by the underlying electricity consumption forecasts. Therefore, the consumption and peak forecasts exhibit the same patterns.

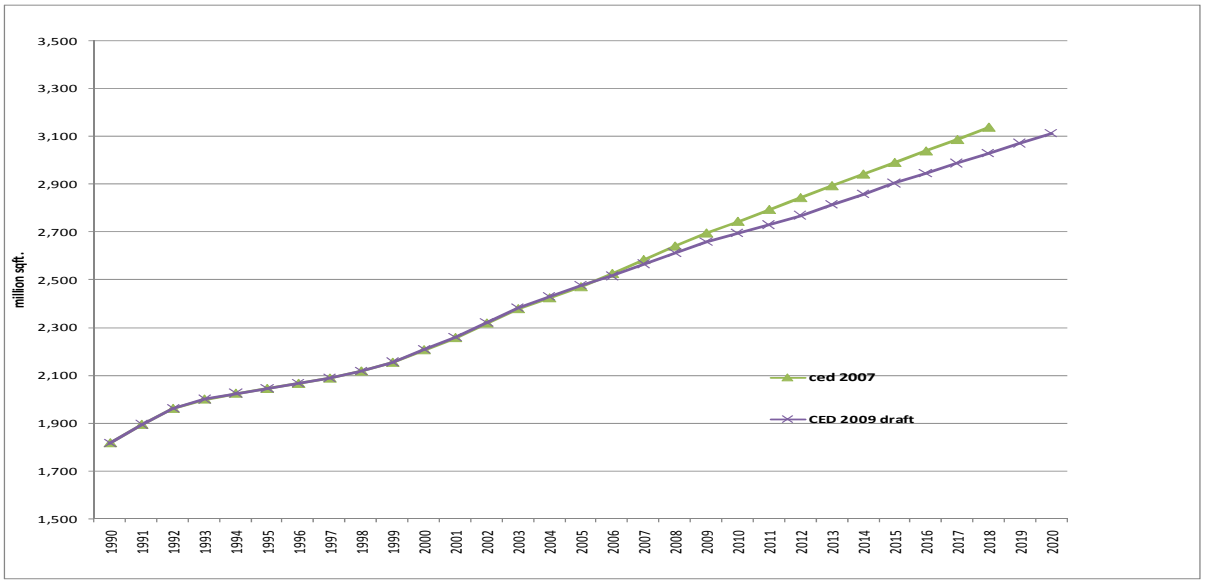
Figure 3-14: SCE Planning Area Commercial Sector Peak



Source: California Energy Commission, 2009

In staff's commercial building sector forecasting model, floor space by building type (that is, retail, schools, offices, etc.) is the key driver of energy use for each specific building type. **Figure 3-15** compares total commercial floor space projections. The lower the *CED 2009* floor space projections compared to the *CED 2007* floor space estimates is caused by lower economic drivers used in the floor space model.

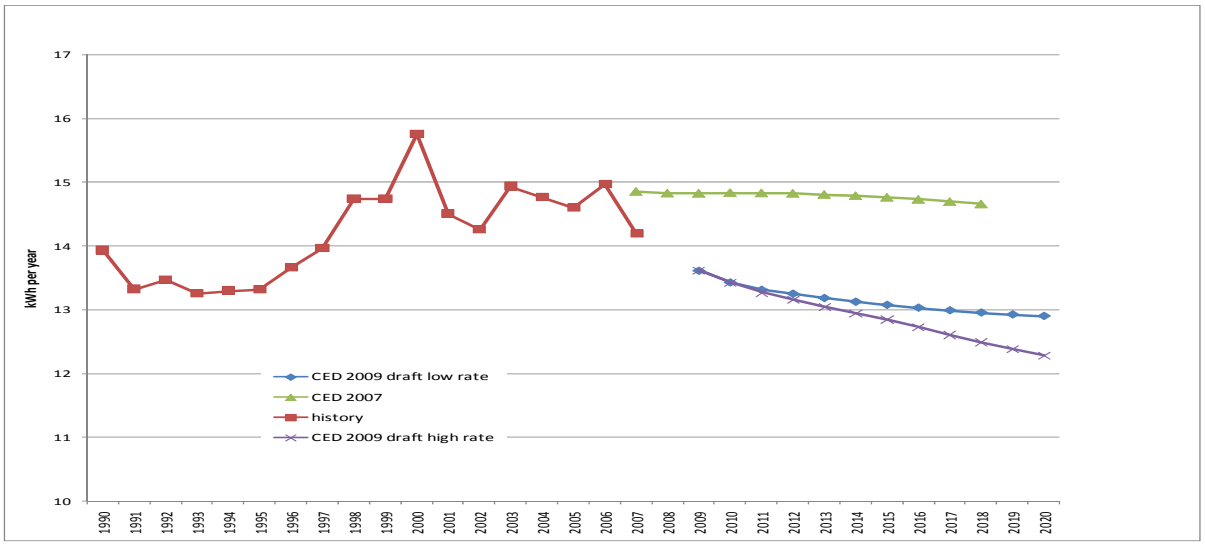
Figure 3-15: SCE Planning Area Commercial Floor Space



Source: California Energy Commission, 2009

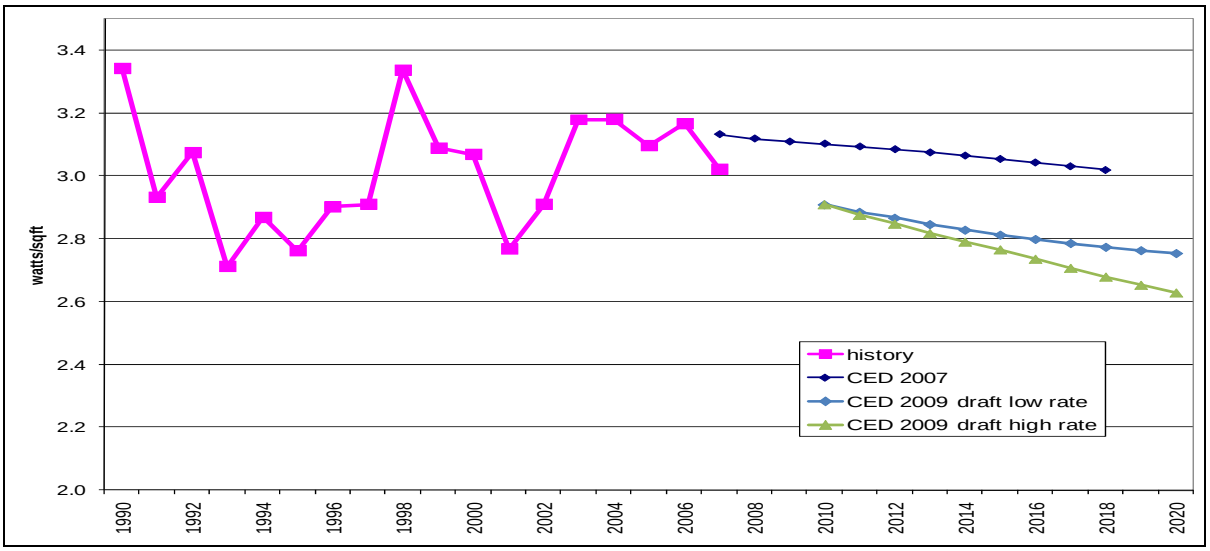
Figures 3-16 and **3-17** show historic and projected commercial sector annual and peak use per square foot, respectively. Annual use per square foot (**Figure 3-15**) starts at a lower value and declines over the forecast period at a faster rate in the *CED 2009* than in the *CED 2007* forecast for both rate scenarios. This is caused by the recent economic conditions as well as an increase in efficiency program savings. The same is true for commercial peak use, as shown in **Figure 3-16**. The lower starting values, in both instances, result from revised estimates of historic use.

Figure 3-16: SCE Planning Area Commercial kWh per Square Foot



Source: California Energy Commission, 2009

Figure 3-17: SCE Planning Area Commercial Peak watts per Square Foot

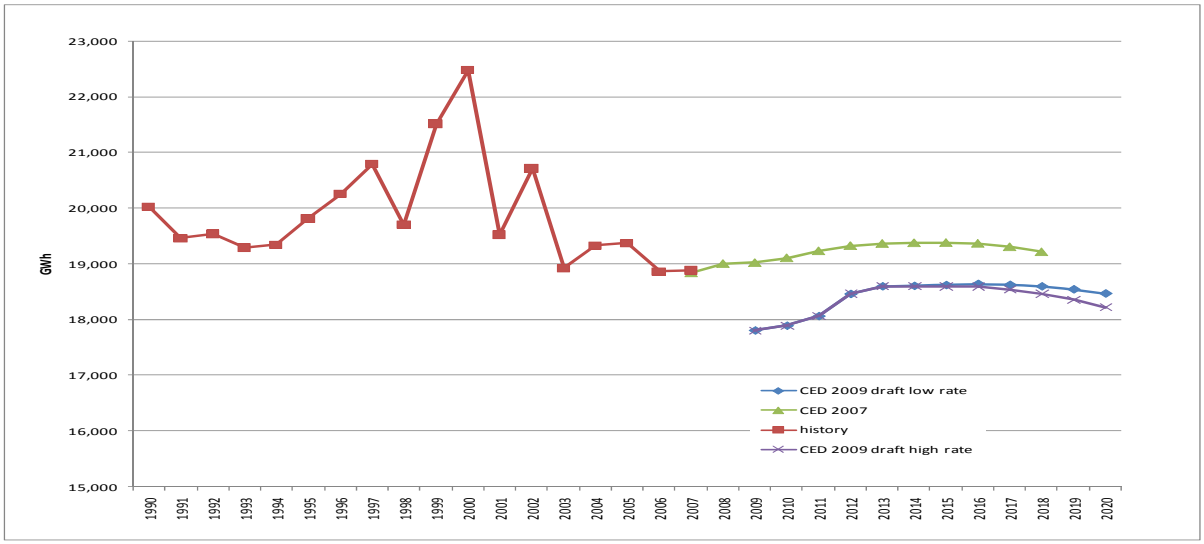


Source: California Energy Commission, 2009

Industrial Sector

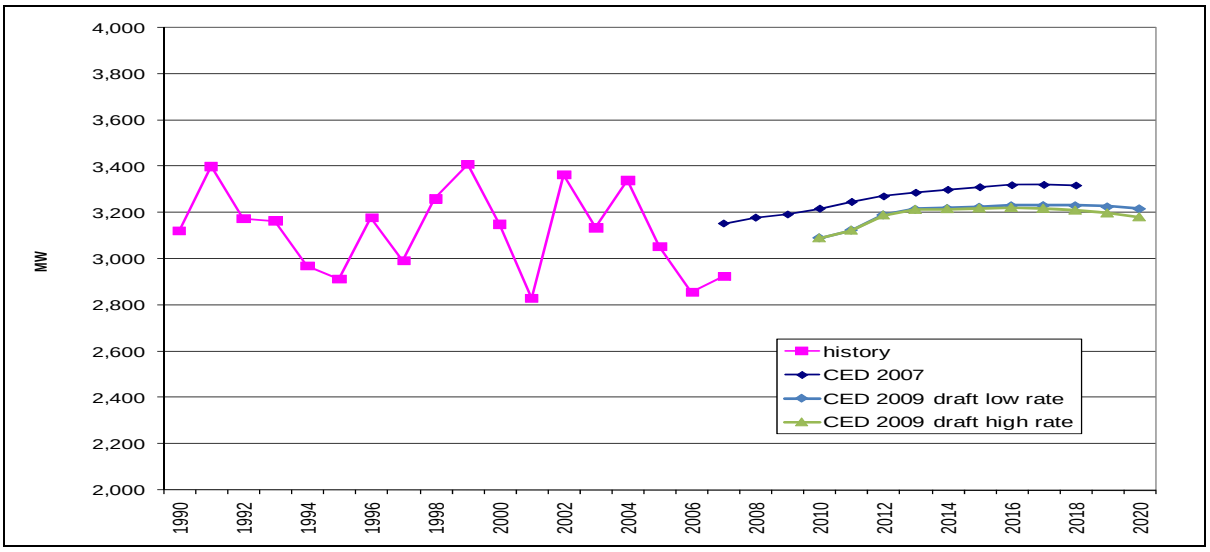
Figure 3-18 provides comparisons of the forecasts' industrial sector electricity consumption for the SCE planning area. The *CED 2009* forecast starts from a lower point than the *CED 2007* forecast and remains below the *CED 2007* forecast level throughout the forecast period. This is a result of the current economic projections used to drive the industrial forecast. **Figure 3-19** compares the industrial sector peak forecasts. Re-estimation of the industrial sector peak causes the *CED 2009* industrial sector peak to start at a lower value. Forecasted growth patterns are similar to those seen in the electricity consumption case.

Figure 3-18: SCE Planning Area Industrial Consumption



Source: California Energy Commission, 2009

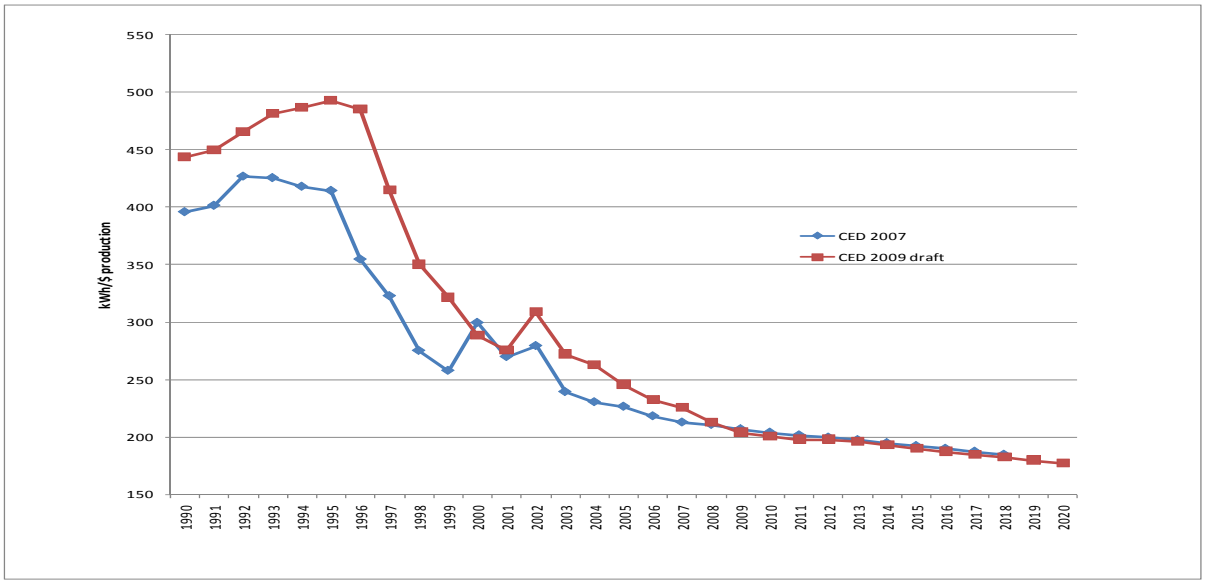
Figure 3-19: SCE Planning Area Industrial Sector Peak



Source: California Energy Commission, 2009

Figure 3-20 compares electricity use per dollar of industrial production value between the *CED 2009* and *CED 2007* forecasts. The *CED 2009* forecast is essentially the same in terms of kWh per dollar of production for the forecast period as that used in the *CED 2007* forecast.

Figure 3-20: SCE Planning Area Industrial Use per Production Unit

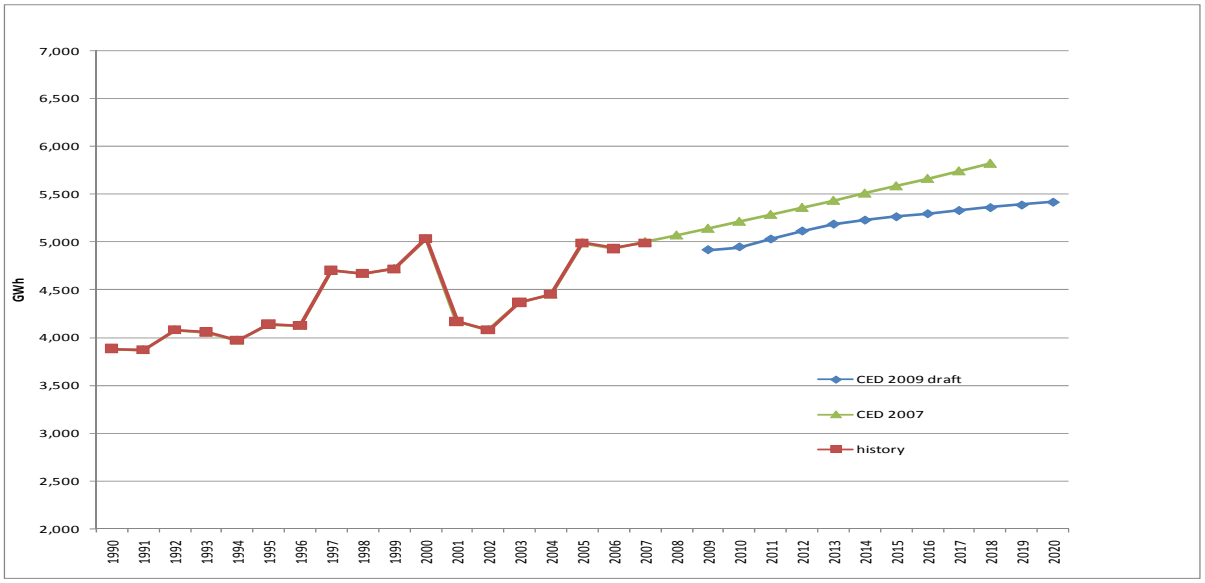


Source: California Energy Commission, 2009

Other Sectors

Figure 3-21 compares the electricity consumption forecasts for the transportation, communication, and utilities sector. The *CED 2009* transportation, communication, and utilities forecast is lower than the *CED 2007* forecast because of the revised economic and demographic drivers. The difference in growth rates of the two forecasts reflects the difference in economic projections.

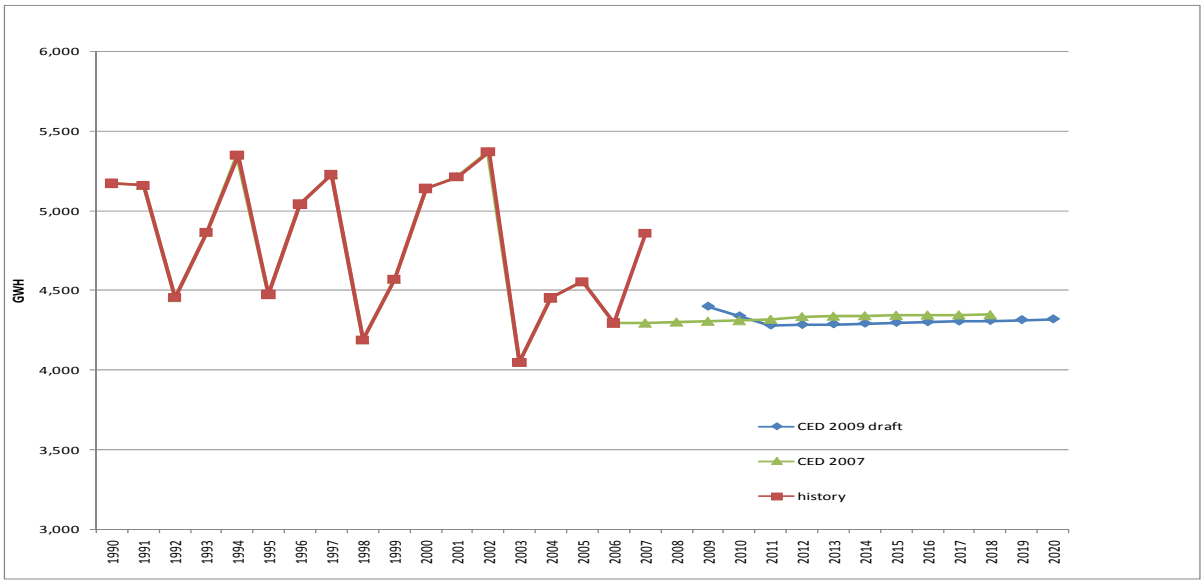
Figure 3-21: SCE Planning Area Transportation, Communication, and Utilities Sector Electricity Forecasts



Source: California Energy Commission, 2009

Figure 3-22 compares the electricity consumption forecasts for the agriculture and water pumping. The *CED 2009* agriculture and water pumping forecast is higher in the short than the *CED 2007* forecast because of a higher starting point. The *CED 2009* forecast then declines to a slightly lower level than the previous forecast because of lower economic and demographic projections.

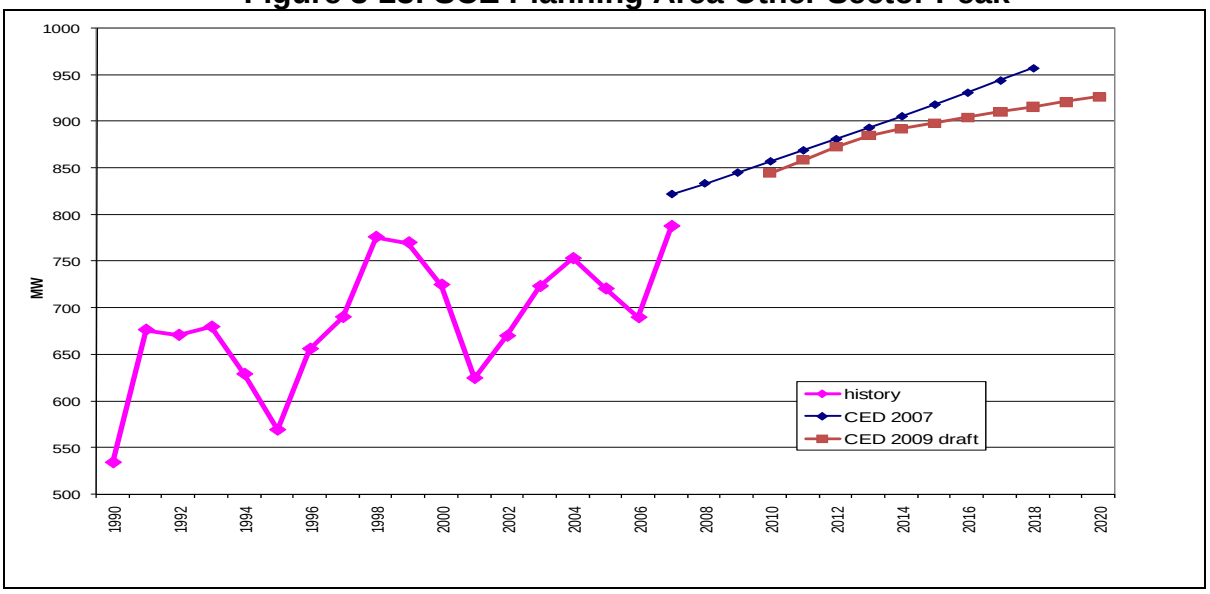
Figure 3-22: SCE Planning Area Agriculture & Water Pumping Sector Forecast



Source: California Energy Commission, 2009

Figure 3-23 compares the combined peak for these sectors between the two forecasts. The *CED 2009* peak forecast is somewhat lower than the *CED 2007*, reflecting the difference in electricity consumption forecasts.

Figure 3-23: SCE Planning Area Other Sector Peak

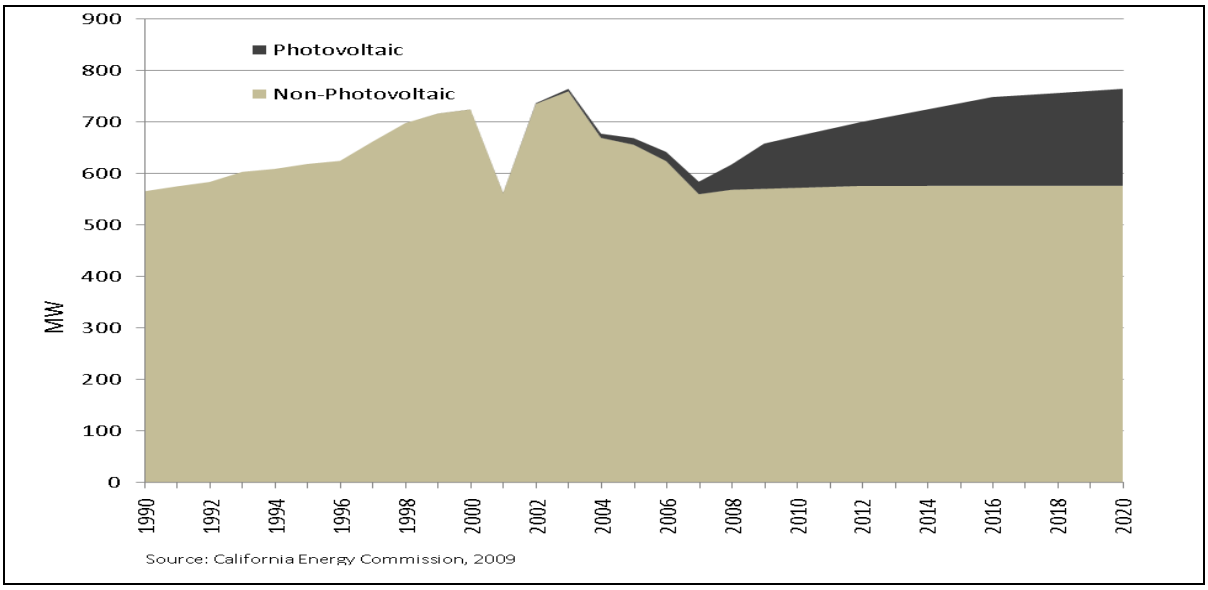


Source: California Energy Commission, 2009

Self-Generation

The peak demand forecast is reduced by self generation, including the effects of the SGIP, CSI, and other programs, as discussed in Chapter 1. The effects of these programs are forecast based on recent trends in installations. **Figure 3-24** shows the staff draft forecast of peak impacts from photovoltaic and non-photovoltaic self generation. Based on current trends, staff projects about 190 MW of peak reduction from photovoltaic systems by 2020.

Figure 3-24: SCE Planning Area Self Generation Peak Forecasts



Conservation/Efficiency Impacts

Staff spent a great deal of time refining methods to account for energy efficiency and conservation impacts while preparing this forecast, particularly for utility efficiency programs. **Tables 3-2** and **3-3** show electricity consumption and peak savings estimates for selected years, for building and appliance standards, utility and public agency programs, and "naturally occurring" savings, or savings associated with rate changes and certain market trends not directly related to programs or standards. Savings are measured against a baseline before 1975, so they incorporate more than 30 years of impacts from rate changes and standards. Chapter 8 provides much more detail on staff work related to energy efficiency and conservation.

Table 3-2: SCE Planning Area Electricity Consumption Savings Estimates

	1990	1998	2003	2008	2011	2015	2020
Residential Energy Savings (GWh)							
Building Standards	1147	1420	1591	1817	2051	2370	2786
Appliance Standards	1223	2318	3033	3699	4044	4470	4969
Utility and Public Agency Programs	176	207	577	2558	3480	2767	1047
Naturally Occurring Savings	9	15	20	26	31	561	1950
Total Residential Savings	2556	3961	5221	8100	9606	10168	10752
Commercial Energy Savings (GWh)							
Building Standards	515	1099	1638	2319	2631	3225	3989
Appliance Standards	348	776	1096	1477	1628	1889	2222
Utility and Public Agency Programs*	89	581	888	1077	1736	1439	1105
Naturally Occurring Savings	2647	1645	3676	2879	4293	4788	5821
Total Commercial Savings	3600	4101	7298	7752	10288	11341	13138
Total Energy Savings	6156	8061	12519	15852	19894	21508	23890

Source: California Energy Commission, 2009

*Commercial programs also include agricultural program savings.

Table 3-3: SCE Planning Area Electricity Peak Savings Estimates

	1990	1998	2003	2008	2011	2015	2020
Residential Energy Savings (MW)							
Building Standards	315	411	415	521	620	741	900
Appliance Standards	336	672	791	1061	1222	1397	1605
Utility and Public Agency Programs	48	60	151	734	1052	865	338
Naturally Occurring Savings	3	4	5	7	9	175	630
Total Residential Savings	702	1147	1361	2323	2904	3178	3472
Commercial Energy Savings (MW)							
Building Standards	124	249	349	480	550	669	821
Appliance Standards	84	176	233	306	340	392	458
Utility and Public Agency Programs*	21	132	189	223	363	299	228
Naturally Occurring Savings	635	372	783	596	897	993	1199
Total Commercial Savings	864	929	1554	1606	2150	2353	2705
Total Energy Savings	1566	2076	2915	3928	5054	5531	6178

Source: California Energy Commission, 2009

*Commercial programs also include agricultural program savings.

CHAPTER 4: San Diego Gas & Electric Planning Area

The San Diego Gas & Electric (SDG&E) planning area includes SDG&E bundled retail customers and customers served by various energy service providers (ESPs) using the SDG&E distribution system to deliver electricity to end users.

This chapter is organized the same as Chapters 2 and 3. First, forecasts of total and per capita consumption and peak loads for the planning area are presented. For perspective, *CED 2009* forecast values are compared to those in the *CED 2007* forecast. The forecasted load factor, jointly determined by the consumption and peak load estimates, is also discussed. Then, sector consumption and peak load forecasts are presented and compared to the sector level *CED 2007* forecast values.

CED 2007 assumed constant electricity rates throughout the forecast period. For this forecast, three price scenarios were developed for electricity rates: high rates, low (constant) rates, and a rate scenario in between the two. The high-rate case assumed approximately 30 percent higher rates by 2020 relative to 2010, while the "mid-rate" case assumed 15 percent higher rates over the same period. In the low-rate case, rates remained at 2010 levels through 2020. Chapter 1 provides more details.

Forecast Results

Table 4-1 compares the planning area electricity consumption and peak demand forecasts for selected years. Both the *CED 2009* low and high-rate scenarios are compared to the *CED 2007* forecast. The draft forecast scenarios are lower that the *CED 2007* forecast for both electricity consumption and peak demand over the entire forecast period. This is caused by lower economic assumptions and increased savings from efficiency programs. The decline in the peak forecast is less than the decline in consumption because most of the efficiency programs have a greater impact on overall consumption than peak.

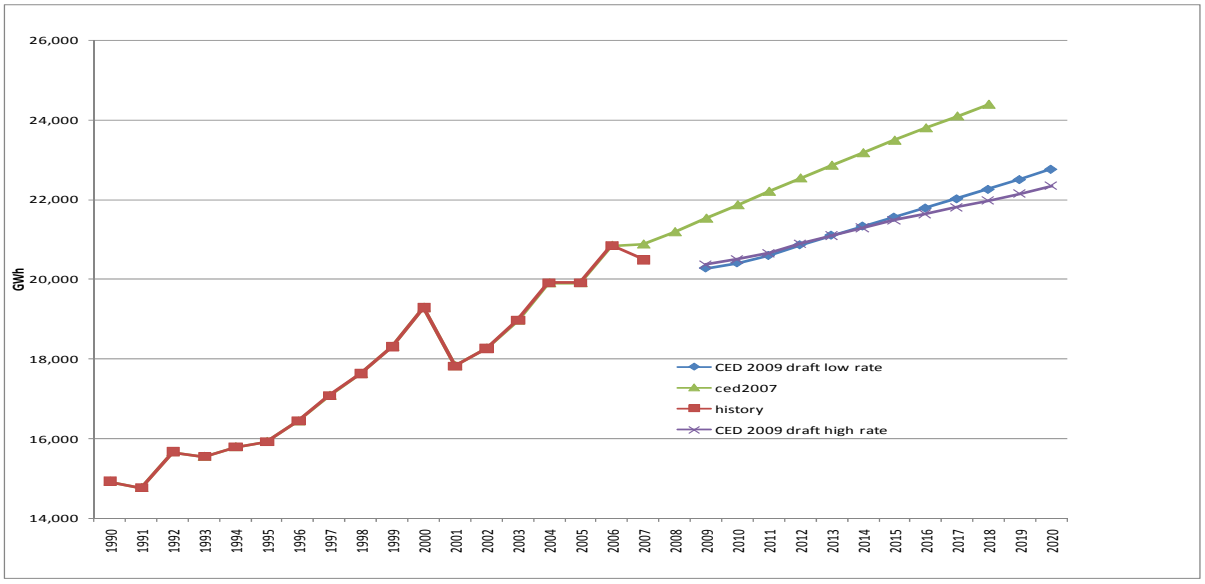
Table 4-1: SDG&E Planning Area Forecast Comparison

Consumption (GWH)					
	CED 2007	CED 2009 Staff Draft Low Rate	CED 2009 Staff Draft High Rate	Percent Difference Staff Low Rate/CED 2007	Percent Difference Staff High Rate/CED 2007
1990	14,926	14,926	14,926	0.00%	0.00%
2000	19,294	19,294	19,294	0.00%	0.00%
2007	21,019	20,493	20,493	-2.50%	-2.50%
2010	21,991	20,502	20,502	-6.77%	-6.77%
2015	23,643	21,660	21,478	-8.39%	-9.15%
2018	24,567	22,364	21,979	-8.97%	-10.54%
Average Annual Growth Rates					
1990-2000	2.60%	2.60%	2.60%		
2000-2007	1.23%	1.21%	1.21%		
2007-2010	1.52%	0.02%	0.02%		
2010-2018	1.39%	1.09%	0.87%		
Peak (MW)					
	CED 2007	CED 2009 Staff Draft Low Rate	CED 2009 Staff Draft High Rate	Percent Difference Staff Low Rate/CED 2007	Percent Difference Staff High Rate/CED 2007
1990	2,961	2,961	2,961	0.00%	0.00%
2000	3,471	3,471	3,471	0.00%	0.00%
2007	4,507	4,664	4,664	3.48%	3.48%
2010	4,714	4,621	4,621	-1.97%	-1.97%
2015	5,023	4,923	4,884	-1.99%	-2.77%
2018	5,247	5,115	5,032	-2.52%	-4.10%
Average Annual Growth Rates					
1990-2000	1.60%	1.60%	1.60%		
2000-2007	5.36%	6.09%	6.09%		
2007-2010	1.51%	-0.31%	-0.31%		
2010-2018	1.35%	1.28%	1.07%		
Historic values are shaded					

Source: California Energy Commission, 2009

As shown in **Figure 4-1**, the *CED 2009* consumption forecast is about over 9 percent lower than the *CED 2007* projection by the end of the forecast horizon for the low-rate scenario and about 11 percent lower for the high-rate scenario. The lower forecasts are caused by lower economic and demographic projections as well as increased assumptions about increased savings from energy efficiency programs.

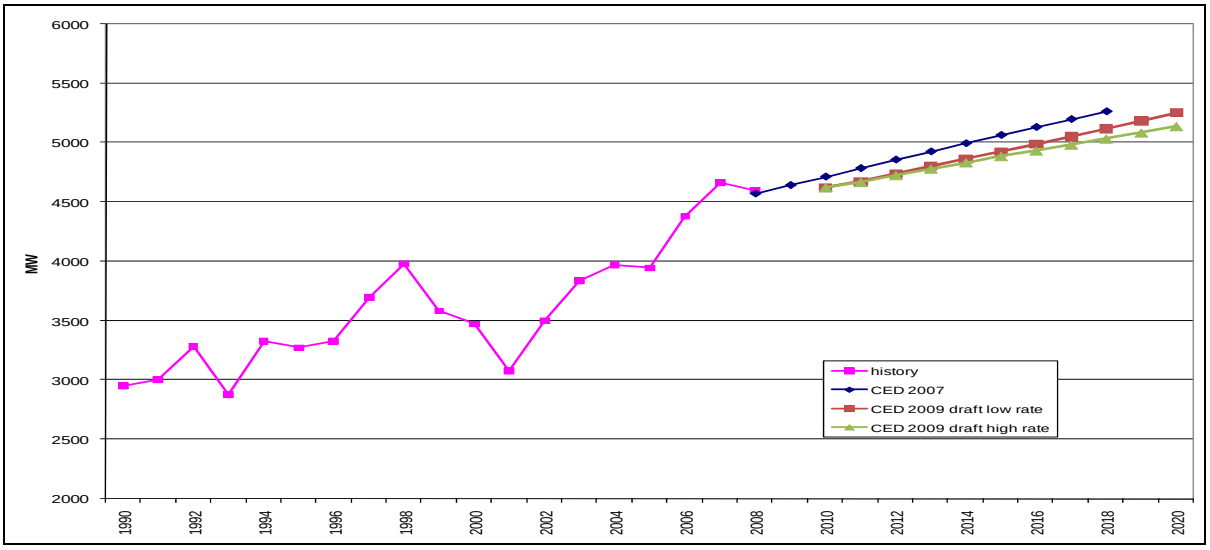
Figure 4-1: SDG&E Planning Area Electricity Forecast



Source: California Energy Commission, 2009

The *CED 2009* SDG&E planning area peak demand forecast is about 2.0 percent lower in the beginning of the forecast period as shown in **Figure 4-2**. . By the end of the forecast period the *CED 2009* forecast is about 2.5 percent lower than the *CED 2007* forecast.

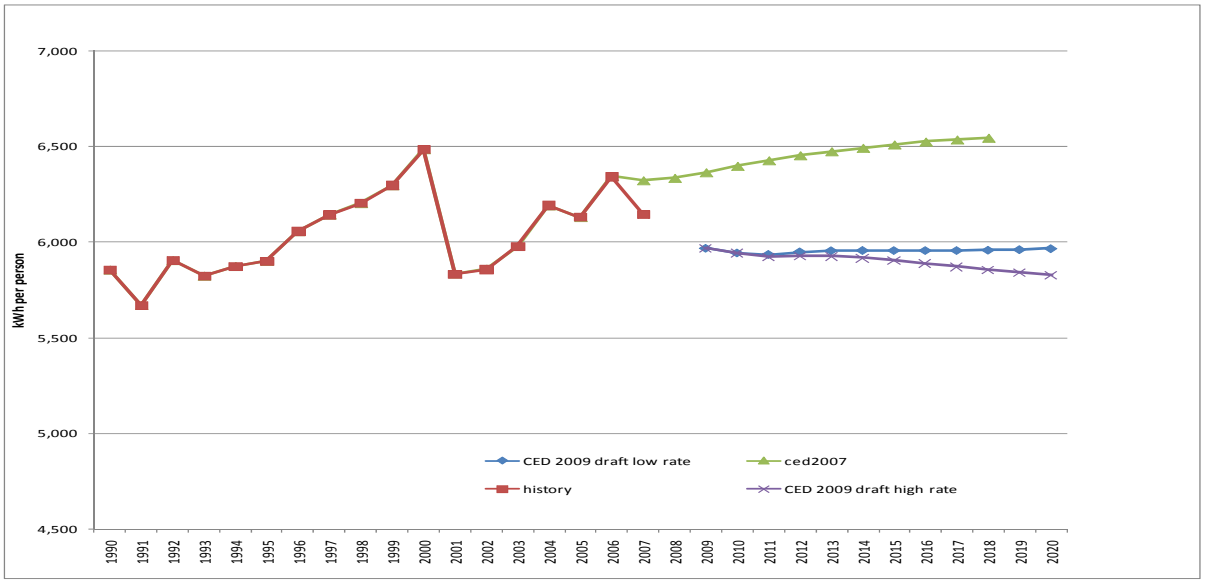
Figure 4-2: SDG&E Planning Area Peak



Source: California Energy Commission, 2009

Figure 4-3 compares forecasted per capita residential electricity consumption. Per capita consumption in the *CED 2009* forecast is significantly lower for both price scenarios than the *CED 2007* forecast. Both scenarios start lower than the *CED 2007* forecast in 2010. The low-rate scenario maintains a relatively flat trajectory over the forecast period while the high-rate scenario produces a decline in per capita consumption over the entire forecast period, resulting in reduced per capita consumption compared to the previous forecast by the end of the forecast period for both scenarios. This reduction is caused by a combination of the aforementioned economic/demographic forecast assumptions and increased savings from energy efficiency programs.

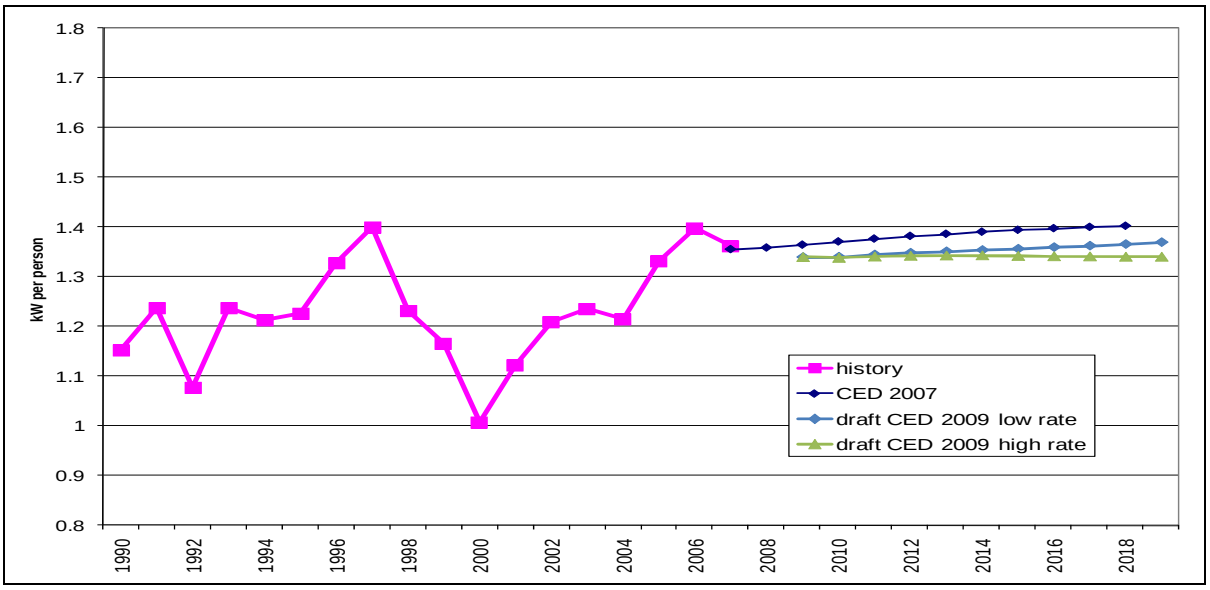
Figure 4-3: SDG&E Planning Area per Capita Electricity Consumption



Source: California Energy Commission, 2009

Per capita peak demand, shown in **Figure 4-4**, is lower over the entire forecast period because of a lower starting point. The *CED 2009* low price scenario grows at the same rate as the *CED 2007* forecast while the *CED 2009* high price scenario remains constant over the forecast period.

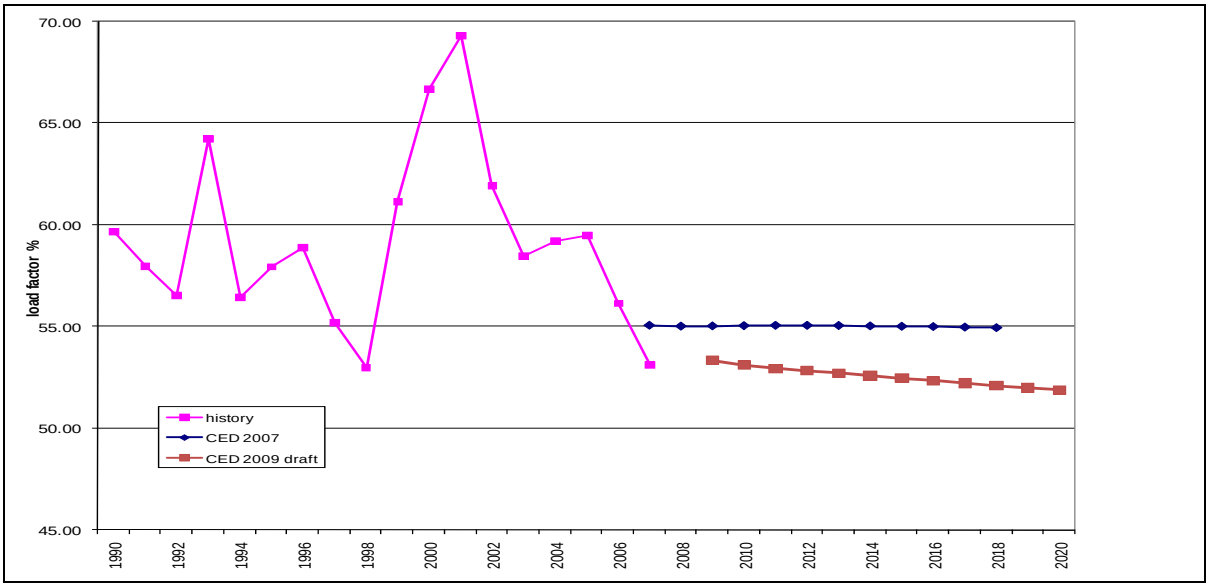
Figure 4-4: SDG&E Planning Area per Capita Peak Demand



Source: California Energy Commission, 2009

Figure 4-5 compares the respective forecast load factors. High load factors observed from 1998-2005 are a product of lower-than-average peak temperatures and reaction to the energy crisis. The projected load factor, based on higher, 1-in-2 peak temperatures and a return to normal air conditioning use patterns, should be lower than these recent values. The forecasted load factor declines slightly, reflecting an increase in air conditioning use in the SDG&E territory.

Figure 4-5: SDG&E Planning Area Peak Load Factor



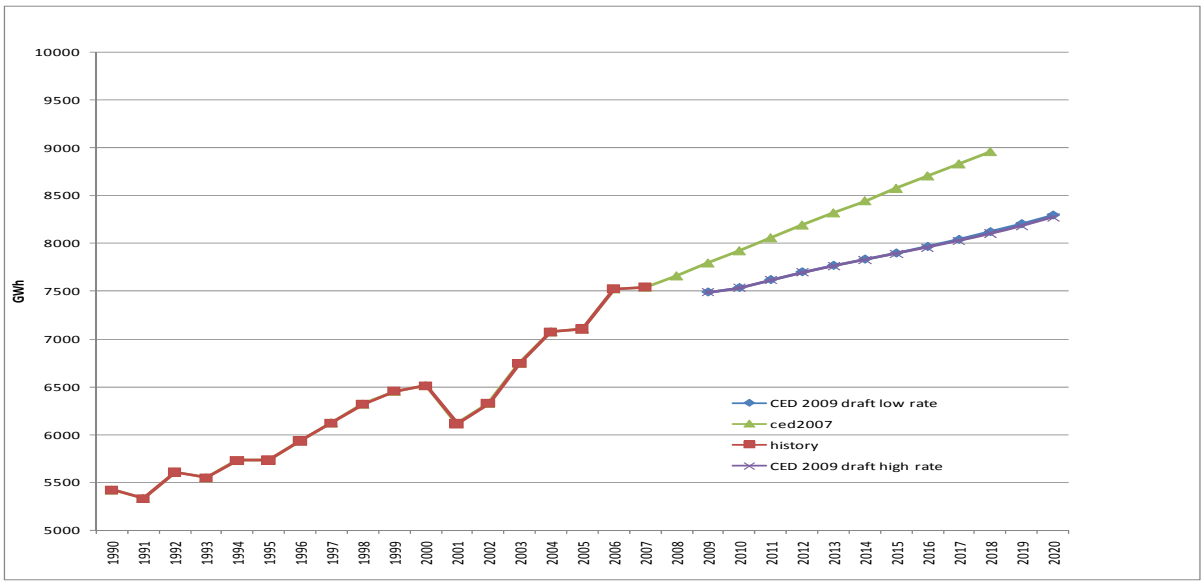
Source: California Energy Commission, 2009

Sector Level Results and Input Assumptions

Residential

Figure 4-6 compares between the *CED 2009* and *CED 2007* SDG&E planning area residential forecasts. The *CED 2009* forecast is lower over the entire forecast period than the *CED 2007* forecast. This is caused by lower household income projections and an increase in efficiency savings over the forecast period.

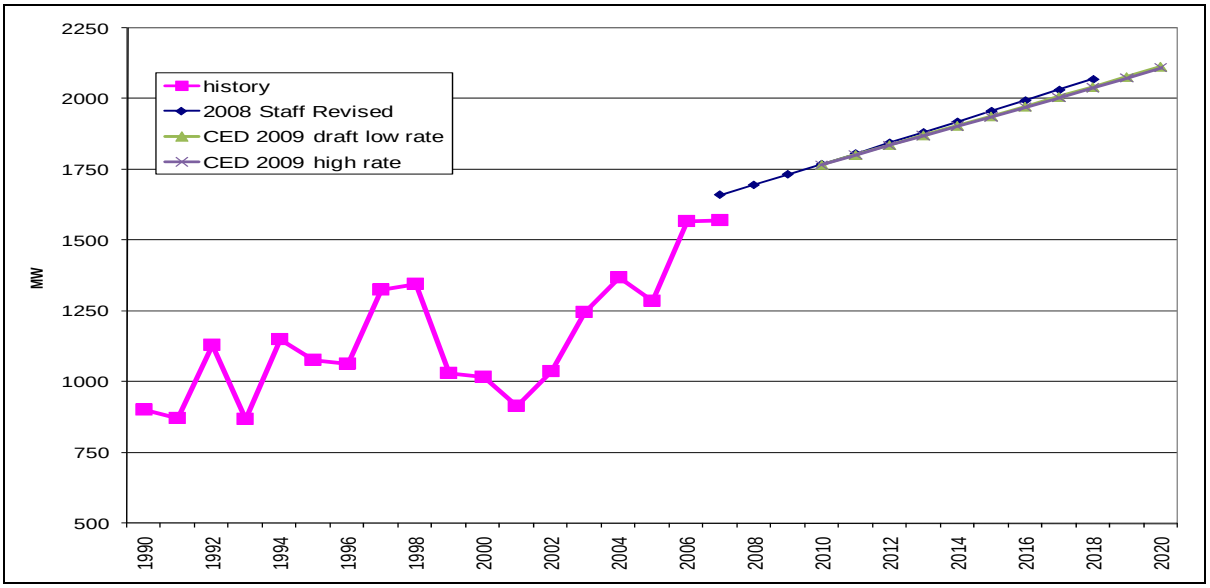
Figure 4-6: SDG&E Planning Area Residential Consumption



Source: California Energy Commission, 2009

Figure 4-7 compares the *CED 2009* and *CED 2007* residential peak demand forecasts. The *CED 2009* forecast is only slightly lower than the *CED 2007* forecast. This is in contrast to the difference in consumption forecasts because there is little change in assumptions on air conditioner usage.

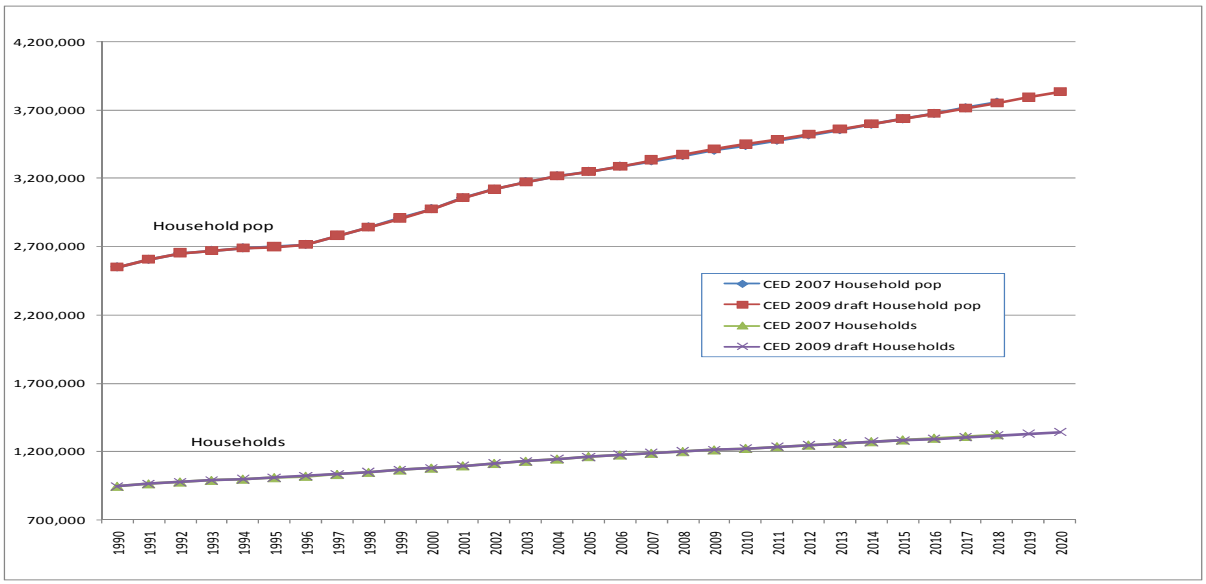
Figure 4-7: SDG&E Planning Area Residential Peak



Source: California Energy Commission, 2009

Figures 4-8, 4-9 and **4-10** compare the residential drivers used in the *CED 2009* forecast with those used in *CED 2007*. **Figure 4-8** provides comparisons of household population and total household projections. There is very little change in either of these drivers over the forecast period.

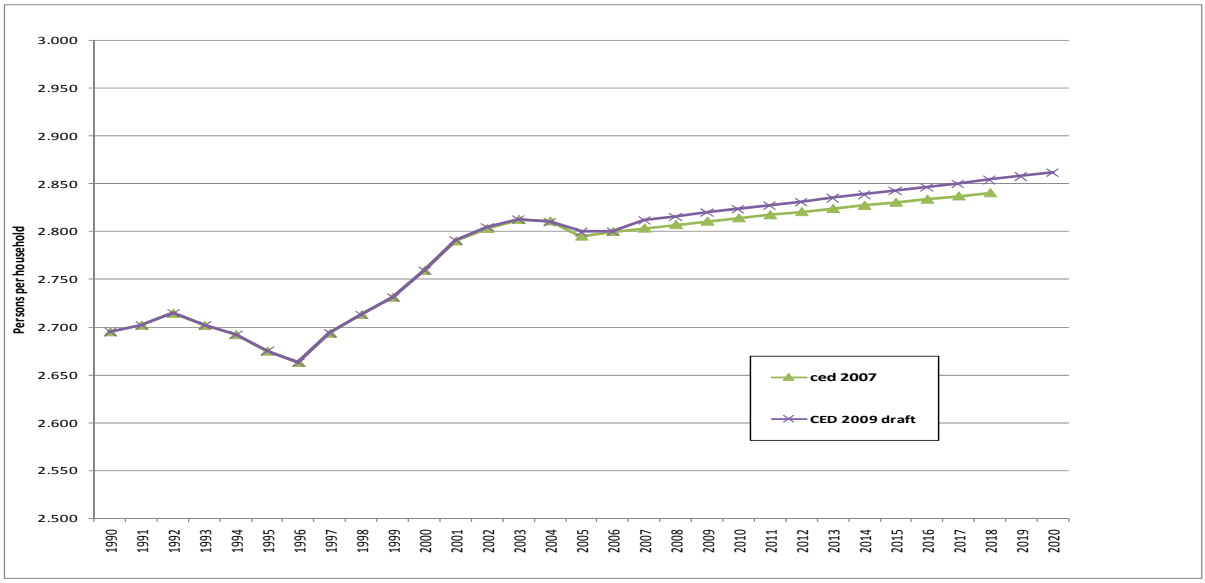
Figure 4- 8: SDG&E Planning Area Household and Household Population Projections



Source: California Energy Commission, 2009

Figure 4-9 provides comparisons of persons per household projections between the two forecasts. There is slight increase in the forecast of persons per household in the *CED 2009* forecast compared with the *CED 2007* forecast.

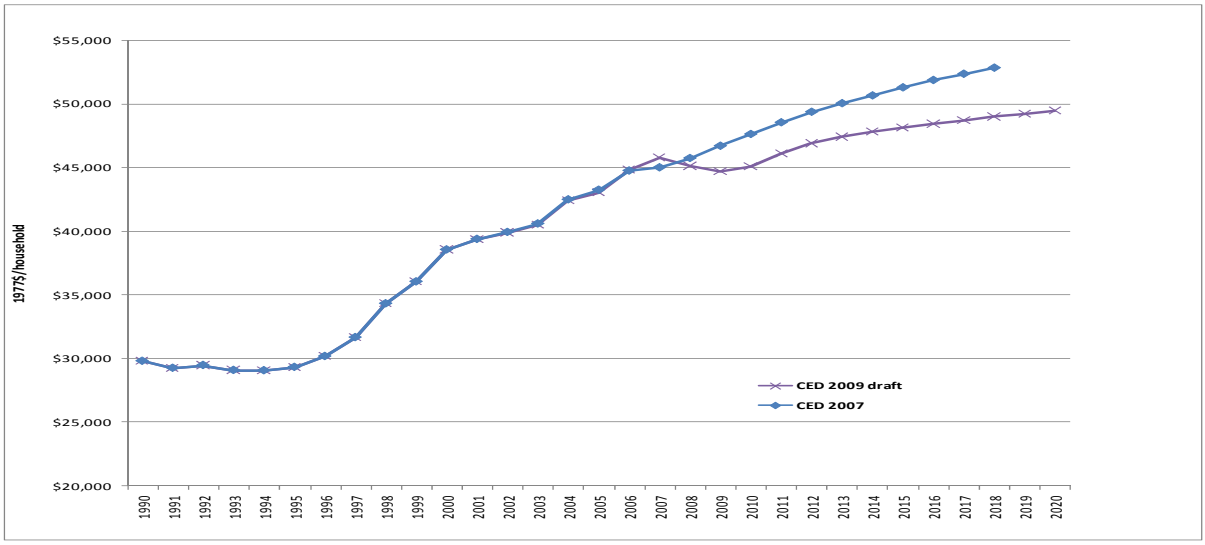
Figure 4- 9: SDG&E Planning Area Persons per Household Projections



Source: California Energy Commission, 2009

Figure 4-10 compares household income between the two forecasts. The *CED 2009* projection, using a more recent forecast from Economy.com, is lower in the short term because of recent economic conditions. This also translates to a lower forecast throughout the forecast period.

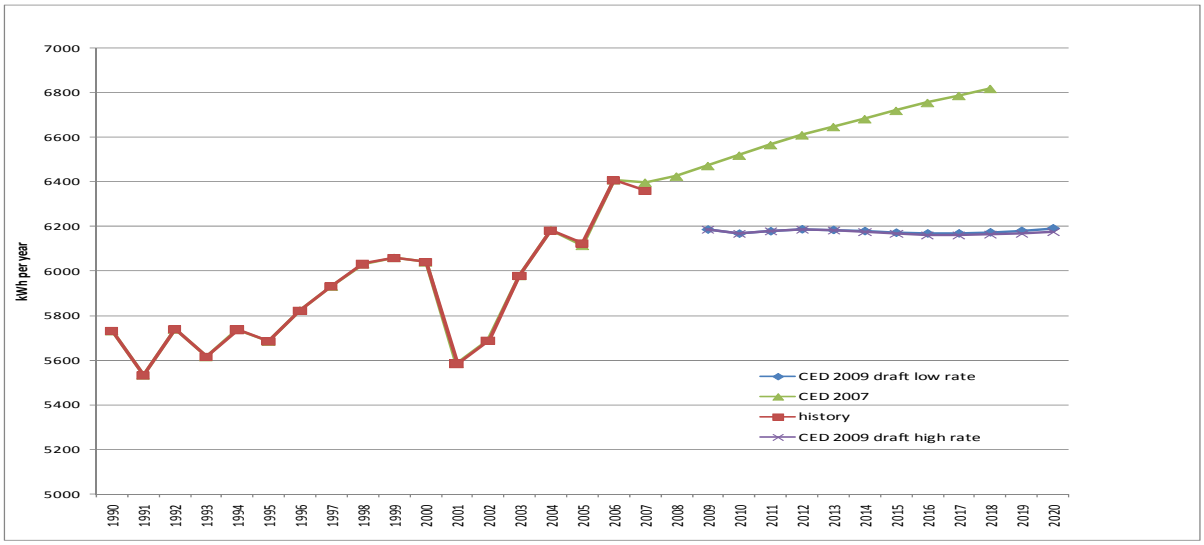
Figure 4-10: SDG&E Planning Area Household Income Projections



Source: California Energy Commission, 2009

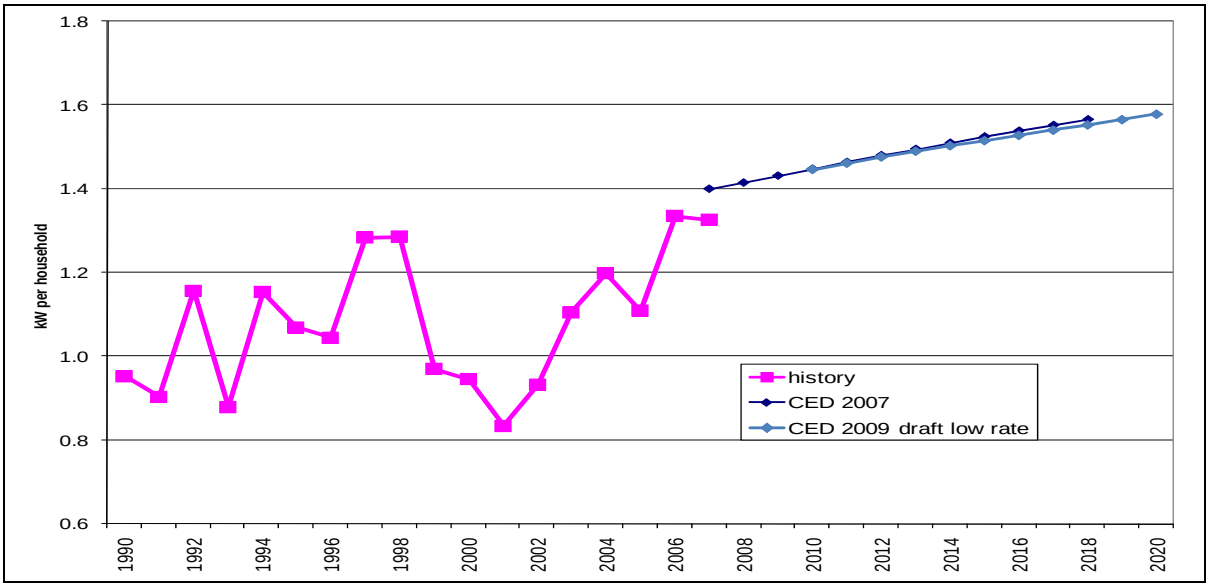
Figures 4-11 and **4-12** compare residential use per household and residential peak use per household, respectively. The *CED 2009* forecast of use per household (**Figure 4-11**) is significantly lower than that projected in CED 2006. This is caused by a combination of lower household income projections and the increase of residential efficiency savings primarily caused by reductions in lighting use per household. In contrast, differences in peak use per household (**Figure 4-12**) are very slight because most of the consumption savings does not directly translate into peak savings.

Figure 4-11: SDG&E Planning Area Use per Household



Source: California Energy Commission, 2009

Figure 4-12: SDG&E Planning Area Peak Use per Household

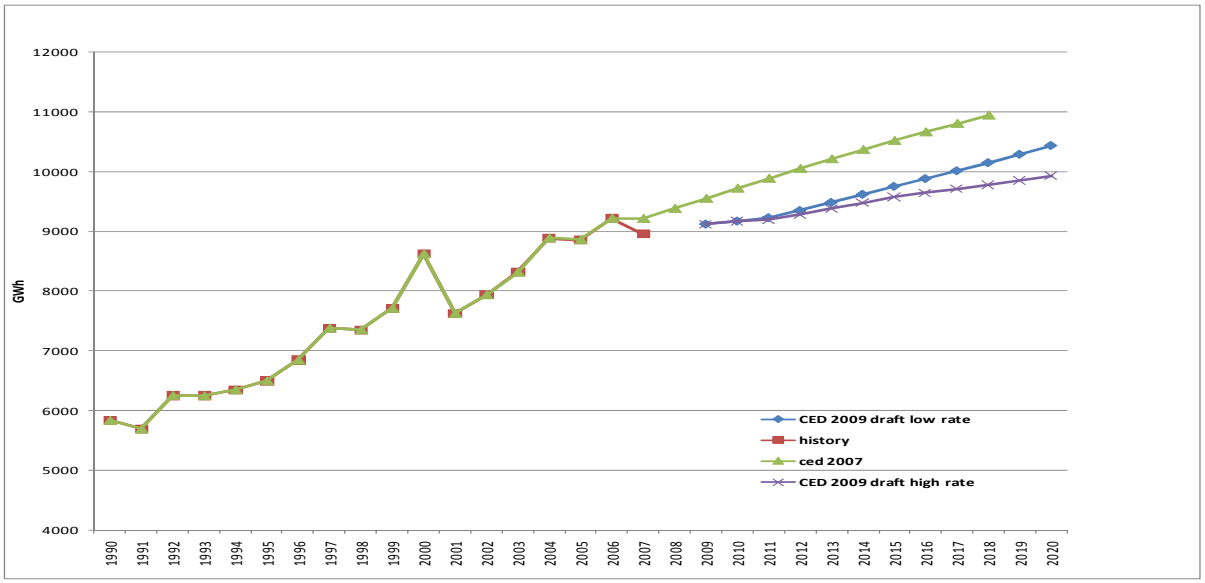


Source: California Energy Commission, 2009

Commercial Building Sector

Figures 4-13 and **4-14** compare the commercial building sector forecasts. In **Figure 4-13**, both the low-rate and high rate *CED 2009* consumption forecasts are lower than the *CED 2007* counterpart because of lower economic projections and increased savings from efficiency programs. The growth rates of the *CED 2009* low-rate forecast is similar to that of the *CED 2007* forecast in the mid to long term, but growth rate of the *CED 2009* high-rate forecast is lower over the entire forecast period.

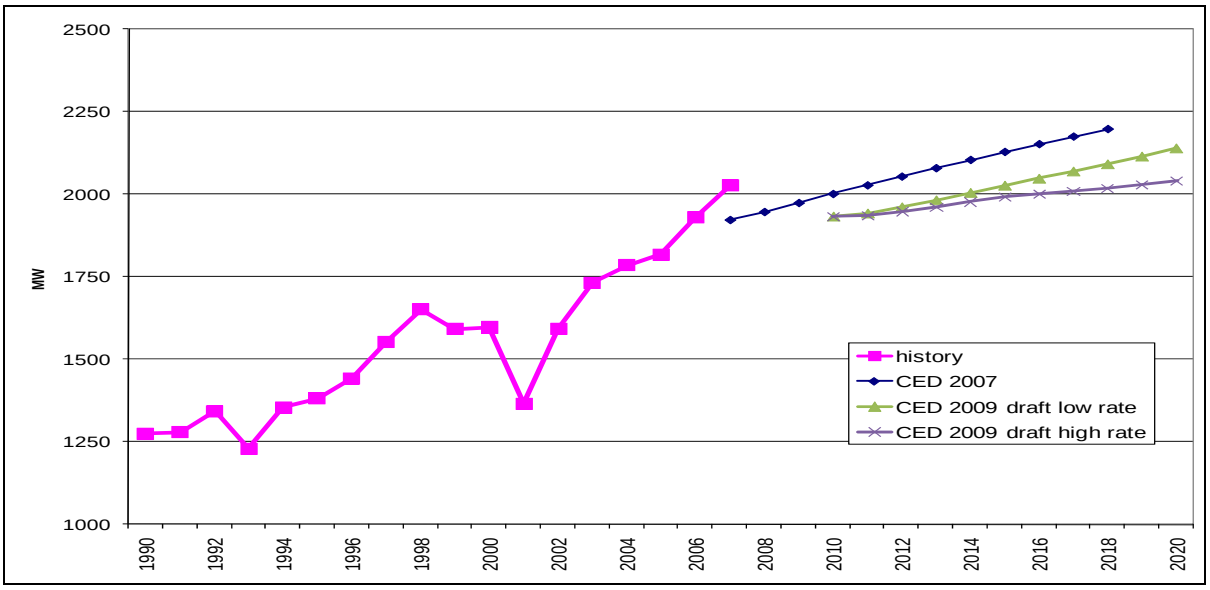
Figure 4-13: SDG&E Planning Area Commercial Consumption



Source: California Energy Commission, 2009

Figure 4-14 compares the commercial building sector peak demand forecasts. Differences in the peak forecasts are similar to those in the consumption forecasts.

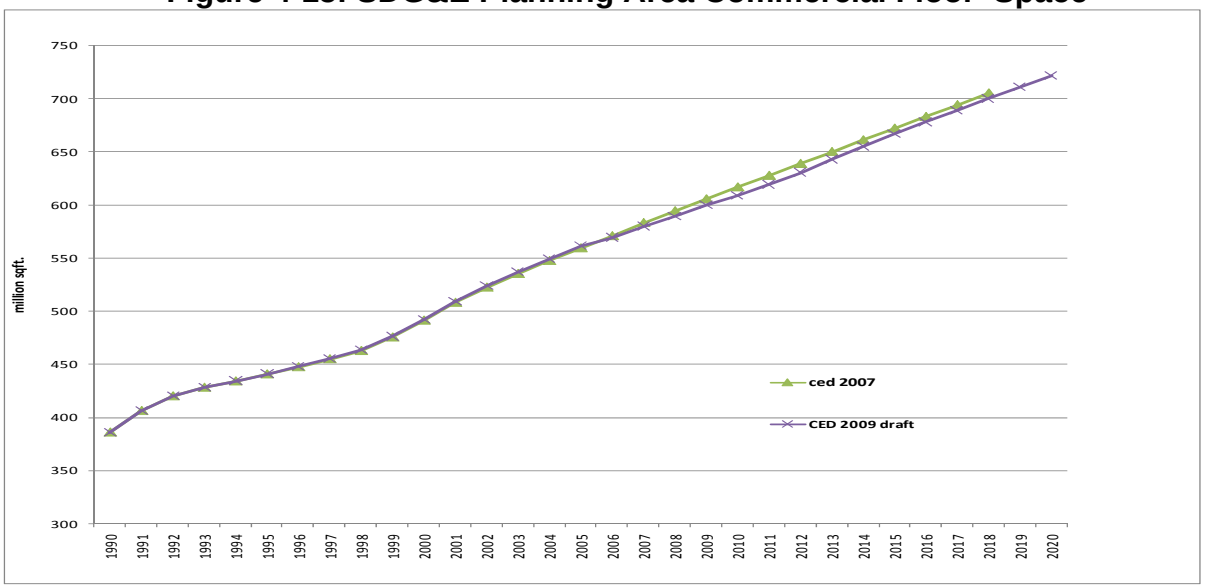
Figure 4-14: SDG&E Planning Area Commercial Sector Peak



Source: California Energy Commission, 2009

In staff's commercial building sector forecasting model, floor space by building type (that is, retail, schools, offices, etc.) is the key driver of energy use for each specific building type. **Figure 4-15** compares total commercial floor space projections. The small difference between the *CED 2009* and the *CED 2007* floor space forecasts is caused by lower economic drivers in the floor space model.

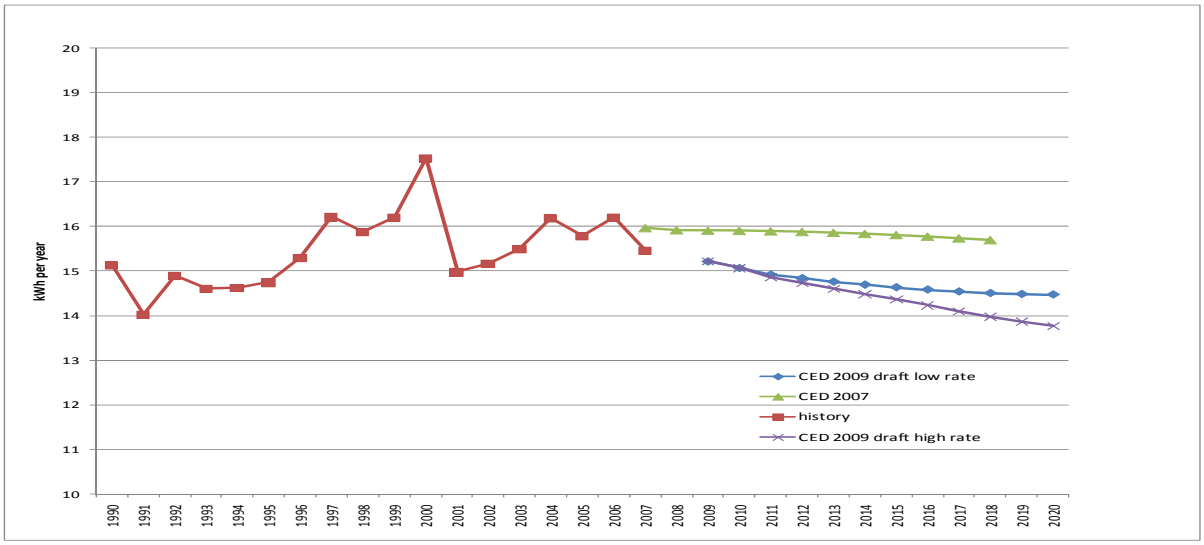
Figure 4-15: SDG&E Planning Area Commercial Floor Space



Source: California Energy Commission, 2009

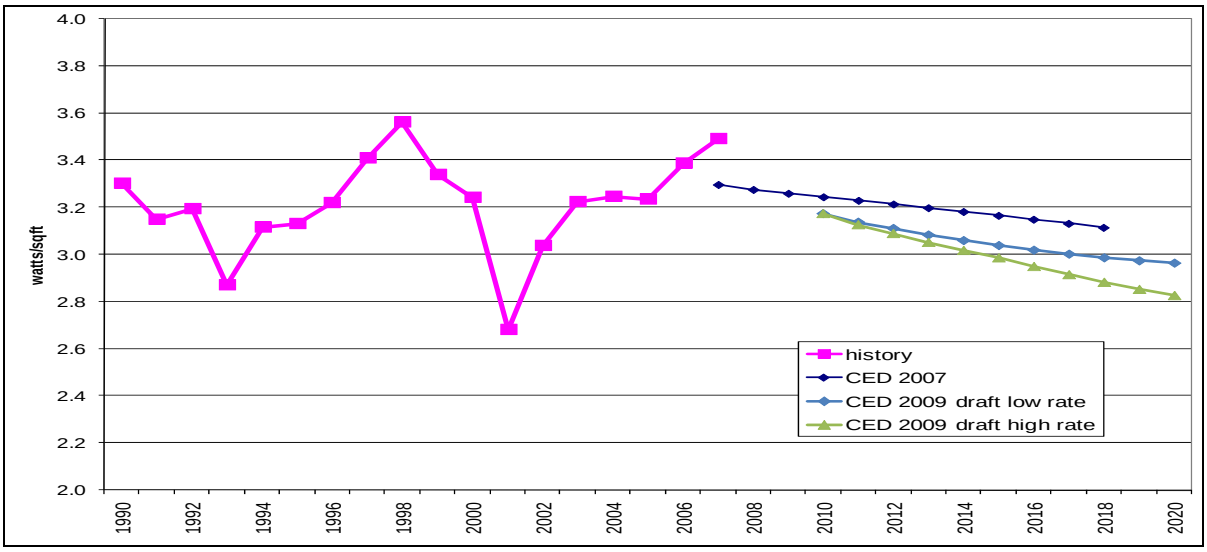
Historic and projected commercial sector annual and peak use per square foot are shown in **Figures 4-16** and **4-17**, respectively. Changes in annual use per square foot are based on the historic floor space estimates presented in **Figure 4-15**. Use per square foot (**Figure 4-16**) in the *CED 2009* forecast declines at a faster rate over the forecast period for both rate scenarios than in the *CED 2007* forecast as does commercial peak per square foot (**Figure 4-17**). Both the energy and peak forecasts decline over the forecast period because of projected commercial building and appliance standards impacts as well as increased efficiency program savings.

Figure 4-16: SDG&E Planning Area Commercial kWh per Square Foot



Source: California Energy Commission, 2009

Figure 4-17: SDG&E Planning Area Commercial Watts per Square Foot

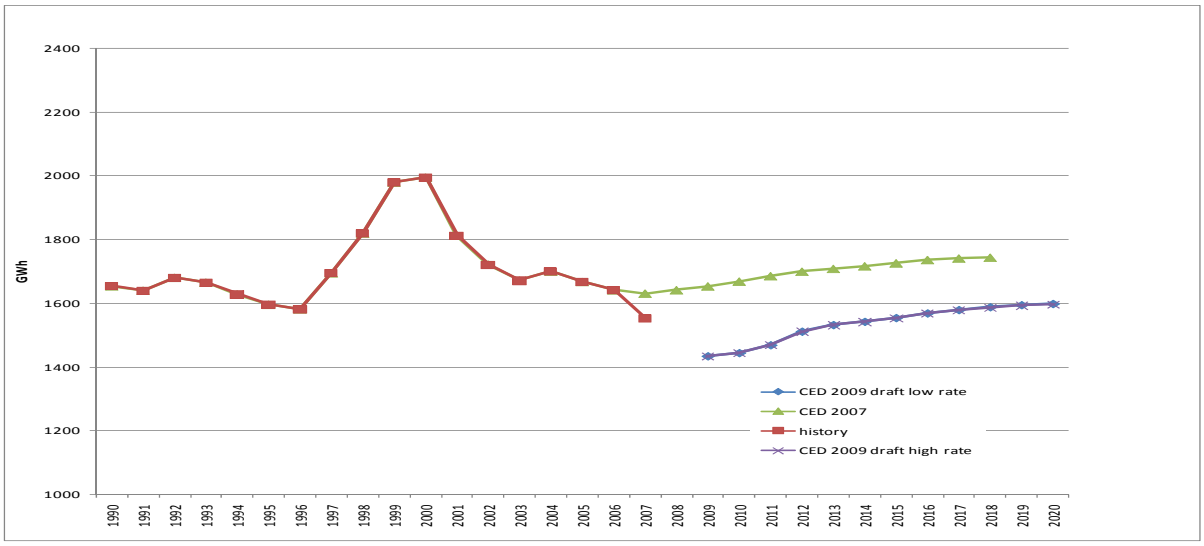


Source: California Energy Commission, 2009

Industrial Sector

Figure 4-18 compares the industrial sector electricity consumption forecasts for the SDG&E planning area. The *CED 2009* forecast is lower throughout the entire forecast period primarily because it is based on a lower industrial economic forecast.

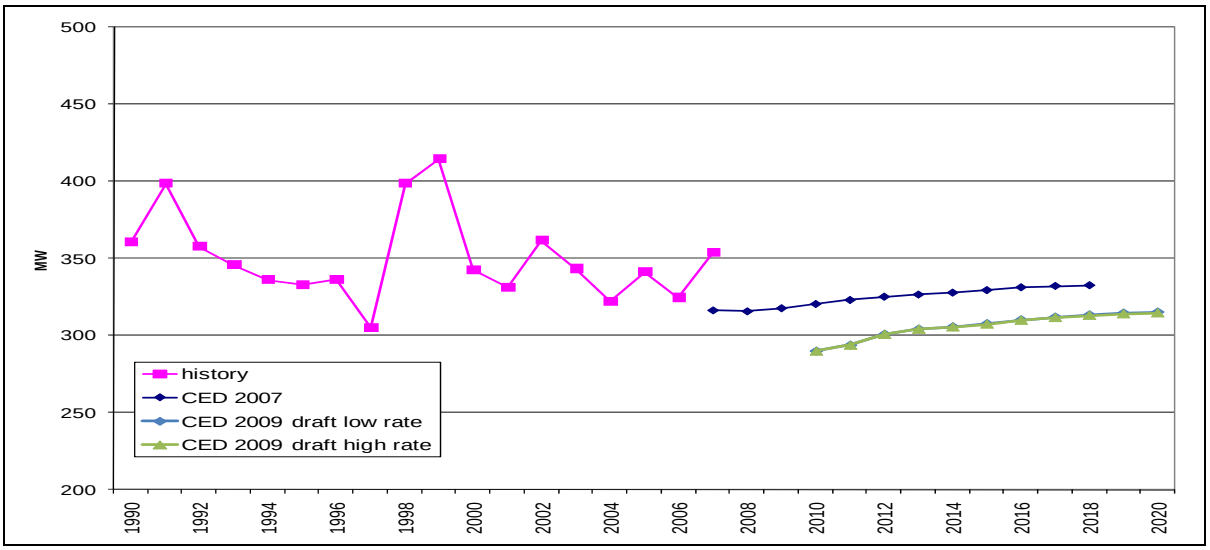
Figure 4-18: SDG&E Planning Area Industrial Consumption



Source: California Energy Commission, 2009

Figure 4-19 compares the industrial sector peak forecasts. The *CED 2009* peak is also lower throughout the forecast period as a result of the lower consumption forecast.

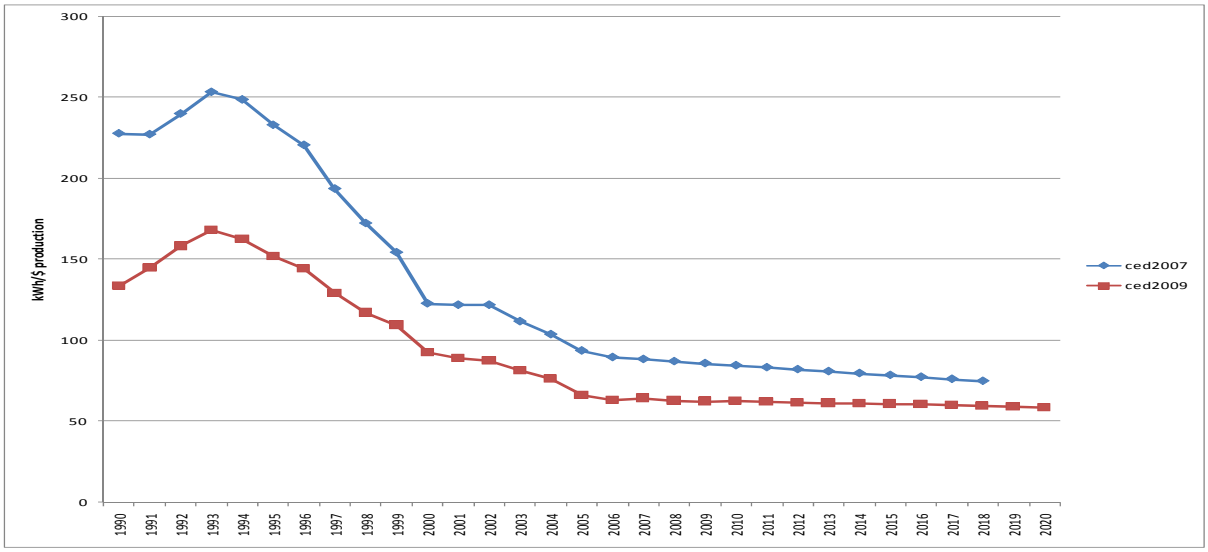
Figure 4-19: SDG&E Planning Area Industrial Sector Peak



Source: California Energy Commission, 2009

Figure 4-20 compares use per dollar value of production between the *CED 2009* and *CED 2007* forecasts. The difference in kWh per dollar of industrial value added in the *CED 2008* staff draft and CED 2006 industrial forecasts, especially in the early years, is caused by different starting points. These points differ as a result of the unclassified electricity sales distribution process that must occur in every forecast cycle. Also, Economy.com has revised the historic industrial production data used for the forecast.

Figure 4-20: SDG&E Planning Area Industrial Use Per Production Unit



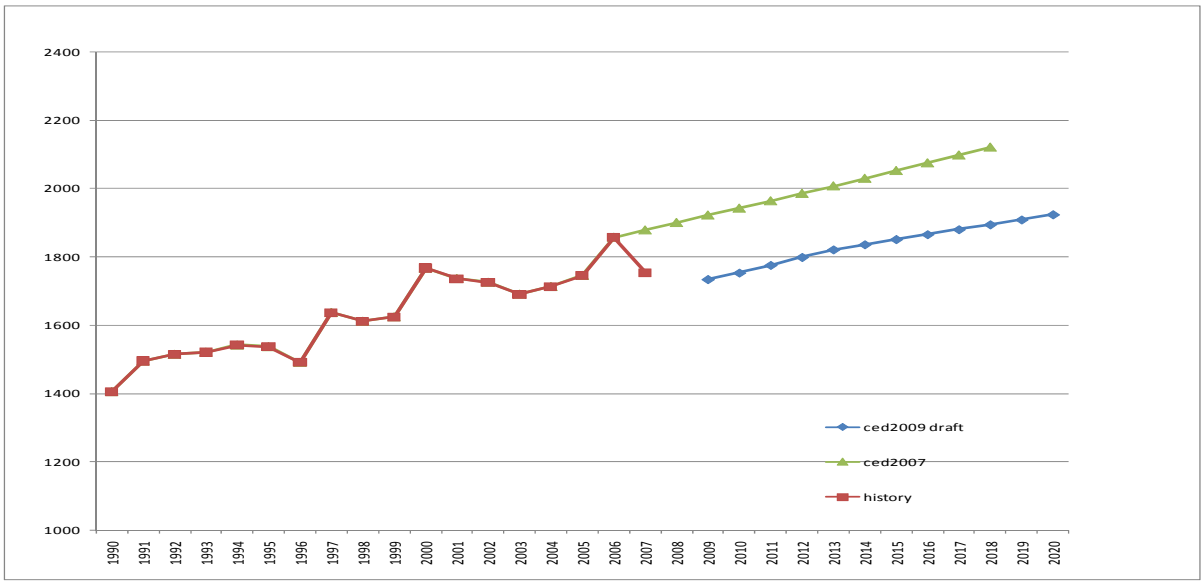
Source: California Energy Commission, 2009

Other Sectors

Figures 4-21 and **4-22** compare the remaining sector electricity consumption forecasts. Figure 4-21 compares the transportation, communication, and utilities (TCU) sector forecasts. The *CED 2009* forecast is lower than the *CED 2007* forecast because of a lower historic starting point.

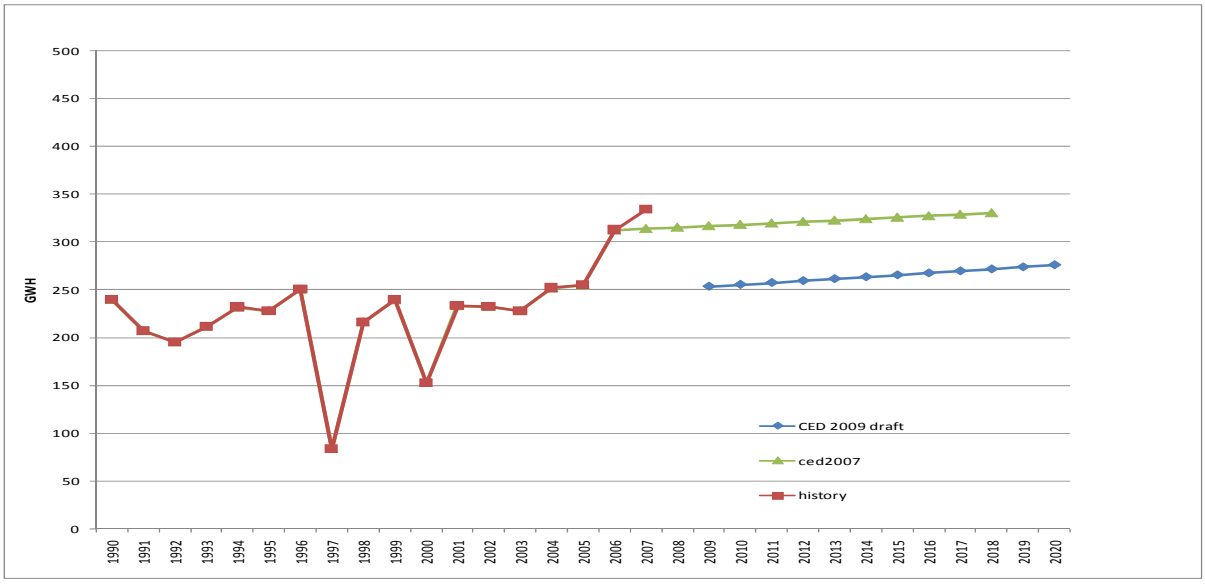
Figure 4-22 provides comparisons of the agriculture and water pumping sector forecasts. The *CED 2009* staff draft agriculture and water pumping forecast is lower than the *CED 2007* because of higher projected electricity rates.

Figure 4-21: SDG&E Planning Area Transportation, Communication & Utilities Sector Electricity Consumption



Source: California Energy Commission, 2009

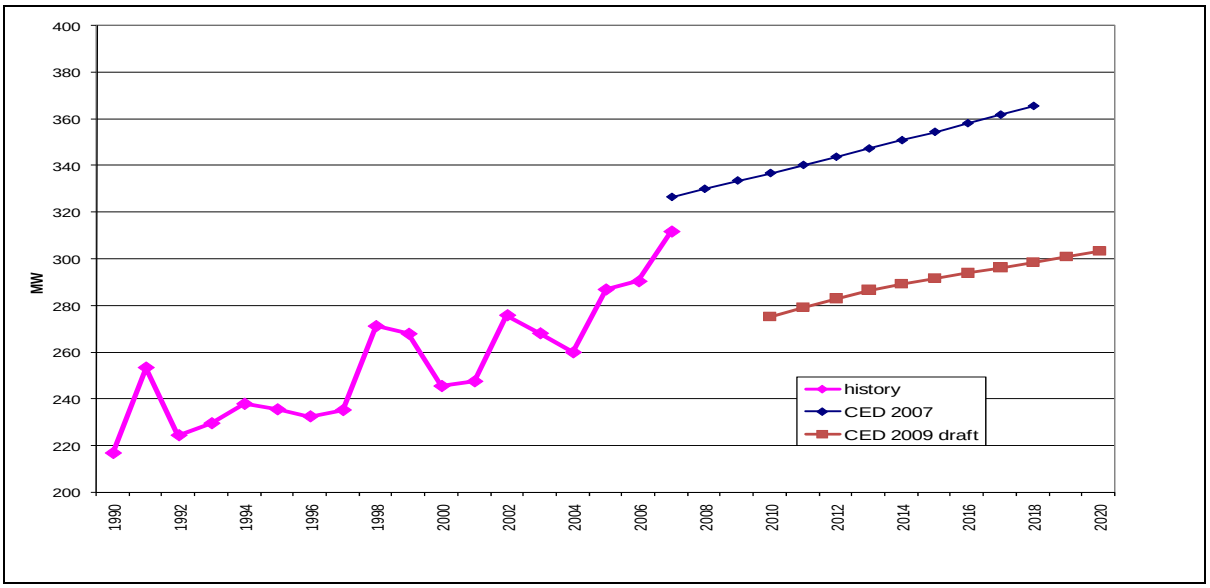
Figure 4-22: SDG&E Planning Area Agriculture & Water Pumping Forecasts



Source: California Energy Commission, 2009

Figure 4-23 compares the combined Other Sector peaks for the *CED 2009* and CED 2006 forecasts. The CED 2006 forecast starts at a lower level, as does the consumption forecast. Both forecasts have a similar growth rate.

Figure 4-23: SDG&E Planning Area Other Sector Peak

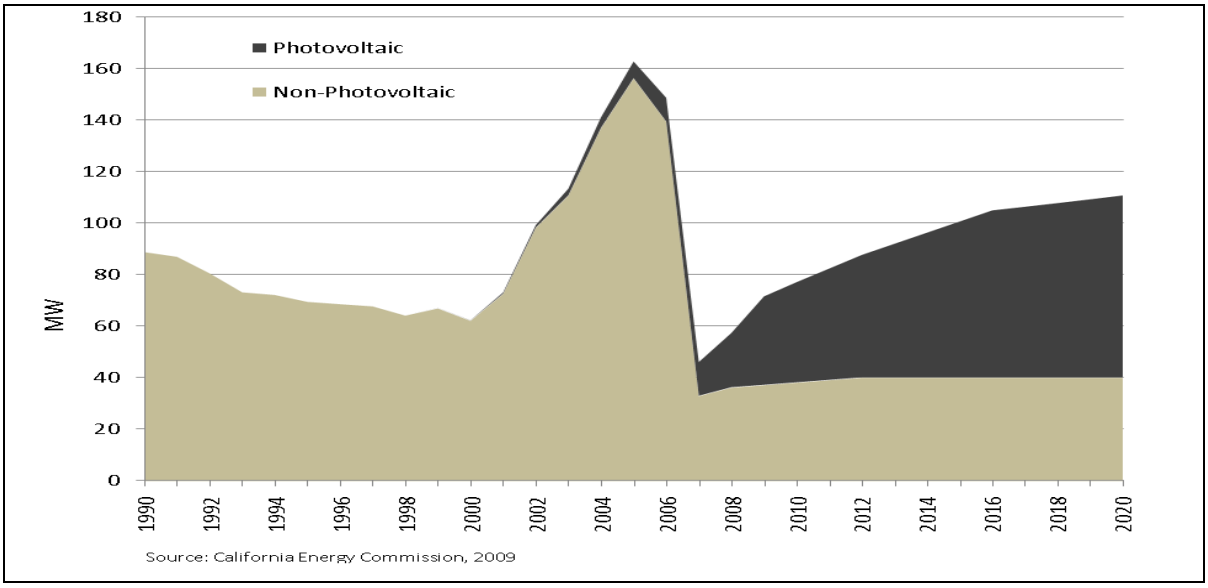


Source: California Energy Commission, 2009

Self-Generation

The peak demand forecast is reduced by self generation, including the effects of the SGIP, CSI, and other programs, as discussed in Chapter 1. The effects of these programs are forecast based on recent trends in installations. **Figure 4-24** shows the staff draft forecast of peak impacts from photovoltaic and non-photovoltaic self generation. Based on current trends, staff projects about 70 MW of peak reduction from photovoltaic systems by 2020.

Figure 4-24: SDG&E Planning Area Self-Generation Peak Forecasts



Conservation/Efficiency Impacts

Staff spent a great deal of time refining methods to account for energy efficiency and conservation impacts while preparing this forecast, particularly for utility efficiency programs. **Tables 4-2** and **4-3** show electricity consumption and peak savings estimates for selected years, for building and appliance standards, utility and public agency programs, and "naturally occurring" savings, or savings associated with rate changes and certain market trends not directly related to programs or standards. Savings are measured against a baseline before 1975, so they incorporate more than 30 years of impacts from rate changes and standards. Chapter 8 provides much more detail on staff work related to energy efficiency and conservation.

Table 4-2: SDG&E Planning Area Electricity Consumption Savings Estimates

	1990	1998	2003	2008	2011	2015	2020
Residential Energy Savings (GWh)							
Building Standards	110	173	211	226	265	315	379
Appliance Standards	270	558	760	899	970	1058	1161
Utility and Public Agency Programs	27	61	180	570	690	514	198
Naturally Occurring Savings	168	264	300	300	301	439	691
Total Residential Savings	575	1057	1451	1994	2225	2326	2430
Commercial Energy Savings (GWh)							
Building Standards	147	297	503	685	807	1004	1245
Appliance Standards	93	191	296	395	454	541	646
Utility and Public Agency Programs*	68	268	307	326	432	371	265
Naturally Occurring Savings	612	530	652	612	637	738	967
Total Commercial Savings	919	1286	1757	2017	2330	2654	3123
Total Energy Savings	1494	2343	3208	4011	4554	4980	5553

Source: California Energy Commission, 2009

*Commercial programs also include agricultural program savings.

Table 4-3: SDG&E Planning Area Electricity Peak Savings Estimates

	1990	1998	2003	2008	2011	2015	2020
Residential Energy Savings (MW)							
Building Standards	18	37	39	49	61	76	95
Appliance Standards	45	119	140	196	225	254	290
Utility and Public Agency Programs	4	13	33	125	160	124	50
Naturally Occurring Savings	28	56	55	66	70	105	173
Total Residential Savings	96	225	268	436	515	559	607
Commercial Energy Savings (MW)							
Building Standards	32	67	105	137	164	202	247
Appliance Standards	20	43	62	79	92	109	128
Utility and Public Agency Programs*	15	60	64	65	88	75	53
Naturally Occurring Savings	134	119	136	123	130	148	192
Total Commercial Savings	201	289	366	404	474	533	619
Total Energy Savings	296	514	634	840	989	1092	1226

Source: California Energy Commission, 2009

*Commercial programs also include agricultural program

CHAPTER 5: Sacramento Municipal Utility District Planning Area

The Sacramento Municipal Utility District (SMUD) planning area includes SMUD retail customers, but does not include the new members of the SMUD control area (Roseville, Redding, and Western Area Power Administration [WAPA]). To support electricity system analysis, staff derives forecasts by control area and California ISO congestion zone from the planning area forecasts. Using historic consumption data and regional population projections, the estimated share of the PG&E forecast for WAPA, Roseville, and Redding forecasts are subtracted from the PG&E planning area and added to the SMUD control area. The results in this chapter are for the SMUD planning area only.

This chapter is organized as follows. First, forecasted consumption and peak loads for the SMUD planning area are discussed; both total and per capita values are presented. The *CED 2009* values are compared to the *CED 2007* forecast; differences between the two forecasts are explained. The forecasted load factor, jointly determined by the consumption and peak load estimates, is also discussed. Second, sector consumption and peak load forecasts are presented. The residential, commercial, industrial and "other" sector staff draft forecasts are compared to those in *CED 2007*; again, differences between the two are discussed.

CED 2007 assumed constant electricity rates throughout the forecast period. For this forecast, three price scenarios were developed for electricity rates: high rates, low (constant) rates, and a rate scenario in between the two. The high-rate case assumed approximately 30 percent higher rates by 2020 relative to 2010, while the "mid-rate" case assumed 15 percent higher rates over the same period. In the low-rate case, rates remained at 2010 levels through 2020. Chapter 1 provides more details.

Forecast Results

Table 5-1 compares electricity consumption and peak demand for selected years. **Figures 5-1** and **5-2** compare the *CED 2009* forecast with the *CED 2007* forecast.

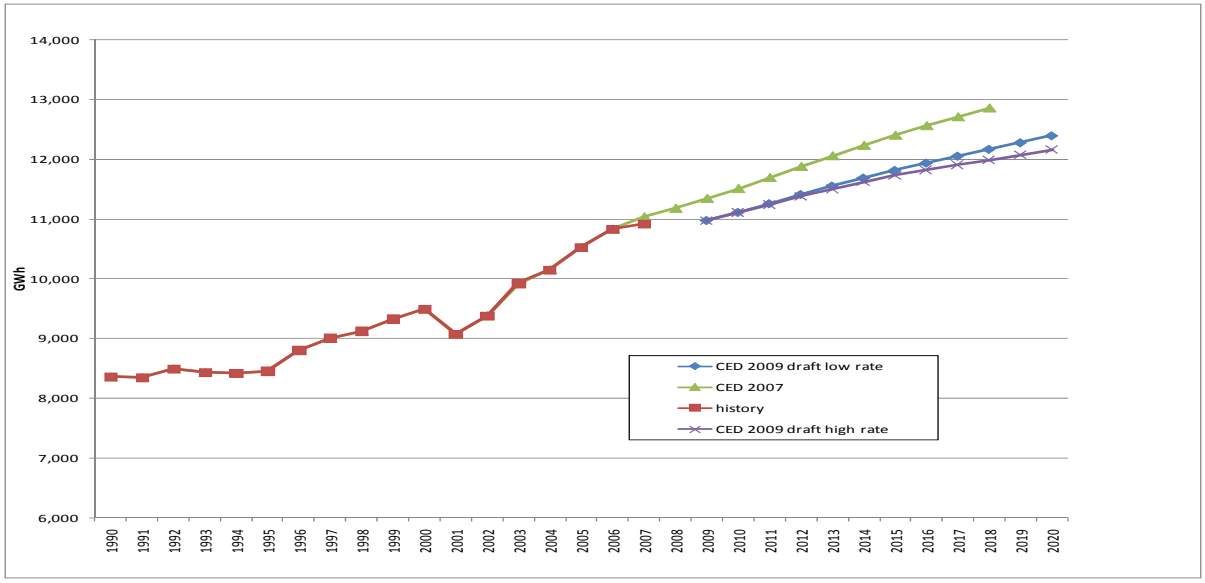
Table 5-1: SMUD Planning Area Forecast Comparison

Consumption (GWH)					
	CED 2007	CED 2009 Staff Draft Low Rate	CED 2009 Staff Draft High Rate	Percent Difference Staff Low Rate/CED 2007	Percent Difference Staff High Rate/CED 2007
1990	8,358	8,358	8,358	0.00%	0.00%
2000	9,491	9,491	9,491	0.00%	0.00%
2007	11,034	10,917	10,917	-1.06%	-1.06%
2010	11,506	11,114	11,114	-3.41%	-3.41%
2015	12,397	11,816	11,729	-4.69%	-5.39%
2018	12,851	12,167	11,989	-5.32%	-6.71%
Average Annual Growth Rates					
1990-2000	1.28%	1.28%	1.28%		
2000-2007	2.18%	2.84%	2.84%		
2007-2010	1.41%	0.60%	0.60%		
2010-2018	1.39%	1.14%	0.95%		
Peak (MW)					
	CED 2007	CED 2009 Staff Draft Low Rate	CED 2009 Staff Draft High Rate	Percent Difference Staff Low Rate/CED 2007	Percent Difference Staff High Rate/CED 2007
1990	2,198	2,167	2,167	-1.41%	-1.41%
2000	2,693	2,688	2,688	-0.19%	-0.19%
2007	3,136	3,092	3,092	-1.40%	-1.40%
2010	3,261	3,077	3,077	-5.64%	-5.64%
2015	3,515	3,276	3,258	-6.80%	-7.31%
2018	3,645	3,384	3,345	-7.16%	-8.23%
Average Annual Growth Rates					
1990-2000	2.05%	2.18%	2.18%		
2000-2007	3.09%	2.84%	2.84%		
2007-2010	1.31%	-0.16%	-0.16%		
2010-2018	1.40%	1.20%	1.05%		
Historic values are shaded					

Source: California Energy Commission, 2009

As seen in **Table 5-1**, the *CED 2009* forecast is 3.4 percent lower than the *CED 2007* forecast in the short term. This difference grows to 5.3 percent for the low-rate scenario and 6.7 percent for the high-rate scenario by the end of the forecast period. The differences in the forecast are caused by the reduced economic projections used in the *CED 2009* forecast. This difference is more pronounced in the short term although the longer term growth (after 2010) is slightly lower than that projected in the *CED 2007* forecast as seen in **Figure 5-1**.

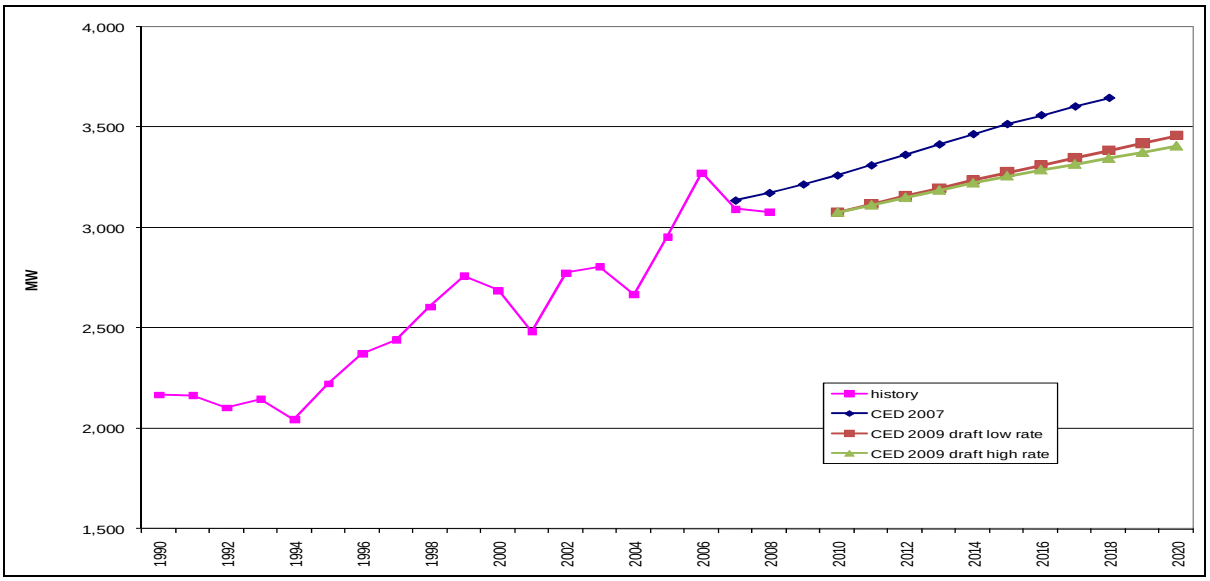
Figure 5-1: SMUD Planning Area Electricity Forecast



Source: California Energy Commission, 2009

The *CED 2009* SMUD planning area peak demand forecast, shown in **Figure 5-2**, is also lower over the entire forecast period than the *CED 2007* forecast. Major reasons for the lower peak forecast are the same as the higher energy forecast.

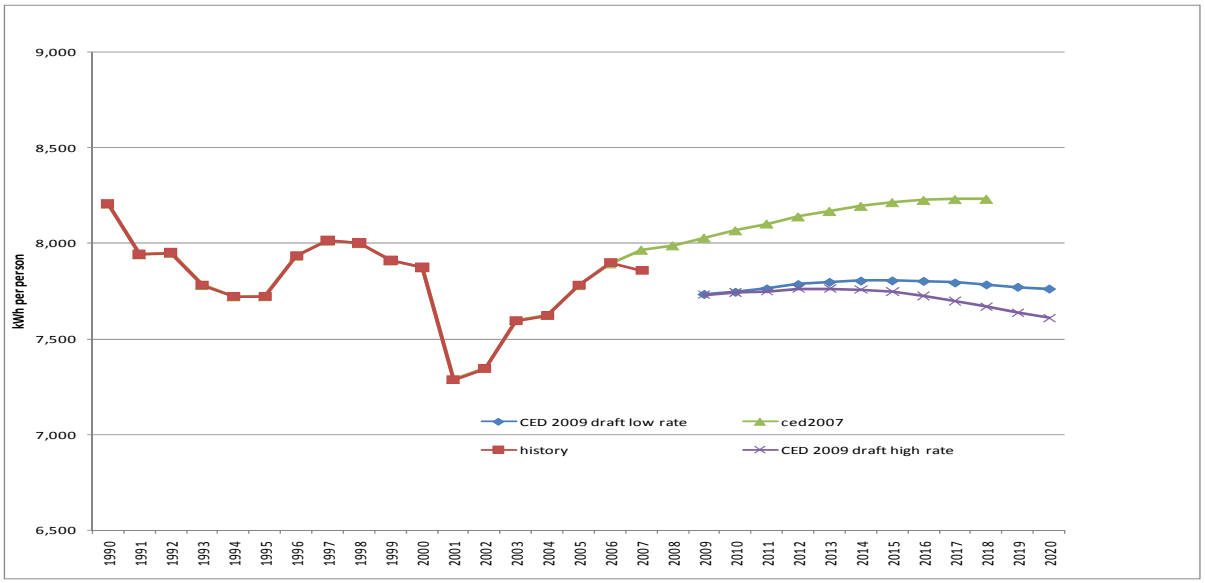
Figure 5-2: SMUD Planning Area Peak



Source: California Energy Commission, 2009

Figures 5-3 compares the old and new per capita electricity consumption forecasts for the SMUD planning area. Projected per capita consumption in the *CED 2009* is lower than in the *CED 2007* forecast. The *CED 2009* per capita electricity consumption forecast is now projected to be lower than pre-energy crisis levels.

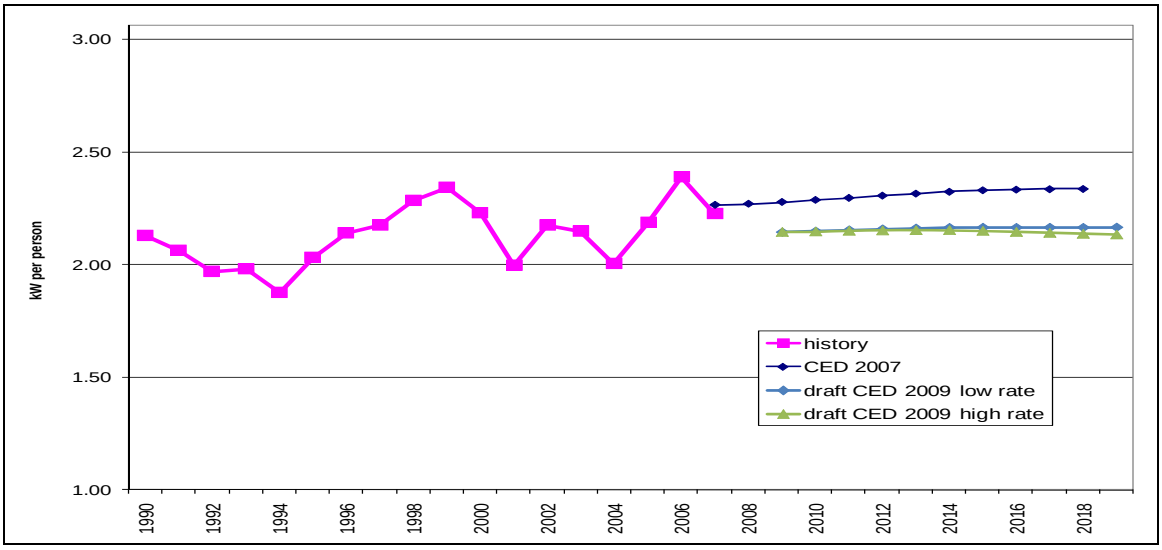
Figure 5-3: SMUD Planning Area per Capita Electricity Consumption



Source: California Energy Commission, 2009

CED 2009 per capita peak demand, shown in **Figure 5-4**, is projected to remain constant over the forecast period at a slightly lower level than the *CED 2007* forecast. The *CED 2009* forecast level is in line with the mid range of values experienced in recent history.

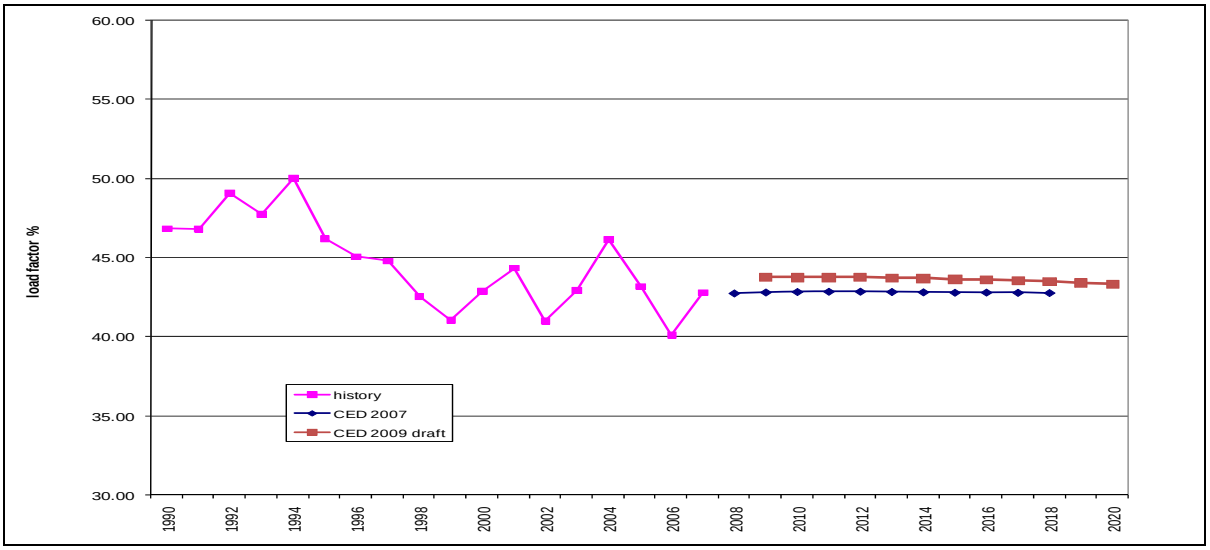
Figure 5-4: SMUD Planning Area per Capita Peak Demand



Source: California Energy Commission, 2009

Figure 5-5 compares the load factors of the two forecasts. The load factor is a measure of the relative increase in peak demand with respect to annual electricity consumption. Lower load factors indicate a sharp rise, while higher load factors indicate a more stable load. Variation in historic load factors is caused in part by annual weather patterns. The SMUD load factor has been declining since the mid-1990's, as the residential sector—with a continually increasing presence of air conditioning—grew faster than other sectors. The forecasted load factor levels out as air condition in the SMUD planning area reaches complete saturation levels.

Figure 5-5: SMUD Planning Area Load Factor



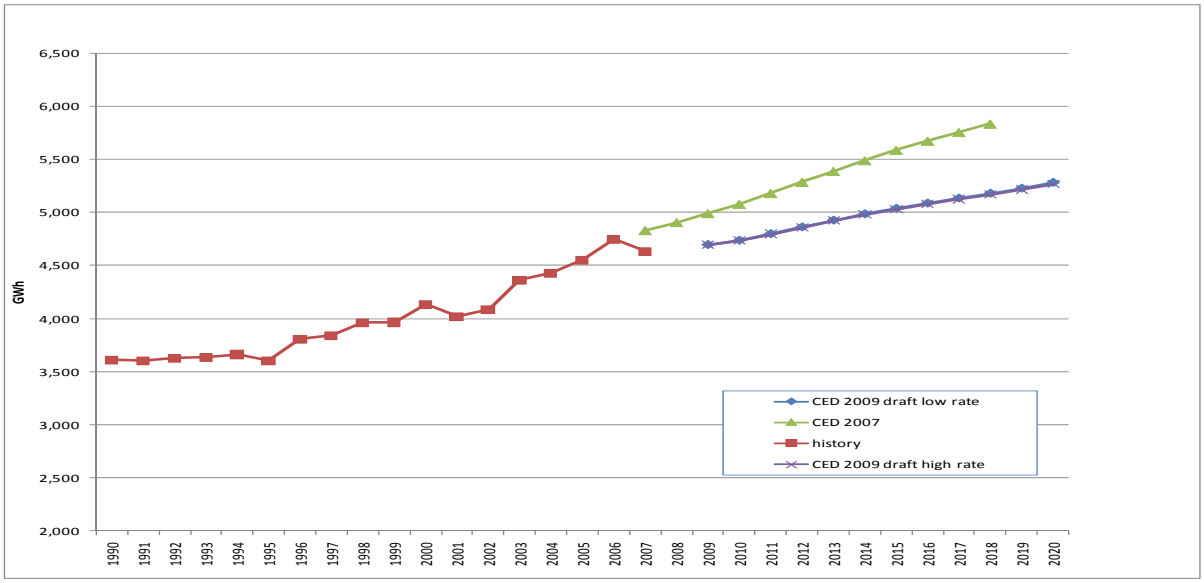
Source: California Energy Commission, 2009

Sector Level Results and Input Assumptions

Residential

Figure 5-6 compares between the *CED 2009* and *CED 2007* SMUD planning area residential forecasts. The *CED 2009* forecast is lower than the *CED 2007* forecast over the entire forecast period. This difference is caused by a lower starting value and the lower economic drivers used in the residential forecast along with increased savings from lighting and other efficiency programs.

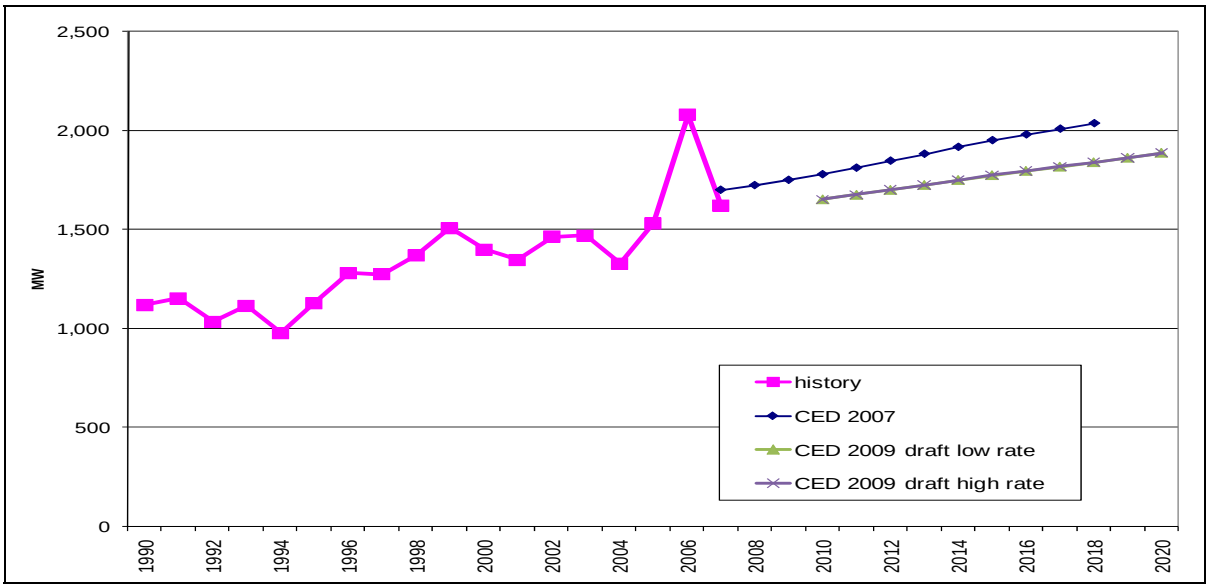
Figure 5-6: SMUD Planning Area Residential Consumption



Source: California Energy Commission, 2009

Figure 5-7 compares the *CED 2009* and *CED 2007* residential peak demand forecasts. The difference in residential peak forecast is less than the difference in the residential electricity consumption forecast because most of the new efficiency measures do not have a direct impact on peak.

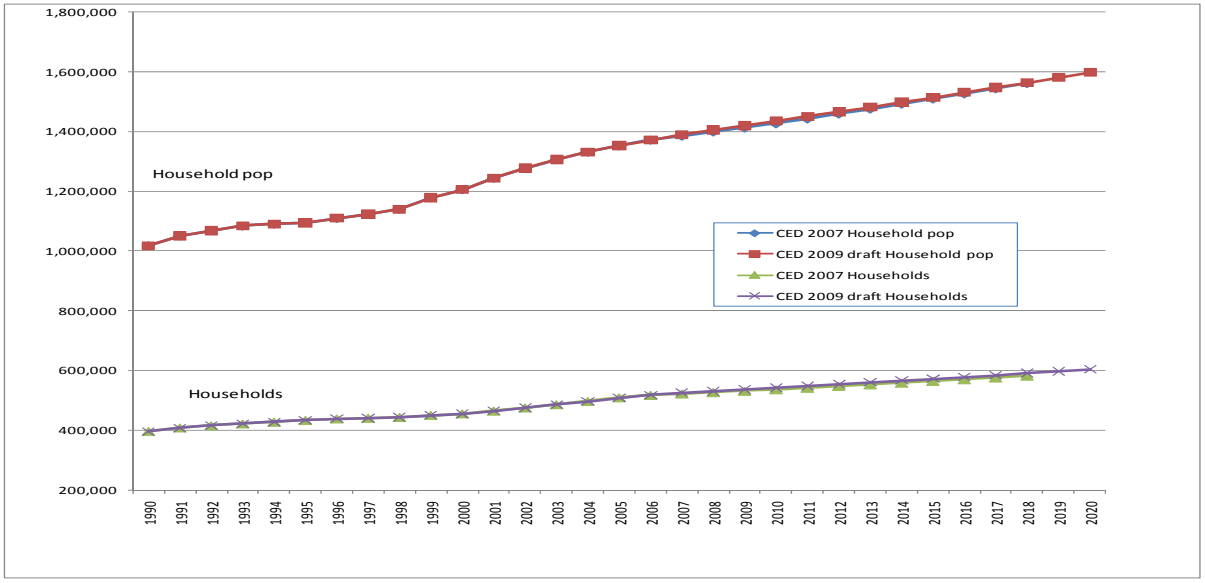
Figure 5-7: SMUD Planning Area Residential Peak



Source: California Energy Commission, 2009

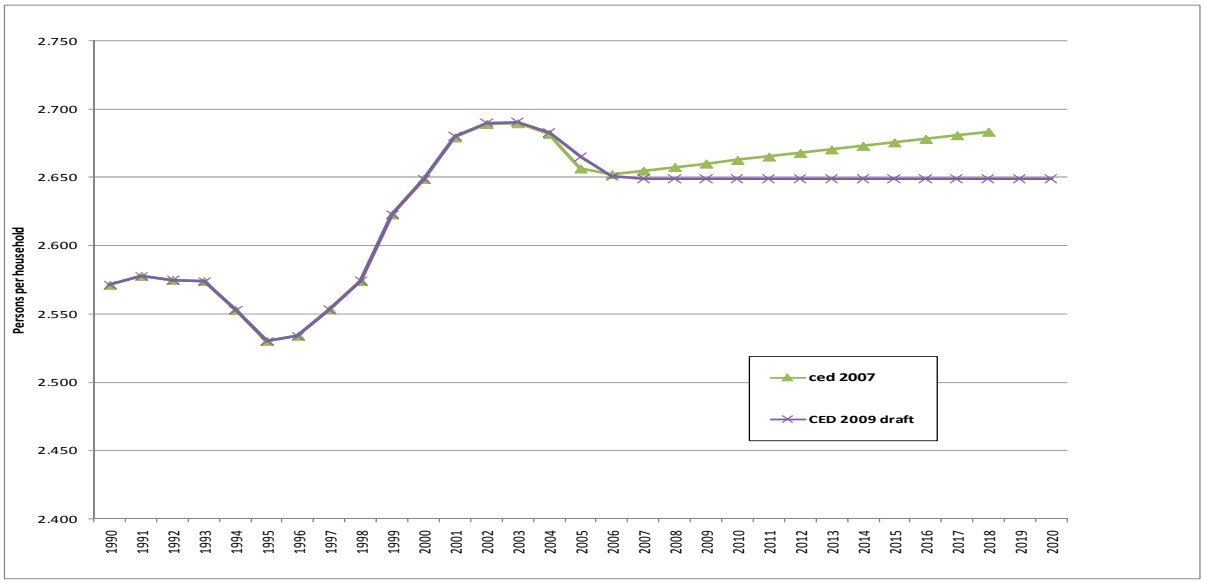
Figures 5-8 and **5-9** compare the residential drivers used in the *CED 2009* forecast with drivers used in *CED 2007*. **Figure 5-8** provides comparisons of total population and total households. **Figure 5-9** compares persons per household projections. The two forecasts of household population are essentially the same. The *CED 2009* forecast of households is slightly higher than the *CED 2007* forecast because of lower projections in persons per household (**Figure 5-9**) used in the current forecast.

Figure 5-8: SMUD Planning Area Residential Household and Household Population Projections



Source: California Energy Commission, 2009

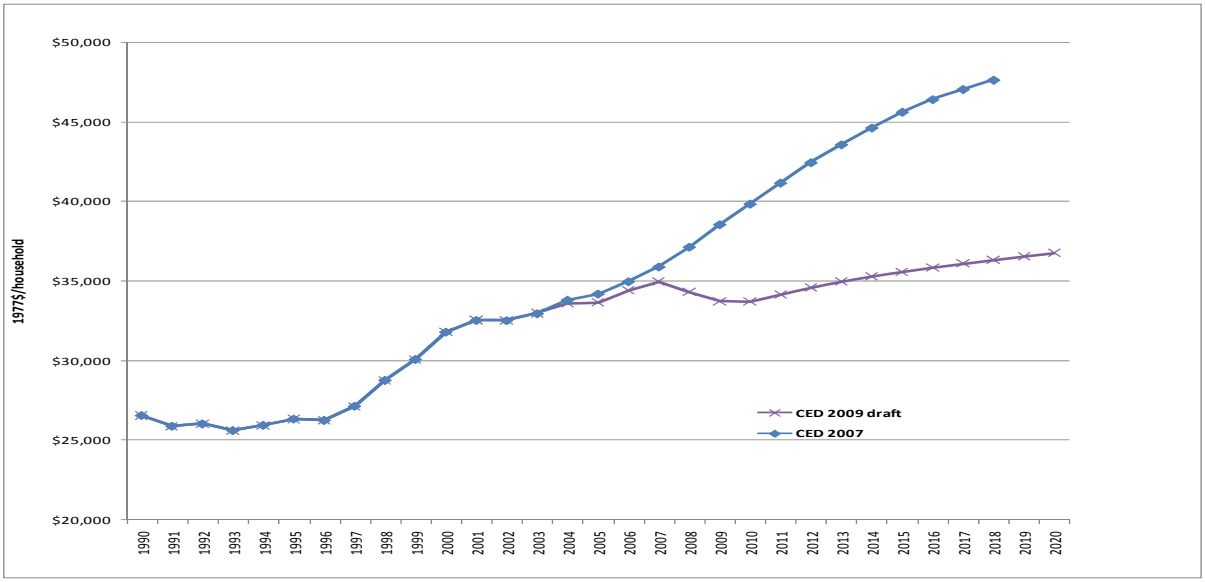
Figure 5-9: SMUD Planning Area Persons per Household Projections



Source: California Energy Commission, 2009

Figure 5-10 compares household income between the two forecasts. Household income is derived as the product of per capita income and persons per household. The *CED 2007* projection declines in the short term as a result of the recent economic situation. It then grows at a much slower rate than the *CED 2007* forecast in the mid to long term than the previous forecast.

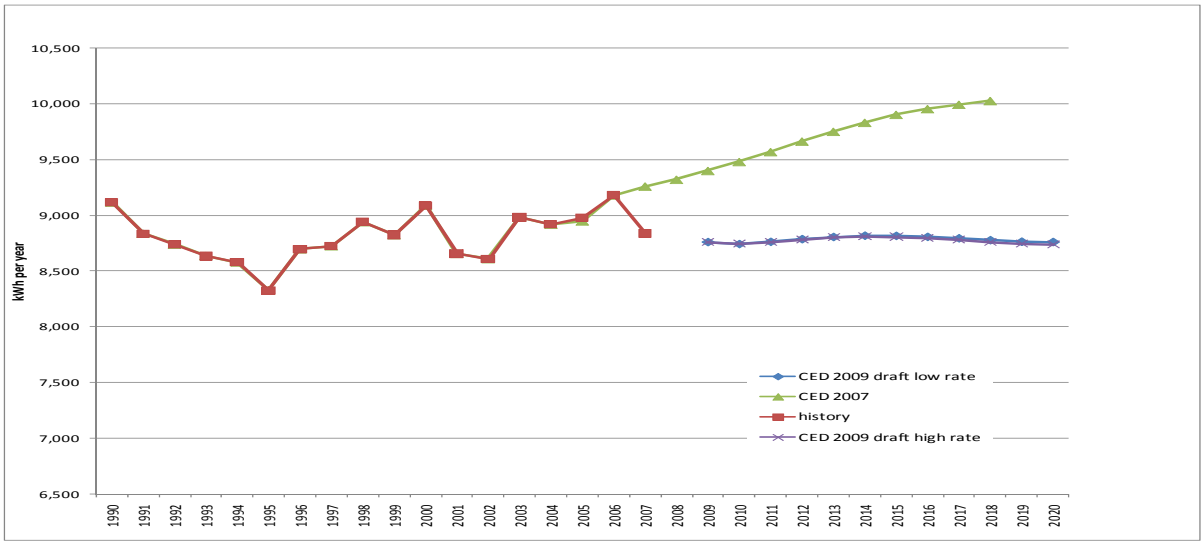
Figure 5-10: SMUD Planning Area Household Income Projections



Source: California Energy Commission, 2009

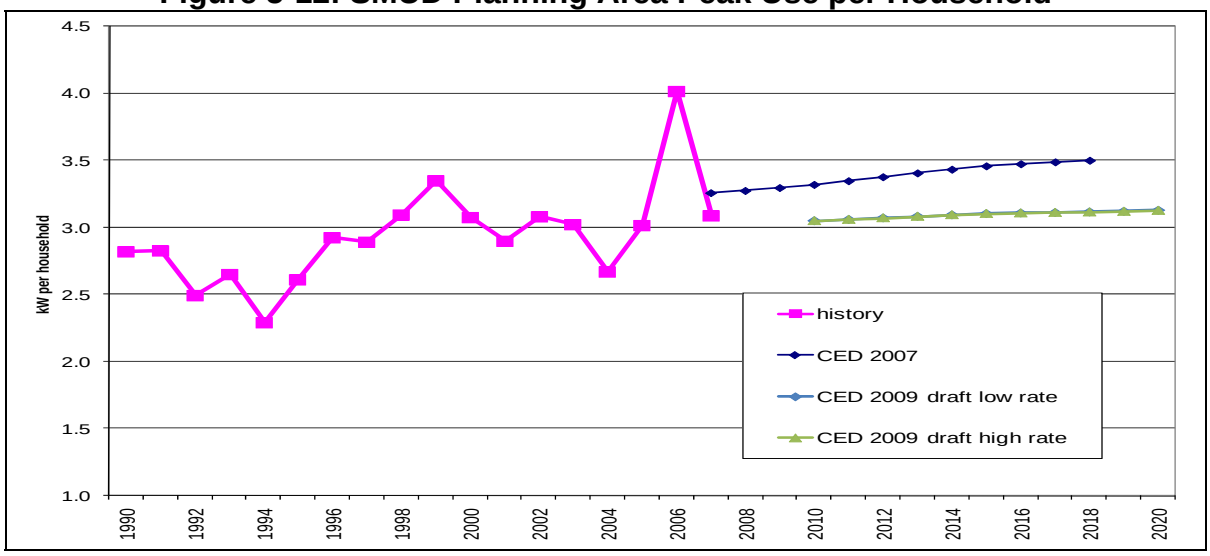
Figure 5-11 compares electricity use per household between the two forecasts as well as the 1990–2007 historic series. The *CED 2009* use per household forecast is now projected to remain relatively constant in contrast to the increasing growth projected in the *CED 2007* forecast. The constant growth projection is a result of lower household income and increases in efficiency savings from lighting programs and standards. The decrease in peak use per household, as seen in **Figure 5-11**, is less than the difference for energy. The reason is the reduced effect of air conditioning savings at peak and less lighting impact on residential peak

Figure 5-11: SMUD Planning Area Electricity Use per Household



Source: California Energy Commission, 2009

Figure 5-12: SMUD Planning Area Peak Use per Household

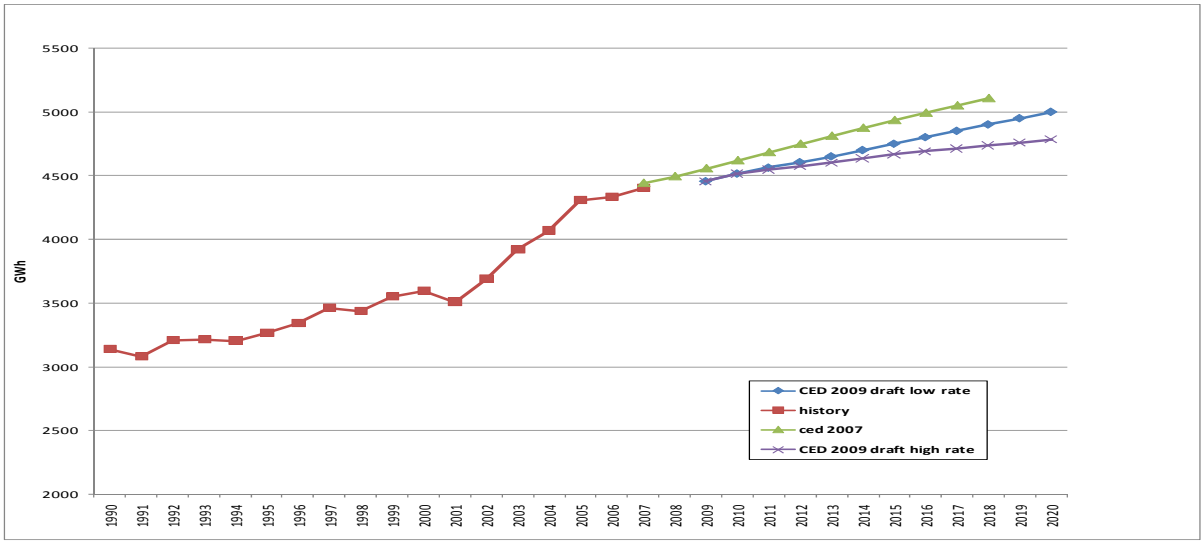


Source: California Energy Commission, 2009

Commercial Building Sector

Figure 5-13 compares the commercial building sector forecasts. The *CED 2009* begins slightly below the *CED 2007* forecast because actual consumption in 2007 was lower than was projected in *CED 2007* and recent economic activity has lowered the short term forecast. The growth rate of the *CED 2009* low-rate scenario is essentially the same as the previous forecast for the mid to long term. The growth of the *CED 2009* high-rate scenario is lower because of increases in prices in the mid to long term.

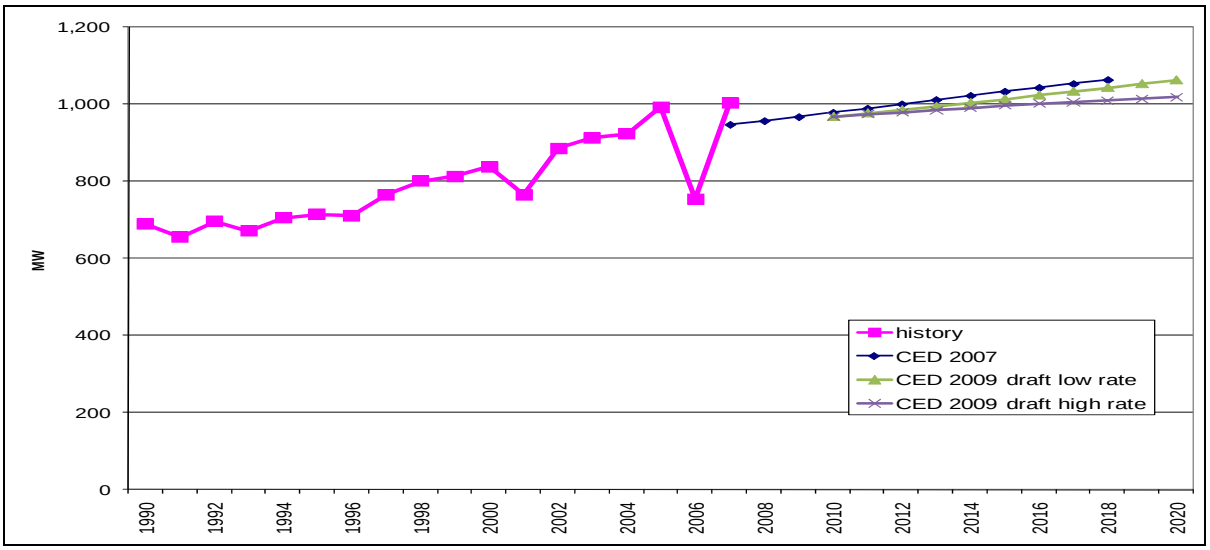
Figure 5-13: SMUD Planning Area Commercial Building Consumption



Source: California Energy Commission, 2009

Figure 5-14 compares the commercial peak demand forecasts. The *CED 2009* forecast is slightly lower than the *CED 2007* commercial peak forecast in the low-rate scenario similar to the electricity consumption result. Differences in peak forecasts are driven primarily by the differences in electricity forecasts.

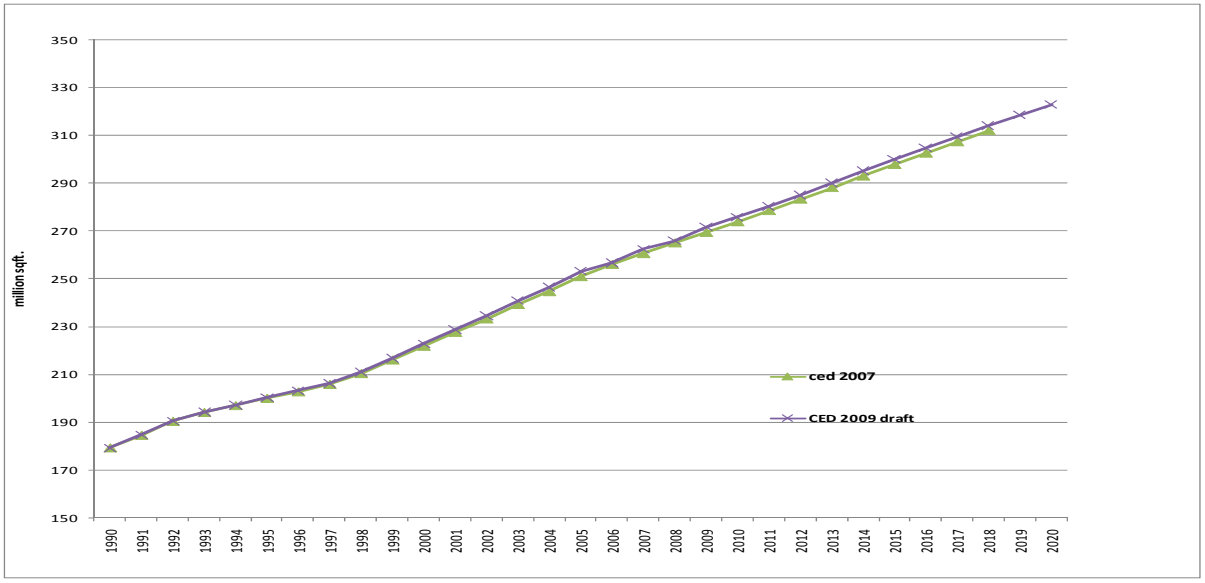
Figure 5-14: SMUD Planning Area Commercial Building Sector Peak



Source: California Energy Commission, 2009

In staff's commercial building sector forecasting model, floor space by building type (for example, retail, offices, schools, and hospitals) is the key driver of electricity growth. **Figure 5-15** compares total commercial floor space projections. The *CED 2009* floor space projections are slightly higher than those used in *CED 2007*.

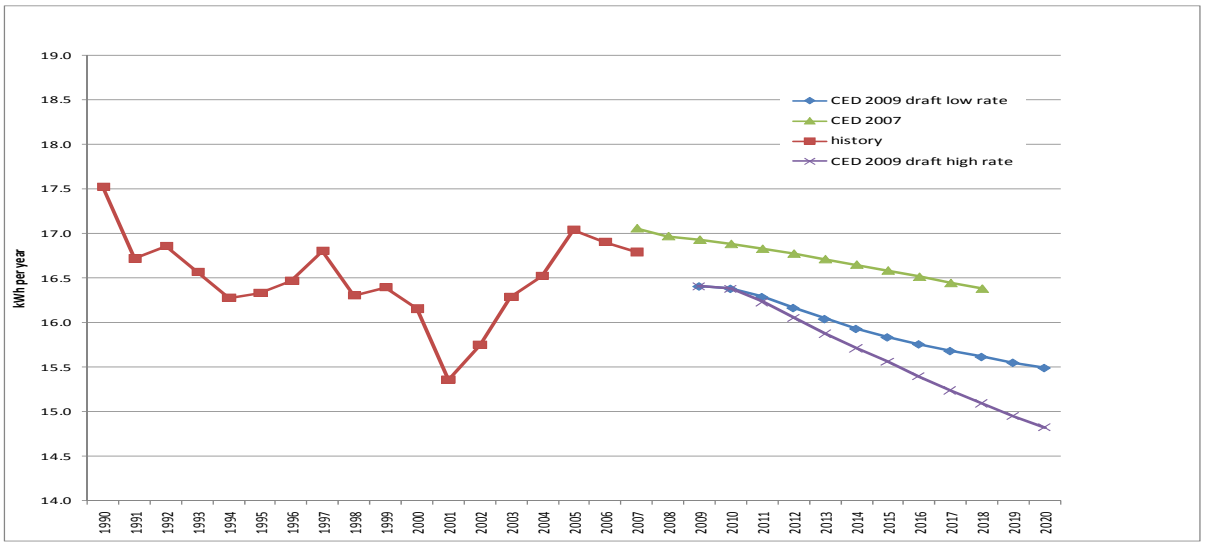
Figure 5-15: SMUD Planning Area Commercial Floor Space



Source: California Energy Commission, 2009

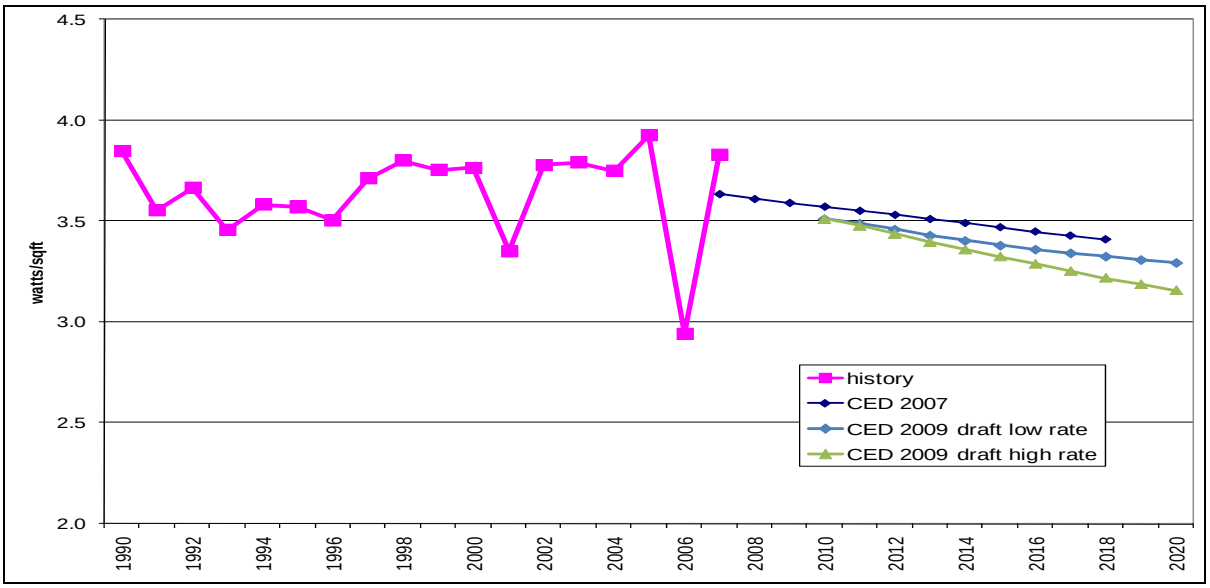
This slightly higher floor space projection is somewhat offset by a decline in projected use per square foot over the forecast period, shown in **Figures 5-16** and **5-17**. This decline is a result of an increasing proportion of new floor space with more efficient end use intensities. Commercial consumption per square foot, in terms of both energy and peak, decreases sharply in the forecast period of the *CED 2009*.

Figure 5-16: SMUD Planning Area Commercial kWh per Square Foot



Source: California Energy Commission, 2009

Figure 5-17: SMUD Planning Area Peak per Square Foot

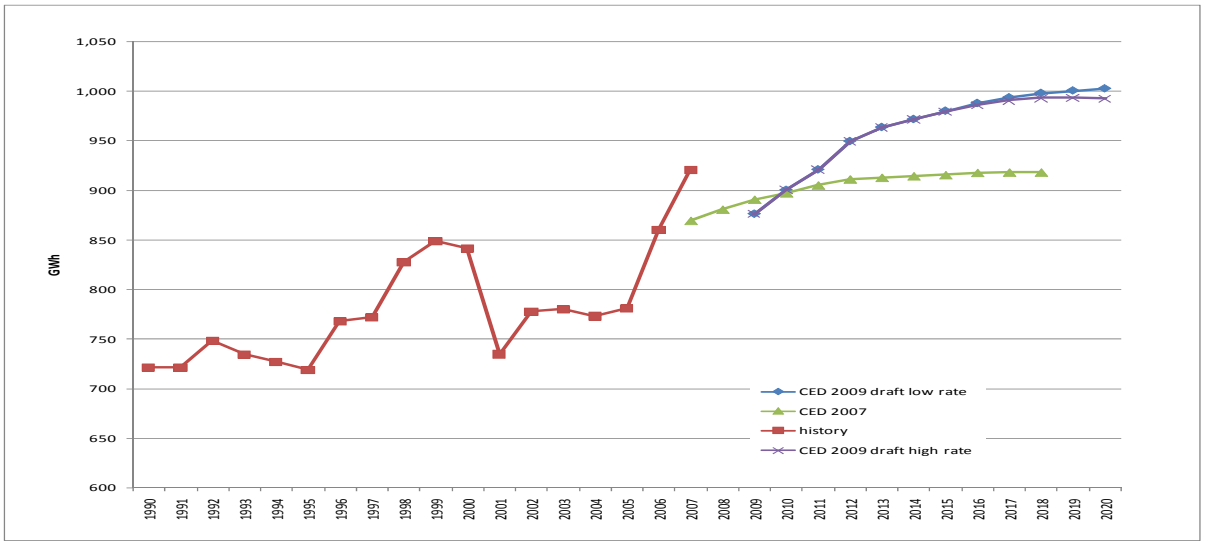


Source: California Energy Commission, 2009

Industrial Sector

Figure 5-18 provides comparisons of the SMUD planning area industrial sector electricity consumption forecasts. The *CED 2009* industrial electricity consumption forecast begins at a lower level than the *CED 2007* forecast, but has a higher growth rate. By the end of the forecast period the staff draft is higher than the previous forecast for both rate scenarios.

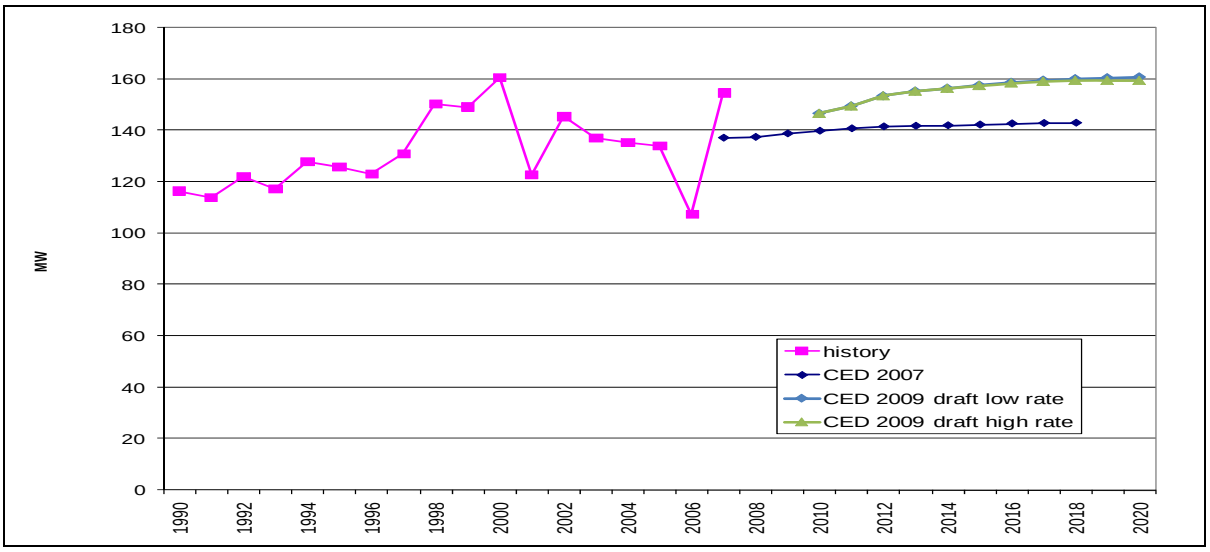
Figure 5-18: SMUD Planning Area Industrial Consumption



Source: California Energy Commission, 2009

Figure 5-19 compares the industrial sector peak forecasts. In contrast to the consumption forecasts, the *CED 2009* forecast starts from a higher initial 2007 value and is higher throughout the forecast period.

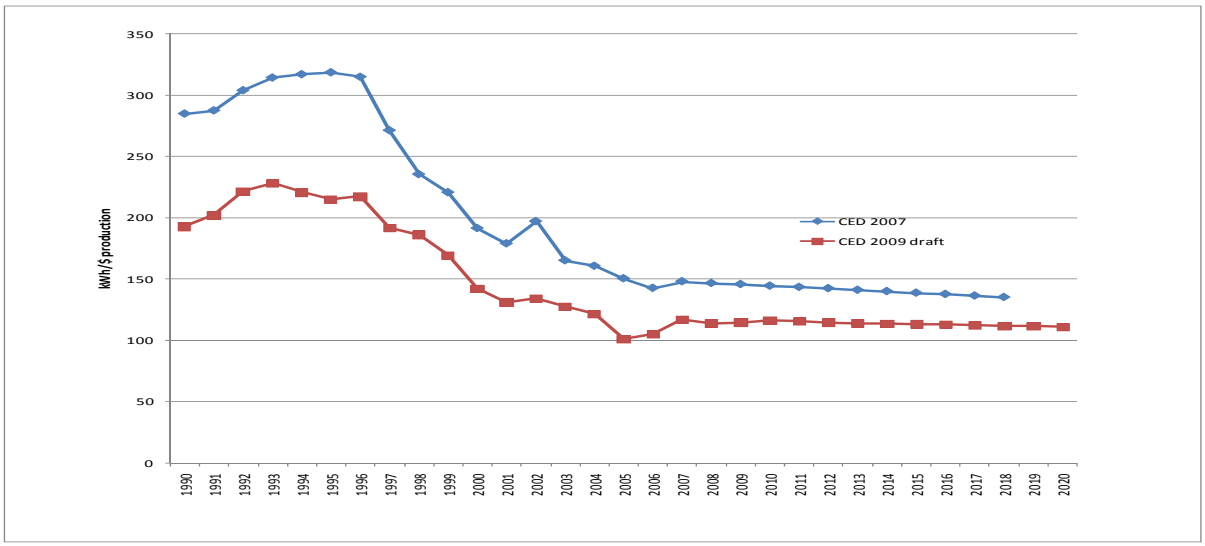
Figure 5-19: SMUD Planning Area Industrial Sector Peak



Source: California Energy Commission, 2009

Figure 5-20 compares use per dollar value of production between the *CED 2009* and *CED 2007* forecasts. The difference in kWh per dollar of industrial value added in the *CED 2009* and *CED 2007* industrial forecasts, especially in the early years, is due to different starting points. These points differ as a result of revised historic industrial production data used for the forecast. The *CED 2009* projection of use per dollar is somewhat flatter than the declining projection used in the previous forecast.

Figure 5-20: SMUD Planning Area Industrial Use per Production Unit



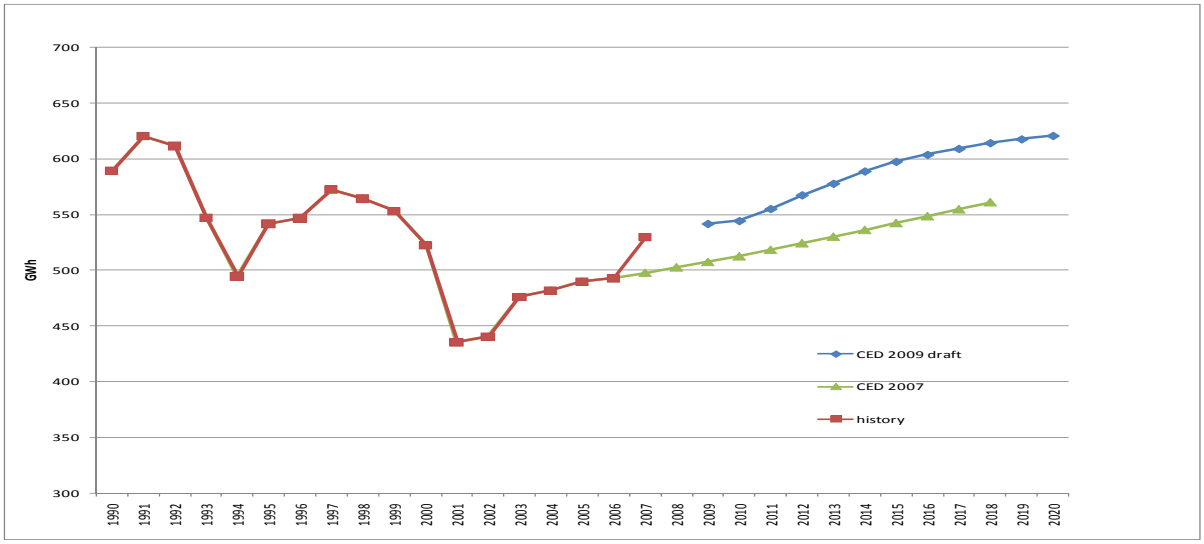
Source: California Energy Commission, 2009

Other Sectors

Figures 5-21 and **5-22** compare the remaining sector electricity consumption forecasts. **Figure 5-21** compares the transportation, communication, and utilities (TCU) sector forecasts. The *CED 2009* forecast is higher than the *CED 2007* forecast because of a higher historic starting point.

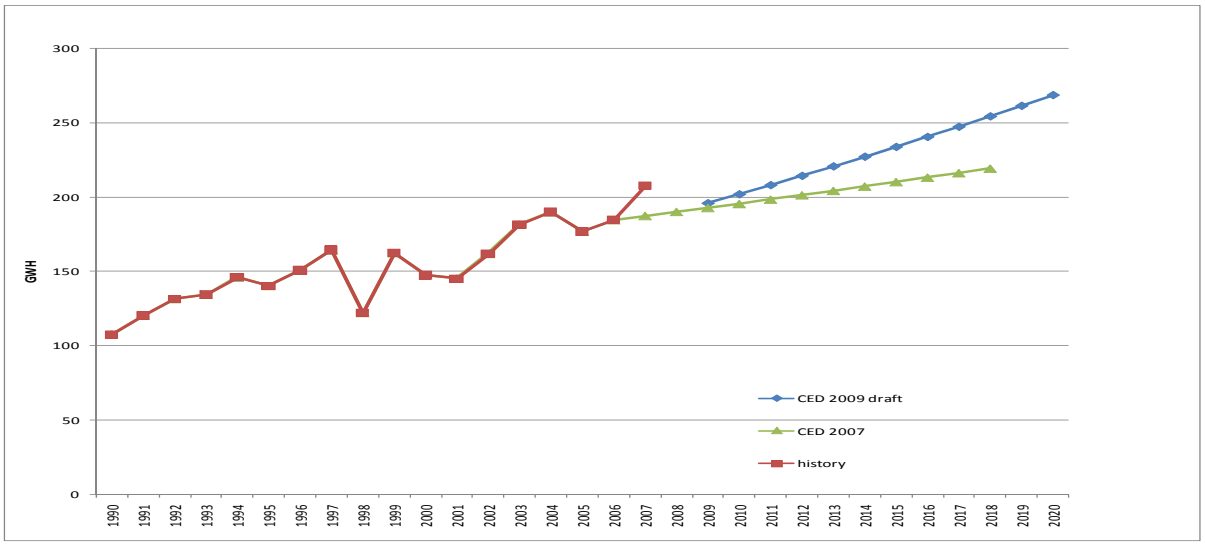
Figure 5-22 provides comparisons of the agriculture and water pumping sector forecasts. The *CED 2009* agriculture and water pumping forecast is about the same as the *CED 2007* forecast in the short term but grows at a faster rate over the forecast period.

Figure 5-21: SMUD Planning Area
Transportation, Communication & Utilities Sector Electricity Consumption



Source: California Energy Commission, 2009

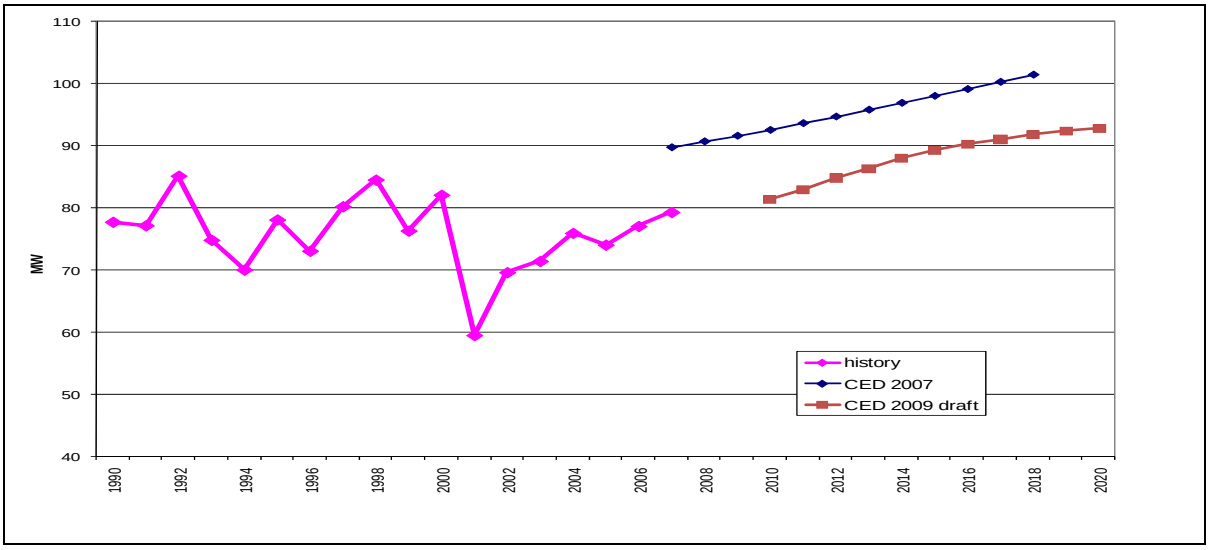
Figure 5-22: SMUD Planning Area
Agriculture & Water Pumping Electricity Consumption Forecasts



Source: California Energy Commission, 2009

Figure 5-23 compares the combined Other Sector peaks for the *CED 2009* and *CED 2007* forecasts. The *CED 2009* forecast is lower over the entire forecast period than the *CED 2007* given a lower assumed starting point resulting from a reclassification of historical consumption. However, the growth rate of the *CED 2009* forecast is essentially the same as the *CED 2007* forecast.

Figure 5-23: SMUD Planning Area Other Sector Peak



Source: California Energy Commission, 2009

Self-Generation

The peak demand forecast is reduced by self generation, including the effects of the SGIP, CSI, and other programs, as discussed in Chapter 1. The effects of these programs are forecast based on recent trends in installations. Based on current trends, staff projects about 15 MW of peak reduction from photovoltaic systems by 2020. Annual values for the SMUD planning area are reported in Form 1.2 in the Appendix.

Conservation/Efficiency Impacts

Staff spent a great deal of time refining methods to account for energy efficiency and conservation impacts while preparing this forecast, particularly for utility efficiency programs. **Tables 5-2** and **5-3** show electricity consumption and peak savings estimates for selected years, for building and appliance standards, utility and public agency programs, and "naturally occurring" savings, or savings associated with rate changes and certain market trends not directly related to programs or standards. Savings are measured against a baseline before 1975, so they incorporate more than 30 years of impacts from rate changes and standards. Chapter 8 provides much more detail on staff work related to energy efficiency and conservation.

Table 5-2: SMUD Planning Area Electricity Consumption Savings Estimates

	1990	1998	2003	2008	2011	2015	2020
Residential Energy Savings (GWh)							
Building Standards	504	624	725	749	788	847	924
Appliance Standards	172	381	538	661	713	778	850
Utility and Public Agency Programs	208	259	255	252	217	145	112
Naturally Occurring Savings	29	36	42	61	112	188	295
Total Residential Savings	912	1301	1560	1723	1830	1959	2181
Commercial Energy Savings (GWh)							
Building Standards	70	142	232	323	386	471	578
Appliance Standards	38	83	120	162	186	218	258
Utility and Public Agency Programs*	6	55	55	56	56	56	52
Naturally Occurring Savings	632	591	773	800	872	973	1149
Total Commercial Savings	747	871	1180	1341	1500	1718	2037
Total Energy Savings	1659	2172	2741	3064	3330	3676	4218

Source: California Energy Commission, 2009

*Commercial programs also include agricultural program savings.

Table 5-3: SMUD Planning Area Electricity Peak Savings Estimates

	1990	1998	2003	2008	2011	2015	2020
Residential Energy Savings (MW)							
Building Standards	156	216	244	266	279	303	335
Appliance Standards	53	132	181	235	252	278	308
Utility and Public Agency Programs	64	90	86	89	77	52	41
Naturally Occurring Savings	9	13	14	22	40	67	107
Total Residential Savings	282	450	526	612	648	700	791
Commercial Energy Savings (MW)							
Building Standards	15	33	54	71	83	100	123
Appliance Standards	8	19	28	35	40	47	55
Utility and Public Agency Programs*	1	13	13	12	12	12	11
Naturally Occurring Savings	139	138	180	175	187	208	244
Total Commercial Savings	164	203	275	293	321	367	433
Total Energy Savings	447	653	800	905	970	1067	1224

Source: California Energy Commission, 2009

*Commercial programs also include agricultural program savings.

CHAPTER 6: Los Angeles Department of Water and Power Planning Area

The Los Angeles Department of Water and Power (LADWP) planning area includes LADWP bundled retail customers and customers served by any energy service providers (ESPs) using the LADWP distribution system to deliver electricity to end users.

This chapter is organized similarly to previous chapters. First, forecasted consumption and peak loads for the LADWP planning area are discussed; both total and per capita values are presented. The *CED 2009* values are compared to the *CED 2007* forecast; significant differences between the two forecasts are explained. The forecasted load factor, jointly determined by the consumption and peak load estimates, is also discussed. Second, sector consumption and peak load forecasts are presented. The residential, commercial, industrial, and "other" sector forecasts are compared to those in *CED 2007*.

CED 2007 assumed constant electricity rates throughout the forecast period. For the *CED 2009* forecast, three price scenarios were developed for electricity rates: high rates, low (constant) rates, and a rate scenario in between the two. The high-rate case assumed approximately 30 percent higher rates by 2020 relative to 2010, while the "mid-rate" case assumed 15 percent higher rates over the same period. In the low-rate case, rates remained at 2010 levels through 2020. Chapter 1 provides more details.

Forecast Results

Table 6-1 compares electricity consumption and peak demand for selected years. **Figures 6-1 and 6-2** present a graphical comparison of the annual energy consumption and peak demand forecasts, respectively.

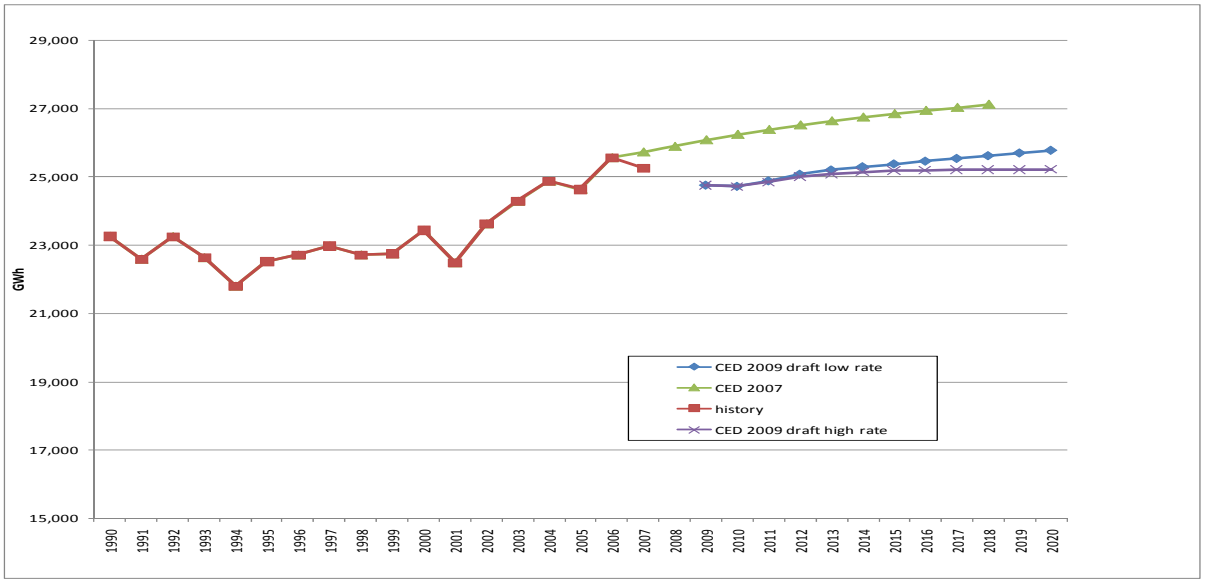
Table 6-1: LADWP Planning Area Forecast Comparison

Consumption (GWH)					
	CED 2007	CED 2009 Staff Draft Low Rate	CED 2009 Staff Draft High Rate	Percent Difference Staff Low Rate/CED 2007	Percent Difference Staff High Rate/CED 2007
1990	23,263	23,263	23,263	0.00%	0.00%
2000	23,437	23,437	23,437	0.00%	0.00%
2007	25,726	25,258	25,258	-1.82%	-1.82%
2010	26,241	24,729	24,729	-5.76%	-5.76%
2015	26,846	25,379	25,189	-5.46%	-6.17%
2018	27,120	25,619	25,213	-5.53%	-7.03%
Average Annual Growth Rates					
1990-2000	0.07%	0.07%	0.07%		
2000-2007	1.34%	1.51%	1.51%		
2007-2010	0.66%	-0.70%	-0.70%		
2010-2018	0.41%	0.44%	0.24%		
Peak (MW)					
	CED 2007	CED 2009 Staff Draft Low Rate	CED 2009 Staff Draft High Rate	Percent Difference Staff Low Rate/CED 2007	Percent Difference Staff High Rate/CED 2007
1990	5,326	5,326	5,326	0.00%	0.00%
2000	5,325	5,325	5,325	0.00%	0.00%
2007	5,685	6,134	6,134	7.90%	7.90%
2010	5,786	5,838	5,838	0.90%	0.90%
2015	5,907	5,978	5,929	1.20%	0.37%
2018	5,966	6,042	5,941	1.27%	-0.42%
Average Annual Growth Rates					
1990-2000	0.00%	0.00%	0.00%		
2000-2007	1.32%	2.87%	2.87%		
2007-2010	0.59%	-1.64%	-1.64%		
2010-2018	0.38%	0.43%	0.22%		
Historic values are shaded					

Source: California Energy Commission, 2009

As shown in **Figure 6-1**, the *CED 2009* electricity consumption forecast is lower throughout the forecast period for both the low and high-rate scenarios. The *CED 2009* forecast begins from a lower starting point caused by the recent economic downturn. After 2011 the low-rate scenario grows at a similar growth rate to the *CED 2007* forecast while the high-rate scenario continues on a relatively flat trajectory.

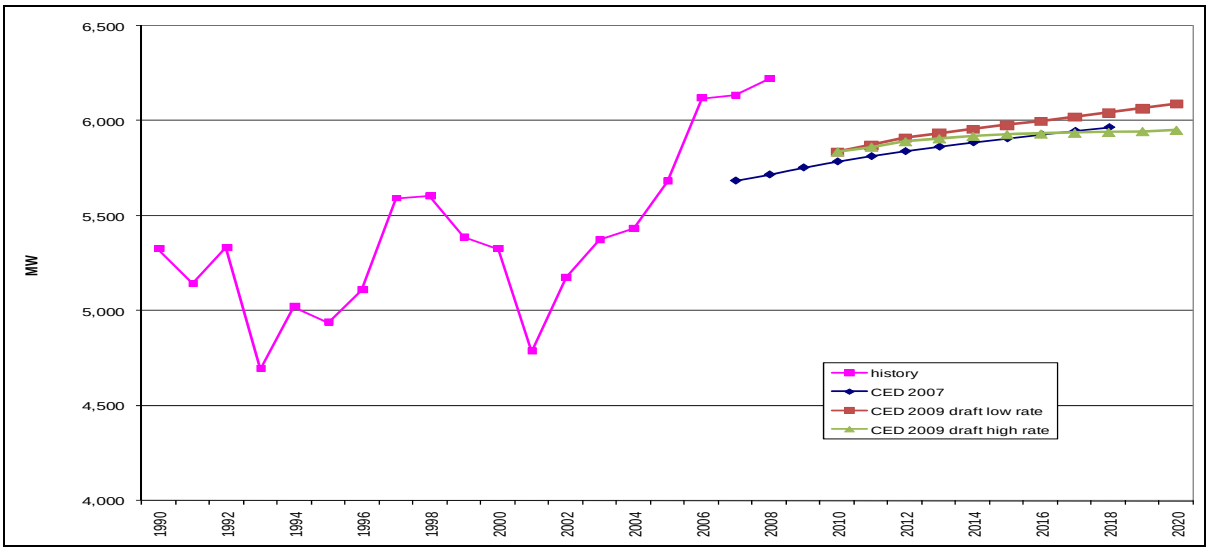
Figure 6-1: LADWP Planning Area Electricity Forecast



Source: California Energy Commission, 2009

In contrast to the electricity consumption forecast, the difference in LADWP planning area peak demand forecasts, shown in **Figure 6-2**, are not as great. The *CED 2009* forecast is slightly higher than the *CED 2007* forecast for both the low and high-rate scenarios in the short and intermediate term forecast horizon. In the long term the high-rate forecast flattens out and is lower than the previous forecast but the low-rate scenario remains above the previous forecast throughout the forecast period.

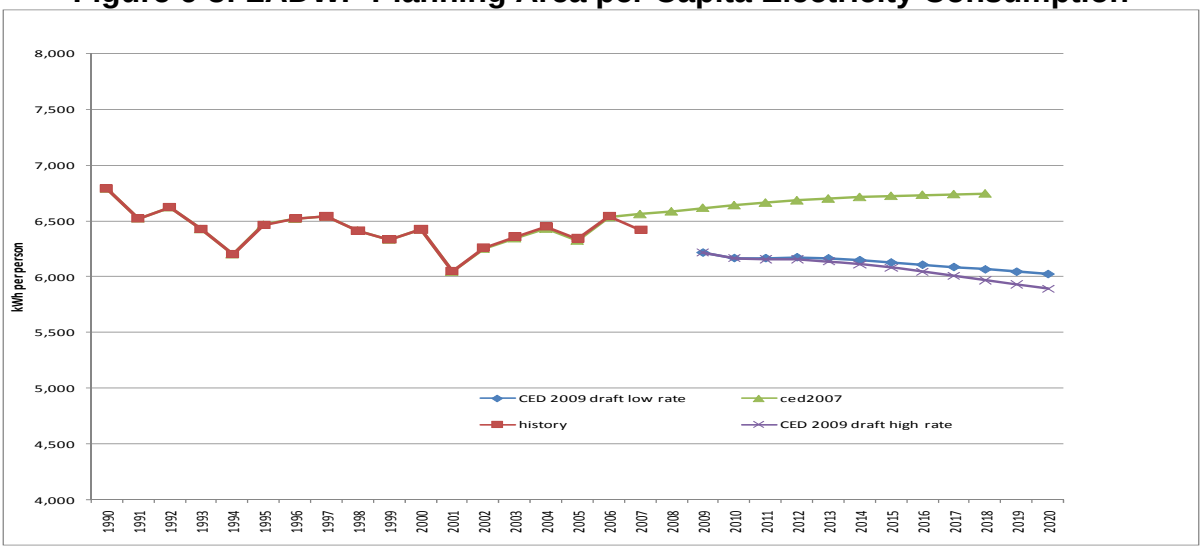
Figure 6-2: LADWP Planning Area Peak



Source: California Energy Commission, 2009

Figures 6-3 provides comparisons of LADWP planning area per capita electricity consumption between the *CED 2009* and *CED 2007* forecasts. Per capita consumption in the *CED 2009* forecast is lower throughout the forecast period than that projected in the *CED 2007* forecast. Projected per capita use is forecasted to decline in both the high- and low-rate scenarios as opposed to the increase in per capita electricity consumption projected in *CED 2007*.

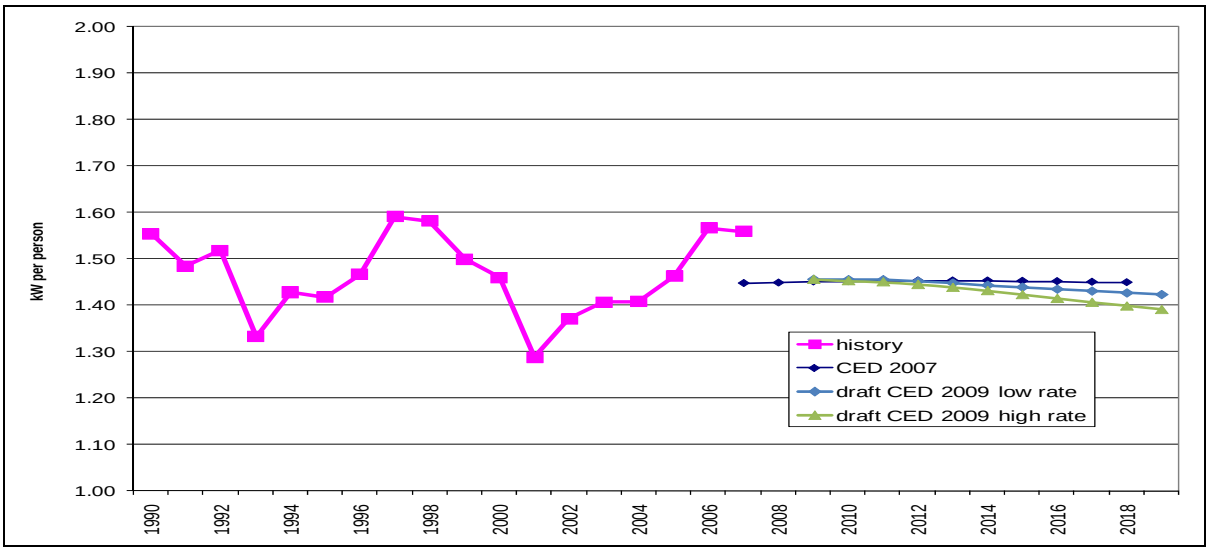
Figure 6-3: LADWP Planning Area per Capita Electricity Consumption



Source: California Energy Commission, 2009

Per capita peak demand, shown in **Figure 6-4**, is slightly lower than projected in the *CED 2007* forecast after 2012. Both *CED 2009* scenarios decline over the forecast period.

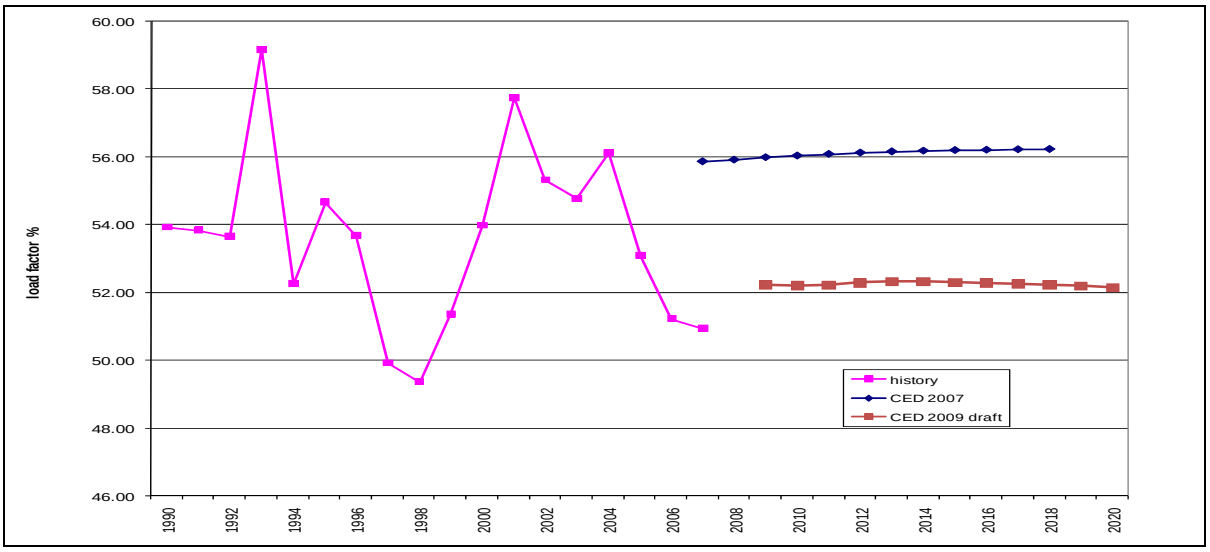
Figure 6-4: LADWP Planning Area per Capita Peak Demand



Source: California Energy Commission, 2009

Figure 6-5 compares the respective load factors. The load factor is a measure of the relative increase in peak demand with respect to annual electricity consumption. The *CED 2009* load factor is lower than the *CED 2007* load factor which reflects the more recent trend of lower load factors in the LADWP planning area.

Figure 6-5: LADWP Planning Area Load Factor



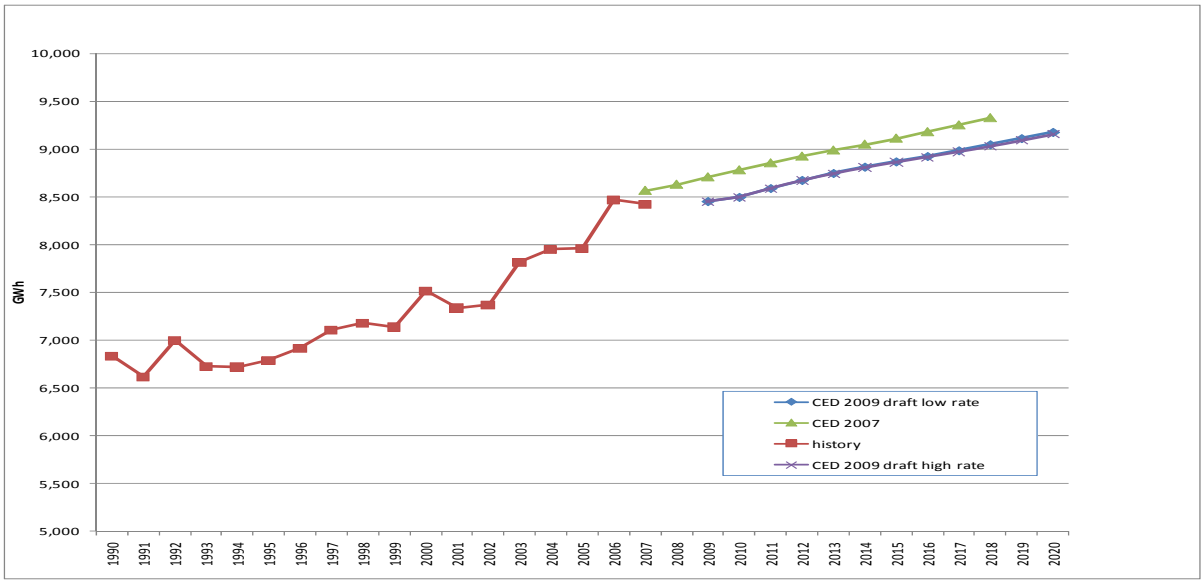
Source: California Energy Commission, 2009

Sector Level Results and Input Assumptions

Residential

Figure 6-6 compares between the *CED 2009* and *CED 2007* LADWP planning area residential forecasts. The *CED 2009* forecast is lower over the forecast period than the *CED 2007* forecast. This is caused in part by recent economic conditions which lowered the projection of household income. Also contributing to the lower forecast is an increase in lighting savings in the residential sector.

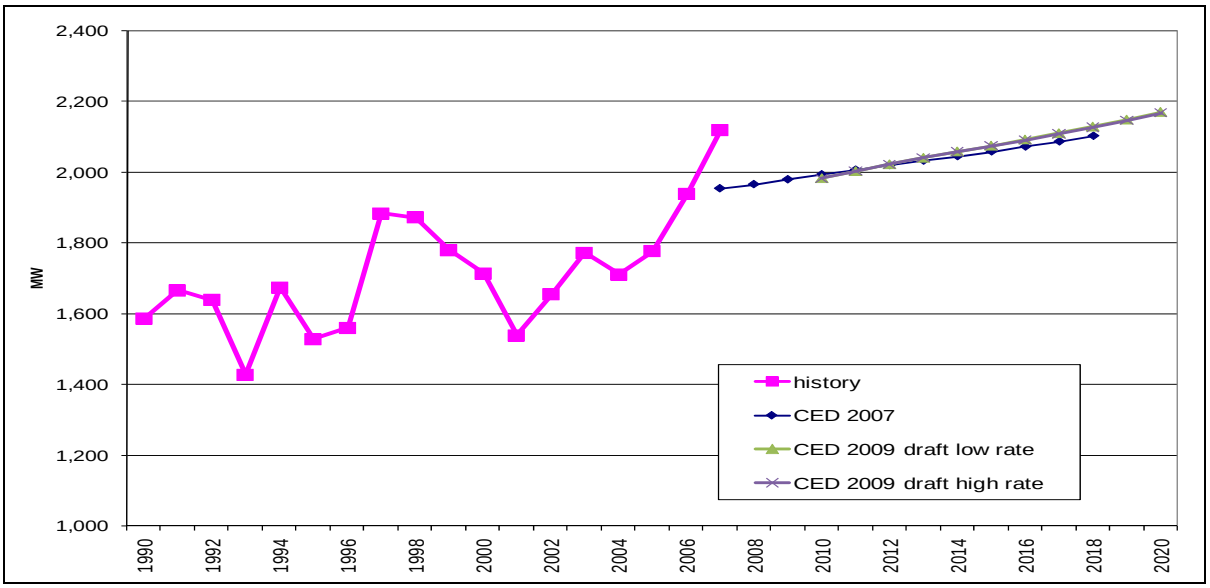
Figure 6-6: LADWP Planning Area Residential Consumption



Source: California Energy Commission, 2009

Figure 6-7 compares the *CED 2009* and *CED 2007* residential peak demand forecasts. Unlike the electricity forecasts the residential peak forecasts are very similar, the *CED 2009* forecast being slightly higher than the *CED 2007* residential peak forecast. This is because most of the reduction in residential electricity does not have a corresponding effect on peak (i.e., residential lighting savings).

Figure 6-7: LADWP Planning Area Residential Peak

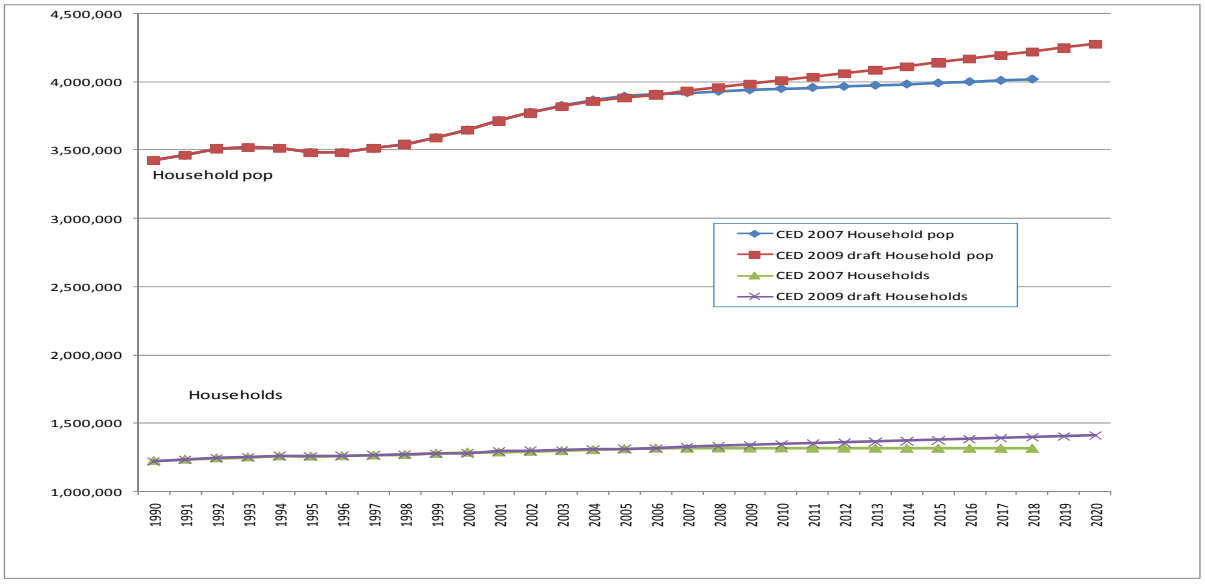


Source: California Energy Commission, 2009

Figures 6-8, 6-9 and **6-10** compare the residential drivers used in the *CED 2009* forecast with those used in *CED 2007*. For this forecast, staff revised the process allocating Los Angeles County population, housing, and income data to the five utility service areas providing electricity within the county—SCE; the cities of Burbank, Glendale, and Pasadena; and LADWP. Sources of information, such as websites for the cities of Glendale and Los Angeles, and the County of Los Angeles, provided substantial insight into population shifts within the area. The result of this revision is to allocate more of the county's population to LADWP but a higher proportion of homes to the warmer valley area and fewer to the coastal region. Also, a higher proportion of the county's personal income is assumed for the residents of Burbank, Glendale, and Pasadena.

Figure 6-8 provides comparisons of household population and total households between the two forecasts. The *CED 2009* forecast of total population and households is higher throughout the forecast period than the *CED 2007* forecast due to continued high population growth seen in the LADWP planning area.

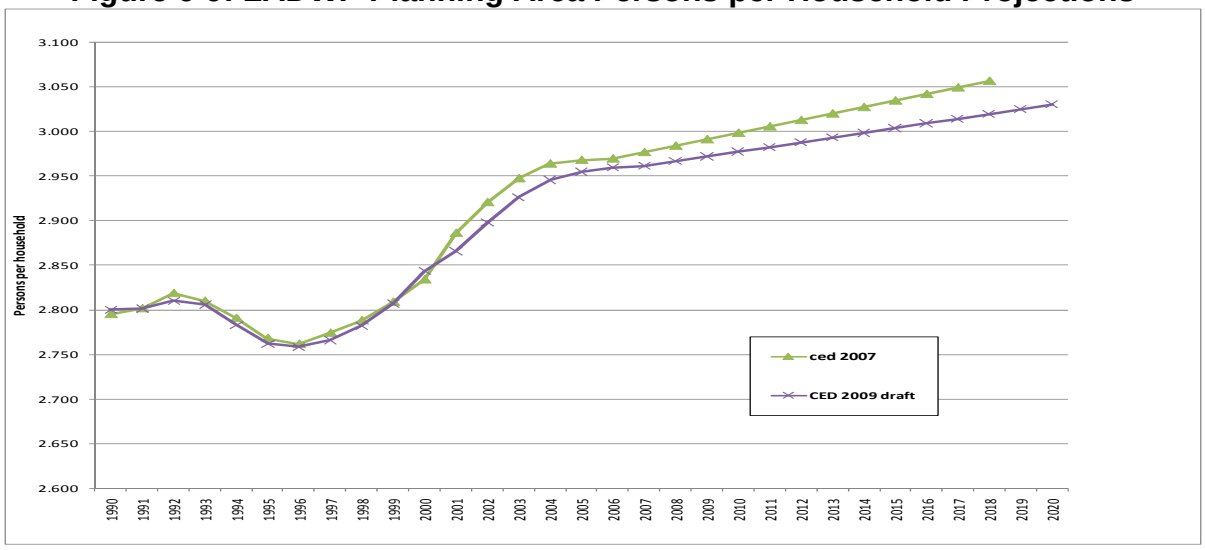
Figure 6-8: LADWP Planning Area Residential Demographic Projections



Source: California Energy Commission, 2009

Staff's *CED 2009* projections of persons per household (**Figure 6-9**) are somewhat lower than those used in the *CED 2007* forecast, based on recent estimates provided by the Department of Finance E5-A estimates. Staff has reduced previous assumptions of increasing persons per household to a rate approximately half of the increase seen in the 1990-2000 period. This yields a forecast of household growth that is slightly higher than the *CED 2007* forecast.

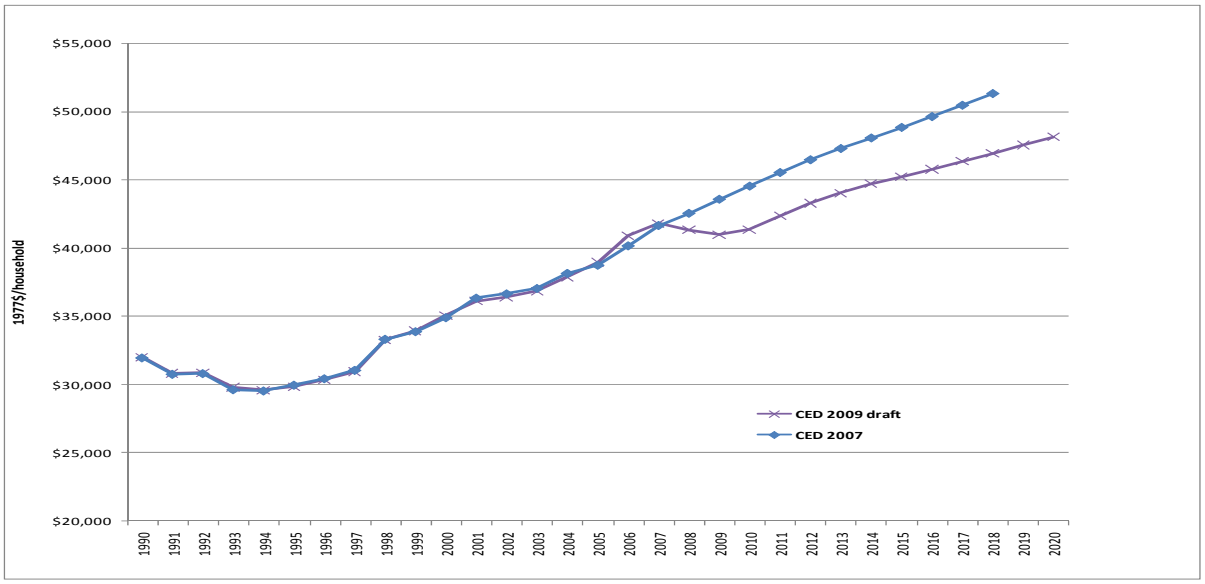
Figure 6-9: LADWP Planning Area Persons per Household Projections



Source: California Energy Commission, 2009

Figure 6-10 compares household income between the two forecasts. Household income is derived as the product of per capita income and persons per household. The *CED 2009* projection declines in the beginning of the forecast period because of current economic conditions. The *CED 2009* forecast then grows at a slightly lower rate than the *CED 2007* forecast for the remainder of the forecast period. This results in a household income forecast that is much lower than the previous forecast for the entire forecast period.

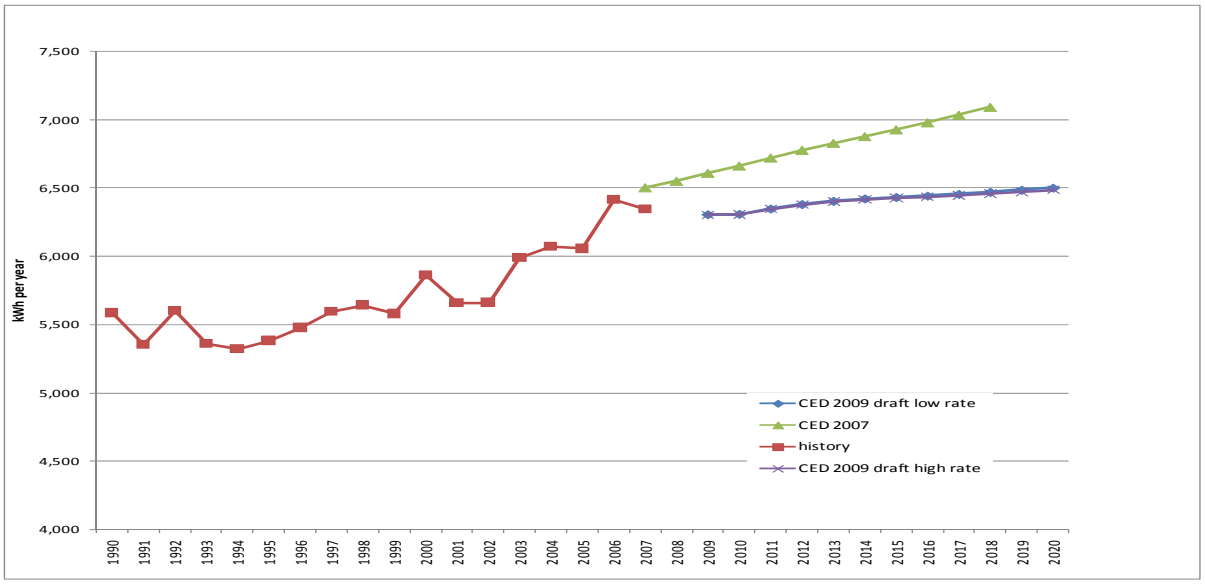
Figure 6-10: LADWP Planning Area Household Income Projections



Source: California Energy Commission, 2009

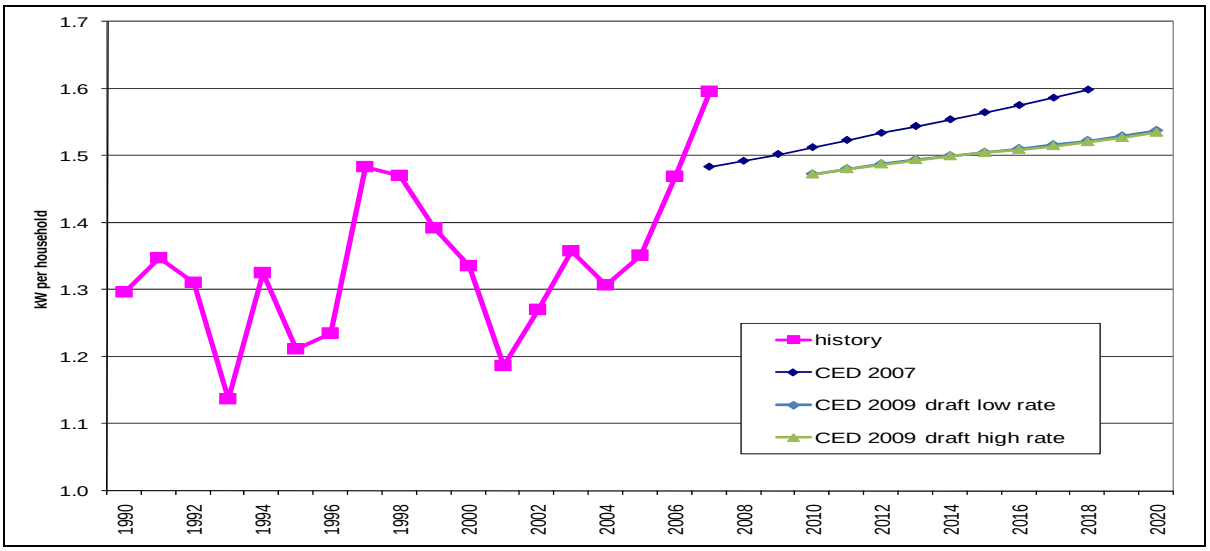
Figure 6-11 compares electricity use per household between the two forecasts as well as the 1990-2007 historic series. The *CED 2009* forecast of use per household is relatively constant over the forecast period compared with the increase of the previous forecast. Peak use per household, as seen in **Figure 6-12**, is also lower in the *CED 2009* forecast but to a lesser degree than the difference for energy. The reason is the reduced effect of air conditioning savings at peak and more off peak savings caused by lighting retrofit.

Figure 6-11: LADWP Planning Area Use per Household



Source: California Energy Commission, 2009

Figure 6-12: LADWP Planning Area Peak Use per Household

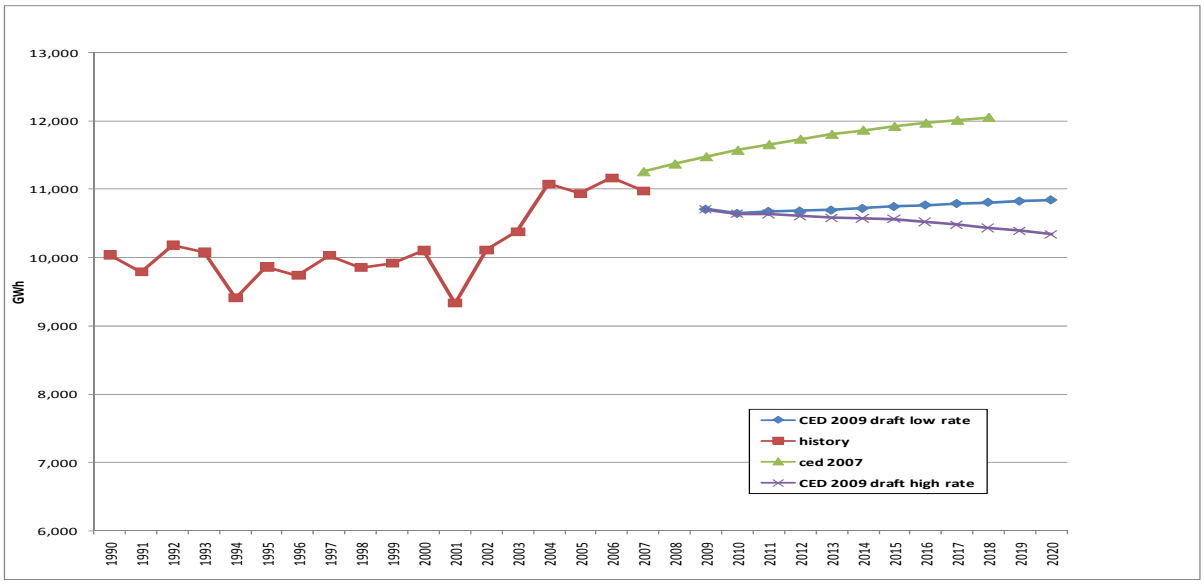


Source: California Energy Commission, 2009

Commercial Building Sector

Figure 6-13 compares the commercial building sector forecasts. The *CED 2009* forecast is lower throughout the entire forecast. This is primarily due to lower projections of commercial floor space in the short- and mid-term period as well as increased compliance of retrofit commercial lighting standards. The *CED 2009* commercial building electricity consumption growth rate is relatively constant in the low-rate scenario and declines in the high-rate scenario.

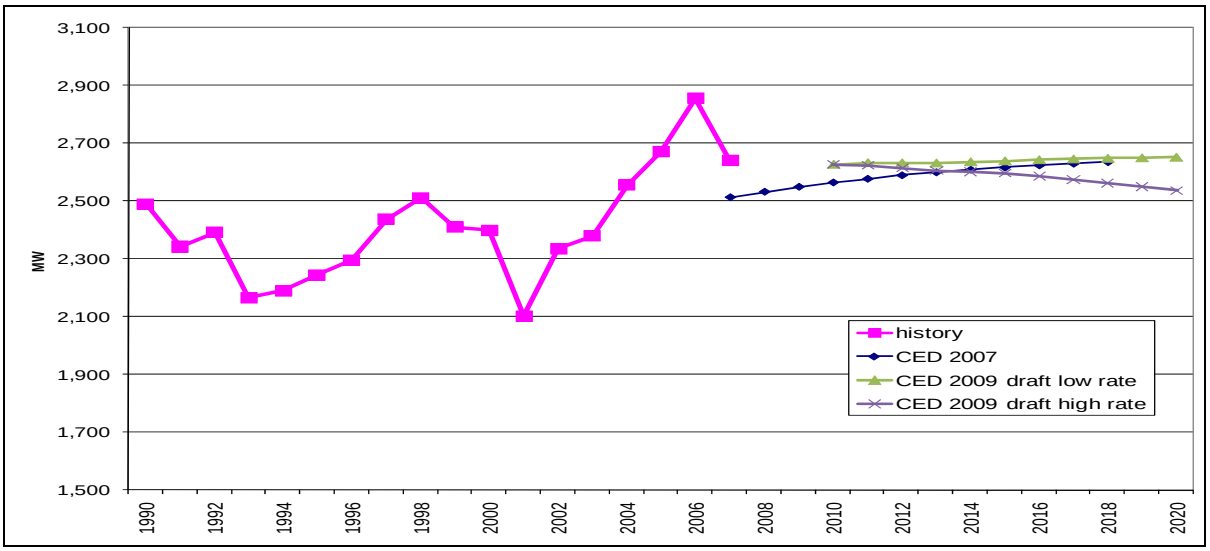
Figure 6-13: LADWP Planning Area Commercial Consumption



Source: California Energy Commission, 2009

Figure 6-14 compares the commercial peak demand forecasts. The *CED 2009* forecast is higher in the short term because of a higher starting point. The low-rate forecast is relatively constant throughout the forecast period and ends at essentially the same point as the *CED 2007* forecast. The high-rate scenario declines over the forecast period and is lower than the *CED 2007* forecast after 2013.

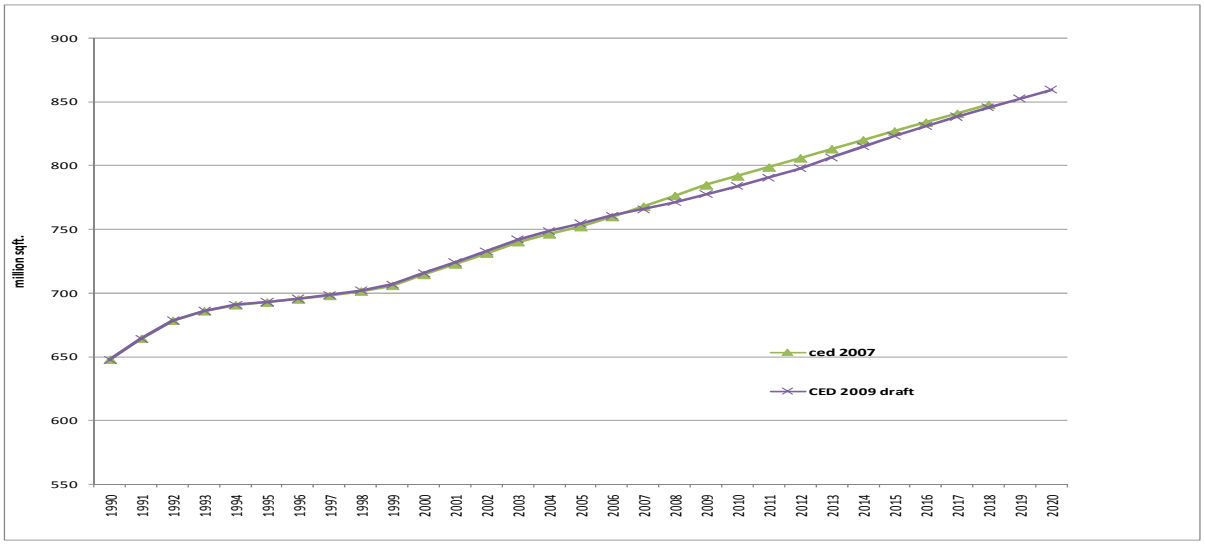
Figure 6-14: LADWP Planning Area Commercial Sector Peak



Source: California Energy Commission, 2009

In staff's commercial building sector forecasting model, floor space by building type (for example, retail, offices, and schools) is the key driver of energy demand trends. The commercial building floor space forecast is based on the historic trend of additions in the LADWP planning area. **Figure 6-15** compares total commercial floor space projections. For the LADWP planning area the *CED 2009* floor space projections are lower in the short- and intermediate-term than the *CED 2007* floor space projections because of methodology changes in estimation discussed in Chapter 1.

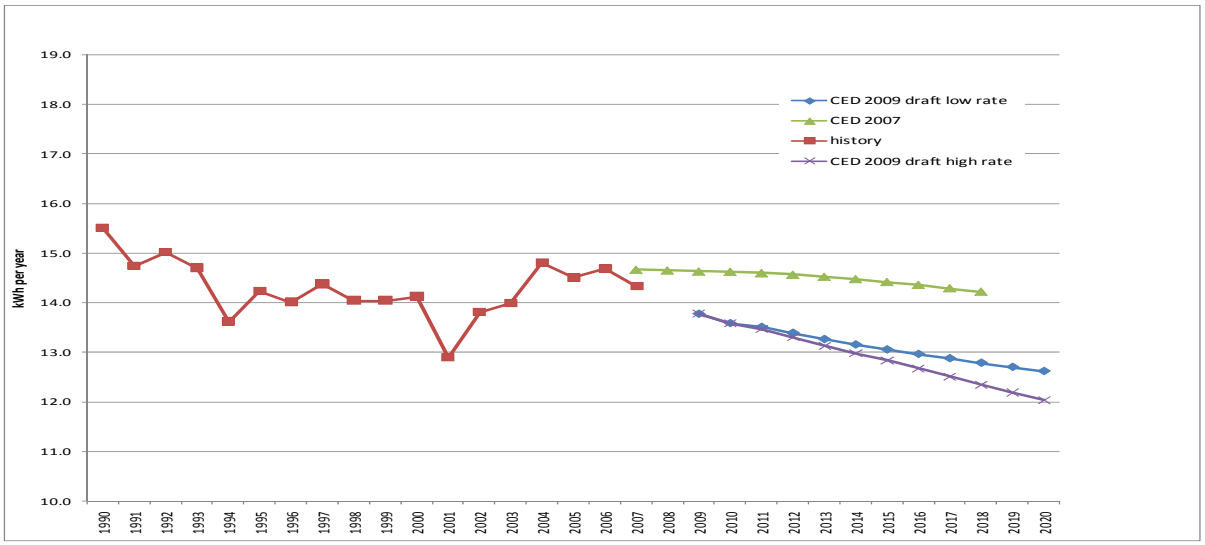
Figure 6-15: LADWP Planning Area Commercial Floor Space



Source: California Energy Commission, 2009

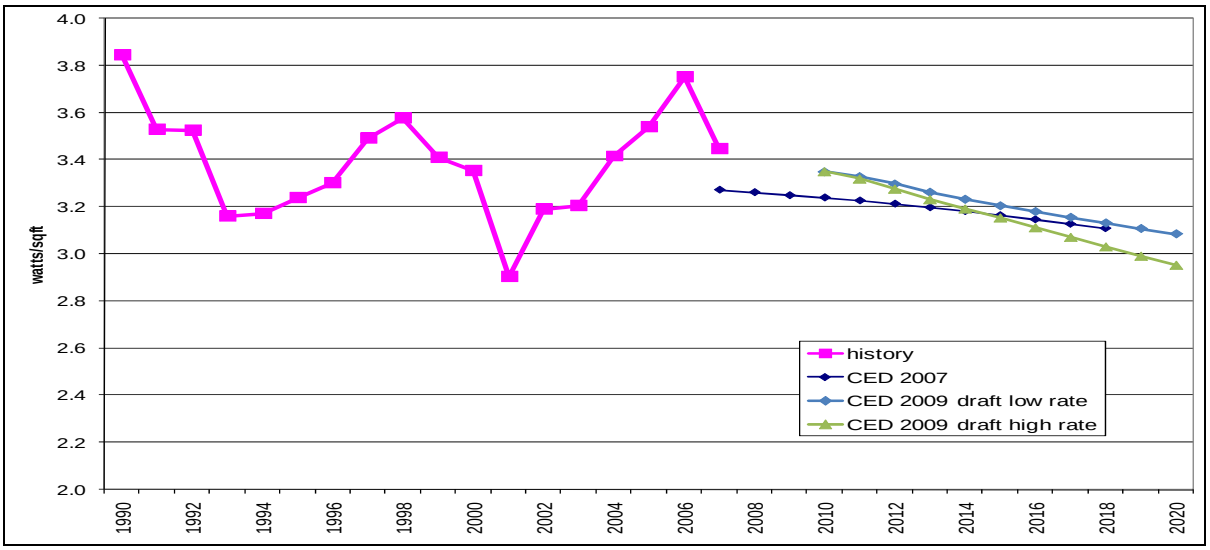
Projected use per square foot over the forecast period, shown in **Figures 6-16** and **6-17** declines in both the energy (**Figure 6-16**) and peak (**Figure 6-17**) cases. This decline is a result of an increasing proportion of new floor space with more efficient end use intensities. Commercial consumption per square foot, in terms of energy and peak, decreases sharply in the forecast period of the *CED 2009* although the peak use per square foot starts from a higher value than assumed in *CED 2007.*

Figure 6-16: LADWP Planning Area Commercial kWh per Square Foot



Source: California Energy Commission, 2009

Figure 6-17: LADWP Planning Area Commercial Watts per Square Foot

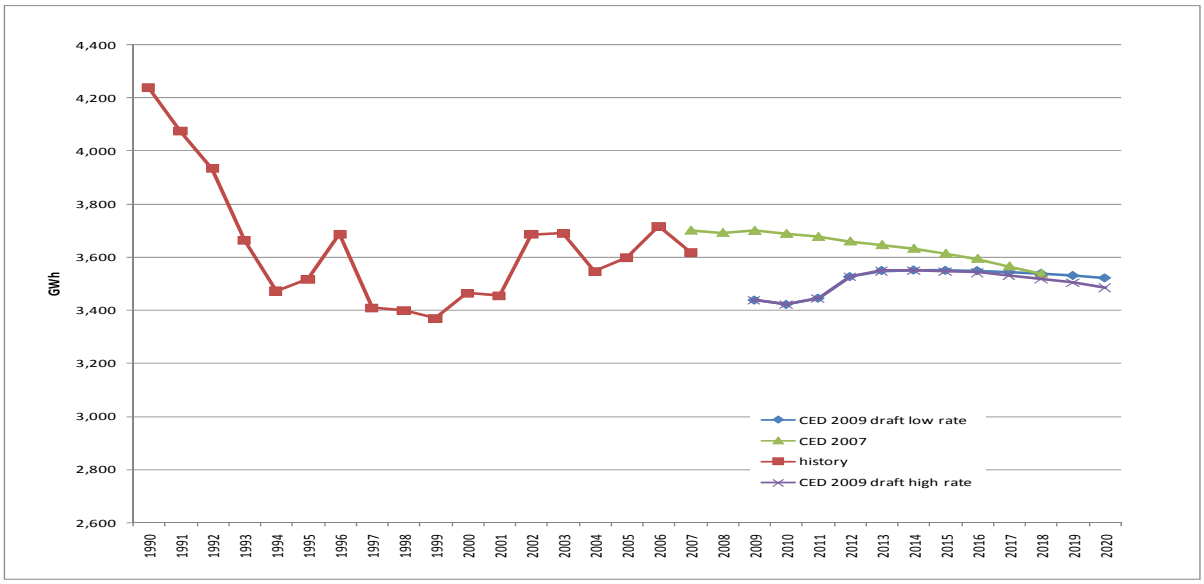


Source: California Energy Commission, 2009

Industrial Sector

Figure 6-18 provides comparisons of the LADWP planning area industrial sector electricity consumption forecasts. The *CED 2009* industrial electricity consumption forecast is much lower at the beginning of the forecast period because of current economic conditions. The *CED 2009* forecast then grows in the intermediate term and ends at essentially the same place as the *CED 2007* forecast

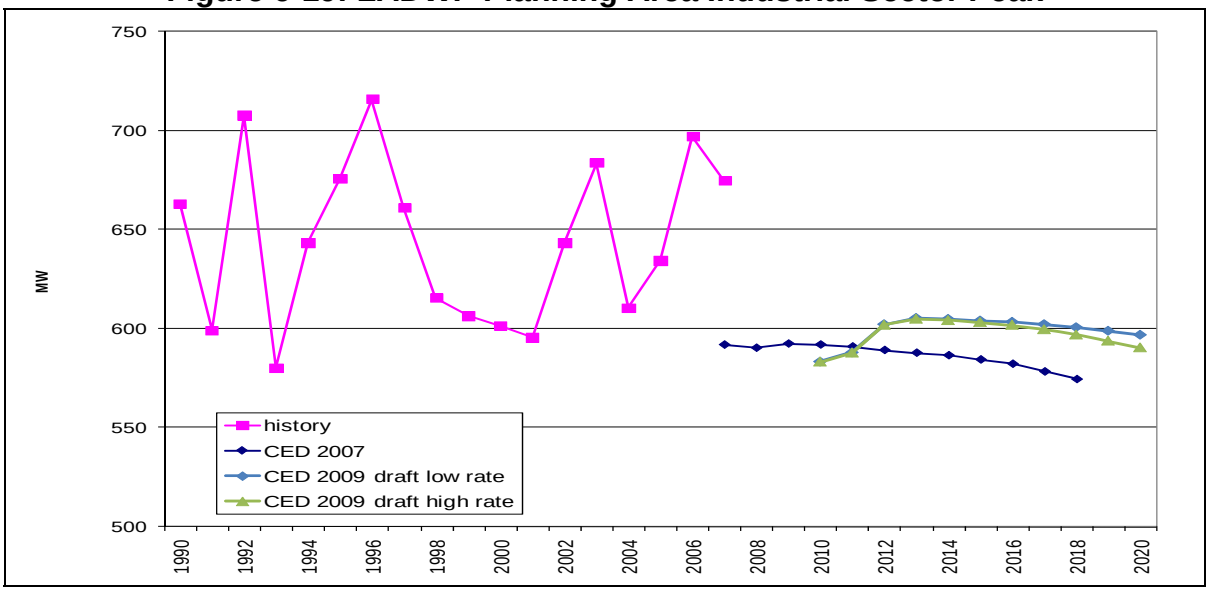
Figure 6-18: LADWP Planning Area Industrial Consumption



Source: California Energy Commission, 2009

Figure 6-19 compares the industrial sector peak forecasts. The differences in peak forecasts are driven by the energy forecast differences.

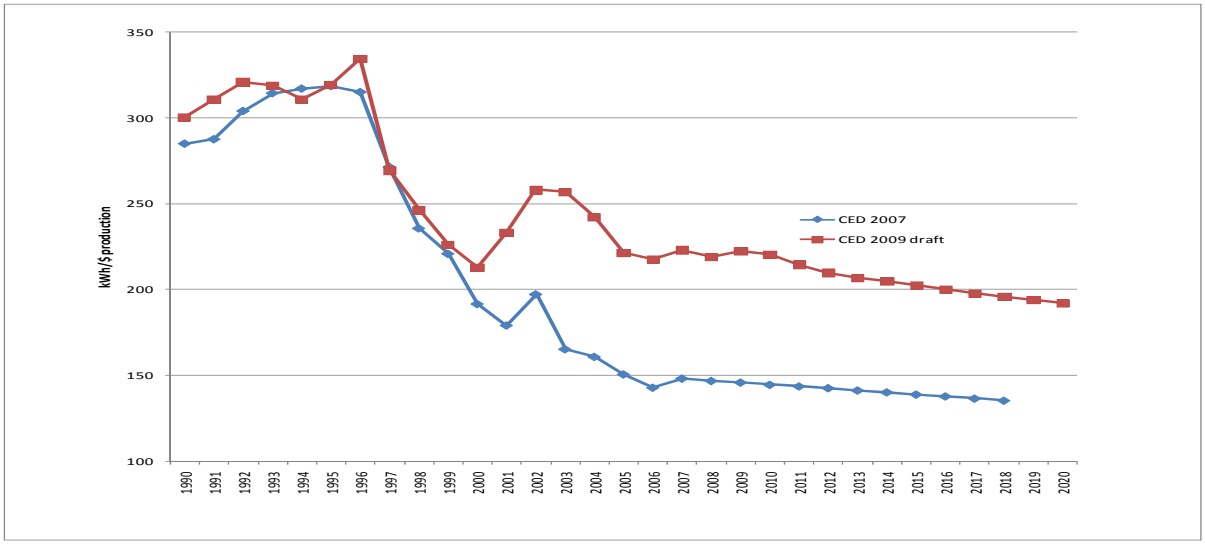
Figure 6-19: LADWP Planning Area Industrial Sector Peak



Source: California Energy Commission, 2009

Figure 6-20 compares use per dollar value of production between the *CED 2009* and *CED 2007* forecasts. The difference in starting points is a reflection of revised historic industrial production estimates provided by Economy.com. Both forecasts decline at similar rates.

Figure 6-20: LADWP Planning Area Industrial Use per Production Unit

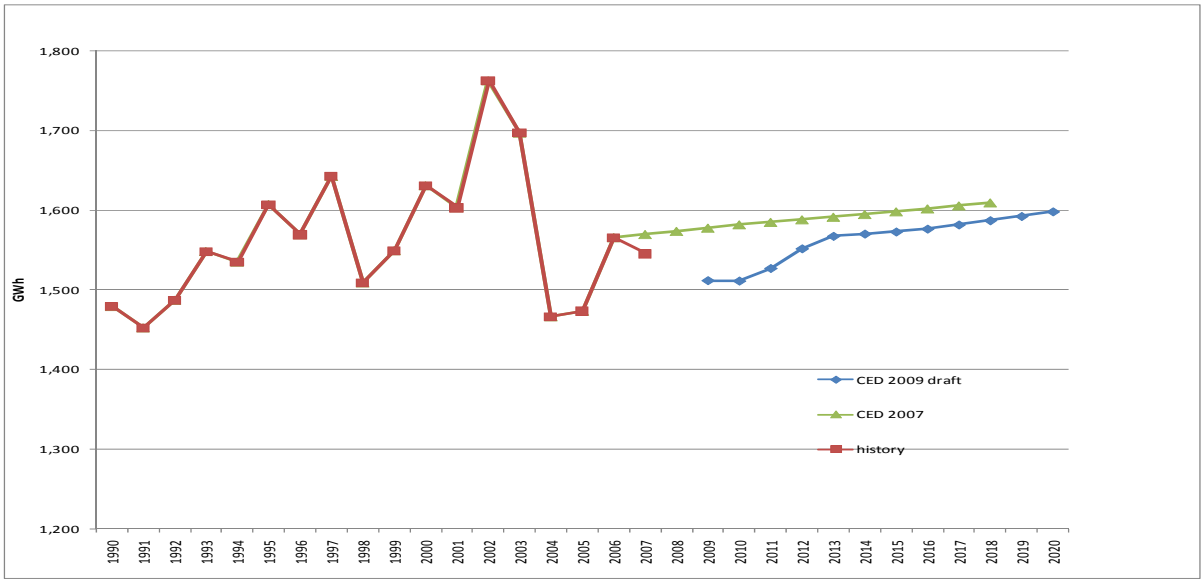


Source: California Energy Commission, 2009

Other Sectors

Figures 6-21 and **6-22** compare the remaining sector electricity consumption forecasts. **Figure 6-21** compares the transportation, communication, and utilities sector forecasts. The *CED 2009* transportation, communication, and utilities forecast is lower than the *CED 2007* forecast due to lower historic starting point.

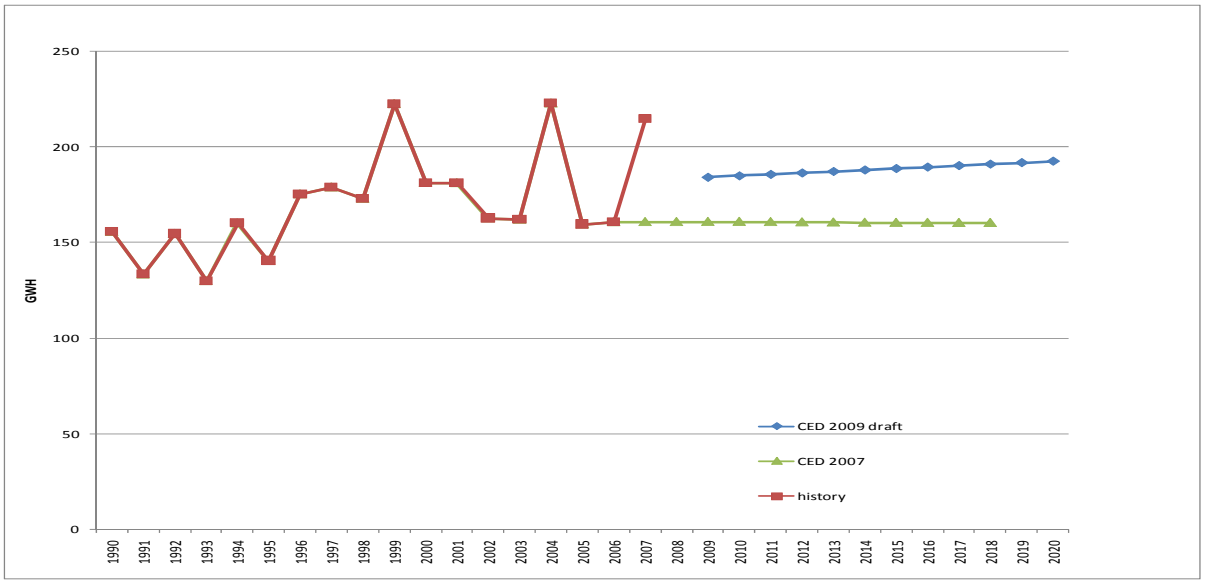
Figure 6-21: LADWP Planning Area Transportation, Communication, and Utilities Sector Electricity Consumption



Source: California Energy Commission, 2009

Figure 6-22 provides comparisons of the agriculture and water pumping sector forecasts. The *CED 2009* agriculture and water pumping forecast is projected to increase slightly over the forecast period. The *CED 2009* forecast is slightly higher over the entire period because of a higher starting value based on more recently reported sector specific consumption data. The increase in the agriculture and water pumping sector is caused by increased water demands.

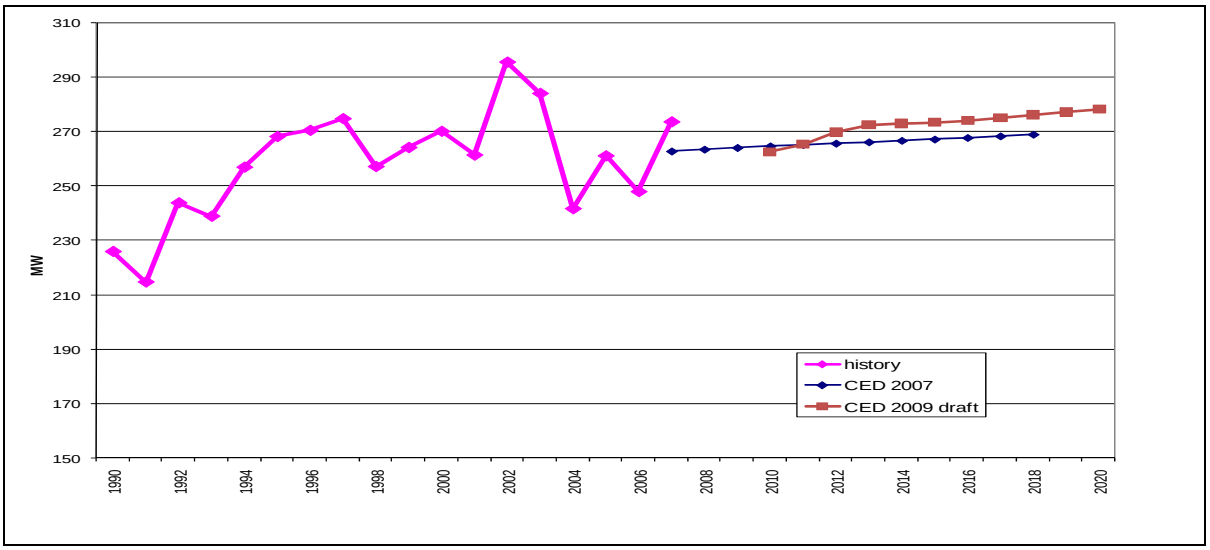
Figure 6-22: LADWP Planning Area Agriculture & Water Pumping Electricity Consumption Forecasts



Source: California Energy Commission, 2009

Figure 6-23 compares the combined Other Sector peaks for the *CED 2009* and *CED 2007* forecasts. The *CED 2009* forecast starts at a lower historic point. The projected growth of the *CED 2009* forecast increases slightly while the *CED 2007* forecast was relatively constant.

Figure 6-23: LADWP Planning Area Other Sector Peak

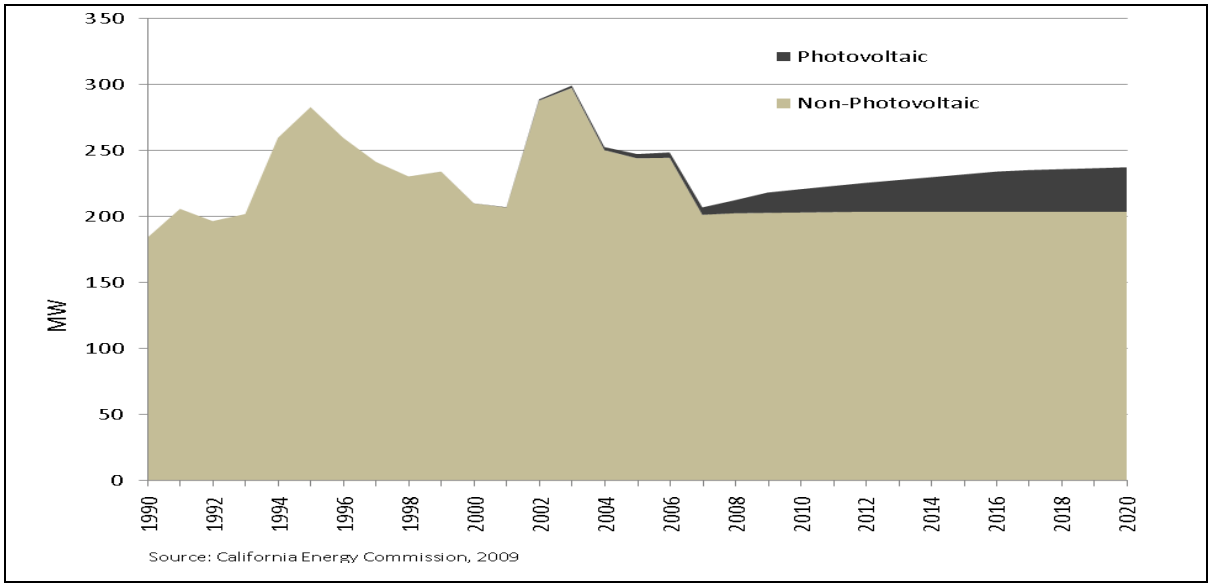


Source: California Energy Commission, 2009

Self-Generation

The peak demand forecast is reduced by self generation, including the effects of the SGIP, CSI, and other programs, as discussed in Chapter 1. The effects of these programs are forecast based on recent trends in installations. **Figure 6-24** shows the staff draft forecast of peak impacts from photovoltaic and non-photovoltaic self generation. Based on current trends, staff projects about 35 MW of peak reduction from photovoltaic systems by 2020.

Figure 6-24: LADWP Planning Area Self Generation Peak Forecast



Conservation/Efficiency Impacts

Tables 6-2 and **6-3** show electricity consumption and peak savings estimates for selected years, for building and appliance standards, utility and public agency programs, and "naturally occurring" savings, or savings associated with rate changes and certain market trends not directly related to programs or standards. Savings are measured against a baseline before 1975, so they incorporate more than 30 years of impacts from rate changes and standards. Chapter 8 provides more detail on staff work related to energy efficiency and conservation.

Table 6-2: LADWP Planning Area Electricity Consumption Savings Estimates

	1990	1998	2003	2008	2011	2015	2020
Residential Energy Savings (GWh)							
Building Standards	257	269	287	282	303	329	363
Appliance Standards	209	559	842	1037	1120	1207	1286
Utility and Public Agency Programs	31	77	30	25	28	34	33
Naturally Occurring Savings	4	6	6	42	151	303	505
Total Residential Savings	500	911	1166	1386	1602	1873	2187
Commercial Energy Savings (GWh)							
Building Standards	134	253	372	484	555	693	864
Appliance Standards	91	174	239	302	334	393	465
Utility and Public Agency Programs*	36	14	2	0	0	0	0
Naturally Occurring Savings	888	1036	766	481	883	979	1199
Total Commercial Savings	1149	1477	1379	1267	1773	2066	2529
Total Energy Savings	1649	2387	2545	2653	3374	3938	4716

Source: California Energy Commission, 2009

*Commercial programs also include agricultural program savings.

Table 6-3: LADWP Planning Area Electricity Peak Savings Estimates

	1990	1998	2003	2008	2011	2015	2020
Residential Energy Savings (MW)							
Building Standards	60	70	65	69	70	76	84
Appliance Standards	49	146	191	253	258	279	296
Utility and Public Agency Programs	7	20	7	6	6	8	8
Naturally Occurring Savings	1	1	1	10	35	70	116
Total Residential Savings	116	237	264	338	369	433	504
Commercial Energy Savings (MW)							
Building Standards	33	65	85	125	134	167	207
Appliance Standards	22	44	55	78	81	95	112
Utility and Public Agency Programs*	9	4	0	0	0	0	0
Naturally Occurring Savings	220	264	176	124	213	236	288
Total Commercial Savings	285	376	316	327	428	497	606
Total Energy Savings	401	614	580	665	798	931	1110

Source: California Energy Commission, 2009

*Commercial programs also include agricultural program savings.

CHAPTER 7: End-User Natural Gas Demand Forecast

This chapter presents the draft forecasts of end-user natural gas demand for the PG&E, Southern California Gas (SCG), and SDG&E natural gas planning areas. Staff prepares these forecasts in parallel with its electricity demand forecasts. The models used by staff are organized along electricity planning area boundaries. The gas demand forecasts presented here are the aggregate of gas demand in the corresponding electricity planning areas. These forecasts do not include natural gas used by utilities or others for electric generation.

The *CEC 2009* forecasts incorporate preliminary forecasts of natural gas prices, and historical consumption data for 2007. See Chapter 1 for a discussion of economic and demographic assumptions.

Statewide Forecast Results

Table 7-1 compares the statewide *CEC 2009* forecast with the *CED 2007* forecast for selected years. As in the case of electricity, three rate scenarios were used, as described later in the chapter. For comparisons with the previous forecast, the high-rate case is used, as rates in this scenario are most similar to rates used in *CED 2007*.

The new forecast is lower in the near term (2010) given current economic conditions, and because recorded 2007 consumption is lower than that forecast for *CED 2007*. In addition, longer-term growth declines relative to the previous forecast because of lower projected economic growth for 2010-2018 (see Chapter 1), so that by 2018 consumption is projected to be almost six percent lower than in *CED 2007*.

Table 7- 1: Statewide Natural Gas Forecast Comparison

	CED 2007	*CED 2009* (High-Rate Case)	Percent Difference
	(MM Therms)		
1990	12,893	12,893	0.00%
2000	13,913	13,913	0.00%
2007	13,386	13,216	-1.27%
2010	13,616	12,992	-4.59%
2018	14,058	13,236	-5.85%
Historic values are shaded			
	Annual Average Growth Rates		
1990- 2000	0.76%	0.76%	
2000- 2007	-0.55%	-0.73%	
2007- 2010	0.57%	-0.57%	
2010- 2018	0.40%	0.23%	

Source: California Energy Commission, 2009

Figure 7-1 compares the forecast by region. As in the state forecast, gas consumption projections in both Southern and Northern California fall in the short term and increase thereafter at a lower rate compared to *CED 2007*.

Figure 7-2 compares the draft forecast of per capita natural gas consumption with *CED 2007*. Annual per capita demand varies in response to annual temperatures and business conditions, but has generally been declining over time. As would be expected from statewide consumption results, per capita natural gas consumption drops below *CED 2007* levels. Both forecasts, however, project a steady decline in per capita consumption over the forecast period.

Figure 7- 1: Natural Gas Consumption Forecast (High-Rate Case)

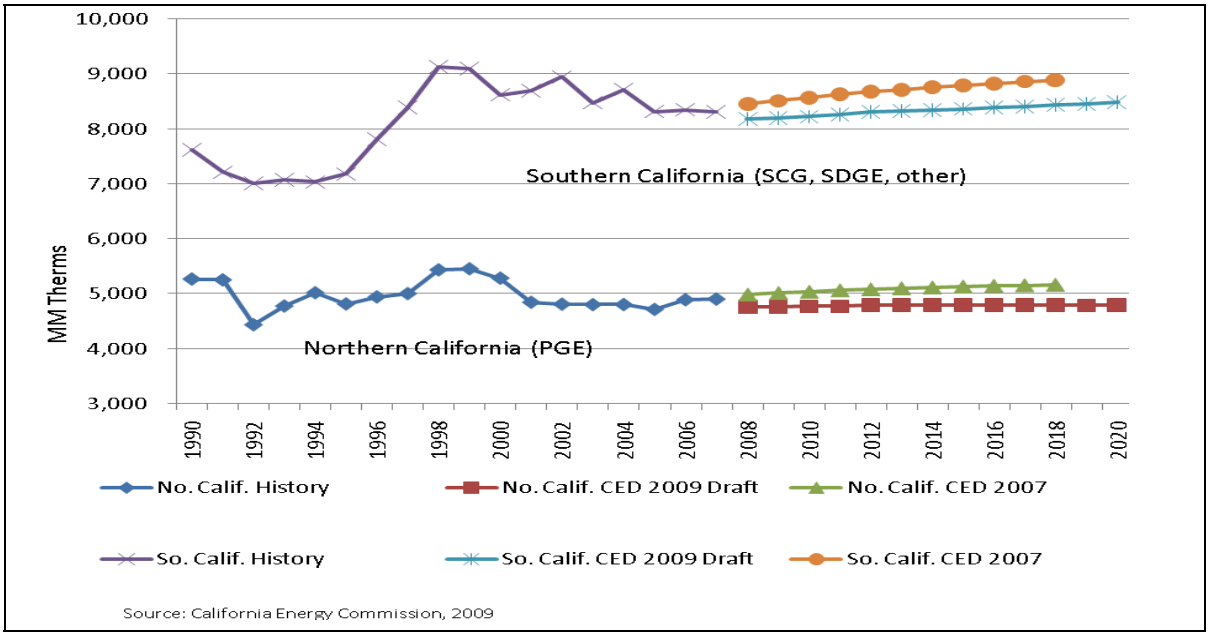
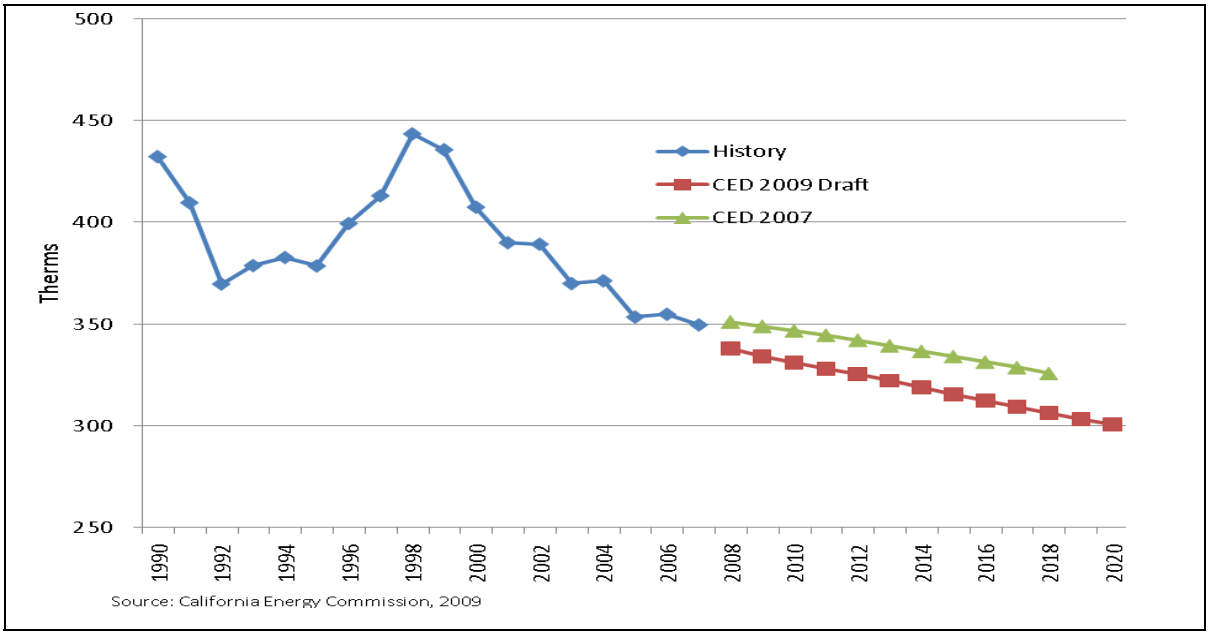


Figure 7- 2: Statewide per Capita Natural Gas Consumption (High-Rate Case)

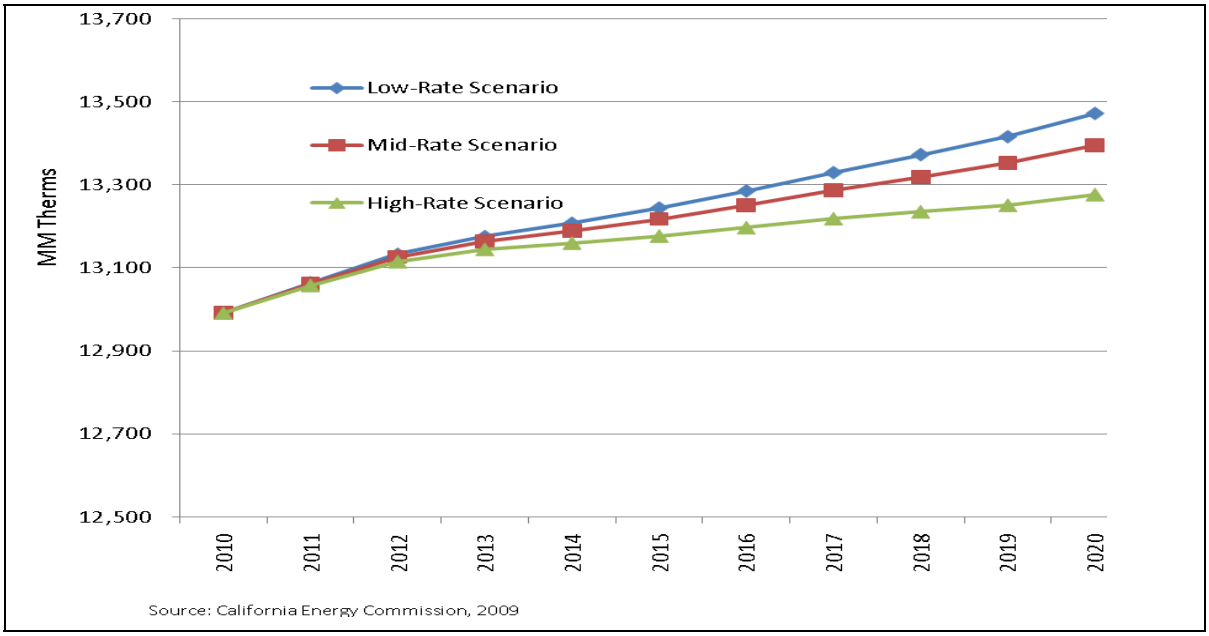


Three scenarios were developed for natural gas rates: high rates, low (constant) rates, and a rate scenario in between the two. The high case for natural gas had rates 30 percent higher by 2020

relative to 2010, matching the increase assumed in staff projections for the *2007 IEPR*,[15] and the "mid" case assumed 10 percent higher prices by 2020, equal to the rate of increase in the "base case" projections used for the scenario analyses undertaken for the *2007 IEPR*. [16] In the low case, rates remained at 2010 levels through 2020.

Figure 7-3 shows projected total statewide natural gas consumption for the three rate scenarios. Under the high-rate scenario, projected natural gas consumption in 2020 is down by around 1.5 percent relative to the low-rate scenario. The estimated price response is lower than that for electricity, since a similar increase (30 percent) in electric rates reduces electricity consumption by 1.8 percent by the end of the forecast period. In the mid-rate case, projected consumption is reduced by around 0.6 percent by 2020. As with electricity, the price response comes from the commercial, residential, and industrial sectors; the agricultural/water pumping and transportation, communications and utility (TCU) are assumed to have a price elasticity of zero. Most of the response owes to the Commercial Model, with a much smaller effect for the Residential and Industrial Models.

Figure 7- 3: Natural Gas Statewide Consumption by Rate Scenario



[15] These projections were not officially adopted for the *2007 IEPR*.

[16] California Energy Commission, *Scenario Analyses of California's Electricity System: Preliminary Results for the 2007 Integrated*

Energy Policy Report, CEC-200-2007-010-SF, June 2007.

Planning Area Results

This section presents forecasting results for each of the three planning areas, including sector level projections. As in the previous section, the high-rate case is used for comparisons with the previous forecast, as rates in this scenario are most similar to rates used in *CED 2007.*

Pacific Gas and Electric Planning Area

The PG&E natural gas planning area is defined as the combined PG&E and SMUD electric planning areas. It includes all PG&E retail gas customers and customers of private marketers using the PG&E natural gas distribution system.

Table 7-2 compares the draft PG&E planning area forecast with *CED 2007*. As in the statewide case, demand drops from 2007 to 2010, so that consumption is projected to be more than five percent less than *CED 2007* by 2010. Longer-term growth is expected to be lower than in the previous forecast, increasing the difference between the two forecasts to more than seven percent by 2018.

Table 7- 2: PG&E Natural Gas Forecast Comparison

	Consumption (MM Therms)		
	CED 2007	*CED 2009* (High-Rate Case)	Percent Difference
1990	5,275	5,275	0. 00%
2000	5,291	5,291	0. 00%
2007	4,961	4,912	-0. 98%
2010	5,038	4,765	-5. 40%
2018	5,163	4,803	-6. 98%
Historic values are shaded			
	Annual Average Growth Rates		
1990- 2000	0. 03%	0. 03%	
2000- 2007	-0. 92%	-1. 06%	
2007- 2010	0. 52%	-1. 00%	
2010- 2018	0. 31%	0. 10%	

Source: California Energy Commission, 2009

Figure 7-4 compares the *CED 2009* and *CED 2007* PG&E planning area residential forecasts. The *CED 2009* forecast is lower throughout the entire forecast period as actual consumption recorded in 2007 was lower than predicted in *CED 2007*, but the two forecasts have nearly the same growth rate, just over one percent.

Figures 7-5 and **7-6** show the forecasts for the PG&E commercial and industrial sectors, which are responsible for most of the reduction in consumption relative to *CED 2007*. By 2018,

projected consumption is down by almost 16 percent in the commercial sector and by more than seven percent in the industrial sector. A major part of the drop in these sectors occurs early in the forecast period (by 2010), because of short-term economic conditions. In the case of commercial, a significant reduction in actual 2007 consumption compared to what was forecast in *CED 2007* (8.3 percent) adds to this difference.

Figure 7-7 shows projected natural gas consumption for the three rate scenarios. By 2020, consumption is down by around 1.7 percent and 0.7 percent, respectively, in the high- and mid-rate cases relative to the constant rate scenario. Rate increases in the high scenario begin to reduce consumption slightly by 2014.

Figure 7- 4: PG&E Planning Area Residential Gas Consumption (High-Rate Case)

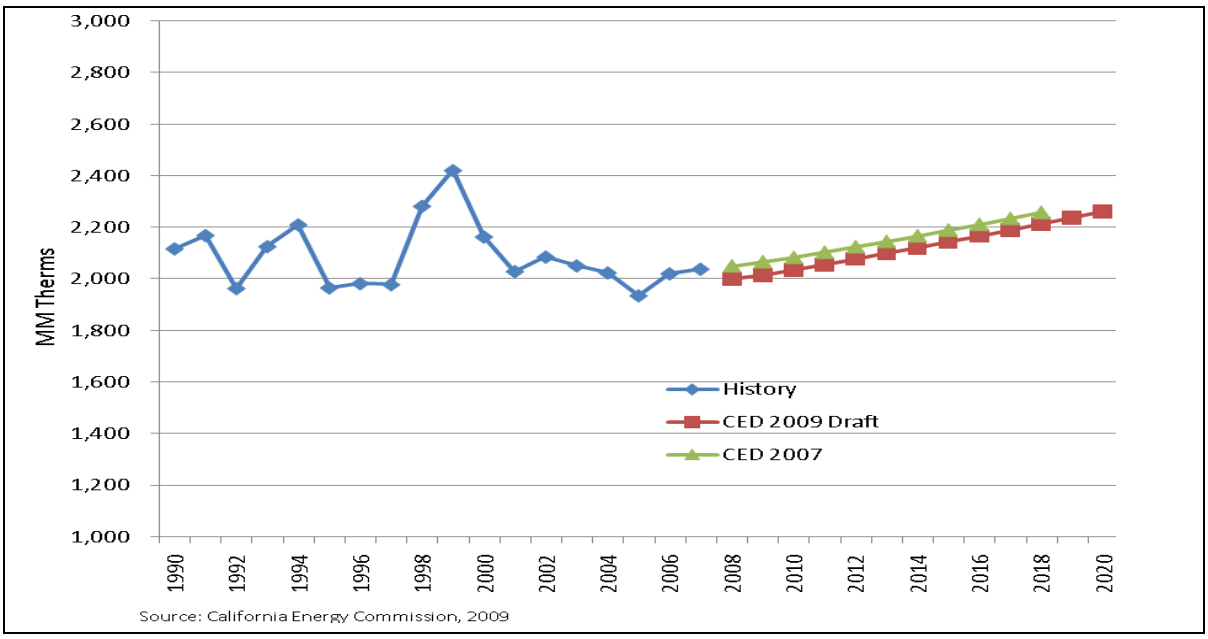


Figure 7- 5: PG&E Planning Area Commercial Gas Consumption (High-Rate Case)

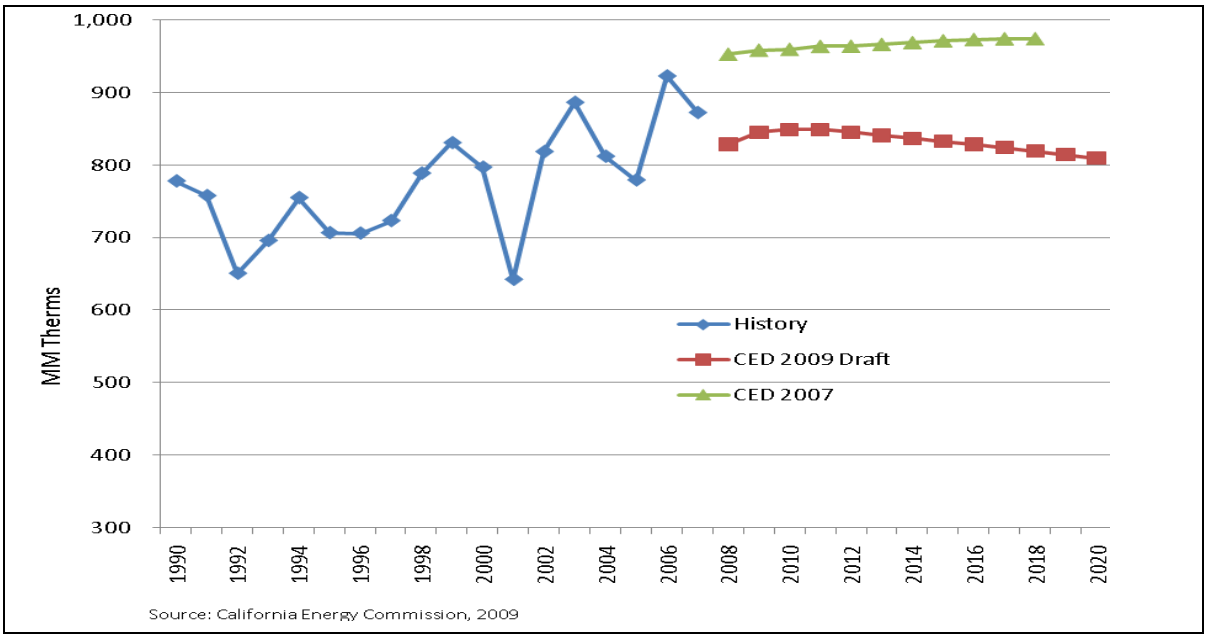


Figure 7- 6: PG&E Planning Area Industrial Gas Consumption (High-Rate Case)

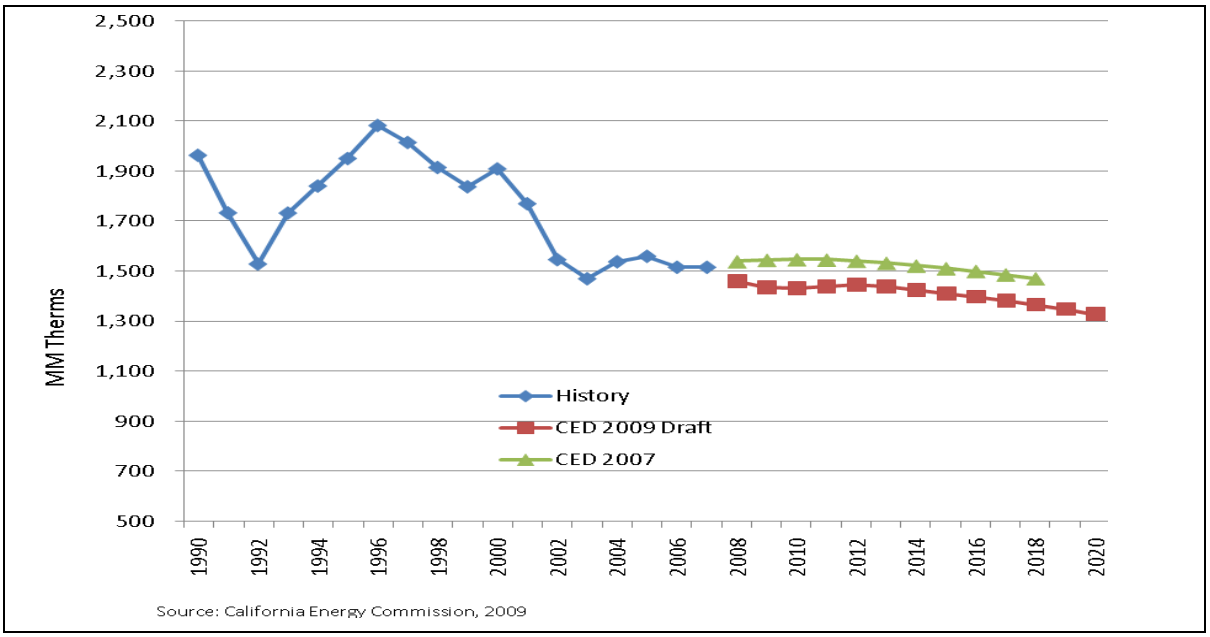
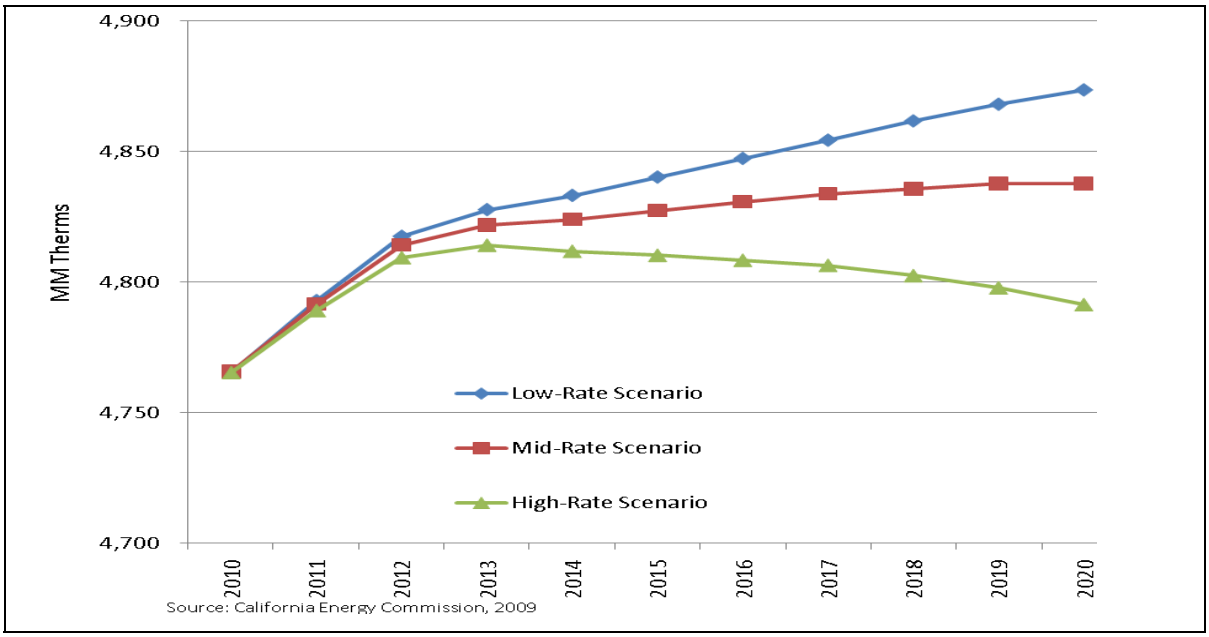


Figure 7- 7: PG&E Gas Consumption by Rate Scenario



Southern California Gas Company Planning Area

The SCG planning area is comprised of the SCE, Burbank and Glendale, Pasadena, and LADWP electric planning areas. It includes customers of those utilities, plus customers of private marketers using the SCG natural gas distribution system.

Table 7-3 compares the draft SCG planning area forecast with *CED 2007*. As in the statewide case, demand declines from 2007 to 2010, so that consumption is projected to be almost four percent less than *CED 2007* by 2010. Longer-term growth is expected to be slightly lower than in the previous forecast, increasing the difference between the two forecasts to almost five percent by 2018.

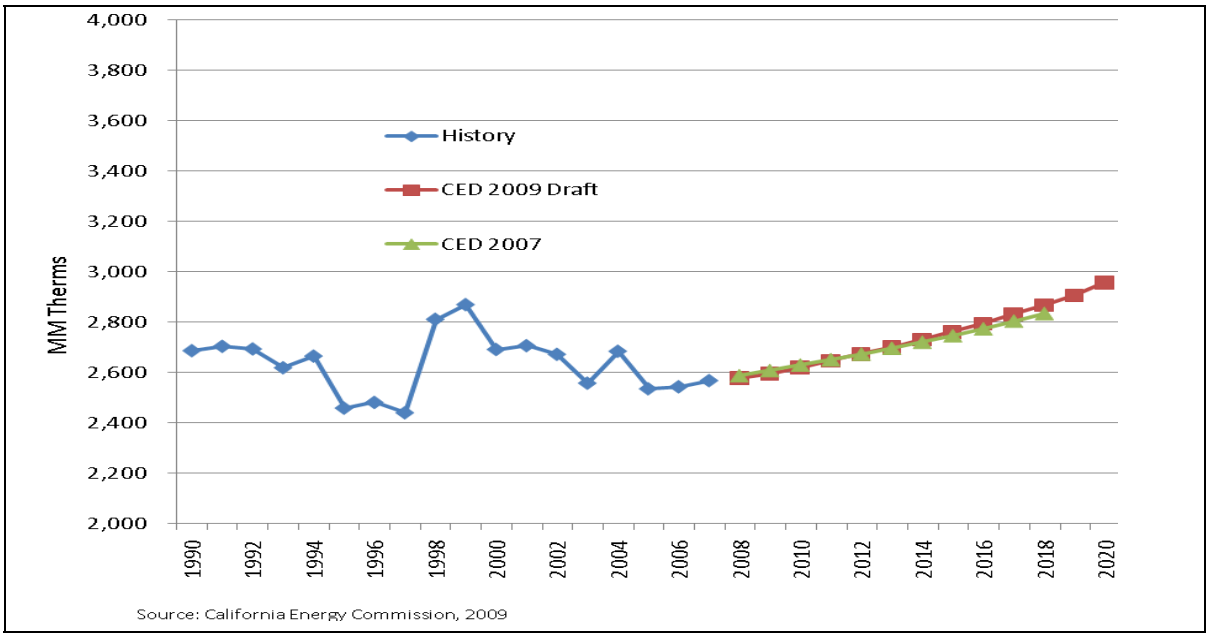
Table 7- 3: SCG Natural Gas Forecast Comparison

	Consumption (MM Therms)		
	CED 2007	*CED 2009* (High-Rate Case)	Percent Difference
1990	6,806	6,806	0. 00%
2000	7,938	7,938	0. 00%
2007	7,707	7,605	-1. 32%
2010	7,835	7,545	-3. 70%
2018	8,083	7,688	-4. 88%
Historic values are shaded			
	Annual Average Growth Rates		
1990- 2000	1. 55%	1. 55%	
2000- 2007	-0. 42%	-0. 61%	
2007- 2010	0. 55%	-0. 26%	
2010- 2018	0. 39%	0. 24%	

Source: California Energy Commission, 2009

Figure 7-8 compares the *CED 2009* and *CED 2007* SCG planning area residential forecasts. The two forecasts are almost identical, although the *CED 2009* projects a slightly lower consumption growth rate in the later years of the forecast period.

Figure 7- 8: SCG Planning Area Residential Gas Consumption (High-Rate Case)



Figures 7-9 and **7-10** show the forecasts for the PG&E commercial and industrial sectors, relative to *CED 2007*. The largest reductions in consumption are expected in the commercial sector, down by over nine percent by 2018, from lower projected long-term growth in the commercial sector. In the industrial sector, after a short-term decline relative to the previous forecast, consumption demand rises slightly above *CED 2007*, as expected industrial output growth is slightly higher than in the *CED 2007* projections in the later years of the forecast.

Figure 7-11 shows projected natural gas consumption for the three rate scenarios. By 2020, consumption is down by around 1.7 percent and 0.7 percent, respectively, in the high- and mid-rate cases relative to the low-rate scenario.

Figure 7- 9: SCG Planning Area Commercial Gas Consumption (High-Rate Case)

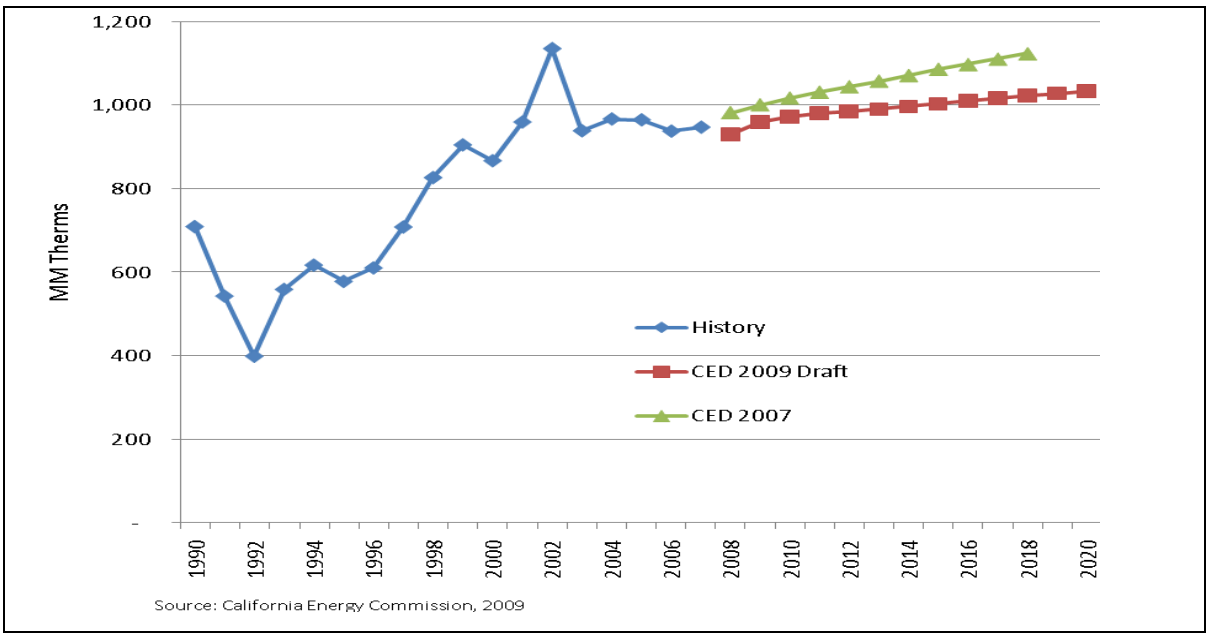


Figure 7- 10: SCG Planning Area Industrial Gas Consumption (High-Rate Case)

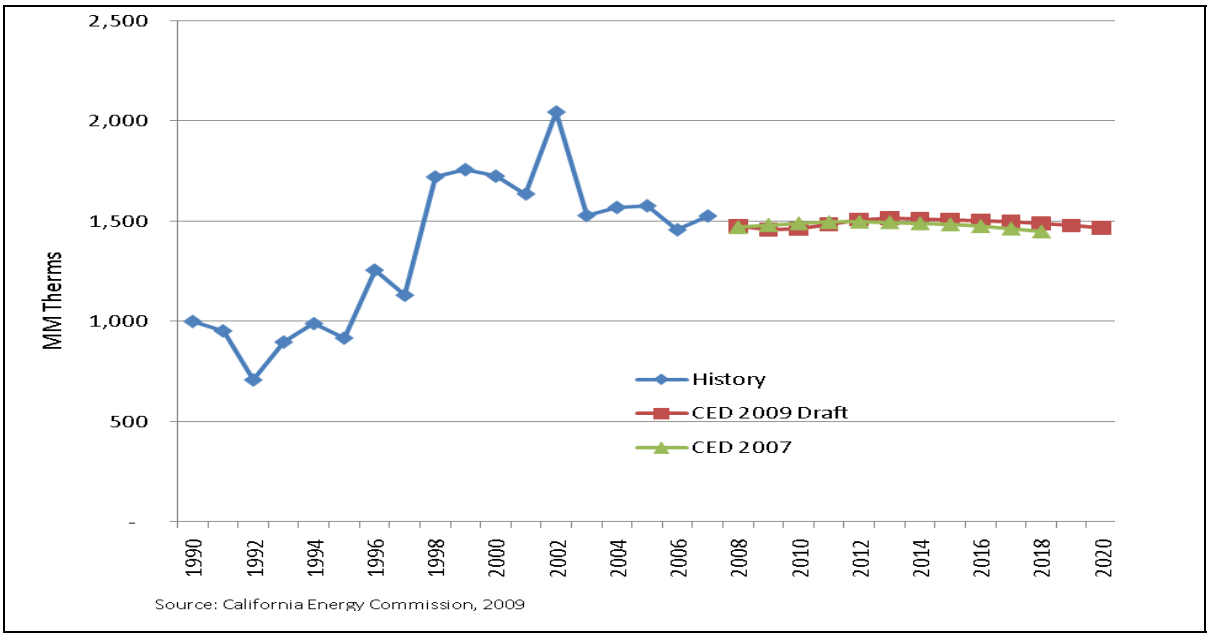
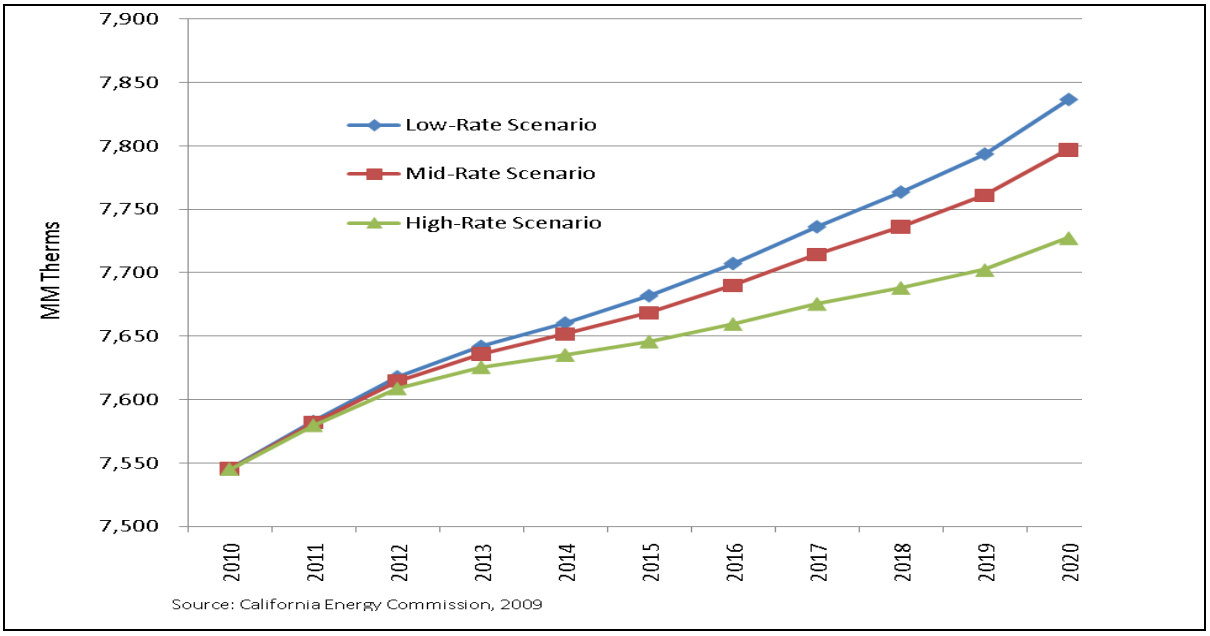


Figure 7- 11: SCG Gas Consumption by Rate Scenario



San Diego Gas and Electric Planning Area

The SDG&E planning area contains SDG&E customers plus customers of private marketers using the SDG&E natural gas distribution system.

Table 7-4 compares the draft SDG&E planning area forecast with *CED 2007*. Demand declines slightly from 2007 to 2010, so that consumption is projected to be over ten percent less than *CED 2007* by 2010. Longer-term growth, however, is expected to be slightly higher than in the previous forecast, decreasing slightly the difference between the two forecasts by 2018.

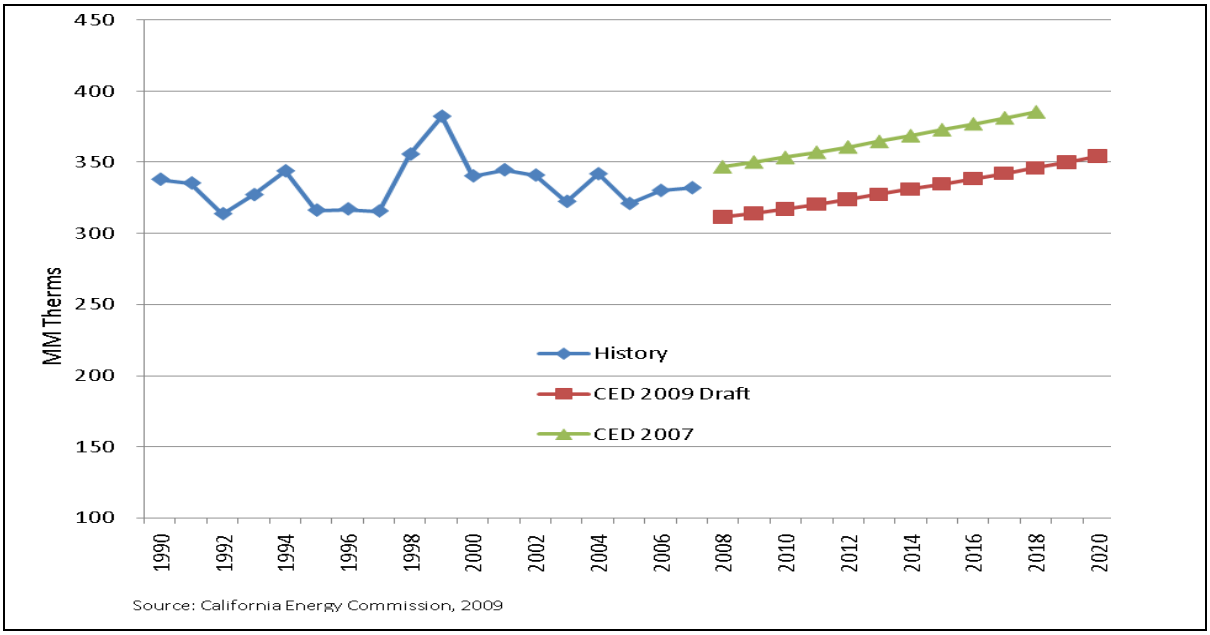
Table 7- 4: SDG&E Natural Gas Forecast Comparison

	Consumption (MM Therms)		
	CED 2007	*CED 2009* (High-Rate Case)	Percent Difference
1990	717	717	0. 00%
2000	565	565	0. 00%
2007	567	547	-3. 43%
2010	588	525	-10. 68%
2018	645	577	-10. 50%
Historic values are shaded			
	Annual Average Growth Rates		
1990- 2000	-2. 35%	-2. 35%	
2000- 2007	0. 03%	-0. 47%	
2007- 2010	1. 25%	-1. 35%	
2007- 2018	1. 16%	1. 18%	

Source: California Energy Commission, 2009

Figure 7-12 compares the *CED 2009* and *CED 2007* SDG&E planning area residential forecasts. The growth rates of the two forecasts are almost identical; the difference in level is caused by lower actual consumption in 2007 compared to the *CED 2007* forecast, followed by a projected decline in 2008.

Figure 7- 12: SDG&E Planning Area Residential Gas Consumption (High-Rate Case)



Figures 7-13 and **7-14** show the forecasts for the PG&E commercial and industrial sectors relative to *CED 2007*. The largest reductions in consumption are expected in the commercial sector, down by more than 12 percent by 2018 because of a decline in 2008 relative to the previous forecast and lower projected long-term growth in the commercial sector. In the industrial sector, the decline is slightly less, around 11 percent by 2018.

Figure 7- 13: SDG&E Planning Area Commercial Gas Consumption (High-Rate Case)

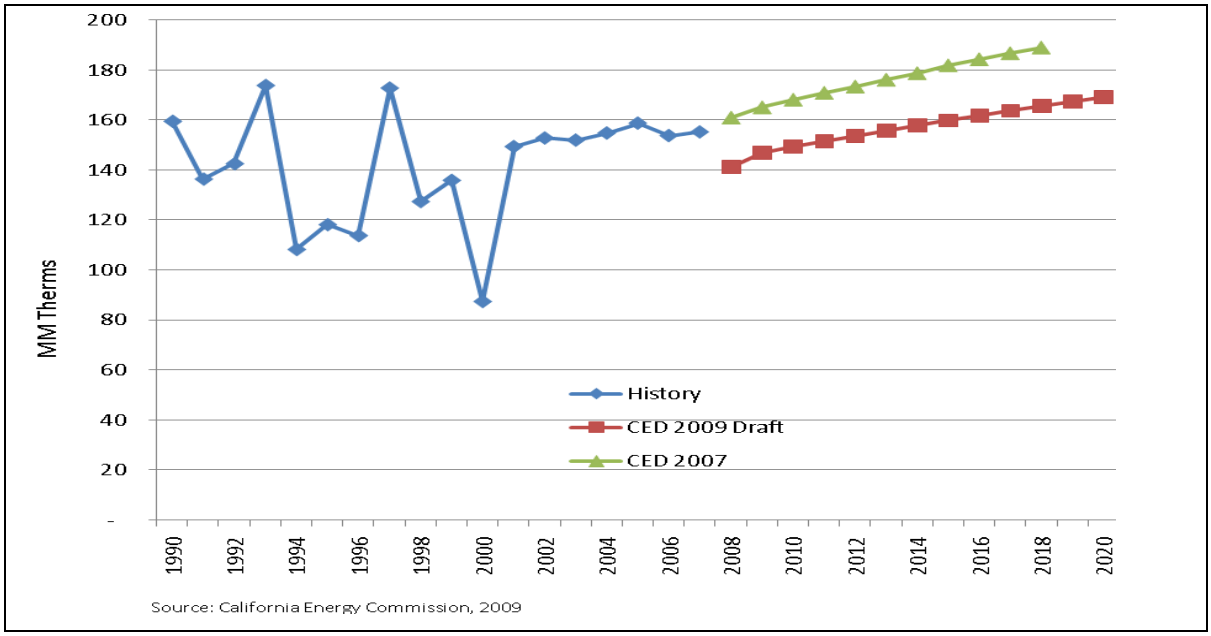


Figure 7- 14: SDG&E Planning Area Industrial Gas Consumption (High-Rate Case)

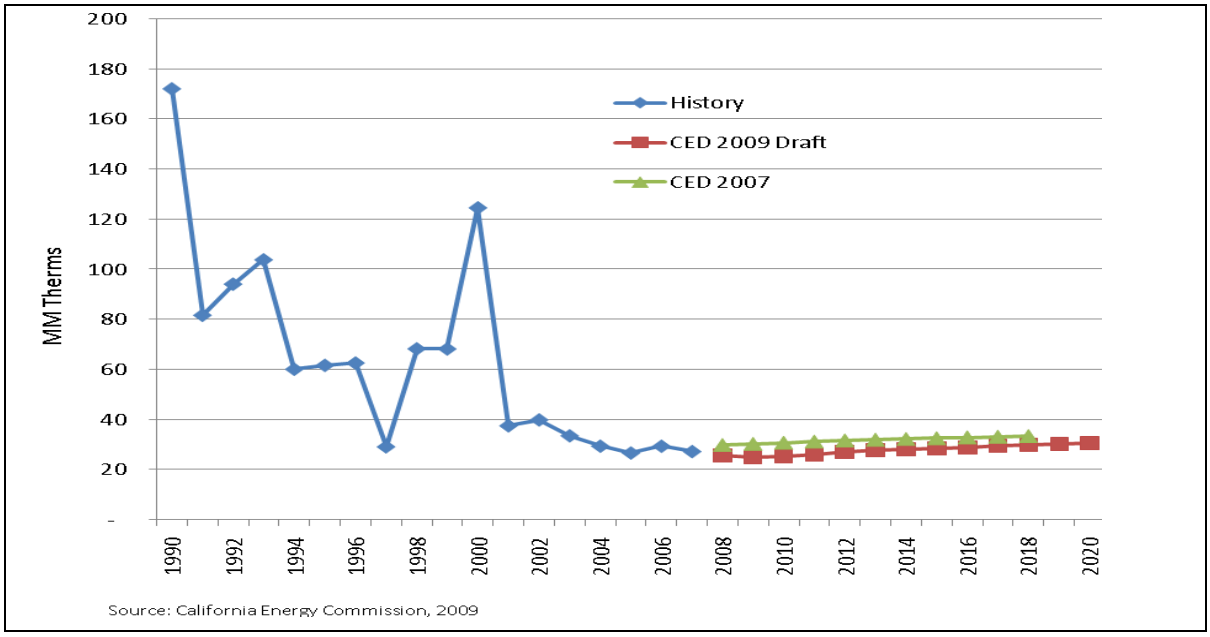
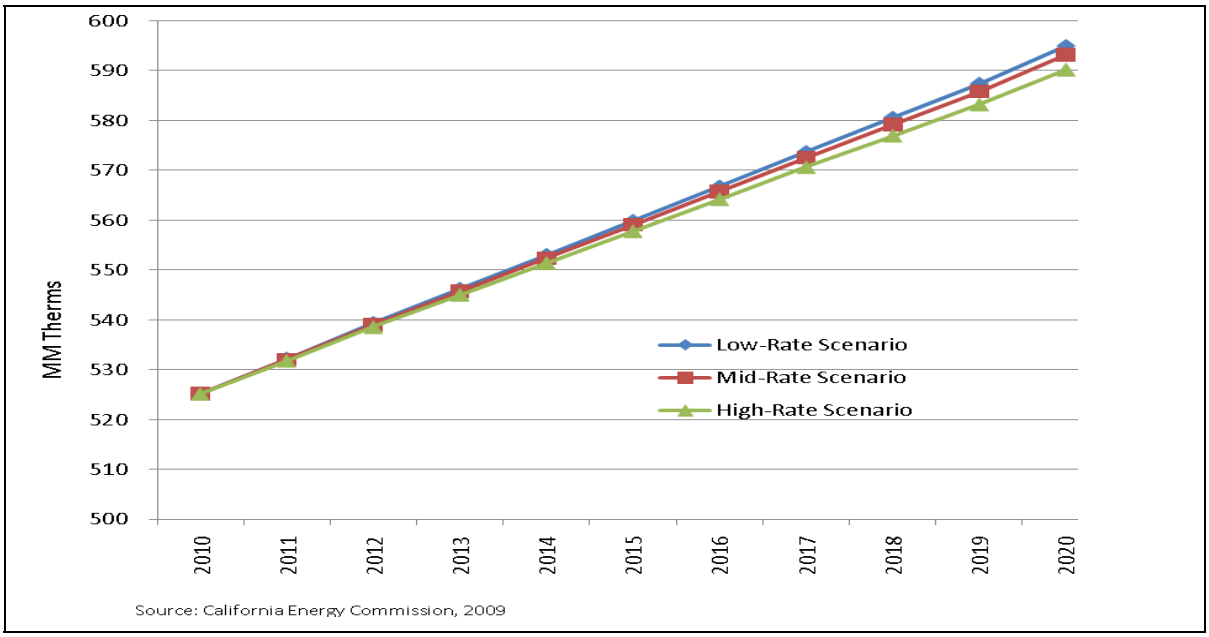


Figure 7-15 shows projected natural gas consumption for the three rate scenarios. By 2020, consumption is down by around 0.8 percent and 0.3 percent, respectively, in the high- and mid-rate cases relative to the low-rate scenario. Price response is significantly lower than in the other planning areas, a reflection of a larger natural gas residential share, a sector with lower responsiveness to price than commercial and industrial consumption.

Figure 7- 15: SDG&E Gas Consumption by Rate Scenario



CHAPTER 8: Energy Efficiency and Conservation

Introduction

With the state's adoption of the first *Energy Action Plan (EAP)* in 2003, energy efficiency became the resource of first choice for meeting the state's future energy needs. Assembly Bill 2021(Levine, Chapter 734, Statutes of 2006) set a statewide goal of reducing total forecasted electricity consumption by 10 percent over the next 10 years. Under AB 2021, the Energy Commission, in consultation with the California Public Utilities Commission (CPUC), is responsible for setting annual statewide efficiency potential estimates and targets in a public process every three years using the most recent IOU and publicly owned utility data. These targets, combined with California's greenhouse gas emission reduction goals, make it essential for the Energy Commission to properly account for energy efficiency impacts when forecasting future electricity and natural gas demand.

Utilities and other stakeholders expressed concern during the 2007 IEPR process about the lack of transparency in staff methods that account for efficiency program impacts in the Energy Commission's demand forecast. In particular, parties asked for clarification of how much uncommitted savings — savings from efficiency programs reasonably expected to occur but not yet implemented or funded — are accounted for in the forecast. Prompted by these concerns, the *2007 IEPR* committed the Energy Commission in 2008 and beyond to examining these methods in a public process that includes the CPUC staff, utilities, and other stakeholders.

To better measure and attribute energy efficiency impacts, staff has undertaken the following steps, as detailed in the *2008 IEPR Update*, during the *2009 IEPR* process:

1. Develop a standardized taxonomy of terms encompassing all major concepts applying to efficiency potential studies and energy demand forecasts.
2. Organize and participate in a stakeholder working group designed to address technical efficiency issues and to develop consistent metrics for efficiency analysis across utilities and various agencies.
3. Review and compare the modeling methods, inputs, and data sources used in Commission forecasts of efficiency savings with the consulting firm Itron's Asset Model. Compare interim savings estimates from the Energy Commission's demand forecast and Asset Model for selected programs given common sets of input and modeling assumptions.
4. Refine and improve the Energy Commission's forecasting models to allow more detailed and complete output of committed efficiency savings. Committed savings are those from efficiency programs that have already been implemented or have been approved and funded.

5. Investigate alternative forecasting methodologies.

6. Develop an uncommitted energy efficiency projection capability.

Step 1 is designed to improve communication between the Energy Commission, the CPUC, energy utilities, and other interested parties on matters related to energy efficiency impacts. This ongoing effort includes Energy Commission and CPUC staff, as well as input from various utilities.

The stakeholder working group (Step 2) has been meeting since November 2008, and has provided valuable information related to available energy efficiency program data. Step 2, along with progress made in Steps 3 and 4, provides the basis for the committed (funded and/or implemented) energy efficiency program impacts presented below. Step 5 is discussed in the Appendix. Estimation of uncommitted efficiency savings (Step 6) is ongoing, and will be finalized after the revised forecast is completed.

Statewide Results

Staff estimates the savings in energy demand associated with three sources: committed utility and public agency efficiency programs, building and appliance standards, and "naturally occurring" savings, which are intended to capture the impacts from energy price changes and certain market trends not directly associated with programs or standards. Each of these sources is discussed in the following sections. **Table 8-1** shows the estimated historical and projected impacts on residential and commercial electricity consumption and peak demand from each source for the five major California utility planning areas—PG&E, SCE, SDG&E, SMUD, and LADWP — assuming the mid-rate electricity scenario. These estimates essentially function as statewide totals, since the five major utility planning areas serve almost 98 percent of electricity demand. The "Total Savings" column represents the amount of savings from programs, standards, and naturally occurring savings explicitly accounted for in the demand forecast. Total savings would change slightly in the other rate scenarios beginning in 2010, decreasing in the low-rate case and increasing in the high-rate scenario, as discussed later in the chapter.

To give some perspective on the impacts of these savings, **Table 8-1** also shows historical and projected electricity use from the *CED 2009* forecast, as well as historical and projected "unmanaged" use, which means estimated use in the absence of these savings impacts. The last column shows the percentage reduction in use attributed to the impacts of the three sources of savings, calculated by dividing total savings by unmanaged use.

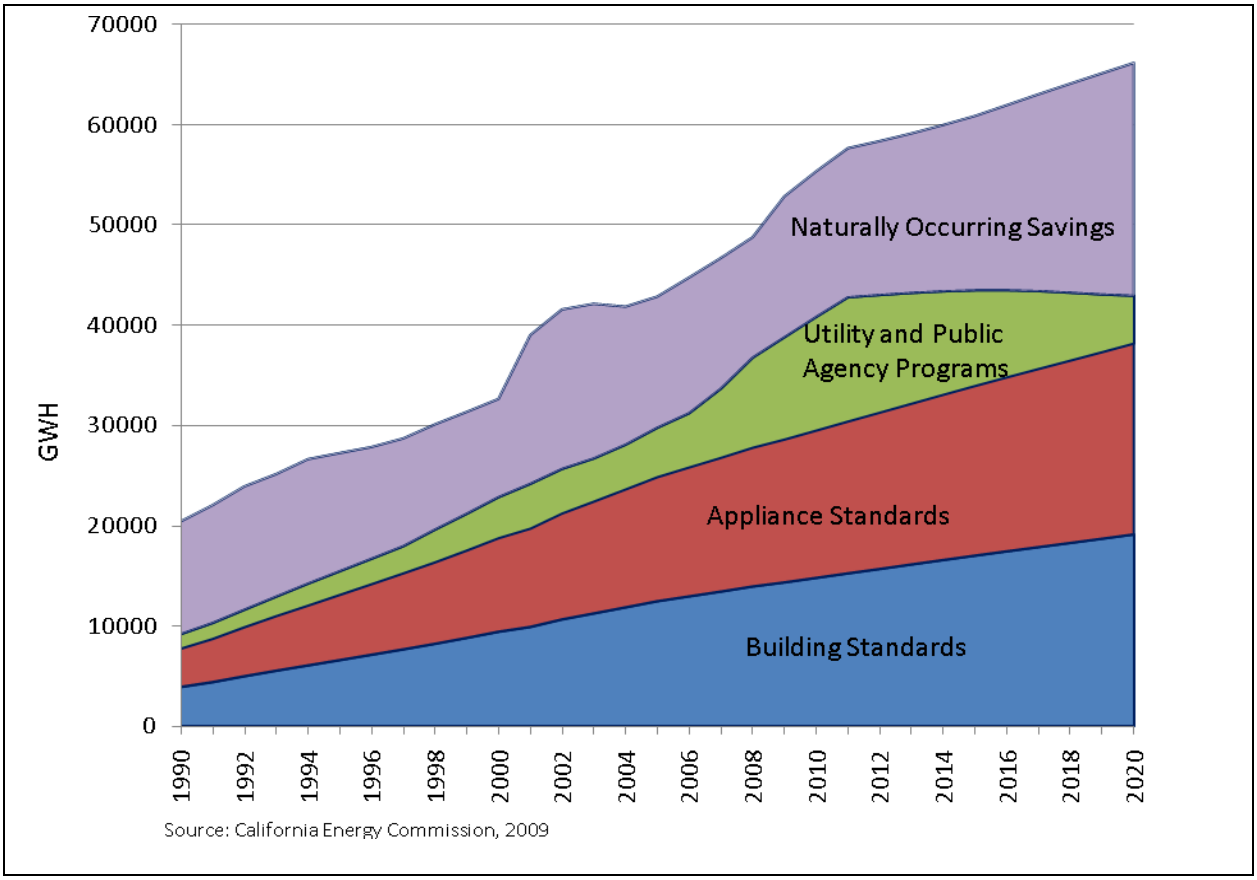
Table 8-1: Electricity Savings for the Five Major California Utilities* Combined—Mid-rate Scenario

Year	Building and Appliance Standards	Utility and Public Agency Programs	Total Savings-Programs, Standards	Naturally Occurring Savings	Total Savings	Elec. Use 2009 Draft Forecast	Elec. Use 2009 Un-managed Forecast	Percent Reduction in Use from Savings
Residential plus Commercial** Consumption Impacts (GWh)								
1990	8,251	1,454	9,705	11,246	20,951	228,473	249,424	8. 4
1998	15,101	3,266	18,366	10,506	28,872	242,561	271,433	10. 6
2003	20,417	4,313	24,730	15,432	40,162	262,099	302,260	13. 3
2008	25,206	8,997	34,203	12,013	46,216	280,184	326,399	14. 2
2011	27,947	12,397	40,344	14,882	55,226	279,880	335,106	16. 5
2015	31,979	9,550	41,529	17,403	58,932	289,493	348,424	16. 9
2020	37,012	4,776	41,788	23,242	65,030	298,616	363,647	17. 9
Residential plus Commercial** Coincident Peak Impacts (MW)								
1990	2,022	354	2,376	2,271	4,647	47,241	51,889	9. 0
1998	3,950	804	4,754	2,228	6,981	54,476	61,458	11. 4
2003	4,934	995	5,930	3,134	9,064	54,842	63,906	14. 2
2008	6,418	2,240	8,658	2,385	11,042	62,948	73,990	14. 9
2011	7,144	3,150	10,294	2,926	13,220	63,130	76,350	17. 3
2015	8,270	2,499	10,769	3,533	14,302	65,968	80,270	17. 8
2020	9,685	1,209	10,894	5,035	15,929	69,244	85,173	18. 7

Source: California Energy Commission, 2009
*PG&E, SCE, SDG&E, LADWP, and SMUD.
**Commercial also includes agricultural program savings.

Figure 8-1 shows the distribution of savings by source from 1990-2020, with building and appliance standards broken out separately. Staff tracks historic impacts back to 1975, so naturally occurring savings in 1990 includes the impacts from rate increases in the 1970s and 1980s. Similarly, the entries for 1990 building and appliance standards include accumulated savings from standards implemented before 1990. Naturally occurring savings increase significantly from 2001-2004 because of substantial rate increases in the IOU planning areas, mainly in the commercial sector. From 2010 on, this category increases once again as a result of rate increases for the mid-rate scenario and lighting savings, as discussed later in the chapter. Savings from building and appliance standards together make up the largest share of the total from 1995 on. Utility and public agency program savings reach a maximum share of over 22 percent in 2011, the end of the current three-year CPUC program cycle. Beyond 2011, program savings decline since the staff forecast incorporates only committed impacts.

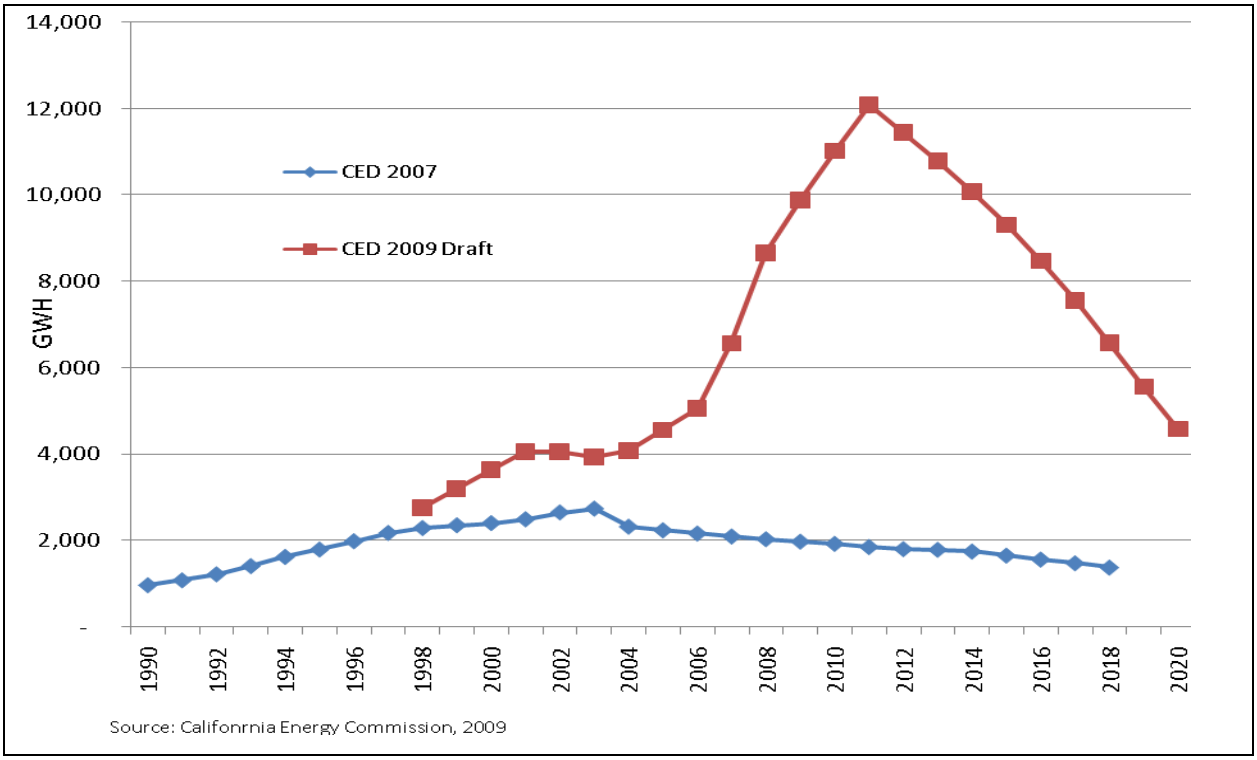
Figure 8-1: Distribution of Efficiency/Conservation Consumption Savings by Source—Mid-Rate Scenario



Utility and Public Agency Programs

The main focus of the effort by staff since the *2007 IEPR* process has been to revise and update estimates of the impacts of utility programs on electricity demand. With the help of the CPUC and the consulting firm Itron, staff set out to re-estimate the historical electricity savings from utility programs as well as to measure the impacts of the 2009-2011 program plans, with the idea of estimating program impacts not previously incorporated in Energy Commission forecasts. **Figure 8-2** shows the results of this analysis for IOUs; impacts for the publicly owned utilities are still under development and will be included in the revised forecast. The figure compares staff's current measurements with the program savings explicitly estimated for *CED 2007*; the difference between the two series indicates preliminary estimates of load impacts attributable to IOU utility programs not captured in the previous forecast.

Figure 8-2: Comparison of Committed Utility Program Consumption Impacts for IOUs



The main difference between impacts in the two forecasts occurs in 2008 and beyond, particularly during the 2009-11 program period, which was not included in *CED 2007*, as the programs were not considered committed. Staff updated program impacts beginning in 1998; the savings estimates from *CED 2007* are used for the 1990-1997 period. Further savings from possible future programs are not considered since the forecast incorporates only committed programs. Additional savings potential will be examined in staff's uncommitted efficiency savings forecast.

Figure 8-3 shows the impacts on electricity consumption from utility programs by IOU. The impact of IOU utility programs reaches a maximum in 2011 and then declines as measure savings decay. **Figure 8-4** provides corresponding peak load impacts and includes the total for the IOUs. **Table 8-2** breaks out the IOU program consumption impacts by sector.

Figure 8-3: Estimated Consumption Impacts from Utility Programs by IOU

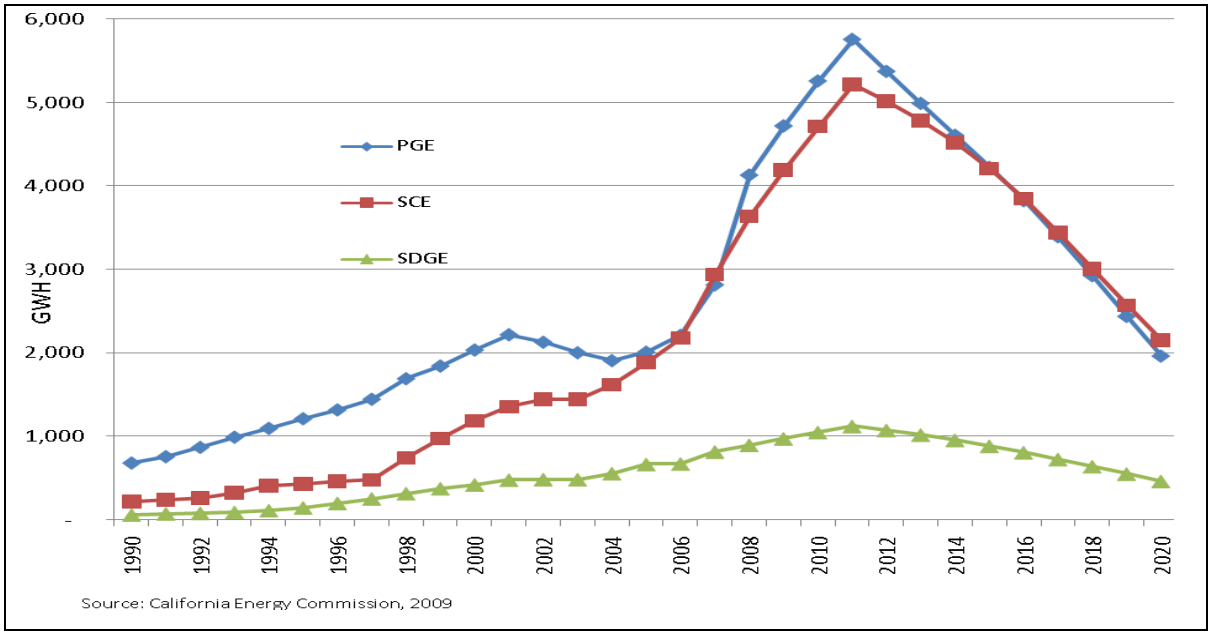


Figure 8-4: Estimated Peak Impacts from IOU Programs

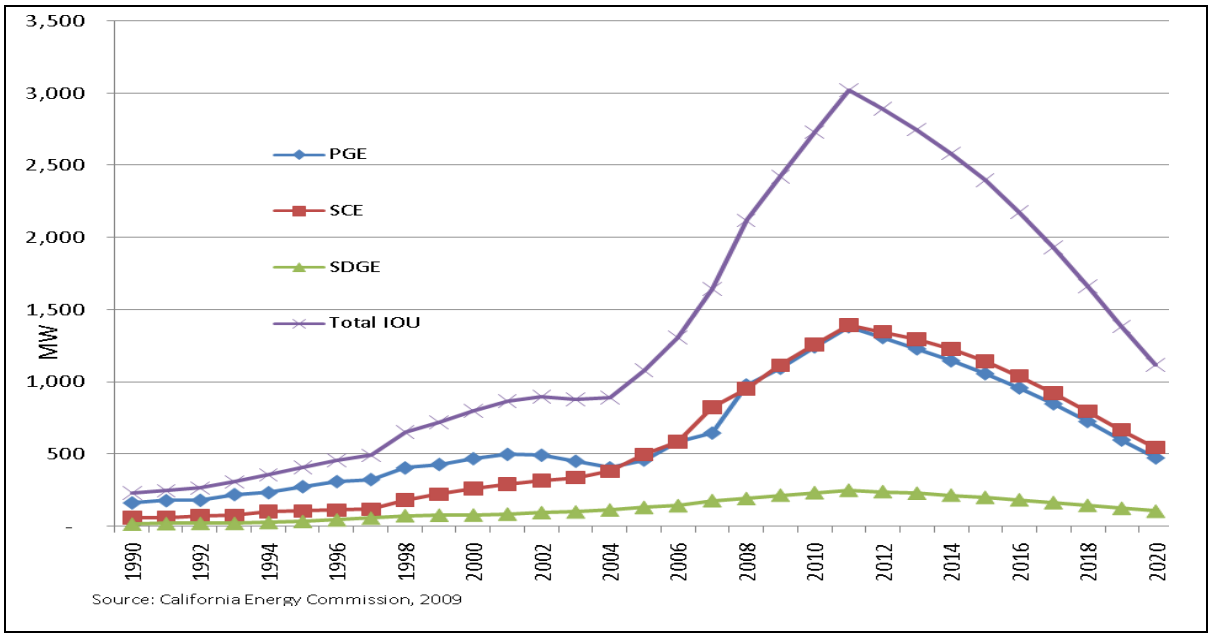


Table 8-2: Estimated IOU Program Impacts by Sector

	Consumption Impacts (GWh)				Peak Impacts (MW)			
	Resid.	Commer.	Agricult.	Total	Resid.	Commer.	Agricult.	Total
1990	849	110	0	959	207	23	0	230
1998	1,253	1,499	0	2,751	337	318	0	655
2003	1,755	2,178	0	3,933	439	442	0	881
2008	5,426	3,080	155	8,661	1,507	595	6	2,119
2011	7,816	3,881	400	12,096	2,234	742	46	3,022
2015	6,192	2,724	400	9,315	1,825	524	46	2,395
2020	2,397	1,785	396	4,578	728	344	45	1,118

Source: California Energy Commission, 2009

It is important to stress that these are preliminary estimates. Staff spent most of the time for this analysis gathering the data itself, and further examination of the numbers may change these results. In addition, the 2009-11 program plans are still under review by the CPUC, and, thus, may be modified to some degree.

Table 8-3 shows savings impacts from publicly owned utility and public agency programs included in the draft forecast. The estimates come from *CED 2007* since these savings have not yet been updated for the *CED 2009* forecast.

Table 8-3: Publicly Owned Utility and Public Agency Program Savings, CED 2009

	Consumption Impacts (GWh)			Peak Impacts (MW)		
	Publicly Owned Utility		Public Agency*	Publicly Owned Utility		Public Agency*
	Residential	Commercial		Residential	Commercial	
1990	238	1	256	71	0	52
1998	336	55	124	110	13	27
2003	285	56	39	93	13	8
2008	277	56	3	96	12	1
2011	245	56	0	83	12	0
2015	179	56	0	60	12	0
2020	142	54	0	47	12	0

Source: California Energy Commission, 2009
*Includes the Federal Schools and Hospitals Programs

Methodology

To develop the IOU efficiency program impacts, staff, with the support of Itron, reviewed data associated with historic, current, and near-term energy efficiency programs as reported to the CPUC. To estimate verified cumulative program savings by end use for each year, staff and Itron took the following steps:

1. Collected reliable data for first-year efficiency program impacts in a disaggregated form such that gross GWh impacts could be attributed to categories that align with Energy Commission end use models. In the program years where only highly aggregate data was available (1998-2002), allocations were made for residential and commercial programs to specific end use categories using distributions from the 2003 data. Industrial and agricultural program savings were not disaggregated; models for these sectors do not operate at the end use level.

2. Applied net-to-gross (NTG) ratios to estimate net GWh impacts by end use category. This adjustment is intended to account for free ridership; that is, to account for measure adoptions that would have occurred without any utility program.

3. Applied realization rates to adjust for "real world" effects. Although staff assumes that the IOUs' estimates of their own portfolio performance are consistent with all relevant CPUC mandates, additional data sources such as evaluation, measurement, and verification (EM&V) reports suggest that the reported impacts are typically higher than the realized impacts. This occurs for various reasons, including measures purchased and not installed and lower actual savings per measure than anticipated. EM&V data yielded estimates of realized savings.

4. Estimated residual impacts for measures beyond the installation year. As is common practice, staff assumed a logistic decay of measure savings, so that 50 percent of installations remain in operation at the end of the estimated expected useful life (EUL). The logistic function models decay in such a way that installations are taken out of service at a rapid rate shortly before and after reaching the EUL.

Table 8-4 summarizes the data inputs and assumptions made in this process. The realization rate of 70 percent applied through 2008 derives from CPUC Energy Division recommendations for "ex-post" adjustment of program savings. [17] This rate is assumed to increase from 70 to 85 percent for the 2009-11 program cycle, consistent with CPUC expectations of more efficient delivery mechanisms. The Appendix provides more details on assumptions and includes first-year reported program impacts.

[17] CPUC Energy Division, *Energy Efficiency 2006-2007 Verification Report*, November, 2008. Energy Division staff recommended adjustment (realization) rates from 60 to 80 percent, depending on the utility.

Table 8-4: Data Sources and Assumptions for IOU Efficiency Program Impacts

Program Year	1998-2002	2003-2007	2008	2009-2011
Program Accomplishments	IOU Annual Reports	Monthly and Quarterly IOU Reports—Processed by Itron	IOU Quarterly Reports	March 2009 IOU Filings
Level of Disaggregation	Sector (residential, commercial, etc.)	End Use Category for Residential and Commercial	Measure	End Use Category for Residential and Commercial
Attribution to End Use	Applied 2003 Distribution for Residential and Commercial	Residential and Commercial—Provided by Itron	By Measure Description	IOU Projections
Net-to-Gross Ratios	Assumed 80 Percent	Provided by Itron	From IOU "Workbooks"	Assumed 80 Percent
Realization Rates	Assumed 70 Percent			Assumed 85 Percent
Expected Useful Life of Measures	Averages determined for each end use category based on 2006 – 2008 program workbook data			
Decay of Measures	Logistic decay of "realized" savings – 100 percent first year, 50 percent at the end of expected useful life			

Source: California Energy Commission, 2009

Following Steps 1-4 described above and using the assumptions given in **Table 8-3**, staff developed estimates of cumulative realized savings for each year: that is, savings adjusted by net-to-gross ratios and realization rates. **Table 8-5** shows these estimates by end use/sector and year.

Once cumulative realized program savings were developed for each year, staff determined whether these savings actually represented reductions in consumption or could be considered overlapping with savings impacts already incorporated in the model through building and appliance standards or some other source of savings. This step eliminated commercial (non-CFL) lighting, considered redundant with existing lighting standards, and industrial program savings, assumed to overlap with savings attributable to "natural" competitive market forces in this sector. [18]

[18] The effects of reduced energy intensity for industrial processes caused by market competition dwarf the impacts of industrial programs.

Table 8-5: Estimated IOU Accumulated Program Savings (GWh)

Sector	End Use	1998	2002	2006	2011	2015	2020
Residential	Heating, Ventilation, Air Conditioning*	11	65	119	296	259	143
	Compact Fluorescent Lighting	53	303	1,632	5,160	4,150	1,216
	Other Residential Lighting	10	56	245	713	694	577
	New Construction	9	49	63	64	62	39
	Pool Pumps	7	42	63	47	20	2
	Refrigerator Recycling	62	358	492	767	548	216
	Other Refrigerator	0	0	6	101	90	18
	Water Heating	2	13	25	57	49	29
	Misc. /Non-descriptive	0	0	6	356	133	5
	Accumulated from Pre-1998**	396	275	39	1	0	0
	Total Residential	550	1,162	2,691	7,564	6,004	2,248
Commercial	Heating, Ventilation, Air Conditioning*	33	143	300	1,363	1,291	1,093
	Compact Fluorescent Lighting	138	352	332	853	110	3
	Other Commercial Lighting	121	521	1,052	2,546	2,140	1,146
	New Construction	162	694	860	884	858	516
	Refrigeration	26	97	175	402	137	6
	Water Heating	0	0	1	1	1	0
	Misc. /Non-descriptive	84	287	195	375	326	166
	Accumulated from Pre-1998**	1,056	734	103	3	0	0
	Total Commercial	1,620	2,828	3,017	6,427	4,863	2,931
Industrial	--	0	0	86	1,398	1,396	1,328
Agricultural	--	0	0	7	400	400	396
Grand Total	--	2,170	3,991	5,801	15,788	12,663	6,903

Source: California Energy Commission, 2009

* Includes building shell measures

** Represents continuing savings from 1997 and previous years from measures not yet decayed.

For those program impacts determined to correspond to load reductions, staff incorporated these effects in the draft forecast either through "post-processing" (subtracting estimated impacts from model output) or by integrating estimated savings directly into the model through changes in inputs. **Table 8-6** summarizes the treatment by end use/sector. **Figure 8-5** shows the effects of these treatments, starting with the total realized program savings given in **Table 8-5**.

Table 8-6: Treatment of IOU Program Savings by End Use/Sector

Sector	End Use	Treatment
Residential	Heating, Ventilation, Air Conditioning*	Subtracted from model output
	Compact Fluorescent Lighting	Incorporated in model
	Other Residential Lighting	Subtracted from model output
	New Construction	Subtracted from model output
	Pool Pumps	Incorporated in model
	Refrigerator Recycling	Incorporated in model
	Other Refrigerator	Subtracted from model output
	Water Heating	Subtracted from model output
	Misc. /Non-descriptive	Subtracted from model output
	Accumulated from Pre-1998**	Subtracted from model output
Commercial	Heating, Ventilation, Air Conditioning*	Subtracted from model output
	Compact Fluorescent Lighting	Subtracted from model output
	Other Commercial Lighting	Excluded
	New Construction	Subtracted from model output
	Refrigeration	Subtracted from model output
	Water Heating	Subtracted from model output
	Misc. /Non-descriptive	Subtracted from model output
	Accumulated from Pre-1998**	Subtracted from model output
Industrial	--	Excluded
Agricultural	--	Subtracted from model output

Source: California Energy Commission, 2009

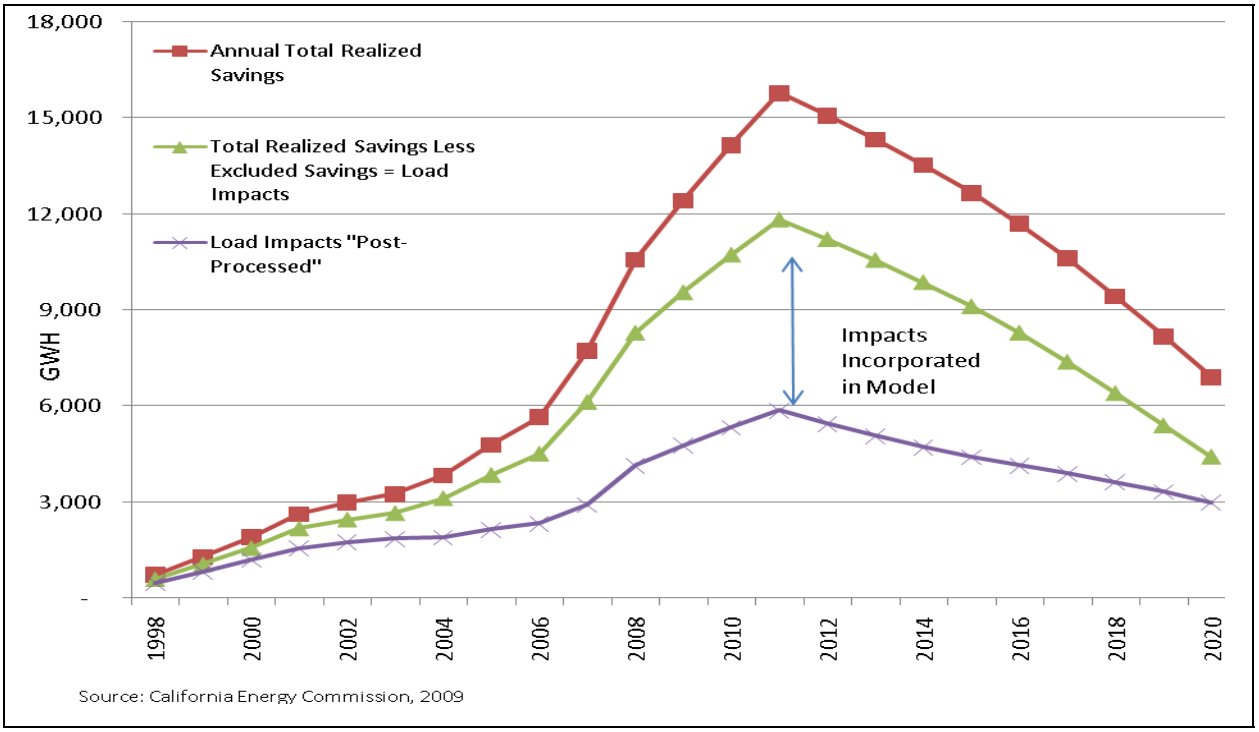
* Includes building shell measures.

** Represents continuing savings from 1997 and previous years from measures not yet decayed.

For years prior to 1998, staff used the same Energy Commission estimates for IOU program impacts as in the previous forecast. For 1998 on, staff added the estimates represented by the curve labeled "Total Realized Savings Less Excluded Savings" in **Figure 8-5** to pre-1998 impacts not yet decayed to give the totals for the *CED 2009* shown in **Figure 8-2**.

For the revised forecast, staff will examine and possibly incorporate pre-1998 estimates recently compiled by Itron. Publicly owned utility impacts, not yet updated by staff, are assumed to be the same as in *CED 2007*, as are public agency programs. Low income efficiency programs are not yet included in the analysis, but will be incorporated in the revised forecast.

Figure 8-5: Estimated Historical and Projected IOU Program Savings and Consumption Impacts (GWh)



Building and Appliance Standards

Energy Commission forecasting models incorporate building and appliance standards through changes in inputs: estimated end use consumption per household in the residential sector and end use consumption per square foot in the commercial sector. **Table 8-7** shows the standards currently included in the energy demand forecast by sector.

To measure the impact of each individual set of standards, staff removed the input effect on from standards one set at a time, beginning with the most recent standards, and calculated savings as the difference in energy demand output between model runs with the set of standards incorporated and without. For example, for the commercial sector, staff began by running the Commercial Model with all sets of standards included and then ran the model excluding changes in inputs associated with the *2005 Title 24 Nonresidential Building Standards* (the most recent standards). The difference in output between the two model runs gives an estimate of the electricity savings associated with the 2005 standards. Next, staff removed the input changes associated with the next-most recent set of standards, the *2004 Title 20 Equipment Standards*, and compared the results from model runs without the 2005 standards and without both the 2005 and 2004 standards, which provided an estimate of the impact of the 2004

standards. The process was repeated until all sets of standards had been "removed" from the model.

Table 8-7: Building and Appliance Standards Incorporated in the *CED 2009* Forecast

Residential Model	
1975 HCD Building Standards 1978 Title 24 Residential Building Standards 1983 Title 24 Residential Building Standards 1991 Title 24 Residential Building Standards 2005 Title 24 Residential Building Standards	1976-82 Title 20 Appliance Standards 1988 Federal Appliance Standards 1990 Federal Appliance Standards 1992 Federal Appliance Standards 2002 Refrigerator Standards
Commercial Model	
1978 Title 24 Nonresidential Building Standards 1978 Title 20 Equipment Standards 1984 Title 24 Nonresidential Building Standards 1984 Title 20 Nonres. Equipment Standards 1985-88 Title 24 Nonresidential Building Standards	1992 Title 24 Nonresidential Building Standards 1998 Title 24 Nonresidential Building Standards 2001 Title 24 Nonresidential Building Standards 2004 Title 20 Equipment Standards 2005 Title 24 Nonresidential Building Standards

Source: California Energy Commission, 2009

Naturally Occurring Savings

Staff estimates of naturally occurring savings are meant to capture load impacts of rate changes, certain market trends, and other changes in consumption not directly associated with standards or efficiency programs. For the draft forecast, staff included impacts from historical and projected rate changes, referred to as price effects, and expected reductions in average lighting use. There are certainly other consumption trends leading to reduced energy that could be included in this category,[19] but staff focused on those savings that potentially overlap with programs and standards. Rate increases provide a greater incentive to participate in utility programs and help improve standards compliance rates. Therefore, at least some price impacts could be attributed to programs and standards; for example, a rate increase could yield savings beyond what would otherwise occur because of the availability of program measures. [20] Utility programs have emphasize lighting measures, so naturally occurring savings from lighting assumed in this forecast could overlap with program impacts.

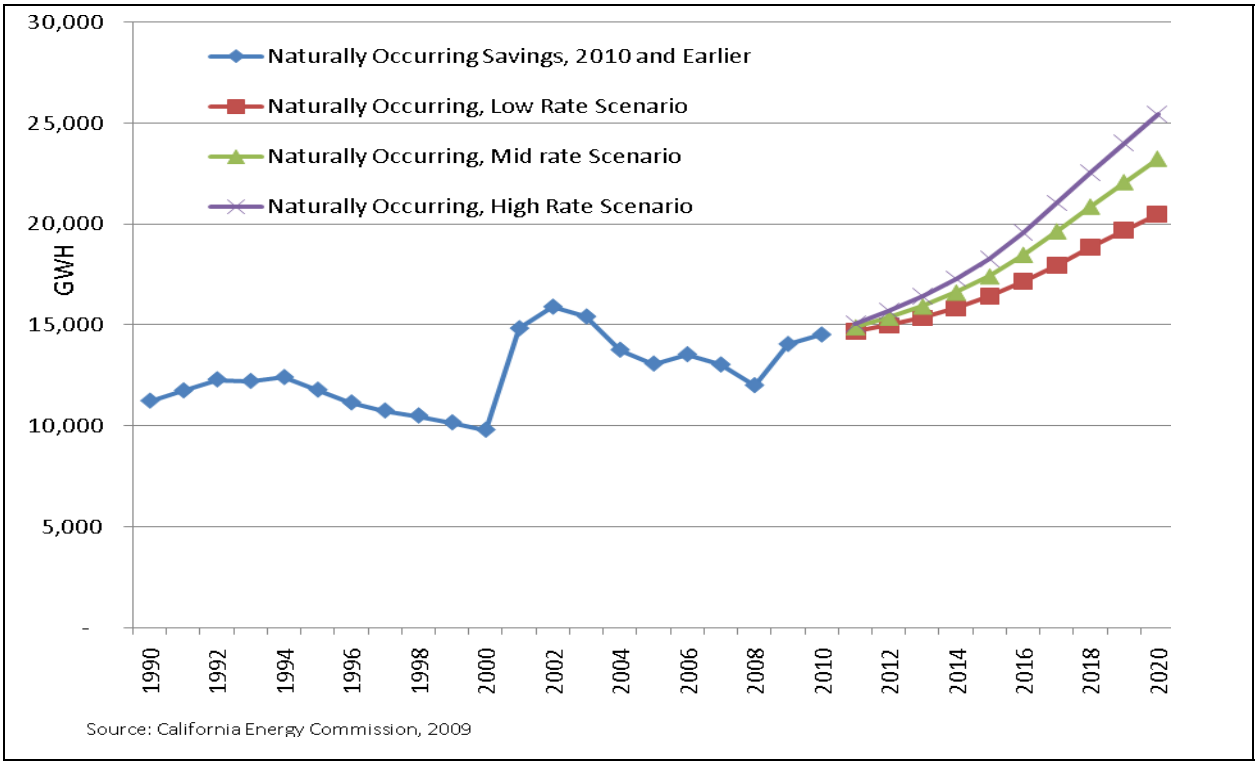
[19] Although not included in naturally occurring savings, other trends are accounted for in the forecast. For example, personal computers have become more efficient in recent years for technological/competitive reasons, and savings associated with this trend are captured through model inputs and calibration to actual consumption.

[20] A utility customer, faced with a rate increase, could reduce electricity usage by switching to incandescent light bulbs with a lower wattage. However, if the utility is offering incentives for CFL bulbs, the incentive might be enough that the customer instead begins to use CFLs and saves even more energy.

Price Effects

For the draft forecast, staff included three scenarios for electricity rates: low (constant), mid, and high, as described in Chapter 1. Therefore, total naturally occurring savings beyond 2010 depend on the rate scenario. **Figure 8-6** shows the amount of this savings under each scenario for the five major California utilities.

Figure 8-6: Historic and Projected Naturally Occurring Savings by Rate Scenario



Total consumption savings from all sources given in **Table 8-1** would change by the same amounts as shown in **Figure 8-6** under the differing rate scenarios. **Table 8-8** shows total savings for the five major California utilities by rate scenario starting in 2011. Table A-7 in the Appendix shows detailed results for the five major utilities.

Table 8-8: Total Savings from Programs, Standards, and Naturally Occurring Impacts for the Five Major California Utilities by Rate Scenario

Year	Consumption Savings (GWh)		
	Low-Rate Case	Mid-Rate Case	High-Rate Case
2011	55,044	55,226	55,402
2015	57,980	58,932	59,795
2020	62,290	65,030	67,326
	Peak Savings (MW)		
	Low-Rate Case	Mid-Rate Case	High-Rate Case
2011	13,183	13,220	13,255
2015	14,110	14,302	14,477
2020	15,375	15,929	16,380

Source: California Energy Commission, 2009

Lighting Savings

For this forecast, residential lighting was broken out as a separate end use for the first time to better capture the impacts of residential lighting efficiency programs. The Appendix provides details on this process and on estimated average lighting use per household. The focus of utility programs and state and federal legislation related to lighting led staff to assume some additional residential[21] savings for this end use, incorporated in the Residential Model.

No direct IOU lighting programs impacts were assumed beyond 2011, the end of the current three-year program cycle. However, staff assumed average lighting per household would remain at 2011 levels without utility incentives through the rest of the forecast period in the IOU planning areas. The difference between the 2011 average and an increasing average that would have occurred as utility impacts decayed was assigned to naturally occurring savings. In the publicly owned utility planning areas, staff assumed a gradual reduction in lighting per household beginning in 2008, so that by 2020 average use fell to 75 percent of estimated 2007 levels. Admittedly these are somewhat crude estimates, but staff felt that it was unrealistic to assume no continued lighting savings beyond utility programs. These numbers are meant to provide a starting point for discussion and further refinement. **Figure 8-7** shows the savings associated with these assumptions for both the IOUs and the publicly owned utilities.

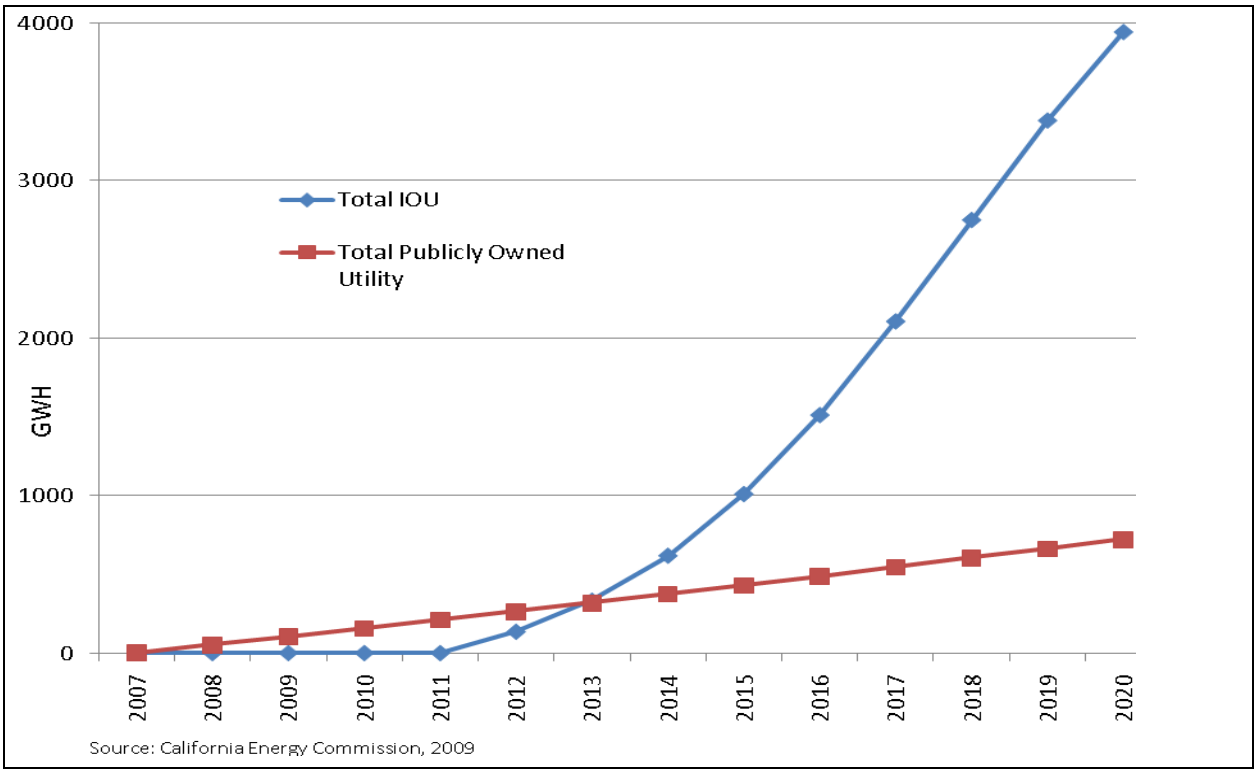
Next Steps

Staff plans to continue to improve estimates of energy savings due to utility and public agency programs, standards, and naturally occurring effects for the revised forecast and beyond. Future work includes the following:

[21] Staff assumed that savings in the commercial sector would be covered by lighting standards incorporated in the Commercial Model.

- Refining IOU efficiency program impact estimates
- Updating efficiency program impact estimates for the publicly owned utilities
- Updating model inputs and incorporating further efficiency programs directly within the forecasting models
- Identifying and estimating overlap among programs, standards, and naturally occurring savings
- Incorporating low income energy efficiency programs.

Figure 8-7: Naturally Occurring Residential Lighting Savings by Utility Type



APPENDIX: California Energy Demand 2010-2020 Staff Draft Forecast Supporting Documents

This Appendix provides additional details on work related to the *California Energy Demand 2009 Staff Draft Forecast* (*CED 2009*). The following sections include information on floor space, residential lighting, self-generation, utility efficiency program impacts, and ongoing evaluation of staff modeling methodologies and alternative forecasting approaches.

Floor Space Forecast

Energy use in the commercial sector is modeled in terms of energy use per square foot for each of twelve different building types. A forecast of floor space in each county serves as the economic driver of demand trends. The historic floor space stock estimates are based on analysis of the McGraw Hill database of permits for new buildings and floor space additions from 1970 through 2007. Staff creates a historic time series of floor space stock by allowing additions to decay as they age, in concert with the logistic survival formula:

$$Survival\left(\text{age } t\right) = \frac{e^{v}}{1+e^{v}} \quad \text{where} \quad v = 6.912\left(1 - \frac{t}{\text{median life}}\right).$$

Logistic survival posits that few buildings are torn down in their early years and that tear-downs accelerate as buildings approach their average lifetime, then slow down again as fewer old buildings remain.

For the *CED 2009*, staff revised the econometric method for forecasting growth in floor space used in *California Energy Demand 2009 Staff Revised Forecast*. The new method forecasts additions rather than total floor space, using projected additions to create a forecast for total stock.

The logic behind this approach begins with the assumption that floor space stock can be defined as a function of economic and demographic variables:

$$Stock_{i,t} = \alpha + EconDemo_i * \beta + \varepsilon_{i,t},$$

where i indicates a commercial building type and t the time period. $EconDemo_i$ refers to one or more economic/demographic variables and can be specified as current and/or past values, since there may be a delay between changes in these variables and a response in terms of construction. The error term ε is the part of stock's variation that cannot be explained by *EconDemo* variables, and is assumed to be random.

Since actual stock counts are not available, this equation needs to be changed to one specified in terms of additions. Converting the equation into changes in the variables from one time period to the next, we have:

$$\Delta\, Stock_{i,t} = \Delta\, EconDemo_i * \beta + u_{i,t},$$

where $u_{i,t}$ equals $\varepsilon_{i,t} - \varepsilon_{i,t-1}$. The change in stock comes from additions and the amount of existing floor space that disappears in year t, or *Decay*, so that:

$$Additions_{i,t} - Decay_{i,t} = \Delta\ EconDemo_i{*}\beta + u_{i,t}, \text{ or:}$$

$$Additions_{i,t} = Decay_{i,t} + \Delta\ EconDemo_i{*}\beta + u_{i,t}.$$

Staff has data for every variable except *Decay*. Assuming that *Decay* is proportional to the amount of stock existing in year t:

$$Decay_{i,t} = Stock_{i,t} {*}\gamma,$$

and using the equation for stock above, we have:

$$Additions_{i,t} = (\alpha + EconDemo_i{*}\beta){*}\ \gamma + \Delta\ EconDemo_i{*}\beta + u_{i,t} + \varepsilon_{i,t}.$$

In other words, additions are specified as a function of both levels and changes in current and past economic/demographic variables plus a random error. Staff tested a variety of these variables for each building type to find the best fit, using county level data. **Table A-1** shows the economic/demographic variables that were used for each building type.

Table A-1: Economic/Demographic Variables Used for Each Building Type

Building Type	*Variables in Final Regression*
Small and Large Office	Non-farm jobs; personal income; employment in high tech; employment in finance
Restaurant	Population; employment in leisure activities
Retail and Grocery Stores	Non-farm jobs; personal income
Warehouse	Non-farm jobs, population
Refrigerated Warehouse	Employment in food manufacturing; population
School	Population aged 5-17
College	Population aged 18-24; population
Hospital	Employment in health/education; population
Hotel	Employment in leisure activities; personal income; population
Miscellaneous	Personal income; population

Source: California Energy Commission, 2009

Using the regression results, additions for each building type and county were forecast using economic and demographic projections from Economy.com and the California Department of Finance and then aggregated to the climate zone level. Projected floor space stock was calculated by adding these additions beginning in the first forecast year to the previous year's estimated stock and subtracting building decay.

Vacancy rates for both historical and forecast years were estimated using data on office building vacancies by county for 1984-2005. Vacancy rates were specified as a function of the rate of net building additions and growth in employment in office related jobs (government, information, and finance). Regression yielded the following:

$$Vacancy\ rate(t) = 14.66 + 42.27 \times additions\ rate(t) - 34.73 \times employment\ growth(t),$$

with both explanatory variables statistically significant at a 95 percent confidence level. This estimated relationship was used to project vacancy rates for all building types, with employment growth in office-related employment replaced by a growth indicator relevant to the particular building type. For example, growth in projected retail employment was used in the case of retail buildings, and growth in school age population was used for schools.

Residential Lighting

To estimate residential lighting use separately within the Residential Model, staff developed estimates of statewide average lighting energy consumption per household by household type (single and multi-family homes) for 1980 through 2004. Data for this purpose came from the consulting firm Itron and various *California Lighting and Appliance Saturation Studies*. Staff then created a new end use for the model, breaking out lighting from the "miscellaneous" category of end uses, so that total lighting use plus revised miscellaneous use equaled original miscellaneous consumption for the historical period.

For the investor-owned utility (IOU) planning areas, staff used reported lighting program savings for 2005-2008 and program plans for 2009-2011, adjusted as described in Chapter 8, to estimate reductions to average lighting values for 2005-2011. No direct IOU lighting programs impacts were assumed beyond 2011, the end of the current three-year program cycle. However, staff assumed average lighting per household would remain at 2011 levels without utility incentives through the rest of the forecast period in the IOU planning areas. The difference between the 2011 average and an increasing average that would have occurred as utility program impacts decayed was assigned to naturally occurring savings. **Table A-2** shows the historical estimates for average lighting use per household by type for selected years and gives projected values by IOU planning areas based on lighting program impacts.

In the publicly owned utility planning areas, staff applied the same statewide historical estimates, and assumed 2004 averages through 2007. For 2008 and beyond, staff assumed a gradual reduction in average lighting use, so that by 2020 average use fell to 75 percent of 2007 levels. Savings relative to 2007 average use were assigned to naturally occurring savings.

Given the focus of utility programs and state and federal legislation related to lighting, staff felt that it was unrealistic to assume no lighting savings beyond 2007 for the publicly owned utilities and 2011 for the IOUs. These estimates of continued savings are meant to provide a starting point for discussion and further refinement.

Table A-2: Estimated Historic and Projected Lighting Use per Household for the Investor-Owned Utilities (kWh per Year)

Planning Area	Housing Type	1980	1990	1995	2000	2004	2008	2011 and Beyond
PGE	Single Family	1,093	1,597	1,719	1,764	1,800	1,527	1,323
	Multi-Family	607	887	955	980	1,000	849	735
SCE	Single Family	1,093	1,597	1,719	1,764	1,800	1,527	1,213
	Multi-Family	607	887	955	980	1,000	849	674
SDGE	Single Family	1,093	1,597	1,719	1,764	1,800	1,527	1,492
	Multi-Family	607	887	955	980	1,000	849	829

Source: California Energy Commission, 2009

Self-Generation

Staff has developed a methodology to predict adoption of residential Photovoltaic (PV) systems, based on the self-generation model used by the Energy Information Agency (EIA).[22] The new model includes two distinct steps. The first step examines the private financial benefit from investing in a PV system. This essentially casts the decision to purchase a system as an investment decision to be made by a prospective homeowner. Under this framework, the homeowner will evaluate the direct financial benefits relative to the cost of investing in a PV system. If the total private financial benefit exceeds the cost, it is assumed that the homeowner will invest in the system. The metric used to capture the overall financial attractiveness of investing in a PV system is the payback period, which measures how long it would take a household to recoup their initial investment in a project given projected returns, a function of the present value of expected annual electricity cost savings.

The extent of investment in PV systems made by households is handled in the second step of the model, which uses a logistic or "s shaped" penetration function to estimate the share of households that would invest in a system in any given year, based on payback. Systems with relatively fast payback will achieve greater penetration than systems with longer payback. As in the EIA model, projects with a payback period of one year are limited to capturing 30 percent

[22] The description of the EIA self-generation model begins on page 124 of *Model Documentation Report: Residential Sector Demand Module of the National Energy Modeling System*, DOE/EIA-MO67, April 2007, Office of Integrated Analysis and Forecasting, Energy Information Administration. http://tonto.eia.doe.gov/FTPROOT/modeldoc/m067(2007).pdf.

of the market for new single family residential construction while projects with less than a one-year payback are limited to capturing 50 percent of the market.

Once the penetration rate is determined, it is multiplied by the projected amount of new single family residential units to arrive at an estimate of the projected number of new homes that purchase a PV system. Multiplying the number of homes adopting a system by system size provides an estimate of the incremental PV capacity installed.

The methodology is applied separately for the existing stock of single family homes. Given the size of the existing housing stock relative to new construction, the penetration of PV systems in the existing housing stock is limited to a maximum of 15 percent under a one year payback scenario and 25 percent under a scenario with less than a one year payback. For each projected year, the existing stock in each year is adjusted to account for PV penetration occurring in prior years.

Utility Efficiency Program Impacts

Staff, along with Itron, began the process of measuring the savings impacts from utility efficiency programs described in Chapter 8 by collecting first-year reported and projected savings data from the IOUs for 1998-2011 and distributing the savings into end uses. Where specific end use attribution was unavailable in the data (1998-2002), staff assigned savings to each end use based on the 2003 distributions. **Tables A-3** through **A-5** give the results of this initial process for selected years, showing "ex-ante" first year net savings[23] for each IOU by end use and sector. The tables clearly show the predominance of lighting measures in each utility; for example, reported first-year lighting savings make up over 70 percent of the total for each utility in 2007.

[23] Savings estimates have been adjusted from gross totals using net-to-gross ratios (adjusting for free-ridership), but not adjusted by realization rates.

Table A-3: Reported and Projected First-Year Program Savings (GWh) for PG&E by End Use and Sector

Sector	End Use	1998	2001	2005	2006	2007	2008	2009-2011*
Residential	Heating, Ventilation, Air Conditioning**	4	17	12	3	24	14	13
	Compact Fluorescent Lighting	21	80	165	264	476	878	360
	Other Residential Lighting	4	15	20	22	77	68	40
	New Construction	3	13	0	0	1	0	0
	Pool Pumps	3	11	2	1	3	3	0
	Refrigerator Recycling	24	95	7	17	32	0	82
	Other Refrigerator	0	0	0	0	0	32	0
	Water Heating	1	3	3	5	17	28	0
	Misc./Non-descriptive	0	0	0	0	0	1	139
	Total Residential	60	234	209	312	630	1,024	633
Commercial	Heating, Ventilation, Air Conditioning**	21	22	13	26	51	121	95
	Compact Fluorescent Lighting	109	111	26	228	385	683	255
	Other Commercial Lighting	78	80	66	45	124	255	51
	New Construction	104	106	3	1	5	0	0
	Refrigeration	17	17	15	23	68	162	46
	Water Heating	0	0	0	1	0	1	0
	Misc./Non-descriptive	57	58	8	10	29	188	0
	Total Commercial	388	394	131	334	662	1,410	447
Industrial	--	0	0	1	3	17	105	24
Agricultural	--	0	0	3	13	4	220	168
Grand Total	--	448	628	344	662	1,313	2,759	1,272

Source: California Energy Commission, 2009

* Utility projected first year savings are the same in each year 2009-2011.

** Includes building shell measures.

Table A-4: Reported and Projected First-Year Program Savings (GWh) for SCE by End Use and Sector

Sector	End Use	1998	2001	2005	2006	2007	2008	2009-2011*
Residential	Heating, Ventilation, Air Conditioning**	7	10	13	8	29	66	21
	Compact Fluorescent Lighting	33	48	297	334	787	487	302
	Other Residential Lighting	6	9	33	52	124	34	43
	New Construction	5	8	0	0	0	0	0
	Pool Pumps	5	7	6	1	2	4	0
	Refrigerator Recycling	39	57	34	48	79	0	63
	Other Refrigerator	0	0	2	2	3	89	0
	Water Heating	1	2	0	0	0	0	0
	Misc./Non-descriptive	0	0	3	0	0	0	17
	Total Residential	96	141	388	445	1024	680	446
Commercial	Heating, Ventilation, Air Conditioning**	23	17	15	15	50	80	205
	Compact Fluorescent Lighting	118	88	51	36	40	296	67
	Other Commercial Lighting	85	63	68	95	181	188	289
	New Construction	113	84	6	16	10	0	0
	Refrigeration	18	14	15	27	7	32	25
	Water Heating	0	0	0	0	0	0	0
	Misc./Non-descriptive	62	46	3	43	60	62	4
	Total Commercial	419	313	158	232	348	658	590
Industrial	--	0	0	0	0	48	40	72
Agricultural	--	0	0	14	0	195	223	160
Grand Total	--	515	454	560	677	1615	1601	1268

Source: California Energy Commission, 2009

* Utility projected first year savings are the same in each year 2009-2011.

** Includes building shell measures.

Table A-5: Reported and Projected First-Year Program Savings (GWh) for SDG&E by End Use and Sector

Sector	End Use	1998	2001	2005	2006	2007	2008	2009-2011*
Residential	Heating, Ventilation, Air Conditioning**	5	4	3	0	5	3	2
	Compact Fluorescent Lighting	22	20	101	38	151	67	46
	Other Residential Lighting	4	4	9	7	25	17	7
	New Construction	4	3	3	0	0	0	0
	Pool Pumps	3	3	1	3	2	1	0
	Refrigerator Recycling	26	23	7	5	11	0	16
	Other Refrigerator	0	0	2	0	1	8	1
	Water Heating	1	1	1	0	0	2	0
	Misc./Non-descriptive	0	0	0	0	0	0	0
	Total Residential	64	57	127	53	195	98	73
Commercial	Heating, Ventilation, Air Conditioning**	3	5	15	5	18	15	30
	Compact Fluorescent Lighting	14	26	8	3	6	0	3
	Other Commercial Lighting	10	19	33	45	105	134	51
	New Construction	14	25	30	6	4	0	5
	Refrigeration	2	4	6	9	12	21	7
	Water Heating	0	0	0	0	0	0	0
	Misc./Non-descriptive	7	14	12	0	28	34	20
	Total Commercial	50	92	104	68	173	204	116
Industrial	--	0	0	0	0	1	0	0
Agricultural	--	0	0	0	0	38	0	0
Grand Total	--	114	149	231	121	407	302	189

Source: California Energy Commission, 2009

* Utility projected first year savings are the same in each year 2009-2011.

** Includes building shell measures.

Table A-6 shows the expected useful lives (EULs) of adopted efficiency measures estimated for each end use/sector, applied to decay measure savings over time. These were calculated by averaging reported EULs over all measures within an end use for residential and commercial programs, and over the entire sector in the case of the agricultural and industrial programs.

The EULs were applied in a logistic decay function to develop accumulated program savings in each year. The function was specified as follows:

Decay Rate = 1 - 1 / (1 + exp(-.75 * (Years after implementation - EUL))).

This function yields an "s shaped" curve with the following characteristics: little initial decay over time, accelerated decay in the years immediately before and after the EUL, and little decay throughout the rest of the forecast period.

Table A-6: Estimated Expected Useful Life by End Use/Sector

End Use	Average Expected Useful Life (Years)	End Use	Average Expected Useful Life (Years)
Residential Sector			
Heating, Ventilation, Air Conditioning	12	Refrigerator Recycling	10
Building Shell	18	Other Refrigerator	10
Compact Fluorescent	10	Water Heating	14
Other Residential	16	Miscellaneous	4
New Construction	20	Non-descriptive	4
Pool Pumps	10		
Commercial Sector			
Heating, Ventilation, Air Conditioning	15	Refrigeration	5
Building Shell	13	Water Heating	12
Compact Fluorescent	2	Misc	12
Other Commercial	12	Non-descriptive	4
New Construction	20		
Agricultural	18	Industrial	16

Source: California Energy Commission, 2009

Electricity Consumption Savings from All Sources

Table A-7 shows total savings for the five major California utilities and is available on-line at http://www.energy.ca.gov/2009_energypolicy/documents/index.html#062609.

Evaluation of Staff Methodology

As discussed in Chapter 8, various parties expressed confusion during the *2007 IEPR* process about energy efficiency impacts incorporated within the Energy Commission Demand Forecast. Prompted by these concerns, the *2007 IEPR* committed the Energy Commission in 2008 and beyond to examining the methods used to incorporate efficiency in the Commission's demand forecast. In addition, the Commission launched an effort to evaluate the forecasting models themselves to identify potential areas for improvement in the forecasting process. Aspen Environmental Group and R.W. Beck, consultants in this effort, have completed a preliminary assessment of the staff demand forecasting methodology. Key findings include:

- The Energy Commission end-use approach is useful, has many advantages, and is a valuable counter-weight to the econometric models used by the utilities. However, the approach is data-intensive, and requires major staff effort to maintain and update the individual models. Currently, updated data is lacking in some areas and staff resources may not be adequate to take full advantage of the end-use approach.
- If the end-use approach is continued, the Energy Commission should consider adding more flexible, short-term econometric models to address policy questions.
- The current methodology requires an updated and more comprehensive price response capability.
- The current methodology requires a more transparent backcasting/calibration procedure.
- The current methodology requires an uncertainty analysis capability.
- Staff's forecast is undermined by inconsistency in energy demand reporting and data sources through time, which may be driven in part by a changing regulatory regime historically, and a lack of consistency through time with respect to data management and submission protocols on the part of individual utilities to the Energy Commission.

The consultants also suggested that the Energy Commission evaluate whether continuing to meet all of the individual tailored needs for the demand forecast is feasible given current methodologies, data requirements, reporting requirements, and resource limitations. This suggestion prompted staff to begin a second evaluation phase that involves an assessment of the applications of the demand forecast, a judgment whether all of these applications are feasible given stakeholder needs and staff resource constraints, and consideration of alternative

or additional methodologies for those applications considered feasible. "Phase II" of the evaluation effort will begin in the summer of 2009.

Draft Demand Forecast Forms Completed by Energy Commission Staff

The list of draft demand forecast forms completed by Energy Commission staff in support of the *2009 Integrated Energy Policy Report* is below. The staff's completed forms are available on-line at http://www.energy.ca.gov/2009_energypolicy/documents/index.html#062609.

Statewide Forms

1.1 Electricity Consumption by Sector
1.1b Electricity Sales by Sector
1.2 Net Energy for Load
1.3 Coincident Peak Demand by Sector
1.4 Noncoincident Peak Demand
1.5a Net Energy for Load by Agency and Balancing Authority
1.5b 1-in-2 Electric Peak Demand by Agency and Balancing Authority
1.7 Private Supply by Sector
2.2 Economic and Demographic Assumptions

Pacific Gas and Electric Planning Area Forms

1.1 Electricity Consumption by Sector
1.1b Electricity Sales by Sector
1.2 Net Energy for Load
1.3 Coincident Peak Demand by Sector
1.4 Peak Demand
1.5 Extreme Energy Peak Demand
1.7 Private Supply by Sector
2.2 Economic and Demographic Assumptions and Electricity Prices
2.3 Electricity Prices

Southern California Edison Planning Area Forms

1.1 Electricity Consumption by Sector
1.1b Electricity Sales by Sector
1.2 Net Energy for Load
1.3 Coincident Peak Demand by Sector
1.4 Peak Demand

1.5 Extreme Energy Peak Demand
1.7 Private Supply by Sector
2.2 Economic and Demographic Assumptions and Electricity Prices
2.3 Electricity Prices

San Diego Gas and Electric Planning Area Forms

1.1 Electricity Consumption by Sector
1.1b Electricity Sales by Sector
1.2 Net Energy for Load
1.3 Coincident Peak Demand by Sector
1.4 Peak Demand
1.5 Extreme Energy Peak Demand
1.7 Private Supply by Sector
2.2 Economic and Demographic Assumptions and Electricity Prices
2.3 Electricity Prices

Sacramento Municipal Utility District Planning Area Forms

1.1 Electricity Consumption by Sector
1.1b Electricity Sales by Sector
1.2 Net Energy for Load
1.3 Coincident Peak Demand by Sector
1.4 Peak Demand
1.5 Extreme Energy Peak Demand
1.7 Private Supply by Sector
2.2 Economic and Demographic Assumptions and Electricity Prices
2.3 Electricity Prices

Los Angeles Water and Power Department Planning Area Forms

1.1 Electricity Consumption by Sector
1.1b Electricity Sales by Sector
1.2 Net Energy for Load
1.3 Coincident Peak Demand by Sector
1.4 Peak Demand
1.5 Extreme Energy Peak Demand
1.7 Private Supply by Sector
2.2 Economic and Demographic Assumptions and Electricity Prices
2.3 Electricity Prices

Natural Gas Planning Areas Forms

1.1 Natural Gas Consumption
2.3 Natural Gas Prices