CONSULTANT REPORT

2009 CALIFORNIA RESIDENTIAL APPLIANCE SATURATION STUDY

Volume 2: Results

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ABSTRACT

In 2009, the California Energy Commission funded and administered a Residential Appliance Saturation Study that serves as an update to the 2003 RASS, with the same utilities participating – Pacific Gas and Electric Company (PG&E), Southern California Edison (SCE), San Diego Gas & Electric Company (SDG&E), Southern California Gas Company (SoCal Gas), and Los Angeles Department of Water and Power (LADWP). KEMA was the prime consultant.

The study was implemented as a mail survey with an option for respondents to complete it on-line. The survey requested households to provide information on appliances, equipment, and general consumption patterns. Data collection was completed in early 2010.

The study yielded energy consumption estimates for 27 electric and 10 natural gas residential end-uses and appliance saturations for households. These consumption estimates were developed using a conditional demand analysis, an approach that applied statistical methods to combine survey data, household energy consumption data and weather information to calculate average annual consumption estimates per appliance. The 2009 RASS resulted in end-use saturations for 24,464 individually metered and 1,257 master-metered households. Survey and conditional demand analysis results were weighted to provide population level estimates representative of the participating utilities that allow comparison across utility service territories, forecast climate zones and other variables of interest- dwelling type, dwelling age group, and income.

Keywords: California Energy Commission, conditional demand analysis, CDA, unit energy consumption, UEC, residential, appliance, saturations, degree day normalization, energy survey, data collection

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CHAPTER 1:
RASS Results Introduction

In 2009, the California Energy Commission funded and administered a Residential Appliance Saturation Study (RASS) that was implemented across the territories of the large investor-owned utilities (IOUs). The 2009 study served as an update to the 2003 RASS, with the same utilities participating—Pacific Gas and Electric Company (PG&E), Southern California Edison Company (SCE), San Diego Gas & Electric Company (SDG&E), Southern California Gas Company (SoCal Gas), and Los Angeles Department of Water and Power (LADWP). KEMA was the prime consultant.

The research team initiated the study in 2008, with the sampling plans and implementation beginning in the spring of 2009. Data were collected using a two-stage direct mail approach to a representative sample of California households. The survey requested households to provide information on appliances, equipment, and general usage patterns. The 2003 RASS survey instrument was updated to reflect changes in available energy-consuming technologies in households. An online version of the survey was also developed. A non-response follow-up was implemented after the initial double mailing stage to a sample of the non-respondents. The non-response effort consisted of telephone calls and in-person assistance with completing the survey. Data collection was completed in early 2010.

Survey results were combined with electric and gas billing data provided by each of the participating utilities to model end uses and to calculate estimates of unit energy consumption (UECs) for each electric and natural gas end use. The combined database was used to develop the conditional demand analysis (CDA) using a statistically adjusted engineering model (SAE) approach. The SAE model applied the 2003 RASS CDA formulas to the current survey data, which provided initial engineering estimates for each end use. Normalized annual consumption (NAC) estimates were developed from billing data using a degree-day normalization (DDN) technique. The engineering estimates from each household were regressed against the respective NAC estimates to provide scalar adjustments to the engineering estimates, which were used to estimate new UECs.

The 2009 RASS resulted in end-use saturations for 24,464 individually metered and 1,257 master-metered households. UEC estimates were provided for individually metered households only, while end-use saturations reflected both individually and master-metered households. Survey and CDA results were weighted to provide population-level estimates representative of the participating utilities that allow comparison across utility service territories, climate zones, and other variables of interest - dwelling type, dwelling age-group, and income level, for example.

By using a statewide survey instrument, the Energy Commission and other parties were provided with a consistent set of questions and study results to use for statewide planning and cross-utility comparisons. The Commission-funded sample included sufficient data for utility specific analyses, but SCE and SDG&E each sponsored the sampling of additional households

within their respective service areas that provided them with supplemental data. The project required a joint effort among the study partners, as they collaborated on a research plan, program materials, and implementation strategy. Each utility provided the data necessary to create a unified sampling plan, as well as household-specific information for households that were selected for the sample. Anonymity to survey participants was provided by assigning a generic identification code that represented the sampling stratification variables. Each participating utility was provided a key to the identification code that allowed the utilities to link survey respondents to a specific account.

Because the study was designed to support interests of a variety of users, the final report included a collection of research products:

- Executive Summary – Presents a summary of key findings.
- Volume One – Describes the study design and implementation methods, along with a detailed description of the data cleaning process and CDA methodology.
- Volume Two – Provides a brief description of the CDA along with tabulated results for end-use UECs and saturations.
- Appendices – All referenced appendices have been compiled into one document for convenience.
- RASS Website – Updated version of the 2003 internet tool that supports customized queries of the survey data, including the ability to compare 2009 results to 2003 results.

Volume Two provides a description of the CDA and detailed UEC tables for 27 electric and 10 natural gas end uses, followed by a series of cross tabulations presenting results for all of the survey questions. The tabulations were weighted to the population of the participating utilities. The numbers displayed on the cross tabs are the counts divided by 1,000 to conserve space on the page. For example, the study population is displayed as 11,087, which represents 11.087 million households. The cross tabs contain responses to all of the survey questions as well as some final plugged/cleaned values as noted in the survey documentation, presented by group. The cross tabs (or banners) were created as individual sets for each participating utility. The banners were constructed in four different column display designs:

- Design 1 is by dwelling type, ownership, residence occupancy (full year or partial year), dwelling age, and gas utility.
- Design 2 is by square footage, type of occupant, primary heating fuel, type of air conditioning, and water heating fuel.
- Design 3 is by education, primary language, ethnicity, and income.
- Climate Design banners are by a combination of Energy Commission forecast climate zone and a condensed dwelling type (single family, multi family, and mobile home).