CALIFORNIA COMMERCIAL END-USE SURVEY

Chapters 6-7

CONSULTANT REPORT

Prepared For:
California Energy Commission

CALMAC Study ID: CEC0023.03

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March 2006
CEC-400-2006-005

This report is dedicated to the memory of Alan Fields, who served as the project manager until his death on February 3, 2004. Alan was a valued colleague and dear friend. He will be missed by his associates at Itron, the California Energy Commission, and the energy industry.

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Publication CEC-400-2006-005APA contains the following 10 appendices that accompany this report:

CHAPTER 6: THE DRCEUS ENERGY SIMULATION AND CALIBRATION PROCESS

6.1 Overview

This chapter provides an overview of the DrCEUS energy simulation and calibration process. Simulation weather data is described in Section 6.2, and calibration data sources are described in Section 6.3. The calibration process and special issues that affected calibration are then discussed respectively in Sections 6.4 and 6.5.

6.2 Simulation Weather Data

Twenty weather stations were used for the California Commercial End-Use Survey (CEUS) study. Both energy use data and weather data were compiled from the same historical period to facilitate calibration. For the IOUs (SDG&E/SCE/PG&E/SCG), 2002 weather data were used. For SMUD, 2003 weather data were used because work started in this service area at a much later point in time. After final calibration was achieved using historical weather, all site simulations were rerun with normal weather to remove any effects of extreme or unusual weather experienced over the historical period. This ensured that the segment-level estimates contained in Chapters 8 through 12 are the most representative of what is likely to occur in future years.

One of the strengths of the methodology used to develop CEUS normalized weather data was its ability to represent typical extreme values of key weather variables that regularly occur every year. It is necessary to represent normal extremes to capture true impacts on peak energy demand. Some common methodologies that tend to cancel normal extremes through averaging and concatenation techniques can artificially reduce energy use at peak times when the weather is hot. Although less critical in California, extreme cold periods that typically occur every year are also accurately represented in the CEUS normalized weather data.

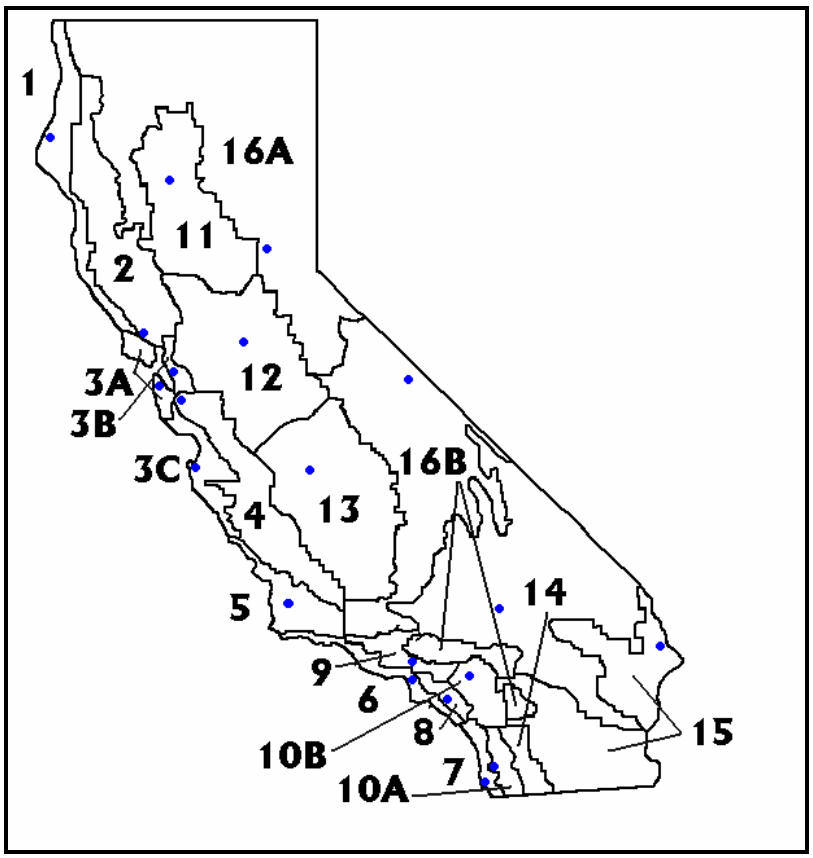
Itron developed a zip code mapping table to assign twenty weather stations to survey premises. These weather stations are shown in Table 6-1 and Figure 6-1. Table 6-1 contains weather station descriptive information, such as the Title 24 California Thermal Zone (CTZ) number and the file name prefix used in designating the DOE-2 weather files (.bin files). Figure 6-1 shows the approximate locations of each weather station within the Title 24 climate zone it represents. Note that on both Table 6-1 and Figure 6-1 there are multiple weather stations for Title 24 Climate Zones 3 (split into 3A/3B/3C), 10 (split into 10A/10B), and 16 (split into 16A/16B). A separate report entitled *California Energy Commission Commercial End-Use Survey: Weather and Data Normalization* provides a complete description of the weather data analysis,

including the zip code mapping table, and is available from the Energy Commission.

Table 6-1: CEUS Simulation Weather Station Information

Map ID	Base CTZ	Representative CTZ City Name	3Digit Code	Actual Weather Station Location	DrCEUS Weather Description	DOE-2 File Name
1	1	Arcata	1	Arcata	CEUS CZ01 (Arcata)	KACV
2	2	Santa Rosa	2	Santa Rosa	CEUS CZ02 (Santa Rosa)	KSTS
3A	3		3.1	San Fran Intl	CEUS CZ03.1 (San Fran Intl)	KSFO
3B	3	Oakland	3.2	Oakland Intl	CEUS CZ03.2 (Oakland Intl)	KOAK
3C	3		3.3	Monterey	CEUS CZ03.3 (Monterey)	KMRY
4	4	Sunnyvale	4	San Jose Intl	CEUS CZ04 (San Jose Intl)	KSJC
5	5	Santa Maria	5	Santa Maria	CEUS CZ05 (Santa Maria)	KSMX
6	6	Los Angeles	6	Los Angeles	CEUS CZ06 (Los Angeles)	KLAX
7	7	San Diego	7	San Diego-Lindbergh Field	CEUS CZ07 (San Diego Int)	KSAN
8	8	El Toro	8	Long Beach	CEUS CZ08 (Long Beach)	KLGB
9	9	Burbank	9	Burbank	CEUS CZ09 (Burbank)	KBUR
10A	10		10.1	San Diego-Miramar	CEUS CZ10.1 (San Diego Mamr)	KNKX
10B	10	Riverside	10.2	Riverside MAFB	CEUS CZ10.2 (Riverside MAFB)	KRIV
11	11	Red Bluff	11	Red Bluff	CEUS CZ11 (Red Bluff)	KRBL
12	12	Sacramento	12	Sacramento Met	CEUS CZ12 (Sacramento Met)	KSAC
13	13	Fresno	13	Fresno AirTrm	CEUS CZ13 (Fresno AirTrm)	KFAT
14	14	China Lake	14	Daggett	CEUS CZ14 (Daggett)	KDAG
15	15	El Centro	15	Blythe	CEUS CZ15 (Blythe)	KBLH
16A	16	Mt. Shasta	16.1	Blue Canyon	CEUS CZ16.1 (Blue Canyon)	KBLU
16B	16		16.2	Bishop	CEUS CZ16.2 (Bishop)	KBIH

Figure 6-1: CEUS Weather Station and Title 24 Climate Zone Map



6.3 Calibration Data Sources

This section presents a brief summary of the available data sources used to calibrate the CEUS sites. Not all sites had a complete set of data. There were primarily three data sources—utility energy consumption histories, interval-metered electricity data, and short-term metering data—as discussed in the following paragraphs.

Electric and Gas Consumption Data

The utility billing system files provided electric energy (kWh), demand (kW), and natural gas usage (therms). Demand values were obviously not available for all sites, especially the smaller ones. Natural gas consumption in therms was converted to kBtu for use in DrCEUS and *all* consumption data was calendarized, that is converted from irregular billing periods to calendar months, and summed to the premise-level. These values were visually and numerically compared to simulated monthly energy and demand in DrCEUS.

Interval-Metered Electricity Data

Interval-metered electricity data—often from load research sites—were available for approximately 17% of the premises. The data were processed into hourly premise-level values, which were used for comparison to 16-day and 8760 hour whole-building load shapes in DrCEUS. Even incomplete interval-metered data (for instance, only a partial year exists or not all of the premise meters were interval meters) were used whenever possible. Data irregularities were noted and considered during the calibration process.

Short-Term Metered (STM) Data

Seventeen percent of the CEUS project premises (485 sites) had STM data from either lighting and/or HVAC fan motor loggers. Coincidentally, 17% of the 485 premises (38 sites) that had STM data also had interval data. Average daily profiles were generated for Weekday, Saturday, and Sunday day types. Example graphs for each type of logger are presented in Figure 6-2 and Figure 6-3.

The time-of-use (TOU) logger data were used whenever possible to verify or revise the lighting schedule and/or HVAC fan operation reported by the surveyors. Where both logger data and interval-metered data were available, an attempt was made to use both data jointly in evaluating the simulation.

Figure 6-2: Lighting Logger Graph Example

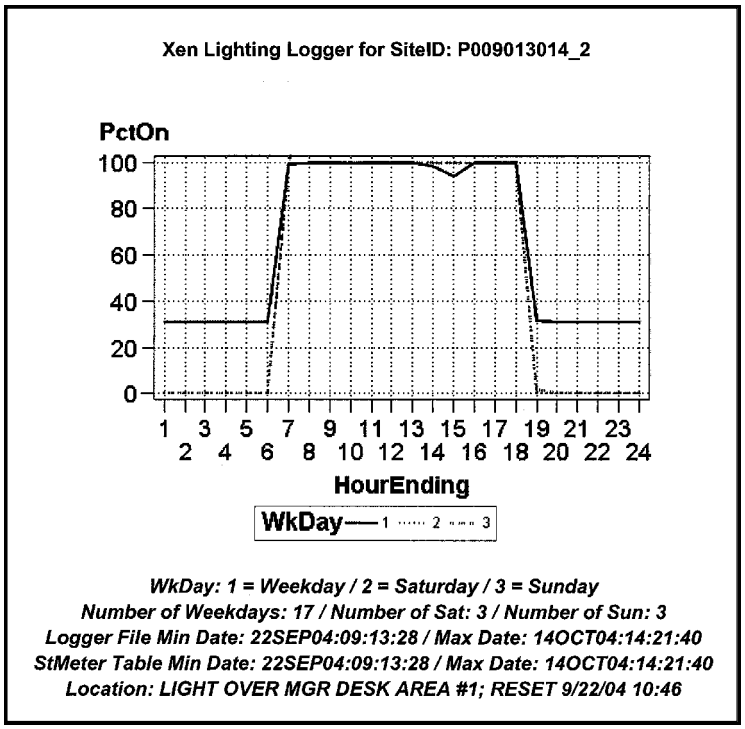
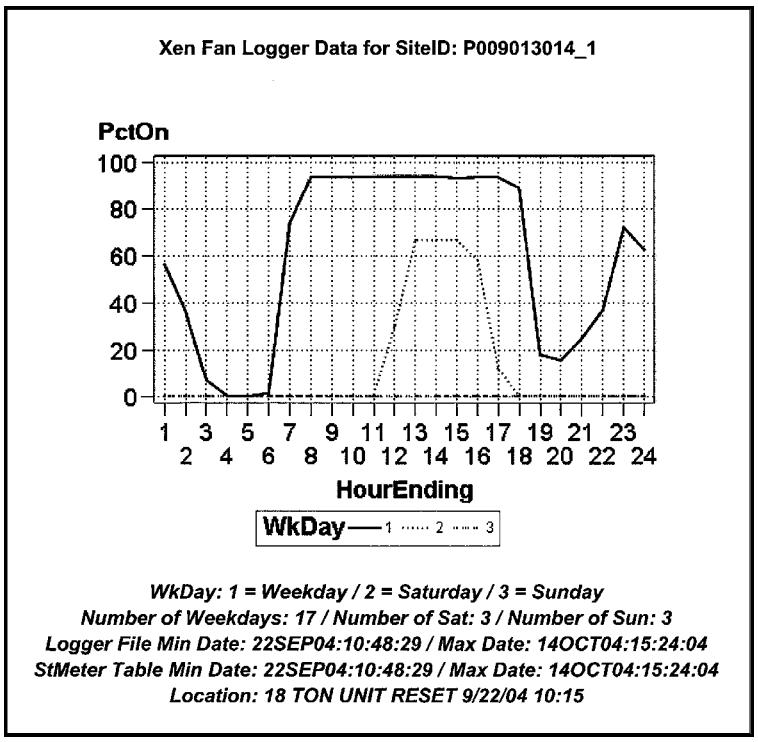


Figure 6-3: Fan Logger Graph Example



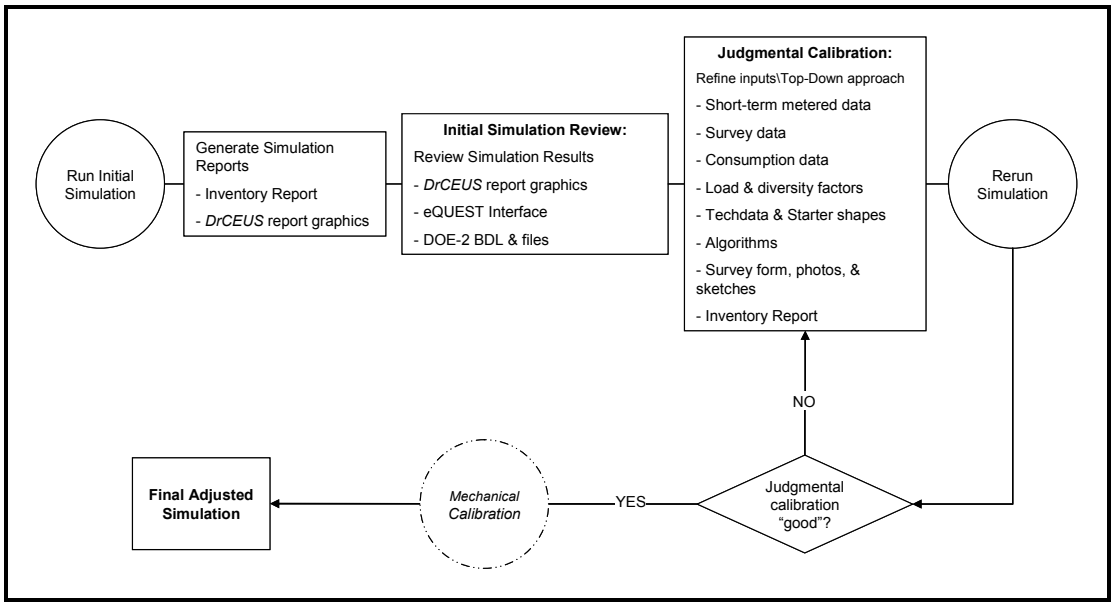
6.4 DrCEUS Simulation and Calibration Process

This chapter explains the DrCEUS energy simulation and calibration process. An overview of the process is described first and, due to its importance, a more detailed discussion of judgmental calibration is provided.

Overview of the Simulation/Calibration Process

Figure 6-4 presents an overview of the calibration process.

Figure 6-4: Overview of the DrCEUS Simulation/Calibration Process



The following bullets summarize the steps in the calibration process.

- ***Run Initial Simulation and Generate Simulation Reports.*** Raw survey data are cleaned, validated, and prepared for simulation in DrCEUS. The site is added to the master database and then simulated in a batch run via the DrCEUS interface. For each site in the batch run, DrCEUS executes the simulation (using eQUEST/DOE2.2) and stores results back into the database. Once stored in the database, the results are available for review in the DrCEUS interface. DrCEUS also generates an Error Log that flags data and run errors. Simulation model input and output are summarized in the Inventory Report and DrCEUS results graphics, which are used to review, troubleshoot, and validate the simulation.
- ***Initial Simulation Review.*** Issues identified on the Simulation Review documents were addressed first. All changes, comments, and issues were recorded on a tracking sheet in the site folder. Once problems identified in the Error Log were cleared, the site was evaluated using the following questions. Is billed intensity OK for this building type? Is the simulation much higher or lower than the bills? Is the end-use distribution reasonable?

Are the full load hours reasonable? The simulation results were evaluated against all available calibration data.

- ***Judgmental Calibration.*** Judgmental calibration is a systematic approach of adjusting simulation model inputs until the output matches known building operation apparent from recorded energy use histories or other calibration data. This process relies heavily on the experience and knowledge of the modeler since many details regarding the operation of a building are never known.
- ***Mechanical Calibration.*** Mechanical calibration refers to the *automated* adjustment of simulation results using algorithms embedded in *DrCEUS* to match historical consumption data. Periods of unusual or extreme operation would be integrated into models using this approach. The calibration of CEUS sites was intended to produce simulation models that predicted typical operation. For this reason, mechanical calibration was not used, hence the dotted line around this process step in Figure 6-4.
- ***Final Adjusted Simulation.*** Once the site is calibrated, it is rerun with normal weather data and can be used to generate segment-level results or for various other analyses.

Note that DrCEUS graphics are an essential part of the calibration process. Key graphics are described and illustrated in the next section, which contains a detailed description of the judgmental calibration process.

6.5 Judgmental Calibration

Assumptions made during the calibration process critically affect all electricity and gas estimates predicted by the simulation models. Judgmental calibration is the art of truing up the building simulation model to actual energy consumption and demand, interval-metered data, and short-term metered data. It involves not only evaluating the model input assumptions and output, but the calibration data as well. The engineer makes adjustments based on professional judgment, rather than through a mechanical or mathematical reconciliation process.

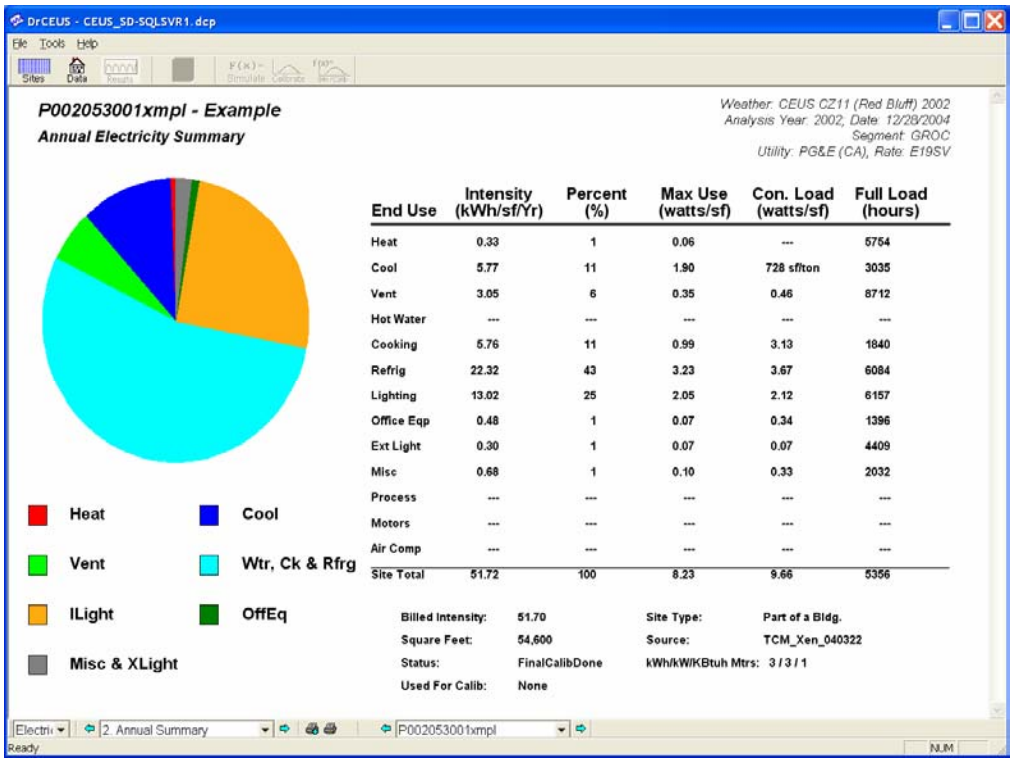
Judgmental calibration can be broken out into several distinct subtasks. After the initial simulation is complete, the results are reviewed and evaluated in a “top-down” approach. That is, the review and evaluation begins from the highest, simplest, and most aggregated level and proceeds down to the most-detailed level until a simulation that meets the precision criterion is achieved. The calibration review process is summarized below.

- ***Review Overall Premise Characteristics.*** Key premise characteristics, such as business name, building type, floor area/size, and location/weather provided a quick assessment of the expected range of energy use per square foot, seasonal usage patterns, and which specific end uses were likely to dominate overall consumption.

- ***Review Simulation Error/Warning Logs.*** DrCEUS, eQUEST, and DOE-2 all generate error diagnostic reports for debugging the simulation models. In addition, eQUEST generates a 3-D view of the model that can be reviewed interactively. This feature allows the quick identification of mistakes made while inputting physical dimensions for windows, doors, walls and floor area, and their relative orientation to each other.
- ***Review Annual Energy Use Results.*** This level of review focused on overall energy use for the year and verification of key end-use characteristics. The DrCEUS annual energy summary graphic, shown in Figure 6-5, was used for this step of the evaluation. The review included, but was not limited to, the following items:
  - Checked that the annual energy intensity (kWh/yr/ft^2) is consistent with the business/building type and size.
  - Compared the *simulated* annual energy use (kWh and kBtu) against *historically recorded* annual energy use from utility data. A general calibration target of 5% or less was used if a full year's worth of consumption data was available, and there were no other site-specific issues that required a different approach.
  - Ensured that the electric and gas meters match the premise.
  - Determined whether the three or four end uses that typically have the largest share of energy use for the building type were present, and that they were in the same relative rank as expected.
  - Verified whether all expected end uses for this building type were represented.
  - Reviewed the reasonableness of end-use level values for cooling ft^2/ton, heating ft^2/kBtuh, inside lighting W/ft^2, and full load operating hours (energy use/connected load).
- ***Review Monthly Energy and Demand.*** Monthly energy use and demand values compiled to the premise level established the primary calibration targets. The DrCEUS monthly energy use graphic, shown in Figure 6-6, was used for this step of the evaluation. The DrCEUS results graphics were specifically designed to facilitate calibration review, which included, but was not limited to the following:
  - Comparisons of the magnitude and month-to-month/seasonal trends of the simulated monthly electric and natural gas use versus the actual monthly consumption recorded by the utility.
  - *For those sites where demand (kW) values were available from the utility billing data,* comparison of the simulated demand to the summed demand for all accounts/meters at the premise and to the demand from the single meter with the largest demand.

- ***Review Daily Results.*** These are the 16-day and 8760-hour results. The DrCEUS daily load shape graphics, shown in Figure 6-7, Figure 6-8, and Figure 6-9, were used for this step of the evaluation. In this part of the calibration process, the interval-metered data and short-term metering calibration data sources are used. Checks that are performed in this step include the following:
  - Check the consistency of the load shapes with what would be expected for this business/building type, such as business hours, weekday versus weekend operation, monthly/seasonal variations (for example summer vacation for schools), holidays, and hot/cold day variations (cooling on a hot day higher than a cold day, cooling in summer higher than cooling in winter, etc.).
  - If interval-metered data are available, evaluate how well the whole-building simulated shapes match the interval-metered shapes for each day type. For the 16-day shapes (Figure 6-7 and Figure 6-8), compare the loads during and after business hours; interval data will often show higher after-hour loads than are simulated. For the 8760-hour results (Figure 6-9), look for inconsistencies in weekly/daily operation. For example, the interval-metered data might show that the site is open on Sunday, whereas the surveyor indicated the site was closed on Sunday.
  - If short-term metering data were available, check that the simulated lighting and/or HVAC end-use load shapes are consistent with on/off schedules recorded by the time-of-use data loggers.
- ***Implement Changes and Rerun.*** After reviewing all of the various inputs and results, the simulation modeler would begin the process of adjusting inputs and revising assumptions, implementing changes to the model, and rerunning the simulation until calibration to available data is achieved.

Figure 6-5: DrCEUS Graphics – Annual Energy Summary



End Use	Intensity (kWh/sf/Yr)	Percent (%)	Max Use (watts/sf)	Con. Load (watts/sf)	Full Load (hours)
Heat	0.33	1	0.06	---	5754
Cool	5.77	11	1.90	728 sf/ton	3035
Vent	3.05	6	0.35	0.46	8712
Hot Water	---	---	---	---	---
Cooking	5.76	11	0.99	3.13	1840
Refrig	22.32	43	3.23	3.67	6084
Lighting	13.02	25	2.05	2.12	6157
Office Eqp	0.48	1	0.07	0.34	1396
Ext Light	0.30	1	0.07	0.07	4409
Misc	0.68	1	0.10	0.33	2032
Process	---	---	---	---	---
Motors	---	---	---	---	---
Air Comp	---	---	---	---	---
Site Total	51.72	100	8.23	9.66	5356

Figure 6-6: DrCEUS Graphics – Monthly Energy Use Comparison

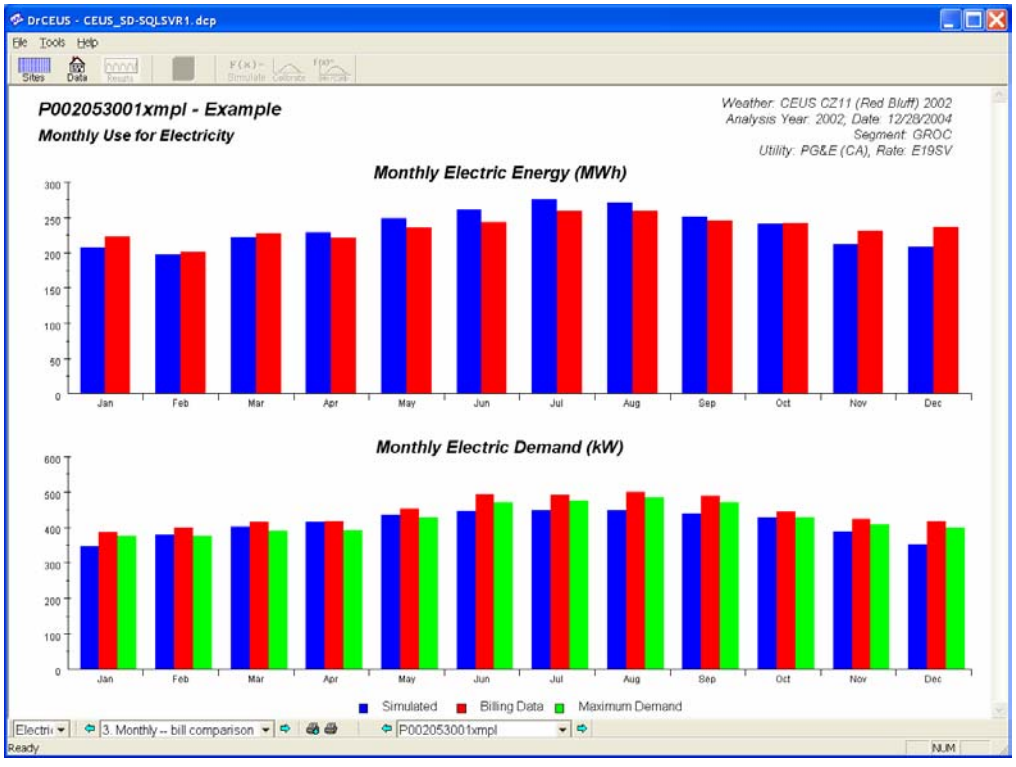


Figure 6-7: DrCEUS Graphics – 16-Day Whole Building Energy Usage

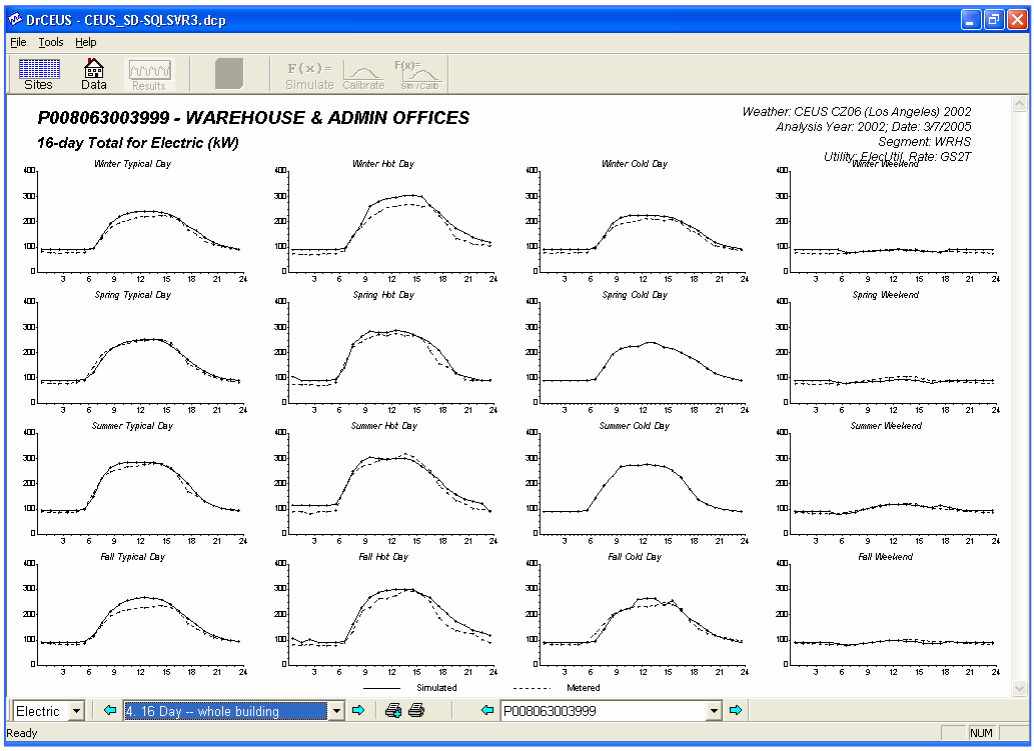


Figure 6-8: DrCEUS Graphics – 16-Day End-Use Energy Usage

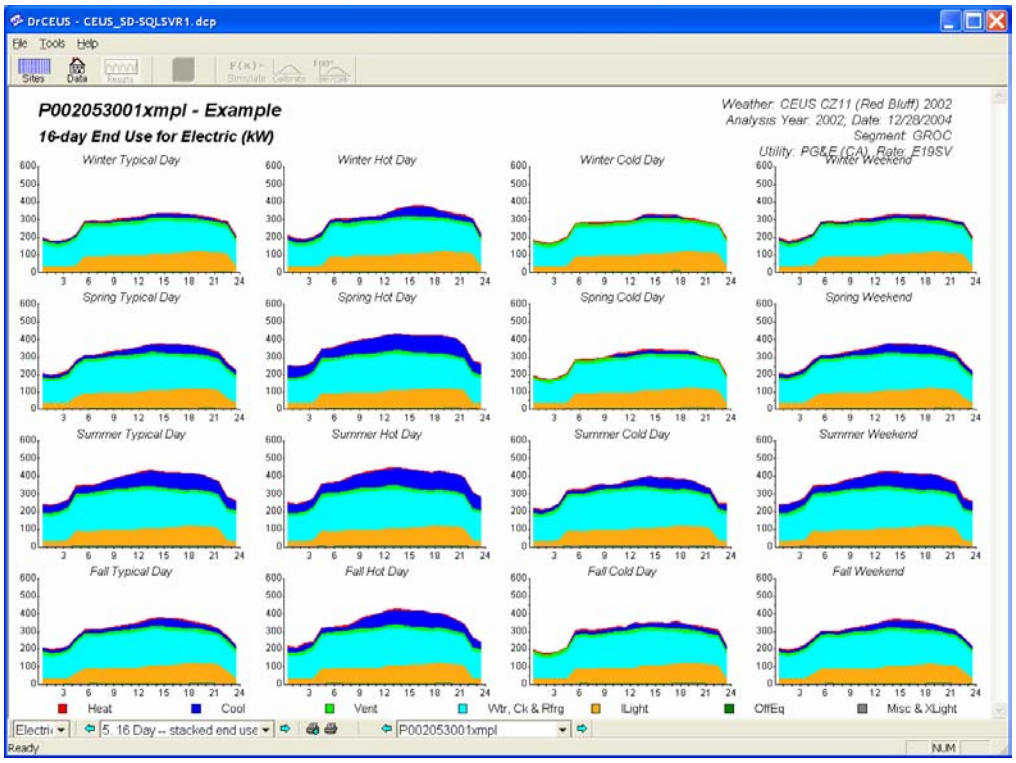
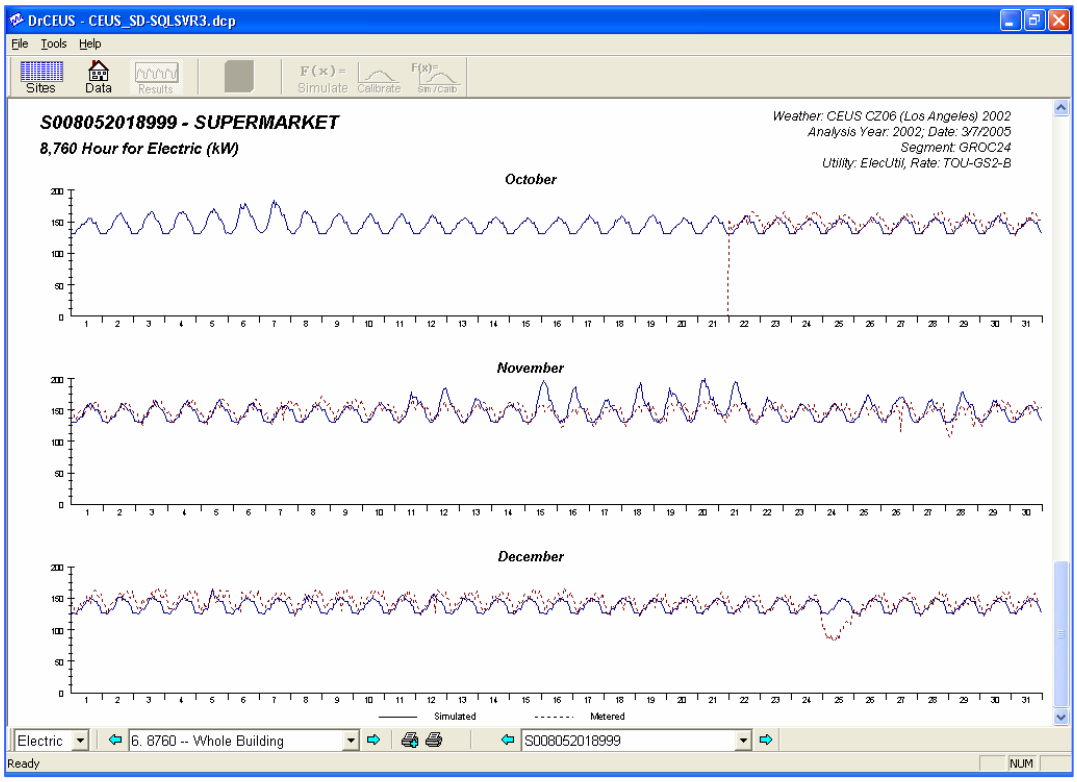


Figure 6-9: DrCEUS Graphics – 8760 Hour Whole Building Loads



6.6 Calibration Special Issues

This section presents a discussion of special issues that affected the calibration process and that are useful for interpreting the CEUS results. First, treatment of the more complex building systems encountered in the survey is discussed. Then, issues are presented that are unique to each of the calibration data types: billed demand, interval-metered data, and short-term-metered data. Finally, the treatment of premises that have natural gas or propane but no utility billing data is discussed.

Complex Building Systems

Some commercial facilities contain sophisticated systems that present unique challenges to energy simulation modeling and calibration. The presence of these systems often made it undesirable to calibrate directly to utility billing information. As with all CEUS sites, the simulation models were designed to produce total energy consumed at the facility and not just metered utility sales. Several examples of special systems encountered in the survey are presented below:

- ***Thermal Energy Storage (TES) Systems.*** Thirty-six premises in the CEUS database (slightly more than 1%) had TES systems. Most of these applications were in large offices, colleges, and hospitals. However, other applications included schools, churches, a detention center, and a

refrigerated warehouse. No attempt was made to simulate the performance of the TES system, although eQUEST and DOE-2 have the capability to do so. For these sites, the simulation was calibrated to monthly energy, and demand was evaluated considering the impact of the TES system. A review of interval-metered data verified the presence of TES systems.

- ***Self-Generation: Cogeneration Systems.*** Fourteen premises in the CEUS database had cogeneration systems. Most were in hospitals and colleges, but also included were two large offices and one school installation. No attempt was made to simulate the performance of the cogeneration system. As such, the simulated/calibrated electric use for these premises was higher than the billed electric use, and simulated/calibrated gas use was lower than the billed gas use. However, both the electric output and the gas usage of the cogeneration systems were taken into consideration when comparing simulation results with actual energy use histories.
- ***Self-Generation: Photovoltaic (PV) Systems***. Nine premises in the CEUS database had PV systems. When PV systems supplied electrical power to the premise,[1] no attempt was made to simulate the performance of the PV system. As such, the simulated energy use for these sites was higher than the billed energy use for almost all months. The capacity of the PV system was considered when comparing differences between simulated energy use and energy purchased from the utility.
- ***Gas Absorption w/Electric Chillers***. Only two premises in the CEUS database had both electric and gas chillers. Simulation output did not match billing data because of the difficulty of replicating chiller sequencing. Even so, the simulation predicted reasonable electric and gas cooling estimates. True sequencing of the chillers, as reflected in the energy bills, was much more irregular than DOE-2 schedules allow.

If the specific circumstances encountered at a site required special calibration techniques, documentation was provided to this effect in each site folder.

Billed Demand Data

For many of the sites in the survey sample, monthly demand data were available from billing records. Demand readings in general provided critical information for judgmental calibration of the simulated hourly shapes, but had to be interpreted with some reservations. Two primary reasons existed for using demand values cautiously.

First, for certain utility rates where demand readings had been recorded in the billing system data but weren't used for calculating utility bills, demand estimates did not seem to be reliable. Comparisons with interval-metered data confirmed this finding.

[1] Some installed PV systems, especially in the SMUD service area, did not actually provide service to the premise, but instead fed all power directly back into the grid.

Second, billing demand readings could be considerably higher than maximum hourly simulated loads, where equipment with a large connected load was subject to short-duration and/or sporadic on and off cycling.

Interval-Metered Data

Interval-metered data proved to be extremely useful in calibrating the simulations. A variety of insights were developed based on comparisons of initial simulation output with interval data, and to the extent possible, these insights were applied to simulations for similar sites that were lacking interval data. However, certain considerations had to be taken when analyzing interval-metered data.

First, some sites contained both standard meters and interval-demand meters so that total consumption was split between them in some fashion. In many of these cases, the meter(s) with interval data was (were) dominant, and load profiles developed for calibration could still be used to inform the simulation process. In other cases, partial interval-metered data appeared to cover a specific end use and still provided useful information.

Second, some interval data were apparently affected by meter malfunctions. In these cases, only those readings that appeared to be reasonable were used to guide the simulations.

Short-Term Metered (STM) Data

The STM data described in Sections 3.5 and 6.3 proved to have mixed usefulness in guiding the simulations. The following points can be made with respect to the value of these data.

- In general, logger data were most useful for smaller sites with little equipment or larger areas with homogenous operation.
- For many sites, lighting loggers did not appear to yield information that was representative of overall lighting patterns and had to be ignored for all intents and purposes. This tended to occur when the surveyors tested only one or two of many systems at a premise. Simulation modelers needed to review other calibration data to determine the applicability of the logger data from that one piece of equipment to the operation of all similar equipment. For future studies using lighting loggers, it is recommended that there either be more extensive metering of fewer sites, or a higher number of loggers for larger sites.
- HVAC fan logger data were often very useful for confirming system operation during both business and non-business hours. The fan STM data clearly indicated whether the HVAC fan remained on or cycled when heating or cooling. These data could often be used to resolve large differences between initial simulations and historical energy consumption data. It was

the least useful for large premises with multiple, independently operating HVAC units.

- Typically, there did not appear to be any advantage gained by having both interval-metered data *and* logger data available for calibration. The same observations already noted were still applicable to these sites. Logger data proved very useful for small-to-medium sites, but were not very useful for larger, more diverse sites that tended to have interval-metered data.

Propane and Non-IOU Commercial Natural Gas

Many sites had propane and/or natural gas that was not provided by one of the IOUs, or was provided by the IOUs but not as a commercial account. For example, there were many sites served by Long Beach Gas and a few served by Southwest Gas. There were also several commercial multifamily premises that had residential gas meters.

For these sites, since no gas consumption was available for calibration, the simulated gas use could only be reviewed by comparing simulated gas consumption to other similar sites.

CHAPTER 7: ANALYSIS OF COMMERCIAL SEGMENTS—KEY CONCEPTS

7.1 Overview

Chapters 8 through 12 present the results of the CEUS analysis, which characterizes energy use for the commonly used commercial building types in the utility service areas covered by the study. The analysis expands the results of the premise-level energy simulation modeling work up to the population segment level. This chapter explains fundamental concepts related to the development of these results and that are needed to interpret, understand, and effectively use the results. The expansion weights, or case weights, used in this process to expand premise-level results to segment-level results are described in Section 7.2. Key concepts and definitions used in the development of segment-level results are described in Section 7.3. Finally, a description of the format used in presenting results is provided in Section 7.4.

7.2 Expansion (Case) Weights

Expansion weights, or case weights, are used to expand the sample results to the population level. Expansion weights were derived as the ratios of population to sample energy (kWh) within strata. As explained in Section 2.4, these strata were defined in terms of electric utility, forecasting climate zone (FCZ),[1] building type[2], and size category as measured by annual energy usage ranges. The assignment of forecasting climate zones to utility service areas is presented in Table 7-1 and the climate zone boundaries are illustrated in Figure 7-1. Note that only 11 of the 16 forecasting climate zones are represented in the CEUS study: 1 through 5 (PG&E), 6 (SMUD), 7 through 10 (SCE), and 13 (SDG&E).

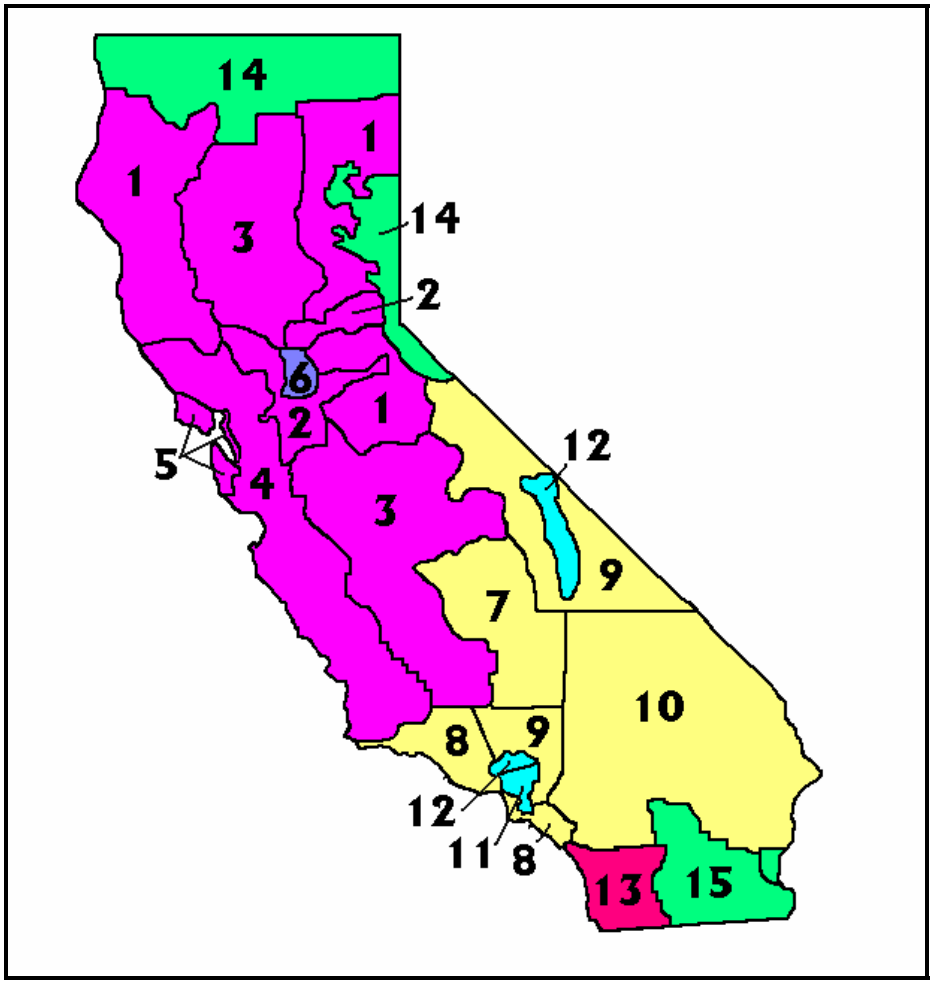
Table 7-1: CEC Forecasting Climate Zone to Utility Mapping

Forecasting Climate Zones	Utility
1, 2, 3, 4, 5	PG&E
6	SMUD
7, 8, 9, 10	SCE
11, 12	LADWP
13	SDG&E
14, 15	Other
16	BGP[3]

[1] Climate zones used by the Energy Commission for energy demand forecasting.

[2] This is the building type as assigned from the SIC-code mapping performed on the original utility frame. The building type used to calculate expansion weights is not changed even if the onsite survey reveals the building type to be something other than the original building type.

Figure 7-1: CEC Forecasting Climate Zones[3]



The application of expansion weights to the estimation of population characteristic results is often referred to as "ratio estimation." In this context, this term is used to convey the fact that the estimate of a population characteristic, such as total population floor stock, is derived by first estimating the ratio of floor stock to energy in the sample for a strata, then applying this ratio to the relevant value of population energy. Suppose, for example, that the floor stock to energy ratio for the small office sample was 0.07 square feet per annual kWh, and that total strata energy was 1 million kWh. Then population floor stock for the population of small office buildings would be estimated as 70,000 square feet (0.07 * 1 million)[4].

In developing these expansion weights, a few modifications to the stratification scheme previously discussed in Chapter 2 had to be made. These modifications took two forms. First, for the IOU service areas, the base year for the analysis

[3] Due to its small size, BGP (Burbank, Glendale, Pasadena) is not represented on this figure. It is located along the northeastern/eastern edge of the LADWP 11/12 region.

[4] See, for instance, William Cochran, *Sampling Techniques*, 1977, p. 30.

was shifted from 2000 to 2002. Since this occurred well into the course of the project, it meant recalculating the expansion weights based on population frames from 2002. This process involved the following conventions.

- Account information from the 2002 frame was annualized to ensure that energy covered 365 billing days.
- Account data were then aggregated to the premise level using the same algorithms as described in Chapter 2. For the PG&E and SDG&E service areas, this entailed using address mapping routines. For SCE, it involved using SCE's premise identifiers.
- Premises from the 2002 frame and their associated annualized 2002 energy usage levels were allocated to strata using the original strata definitions and size thresholds.

Second, a few strata were collapsed when no sites in a stratum were surveyed, even though such sites existed in the population. In almost every case, this occurred because Census sites could not be recruited for the survey. As a result, the Census strata were typically merged with the Large strata.

Table 7-2 through Table 7-5 present the annualized energy use and the final expansion weights that were used for the segment-level analysis.

Table 7-2: PG&E Segment-Level Analysis Expansion Weights

FCZ	Building Type	Size	# of Surveyed Sites	Total Site kWh	Total Strata kWh	Expansion Weight
	All PG&E		1,001	2,140,992,286	25,096,573,892	
1	Small Office	Small	1	10,546	18,199,062	1,725.684
1	Small Office	Medium	2	103,815	52,308,642	503.864
1	Small Office	Large	2	537,782	42,799,548	79.585
1	Large Office	Small	1	829,448	27,385,607	33.017[5]
1	Restaurant	Small	1	11,071	39,942,387	3,607.839
1	Restaurant	Medium	1	106,963	44,361,745	414.739
1	Restaurant	Large	1	271,000	13,212,711	48.755
1	Retail	Small	2	41,298	34,772,170	841.982
1	Retail	Medium	2	1,019,920	47,724,271	46.792
1	Retail	Large	2	3,570,593	25,227,699	7.065
1	Food Store	Small	2	154,268	33,672,407	218.272
1	Food Store	Medium	3	1,912,627	66,104,993	34.562
1	Food Store	Large	1	1,618,720	70,606,120	43.618

[5] The strata for medium- and large-sized Large Office buildings were combined with the strata for small-sized Large Office buildings because no medium- or large-sized Large Office buildings were surveyed for FCZ 1.

Table 7-2 (cont'd): PG&E Segment-Level Analysis Expansion Weights

FCZ	Building Type	Size	# of Surveyed Sites	Total Site kWh	Total Strata kWh	Expansion Weight
1	Refg. Warehouse	Small	1	8,378	3,743,986	446.883
1	Refg. Warehouse	Medium	1	531,562	6,879,317	12.942
1	Unref. Warehouse	Small	1	96,837	12,250,296	126.504
1	Unref. Warehouse	Medium	1	185,520	10,760,054	57.999
1	Unref. Warehouse	Large	1	5,995,706	12,577,944	2.098
1	School	Small	2	751,080	24,975,854	33.253
1	School	Medium	1	280,960	25,529,364	90.865
1	School	Large	1	1,950,000	8,624,303	4.423
1	College	Small	1	12,088	2,364,308	195.591
1	College	Medium	1	1,238,400	10,809,188	8.728
1	College	Large	1	12,196,902	11,142,628	0.914
1	Health	Small	1	41,202	15,707,048	381.221
1	Health	Medium	1	735,320	23,944,062	32.563
1	Health	Large	1	4,517,283	26,734,834	5.918
1	Lodging	Small	2	247,222	32,294,112	130.628
1	Lodging	Medium	1	316,200	16,883,557	53.395
1	Lodging	Large	1	4,011,896	10,861,542	2.707
1	Miscellaneous	Small	1	5,079	33,269,783	6,550.459
1	Miscellaneous	Medium	6	672,429	99,166,860	147.476
1	Miscellaneous	Large	5	6,111,784	75,036,976	12.277[6]
2	Small Office	Small	1	5,659	17,897,410	3,162.645
2	Small Office	Medium	2	92,165	63,812,564	692.373
2	Small Office	Large	3	305,142	87,792,097	287.709
2	Large Office	Small	1	2,691,509	34,167,162	12.694
2	Large Office	Medium	1	2,337,975	33,245,756	14.220
2	Large Office	Large	2	10,433,292	44,011,153	4.218
2	Restaurant	Small	1	49,107	36,527,053	743.826
2	Restaurant	Medium	2	346,249	66,844,693	193.054
2	Restaurant	Large	1	299,520	40,664,215	135.765
2	Retail	Small	2	159,334	34,329,194	215.454
2	Retail	Medium	4	737,500	83,605,885	113.364
2	Retail	Large	3	5,993,494	97,605,743	16.285
2	Food Store	Small	2	107,461	39,262,074	365.361
2	Food Store	Medium	3	616,270	63,311,515	102.733
2	Food Store	Large	1	2,807,793	103,309,117	36.794

[6] The stratum for census-sized Miscellaneous buildings was combined with the stratum for large-sized Miscellaneous buildings because no census-sized Miscellaneous buildings were surveyed for FCZ 1.

Table 7-2 (cont'd): PG&E Segment-Level Analysis Expansion Weights

FCZ	Building Type	Size	# of Surveyed Sites	Total Site kWh	Total Strata kWh	Expansion Weight
2	Refg. Warehouse	Small	1	247,760	7,290,866	29.427
2	Refg. Warehouse	Medium	1	435,509	9,138,880	20.984
2	Refg. Warehouse	Large	1	9,370,571	25,276,561	2.697
2	Unref. Warehouse	Small	1	38,831	23,019,693	592.817
2	Unref. Warehouse	Medium	3	776,120	69,395,866	89.414
2	Unref. Warehouse	Large	9	27,070,688	216,614,160	8.002[7]
2	School	Small	1	18,150	23,302,812	1,283.901
2	School	Medium	1	359,200	65,033,160	181.050
2	School	Large	1	738,240	36,786,683	49.830
2	College	Small	2	394,338	3,227,713	8.185
2	College	Medium	3	2,212,513	3,785,040	1.711
2	College	Census	1	9,329,325	125,677,388	13.471[8]
2	Health	Small	1	288,480	19,417,979	67.311
2	Health	Medium	1	561,900	15,127,314	26.922
2	Health	Large	2	12,949,731	52,019,953	4.017[9]
2	Lodging	Small	1	228,480	16,943,050	74.156
2	Lodging	Medium	1	421,500	17,055,813	40.465
2	Miscellaneous	Small	2	15,887	29,872,250	1,880.295
2	Miscellaneous	Medium	7	997,574	127,227,888	127.537
2	Miscellaneous	Large	7	4,201,558	105,298,409	25.062
2	Miscellaneous	Census	1	18,209,759	18,209,759	1.000
3	Small Office	Small	3	53,137	48,567,097	913.998
3	Small Office	Medium	7	198,240	180,639,808	911.216
3	Small Office	Large	9	1,772,623	227,425,298	128.299
3	Large Office	Small	2	2,516,236	105,544,835	41.946
3	Large Office	Medium	1	2,654,660	46,420,284	17.486
3	Large Office	Large	2	12,449,601	57,448,557	4.614[10]
3	Restaurant	Small	3	103,204	94,872,792	919.274
3	Restaurant	Medium	4	541,775	183,995,796	339.617
3	Restaurant	Large	6	4,582,411	141,020,854	30.774
3	Retail	Small	5	83,040	99,709,054	1,200.735
3	Retail	Medium	12	3,113,218	257,761,810	82.796
3	Retail	Large	8	16,490,561	208,179,757	12.624
3	Retail	Census	1	28,186,376	28,186,376	1.000

[7] The stratum for census-sized Unrefrigerated Warehouses was combined with the stratum for large-sized Unrefrigerated Warehouses because no census-sized Unrefrigerated Warehouses were surveyed for FCZ 2.

[8] The stratum for large-sized Colleges was combined with the stratum for census-sized Colleges because no large Colleges were surveyed for FCZ 2.

[9] The stratum for census-sized Health was combined with the stratum for large-sized Health because no census-sized Health facilities were surveyed in for FCZ 2.

[10] The stratum for census-sized Large Office was combined with the stratum for large-sized Large Office because no census-sized Large Offices were surveyed for FCZ 3.

Table 7-2 (cont'd): PG&E Segment-Level Analysis Expansion Weights

FCZ	Building Type	Size	# of Surveyed Sites	Total Site kWh	Total Strata kWh	Expansion Weight
3	Food Store	Small	6	182,070	137,361,554	754.444
3	Food Store	Medium	11	4,965,306	218,975,912	44.101
3	Food Store	Large	3	6,167,786	238,781,230	38.714
3	Refg. Warehouse	Small	2	322,619	22,848,852	70.823
3	Refg. Warehouse	Medium	5	6,153,204	109,085,518	17.728
3	Refg. Warehouse	Large	3	13,492,753	176,380,980	13.072
3	Unref. Warehouse	Small	5	46,118	58,652,757	1,271.798
3	Unref. Warehouse	Medium	4	692,121	83,572,835	120.749
3	Unref. Warehouse	Large	4	8,589,460	125,642,230	14.627[11]
3	School	Small	5	480,589	75,926,241	157.986
3	School	Medium	4	2,715,563	183,958,714	67.742
3	School	Large	4	6,977,528	129,093,784	18.501
3	College	Small	1	70,080	8,779,225	125.274
3	College	Large	1	8,873,169	47,945,898	5.403[12]
3	College	Census	3	67,271,850	66,276,391	0.985
3	Health	Small	4	2,724,507	45,500,716	16.701
3	Health	Medium	3	2,953,787	93,887,105	31.785
3	Health	Large	5	39,961,636	100,486,838	2.515
3	Health	Census	2	36,098,820	66,139,651	1.832
3	Lodging	Small	1	28,469	40,533,716	1,423.801
3	Lodging	Medium	2	815,280	53,114,884	65.149
3	Lodging	Large	1	2,049,160	7,054,349	3.443
3	Miscellaneous	Small	3	43,755	86,128,513	1,968.427
3	Miscellaneous	Medium	17	1,544,644	294,920,337	190.931
3	Miscellaneous	Large	19	29,371,275	225,896,943	7.691
3	Miscellaneous	Census	3	103,065,774	191,400,706	1.857
4	Small Office	Small	4	27,834	69,007,153	2,479.240
4	Small Office	Medium	9	344,447	244,115,667	708.718
4	Small Office	Large	17	5,654,106	393,526,219	69.600
4	Large Office	Small	7	9,069,257	331,736,802	36.578
4	Large Office	Medium	10	22,243,418	332,861,442	14.964
4	Large Office	Large	11	89,525,803	363,881,029	4.065
4	Large Office	Census	2	54,099,590	243,825,126	4.507
4	Restaurant	Small	5	221,868	169,152,915	762.403
4	Restaurant	Medium	7	886,153	275,590,309	310.996
4	Restaurant	Large	8	3,722,645	178,224,812	47.876
4	Retail	Small	8	124,972	152,628,474	1,221.300
4	Retail	Medium	18	4,169,348	378,893,868	90.876
4	Retail	Large	16	20,956,223	345,230,742	16.474

[11] The stratum for census-sized Refrigerated Warehouse was combined with the stratum for large-sized Refrigerated Warehouse because no census-sized Refrigerated Warehouse were surveyed for FCZ 3.

[12] The stratum for medium-sized Colleges was combined with the stratum for large-sized Colleges because no medium-sized Colleges were surveyed for FCZ 3.

Table 7-2 (cont'd): PG&E Segment-Level Analysis Expansion Weights

FCZ	Building Type	Size	# of Surveyed Sites	Total Site kWh	Total Strata kWh	Expansion Weight
4	Food Store	Small	6	425,131	150,404,931	353.785
4	Food Store	Medium	12	4,086,955	251,124,569	61.445
4	Food Store	Large	7	15,550,510	348,096,767	22.385
4	Refg. Warehouse	Small	1	412,080	14,680,139	35.624
4	Refg. Warehouse	Medium	2	2,650,927	43,050,197	16.240
4	Refg. Warehouse	Large	1	3,086,033	66,444,895	21.531
4	Unref. Warehouse	Small	4	87,335	57,279,076	655.855
4	Unref. Warehouse	Medium	7	2,180,670	136,096,817	62.411
4	Unref. Warehouse	Large	3	3,132,623	83,552,801	26.672
4	School	Small	5	295,309	94,544,373	320.154
4	School	Medium	4	1,133,901	167,639,391	147.843
4	School	Large	3	3,834,276	108,190,016	28.217
4	College	Small	1	32,254	12,900,935	399.979
4	College	Medium	2	2,754,076	36,371,342	13.206
4	College	Large	1	8,176,836	79,680,345	9.745
4	College	Census	2	48,282,206	62,948,553	1.304
4	Health	Small	4	962,367	59,696,590	62.031
4	Health	Medium	3	2,022,396	100,590,947	49.739
4	Health	Large	5	35,612,706	179,761,028	5.048
4	Health	Census	4	79,027,555	118,657,214	1.501
4	Lodging	Small	5	625,271	72,396,872	115.785
4	Lodging	Medium	4	2,685,364	125,289,485	46.656
4	Lodging	Large	3	9,049,506	61,523,657	6.799
4	Miscellaneous	Small	7	65,203	100,194,526	1,536.655
4	Miscellaneous	Medium	22	4,810,531	390,482,713	81.172
4	Miscellaneous	Large	30	32,763,422	408,360,856	12.464
4	Miscellaneous	Census	3	48,257,126	366,573,178	7.596
5	Small Office	Small	3	28,099	85,658,737	3,048.462
5	Small Office	Medium	12	1,969,178	320,550,967	162.784
5	Small Office	Large	26	6,802,706	681,212,910	100.139
5	Large Office	Small	12	17,351,753	656,971,883	37.862
5	Large Office	Medium	11	36,144,666	683,872,797	18.920
5	Large Office	Large	31	206,462,558	761,608,999	3.689
5	Large Office	Census	15	269,870,858	593,333,982	2.199
5	Restaurant	Small	9	382,464	285,732,057	747.082
5	Restaurant	Medium	8	1,061,007	321,543,733	303.055
5	Restaurant	Large	8	4,987,097	183,188,006	36.732
5	Retail	Small	13	325,065	199,951,587	615.112
5	Retail	Medium	23	4,476,869	502,841,254	112.320
5	Retail	Large	20	45,923,699	502,409,876	10.940
5	Food Store	Small	11	673,640	243,261,781	361.115
5	Food Store	Medium	16	7,769,141	292,274,556	37.620
5	Food Store	Large	6	12,387,494	395,306,239	31.912

Table 7-2 (cont'd): PG&E Segment-Level Analysis Expansion Weights

FCZ	Building Type	Size	# of Surveyed Sites	Total Site kWh	Total Strata kWh	Expansion Weight
5	Refg. Warehouse	Small	3	493,914	25,350,109	51.325
5	Refg. Warehouse	Medium	1	1,017,680	29,160,035	28.653
5	Refg. Warehouse	Large	1	6,106,546	9,463,246	1.550
5	Unref. Warehouse	Small	7	237,672	96,416,180	405.669
5	Unref. Warehouse	Medium	13	2,560,064	217,960,135	85.139
5	Unref. Warehouse	Large	12	23,792,071	223,815,305	9.407
5	Unref. Warehouse	Census	1	20,806,869	56,749,761	2.727
5	School	Small	6	861,234	110,940,270	128.815
5	School	Medium	4	1,230,040	151,880,496	123.476
5	School	Large	3	3,488,352	87,455,556	25.071
5	College	Small	3	600,780	18,799,988	31.293
5	College	Medium	3	2,670,037	72,339,238	27.093
5	College	Large	3	21,012,683	55,660,948	2.649
5	College	Census	2	43,808,644	229,448,153	5.238
5	Health	Small	7	1,103,290	85,166,871	77.194
5	Health	Medium	5	6,987,327	144,120,222	20.626
5	Health	Large	10	74,523,877	358,019,145	4.804
5	Health	Census	3	47,187,244	61,574,699	1.305
5	Lodging	Small	4	328,281	63,534,666	193.537
5	Lodging	Medium	6	5,018,733	153,002,711	30.486
5	Lodging	Large	8	25,190,482	222,880,481	8.848
5	Lodging	Census	3	52,460,650	52,056,170	0.992
5	Miscellaneous	Small	8	95,191	147,681,965	1,551.428
5	Miscellaneous	Medium	29	2,376,466	508,055,268	213.786
5	Miscellaneous	Large	44	48,844,435	527,427,281	10.798
5	Miscellaneous	Census	2	24,180,309	98,590,416	4.077

Table 7-3: SMUD Segment-Level Analysis Expansion Weights

FCZ	Building Type	Size	# of Surveyed Sites	Total Site kWh	Total Strata kWh	Expansion Weight
	ALL SMUD		300	491,418,293	3,785,699,713	
6	Small Office	Small	5	137,734	58,022,965	421.269
6	Small Office	Medium	21	1,188,006	213,637,406	179.829
6	Small Office	Large	35	9,975,949	350,440,477	35.129
6	Large Office	Small	12	16,677,048	261,226,147	15.664
6	Large Office	Medium	7	16,847,051	172,888,343	10.262
6	Large Office	Large	14	99,016,186	265,584,414	2.682
6	Large Office	Census	2	55,518,685	185,405,143	3.340
6	Restaurant	Small	4	238,963	52,799,496	220.953
6	Restaurant	Medium	7	1,123,197	116,757,960	103.951
6	Restaurant	Large	4	1,962,432	98,407,298	50.146
6	Retail	Small	8	191,475	61,244,222	319.856
6	Retail	Medium	24	8,218,300	193,995,918	23.605
6	Retail	Large	14	30,358,862	183,692,430	6.051
6	Food Store	Small	5	377,492	43,249,423	114.570
6	Food Store	Medium	7	2,744,583	58,345,745	21.259
6	Food Store	Large	7	16,927,335	188,741,693	11.150
6	Refg. Warehouse	Small	2	473,929	3,216,817	6.788
6	Refg. Warehouse	Medium	2	3,699,092	4,900,628	1.325
6	Refg. Warehouse	Large	1	5,479,350	5,479,350	1.000
6	Unref. Warehouse	Small	4	100,436	32,556,760	324.156
6	Unref. Warehouse	Medium	9	1,731,853	63,090,633	36.430
6	Unref. Warehouse	Large	6	10,517,873	54,463,094	5.178
6	School	Small	6	1,139,312	37,140,612	32.599
6	School	Medium	5	2,198,265	89,270,568	40.610
6	School	Large	4	7,818,662	70,633,963	9.034
6	College	Small	2	181,990	6,175,508	33.933
6	College	Medium	2	777,253	12,620,851	16.238
6	College	Large	2	11,865,545	27,119,398	2.286
6	College	Census	1	34,121,169	34,121,169	1.000
6	Health	Small	5	764,765	25,120,054	32.847
6	Health	Medium	4	4,034,454	44,970,860	11.147
6	Health	Large	4	37,295,419	81,743,703	2.192
6	Health	Census	3	48,676,787	59,479,963	1.222
6	Lodging	Small	2	125,857	9,741,937	77.405
6	Lodging	Medium	3	2,003,199	35,153,042	17.548
6	Lodging	Large	2	11,640,964	41,405,563	3.557
6	Miscellaneous	Small	4	143,836	37,933,842	263.730
6	Miscellaneous	Medium	24	2,189,530	173,706,120	79.335
6	Miscellaneous	Large	27	42,935,456	331,216,196	7.714[13]

[13] The stratum for census-sized Miscellaneous buildings was combined with the stratum for large-sized Miscellaneous buildings because no census-sized Miscellaneous buildings were surveyed for FCZ 6.

Table 7-4: SCE Segment-Level Analysis Expansion Weights

FCZ	Building Type	Size	# of Surveyed Sites	Total Site kWh	Total Strata kWh	Expansion Weight
	All SCE		1,144	2,037,276,753	29,440,099,119	
7	Small Office	Small	3	19,346	13,202,832	682.458
7	Small Office	Medium	3	109,475	56,727,304	518.176
7	Small Office	Large	2	449,430	55,345,515	123.146
7	Large Office	Small	1	781,083	14,500,678	18.565
7	Large Office	Medium	1	5,139,877	11,482,836	2.234
7	Large Office	Large	1	6,081,522	20,965,812	3.447
7	Restaurant	Small	1	80,964	24,614,539	304.018
7	Restaurant	Medium	1	206,640	52,941,966	256.204
7	Restaurant	Large	1	297,155	32,474,288	109.284
7	Retail	Small	1	53,960	35,321,289	654.583
7	Retail	Medium	3	656,099	69,591,794	106.069
7	Retail	Large	5	11,092,496	86,362,421	7.786[14]
7	Food Store	Small	2	214,542	30,011,504	139.886
7	Food Store	Medium	3	840,569	61,840,188	73.569
7	Food Store	Large	2	4,250,435	82,264,614	19.354
7	Refg. Warehouse	Small	1	2,189,505	2,989,923	1.366
7	Refg. Warehouse	Medium	1	1,768,608	4,762,715	2.693
7	Refg. Warehouse	Large	1	994,428	16,778,415	16.872
7	Unref. Warehouse	Small	1	70,564	10,398,505	147.363
7	Unref. Warehouse	Medium	2	256,520	15,933,381	62.114[15]
7	School	Small	2	233,584	24,271,108	103.907
7	School	Medium	2	860,800	40,662,409	47.238
7	School	Large	1	4,764,984	30,832,939	6.471
7	College	Small	1	26,074	3,563,185	136.657
7	College	Medium	1	900,374	7,337,965	8.150
7	College	Large	1	4,750,791	4,750,791	1.000
7	Health	Small	1	21,760	14,169,204	651.158
7	Health	Medium	2	3,165,119	25,771,154	8.142
7	Health	Large	1	4,620,868	39,801,416	8.613
7	Lodging	Small	1	113,706	16,721,627	147.060
7	Lodging	Medium	1	898,458	19,317,758	21.501
7	Lodging	Large	1	2,093,136	4,643,023	2.218
7	Miscellaneous	Small	1	1,872	25,728,804	13,744.019
7	Miscellaneous	Medium	6	1,237,111	86,751,283	70.124
7	Miscellaneous	Large	2	1,053,660	46,148,132	43.798
7	Miscellaneous	Census	1	15,760,312	15,760,312	1.000
8	Small Office	Small	5	47,941	116,400,452	2,427.974
8	Small Office	Medium	16	739,880	485,602,102	656.325
8	Small Office	Large	41	9,104,562	1,056,490,583	116.040

[14] The stratum for census-sized Retail buildings was combined with the stratum for large-sized Retail buildings because no census-sized Retail buildings were surveyed for FCZ 7.

[15] The stratum for large-sized Unrefrigerated Warehouses was combined with the stratum for medium-sized Unref. Warehouses because no large-sized Unrefrigerated Warehouses were surveyed for FCZ 7.

Table 7-4 (cont'd): SCE Segment-Level Analysis Expansion Weights

FCZ	Building Type	Size	# of Surveyed Sites	Total Site kWh	Total Strata kWh	Expansion Weight
8	Large Office	Small	17	18,524,893	840,576,087	45.375
8	Large Office	Medium	12	28,160,305	792,757,433	28.152
8	Large Office	Large	19	115,722,623	627,345,999	5.421
8	Large Office	Census	2	14,648,640	190,745,047	13.021
8	Restaurant	Small	7	466,555	254,258,021	544.969
8	Restaurant	Medium	12	1,469,829	551,057,068	374.912
8	Restaurant	Large	15	6,287,756	371,222,679	59.039
8	Retail	Small	16	386,089	308,402,870	798.787
8	Retail	Medium	38	6,937,520	823,821,933	118.749
8	Retail	Large	41	85,485,790	924,551,257	10.815[16]
8	Food Store	Small	7	451,556	202,045,963	447.444
8	Food Store	Medium	14	7,463,178	307,146,104	41.155
8	Food Store	Large	20	43,307,105	590,209,086	13.628
8	Food Store	Census	2	49,903,765	62,780,488	1.258
8	Refg. Warehouse	Small	1	100,512	14,239,875	141.673
8	Refg. Warehouse	Medium	2	1,391,660	28,483,295	20.467
8	Refg. Warehouse	Large	1	5,471,558	31,005,547	5.667
8	Refg. Warehouse	Census	1	18,518,903	17,853,126	0.964
8	Unref. Warehouse	Small	7	135,982	131,540,302	967.335
8	Unref. Warehouse	Medium	13	2,782,416	273,832,654	98.415
8	Unref. Warehouse	Large	16	41,702,103	285,673,471	6.850[17]
8	School	Small	5	227,854	96,602,737	423.968
8	School	Medium	5	2,504,131	206,134,602	82.318
8	School	Large	4	8,427,844	157,280,300	18.662
8	College	Small	3	363,760	30,489,363	83.817
8	College	Medium	3	6,867,090	67,626,969	9.848
8	College	Large	4	25,498,753	105,014,194	4.118
8	College	Census	1	43,320,784	247,548,608	5.714
8	Health	Small	5	458,447	73,861,598	161.113
8	Health	Medium	7	7,046,352	169,992,693	24.125
8	Health	Large	7	39,294,767	194,634,304	4.953
8	Health	Census	3	38,925,499	227,678,762	5.849
8	Lodging	Small	3	3,490,453	59,088,347	16.929
8	Lodging	Medium	7	2,821,358	175,034,817	62.039
8	Lodging	Large	8	22,547,670	251,052,095	11.134
8	Lodging	Census	1	9,346,297	9,346,297	1.000
8	Miscellaneous	Small	8	104,965	169,084,631	1,610.867
8	Miscellaneous	Medium	38	3,019,637	700,376,649	231.941
8	Miscellaneous	Large	43	47,183,612	662,861,056	14.049

[16] The stratum for census-sized Retail buildings was combined with the stratum for large-sized Retail buildings because no census-sized Retail buildings were surveyed for FCZ 8.

[17] The stratum for census-sized Unrefrigerated Warehouses buildings was combined with the stratum for large-sized Unref. Warehouses buildings because no census-sized Unrefrigerated Warehouses buildings were surveyed for FCZ 8.

Table 7-4 (cont'd): SCE Segment-Level Analysis Expansion Weights

FCZ	Building Type	Size	# of Surveyed Sites	Total Site kWh	Total Strata kWh	Expansion Weight
8	Miscellaneous	Census	2	78,134,896	203,615,798	2.606
9	Small Office	Small	1	9,350	93,362,389	9,985.282
9	Small Office	Medium	11	405,439	344,622,148	849.998
9	Small Office	Large	20	4,859,144	526,336,937	108.319
9	Large Office	Small	7	8,027,710	350,331,980	43.640
9	Large Office	Medium	4	9,690,703	252,643,233	26.071
9	Large Office	Large	7	56,537,808	158,491,416	2.803
9	Large Office	Census	1	14,895,129	121,765,682	8.175
9	Restaurant	Small	6	332,587	185,584,912	558.004
9	Restaurant	Medium	9	1,637,086	427,650,529	261.227
9	Restaurant	Large	8	2,615,974	259,318,052	99.129
9	Retail	Small	13	423,257	222,916,311	526.669
9	Retail	Medium	24	6,715,423	553,421,458	82.411
9	Retail	Large	29	52,895,941	598,255,727	11.310
9	Retail	Census	1	14,088,270	74,632,745	5.298
9	Food Store	Small	9	616,005	215,289,492	349.493
9	Food Store	Medium	13	10,614,870	300,818,340	28.339
9	Food Store	Large	13	32,434,558	485,965,610	14.983
9	Food Store	Census	2	28,317,834	53,943,980	1.905
9	Refg. Warehouse	Small	1	448,560	18,236,853	40.656
9	Refg. Warehouse	Medium	1	6,530,009	20,528,307	3.144
9	Refg. Warehouse	Large	1	3,913,368	42,513,921	10.864
9	Unref. Warehouse	Small	6	214,432	114,644,531	534.643
9	Unref. Warehouse	Medium	14	4,538,630	324,271,581	71.447
9	Unref. Warehouse	Large	13	23,855,621	209,556,183	8.784
9	Unref. Warehouse	Census	1	15,596,386	32,224,668	2.066
9	School	Small	5	197,816	82,962,406	419.392
9	School	Medium	5	2,074,022	246,246,792	118.729
9	School	Large	8	13,336,114	183,160,872	13.734
9	College	Small	3	250,896	28,651,547	114.197
9	College	Medium	2	886,740	53,048,306	59.824
9	College	Large	3	26,422,803	75,295,262	2.850
9	College	Census	2	52,384,545	167,695,159	3.201
9	Health	Small	6	1,020,762	78,973,909	77.368
9	Health	Medium	5	4,593,327	131,959,935	28.729
9	Health	Large	9	68,128,494	179,650,343	2.637
9	Health	Census	6	135,333,723	278,212,398	2.056
9	Lodging	Small	3	308,450	47,709,005	154.673
9	Lodging	Medium	4	2,251,590	90,129,907	40.029
9	Lodging	Large	2	10,548,417	86,835,123	8.232[18]
9	Miscellaneous	Small	8	77,349	143,064,320	1,849.595

[18] The stratum for census-sized Lodging was combined with the stratum for large-sized Lodging because no census-sized Lodging facilities were surveyed for FCZ 9.

Table 7-4 (cont'd): SCE Segment-Level Analysis Expansion Weights

FCZ	Building Type	Size	# of Surveyed Sites	Total Site kWh	Total Strata kWh	Expansion Weight
9	Miscellaneous	Medium	30	4,234,803	552,403,347	130.444
9	Miscellaneous	Large	35	51,114,983	631,276,226	12.350[19]
10	Small Office	Small	2	86,004	58,046,832	674.935
10	Small Office	Medium	9	236,543	271,813,672	1,149.109
10	Small Office	Large	14	4,086,167	356,370,927	87.214
10	Large Office	Small	2	1,999,971	158,705,472	79.354
10	Large Office	Medium	3	7,854,181	154,428,535	19.662[20]
10	Restaurant	Small	3	350,496	99,955,045	285.182
10	Restaurant	Medium	6	1,043,271	284,658,455	272.852
10	Restaurant	Large	7	4,736,390	198,065,439	41.818
10	Retail	Small	9	230,111	162,755,266	707.290
10	Retail	Medium	19	5,840,655	433,641,943	74.245
10	Retail	Large	25	58,923,071	557,621,247	9.464
10	Retail	Census	2	35,302,376	41,740,328	1.182
10	Food Store	Small	5	404,847	103,285,380	255.122
10	Food Store	Medium	11	5,157,604	206,080,712	39.957
10	Food Store	Large	6	11,313,896	296,987,904	26.250
10	Refg. Warehouse	Small	1	20,330	5,038,202	247.821
10	Refg. Warehouse	Medium	1	1,639,041	20,872,560	12.735
10	Refg. Warehouse	Large	1	7,784,353	17,508,936	2.249
10	Refg. Warehouse	Census	1	15,386,433	15,386,433	1.000
10	Unref. Warehouse	Small	3	120,870	59,079,435	488.785
10	Unref. Warehouse	Medium	7	1,602,960	147,278,160	91.879
10	Unref. Warehouse	Large	9	13,949,995	216,118,508	15.492[21]
10	School	Small	2	70,760	35,972,460	508.373
10	School	Medium	4	2,787,476	217,207,715	77.923
10	School	Large	4	9,240,053	159,753,202	17.289
10	College	Small	1	51,780	13,163,068	254.211
10	College	Medium	1	1,068,780	25,719,596	24.064
10	College	Large	1	3,670,797	40,011,698	10.900
10	College	Census	1	22,691,365	22,689,523	1.000
10	Health	Small	3	342,031	44,167,258	129.132
10	Health	Medium	3	2,004,305	90,853,347	45.329
10	Health	Large	5	28,851,530	83,259,524	2.886

[19] The stratum for census-sized Miscellaneous buildings was combined with the stratum for large-sized Miscellaneous buildings because no census-sized Miscellaneous buildings were surveyed for FCZ 9.

[20] The stratum for large-sized Large Office buildings was combined with the stratum for medium-sized Large Office buildings because no large-sized Large Office buildings were surveyed for FCZ 10.

[21] The stratum for census-sized Unref. Warehouses buildings was combined with the stratum for large-sized Unref. Warehouses buildings because no census-sized Unrefrigerated Warehouses were surveyed for FCZ 10.

Table 7-4 (cont'd): SCE Segment-Level Analysis Expansion Weights

FCZ	Building Type	Size	# of Surveyed Sites	Total Site kWh	Total Strata kWh	Expansion Weight
10	Health	Census	5	126,673,547	250,405,429	1.977
10	Lodging	Small	3	290,132	46,561,545	160.484
10	Lodging	Medium	4	2,454,120	82,731,008	33.711
10	Lodging	Large	4	20,070,364	115,363,032	5.748
10	Lodging	Census	1	27,340,211	27,400,660	1.002
10	Miscellaneous	Small	5	87,680	92,445,337	1,054.349
10	Miscellaneous	Medium	26	2,249,357	450,154,982	200.126
10	Miscellaneous	Large	31	61,032,854	532,091,613	8.718[22]

Table 7-5: SDG&E Segment-Level Analysis Expansion Weights

FCZ	Building Type	Size	# of Surveyed Sites	Total Site kWh	Total Strata kWh	Expansion Weight
	All SDGE		345	581,161,105	7,934,654,069	
13A[23]	Small Office	Small	3	31,639	101,742,028	3,215.755
13A	Small Office	Medium	14	410,936	356,503,515	867.540
13A	Small Office	Large	26	9,098,491	577,053,071	63.423
13A	Large Office	Small	4	7,177,873	286,462,752	39.909
13A	Large Office	Medium	8	26,611,366	294,834,540	11.079
13A	Large Office	Large	9	85,347,547	282,726,210	3.313
13A	Large Office	Census	4	48,216,297	199,730,360	4.142
13A	Restaurant	Small	5	552,875	136,195,253	246.340
13A	Restaurant	Medium	7	908,681	205,631,046	226.296
13A	Restaurant	Large	6	2,792,846	156,920,539	56.187
13A	Retail	Small	8	172,803	132,522,336	766.898
13A	Retail	Medium	16	3,330,342	316,381,058	95.000
13A	Retail	Large	17	38,889,108	294,488,661	7.573
13A	Food Store	Small	3	258,855	84,399,905	326.051
13A	Food Store	Medium	10	3,218,534	147,504,337	45.830
13A	Food Store	Large	3	6,872,206	241,352,568	35.120
13A	Refg. Warehouse	Small	1	19,137	12,618,099	659.342
13A	Refg. Warehouse	Medium	1	889,780	8,715,590	9.795
13A	Refg. Warehouse	Large	1	4,660,516	13,475,183	2.891
13A	Unref.Warehouse	Small	3	106,487	52,765,710	495.512
13A	Unref.Warehouse	Medium	6	1,933,042	102,694,255	53.126

[22] The stratum for census-sized Miscellaneous buildings was combined with the stratum for large-sized Miscellaneous buildings because no census-sized Miscellaneous buildings were surveyed for FCZ 10.

[23] FCZ 13 was split into 13A and 13B, which respectively represent the "Coastal" and "Inland" areas of SDG&E's service area. 13A encompasses SDG&E premises in Standards Climate Zones 6, 7, and 8, while 13B encompasses SDG&E premises in Standards climate zones 10, 14, and 15.

Table 7-5 (cont'd): SDG&E Segment-Level Analysis Expansion Weights

FCZ	Building Type	Size	# of Surveyed Sites	Total Site kWh	Total Strata kWh	Expansion Weight
13A	Unref.Warehouse	Large	3	2,913,662	89,310,280	30.652[24]
13A	School	Small	3	909,944	53,447,292	58.737
13A	School	Medium	3	1,330,201	112,256,224	84.390
13A	School	Large	4	3,925,054	45,394,236	11.565
13A	College	Small	2	385,099	19,042,070	49.447
13A	College	Medium	5	4,578,806	41,050,161	8.965
13A	College	Census	1	57,760,067	336,115,436	5.819[25]
13A	Health	Small	4	466,556	43,428,701	93.084
13A	Health	Medium	12	16,792,627	105,224,608	6.266
13A	Health	Large	1	3,360,623	141,237,686	42.027
13A	Health	Census	1	12,548,066	193,138,830	15.392
13A	Lodging	Small	3	1,355,259	38,874,944	28.685
13A	Lodging	Medium	5	5,394,408	96,320,411	17.856
13A	Lodging	Large	10	44,278,079	173,077,480	3.909
13A	Lodging	Census	2	15,246,550	52,636,111	3.452
13A	Miscellaneous	Small	6	176,850	72,120,151	407.803
13A	Miscellaneous	Medium	17	1,781,625	274,698,141	154.184
13A	Miscellaneous	Large	24	46,056,420	356,735,117	7.746
13A	Miscellaneous	Census	1	7,930,181	88,277,199	11.132
13B	Small Office	Small	2	14,535	41,596,338	2,861.869
13B	Small Office	Medium	6	92,671	105,706,757	1,140.663
13B	Small Office	Large	6	730,759	131,328,405	179.715
13B	Large Office	Medium	2	4,133,540	103,936,090	25.145[26]
13B	Large Office	Large	1	6,824,843	44,689,254	6.548
13B	Restaurant	Small	2	96,688	39,182,605	405.247
13B	Restaurant	Medium	2	162,506	58,517,196	360.094
13B	Restaurant	Large	1	301,317	28,883,196	95.857
13B	Retail	Small	3	54,036	47,286,516	875.099
13B	Retail	Medium	4	660,597	96,610,423	146.247
13B	Retail	Large	2	7,159,702	77,827,936	10.870
13B	Food Store	Small	2	113,449	28,337,138	249.779
13B	Food Store	Medium	4	1,926,988	50,430,477	26.171
13B	Food Store	Large	1	2,022,944	102,256,079	50.548
13B	Refg. Warehouse	Small	2	14,890	10,865,842	729.748[27]
13B	Unref.Warehouse	Small	2	10,149	20,535,768	2,023.358

[24] The stratum for census-sized Unrefrigerated Warehouses was combined with the stratum for large-sized Unrefrigerated Warehouses because no census-sized Unrefrigerated Warehouses buildings were surveyed for FCZ 13A.

[25] The stratum for large-sized Colleges was combined with the stratum for census-sized Colleges because no large-sized Colleges were surveyed for FCZ 13A.

[26] The stratum for small-sized Large Office was combined with the stratum for medium-sized Large Office because no small-sized Large Offices were surveyed for FCZ 13B.

[27] The strata for medium- and large-sized Refrigerated Warehouse were combined with the strata for small-sized Refrigerated Warehouse because no medium- or large-sized Ref. Warehouses were surveyed for FCZ 13B.

Table 7-5 (cont'd): SDG&E Segment-Level Analysis Expansion Weights

FCZ	Building Type	Size	# of Surveyed Sites	Total Site kWh	Total Strata kWh	Expansion Weight
13B	Unref.Warehouse	Medium	2	399,542	23,794,178	59.554
13B	Unref.Warehouse	Large	1	6,202,239	35,160,160	5.669
13B	School	Small	1	80,170	23,555,994	293.826
13B	School	Medium	3	1,087,933	50,983,341	46.863
13B	School	Large	3	5,191,710	34,758,291	6.695
13B	College	Small	1	36,169	4,520,219	124.975
13B	College	Medium	1	680,206	8,816,175	12.961
13B	College	Large	1	7,117,902	14,262,839	2.004
13B	Health	Small	2	228,302	17,123,805	75.005
13B	Health	Medium	2	1,908,128	28,413,574	14.891
13B	Health	Census	2	25,745,888	29,480,589	1.145[28]
13B	Lodging	Small	3	388,514	40,283,349	103.686[29]
13B	Miscellaneous	Small	2	33,376	30,154,224	903.462
13B	Miscellaneous	Medium	7	365,077	103,039,329	282.240
13B	Miscellaneous	Large	9	17,412,093	87,931,205	5.050
13B	Miscellaneous	Census	1	21,274,801	77,284,682	3.633

7.3 Definitions and Concepts

One of the primary objectives of the study was to develop segment and utility level end-use indices, end-use level fuel shares, and building-type and end-use energy intensities. In order to understand and interpret the results of the analysis, the definitions and concepts that were used to develop the estimates must be understood. These concepts and definitions are provided below.

Segments. For the CEUS study, a segment is defined as an aggregation of individual premises. Segments can be based on region, climate zone, service area, building type, or any other premise characteristic that is available in the CEUS data set. For this report, results are presented for five analysis region based segments: the three electric IOUs and SMUD *service area* segments and a statewide segment. The statewide segment is the aggregation of premises in all four participating electric utilities (PG&E, SCE, SDG&E and SMUD), and is not a true representation of statewide energy use.

The scope of the segment analysis also included producing results for individual utility service areas at the *forecasting climate zone* level. However, the volume of information for such a refined level of geography is too substantial to include in print form in this report. A description of the forecasting climate zone results can be found in Appendix I.

[28] The stratum for large-sized Health was combined with the stratum for census-sized Health because no large-sized Health facilities were surveyed for FCZ 13B.

[29] The strata for medium- and large-sized Lodging were combined with the strata for small-sized Lodging because no medium- or large-sized Lodging facilities were surveyed for FCZ 13B.

Building Types. The following building types were used to create building-type segments: Small Office (<30,000 ft^2), Large Office (>=30,000 ft^2), Restaurant, Retail, Food/Liquor, Unrefrigerated Warehouse, Refrigerated Warehouse, School, College, Health Care, Hotel, and Miscellaneous. Limited results are also presented for two composite building types; "All Offices," which encompasses the Small and Large Office building types, and "All Warehouses," which encompasses the Refrigerated Warehouse and Unrefrigerated Warehouse building types.

End-Use Definitions. Thirteen distinct end uses were used for this study; three are HVAC end uses and ten are non-HVAC end uses. Six of the end uses can be both electric and natural gas, while the remaining seven are electric only. The HVAC end uses are as follows:

- Space Heating – Electric and Gas
- Space Cooling – Electric and Gas
- Ventilation

The non-HVAC end uses include the following:

- Water Heating – Electric and Gas
- Cooking – Electric and Gas
- Refrigeration
- Inside Lighting
- Office Equipment
- Outdoor Lighting
- Miscellaneous Equipment – Electric and Gas
- Process – Electric and Gas
- Motors
- Air Compressors

The DOE-2 building energy simulation program disaggregates total HVAC energy use into six distinct end-use categories. They include space heating, space cooling, pumps and auxiliary, ventilation, heat pump supplemental heating, and heat rejection. Within DrCEUS, these six categories are consolidated into three HVAC end uses: space heating, space cooling, and ventilation. DOE-2 Heat rejection energy was allocated to DrCEUS space cooling. DOE-2 pump and auxiliary energy is portioned out to DrCEUS space heating or space cooling energy usage depending on which hourly end use is active. Heat pump

Supplemental Heating energy is incorporated into the DrCEUS Space Heating end use.

For the non-HVAC equipment, a large number of end uses were used to avoid putting too much energy consumption into the miscellaneous category. In addition, the lists of specific equipment for each end use did *not* vary by building type in order to ensure consistent recording of equipment types by end use. For example, a microwave, whether in an office or a restaurant, would still be specified as cooking equipment.

Appendix C contains a detailed discussion of both HVAC and non-HVAC equipment mapping schemes. Appendix H contains a description of the algorithms used to calculate energy consumption for the non-HVAC end uses. Together, these appendices describe the methods and conventions used to calculate energy consumption at the end-use level within DrCEUS.

Floor Stock. This term is used to describe the "stock" or amount of floor area or floor space. In this report, floor stock represents the total premise floor area for a segment and is typically expressed in units of thousands of square feet (kft^2) or billions of square feet. Floor stock for a particular segment of the population of commercial buildings is estimated by summing the product of the surveyed premise floor areas and the corresponding expansion weights.

End-Use Floor Stock (End-Use ft^2). It is also useful to define a concept that relates only to the portion of the floor stock in which a specific end-use and fuel type are present. For all *non-HVAC end uses*, the end-use floor stock is defined as the *premise-level* floor stock associated with the end use *and* fuel in question. As a result, the end-use floor stock for gas water heating, for example, is based only on the floor area of premises in which gas water heaters are present. For example, if a 20,000 square foot premise has gas water heating equipment, then the entire 20,000 square feet is considered as the gas water heating end-use floor stock. If that same premise also has electric water heating equipment, then the electric water heating end-use floor stock would also be 20,000 square feet.

The approach used for *HVAC end uses*—space heating, space cooling, and ventilation—differs from that of the non-HVAC end uses in one significant way. That is, only the portions of floor area *actually heated and cooled* are used instead of the *entire premise* floor area. For instance, if a 20,000 square foot premise has gas space heating equipment serving 15,000 square feet of floor area, the end-use floor stock for gas space heating would be 15,000 square feet. Estimates of the percentage of heated and cooled floor area were captured on the on-site survey form at the activity area level (see Figure 7-2, "% Cooled", "% Heated" columns).

Figure 7-2: Activity Area and Thermal Zone

Site ID #_ _ _ _ _ _ _ _ _ _

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Component ID ___ **Activity Area and Thermal Zone Definitions**

Activity Area ID# Assignments *Identify an Area ID# for each distinct Activity Area type within the surveyed area. A maximum of eight Activity Area types can be specified. Use the codes on Form AA.*

Area ID#	Activity Area Code (Form AA)	Activity Area Survey Reference Description	Typical hourly max # of occupants	Activity Area Floor Area, ft^2	% of Total Surveyed Floor Area	% Cooled	% Heated	% Uncnd	% Refgd
1									

The heated *(% Heated*) and cooled *(% Cooled*) activity area floor areas were then summed up to obtain premise-level heated and cooled floor areas. End-use floor stock for space heating is the heated floor area, for space cooling it is the cooled floor area, and for ventilation it is the *maximum* of the premise-level heated or cooled (conditioned) floor area. As with the non-HVAC end uses, if a premise has HVAC equipment of both fuel types for a single end use, then the end-use floor stock would be associated with *both* fuel types. Examples would include a gas boiler that uses electric pumps or a gas absorption chiller with pumps and cooling towers.

Fuel Shares. Associated with the concept of end-use floor stock is the definition of an end-use and fuel-specific "share." For any end use and fuel, a fuel share is defined as the fraction of total floor stock in which the fuel-specific end use is present. It is simply computed as the ratio of end-use floor stock to total floor stock in the segment. For instance, if the total floor stock for a segment is 1,000,000 square feet, but the total floor area for premises in that segment that use gas water heating (i.e., the gas water heating floor stock) is only 800,000 square feet, then the gas water heating fuel share would be 80%. As explained in the previous section, if a premise has equipment of both fuel types for a single end use, then the end-use floor area is associated with *both* fuel types. Therefore, it is possible for a single building with both a gas water heater and an electric water heater to have an electric end-use fuel share of 100% and a gas end-use fuel share of 100%. Fuel shares are also sometimes referred to as fuel saturations.

Energy-Use Indices (EUIs). For the analysis of energy usage patterns, it is very useful to develop indicators of energy usage per square foot at the end-use level. Two such indicators are used in the analytical literature. The first of these is an energy use index (EUI). An EUI is defined as the annual energy usage for a specific fuel and end use per square foot of *end-use floor stock* (area served by the fuel and end-use in question). For instance, if the total floor stock for a segment is 1,000,000 square feet, but the total floor area for premises that use gas water heating equipment (i.e., the end-use floor stock) is 800,000 square feet, the gas water heating EUI would be derived by dividing total segment gas

water heating energy usage by the gas water heating end-use floor stock (800,000 ft^2).

As with all energy estimates produced for this study, simulation results represent the total end-use consumption at a premise, rather than just purchases from the electric or gas utility. For electricity, simulations include all portions of electric usage satisfied through self-generation. For gas, simulated usage is restricted to end-use consumption, and excludes the use of gas for self-generation.

Energy Intensities (EIs). The second indicator is an energy intensity (EI), defined as the total fuel-specific consumption per square foot of total floor stock. EIs can be expressed at the segment or building-type level, at the premise level, or at the end-use level. For example, the energy intensity for electric end uses is referred to as an "electric end-use EI," and for gas end uses it is referred to as a "gas end-use EI".

The difference between an EI and an EUI is in the floor stock used to develop the estimate; the EUI is based on end-use floor stock, while the EI is based on segment total floor stock. For example, for a segment, make the following assumptions:

- Total segment floor stock is 1,000,000 square feet,
- The gas water heating end-use floor stock is 800,000 square feet
- Total water heating gas consumption is 5,000,000 kBtu/year for the segment.

Then the gas water heating EI would be 5 kBtu per square foot (5,000,000 divided by 1,000,000), while the EUI would be 6.25 kBtu per square foot (5,000,000 divided by 800,000). Again, the distinction between an EI and an EUI is that the EIs characterize the *entire* floor stock in the segment, while the EUIs pertain only to the floor stock that has the end-use and fuel in question. Another approach to note is that the EI can be calculated as the product of the fuel share and corresponding EUI (0.8 multiplied by 6.25).

Calculation of Total Energy Use. Using the above concepts, there are two general ways to express total energy use in terms of its end-use components. A formal presentation of these approaches may help to clarify the concepts defined above. Both options for expressing total energy usage (call this *TotalEnergyUsage*) in terms of its end-use components would make use of the fundamental identity:

$$TotalEnergyUsage = \sum_i EnergyUsage_i$$

where $EnergyUsage_i$ refers to usage through end-use *i*.

Energy usage for end use *i* can be expressed as either:

$$EnergyUsage_i = EI_i * Floorstock$$

or:

$$EnergyUsage_i = EUI_i * FuelShare_i * Floorstock$$

where:

$$EI_i = \frac{EnergyUsage_i}{Floorstock}$$

$$EUI_i = \frac{EnergyUsage_i}{EndUseFloorstock_i}$$

$$FuelShare_i = \frac{EndUseFloorstock_i}{Floorstock}$$

and where:

Floorstock indicates total segment floor stock,

$EndUseFloorstock_i$ represents floor stock with end-use *i* in the segment,

$EnergyUsage_i$ is the total energy usage through end-use *i* in the segment, and

$FuelShare_i$ is the percentage of floor stock of end-use *i*.

7.4 Presentation of Results

This section provides a general description of the approach used to present segment-level results in Chapters 8 through 12, and provides additional information that is needed to interpret these results. Chapter 8 presents results at the Statewide level, which in this context refers to the four electric utility areas covered by this project. Chapters 9 through 12 summarize results by service area. For each service area and customer segment, the following commercial customer characteristics are presented:

- Floor stocks,
- Energy (electric and gas) usage,
- Fuel Shares,
- Electric and natural gas EUIs,

- Electric and natural gas EIs, and
- 16-day hourly end-use load profiles.

In Chapters 8 through 12, these characteristics are presented in the three sections described below:

- The ***Overview of Energy Usage*** section provides the highest level of analysis results. Estimates of segment-level and building-type floor stocks, energy usage, building type EIs and end-use EIs are presented in this section. These results can be used to make observations about energy use for the overall analysis/service area, and to make comparisons across building types.

  The tables in this section include two additional building types that are *not* included in the other result sections: "All Offices" and "All Warehouses". Results for these two additional building types are included for comparison to other historical CEUS results and any other previous studies that did not make the distinction between Small and Large Offices or Refrigerated and Unrefrigerated Warehouses. Additional results for these building types are available in the segment-level databases, but they are not presented in this report.
- The "***Segment-Level Fuel Shares, EUIs, and End-Use Energy Intensities***" section presents detailed results by building type. These data can be used to analyze the energy use and end-use fuel shares for individual building types.
- The "***Segment-Level Hourly End-Use Electric Shapes***" section presents the 16-day stacked electric end-use shapes by building type, which can be used to gain a general sense for the time dependent use of electricity, the largest end uses and their hourly variation, and the relative weather-sensitivity and magnitude of seasonal variations in energy use. The results presented are 16 day-type hourly stacked end-use graphs from DrCEUS. The 16 day-type basis (4 day types X 4 seasons) for these graphs is defined as follows:
  - **Four Day Types.** Typical Day (weekday), Hot Day (weekday), Cold Day (weekday) and Weekend (Saturday, Sunday, and holidays). Note that the Hot and Cold day types are the hottest\coldest30 single days during a season, whereas the Typical and Weekend day types are an average of all days of those respective types during the season.
  - **Four Seasons.** Winter (December through February), Spring (March through May), Summer (June through September), Fall (October through November).

[30] The hottest/coldest days are determined as the first weekday during a season that has the highest or lowest hourly temperature.

For segment-level results, note that only a single set of holidays is used, even though at the premise level each premise can have its own set of holidays defined. Holidays which are calendar weekdays are treated as Weekend day types, because the assumption is that businesses would be closed or at partial operation on these days. The holidays used by the Segment Processor include New Year's Day, President's Day, Independence Day (Fourth of July), Memorial Day, Labor Day, Veteran's Day, Thanksgiving Day, and Christmas Day.

Table Column Labels. Many of the result tables and figures use abbreviated end-use labels. Table 7-6 can be used to decipher these codes. It provides both the abbreviated end-use code that is used as the column label in the results table, and the corresponding full description of the end use. Appendix C contains detailed information for mapping equipment into specific end-use categories.

Table 7-6: Segment-Level Result Table End-Use Codes

End-Use Code	End-Use Description
Heat	Space Heating
Cool	Space Cooling
Vent.	Ventilation
WH	Water Heating
Cook	Cooking
Int. Ltg.	Interior Lighting
Ext. Ltg.	Exterior Lighting
Office Equip.	Office Equipment
Misc.	Miscellaneous Equipment
Air Comp.	Air Compressors
Motors	Motors (non-HVAC)
Proc.	Process