Southern California Edison
Annual Rate Group Load Studies
Methodology

SCE's Annual Rate Group Load Studies (Load Studies) have been produced every year since 1974. These Load Studies estimate the energy usage behavior of SCE's customers, usually expressed either as load curves or time of use consumption values.

<u>Purpose</u>

The purpose of the Annual Rate Group Load Studies is to provide aggregated load data analyses to support a wide variety of applications. These applications include:

- revenue allocation and rate design (under current marginal cost-based methods as adopted by the California Public Utilities Commission);
- electric system planning and forecasting;
- energy management program planning;
- uneconomic bypass and cogeneration analysis; and
- other miscellaneous analyses

To accomplish these goals, load data from over 5,000 customers, representing all classes of Edison customers are analyzed. Properly weighted and summarized load data result in statistically valid estimates of load profiles, time-of-use consumption, and various other usage parameters for each rate group and its subgroups. The entire process is very data intensive as the number of data points for each sampled customer exceeds 35,000.

<u>Rate groups</u>

SCE Customers receive service on several dozen rate schedules. In order to analyze the loads of different types of customers, customers have been classified by rate schedule into several major rate groups:

- Domestic: Residential customers
- Lighting, Small and Medium Power (LSMP): Small commercial and industrial customers < 500 kW
- Agricultural and Pumping (AG&P): General agricultural and water or sewage pumping customers
- Large Power: Large commercial and industrial customers, $\geq$ 500 kW
- Resale: Other utilities or municipalities which purchase power wholesale for distribution to their own customers.
- Street Lighting

To produce these Load Studies for Domestic, LSMP, and AG&P major rate groups, customer load data is analyzed from stratified random samples representing these rate groups. These samples have been designed to produce valid statistics for each of the these major rate groups. The Large Power and Resale major rate groups are 100% metered, so the load data for all the population accounts in these rate groups are used in producing the Load Studies. A sixth major rate group, street lighting, is modeled.

Similar load profiles have also been created for the subgroups of some of the above major rate groups. For example, for the 1995 General Rate case, statistics derived from the annual Load Studies for following rate groups were used:

Major Rate Group	Rate Group	Description	Rate Schedules
Domestic	**Domestic**	Domestic Single/Multiple, and Master Metered	D, D-CARE, DE, DS, TOU-D-1, TOU-D-2, TOU-EV-1, TOU-EV-2, DM, DMS-1, DMS-2, DMS-3
LSMP	**GS-1**	General Service, Non-demand Metered, Small Commercial	GS-1, TOU-GS-1, TOU-EV-3
LSMP	**TC-1**	Traffic Control	TC-1

LSMP	**GS-2**	General Service, Demand Metered, Medium Commercial/Industrial	GS-2, GS-2-RTP, RTP-2-GS, RTP-3-GS, TOU-EV-4
LSMP	**TOU-GS-2**	General Service, Time-of-Use, Medium Commercial/Industrial	TOU-GS-2, TOU-GS-2-SOP
AG&P	**PA-1**	Small Agriculture & Pumping	PA-1
AG&P	**PA-2**	Agriculture & Pumping, Demand Metered	PA-2
AG&P	**TOU-PA-5**	Ag & Pump,Time-of-Use, TOU-PA-5	TOU-PA-5
AG&P	**Ag-TOU**	Agriculture & Pumping, Time-of-Use	PA-RTP, TOU-PA, TOU-PA-3, TOU-PA-4, TOU-PA-6, TOU-PA-7, TOU-PA-SOP, TOU-PA-SOP-I
Large Power	**TOU-8-SEC**	General Service, Time-of-Use, Large Power (> 500 kW) Secondary Voltage (below 2 kv)	TOU-8-S, I-6-S, RTP-2-S, RTP-2-I-S, RTP-3-S, TOU-8-CR-1-S, TOU-8-RTP-S, TOU-8-SOP-S, TOU-SOP-I-S, TOU-8-SOP-RTP-S
Large Power	**TOU-8-PRI**	General Service, Time-of-Use, Large Power (> 500 kW) Primary Voltage (2 kv-50 kv)	TOU-8-P, I-6-P, RTP-2-P, RTP-2-I-P, RTP-3-P, TOU-8-CR-1-P, TOU-8-RTP-P, TOU-8-SOP-P, TOU-SOP-I-P, TOU-8-SOP-RTP-P
Large Power	**TOU-8-SUB**	General Service, Time-of-Use, Large Power (> 500 kW) Sub-Transmission Voltage (above 50 kv)	TOU-8-T, I-6-T, RTP-2-T, RTP-2-I-T, RTP-3-T, TOU-8-CR-1-T, TOU-8-RTP-T, TOU-8-SOP-T, TOU-SOP-I-T, TOU-8-SOP-RTP-T
Street Lighting	**Street Lighting**	Street and Area Lighting	AL-1, DWL, LS-1, LS-2, LS-3, OL-1

<u>Methodology</u>

Six major steps form the bases for all results presented in the Load Studies.

Step 1)   <u>Collect Individual Customer Load Data</u> – Individual customer load data is collected from carefully selected sampling points (customers) using a variety of load data recorders collecting 15-minute integrated demands. Validations of the data are performed in the course of data collection and analysis. Intervals of data not passing various validation criteria in addition to data corresponding to periods of inactive customer status (or, in some cases, active status migrated to a different rate group) are deleted from the analysis.

Data plugging is also performed at this analysis stage. The Large Power rate group was targeted for data plugging due to these customers' stable usage patterns. In general, load profiles are plugged at the customer level using the customers' average seasonal day type profile (e.g. summer/winter - weekday/weekend combinations). Usually, less than 0.5 % of all data points in Large Power rate group need to be plugged.

Step 2) <u>Develop First Approximation Sales Level Profiles for Sampled Rate Groups</u> – The first approximations of sales level rate group profiles are calculated as weighted averages of the individual customer load data. Weighted averages were necessary since the sampling units were selected disproportionately (e.g. stratified to increase efficiency). The estimated average customer load profile is multiplied by the number of active customers (from billing files) to obtain total population load profile estimates. At the same time, the variance of the estimate is calculated for later use to determine the precision of the estimate.

Step 3) <u>Balance Sampled Rate Group Profiles to Recorded kWh Sales</u> – For each sampled rate group, the total population kWh usage represented by the Step 2 load profile is calculated and compared to the recorded corporate kWh sales (adjusted to correct for billing lag) for the same period. The entire profile is then shifted up or down as necessary in order to balance the kWh in the estimated profile to equal the recorded kWh sales.

Step 4) <u>Calculate Load Profiles for the Non-Sampled Groups</u> -- Since load data are collected for all Large Power and Resale customers, rather than just a sample of customers, the demand in each interval for these groups is calculated essentially by totaling the individual customer demands.

Step 5) <u>Estimated Final Approximation Load Profiles for Sampled Rate Groups</u>

Accuracy of the sampled rate group load profiles is improved by balancing the summed estimated profiles to the Net Main System Load profile. In this step, models for the Street Lighting Rate Group load profile and the total System Loss profile were developed. The sum of the modeled profiles plus the estimated profiles for the five major rate groups is compared, interval by interval, to the System profile. The discrepancy in each interval is assumed to be sampling error and is allocated back to the sampled rate groups in proportion to the variances of their demand estimates. Groups having a lower degree of confidence are allocated a higher percentage of the total sampling error. This procedure generally has the effect of smoothing the sampled rate group profiles; however, it produces no net change in total kWh. The load characteristics shown in the tables and plots for the sampled rate groups are all calculated based on the final sales level profiles developed in this step.

Step 6) <u>Estimated Generation Level Profiles</u> – Generation level profiles are estimated by allocating a portion of the system Loss profile (see Step 5) to each rate group. Since losses vary significantly by service voltage level, a disaggregation of the final sales level profiles into voltage level profiles is necessary. Results from a loss study performed by System Planning using 1991 Load Study data is then applied to the voltage level profiles to estimate a loss factor for each voltage level for each interval of the year. These loss factors are applied to the sales level profiles to estimate loss profiles for each rate group and voltage level. The sum of the estimated loss profiles is then balanced to the total System Loss profile, and the loss profiles are added to the sales level load profiles to produce generation level load profiles.