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Sacramento Municipal Utility District
Docket #09-IEP-1C Demand Forecast
Form 4: Demand Forecast Methods and Models.

This form reports on SMUD's models to forecast system energy, peak and retail sales. Section 1, reviews SMUD's energy, peak and hourly load models. Section 2, reviews SMUD's customer account forecast methodology, and Section 3 reviews SMUD's retail sales models.

Section 1: Energy, Peak and Hourly Load Models

Demand Forecast methodology

SMUD's forecasts of system peak, energy and hourly loads are based on statistical regression models.

The forecast (dependent) variables include: daily energy, daily peak, and hourly loads. These variables are normalized by the number of total retail customers served by SMUD. The forecast is the product of the estimated electricity demands per customer times the projected number of customer accounts for the system.

The objective of the energy modeling approach is to explain the daily variation in system energy and daily peak. The independent variables include:

- Weekdays (Monday-Saturday),
- Holidays (California State Recognized Holidays),
- Months of the year (January – December)
- Summer Season (June to September)
- Winter Season (November to February)
- Cooling Degree Day (Base = 60, 65, 70 and 75)
- Heating Degree Day (Base = 65, 60, 55)
- Lagged Cooling and Heating Degree days (1 to 4)
- Cooling Adjustment Index (CAI) =
  exp(.2+.2*(loads.maxtemp-90)))/(1+exp(.2+.2*(loads.maxtemp-90)))
- Change in Daylight Savings Time.

The daily energy, peak and hourly loads are from SMUD's Energy Management System (EMS) load data for the retail service planning area territory. The EMS loads are net imports, measured at SMUD 230 kW transmission system, and gross generation from SMUD's generation units. Temperature variables include daily maximum and minimum temperatures from the National Weather Service Sacramento City and Executive Airport weather stations.

The model equations are estimated using the MetrixND software from Itron. The time period is from January 1, 2004 to July 31, 2008. Parameter estimates and other regression summary statistics are included in the Excel spreadsheet, “Docket #9-IEP-1C Demand Forecast Form 4 Model Parameters.xls.”

The energy, peak and hourly load forecasts are estimated by multiplying the per unit load estimates by the number of expected customers from 2009-2020.

In SMUD’s load models, both price and income effects are excluded. These variables tend to do poorly statistically and do not correctly explain (i.e. insignificant t-statistics and wrong parameter sign) the variation in energy use.

Weather Adjustment Procedures

The forecast of SMUD’s loads are based on average daily temperatures for Sacramento County for the period 1971 to 2000. The weather data comes from the National Weather Service’s Sacramento Weather Stations for Executive Airport and Sacramento City. The simulation under the average temperatures is the “1 in 2“ load forecast.

The extreme peak temperatures were determined by examining the confidence intervals for the typical peak day load temperature conditions (mean + z-stat * standard deviation).

The results from this procedure produce the following temperature conditions for each confidence interval and load scenario.

Table 1.1
Extreme Temperature Conditions

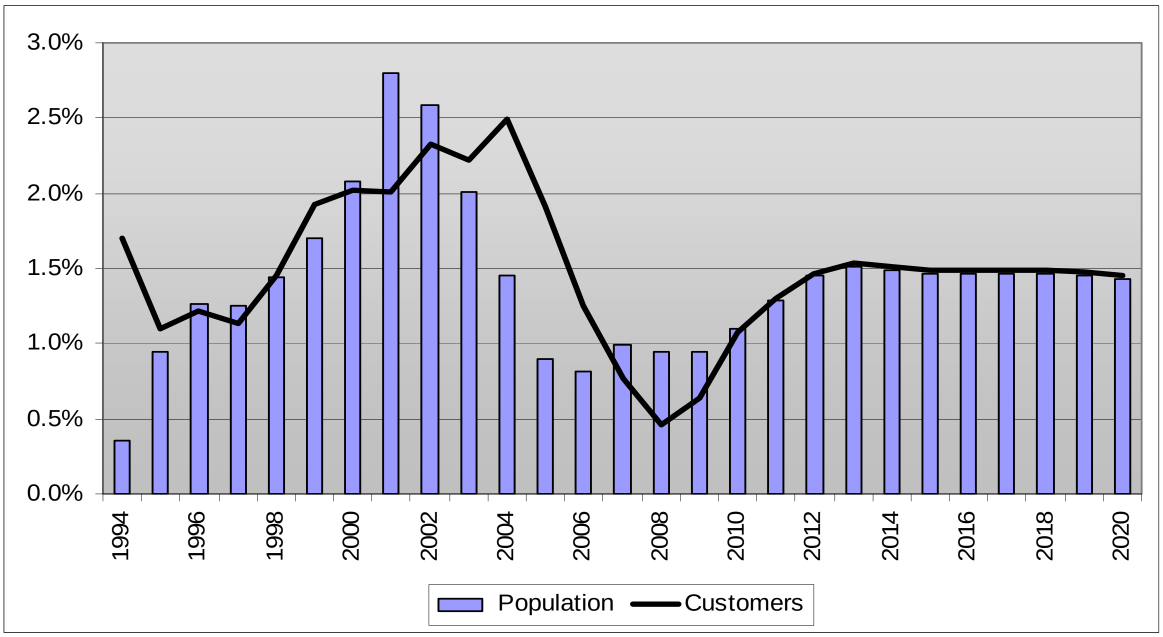
Confidence Interval	Scenario	Design Maximum Daily Temperature (Degrees Fahrenheit)
50 Percent	1 in 2	106
20 Percent	1 in 5	108
10 Percent	1 in 10	110
5 Percent	1 in 20	112
2.5 Percent	1 in 40	114

Historic and Forecast Population Trends

The population forecast for Sacramento County is the primary driver of SMUD’s load forecast. Net additions to SMUD’s customer base are proportional to the growth in population over the forecast period. Because of the housing crisis in Sacramento County, the number of new customer accounts for 2009 is based on a forecast of residential housing permits from the California Construction Industry Research Board (See California Construction Review, July 2009).

The figure below shows the historical and projected population and customer growth rates.

Figure 1.1
SMUD Population and Customer Growth
1994-2020



Over the forecast period, SMUD believes that the short run deviation in growth is limited to 2009 and that its growth will resume along its long run “steady state” path beginning in mid-2010. The population growth rate is based on Global Insight’s June 2009 Regional forecast for Sacramento County. This forecast is slightly above the California Department of Finance July 2008 projected annual growth rate of 1.1 percent but well below Sacramento’s historical growth of 2.8 percent from 1980 to 1989, and 1.7 percent from 1990 and 2008.

Table 1.2 below shows Sacramento County population statistics from the California Department of Finance, Demographic Research Unit, Table E-6, County Population Estimates and Components of Change, various years. This table breaks down population growth by natural increase, net migration from within the United States (Domestic) and from foreign counties.

Table 1.2
Sacramento County Population 1991-2007

	Population (July 1)	Percent Change*	Numeric Change	Births	Deaths	Natural Increase	Net Migration	Net Foreign Immigration	Net Domestic Migration	Annual Percentage Change		
										Natural Increase	Net Migration	Total
1991	1,080,078	3.17	33,208	19,663	7,764	11,899	21,309	4,896	16,413			
1992	1,096,607	1.53	16,529	19,977	7,715	12,262	4,267	6,345	(2,078)	1.1%	0.4%	1.5%
1993	1,111,097	1.32	14,490	19,277	7,684	11,593	2,897	5,183	(2,286)	1.1%	0.3%	1.3%
1994	1,116,418	0.48	5,321	18,759	8,268	10,491	(5,170)	4,900	(10,070)	0.9%	-0.5%	0.5%
1995	1,120,733	0.39	4,315	18,780	8,346	10,434	(6,119)	2,886	(9,005)	0.9%	-0.5%	0.4%
1996	1,134,687	1.25	13,954	18,251	8,570	9,681	4,273	4,969	(696)	0.9%	0.4%	1.2%
1997	1,149,127	1.27	14,440	17,485	8,569	8,916	5,524	5,767	(243)	0.8%	0.5%	1.3%
1998	1,165,767	1.45	16,640	17,679	8,695	8,984	7,656	2,249	5,407	0.8%	0.7%	1.4%
1999	1,204,658	3.34	38,891	17,560	8,908	8,652	30,239	2,379	27,860	0.7%	2.6%	3.3%
2000	1,233,386	2.38	28,728	17,968	8,922	9,046	19,682	4,072	15,610	0.8%	1.6%	2.4%
2001	1,271,471	3.09	38,085	18,600	9,250	9,350	28,735	5,112	23,623	0.8%	2.3%	3.1%
2002	1,302,397	2.43	30,926	19,202	9,551	9,651	21,275	4,794	16,481	0.8%	1.7%	2.4%
2003	1,332,269	2.29	29,872	19,736	9,477	10,259	19,613	5,131	14,482	0.8%	1.5%	2.3%
2004	1,357,617	1.90	25,348	20,459	9,775	10,684	14,664	5,688	8,976	0.8%	1.1%	1.9%
2005	1,378,068	1.51	20,451	21,043	9,494	11,549	8,902	5,674	3,228	0.9%	0.7%	1.5%
2006	1,396,353	1.33	18,285	21,365	9,597	11,768	6,517	5,812	705	0.9%	0.5%	1.3%
2007	1,415,117	1.34	18,764	21,703	9,716	11,987	6,777	5,424	1,353	0.9%	0.5%	1.3%

California Department of Finance E-6 Report

The growth by "Natural Increase" (births minus deaths) represents about 1 percent of Sacramento's annual growth. This rate has been relatively stable overtime and is assumed to remain at this level in the future. The other category is "Net Migration." Net domestic migration is dependent upon differences in the local economies and housing markets in California. Foreign migration is dependent upon the economic and political conditions in these countries. In the future, SMUD is assuming that net migration will be about 0.5 percent per year. Based on these assumptions, SMUD believes that the projected population and customer growth rates are reasonable.

Forecast Calibration procedures

SMUD forecast are based on the estimated model parameters, typical weather conditions, and its projected customer additions. The load forecast is not calibrated or adjusted based on the "within sample" errors.

Energy and Peak Loss Estimated

Energy and peak loss estimates are based on the historical relationship between the EMS loads and retail sales. Incremental losses are based on models of SMUD's transmission system.

Hourly Loads by Subarea

The SMUD service territory area is a single contiguous planning area and does not have subareas.

Economic and Demographic Projections

SMUD's load forecast is based entirely on its population projection discussed above.

Historic Forecast Performance

Forecast performance is illustrated in the figures below. These figures compare the actual loads with the predicted loads from the forecasting models for daily peak (Figure1.2), daily energy (Figure 1.3) and for actual daily energy and predicted daily energy based on the "normal weather patterns" (Figure 1.4). This figure shows the months where deviations from "normal weather" are likely to occur. The within-sample period is 2007.

These figures show that the forecasting models do a very good job at explaining both the day to day movements and energy use levels.

Figure 1.2
Actual and Predicted Daily Peak Loads
(kW/customer)

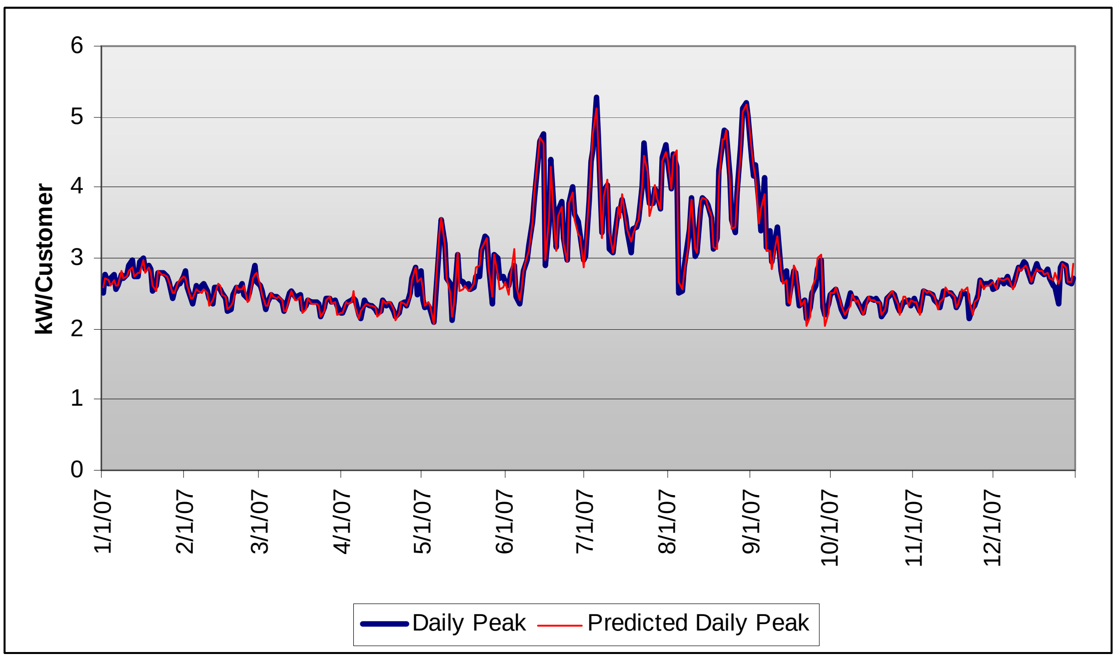


Figure 1.3
Actual and Predicted Daily Energy
(kWh/customer)

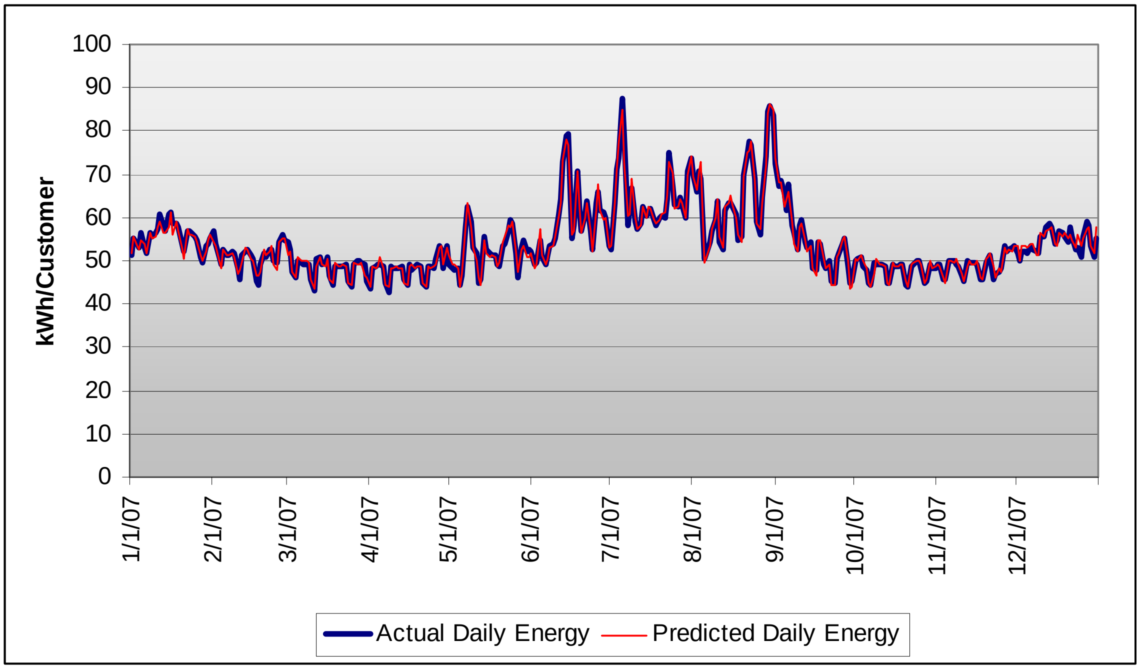
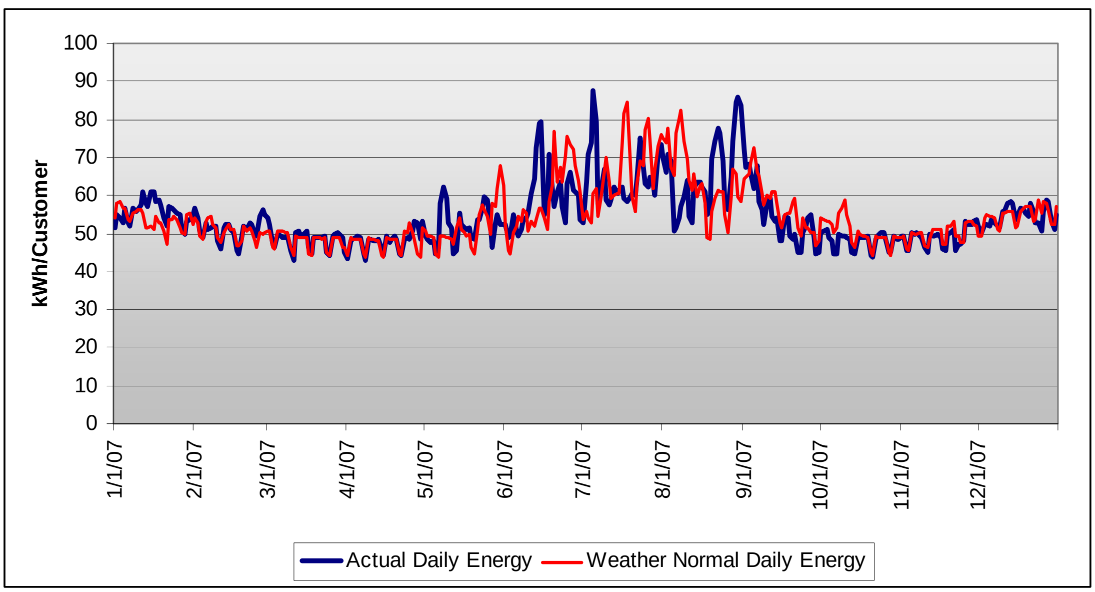


Figure 1.4
Actual and Predicted Weather Normalized Daily Energy
(kWh/customer)



Local Private Supply Estimates

Local private supply are based on the historical performance records of a local cogeneration facility in SMUD's service territory and the predicted performance of DG projects which include SMUD's PV solar program and SMUD's Advanced Renewable and Distributed Generation projects.

Forecast Uncertainties

In SMUD's forecast, the major uncertainties are associated with the temperature forecast. (See section on weather adjustments above)

The regression forecast models describe short term energy use behavior. Both the system energy and peak models adequately explain the day to day variation due to changes in daily weather conditions. The day of the week and month of the year variables represent institutional factors such as the standard workday and seasonal patterns which tend to change very slowly overtime.

The forecast is reasonable given the current mix of housing types and vintages, business sector characteristics and the current stock of installed energy efficiency measures. Because these underlying factors change very slowly over time, we believe that the forecast is reasonable for the short-term. Moreover, since the forecast is updated annually, the estimated parameter explicitly account for changes in energy use behavior.

SMUD's historical energy efficiency and time-of-use program impacts are incorporated directly into the load forecast based on the realized impacts these programs have on actual system loads.

Section 2: Customer Class Forecast Methodology

This Section provides greater detail on the methodology used to forecast changes in the number of customer accounts by class. In general, the Forecast employs the following approaches:

- o *Residential accounts*: based on project of new housing starts for 2009 and the expected growth in population for Sacramento County from 2010 to 2020,
- o *Electric heat and Agricultural:* based on historical decline in billing accounts,
- o *Commercial customers:* based on residential account growth and historical growth rates.

Historical Customer Population

The Forecast uses SMUD's billing data to establish the current base for its customer count and monthly allocation of future growth. Table 2-1 summarizes the number of historical SMUD accounts by major customer class.

Table 2.1
Annual Average SMUD Customer Count
By Customer Class 1994 – 2008

End of Year	Small and Medium Commercial*				Large Commercial			Reaidential			Agric	Lighting	Total	Percent Increase
	<20 kW	20-299 kW	300-499 kW	Subtotal	500-999 kW	> 1,000 kW	Subtotal	Electric Heat	Standard Heat	Subtotal				
1994	42,334	6,775	-	49,109	250	108	358	124,420	296,859	421,279	2,597	1,654	474,997	
1995	42,771	6,764	-	49,535	268	120	388	124,652	301,367	426,019	2,562	1,747	480,251	1.1%
1996	43,412	6,970	-	50,382	266	118	384	124,431	306,405	430,836	2,584	1,799	485,985	1.2%
1997	43,926	7,106	-	51,032	265	172	437	124,223	311,350	435,573	2,565	1,960	491,567	1.1%
1998	44,439	7,253	-	51,692	293	108	401	124,414	317,678	442,092	2,515	2,039	498,739	1.5%
1999	45,058	7,367	-	52,425	299	126	425	124,584	326,312	450,896	2,533	2,094	508,373	1.9%
2000	46,036	7,547	-	53,583	293	134	427	124,270	335,712	459,982	2,515	2,143	518,650	2.0%
2001	46,977	7,489	486	54,952	282	124	406	124,420	344,613	469,033	2,477	2,180	529,048	2.0%
2002	45,547	10,075	556	56,178	299	124	423	124,602	355,464	480,066	2,435	2,215	541,317	2.3%
2003	46,163	10,306	625	57,094	322	130	452	124,009	367,127	491,136	2,423	2,278	553,383	2.2%
2004	46,960	10,599	674	58,233	315	132	447	123,904	379,852	503,756	2,382	2,304	567,122	2.5%
2005	47,756	10,906	773	59,435	306	130	436	123,903	389,463	513,366	2,351	2,384	577,972	1.9%
2006	48,619	11,190	787	60,596	321	139	460	123,081	396,318	519,399	2,346	2,453	585,254	1.3%
2007	49,864	11,362	838	62,064	332	142	474	122,493	399,833	522,326	2,356	2,491	589,711	0.8%
2008	50,209	11,440	801	62,450	331	148	479	122,055	402,874	524,929	2,373	2,622	592,853	0.5%
Annual Increase	1.2%	3.8%	7.4%	1.7%	2.0%	2.3%	2.1%	-0.1%	2.2%	1.6%	-0.6%	3.3%	1.6%	

Notes: The May 2001 rate action created a new 300-499 kW category, and redifend the other small and medium commercial classes as: The < 30 kW category shifted to < 20 kW, and the 30-500 kW became the 20-299 kW.

Residential Customers and Historical County Population

The forecast of Residential customers relies on the close relationship of historical accounts to the total population for the County of Sacramento. Over the 10-year period 1999-2008, as indicated in Table 2-2, the average has been 2.72 persons per SMUD residential account.

Table 2.2
Persons per Residential Account
Count in January

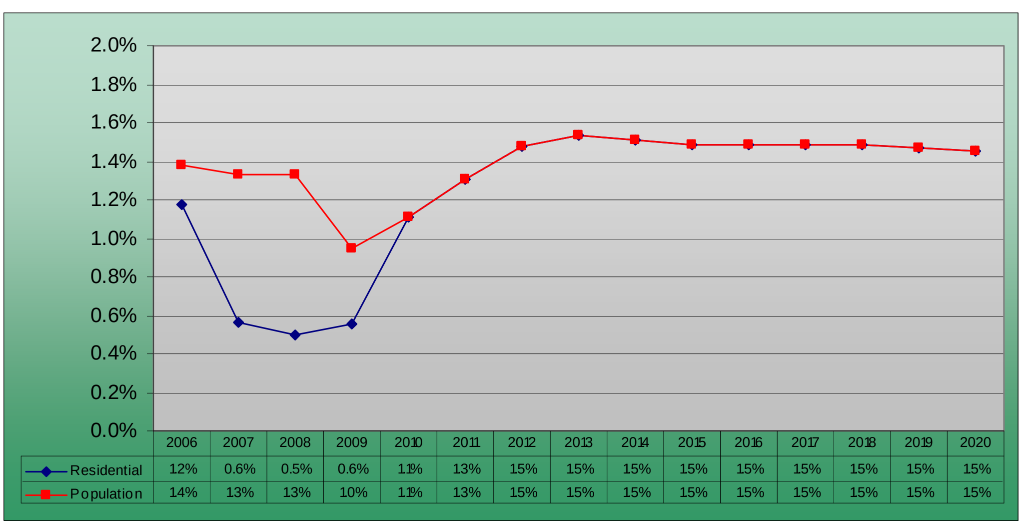
Year (January 1)	Sacramento County Population	Residential Accounts	Persons per Account
1999	1,189,122	442,904	2.68
2000	1,223,499	451,787	2.71
2001	1,252,712	460,123	2.72
2002	1,287,583	469,919	2.74
2003	1,317,992	481,044	2.74
2004	1,345,634	492,534	2.73
2005	1,368,390	504,962	2.71
2006	1,387,257	514,257	2.70
2007	1,405,694	520,093	2.70
2008	1,424,415	522,942	2.72

Average 1999-2008	2.72

Population and Residential Account Forecasts

The Residential Forecast is based on a population forecast from Global Insight. Figure 2-1 shows the relationship between forecasted population growth and residential customer growth.

Figure 2.1
Residential Customer Growth Forecast 2008-2020



Because of the crisis in the local housing market, the growth in residential customer from 2006-2008 has lagged behind the growth in population. This trend is projected to continue in 2009 based on the forecast of new residential housing permits from the California Construction Review, August 2008. Beginning in 2010, the housing market is projected to recover at the same rate of growth as the growth in population.

Table 2-3 summarizes the final population forecast and the number of residential accounts derived from the population growth rates presented in Figure 2.1. During the forecast period, the County population will increase from around 1.42 million in 2008 to 1.68 million residents in 2020. During that time residential accounts will increase from 524,929 to 617,593, or around 92,664 additional customers.

Table 2.3
Forecast Population and Residential Accounts

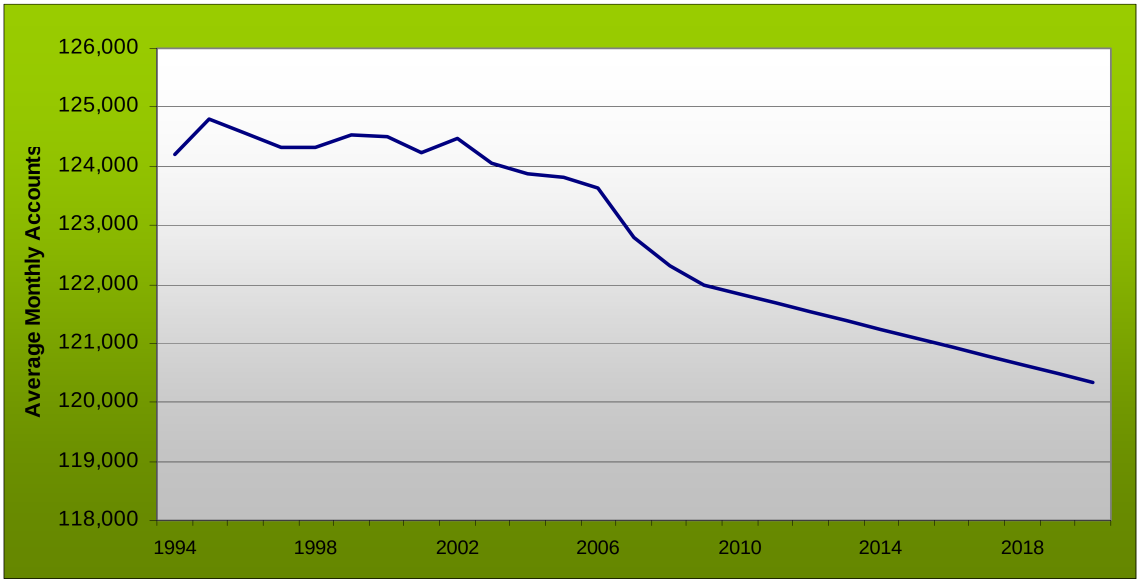
		Residential Accounts		
End of Year	Population	Total	Change	% Change
2006	1,387,257	519,399		
2007	1,405,694	522,326	2,927	0.6%
2008	1,424,415	524,929	2,603	0.5%
2009	1,437,959	527,845	2,916	0.6%
2010	1,453,876	533,688	5,843	1.1%
2011	1,472,917	540,678	6,990	1.3%
2012	1,494,637	548,651	7,973	1.5%
2013	1,517,619	557,087	8,436	1.5%
2014	1,540,539	565,501	8,414	1.5%
2015	1,563,462	573,915	8,414	1.5%
2016	1,586,721	582,453	8,538	1.5%
2017	1,610,334	591,121	8,668	1.5%
2018	1,634,280	599,910	8,789	1.5%
2019	1,658,345	608,744	8,834	1.5%
2020	1,682,450	617,593	8,849	1.5%

Note: Population at beginning of year.

Electric Heat Customers

The residential forecast adjusts for electrically-heated accounts which have been declining in number as new construction relies on gas furnaces and as existing homes convert to gas from electric resistance and heat pump equipment. Currently, around 122,055 residential accounts heat with electricity. As shown in Figure 2-2, over the next 12 years, the Forecast projects that number will decline to around 120,000 accounts.

Figure 2.2
Historical and Forecast Electric Heat Customers



Commercial Customer Forecast

The Forecast for small commercial and streetlight customers is tied to the projected residential growth. The Forecast for agriculture and commercial customers with maximum demands greater than 500 kW is tied to their historical growth rates. Table 2.4 presents the customer forecast for each rate class.

Table 2.4
Forecast Commercial Customers

End of Year	Small Commercial				Large Commercial			Total Commercial	Total Residential
	< 20 KW	20-299 KW	Agriculture	Lighting	300-499 KW	500-999 KW	> 1000 KW		
2008	50,209	11,440	2,373	2,622	801	331	148	67,924	524,929
2009	50,542	11,541	2,351	2,682	808	337	148	68,409	527,845
2010	50,956	11,666	2,329	2,745	817	344	149	69,006	533,688
2011	51,550	11,847	2,307	2,808	830	351	150	69,843	540,678
2012	52,240	12,059	2,286	2,873	844	358	152	70,812	548,651
2013	52,995	12,291	2,265	2,940	861	365	153	71,870	557,087
2014	53,767	12,529	2,244	3,008	877	373	154	72,952	565,501
2015	54,538	12,769	2,223	3,078	894	380	155	74,037	573,915
2016	55,315	13,011	2,202	3,149	911	388	157	75,133	582,453
2017	56,103	13,258	2,182	3,222	928	396	158	76,247	591,121
2018	56,902	13,509	2,161	3,297	946	404	159	77,378	599,910
2019	57,708	13,764	2,141	3,373	964	412	161	78,523	608,744
2020	58,515	14,020	2,122	3,451	982	420	162	79,672	617,593
Annual Growt	1.3%	1.7%	-0.9%	2.3%	1.7%	2.0%	0.8%	1.3%	1.4%

Table 2.5 presents the historical growth rate for each rate class and the method used to estimate their projected growth rate.

Small commercial and lighting customer accounts are tied to the forecasted growth rate for residential customers. The projected residential growth rate is weighted by an adjustment factor equal to the ratio of the historical growth rates (= small commercial /residential growth rate). The historical period varies by rate class because of the 2001 rate action which reclassified the Small Commercial rate classes. (See Table III.1 above).

The growth rate for Large Commercial customers (300 and 499 kW) is assumed to be the same as Small Commercial customers (20-299 kW). The historical annual growth rate for these customers is 7.6 %. This growth, however, is primarily from customer accounts that move up from the Small Commercial rate schedule. As this rate class matures, future growth is expected to be similar to the small commercial customers.

Agricultural and large commercial accounts above 500 kW are based on their historical growth rate. These customer classes are not directly tied to the local economy and are influenced by other trends and structural, economic or technological changes. The Forecast for agricultural customer accounts reflects a slow historic loss in farm, ranch and dairy accounts over past decade. The Forecast shows an annual loss of approximately one percent per year.

Table 2.5
Forecast Customers Growth Rates

Customer Class	Historical Period	Annual Growth Rate	Adjustment Factor	Projected Growth Rate	Forecast Method
Residential	1998-2007	1.9%		1.4%	Population
Agricultural	1998-2007	-0.9%		-0.9%	Historical
Small Commercial (<20 kW)	2003-2007	1.8%	0.98	1.3%	Adjusted
Small Commercial (20-299 kW)	2003-2007	2.4%	1.28	1.7%	Adjusted
Large Commercial (300-499 kW)	2003-2008	7.6%		1.7%	20-299 kW
Large Commercial (500-999 kW)	1998-2007	2.0%		2.0%	Historical
Large Commercial (1,000 + kW)	1998-2007	0.8%		0.8%	Historical
Streetlighting	1995-2007	3.1%	1.66	2.3%	Adjusted

Section 3: Retail Sales Models

SMUD estimates the average customer use by regression modeling. This involves the use of multivariate regression formulas that associate historical energy use for each customer class with variables that strongly influence their outcome. Staff developed the final regression formulas using iterative runs of MetrixND, an ITRON utility forecasting software to find the variables with the best predictive power.

The general multivariate regression equation takes the following form where the dependent variable can be predicted by adjusting a base value (y-intercept) by a given constant and a series of explanatory variables, which are multiplied by associated coefficients. In this case, the dependent variable is monthly energy use per customer account. The explanatory variables consist of temperature-related indices and monthly variances. The Constant is the energy use not otherwise affected by the explanatory variables.

Equation 1:

Predicted monthly energy use per customer = Constant+ Monthly adjustment + (Temperature-related adjustments)(Temperature-related variables)*

SMUD used historic 21-day cycle energy use data archived from SAP and earlier billing systems. The data was matched with historic temperature-related information maintained by Load Forecasting and Economic Analysis. Table 3-1 presents the baseline periods employed for each customer class.

Table 3.1
Historic Database

Customer Class	Description	Baseline Data
Residential	Electric Heat Non-Electric Heat	1998 – 2006
Small Commercial	< 20 kW 20 – 299 kW Agriculture and Landscape	2000 – 2006
Large Commercial	300 – 499 kW 500 – 999 kW > 1000 kW	2002 – 2006
Lighting	Street and Traffic Security Night Lighting	1993 – 2006

Weather-Related Data

The forecast regression model uses cooling degree-days (CDD) and heating degree-days (HDD) to represent temperature-related variables associated with monthly energy use. Both are measured on a daily basis and computed as the average of the high and low temperatures relative to a baseline. The formulas are as follows:

Equation 2:

Cooling Degree-days = (Daily High temp + Daily Low temp)/2 - Baseline temperature
Heating Degree-days = Baseline temperature - (Daily High temp + Daily Low temp)/2

The baseline reflects the temperature threshold above which varying levels of cooling can be expected to occur or below which heating can be expected to occur. The forecast uses Base 65 cooling and heating baselines in its regression models. The values shown in Table IV-2 show the sum of the sums of monthly degree-days, normalized for the forecast period. To conform to 21-day cycle data, the degree-days use the running 30-day sums computed daily in the calendar month.

Table 3.2
Weather-Normalized Monthly Degree-Day Sums
Base 65

Month	Cooling Degree Days			Heating Degree Days		
	Actual*	Lag**	Sum***	Actual*	Lag**	Sum***
1	-	-	-	545	560	17,745
2	-	-	-	349	545	13,404
3	-	-	-	279	349	10,516
4	17	-	268	150	279	6,882
5	106	17	1,920	46	150	3,392
6	237	106	5,279	5	46	778
7	359	237	9,395	-	5	-
8	339	359	11,071	-	-	-
9	240	339	8,772	1	-	-
10	78	240	5,080	57	1	782
11	-	78	707	317	57	5,711
12	-	-	-	560	317	14,292
Total	***1,375***	***1,375***	***42,492***	***2,306***	***2,306***	***73,502***

Notes:
* Average degree days per month.
** Average lagged forward by one month.
*** Monthly sum of the daily 30-day sum of degree days.

Regression Variables

Table 3-3 presents the regression variables used by the Forecast to determine monthly energy use for each class of customer. The table also provides selective statistics on the relative strength of the estimation variables.

The regression values, which represent normal weather conditions, remain constant through the Forecast period.

They include the following:

- *A Constant* which represents the base energy use unaffected by other variables,
- *Monthly dummy variables* which are adjustment offsets to January energy use,
- *Heating degree-day variables*
- *Cooling degree-day variables* used for all customer classes

Table 3.3
Regression Coefficients by Customer Class

Variable	**Elec Heat**	**Std Heat**	**< 20 kW**	**20-299 kW**	**300-500 kW**	**500-1000 kW**	**>1000 kW**	**Agric**	**Lighting**
Constant	739	674	1,033	14,866	80,114	195,777	1,024,917	(66)	2,567
February	(146)	(114)	(37)	(265)	(1,180)	(1,668)	6,645	(40)	(17)
March	(130)	(63)	(97)	(891)	(3,496)	(4,561)	(32,948)	403	(42)
April	(258)	(136)	(147)	(1,325)	(6,188)	(5,736)	(41,512)	1,558	(58)
May	(265)	(163)	(146)	(1,078)	(5,914)	(4,356)	(31,397)	2,793	(61)
June	(225)	(168)	(81)	(183)	(1,665)	2,038	(20,677)	3,856	(67)
July	(236)	(196)	(86)	(486)	(3,116)	(10,886)	(60,505)	3,732	(51)
August	(234)	(193)	(87)	(761)	(4,126)	(18,714)	(72,638)	2,858	(63)
September	(303)	(250)	(69)	(401)	42	(8,354)	(35,575)	1,242	(72)
October	(263)	(217)	(85)	(580)	357	(189)	(18,843)	392	(73)
November	(269)	(180)	(126)	(1,303)	(4,327)	(5,429)	(18,979)	48	(82)
December	(109)	(39)	(41)	(418)	(740)	4,766	29,210	(60)	(52)
SumCDD	0.023	0.029	0.02	0.28	1.39	3.05	270.05		
LagCDD65	0.495	0.498	0.10	2.39		39.96			
LagHDD65	0.439		0.12						
SumHDD	0.016	0.005	0.004						

Selective Statistics

R-Squared	0.975	0.961	0.991	0.993	0.971	0.965	0.937	0.986	0.947
Durbin-Watson Statistic	2.045	2.25	2.019	1.908	1.797	1.671	1.967	1.295	2.168
F-Statistic	107.684	82.045	146.051	247.634	57.604	44.514	23.355	120.783	35.808
Mean Abs. Dev. (MAD)	22.16	22.03	7.97	112.79	1078.26	2468.09	12232.05	125.31	0.0036
ean Abs. % Err. (MAPE)	2.58%	3.20%	0.74%	0.72%	1.29%	1.18%	1.21%	8.11%	22%

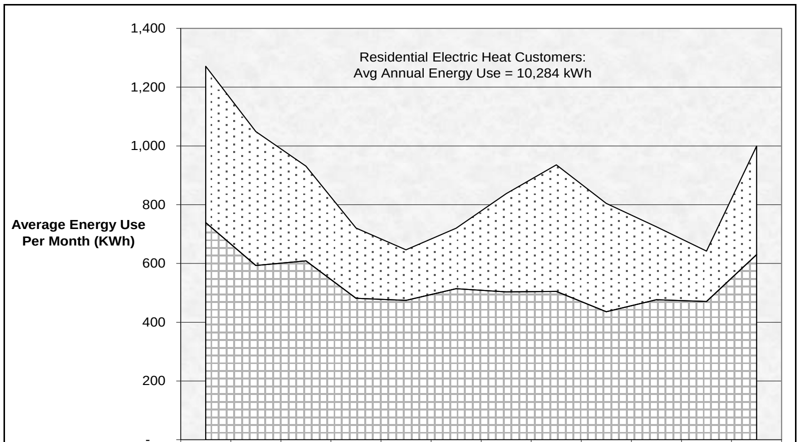
* note: a blank space indicates that the parameter was assumed to equal zero.

Temperature-Related Energy Use

The figures below illustrate the role ambient temperature plays in the forecast monthly energy use of customer classes. Winter temperatures are only significant in predicting energy use for electric-heated customers. Cooling-related energy use during the summer months is particularly significant for residential customers when it can represent 50% or more of the load.

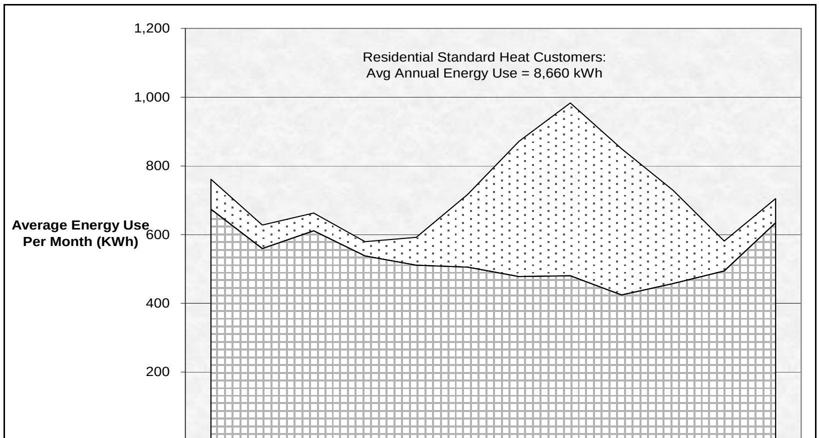
For commercial accounts, cooling energy use is most significant for smaller customers where it can affect around 20% of summer use.

Figure 3.1
Temperature-Related Energy Use: Residential Electric Heat



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temperature-Related	532	455	323	239	172	206	334	431	369	248	172	369
Base Electric Use	739	593	609	481	474	514	503	505	436	477	471	630

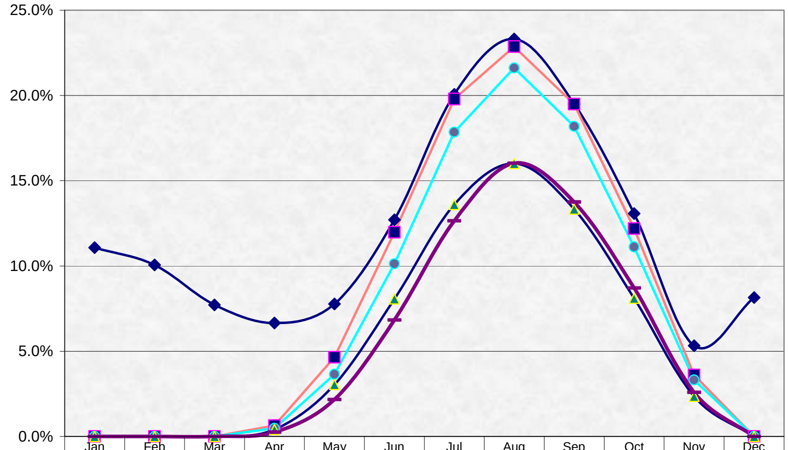
Figure 3.2
Temperature-Related Energy Use: Residential Standard Heat



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temperature-Related	87	68	52	42	81	211	393	503	426	272	87	70
Base Electric Use	674	559	611	538	511	506	478	480	424	457	494	634

Figure 3.3

Temperature-Related Energy Use: Commercial
As a Percent of Total Energy Use: Commercial Class Customers



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
< 20 kW	11.1%	10.1%	7.7%	6.7%	7.8%	12.7%	20.1%	23.3%	19.5%	13.1%	5.3%	8.1%
20-300 kW	0.0%	0.0%	0.0%	0.6%	4.7%	12.0%	19.8%	22.9%	19.5%	12.2%	3.6%	0.0%
500-1000 kW	0.0%	0.0%	0.0%	0.5%	3.7%	10.1%	17.8%	21.6%	18.2%	11.1%	3.3%	0.0%
300-500 kW	0.0%	0.0%	0.0%	0.4%	3.0%	8.1%	13.6%	16.0%	13.3%	8.1%	2.3%	0.0%
>1000 kW	0.0%	0.0%	0.0%	0.3%	2.2%	6.8%	12.6%	16.0%	13.7%	8.7%	2.6%	0.0%