



**CALIFORNIA  
ENERGY COMMISSION**



California Energy Commission

## **CONSULTANT REPORT**

# **2019 California Residential Appliance Saturation Study (RASS)**

## **Volume 2: Results**

Prepared for: **California Energy Commission**

Prepared by: **DNV GL Energy Insights USA, Inc.**



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# California Energy Commission

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# ABSTRACT

From 2018 to 2020, the California Energy Commission funded and administered a Residential Appliance Saturation Study (RASS) that serves as an update to the *2009 RASS*, with the following utilities participating: Pacific Gas and Electric Company, Southern California Edison, Sacramento Municipal Utility District, San Diego Gas & Electric Company, Southern California Gas Company, and Los Angeles Department of Water and Power. DNV GL Energy Insights (formerly KEMA, Inc.) was the prime consultant for this study as well as the 2009 and 2003 studies.

The research team implemented the study as online and mailed paper surveys. The surveys requested households to provide information on appliances, equipment, and general consumption patterns, including electric vehicle charging and the presence of renewable energy technology such as a solar photovoltaic system. The research team completed data collection in early 2020 just before the full impact of COVID-19 events.

The study yielded energy consumption estimates for 28 electric and nine natural gas residential end uses and appliance saturations for households. The project team developed these consumption estimates using a conditional demand analysis, an approach that applied statistical methods to combine survey responses, household energy consumption data, and weather information to calculate average annual consumption estimates per appliance. The *2019 RASS* resulted in end-use saturations for 39,682 individually metered and 303 master-metered households. The team weighted survey and conditional demand analysis results to provide population-level estimates, representative of the participating utilities that allow comparison across utility service territories, forecasting climate zones, and other variables of interest including dwelling type, dwelling age group, and income.

**Keywords:** California Energy Commission, conditional demand analysis, CDA, unit energy consumption, UEC, residential, energy survey, online survey, appliance, saturations, degree-day normalization, AMI data, hourly load shapes, electric vehicles, EVs

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# CHAPTER 1:

## RASS Results Introduction

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From 2018 through 2020, the California Energy Commission (CEC) funded and administered a Residential Appliance Saturation Study (RASS) that was implemented across the territories of the large investor-owned utilities (IOUs) and two of the largest municipal utilities. The 2019 study served as an update to the *2009 RASS*. Participating utilities included Pacific Gas and Electric Company (PG&E), Southern California Edison Company (SCE), San Diego Gas & Electric Company (SDG&E), Southern California Gas Company (SoCalGas), Sacramento Municipal Utility District (SMUD) and Los Angeles Department of Water and Power (LADWP). DNV GL was the prime consultant.

The research team initiated the study the end of 2018 with the sampling plans and implementation beginning in the fall of 2019. The team collected data using online and direct mail approaches to a representative sample of California households. The survey asked households to provide information on appliances, equipment, and general usage patterns. The *2009 RASS* survey was updated to reflect changes in available energy-consuming and generation-storage technologies in households, including new questions about electric vehicles (EV), photovoltaic (PV) systems, and battery storage systems. A smaller and more focused nonresponse follow-up recruitment effort was implemented to a sample of the nonrespondents after the initial contact methods were exhausted. The nonresponse effort consisted of telephone calls and in-person assistance with completing the survey. The team completed data collection in early 2020 just before the full impact of COVID-19 events.

The study yielded unit energy consumption (UEC) estimates for 28 electric and 9 natural gas residential end uses and appliance saturations for households. A UEC represents the amount of energy an appliance is estimated to use in a year. The team developed the UEC estimates 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. Details of the conditional demand analysis method are presented in Volume One.

The *2019 RASS* resulted in end-use saturations for 39,682 individually metered and 303 master-metered households. UEC estimates were provided for individually metered households only, while end-use saturations reflected both individually and master-metered households. The research team weighted survey and conditional demand analysis (CDA) results to provide population-level estimates representative of the participating utilities that allow comparison across utility service territories, forecasting climate zones, and other variables of interest such as dwelling type, dwelling age group, and income.

By using a statewide survey instrument, the research team provided the CEC and other parties with a consistent set of questions and study results to use for statewide planning and cross-utility comparisons. 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. The research team provided

anonymity to survey participants 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:

- The **Executive Summary** presents a summary of key findings.
- The **Project Overview** presents a detailed summary of key findings.
- **Volume One** describes the study design and implementation methods, along with a detailed description of the data cleaning process, CDA method, and development of hourly electric and daily gas loads.
- **Volume Two** provides a brief description of the CDA along with tabulated results for end-use UECs and saturations and an overview of hourly electric and daily gas loads.
- All referenced **appendices** have been compiled into one document for convenience.
- The **RASS Website**, an updated version of the 2009 web tool, supports customized queries of the survey data, including the ability to compare 2019 results to 2009 and 2003 results.

**Volume Two** provides a description of the CDA and detailed UEC tables for 28 electric and 9 natural gas end uses, overarching electric load profile and daily gas usage results, followed by a series of cross tabulations presenting results for all the survey questions. The team weighted the survey responses to the population of the participating utilities in the tabulations. The numbers displayed on the cross tabs representing the population are the number of households divided by 1,000 to conserve space on the page. The number of households that responded to a question are displayed as the actual numbers. For example, the number of respondents would be displayed as 22,000, but if the number represented the population, it would be displayed as 22 (22,000 divided by 1,000). The cross tabs contain responses to all the survey questions as well as some final plugged/cleaned values as noted in the survey documentation, presented by group. There are seven sets of cross tabs ("banners"): one for all participating utilities combined and a separate set for each of the six participating utilities. Each set contains five groups of survey results:

- Group 1 presents results from the Home and Lifestyle, Electric Vehicle, Renewable Energy Technologies, and Household Information sections of the survey.
- Group 2 covers results from the Space Heating and Space Cooling sections of the survey.
- Group 3 includes results from the Water Heating, Laundry, Spas and Hot Tubs, and Pools sections of the survey.
- Group 4 has results from the Food Preparation, Refrigerators, and Freezers sections of the survey.
- Group 5 contains results from the Entertainment and Technology, Lighting, and Miscellaneous Equipment sections of the survey.

Within each of these five groups, responses are reported by each of the following:

- Total for respondents to the question
- Dwelling type
- Home ownership
- Dwelling age
- Electric utility
- Gas utility
- Square footage
- Primary heating fuel
- Type of space cooling system
- Primary water-heating fuel
- Primary language spoken in the home
- Education level completed by head of household
- Ethnicity of the head of household
- Presence of children and seniors
- Household Income
- Net-metering status
- Forecasting climate zone

# CHAPTER 2:

## Conditional Demand Analysis Results

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The CDA analysis used a statistically adjusted engineering (SAE) model to produce UEC estimates for electric and natural gas end uses. The parameter estimates from the SAE model provided scalar adjustments to engineering estimates. The research team estimated the SAE model using only individually metered households with 12 months of energy usage and significant degree-day normalization (DDN) weather normalization models. The model was fit to all individually metered households, regardless of whether normalized consumption data were available, by multiplying the scalar adjustments for each end use by the respective engineering estimates.

The team calibrated the estimated UECs to electric and gas consumption data at the sampling stratum level for all individually metered survey respondents, regardless of whether normalized consumption data were available. The following steps were used in the calibration.

- The team estimated UECs for all individually metered households. The individual end-use UECs within a household were combined to provide an estimated total UEC for that household.
- The team defined energy consumption for each household as follows:
  - Where an estimated DDN model was available, the annual consumption from the DDN model was used to represent the actual consumption.
  - In cases where a DDN model was not available but limited billing data were available, an average use per day from the available billing series was calculated and used to estimate 12-month consumption.
  - For cases where average use per day could not be constructed from the available billing data, then the team used the mean annual consumption for households in the same sample stratum, the sample cell from the sample design that represents the combination of attributes of the home.
- The team calculated calibration factors at the sample stratum level by dividing normalized annual consumption (NAC) for the stratum by the predicted household UEC for the stratum. This calculation was done for electric and gas separately. Because some of the strata had no customers with valid NAC estimates and others had relatively few, the team collapsed the strata together to ensure more stable calibration factors. The calibration factors were calculated only for households that had electric or gas NAC estimates.
- The calibration factors for each stratum were multiplied by each of the respective UECs to provide calibrated UEC estimates. All individually metered gas and electric households were included in the UEC estimates, regardless of whether billing data were available.
- Once UECs were calibrated, the team determined the weighted average UECs for various household segments using case weights.

**Table 1** through **Table 10** present the electric and gas calibration ratios by sampling stratum for each electric utility. The tables also include the number of records included in the calculation of each of the respective electric and gas calibration factors and the total number of households for which UECs were calculated. A calibration ratio of one would indicate that the estimated household UEC provides a perfect estimate for actual household consumption. Deviations from one result from survey response bias, but the proximity of the calibration ratios to one indicates that such bias was limited. The gas calibration ratios in some cases are further from one, but this result is most likely because the stratification was based on electric usage, so did not necessarily group customers with similar gas usage together.

**Table 1: PG&E Calibration Ratios — Electric**

| Strata ID | Collapsed Strata | Email Available | CEC Forecasting Climate Zone | Net Metered | Dwelling | Annual kWh | Electric Calibration Factor | Responses Used in Calibration Factor | Total Responses |
|-----------|------------------|-----------------|------------------------------|-------------|----------|------------|-----------------------------|--------------------------------------|-----------------|
| 018       | 18               | No              | 1                            | No          | MF       | High       | 0.95                        | 153                                  | 193             |
| 019       | 18               | No              | 1                            | No          | MF       | Low        | 0.95                        | 94                                   | 151             |
| 020       | 18               | No              | 1                            | No          | MF       | Middle     | 0.95                        | 228                                  | 275             |
| 024       | 18               | No              | 1                            | Yes         | MF       | NA         | 0.95                        | 0                                    | 9               |
| 049       | 18               | Yes             | 1                            | No          | MF       | High       | 0.95                        | 441                                  | 678             |
| 050       | 18               | Yes             | 1                            | No          | MF       | Low        | 0.95                        | 197                                  | 443             |
| 051       | 18               | Yes             | 1                            | No          | MF       | Middle     | 0.95                        | 494                                  | 799             |
| 055       | 18               | Yes             | 1                            | Yes         | MF       | NA         | 0.95                        | 0                                    | 25              |
| 021       | 21               | No              | 1                            | No          | SF       | High       | 0.96                        | 226                                  | 273             |
| 022       | 21               | No              | 1                            | No          | SF       | Low        | 0.96                        | 300                                  | 362             |
| 023       | 21               | No              | 1                            | No          | SF       | Middle     | 0.96                        | 514                                  | 604             |
| 025       | 21               | No              | 1                            | Yes         | SF       | NA         | 0.96                        | 0                                    | 104             |
| 052       | 21               | Yes             | 1                            | No          | SF       | High       | 0.96                        | 406                                  | 626             |
| 053       | 21               | Yes             | 1                            | No          | SF       | Low        | 0.96                        | 474                                  | 702             |
| 054       | 21               | Yes             | 1                            | No          | SF       | Middle     | 0.96                        | 995                                  | 1,410           |
| 056       | 21               | Yes             | 1                            | Yes         | SF       | NA         | 0.96                        | 0                                    | 507             |
| 026       | 26               | No              | 2                            | No          | MF       | NA         | 0.91                        | 97                                   | 137             |
| 029       | 26               | No              | 2                            | Yes         | MF       | NA         | 0.91                        | 0                                    | 3               |
| 057       | 26               | Yes             | 2                            | No          | MF       | NA         | 0.91                        | 162                                  | 294             |
| 060       | 26               | Yes             | 2                            | Yes         | MF       | NA         | 0.91                        | 0                                    | 6               |
| 027       | 27               | No              | 2                            | No          | SF       | High       | 1.13                        | 86                                   | 107             |
| 028       | 27               | No              | 2                            | No          | SF       | Low        | 1.13                        | 263                                  | 362             |
| 030       | 27               | No              | 2                            | Yes         | SF       | NA         | 1.13                        | 0                                    | 34              |
| 058       | 27               | Yes             | 2                            | No          | SF       | High       | 1.13                        | 100                                  | 174             |
| 059       | 27               | Yes             | 2                            | No          | SF       | Low        | 1.13                        | 463                                  | 758             |
| 061       | 27               | Yes             | 2                            | Yes         | SF       | NA         | 1.13                        | 0                                    | 140             |
| 031       | 31               | No              | 3                            | No          | MF       | NA         | 1.25                        | 14                                   | 24              |
| 062       | 31               | Yes             | 3                            | No          | MF       | NA         | 1.25                        | 29                                   | 65              |
| 032       | 32               | No              | 3                            | No          | SF       | NA         | 1.09                        | 127                                  | 172             |
| 033       | 32               | No              | 3                            | Yes         | SF       | NA         | 1.09                        | 0                                    | 15              |
| 063       | 32               | Yes             | 3                            | No          | SF       | NA         | 1.09                        | 150                                  | 262             |
| 064       | 32               | Yes             | 3                            | Yes         | SF       | NA         | 1.09                        | 0                                    | 57              |
| 034       | 34               | No              | 4                            | No          | MF       | NA         | 1.15                        | 114                                  | 149             |
| 037       | 34               | No              | 4                            | Yes         | MF       | NA         | 1.15                        | 0                                    | 1               |
| 065       | 34               | Yes             | 4                            | No          | MF       | NA         | 1.15                        | 167                                  | 279             |
| 069       | 34               | Yes             | 4                            | Yes         | MF       | NA         | 1.15                        | 0                                    | 10              |
| 035       | 35               | No              | 4                            | No          | SF       | High       | 1.10                        | 134                                  | 160             |
| 036       | 35               | No              | 4                            | No          | SF       | Low        | 1.10                        | 406                                  | 528             |
| 038       | 35               | No              | 4                            | Yes         | SF       | NA         | 1.10                        | 0                                    | 92              |
| 066       | 35               | Yes             | 4                            | No          | SF       | High       | 1.10                        | 164                                  | 278             |
| 067       | 35               | Yes             | 4                            | No          | SF       | Low        | 1.10                        | 228                                  | 384             |
| 068       | 35               | Yes             | 4                            | No          | SF       | Middle     | 1.10                        | 485                                  | 739             |
| 070       | 35               | Yes             | 4                            | Yes         | SF       | NA         | 1.10                        | 0                                    | 328             |

| Strata ID | Collapsed Strata | Email Available | CEC Forecasting Climate Zone | Net Metered | Dwelling | Annual kWh | Electric Calibration Factor | Responses Used in Calibration Factor | Total Responses |
|-----------|------------------|-----------------|------------------------------|-------------|----------|------------|-----------------------------|--------------------------------------|-----------------|
| 039       | 39               | No              | 5                            | No          | MF       | NA         | 1.11                        | 90                                   | 118             |
| 042       | 39               | No              | 5                            | Yes         | MF       | NA         | 1.11                        | 0                                    | 1               |
| 071       | 39               | Yes             | 5                            | No          | MF       | NA         | 1.11                        | 99                                   | 225             |
| 074       | 39               | Yes             | 5                            | Yes         | MF       | NA         | 1.11                        | 0                                    | 3               |
| 040       | 40               | No              | 5                            | No          | SF       | High       | 1.11                        | 74                                   | 102             |
| 041       | 40               | No              | 5                            | No          | SF       | Low        | 1.11                        | 224                                  | 305             |
| 043       | 40               | No              | 5                            | Yes         | SF       | NA         | 1.11                        | 0                                    | 61              |
| 072       | 40               | Yes             | 5                            | No          | SF       | High       | 1.11                        | 100                                  | 167             |
| 073       | 40               | Yes             | 5                            | No          | SF       | Low        | 1.11                        | 326                                  | 547             |
| 075       | 40               | Yes             | 5                            | Yes         | SF       | NA         | 1.11                        | 0                                    | 183             |
| 044       | 44               | No              | 6                            | No          | MF       | NA         | 0.85                        | 87                                   | 119             |
| 047       | 44               | No              | 6                            | Yes         | MF       | NA         | 0.85                        | 0                                    | 2               |
| 076       | 44               | Yes             | 6                            | No          | MF       | NA         | 0.85                        | 118                                  | 237             |
| 079       | 44               | Yes             | 6                            | Yes         | MF       | NA         | 0.85                        | 0                                    | 4               |
| 045       | 45               | No              | 6                            | No          | SF       | High       | 1.02                        | 69                                   | 90              |
| 046       | 45               | No              | 6                            | No          | SF       | Low        | 1.02                        | 197                                  | 268             |
| 048       | 45               | No              | 6                            | Yes         | SF       | NA         | 1.02                        | 0                                    | 31              |
| 077       | 45               | Yes             | 6                            | No          | SF       | High       | 1.02                        | 110                                  | 166             |
| 078       | 45               | Yes             | 6                            | No          | SF       | Low        | 1.02                        | 319                                  | 500             |
| 080       | 45               | Yes             | 6                            | Yes         | SF       | NA         | 1.02                        | 0                                    | 119             |

Source: 2019 California Residential Appliance Saturation Survey

**Table 2: PG&E Calibration Ratios — Gas**

| Strata ID | Collapsed Strata | Email Available | CEC Forecasting Climate Zone | Net Metered | Dwelling | Annual kWh | Gas Calibration Factor | Responses Used in Calibration Factor | Total Responses |
|-----------|------------------|-----------------|------------------------------|-------------|----------|------------|------------------------|--------------------------------------|-----------------|
| 018       | 18               | No              | 1                            | No          | MF       | High       | 1.08                   | 99                                   | 139             |
| 019       | 18               | No              | 1                            | No          | MF       | Low        | 1.08                   | 80                                   | 110             |
| 020       | 18               | No              | 1                            | No          | MF       | Middle     | 1.08                   | 154                                  | 206             |
| 024       | 18               | No              | 1                            | Yes         | MF       | NA         | 1.08                   | 7                                    | 9               |
| 049       | 18               | Yes             | 1                            | No          | MF       | High       | 1.08                   | 331                                  | 498             |
| 050       | 18               | Yes             | 1                            | No          | MF       | Low        | 1.08                   | 196                                  | 341             |
| 051       | 18               | Yes             | 1                            | No          | MF       | Middle     | 1.08                   | 379                                  | 596             |
| 055       | 18               | Yes             | 1                            | Yes         | MF       | NA         | 1.08                   | 17                                   | 24              |
| 021       | 21               | No              | 1                            | No          | SF       | High       | 1.09                   | 222                                  | 262             |
| 022       | 21               | No              | 1                            | No          | SF       | Low        | 1.09                   | 307                                  | 352             |
| 023       | 21               | No              | 1                            | No          | SF       | Middle     | 1.09                   | 511                                  | 588             |
| 025       | 21               | No              | 1                            | Yes         | SF       | NA         | 1.09                   | 93                                   | 102             |
| 052       | 21               | Yes             | 1                            | No          | SF       | High       | 1.09                   | 437                                  | 599             |
| 053       | 21               | Yes             | 1                            | No          | SF       | Low        | 1.09                   | 497                                  | 660             |
| 054       | 21               | Yes             | 1                            | No          | SF       | Middle     | 1.09                   | 1,027                                | 1,384           |
| 056       | 21               | Yes             | 1                            | Yes         | SF       | NA         | 1.09                   | 399                                  | 500             |
| 026       | 26               | No              | 2                            | No          | MF       | NA         | 0.94                   | 70                                   | 95              |
| 029       | 26               | No              | 2                            | Yes         | MF       | NA         | 0.94                   | 1                                    | 1               |
| 057       | 26               | Yes             | 2                            | No          | MF       | NA         | 0.94                   | 139                                  | 242             |
| 060       | 26               | Yes             | 2                            | Yes         | MF       | NA         | 0.94                   | 1                                    | 2               |
| 027       | 27               | No              | 2                            | No          | SF       | High       | 1.19                   | 48                                   | 58              |
| 028       | 27               | No              | 2                            | No          | SF       | Low        | 1.19                   | 207                                  | 257             |
| 030       | 27               | No              | 2                            | Yes         | SF       | NA         | 1.19                   | 21                                   | 26              |
| 058       | 27               | Yes             | 2                            | No          | SF       | High       | 1.19                   | 61                                   | 94              |
| 059       | 27               | Yes             | 2                            | No          | SF       | Low        | 1.19                   | 417                                  | 593             |
| 061       | 27               | Yes             | 2                            | Yes         | SF       | NA         | 1.19                   | 72                                   | 93              |
| 031       | 31               | No              | 3                            | No          | MF       | NA         | 0.92                   | 11                                   | 15              |
| 062       | 31               | Yes             | 3                            | No          | MF       | NA         | 0.92                   | 29                                   | 57              |
| 032       | 32               | No              | 3                            | No          | SF       | NA         | 1.06                   | 59                                   | 77              |
| 033       | 32               | No              | 3                            | Yes         | SF       | NA         | 1.06                   | 7                                    | 8               |

| Strata ID | Collapsed Strata | Email Available | CEC Forecasting Climate Zone | Net Metered | Dwelling | Annual kWh | Gas Calibration Factor | Responses Used in Calibration Factor | Total Responses |
|-----------|------------------|-----------------|------------------------------|-------------|----------|------------|------------------------|--------------------------------------|-----------------|
| 063       | 32               | Yes             | 3                            | No          | SF       | NA         | 1.06                   | 78                                   | 118             |
| 064       | 32               | Yes             | 3                            | Yes         | SF       | NA         | 1.06                   | 19                                   | 27              |
| 034       | 34               | No              | 4                            | No          | MF       | NA         | 1.15                   | 76                                   | 108             |
| 037       | 34               | No              | 4                            | Yes         | MF       | NA         | 1.15                   | 1                                    | 1               |
| 065       | 34               | Yes             | 4                            | No          | MF       | NA         | 1.15                   | 142                                  | 218             |
| 069       | 34               | Yes             | 4                            | Yes         | MF       | NA         | 1.15                   | 5                                    | 6               |
| 035       | 35               | No              | 4                            | No          | SF       | High       | 1.07                   | 56                                   | 67              |
| 036       | 35               | No              | 4                            | No          | SF       | Low        | 1.07                   | 287                                  | 331             |
| 038       | 35               | No              | 4                            | Yes         | SF       | NA         | 1.07                   | 51                                   | 60              |
| 066       | 35               | Yes             | 4                            | No          | SF       | High       | 1.07                   | 97                                   | 142             |
| 067       | 35               | Yes             | 4                            | No          | SF       | Low        | 1.07                   | 187                                  | 261             |
| 068       | 35               | Yes             | 4                            | No          | SF       | Middle     | 1.07                   | 386                                  | 529             |
| 070       | 35               | Yes             | 4                            | Yes         | SF       | NA         | 1.07                   | 190                                  | 240             |
| 039       | 39               | No              | 5                            | No          | MF       | NA         | 1.70                   | 80                                   | 101             |
| 042       | 39               | No              | 5                            | Yes         | MF       | NA         | 1.70                   | 0                                    | 0               |
| 071       | 39               | Yes             | 5                            | No          | MF       | NA         | 1.70                   | 108                                  | 196             |
| 074       | 39               | Yes             | 5                            | Yes         | MF       | NA         | 1.70                   | 2                                    | 3               |
| 040       | 40               | No              | 5                            | No          | SF       | High       | 1.34                   | 59                                   | 74              |
| 041       | 40               | No              | 5                            | No          | SF       | Low        | 1.34                   | 191                                  | 246             |
| 043       | 40               | No              | 5                            | Yes         | SF       | NA         | 1.34                   | 37                                   | 47              |
| 072       | 40               | Yes             | 5                            | No          | SF       | High       | 1.34                   | 89                                   | 116             |
| 073       | 40               | Yes             | 5                            | No          | SF       | Low        | 1.34                   | 295                                  | 424             |
| 075       | 40               | Yes             | 5                            | Yes         | SF       | NA         | 1.34                   | 117                                  | 152             |
| 044       | 44               | No              | 6                            | No          | MF       | NA         | 1.76                   | 74                                   | 97              |
| 047       | 44               | No              | 6                            | Yes         | MF       | NA         | 1.76                   | 2                                    | 2               |
| 076       | 44               | Yes             | 6                            | No          | MF       | NA         | 1.76                   | 111                                  | 187             |
| 079       | 44               | Yes             | 6                            | Yes         | MF       | NA         | 1.76                   | 2                                    | 3               |
| 045       | 45               | No              | 6                            | No          | SF       | High       | 1.12                   | 50                                   | 61              |
| 046       | 45               | No              | 6                            | No          | SF       | Low        | 1.12                   | 187                                  | 243             |
| 048       | 45               | No              | 6                            | Yes         | SF       | NA         | 1.12                   | 16                                   | 21              |
| 077       | 45               | Yes             | 6                            | No          | SF       | High       | 1.12                   | 77                                   | 105             |
| 078       | 45               | Yes             | 6                            | No          | SF       | Low        | 1.12                   | 289                                  | 423             |
| 080       | 45               | Yes             | 6                            | Yes         | SF       | NA         | 1.12                   | 62                                   | 85              |

Source: 2019 California Residential Appliance Saturation Survey

**Table 3: SDG&E Calibration Ratios — Electric**

| Strata ID | Collapsed Strata | Email Available | CEC Forecasting Climate Zone | Net Metered | Dwelling | Annual kWh | Electric Calibration Factor | Responses Used in Calibration Factor | Total Responses |
|-----------|------------------|-----------------|------------------------------|-------------|----------|------------|-----------------------------|--------------------------------------|-----------------|
| 130       | 130              | No              | 12                           | No          | MF       | NA         | 0.95                        | 158                                  | 196             |
| 133       | 130              | No              | 12                           | Yes         | MF       | NA         | 0.95                        | 0                                    | 1               |
| 135       | 130              | Yes             | 12                           | No          | MF       | High       | 0.95                        | 196                                  | 284             |
| 136       | 130              | Yes             | 12                           | No          | MF       | Low        | 0.95                        | 183                                  | 323             |
| 137       | 130              | Yes             | 12                           | No          | MF       | Middle     | 0.95                        | 372                                  | 548             |
| 141       | 130              | Yes             | 12                           | Yes         | MF       | NA         | 0.95                        | 0                                    | 9               |
| 131       | 131              | No              | 12                           | No          | SF       | High       | 0.97                        | 82                                   | 102             |
| 132       | 131              | No              | 12                           | No          | SF       | Low        | 0.97                        | 385                                  | 470             |
| 134       | 131              | No              | 12                           | Yes         | SF       | NA         | 0.97                        | 0                                    | 29              |
| 138       | 131              | Yes             | 12                           | No          | SF       | High       | 0.97                        | 405                                  | 641             |
| 139       | 131              | Yes             | 12                           | No          | SF       | Low        | 0.97                        | 513                                  | 780             |
| 140       | 131              | Yes             | 12                           | No          | SF       | Middle     | 0.97                        | 917                                  | 1,343           |
| 142       | 131              | Yes             | 12                           | Yes         | SF       | NA         | 0.97                        | 0                                    | 446             |

Source: 2019 California Residential Appliance Saturation Survey

**Table 4: SDG&E Calibration Ratios – Gas**

| Strata ID | Collapsed Strata | Email Available | CEC Forecasting Climate Zone | Net Metered | Dwelling | Annual kWh | Gas Calibration Factor | Responses Used in Calibration Factor | Total Responses |
|-----------|------------------|-----------------|------------------------------|-------------|----------|------------|------------------------|--------------------------------------|-----------------|
| 130       | 130              | No              | 12                           | No          | MF       | NA         | 0.93                   | 75                                   | 105             |
| 133       | 130              | No              | 12                           | Yes         | MF       | NA         | 0.93                   | 0                                    | 0               |
| 135       | 130              | Yes             | 12                           | No          | MF       | High       | 0.93                   | 90                                   | 170             |
| 136       | 130              | Yes             | 12                           | No          | MF       | Low        | 0.93                   | 89                                   | 176             |
| 137       | 130              | Yes             | 12                           | No          | MF       | Middle     | 0.93                   | 162                                  | 301             |
| 141       | 130              | Yes             | 12                           | Yes         | MF       | NA         | 0.93                   | 5                                    | 6               |
| 131       | 131              | No              | 12                           | No          | SF       | High       | 0.91                   | 60                                   | 84              |
| 132       | 131              | No              | 12                           | No          | SF       | Low        | 0.91                   | 358                                  | 448             |
| 134       | 131              | No              | 12                           | Yes         | SF       | NA         | 0.91                   | 19                                   | 24              |
| 138       | 131              | Yes             | 12                           | No          | SF       | High       | 0.91                   | 325                                  | 532             |
| 139       | 131              | Yes             | 12                           | No          | SF       | Low        | 0.91                   | 478                                  | 736             |
| 140       | 131              | Yes             | 12                           | No          | SF       | Middle     | 0.91                   | 847                                  | 1,250           |
| 142       | 131              | Yes             | 12                           | Yes         | SF       | NA         | 0.91                   | 257                                  | 378             |

Source: 2019 California Residential Appliance Saturation Survey

**Table 5: LADWP Calibration Ratios — Electric**

| Strata ID | Collapsed Strata | Email Available | CEC Forecasting Climate Zone | Net Metered | Dwelling | Annual kWh | Electric Calibration Factor | Responses Used in Calibration Factor | Total Responses |
|-----------|------------------|-----------------|------------------------------|-------------|----------|------------|-----------------------------|--------------------------------------|-----------------|
| 001       | 1                | No              | 16                           | No          | MF       | High       | 1.01                        | 73                                   | 85              |
| 002       | 1                | No              | 16                           | No          | MF       | Low        | 1.01                        | 288                                  | 349             |
| 005       | 1                | No              | 16                           | Yes         | MF       | NA         | 1.01                        | 0                                    | 0               |
| 010       | 1                | Yes             | 16                           | No          | MF       | High       | 1.01                        | 94                                   | 123             |
| 011       | 1                | Yes             | 16                           | No          | MF       | Low        | 1.01                        | 353                                  | 442             |
| 013       | 1                | Yes             | 16                           | Yes         | MF       | NA         | 1.01                        | 0                                    | 2               |
| 003       | 3                | No              | 16                           | No          | SF       | High       | 1.04                        | 61                                   | 74              |
| 004       | 3                | No              | 16                           | No          | SF       | Low        | 1.04                        | 238                                  | 276             |
| 006       | 3                | No              | 16                           | Yes         | SF       | NA         | 1.04                        | 0                                    | 23              |
| 012       | 3                | Yes             | 16                           | No          | SF       | NA         | 1.04                        | 294                                  | 377             |
| 014       | 3                | Yes             | 16                           | Yes         | SF       | NA         | 1.04                        | 0                                    | 34              |
| 007       | 7                | No              | 17                           | No          | MF       | NA         | 1.06                        | 125                                  | 160             |
| 015       | 7                | Yes             | 17                           | No          | MF       | NA         | 1.06                        | 189                                  | 240             |
| 008       | 8                | No              | 17                           | No          | SF       | NA         | 1.06                        | 221                                  | 254             |
| 009       | 8                | No              | 17                           | Yes         | SF       | NA         | 1.06                        | 0                                    | 19              |
| 016       | 8                | Yes             | 17                           | No          | SF       | NA         | 1.06                        | 235                                  | 303             |
| 017       | 8                | Yes             | 17                           | Yes         | SF       | NA         | 1.06                        | 0                                    | 35              |

Source: 2019 California Residential Appliance Saturation Survey

**Table 6: LADWP Calibration Ratios — Gas**

| Strata ID | Collapsed Strata | Email Available | CEC Forecasting Climate Zone | Net Metered | Dwelling | Annual kWh | Gas Calibration Factor | Responses Used in Calibration Factor | Total Responses |
|-----------|------------------|-----------------|------------------------------|-------------|----------|------------|------------------------|--------------------------------------|-----------------|
| 001       | 1                | No              | 16                           | No          | MF       | High       | 1.30                   | 42                                   | 62              |
| 002       | 1                | No              | 16                           | No          | MF       | Low        | 1.30                   | 213                                  | 284             |
| 005       | 1                | No              | 16                           | Yes         | MF       | NA         | 1.30                   | 0                                    | 0               |
| 010       | 1                | Yes             | 16                           | No          | MF       | High       | 1.30                   | 51                                   | 88              |
| 011       | 1                | Yes             | 16                           | No          | MF       | Low        | 1.30                   | 222                                  | 316             |
| 013       | 1                | Yes             | 16                           | Yes         | MF       | NA         | 1.30                   | 1                                    | 2               |
| 003       | 3                | No              | 16                           | No          | SF       | High       | 1.57                   | 56                                   | 73              |
| 004       | 3                | No              | 16                           | No          | SF       | Low        | 1.57                   | 220                                  | 261             |
| 006       | 3                | No              | 16                           | Yes         | SF       | NA         | 1.57                   | 18                                   | 22              |
| 012       | 3                | Yes             | 16                           | No          | SF       | NA         | 1.57                   | 238                                  | 339             |
| 014       | 3                | Yes             | 16                           | Yes         | SF       | NA         | 1.57                   | 26                                   | 33              |
| 007       | 7                | No              | 17                           | No          | MF       | NA         | 1.61                   | 76                                   | 121             |
| 015       | 7                | Yes             | 17                           | No          | MF       | NA         | 1.61                   | 114                                  | 166             |
| 008       | 8                | No              | 17                           | No          | SF       | NA         | 1.25                   | 206                                  | 247             |
| 009       | 8                | No              | 17                           | Yes         | SF       | NA         | 1.25                   | 15                                   | 17              |
| 016       | 8                | Yes             | 17                           | No          | SF       | NA         | 1.25                   | 203                                  | 278             |
| 017       | 8                | Yes             | 17                           | Yes         | SF       | NA         | 1.25                   | 21                                   | 32              |

Source: 2019 California Residential Appliance Saturation Survey

**Table 7: SCE Calibration Ratios — Electric**

| Strata ID | Collapsed Strata | Email Available | CEC Forecasting Climate Zone | Net Metered | Dwelling | Annual kWh | Electric Calibration Factor | Responses Used in Calibration Factor | Total Responses |
|-----------|------------------|-----------------|------------------------------|-------------|----------|------------|-----------------------------|--------------------------------------|-----------------|
| 081       | 81               | No              | 7                            | No          | MF       | High       | 1.03                        | 185                                  | 266             |
| 082       | 81               | No              | 7                            | No          | MF       | Low        | 1.03                        | 142                                  | 267             |
| 083       | 81               | No              | 7                            | No          | MF       | Middle     | 1.03                        | 383                                  | 564             |
| 087       | 81               | No              | 7                            | Yes         | MF       | NA         | 1.03                        | 0                                    | 4               |
| 108       | 81               | Yes             | 7                            | No          | MF       | High       | 1.03                        | 142                                  | 239             |
| 109       | 81               | Yes             | 7                            | No          | MF       | Low        | 1.03                        | 454                                  | 824             |
| 113       | 81               | Yes             | 7                            | Yes         | MF       | NA         | 1.03                        | 0                                    | 5               |
| 084       | 84               | No              | 7                            | No          | SF       | High       | 1.04                        | 369                                  | 506             |
| 085       | 84               | No              | 7                            | No          | SF       | Low        | 1.04                        | 423                                  | 640             |
| 086       | 84               | No              | 7                            | No          | SF       | Middle     | 1.04                        | 1,020                                | 1,312           |
| 088       | 84               | No              | 7                            | Yes         | SF       | NA         | 1.04                        | 0                                    | 196             |
| 110       | 84               | Yes             | 7                            | No          | SF       | High       | 1.04                        | 354                                  | 540             |
| 111       | 84               | Yes             | 7                            | No          | SF       | Low        | 1.04                        | 475                                  | 770             |
| 112       | 84               | Yes             | 7                            | No          | SF       | Middle     | 1.04                        | 819                                  | 1283            |
| 114       | 84               | Yes             | 7                            | Yes         | SF       | NA         | 1.04                        | 0                                    | 423             |
| 089       | 89               | No              | 8                            | No          | MF       | NA         | 1.01                        | 79                                   | 111             |
| 092       | 89               | No              | 8                            | Yes         | MF       | NA         | 1.01                        | 0                                    | 0               |
| 115       | 89               | Yes             | 8                            | No          | MF       | NA         | 1.01                        | 54                                   | 104             |
| 090       | 90               | No              | 8                            | No          | SF       | High       | 0.97                        | 77                                   | 102             |
| 091       | 90               | No              | 8                            | No          | SF       | Low        | 0.97                        | 261                                  | 349             |
| 093       | 90               | No              | 8                            | Yes         | SF       | NA         | 0.97                        | 0                                    | 54              |
| 116       | 90               | Yes             | 8                            | No          | SF       | NA         | 0.97                        | 281                                  | 467             |
| 117       | 90               | Yes             | 8                            | Yes         | SF       | NA         | 0.97                        | 0                                    | 92              |
| 094       | 94               | No              | 9                            | No          | MF       | NA         | 1.17                        | 19                                   | 42              |
| 118       | 94               | Yes             | 9                            | No          | MF       | NA         | 1.17                        | 14                                   | 30              |
| 095       | 95               | No              | 9                            | No          | SF       | High       | 1.17                        | 41                                   | 59              |
| 096       | 95               | No              | 9                            | No          | SF       | Low        | 1.17                        | 155                                  | 242             |
| 097       | 95               | No              | 9                            | Yes         | SF       | NA         | 1.17                        | 0                                    | 39              |
| 119       | 95               | Yes             | 9                            | No          | SF       | NA         | 1.17                        | 148                                  | 290             |
| 120       | 95               | Yes             | 9                            | Yes         | SF       | NA         | 1.17                        | 0                                    | 62              |
| 098       | 98               | No              | 10                           | No          | MF       | NA         | 1.10                        | 79                                   | 131             |
| 121       | 98               | Yes             | 10                           | No          | MF       | NA         | 1.10                        | 63                                   | 118             |
| 099       | 99               | No              | 10                           | No          | SF       | High       | 1.02                        | 81                                   | 107             |
| 100       | 99               | No              | 10                           | No          | SF       | Low        | 1.02                        | 102                                  | 171             |
| 101       | 99               | No              | 10                           | No          | SF       | Middle     | 1.02                        | 214                                  | 300             |
| 102       | 99               | No              | 10                           | Yes         | SF       | NA         | 1.02                        | 0                                    | 67              |
| 122       | 99               | Yes             | 10                           | No          | SF       | High       | 1.02                        | 81                                   | 134             |
| 123       | 99               | Yes             | 10                           | No          | SF       | Low        | 1.02                        | 342                                  | 562             |
| 124       | 99               | Yes             | 10                           | Yes         | SF       | NA         | 1.02                        | 0                                    | 134             |
| 103       | 103              | No              | 11                           | No          | MF       | NA         | 1.27                        | 44                                   | 68              |
| 106       | 103              | No              | 11                           | Yes         | MF       | NA         | 1.27                        | 0                                    | 1               |
| 125       | 103              | Yes             | 11                           | No          | MF       | NA         | 1.27                        | 40                                   | 89              |
| 128       | 103              | Yes             | 11                           | Yes         | MF       | NA         | 1.27                        | 0                                    | 0               |
| 104       | 104              | No              | 11                           | No          | SF       | High       | 1.08                        | 73                                   | 131             |
| 105       | 104              | No              | 11                           | No          | SF       | Low        | 1.08                        | 327                                  | 470             |
| 107       | 104              | No              | 11                           | Yes         | SF       | NA         | 1.08                        | 0                                    | 93              |
| 126       | 104              | Yes             | 11                           | No          | SF       | High       | 1.08                        | 66                                   | 139             |
| 127       | 104              | Yes             | 11                           | No          | SF       | Low        | 1.08                        | 318                                  | 574             |
| 129       | 104              | Yes             | 11                           | Yes         | SF       | NA         | 1.08                        | 0                                    | 210             |

Source: 2019 California Residential Appliance Saturation Survey

**Table 8: SCE Calibration Ratios — Gas**

| Strata ID | Collapsed Strata | Email Available | CEC Forecasting Climate Zone | Net Metered | Dwelling | Annual kWh | Gas Calibration Factor | Responses Used in Calibration Factor | Total Responses |
|-----------|------------------|-----------------|------------------------------|-------------|----------|------------|------------------------|--------------------------------------|-----------------|
| 081       | 81               | No              | 7                            | No          | MF       | High       | 1.17                   | 119                                  | 171             |
| 082       | 81               | No              | 7                            | No          | MF       | Low        | 1.17                   | 131                                  | 205             |
| 083       | 81               | No              | 7                            | No          | MF       | Middle     | 1.17                   | 271                                  | 388             |
| 087       | 81               | No              | 7                            | Yes         | MF       | NA         | 1.17                   | 3                                    | 3               |
| 108       | 81               | Yes             | 7                            | No          | MF       | High       | 1.17                   | 94                                   | 149             |
| 109       | 81               | Yes             | 7                            | No          | MF       | Low        | 1.17                   | 343                                  | 573             |
| 113       | 81               | Yes             | 7                            | Yes         | MF       | NA         | 1.17                   | 3                                    | 3               |
| 084       | 84               | No              | 7                            | No          | SF       | High       | 1.11                   | 404                                  | 490             |
| 085       | 84               | No              | 7                            | No          | SF       | Low        | 1.11                   | 452                                  | 581             |
| 086       | 84               | No              | 7                            | No          | SF       | Middle     | 1.11                   | 1,025                                | 1,243           |
| 088       | 84               | No              | 7                            | Yes         | SF       | NA         | 1.11                   | 152                                  | 189             |
| 110       | 84               | Yes             | 7                            | No          | SF       | High       | 1.11                   | 368                                  | 501             |
| 111       | 84               | Yes             | 7                            | No          | SF       | Low        | 1.11                   | 467                                  | 681             |
| 112       | 84               | Yes             | 7                            | No          | SF       | Middle     | 1.11                   | 840                                  | 1,155           |
| 114       | 84               | Yes             | 7                            | Yes         | SF       | NA         | 1.11                   | 291                                  | 402             |
| 089       | 89               | No              | 8                            | No          | MF       | NA         | 1.35                   | 62                                   | 81              |
| 092       | 89               | No              | 8                            | Yes         | MF       | NA         | 1.35                   | 0                                    | 0               |
| 115       | 89               | Yes             | 8                            | No          | MF       | NA         | 1.35                   | 42                                   | 66              |
| 090       | 90               | No              | 8                            | No          | SF       | High       | 1.15                   | 70                                   | 91              |
| 091       | 90               | No              | 8                            | No          | SF       | Low        | 1.15                   | 275                                  | 326             |
| 093       | 90               | No              | 8                            | Yes         | SF       | NA         | 1.15                   | 47                                   | 53              |
| 116       | 90               | Yes             | 8                            | No          | SF       | NA         | 1.15                   | 312                                  | 416             |
| 117       | 90               | Yes             | 8                            | Yes         | SF       | NA         | 1.15                   | 67                                   | 88              |
| 094       | 94               | No              | 9                            | No          | MF       | NA         | 1.25                   | 28                                   | 36              |
| 118       | 94               | Yes             | 9                            | No          | MF       | NA         | 1.25                   | 15                                   | 24              |
| 095       | 95               | No              | 9                            | No          | SF       | High       | 1.17                   | 33                                   | 42              |
| 096       | 95               | No              | 9                            | No          | SF       | Low        | 1.17                   | 140                                  | 177             |
| 097       | 95               | No              | 9                            | Yes         | SF       | NA         | 1.17                   | 25                                   | 31              |
| 119       | 95               | Yes             | 9                            | No          | SF       | NA         | 1.17                   | 152                                  | 210             |
| 120       | 95               | Yes             | 9                            | Yes         | SF       | NA         | 1.17                   | 41                                   | 52              |
| 098       | 98               | No              | 10                           | No          | MF       | NA         | 0.94                   | 67                                   | 99              |
| 121       | 98               | Yes             | 10                           | No          | MF       | NA         | 0.94                   | 57                                   | 87              |
| 099       | 99               | No              | 10                           | No          | SF       | High       | 1.00                   | 59                                   | 89              |
| 100       | 99               | No              | 10                           | No          | SF       | Low        | 1.00                   | 68                                   | 124             |
| 101       | 99               | No              | 10                           | No          | SF       | Middle     | 1.00                   | 155                                  | 239             |
| 102       | 99               | No              | 10                           | Yes         | SF       | NA         | 1.00                   | 42                                   | 60              |
| 122       | 99               | Yes             | 10                           | No          | SF       | High       | 1.00                   | 69                                   | 109             |
| 123       | 99               | Yes             | 10                           | No          | SF       | Low        | 1.00                   | 267                                  | 458             |
| 124       | 99               | Yes             | 10                           | Yes         | SF       | NA         | 1.00                   | 70                                   | 113             |
| 103       | 103              | No              | 11                           | No          | MF       | NA         | 0.95                   | 41                                   | 54              |
| 106       | 103              | No              | 11                           | Yes         | MF       | NA         | 0.95                   | 1                                    | 1               |
| 125       | 103              | Yes             | 11                           | No          | MF       | NA         | 0.95                   | 45                                   | 67              |
| 128       | 103              | Yes             | 11                           | Yes         | MF       | NA         | 0.95                   | 0                                    | 0               |
| 104       | 104              | No              | 11                           | No          | SF       | High       | 1.00                   | 80                                   | 114             |
| 105       | 104              | No              | 11                           | No          | SF       | Low        | 1.00                   | 332                                  | 421             |
| 107       | 104              | No              | 11                           | Yes         | SF       | NA         | 1.00                   | 72                                   | 86              |
| 126       | 104              | Yes             | 11                           | No          | SF       | High       | 1.00                   | 71                                   | 107             |
| 127       | 104              | Yes             | 11                           | No          | SF       | Low        | 1.00                   | 340                                  | 517             |
| 129       | 104              | Yes             | 11                           | Yes         | SF       | NA         | 1.00                   | 131                                  | 185             |

Source: 2019 California Residential Appliance Saturation Survey

**Table 9: SMUD Calibration Ratios - Electric**

| Strata ID | Collapsed Strata | Email Available | CEC Forecasting Climate Zone | Net Metered | Dwelling | Annual kWh | Electric Calibration Factor | Responses Used in Calibration Factor | Total Responses |
|-----------|------------------|-----------------|------------------------------|-------------|----------|------------|-----------------------------|--------------------------------------|-----------------|
| 143       | 143              | No              | 13                           | No          | MF       | NA         | 1.28                        | 58                                   | 96              |
| 147       | 143              | Yes             | 13                           | No          | MF       | NA         | 1.28                        | 115                                  | 256             |
| 150       | 143              | Yes             | 13                           | Yes         | MF       | NA         | 1.28                        | 0                                    | 1               |
| 144       | 144              | No              | 13                           | No          | SF       | High       | 1.22                        | 69                                   | 95              |
| 145       | 144              | No              | 13                           | No          | SF       | Low        | 1.22                        | 276                                  | 395             |
| 146       | 144              | No              | 13                           | Yes         | SF       | NA         | 1.22                        | 0                                    | 12              |
| 148       | 144              | Yes             | 13                           | No          | SF       | High       | 1.22                        | 142                                  | 275             |
| 149       | 144              | Yes             | 13                           | No          | SF       | Low        | 1.22                        | 602                                  | 1,123           |
| 151       | 144              | Yes             | 13                           | Yes         | SF       | NA         | 1.22                        | 0                                    | 113             |

Source: 2019 California Residential Appliance Saturation Survey

**Table 10: SMUD Calibration Ratios — Gas**

| Strata ID | Collapsed Strata | Email Available | CEC Forecasting Climate Zone | Net Metered | Dwelling | Annual kWh | Gas Calibration Factor | Responses Used in Calibration Factor | Total Responses |
|-----------|------------------|-----------------|------------------------------|-------------|----------|------------|------------------------|--------------------------------------|-----------------|
| 143       | 143              | No              | 13                           | No          | MF       | NA         | 1.31                   | 47                                   | 71              |
| 147       | 143              | Yes             | 13                           | No          | MF       | NA         | 1.31                   | 86                                   | 140             |
| 150       | 143              | Yes             | 13                           | Yes         | MF       | NA         | 1.31                   | 1                                    | 1               |
| 144       | 144              | No              | 13                           | No          | SF       | High       | 1.02                   | 69                                   | 77              |
| 145       | 144              | No              | 13                           | No          | SF       | Low        | 1.02                   | 334                                  | 367             |
| 146       | 144              | No              | 13                           | Yes         | SF       | NA         | 1.02                   | 9                                    | 10              |
| 148       | 144              | Yes             | 13                           | No          | SF       | High       | 1.02                   | 160                                  | 204             |
| 149       | 144              | Yes             | 13                           | No          | SF       | Low        | 1.02                   | 770                                  | 1,020           |
| 151       | 144              | Yes             | 13                           | Yes         | SF       | NA         | 1.02                   | 82                                   | 102             |

Source: 2019 California Residential Appliance Saturation Survey

## Estimated UECs

This section presents electric and natural gas UEC estimates by household segment. Saturations presented in each of the tables were divided by 1,000. While UEC estimates were provided for the following segmentation variables, the discussion that follows focuses primarily on segmentation by residence type.

- Residence type – Single-family homes, townhomes, 2–4-unit apartments, 5+ unit apartments, and mobile homes
- New dwellings (defined as built in 2013 through 2019) and old dwellings (defined as those built before 2013)
- Utility service area
- Weather-sensitive end uses only
- CEC forecasting climate zones along with residence type

UEC estimates based on either low saturations or ones that are reported for small segments or both may not accurately reflect the actual energy usage for the end use. The authors recommend that caution is used when examining UECs from end uses that are the result of fewer than 25 observations and that extreme care is employed if fewer than 10 observations

were used to calculate the end-use UEC for the segment. The number of observations needed to accurately determine the end-use UEC for a segment will be larger for non-weather-sensitive end uses than for space-conditioning and weather-sensitive end uses.

## Estimated Electric UECs

The average annual household electricity consumption was estimated as 6,174 kWh for individually metered households in the study population, based on *2019 RASS* normalized interval data for 39,682 households. This section presents results for the calibrated electric UECs, segment frequencies, and the associated saturations.

- **Table 11** shows estimated UECs by residence type.
- **Table 12** and **Table 13** present estimated UECs by age of dwelling.
- **Table 14** presents estimated UECs by electric utility service area.
- **Table 15** through **Table 17** show weather-sensitive end-use estimated UECs by CEC forecasting climate zone.
- **Table 18** through **Table 32** present estimated UECs for space conditioning end uses by CEC forecasting climate zone and residence type.

## Space Heating

Separate electric space heating UECs were estimated for conventional (resistance) electric space heating and heat-pump space heating.

As presented in **Table 11**, conventional space heating UECs varied from 1,509 kilowatt-hours (kWh) for single-family homes to 582 kWh for apartments in buildings with five or more units. Heat-pump UECs showed similar variation ranging from 1,221 kWh for single-family homes to 461 kWh for apartments in buildings with five or more units. Auxiliary heating UECs varied from 825 kWh for single-family homes to 99 kWh for apartments in buildings with two to four units.

## Ventilation

Furnace fans, used to blow forced hot air from a gas heating system, had estimated UECs that ranged from 159 kWh for single-family homes to 45 kWh for apartments in buildings with five or more units.

## Air Conditioning

Air-conditioning UECs were estimated separately for central air conditioning (CAC), room air conditioning (RAC), and evaporative coolers. Key findings included the following:

Central air conditioning — UECs were higher than the *2009 RASS*, ranging from 1,372 kWh for single-family homes to 594 kWh for apartments in buildings with five or more units.

Room air conditioning — The average room air conditioning UEC for single-family homes was 828 kWh, and mobile homes were 1,026 kWh.

Evaporative cooling — UECs ranged from 1,488 kWh for mobile homes to 453 kWh for apartments in buildings with five or more units.

## **Water Heating**

Water heating UECs were estimated for conventional electric water heating and solar water heat with electric backup. For conventional water heat, UECs ranged from a high of 2,539 kWh for single-family homes to 1,153 kWh for townhomes.

The UEC for solar water heating with electric backup for single-family homes was roughly half of conventional water heating at 1,297 kWh. Solar water heating was also estimated for townhomes, but not for either type of apartment buildings or mobile-home residences types. Solar water heat UECs were reported with extreme caution, due to the relatively low saturations.

## **Dishwashers, Clothes Washers, and Dryers**

Dishwasher UECs range from 93 kWh for single-family homes to 51 kWh for mobile homes. Clothes washer UECs reflected only the consumption attributed to the motor loads, as water heating for clothes washers was captured by the water heating UECs. The estimated UECs for clothes washers ranged from 94 kWh for single-family homes to 62 kWh for apartments in buildings with five or more units. Electric dryer UECs ranged from 552 kWh to 354 kWh across residence types.

## **Refrigerators and Freezers**

UECs for first refrigerators ranged from 1,209 kWh for single-family homes to 968 kWh for apartments in buildings with five or more units. Meanwhile, UEC estimates for second refrigerators (which reflect the usage of all secondary units) showed considerable variation by residence type. Estimates for second refrigerators for single-family and mobile homes were 1,161 kWh and 1,110 kWh, respectively. Townhomes and the two types of apartments had estimated UECs for second refrigerators of 641 kWh and 566/565 kWh, respectively.

Freezer UECs ranged between 853 and 760 kWh.

## **Pools and Spas**

The estimated pool pump UEC was 2,895 kWh for single-family homes, with some variation by utility. Pool pumps reported the highest UEC for SMUD territory at 3,468 kWh, followed by SCE at 2,939 kWh and LADWP at 2,898. SDG&E and PG&E territories had the lowest estimated pool pump UECs at 2,723 and 2,775, respectively.

Spa UECs were estimated separately for filter pumps and spa heat. The estimated UEC for spa filter pumps ranged from 322 kWh for single-family homes to 106 for mobile homes. Spa heating UECs were much higher, ranging from 1,032 kWh for single-family homes to 683 kWh for townhomes to 679 kWh for mobile homes. The research team estimated both spa UECs for mobile homes using a small sample. Caution should be used when interpreting this UECs estimate.

## **Outdoor Lighting**

The estimated UECs for outdoor lighting for single-family homes was 251 kWh, which was lower compared to an estimate of 388 kWh from the *2009 RASS*. The estimated outdoor lighting UEC for townhomes of 156 kWh was also lower than the 2009 estimate of 210 kWh. The outdoor lighting UEC estimates for the remaining three residence types were all lower than the 2009 estimates at 144 kWh, 116 kWh, and 164 kWh for small and larger apartment

buildings and mobile homes, respectively. The 2009 estimates for these residence types were 168 kWh, 196 kWh, and 204 kWh, respectively.

### **Cooking**

The electric range/oven UECs varied from 404 kWh for single-family homes to 256 kWh for larger apartment buildings.

### **Televisions**

Television UECs were lower than in the *2009 RASS*. Estimates presented in **Table 11** show that television UECs ranged from 483 kWh for single-family homes to 389 kWh for apartments in buildings with five or more units. These estimates compare to 2009 estimates of 738 kWh and 611 kWh, respectively.

### **Personal Computers and Home Offices**

Personal computer (PC) UECs decreased dramatically from the *2009 RASS* for all residence types. The average UEC for PCs in the current study ranged from 298 kWh for single-family homes to 180 kWh for mobile homes. Homeoffice UECs also decreased across all residence types, ranging from 53 kWh for single-family homes down to 24 kWh for mobile homes.

### **Well Pumps**

The estimated UECs for well pumps for single-family homes, townhomes, and mobile homes were 1,358 kWh, 1,329 kWh, and 1,121 kWh respectively. UECs were also estimated for small and large multifamily homes, 1,031 kWh and 1,474 kWh, respectively. The multifamily estimates are based on small sample sizes, may reflect usage of more than one unit, and should be treated with caution.

### **Electric Vehicles**

The team estimated electric vehicle UECs for households with EV charging the first time in this year's study. The average EV charging UEC ranged from 1,062 kWh for single-family homes to 599 kWh for apartments in buildings with two to four units. Caution should be used with the UECs that are based on small sample sizes, such as with mobile homes.

### **Miscellaneous**

Estimates for the miscellaneous UEC ranged from 2,099 kWh for single-family homes to 1,150 kWh for apartments in buildings with five or more units. These estimates compare to estimates from the *2009 RASS* that ranged from 2,177 kWh for single-family homes to 1,141 kWh for larger apartment buildings.

**Table 11: Electric UECs by Residence Type**

|                          | Single Family UEC | Single Family Saturation | Townhome UEC | Townhome Saturation | 2-4 Unit Apt. UEC | 2-4 Unit Apt. Saturation | 5+ Unit Apt. UEC | 5+ Unit Apt. Saturation | Mobile Home UEC | Mobile Home Saturation |
|--------------------------|-------------------|--------------------------|--------------|---------------------|-------------------|--------------------------|------------------|-------------------------|-----------------|------------------------|
| All Household            | 7,553             | 26,263 homes             | 4,691        | 3,297 homes         | 4,139             | 2,723 homes              | 3,670            | 6,563 homes             | 5,798           | 836 homes              |
| Conv. Heat               | 1,509             | 0.10                     | 951          | 0.18                | 592               | 0.24                     | 582              | 0.26                    | 1,193           | 0.06                   |
| Heat Pump                | 1,221             | 0.03                     | 593          | 0.03                | 559               | 0.05                     | 461              | 0.09                    | 980             | 0.01                   |
| Aux. Heat                | 825               | 0.08                     | 226          | 0.08                | 99                | 0.06                     | 113              | 0.06                    | 528             | 0.06                   |
| Furnace Fan              | 159               | 0.76                     | 66           | 0.58                | 59                | 0.43                     | 45               | 0.39                    | 116             | 0.63                   |
| Attic Ceiling Fan        | 133               | 0.03                     | 129          | 0.01                | 285               | 0.01                     | 185              | 0.01                    | 442             | 0.03                   |
| Central Air Conditioning | 1,372             | 0.66                     | 735          | 0.51                | 911               | 0.44                     | 594              | 0.48                    | 1,246           | 0.53                   |
| Room AC                  | 828               | 0.14                     | 435          | 0.18                | 430               | 0.20                     | 289              | 0.21                    | 1,026           | 0.29                   |
| Evap. Cooler             | 1,001             | 0.12                     | 518          | 0.08                | 553               | 0.09                     | 453              | 0.06                    | 1,488           | 0.27                   |
| Water Heat               | 2,539             | 0.04                     | 1,153        | 0.05                | 1,196             | 0.07                     | 1,163            | 0.10                    | 2,107           | 0.05                   |
| Solar Water Heat         | 1,297             | 0.00                     | 1,258        | 0.00                | .                 | 0.00                     | .                | 0.00                    | .               | 0.00                   |
| Dryer                    | 552               | 0.35                     | 429          | 0.38                | 430               | 0.23                     | 354              | 0.21                    | 478             | 0.40                   |
| Clothes Washer           | 94                | 0.94                     | 82           | 0.83                | 79                | 0.51                     | 62               | 0.36                    | 73              | 0.92                   |
| Dishwasher               | 93                | 0.74                     | 79           | 0.64                | 69                | 0.48                     | 63               | 0.56                    | 51              | 0.53                   |
| First Refrigerator       | 1,209             | 1.00                     | 1,109        | 1.00                | 1,002             | 1.00                     | 968              | 1.00                    | 1,034           | 1.00                   |
| Second Refrigerator      | 1,161             | 0.38                     | 641          | 0.21                | 566               | 0.09                     | 565              | 0.05                    | 1,110           | 0.20                   |
| Freezer                  | 853               | 0.23                     | 799          | 0.11                | 760               | 0.10                     | 782              | 0.05                    | 818             | 0.30                   |
| Pool Pump                | 2,895             | 0.15                     | .            | 0.00                | .                 | 0.00                     | .                | 0.00                    | .               | 0.00                   |
| Spa                      | 322               | 0.13                     | 129          | 0.03                | .                 | 0.00                     | .                | 0.00                    | 106             | 0.04                   |
| Outdoor Lighting         | 251               | 0.76                     | 156          | 0.56                | 144               | 0.38                     | 116              | 0.25                    | 164             | 0.53                   |
| Range/Oven               | 404               | 0.43                     | 359          | 0.46                | 294               | 0.52                     | 256              | 0.59                    | 269             | 0.31                   |
| TV                       | 483               | 0.66                     | 471          | 0.62                | 425               | 0.68                     | 389              | 0.57                    | 571             | 0.68                   |
| Spa Electric Heat        | 1,032             | 0.06                     | 683          | 0.02                | .                 | 0.00                     | .                | 0.00                    | 679             | 0.03                   |
| Microwave                | 157               | 0.90                     | 141          | 0.84                | 145               | 0.82                     | 131              | 0.81                    | 136             | 0.91                   |
| Home Office              | 53                | 0.19                     | 49           | 0.14                | 51                | 0.13                     | 44               | 0.13                    | 24              | 0.06                   |
| PC                       | 298               | 0.86                     | 250          | 0.83                | 217               | 0.75                     | 227              | 0.74                    | 180             | 0.68                   |
| Well Pump                | 1,358             | 0.05                     | 1,329        | 0.00                | 1,031             | 0.01                     | 1,474            | 0.01                    | 1,121           | 0.10                   |
| Elec Vehicle             | 1,062             | 0.06                     | 690          | 0.06                | 599               | 0.04                     | 734              | 0.04                    | 901             | 0.01                   |
| Miscellaneous            | 2,099             | 1.00                     | 1,494        | 1.00                | 1,290             | 1.00                     | 1,150            | 1.00                    | 1,473           | 1.00                   |

Note: Apt. = apartment

Source: 2019 California Residential Appliance Saturation Survey

**Table 12: Electric UECs by Home Age**

|                          | <b>New Dwelling UEC</b> | <b>New Dwelling Saturation</b> | <b>Old Dwelling UEC</b> | <b>Old Dwelling Saturation</b> |
|--------------------------|-------------------------|--------------------------------|-------------------------|--------------------------------|
| All Household            | 6,292                   | 2,399 homes                    | 6,166                   | 37,283 homes                   |
| Conv. Heat               | 955                     | 0.19                           | 952                     | 0.15                           |
| Heat Pump                | 806                     | 0.08                           | 763                     | 0.04                           |
| Aux. Heat                | 101                     | 0.03                           | 512                     | 0.08                           |
| Furnace Fan              | 150                     | 0.75                           | 129                     | 0.63                           |
| Attic Ceiling Fan        | 119                     | 0.02                           | 154                     | 0.02                           |
| Central Air Conditioning | 1,193                   | 0.85                           | 1,160                   | 0.57                           |
| Room AC                  | 561                     | 0.10                           | 622                     | 0.17                           |
| Evaporative Cooler       | 938                     | 0.11                           | 887                     | 0.10                           |
| Water Heat               | 1,963                   | 0.03                           | 1,787                   | 0.06                           |
| Solar Water Heat         | 1,226                   | 0.00                           | 1,300                   | 0.00                           |
| Dryer                    | 456                     | 0.38                           | 506                     | 0.31                           |
| Clothes Washer           | 85                      | 0.83                           | 89                      | 0.77                           |
| Dishwasher               | 90                      | 0.86                           | 84                      | 0.66                           |
| First Refrigerator       | 1,094                   | 0.99                           | 1,132                   | 1.00                           |
| Second Refrigerator      | 1,049                   | 0.26                           | 1,083                   | 0.27                           |
| Freezer                  | 834                     | 0.12                           | 841                     | 0.18                           |
| Pool Pump                | 2,540                   | 0.07                           | 2,911                   | 0.09                           |
| Spa                      | 347                     | 0.11                           | 311                     | 0.08                           |
| Outdoor Lighting         | 251                     | 0.55                           | 223                     | 0.60                           |
| Range/Oven               | 393                     | 0.46                           | 348                     | 0.47                           |
| TV                       | 499                     | 0.64                           | 459                     | 0.64                           |
| Spa Electric Heat        | 847                     | 0.06                           | 1,031                   | 0.04                           |
| Microwave                | 156                     | 0.91                           | 149                     | 0.87                           |
| Home Office              | 54                      | 0.16                           | 50                      | 0.16                           |
| PC                       | 296                     | 0.88                           | 270                     | 0.82                           |
| Well Pump                | 1,504                   | 0.03                           | 1,339                   | 0.04                           |
| Elec Vehicle             | 1,095                   | 0.09                           | 956                     | 0.05                           |
| Miscellaneous            | 1,550                   | 1.00                           | 1,783                   | 1.00                           |

Source: 2019 California Residential Appliance Saturation Survey

**Table 13: Electric Household UECs by Home Age, Electric Utility, and Residence Type**

|                     | <b>New Dwelling Household UEC</b> | <b>New Dwelling Count of Households</b> | <b>Old Dwelling Household UEC</b> | <b>Old Dwelling Count of Households</b> |
|---------------------|-----------------------------------|---|-----------------------------------|---|
| All                 | 6,292                             | 2,399                                   | 6,166                             | 37,283                                  |
| All PG&E            | 5,742                             | 1,050                                   | 6,304                             | 14,917                                  |
| Single Family PG&E  | 8,247                             | 626                                     | 7,497                             | 10,252                                  |
| Multifamily PG&E    | 4,014                             | 424                                     | 3,968                             | 4,665                                   |
| All SCE             | 7,584                             | 769                                     | 6,360                             | 12,612                                  |
| Single Family SCE   | 8,874                             | 503                                     | 7,510                             | 8,431                                   |
| Multifamily SCE     | 4,369                             | 266                                     | 4,461                             | 4,181                                   |
| All SDG&E           | 5,571                             | 323                                     | 5,203                             | 4,849                                   |
| Single Family SDG&E | 8,794                             | 169                                     | 6,376                             | 3,034                                   |
| Multifamily SDG&E   | 3,359                             | 154                                     | 3,721                             | 1,815                                   |
| All SMUD            | 7,128                             | 149                                     | 8,305                             | 2,217                                   |
| Single Family SMUD  | 8,033                             | 111                                     | 9,621                             | 1,750                                   |
| Multifamily SMUD    | 5,171                             | 38                                      | 5,141                             | 467                                     |
| All LADWP           | 4,826                             | 108                                     | 5,124                             | 2,688                                   |
| Single Family LADWP | 9,786                             | 23                                      | 7,361                             | 1,364                                   |
| Multifamily LADWP   | 3,586                             | 85                                      | 3,822                             | 1,324                                   |

Source: 2019 California Residential Appliance Saturation Survey

**Table 14: Electric UECs by Electric Utility**

|                          | <b>PG&amp;E<br/>UEC</b> | <b>PG&amp;E<br/>Saturation</b> | <b>SCE<br/>UEC</b> | <b>SCE<br/>Saturation</b> | <b>SDG&amp;E<br/>UEC</b> | <b>SDG&amp;E<br/>Saturation</b> | <b>SMUD<br/>UEC</b> | <b>SMUD<br/>Saturation</b> | <b>LADWP<br/>UEC</b> | <b>LADWP<br/>Saturation</b> |
|--------------------------|-------------------------|--------------------------------|--------------------|---------------------------|--------------------------|---------------------------------|---------------------|----------------------------|----------------------|-----------------------------|
| All Household            | 6,266                   | 15,967 homes                   | 6,424              | 13,381 homes              | 5,230                    | 5,172 homes                     | 8,246               | 2,366 homes                | 5,112                | 2,796 homes                 |
| Conv. Heat               | 1,302                   | 0.16                           | 635                | 0.13                      | 541                      | 0.19                            | 1,329               | 0.18                       | 452                  | 0.14                        |
| Heat Pump                | 1,163                   | 0.03                           | 565                | 0.04                      | 433                      | 0.05                            | 1,160               | 0.10                       | 542                  | 0.06                        |
| Aux. Heat                | 655                     | 0.09                           | 123                | 0.06                      | 90                       | 0.06                            | 776                 | 0.08                       | .                    | 0.08                        |
| Furnace Fan              | 171                     | 0.65                           | 101                | 0.67                      | 90                       | 0.61                            | 201                 | 0.79                       | 73                   | 0.46                        |
| Attic Ceiling Fan        | 133                     | 0.02                           | 171                | 0.02                      | 145                      | 0.02                            | 159                 | 0.02                       | 136                  | 0.01                        |
| Central Air Conditioning | 1,132                   | 0.51                           | 1,344              | 0.68                      | 599                      | 0.54                            | 1,194               | 0.89                       | 1,021                | 0.52                        |
| Room AC                  | 682                     | 0.13                           | 665                | 0.18                      | 374                      | 0.15                            | 849                 | 0.07                       | 529                  | 0.29                        |
| Evap. Cooler             | 809                     | 0.10                           | 1,109              | 0.12                      | 525                      | 0.08                            | 801                 | 0.13                       | 587                  | 0.09                        |
| Water Heat               | 2,071                   | 0.07                           | 1,443              | 0.04                      | 1,290                    | 0.06                            | 2,677               | 0.08                       | 1,538                | 0.05                        |
| Solar Water Heat         | 1,325                   | 0.00                           | 916                | 0.00                      | 1,392                    | 0.00                            | 1,396               | 0.00                       | 1,301                | 0.00                        |
| Dryer                    | 511                     | 0.46                           | 491                | 0.20                      | 420                      | 0.24                            | 602                 | 0.59                       | 438                  | 0.17                        |
| Clothes Washer           | 82                      | 0.81                           | 95                 | 0.79                      | 83                       | 0.78                            | 112                 | 0.81                       | 89                   | 0.62                        |
| Dishwasher               | 81                      | 0.69                           | 89                 | 0.67                      | 79                       | 0.72                            | 92                  | 0.76                       | 80                   | 0.51                        |
| First Refrigerator       | 1,121                   | 1.00                           | 1,145              | 1.00                      | 1,044                    | 1.00                            | 1,398               | 0.99                       | 1,083                | 1.00                        |
| Second Refrigerator      | 1,080                   | 0.27                           | 1,093              | 0.30                      | 922                      | 0.26                            | 1,442               | 0.24                       | 1,062                | 0.20                        |
| Freezer                  | 858                     | 0.20                           | 836                | 0.16                      | 722                      | 0.14                            | 950                 | 0.22                       | 798                  | 0.10                        |
| Pool Pump                | 2,775                   | 0.08                           | 2,939              | 0.11                      | 2,723                    | 0.08                            | 3,468               | 0.14                       | 2,898                | 0.07                        |
| Spa                      | 319                     | 0.07                           | 314                | 0.10                      | 332                      | 0.11                            | 305                 | 0.09                       | 243                  | 0.04                        |
| Outdoor Lighting         | 214                     | 0.62                           | 229                | 0.61                      | 225                      | 0.62                            | 275                 | 0.67                       | 219                  | 0.46                        |
| Range/Oven               | 344                     | 0.58                           | 359                | 0.37                      | 335                      | 0.52                            | 433                 | 0.58                       | 328                  | 0.36                        |
| TV                       | 442                     | 0.63                           | 508                | 0.64                      | 397                      | 0.64                            | 543                 | 0.66                       | 404                  | 0.65                        |
| Spa Electric Heat        | 1,102                   | 0.05                           | 911                | 0.03                      | 985                      | 0.05                            | 1,023               | 0.05                       | 822                  | 0.02                        |
| Microwave                | 145                     | 0.87                           | 155                | 0.87                      | 139                      | 0.90                            | 174                 | 0.91                       | 146                  | 0.82                        |
| Home Office              | 47                      | 0.16                           | 50                 | 0.15                      | 55                       | 0.19                            | 59                  | 0.17                       | 54                   | 0.19                        |
| PC                       | 274                     | 0.81                           | 269                | 0.83                      | 268                      | 0.86                            | 308                 | 0.79                       | 268                  | 0.80                        |
| Well Pump                | 1,321                   | 0.07                           | 1,418              | 0.02                      | 1,101                    | 0.02                            | 1,776               | 0.01                       | 1,828                | 0.01                        |
| Elec Vehicle             | 929                     | 0.06                           | 1,142              | 0.06                      | 772                      | 0.06                            | 1,632               | 0.02                       | 719                  | 0.06                        |
| Miscellaneous            | 1,772                   | 1.00                           | 1,804              | 1.00                      | 1,700                    | 1.00                            | 2,097               | 1.00                       | 1,582                | 1.00                        |

Source: 2019 California Residential Appliance Saturation Survey

**Table 15: Electric UECs for Weather-Sensitive End Uses in Forecasting Climate Zones 1-6**

|                          | Zone 1 UEC | Zone 1 Saturation | Zone 2 UEC | Zone 2 Saturation | Zone 3 UEC | Zone 3 Saturation | Zone 4 UEC | Zone 4 Saturation | Zone 5 UEC | Zone 5 Saturation | Zone 6 UEC | Zone 6 Saturation |
|--------------------------|------------|-------------------|------------|-------------------|------------|-------------------|------------|-------------------|------------|-------------------|------------|-------------------|
| All Household            | 4,987      | 7,161 homes       | 6,346      | 2,015 homes       | 8,339      | 595 homes         | 7,793      | 2,948 homes       | 8,154      | 1712 homes        | 5,720      | 1,536 homes       |
| Conv. Heat               | 880        | 0.16              | 1,518      | 0.18              | 1,371      | 0.11              | 1,962      | 0.14              | 1,353      | 0.15              | 1,498      | 0.18              |
| Heat Pump                | 773        | 0.02              | 1,441      | 0.03              | 1,283      | 0.02              | 1,515      | 0.05              | 1,076      | 0.03              | 1,462      | 0.01              |
| Aux. Heat                | 224        | 0.10              | 566        | 0.06              | 545        | 0.06              | 1,160      | 0.06              | 497        | 0.09              | 776        | 0.10              |
| Furnace Fan              | 148        | 0.62              | 222        | 0.64              | 171        | 0.82              | 207        | 0.73              | 146        | 0.69              | 186        | 0.59              |
| Attic Ceiling Fan        | 77         | 0.01              | 29         | 0.02              | 104        | 0.09              | 84         | 0.01              | 357        | 0.03              | 55         | 0.00              |
| Central Air Conditioning | 539        | 0.40              | 412        | 0.35              | 2,083      | 0.82              | 1,134      | 0.77              | 2,186      | 0.74              | 836        | 0.19              |
| Room AC                  | 268        | 0.12              | 256        | 0.14              | 1,331      | 0.19              | 723        | 0.15              | 1,515      | 0.20              | 346        | 0.05              |
| Evaporative Cooler       | 337        | 0.07              | 261        | 0.07              | 1,180      | 0.12              | 869        | 0.15              | 1,488      | 0.18              | 181        | 0.03              |
| Water Heat               | 1,142      | 0.03              | 1,794      | 0.14              | 2,469      | 0.09              | 2,579      | 0.12              | 2,273      | 0.04              | 2,356      | 0.11              |
| Solar Water Heat         | 1,275      | 0.00              | 1,243      | 0.00              | 1,877      | 0.00              | 1,161      | 0.00              | 1,906      | 0.00              | 1,156      | 0.00              |

Source: 2019 California Residential Appliance Saturation Survey

**Table 16: Electric UECs for Weather-Sensitive End Uses in Forecasting Climate Zones 7-12**

|                          | Zone 7 UEC | Zone 7 Saturation | Zone 8 UEC | Zone 8 Saturation | Zone 9 UEC | Zone 9 Saturation | Zone 10 UEC | Zone 10 Saturation | Zone 11 UEC | Zone 11 Saturation | Zone 12 UEC | Zone 12 Saturation |
|--------------------------|------------|-------------------|------------|-------------------|------------|-------------------|-------------|--------------------|-------------|--------------------|-------------|--------------------|
| All Household            | 5,669      | 7,839 homes       | 5,740      | 1,279 homes       | 7,828      | 764 homes         | 7,177       | 1,724 homes        | 8,882       | 1,775 homes        | 5,230       | 5,172 homes        |
| Conv. Heat               | 552        | 0.16              | 566        | 0.12              | 1,480      | 0.10              | 707         | 0.10               | 1,049       | 0.09               | 541         | 0.19               |
| Heat Pump                | 455        | 0.04              | 604        | 0.01              | 1,383      | 0.05              | 574         | 0.03               | 746         | 0.03               | 433         | 0.05               |
| Aux. Heat                | 133        | 0.06              | 283        | 0.07              | 332        | 0.05              | 75          | 0.08               | 139         | 0.06               | 90          | 0.06               |
| Furnace Fan              | 82         | 0.60              | 92         | 0.72              | 200        | 0.72              | 106         | 0.74               | 126         | 0.84               | 90          | 0.61               |
| Attic Ceiling Fan        | 165        | 0.03              | 116        | 0.02              | 443        | 0.01              | 143         | 0.03               | 280         | 0.01               | 145         | 0.02               |
| Central Air Conditioning | 979        | 0.60              | 914        | 0.57              | 1,807      | 0.70              | 1,519       | 0.83               | 2,296       | 0.90               | 599         | 0.54               |
| Room AC                  | 534        | 0.22              | 399        | 0.10              | 1,447      | 0.17              | 1,039       | 0.13               | 1,097       | 0.10               | 374         | 0.15               |
| Evap. Cooler             | 722        | 0.10              | 505        | 0.05              | 1,287      | 0.20              | 1,335       | 0.20               | 2,081       | 0.13               | 525         | 0.08               |
| Water Heat               | 1,198      | 0.05              | 1,192      | 0.04              | 2,401      | 0.07              | 2,010       | 0.02               | 1,992       | 0.04               | 1,290       | 0.06               |
| Solar Water Heat         | 836        | 0.00              | .          | 0.00              | 1,385      | 0.00              | 739         | 0.00               | .           | 0.00               | 1,392       | 0.00               |

Source: 2019 California Residential Appliance Saturation Survey

**Table 17: Electric UECs for Weather-Sensitive End Uses in Forecasting Climate Zones 13, 16, and 17**

|                          | <b>Zone 13<br/>UEC</b> | <b>Zone 13<br/>Saturation</b> | <b>Zone 16<br/>UEC</b> | <b>Zone 16<br/>Saturation</b> | <b>Zone 17<br/>UEC</b> | <b>Zone 17<br/>Saturation</b> |
|--------------------------|------------------------|-------------------------------|------------------------|-------------------------------|------------------------|-------------------------------|
| All Household            | 8,246                  | 2,366 homes                   | 4,768                  | 1,785 homes                   | 5,840                  | 1,011 homes                   |
| Conv. Heat               | 1,329                  | 0.18                          | 513                    | 0.13                          | 364                    | 0.14                          |
| Heat Pump                | 1,160                  | 0.10                          | 460                    | 0.05                          | 658                    | 0.07                          |
| Aux. Heat                | 776                    | 0.08                          | .                      | 0.06                          | .                      | 0.10                          |
| Furnace Fan              | 201                    | 0.79                          | 70                     | 0.41                          | 78                     | 0.58                          |
| Attic Ceiling Fan        | 159                    | 0.02                          | 98                     | 0.01                          | 161                    | 0.03                          |
| Central Air Conditioning | 1,194                  | 0.89                          | 887                    | 0.42                          | 1,183                  | 0.73                          |
| Room AC                  | 849                    | 0.07                          | 435                    | 0.27                          | 689                    | 0.34                          |
| Evap. Cooler             | 801                    | 0.13                          | 511                    | 0.09                          | 779                    | 0.08                          |
| Water Heat               | 2,677                  | 0.08                          | 1,556                  | 0.04                          | 1,510                  | 0.06                          |
| Solar Water Heat         | 1,396                  | 0.00                          | 1,301                  | 0.00                          | .                      | 0.00                          |

Source: 2019 California Residential Appliance Saturation Survey

**Table 18: Space Conditioning Electric UECs for Single-Family Homes in Forecasting Climate Zones 1-6**

| <b>Single-Family</b>     | <b>Zone 1<br/>UEC</b> | <b>Zone 1<br/>Saturation</b> | <b>Zone 2<br/>UEC</b> | <b>Zone 2<br/>Saturation</b> | <b>Zone 3<br/>UEC</b> | <b>Zone 3<br/>Saturation</b> | <b>Zone 4<br/>UEC</b> | <b>Zone 4<br/>Saturation</b> | <b>Zone 5<br/>UEC</b> | <b>Zone 5<br/>Saturation</b> | <b>Zone 6<br/>UEC</b> | <b>Zone 6<br/>Saturation</b> |
|--------------------------|-----------------------|------------------------------|-----------------------|------------------------------|-----------------------|------------------------------|-----------------------|------------------------------|-----------------------|------------------------------|-----------------------|------------------------------|
| All Household            | 6,313                 | 4,277 homes                  | 7,465                 | 1,427 homes                  | 9,441                 | 426 homes                    | 8,489                 | 2,377 homes                  | 9,098                 | 1,259 homes                  | 6,407                 | 1,112 homes                  |
| Conv. Heat               | 1,455                 | 0.10                         | 2,102                 | 0.16                         | 1,607                 | 0.11                         | 2,149                 | 0.13                         | 1,571                 | 0.13                         | 1,569                 | 0.15                         |
| Heat Pump                | 1,302                 | 0.00                         | 1,589                 | 0.03                         | 1,503                 | 0.02                         | 2,057                 | 0.04                         | 1,589                 | 0.02                         | 1,578                 | 0.02                         |
| Aux. Heat                | 366                   | 0.12                         | 785                   | 0.05                         | 822                   | 0.02                         | 1,213                 | 0.05                         | 558                   | 0.11                         | 807                   | 0.12                         |
| Central Air Conditioning | 644                   | 0.51                         | 488                   | 0.35                         | 2,312                 | 0.89                         | 1,217                 | 0.78                         | 2,378                 | 0.74                         | 1,004                 | 0.19                         |
| Room AC                  | 397                   | 0.10                         | 326                   | 0.13                         | 1,790                 | 0.08                         | 816                   | 0.14                         | 1,658                 | 0.21                         | 382                   | 0.06                         |

Source: 2019 California Residential Appliance Saturation Survey

**Table 19: Space Conditioning Electric UECs for Single-Family Homes in Forecasting Climate Zones 7-12**

| Single-Family            | Zone 7 UEC | Zone 7 Saturation | Zone 8 UEC | Zone 8 Saturation | Zone 9 UEC | Zone 9 Saturation | Zone 10 UEC | Zone 10 Saturation | Zone 11 UEC | Zone 11 Saturation | Zone 12 UEC | Zone 12 Saturation |
|--------------------------|------------|-------------------|------------|-------------------|------------|-------------------|-------------|--------------------|-------------|--------------------|-------------|--------------------|
| All Household            | 6,900      | 4,807 homes       | 6,494      | 900 homes         | 9,079      | 602 homes         | 8,019       | 1,311 homes        | 9,605       | 1,314 homes        | 6,508       | 3,203 homes        |
| Conv. Heat               | 824        | 0.09              | 983        | 0.04              | 2,024      | 0.08              | 935         | 0.07               | 1,244       | 0.06               | 1,291       | 0.09               |
| Heat Pump                | 619        | 0.03              | 711        | 0.01              | 1,737      | 0.04              | 855         | 0.02               | 1,081       | 0.02               | 734         | 0.03               |
| Aux. Heat                | 398        | 0.07              | 523        | 0.09              | 667        | 0.06              | 137         | 0.09               | 143         | 0.04               | 243         | 0.08               |
| Central Air Conditioning | 1,174      | 0.67              | 987        | 0.57              | 1,937      | 0.80              | 1,674       | 0.86               | 2,380       | 0.93               | 757         | 0.61               |
| Room AC                  | 731        | 0.19              | 406        | 0.13              | 1,829      | 0.15              | 1,143       | 0.13               | 946         | 0.07               | 493         | 0.16               |

Source: 2019 California Residential Appliance Saturation Survey

**Table 20: Space Conditioning Electric UECs for Single-Family Homes in Forecasting Climate Zones 13, 16, and 17**

| Single-Family            | Zone 13 UEC | Zone 13 Saturation | Zone 16 UEC | Zone 16 Saturation | Zone 17 UEC | Zone 17 Saturation |
|--------------------------|-------------|--------------------|-------------|--------------------|-------------|--------------------|
| All Household            | 9,545       | 1,861 homes        | 6,846       | 788 homes          | 8,439       | 599 homes          |
| Conv. Heat               | 1,627       | 0.15               | 923         | 0.07               | 964         | 0.06               |
| Heat Pump                | 1,519       | 0.07               | 700         | 0.02               | 1,152       | 0.08               |
| Aux. Heat                | 861         | 0.07               | .           | 0.09               | .           | 0.08               |
| Central Air Conditioning | 1,382       | 0.93               | 1,398       | 0.53               | 1,705       | 0.83               |
| Room AC                  | 1,056       | 0.06               | 645         | 0.21               | 1,285       | 0.24               |

Source: 2019 California Residential Appliance Saturation Survey

**Table 21: Space Conditioning Electric UECs for Townhomes in Forecasting Climate Zones 1-6**

| Townhome                 | Zone 1 UEC | Zone 1 Saturation | Zone 2 UEC | Zone 2 Saturation | Zone 3 UEC | Zone 3 Saturation | Zone 4 UEC | Zone 4 Saturation | Zone 5 UEC | Zone 5 Saturation | Zone 6 UEC | Zone 6 Saturation |
|--------------------------|------------|-------------------|------------|-------------------|------------|-------------------|------------|-------------------|------------|-------------------|------------|-------------------|
| All Household            | 4,328      | 777 homes         | 4,137      | 171 homes         | 5,114      | 25 homes          | 5,091      | 121 homes         | 5,233      | 56 homes          | 3,863      | 113 homes         |
| Conv. Heat               | 1,564      | 0.14              | 924        | 0.32              | 3,358      | 0.08              | 927        | 0.03              | 979        | 0.54              | 1,504      | 0.36              |
| Heat Pump                | 549        | 0.03              | 1,005      | 0.01              | 706        | 0.05              | 630        | 0.01              | 608        | 0.01              | 776        | 0.00              |
| Aux. Heat                | 160        | 0.15              | 189        | 0.11              | 504        | 0.22              | 192        | 0.02              | .          | 0.02              | 243        | 0.03              |
| Central Air Conditioning | 430        | 0.29              | 266        | 0.42              | 1,397      | 0.38              | 775        | 0.88              | 1,251      | 0.81              | 411        | 0.27              |
| Room AC                  | 112        | 0.11              | 179        | 0.11              | 764        | 0.18              | 338        | 0.24              | 916        | 0.05              | 167        | 0.03              |

Source: 2019 California Residential Appliance Saturation Survey

**Table 22: Space Conditioning Electric UECs and Saturations for Townhomes in Forecasting Climate Zones 7-12**

| Townhome                 | Zone 7 UEC | Zone 7 Saturation | Zone 8 UEC | Zone 8 Saturation | Zone 9 UEC | Zone 9 Saturation | Zone 10 UEC | Zone 10 Saturation | Zone 11 UEC | Zone 11 Saturation | Zone 12 UEC | Zone 12 Saturation |
|--------------------------|------------|-------------------|------------|-------------------|------------|-------------------|-------------|--------------------|-------------|--------------------|-------------|--------------------|
| All Household            | 5,079      | 756 homes         | 5,068      | 132 homes         | 5,679      | 30 homes          | 5,192       | 87 homes           | 8,262       | 75 homes           | 4,300       | 528 homes          |
| Conv. Heat               | 452        | 0.21              | 796        | 0.16              | 1,468      | 0.40              | 634         | 0.12               | 809         | 0.04               | 728         | 0.21               |
| Heat Pump                | 386        | 0.02              | 745        | 0.01              | 488        | 0.04              | 787         | 0.06               | 861         | 0.01               | 323         | 0.06               |
| Aux. Heat                | 130        | 0.09              | 102        | 0.02              | .          | 0.06              | .           | 0.04               | 198         | 0.00               | 115         | 0.02               |
| Central Air Conditioning | 827        | 0.61              | 858        | 0.68              | 1,141      | 0.77              | 1,032       | 0.83               | 1,943       | 0.88               | 310         | 0.53               |
| Room AC                  | 352        | 0.18              | 291        | 0.02              | 525        | 0.17              | 779         | 0.05               | 1,230       | 0.45               | 181         | 0.12               |

Source: 2019 California Residential Appliance Saturation Survey

**Table 23: Space Conditioning Electric UECs for Townhomes in Forecasting Climate Zones 13, 16, and 17**

| Townhome                 | Zone 13 UEC | Zone 13 Saturation | Zone 16 UEC | Zone 16 Saturation | Zone 17 UEC | Zone 17 Saturation |
|--------------------------|-------------|--------------------|-------------|--------------------|-------------|--------------------|
| All Household            | 5,751       | 179 homes          | 3,868       | 177 homes          | 4,808       | 70 homes           |
| Conv. Heat               | 1,186       | 0.27               | 673         | 0.09               | 904         | 0.20               |
| Heat Pump                | 1,271       | 0.12               | 141         | 0.02               | 553         | 0.01               |
| Aux. Heat                | 231         | 0.02               | .           | 0.05               | .           | 0.12               |
| Central Air Conditioning | 724         | 0.79               | 445         | 0.33               | 939         | 0.80               |
| Room AC                  | 559         | 0.03               | 438         | 0.40               | 843         | 0.18               |

Source: 2019 California Residential Appliance Saturation Survey

**Table 24: Space Conditioning Electric UECs for 2-4 Unit Apartments in Forecasting Climate Zones 1-6**

| 2-4 Unit Apartment       | Zone 1 UEC | Zone 1 Saturation | Zone 2 UEC | Zone 2 Saturation | Zone 3 UEC | Zone 3 Saturation | Zone 4 UEC | Zone 4 Saturation | Zone 5 UEC | Zone 5 Saturation | Zone 6 UEC | Zone 6 Saturation |
|--------------------------|------------|-------------------|------------|-------------------|------------|-------------------|------------|-------------------|------------|-------------------|------------|-------------------|
| All Household            | 3,460      | 655 homes         | 3,227      | 119 homes         | 4,617      | 25 homes          | 5,367      | 112 homes         | 4,982      | 110 homes         | 3,883      | 105 homes         |
| Conv. Heat               | 698        | 0.17              | 663        | 0.17              | 813        | 0.04              | 1,132      | 0.17              | 785        | 0.19              | 1,379      | 0.30              |
| Heat Pump                | 575        | 0.01              | 1,116      | 0.01              | 707        | 0.01              | 1,006      | 0.22              | 372        | 0.08              | 558        | 0.01              |
| Aux. Heat                | 160        | 0.06              | 118        | 0.20              | 160        | 0.03              | 222        | 0.20              | 130        | 0.07              | 211        | 0.02              |
| Central Air Conditioning | 401        | 0.23              | 237        | 0.08              | 1,639      | 0.89              | 875        | 0.83              | 1,754      | 0.77              | 353        | 0.03              |
| Room AC                  | 146        | 0.16              | 112        | 0.09              | 1,085      | 0.74              | 577        | 0.21              | 858        | 0.15              | 20         | 0.02              |

Source: 2019 California Residential Appliance Saturation Survey

**Table 25: Space Conditioning Electric UECs for 2-4 Unit Apartments in Forecasting Climate Zones 7-12**

| 2-4 Unit Apartment       | Zone 7 UEC | Zone 7 Saturation | Zone 8 UEC | Zone 8 Saturation | Zone 9 UEC | Zone 9 Saturation | Zone 10 UEC | Zone 10 Saturation | Zone 11 UEC | Zone 11 Saturation | Zone 12 UEC | Zone 12 Saturation |
|--------------------------|------------|-------------------|------------|-------------------|------------|-------------------|-------------|--------------------|-------------|--------------------|-------------|--------------------|
| All Household            | 4,055      | 645 homes         | 4,437      | 82 homes          | 4,707      | 35 homes          | 4,089       | 85 homes           | 7,096       | 110 homes          | 3,759       | 349 homes          |
| Conv. Heat               | 438        | 0.25              | 519        | 0.61              | 476        | 0.10              | 570         | 0.08               | 1,072       | 0.31               | 306         | 0.36               |
| Heat Pump                | 429        | 0.04              | 552        | 0.03              | 376        | 0.05              | 250         | 0.25               | 402         | 0.04               | 504         | 0.08               |
| Aux. Heat                | 91         | 0.03              | 112        | 0.02              | .          | 0.15              | 160         | 0.06               | .           | 0.28               | 66          | 0.07               |
| Central Air Conditioning | 622        | 0.49              | 1,072      | 0.67              | 1,058      | 0.68              | 879         | 0.81               | 2,540       | 0.81               | 370         | 0.35               |
| Room AC                  | 428        | 0.26              | 271        | 0.03              | 1,139      | 0.19              | 605         | 0.12               | 604         | 0.03               | 206         | 0.07               |

Source: 2019 California Residential Appliance Saturation Survey

**Table 26: Space Conditioning Electric UECs for 2-4 Unit Apartments in Forecasting Climate Zones 13, 16, and 17**

| 2-4 Unit Apartment       | Zone 13 UEC | Zone 13 Saturation | Zone 16 UEC | Zone 16 Saturation | Zone 17 UEC | Zone 17 Saturation |
|--------------------------|-------------|--------------------|-------------|--------------------|-------------|--------------------|
| All Household            | 4,823       | 85 homes           | 4,083       | 158 homes          | 3,906       | 48 homes           |
| Conv. Heat               | 703         | 0.27               | 336         | 0.26               | 1,146       | 0.04               |
| Heat Pump                | 929         | 0.14               | 704         | 0.01               | 303         | 0.26               |
| Aux. Heat                | 202         | 0.02               | .           | 0.01               | .           | 0.03               |
| Central Air Conditioning | 738         | 0.78               | 576         | 0.31               | 678         | 0.58               |
| Room AC                  | 794         | 0.18               | 381         | 0.30               | 431         | 0.53               |

Source: 2019 California Residential Appliance Saturation Survey

**Table 27: Space Conditioning Electric UECs for 5+ Unit Apartments in Forecasting Climate Zones 1-6**

| 5+ Apartment             | Zone 1 UEC | Zone 1 Saturation | Zone 2 UEC | Zone 2 Saturation | Zone 3 UEC | Zone 3 Saturation | Zone 4 UEC | Zone 4 Saturation | Zone 5 UEC | Zone 5 Saturation | Zone 6 UEC | Zone 6 Saturation |
|--------------------------|------------|-------------------|------------|-------------------|------------|-------------------|------------|-------------------|------------|-------------------|------------|-------------------|
| All Household            | 3,192      | 1,414 homes       | 3,266      | 231 homes         | 4,899      | 50 homes          | 4,208      | 257 homes         | 4,460      | 217 homes         | 4,048      | 167 homes         |
| Conv. Heat               | 715        | 0.30              | 884        | 0.16              | 703        | 0.33              | 1,029      | 0.40              | 524        | 0.21              | 1,281      | 0.19              |
| Heat Pump                | 755        | 0.07              | 663        | 0.02              | 625        | 0.05              | 431        | 0.11              | 564        | 0.04              | 555        | 0.01              |
| Aux. Heat                | 142        | 0.07              | 365        | 0.05              | .          | 0.20              | 187        | 0.06              | 207        | 0.01              | 188        | 0.07              |
| Central Air Conditioning | 278        | 0.30              | 182        | 0.37              | 1,022      | 0.74              | 474        | 0.60              | 1,274      | 0.73              | 442        | 0.18              |
| Room AC                  | 150        | 0.11              | 87         | 0.21              | 416        | 0.21              | 289        | 0.16              | 452        | 0.15              | 76         | 0.02              |

Source: 2019 California Residential Appliance Saturation Survey

**Table 28: Space Conditioning Electric UECs for 5+ Unit Apartments in Forecasting Climate Zones 7-12**

| 5+ Apartment             | Zone 7 UEC | Zone 7 Saturation | Zone 8 UEC | Zone 8 Saturation | Zone 9 UEC | Zone 9 Saturation | Zone 10 UEC | Zone 10 Saturation | Zone 11 UEC | Zone 11 Saturation | Zone 12 UEC | Zone 12 Saturation |
|--------------------------|------------|-------------------|------------|-------------------|------------|-------------------|-------------|--------------------|-------------|--------------------|-------------|--------------------|
| All Household            | 3,794      | 1,554 homes       | 3,035      | 141 homes         | 4,681      | 38 homes          | 4,135       | 185 homes          | 5,893       | 148 homes          | 3,356       | 1,019 homes        |
| Conv. Heat               | 472        | 0.24              | 501        | 0.30              | 789        | 0.11              | 565         | 0.25               | 559         | 0.14               | 403         | 0.36               |
| Heat Pump                | 352        | 0.08              | 380        | 0.02              | 988        | 0.15              | 375         | 0.06               | 394         | 0.11               | 279         | 0.12               |
| Aux. Heat                | 93         | 0.04              | 68         | 0.01              | 232        | 0.02              | 69          | 0.06               | 70          | 0.02               | 95          | 0.04               |
| Central Air Conditioning | 584        | 0.49              | 378        | 0.40              | 1,489      | 0.84              | 852         | 0.73               | 1,693       | 0.90               | 321         | 0.46               |
| Room AC                  | 303        | 0.28              | 189        | 0.02              | 1,153      | 0.05              | 537         | 0.12               | 941         | 0.09               | 214         | 0.19               |

Source: 2019 California Residential Appliance Saturation Survey

**Table 29: Space Conditioning Electric UECs for 5+ Unit Apartments in Forecasting Climate Zones 13, 16, and 17**

| 5+ Apartment             | Zone 13 UEC | Zone 13 Saturation | Zone 16 UEC | Zone 16 Saturation | Zone 17 UEC | Zone 17 Saturation |
|--------------------------|-------------|--------------------|-------------|--------------------|-------------|--------------------|
| All Household            | 4,733       | 202 homes          | 3,307       | 657 homes          | 3,864       | 283 homes          |
| Conv. Heat               | 933         | 0.23               | 422         | 0.17               | 232         | 0.23               |
| Heat Pump                | 698         | 0.27               | 424         | 0.13               | 232         | 0.06               |
| Aux. Heat                | 244         | 0.19               | .           | 0.08               | .           | 0.13               |
| Central Air Conditioning | 555         | 0.78               | 495         | 0.42               | 677         | 0.66               |
| Room AC                  | 502         | 0.15               | 253         | 0.24               | 342         | 0.44               |

Source: 2019 California Residential Appliance Saturation Survey

**Table 30: Space Conditioning Electric UECs for Mobile Homes in Forecasting Climate Zones 1-6**

| Mobile Home              | Zone 1 UEC | Zone 1 Saturation | Zone 2 UEC | Zone 2 Saturation | Zone 3 UEC | Zone 3 Saturation | Zone 4 UEC | Zone 4 Saturation | Zone 5 UEC | Zone 5 Saturation | Zone 6 UEC | Zone 6 Saturation |
|--------------------------|------------|-------------------|------------|-------------------|------------|-------------------|------------|-------------------|------------|-------------------|------------|-------------------|
| All Household            | 4,603      | 38 homes          | 6,303      | 67 homes          | 6,517      | 69 homes          | 6,864      | 81 homes          | 7,623      | 70 homes          | 4,029      | 39 homes          |
| Conv. Heat               | 1,568      | 0.02              | 1,772      | 0.24              | 1,517      | 0.04              | 1,457      | 0.04              | 987        | 0.04              | 1,481      | 0.07              |
| Heat Pump                | 837        | 0.00              | 1,160      | 0.07              | 1,295      | 0.03              | 1,345      | 0.03              | 1,580      | 0.01              | .          | 0.00              |
| Aux. Heat                | .          | 0.13              | .          | 0.08              | 537        | 0.31              | 760        | 0.03              | 386        | 0.02              | 525        | 0.06              |
| Central Air Conditioning | 217        | 0.31              | 382        | 0.37              | 682        | 0.44              | 1,398      | 0.89              | 2,128      | 0.53              | 379        | 0.66              |
| Room AC                  | 365        | 0.52              | 301        | 0.12              | 1,437      | 0.53              | 1,330      | 0.07              | 1,608      | 0.43              | 271        | 0.04              |

Source: 2019 California Residential Appliance Saturation Survey

**Table 31: Space-Conditioning Electric UECs for Mobile Homes in Forecasting Climate Zones 7-12**

| Mobile Home              | Zone 7 UEC | Zone 7 Saturation | Zone 8 UEC | Zone 8 Saturation | Zone 9 UEC | Zone 9 Saturation | Zone 10 UEC | Zone 10 Saturation | Zone 11 UEC | Zone 11 Saturation | Zone 12 UEC | Zone 12 Saturation |
|--------------------------|------------|-------------------|------------|-------------------|------------|-------------------|-------------|--------------------|-------------|--------------------|-------------|--------------------|
| All Household            | 4,685      | 77 homes          | 3,879      | 24 homes          | 5,572      | 59 homes          | 5,508       | 56 homes           | 7,084       | 128 homes          | 3,950       | 73 homes           |
| Conv. Heat               | 806        | 0.12              | .          | 0.09              | 849        | 0.03              | 515         | 0.15               | 651         | 0.11               | 1,013       | 0.05               |
| Heat Pump                | 211        | 0.00              | 325        | 0.03              | 1,276      | 0.00              | .           | 0.00               | 530         | 0.03               | 680         | 0.00               |
| Aux. Heat                | .          | 0.02              | .          | 0.02              | .          | 0.01              | .           | 0.04               | 161         | 0.07               | .           | 0.02               |
| Central Air Conditioning | 936        | 0.68              | 408        | 0.62              | 2,235      | 0.09              | 1,350       | 0.56               | 2,067       | 0.66               | 701         | 0.91               |
| Room AC                  | 709        | 0.21              | 552        | 0.27              | 840        | 0.32              | 1,621       | 0.13               | 1,763       | 0.15               | 810         | 0.08               |

Source: 2019 California Residential Appliance Saturation Survey

**Table 32: Space-Conditioning Electric UECs for Mobile Homes in Forecasting Climate Zones 13, 16, and 17**

| Mobile Home              | Zone 13 UEC | Zone 13 Saturation | Zone 16 UEC | Zone 16 Saturation | Zone 17 UEC | Zone 17 Saturation |
|--------------------------|-------------|--------------------|-------------|--------------------|-------------|--------------------|
| All Household            | 6,804       | 39 homes           | 4,965       | 5 homes            | 4,829       | 11 homes           |
| Conv. Heat               | .           | 0.01               | .           | 0.15               | .           | 0.01               |
| Heat Pump                | 685         | 0.02               | .           | 0.00               | .           | 0.00               |
| Aux. Heat                | .           | 0.02               | .           | 0.00               | .           | 0.06               |
| Central Air Conditioning | 946         | 0.98               | 878         | 0.69               | 985         | 0.12               |
| Room AC                  | 826         | 0.03               | 669         | 0.62               | 1,170       | 0.92               |

Source: 2019 California Residential Appliance Saturation Survey

## Estimated Natural Gas UECs

The research team estimated the average annual household natural gas consumption as 360 therms for individually metered households in the study population. This section presents results for the calibrated natural gas UECs, segment frequencies, and associated saturations.

- **Table 33** shows estimated UECs by residence type for all households and homes with gas account data.
- **Table 34** presents estimated UECs by dwelling age for all households and homes with gas account data. New dwellings are those built between 2013 and 2019.
- **Table 35** presents estimated UECs by home age by gas utility and residence type.
- **Table 36** shows estimated UECs by gas utility service area.
- **Table 37** through **Table 40** detail estimates by CEC forecasting climate zone.

Natural gas UECs and saturations were estimated for every household that was found to have a natural gas line, regardless of whether natural gas billing data were available for them. Of the 32,582 households for which natural gas UECs were estimated, normalized annual consumption data were available for 23,606 households, with 8,976 having insufficient or no gas billing data. These 8,976 households either indicated that they received natural gas from the smaller municipal gas utilities, were not included in the account matching process defined in Chapter 4, or did not have sufficient data for the normalization process. Of the 39,682 individually metered households in the study, 7,100 had no gas service, leaving them as electric-only households.

The columns titled Homes w/gas refers to households for which natural gas-normalized annual consumption could be estimated from one of the three participating gas utilities: PG&E, SDG&E, or SoCalGas. The columns titled All Homes includes all households for which gas UECs were estimated, including those that could not be matched to the gas billing records. Households serviced by one of the small providers were also included in the All Homes column, as were households that received gas service from SoCalGas, but could not be matched to the billing data.

### Space Heating

The UECs for primary gas heat showed considerable variation by residence type, ranging from 189 therms for single-family homes to 53 therms for apartments in buildings with five or more units. Secondary space heating UECs varied from 59 therms for single-family homes to 38 therms for apartments in buildings with five or more units.

### Water Heating

Natural-gas water heating UECs ranged from 258 therms for single-family homes to 246 therms for apartments in buildings with two to four units. Solar water heat with gas backup UECs were lower, ranging from 199 therms to 154 therms.

### Dryers

UECs for gas dryers varied between 19 therms for townhomes and 11 therms for single-family homes.

**Ranges/Ovens**

Gas range/oven UECs were estimated between 25 therms for single-family homes and 19 therms for mobile homes.

**Pools and Spa Heat**

The UEC for gas pool heat for single-family homes was 162 therms, and spa heat was 38 therms per year.

**Miscellaneous**

Miscellaneous gas usage for single-family homes, townhomes, and apartments in buildings with two to four units was estimated at 17 therms per year. Apartments in buildings with five or more units and mobile homes had miscellaneous gas usage of 19 therms and 21 therms, respectively.

**Table 33: Gas UECs by Residence Type for All Households and for Households with Gas Account Data**

|                               | Single Family All Homes UEC | Single Family All Homes Saturation | Single Family Homes w/ Gas Data UEC | Single Family Homes w/ Gas Data Saturation | Town-home All Homes UEC | Town-home All Homes Saturation | Town-home Homes w/Gas Data UEC | Town-home Homes w/Gas Data Saturation | 2-4 Unit Apt. All Homes UEC | 2-4 Unit Apt. All Homes Saturation | 2-4 Unit Apt. Homes w/Gas Data UEC | 2-4 Unit Apt. Homes w/Gas Data Saturation | 5+ Unit Apt. All Homes UEC | 5+ Unit Apt. All Homes Saturation | 5+ Unit Apt. Homes w/Gas Data UEC | 5+ Unit Apt. Homes w/Gas Data Saturation | Mobile Home All Homes UEC | Mobile Home All Homes Saturation | Mobile Home Homes w/Gas Data UEC | Mobile Home Homes w/Gas Data Saturation |
|-------------------------------|-----------------------------|------------------------------------|-------------------------------------|--|-------------------------|--------------------------------|--------------------------------|---------------------------------------|-----------------------------|------------------------------------|------------------------------------|---|----------------------------|-----------------------------------|-----------------------------------|--|---------------------------|----------------------------------|----------------------------------|---|
| All Household UEC             | 434                         | 22,846 homes                       | 443                                 | 17,269 homes                               | 301                     | 2,872 homes                    | 306                            | 2,061 homes                           | 221                         | 2,124 homes                        | 225                                | 1,437 homes                               | 173                        | 4,189 homes                       | 202                               | 2,501 homes                              | 324                       | 551 homes                        | 300                              | 338 homes                               |
| Primary Heat                  | 189                         | 0.83                               | 191                                 | 0.83                                       | 83                      | 0.72                           | 81                             | 0.71                                  | 69                          | 0.59                               | 69                                 | 0.58                                      | 53                         | 0.54                              | 53                                | 0.60                                     | 144                       | 0.78                             | 136                              | 0.73                                    |
| Auxiliary Heat                | 59                          | 0.02                               | 59                                  | 0.02                                       | 42                      | 0.04                           | 43                             | 0.05                                  | 44                          | 0.02                               | 49                                 | 0.02                                      | 38                         | 0.02                              | 41                                | 0.02                                     | 52                        | 0.00                             | 37                               | 0.00                                    |
| Conv. Gas Water Heat          | 258                         | 0.93                               | 260                                 | 0.94                                       | 257                     | 0.83                           | 258                            | 0.85                                  | 246                         | 0.64                               | 251                                | 0.64                                      | 248                        | 0.50                              | 246                               | 0.60                                     | 253                       | 0.84                             | 257                              | 0.85                                    |
| Solar Water Heat w/Gas Backup | 187                         | 0.00                               | 184                                 | 0.00                                       | 168                     | 0.00                           | 229                            | 0.00                                  | 199                         | 0.00                               | .                                  | 0.00                                      | 154                        | 0.00                              | 154                               | 0.00                                     | 174                       | 0.00                             | 174                              | 0.00                                    |
| Dryer                         | 11                          | 0.52                               | 12                                  | 0.53                                       | 19                      | 0.41                           | 19                             | 0.41                                  | 18                          | 0.26                               | 18                                 | 0.26                                      | 17                         | 0.16                              | 17                                | 0.19                                     | 17                        | 0.45                             | 17                               | 0.35                                    |
| Range/Oven                    | 25                          | 0.76                               | 25                                  | 0.77                                       | 22                      | 0.73                           | 22                             | 0.73                                  | 24                          | 0.67                               | 25                                 | 0.68                                      | 21                         | 0.66                              | 22                                | 0.71                                     | 19                        | 0.86                             | 20                               | 0.82                                    |
| Pool Heat                     | 162                         | 0.06                               | 163                                 | 0.05                                       | 150                     | 0.00                           | 150                            | 0.00                                  | 210                         | 0.01                               | 211                                | 0.01                                      | 177                        | 0.01                              | 170                               | 0.01                                     | 181                       | 0.01                             | 181                              | 0.01                                    |
| Spa Heat                      | 38                          | 0.07                               | 38                                  | 0.08                                       | 29                      | 0.01                           | 28                             | 0.02                                  | .                           | 0.00                               | .                                  | 0.00                                      | .                          | 0.00                              | .                                 | 0.00                                     | 39                        | 0.01                             | 38                               | 0.00                                    |
| Misc.                         | 17                          | 0.13                               | 17                                  | 0.12                                       | 17                      | 0.08                           | 17                             | 0.07                                  | 17                          | 0.05                               | 17                                 | 0.05                                      | 19                         | 0.05                              | 19                                | 0.05                                     | 21                        | 0.06                             | 27                               | 0.05                                    |

Note: Apt. = apartment

Source: 2019 California Residential Appliance Saturation Survey

**Table 34: Gas UECs by Home Age for All Households and for Households**

|                               | New Dwelling All Homes UEC | New Dwelling All Homes Saturation | New Dwelling Homes w/Gas Data UEC | New Dwelling Homes w/Gas Data Saturation | Old Dwelling All Homes UEC | Old Dwelling All Homes Saturation | Old Dwelling Homes w/Gas Data UEC | Old Dwelling Homes w/Gas Data Saturation |
|-------------------------------|----------------------------|-----------------------------------|-----------------------------------|--|----------------------------|-----------------------------------|-----------------------------------|--|
| All Household UEC             | 312                        | 1,929 homes                       | 337                               | 1,254 homes                              | 363                        | 30,653 homes                      | 379                               | 22,352 homes                             |
| Primary Heat                  | 178                        | 0.69                              | 179                               | 0.74                                     | 153                        | 0.75                              | 157                               | 0.77                                     |
| Auxiliary Heat                | 49                         | 0.04                              | 48                                | 0.06                                     | 52                         | 0.02                              | 54                                | 0.02                                     |
| Conv. Gas Water Heat          | 190                        | 0.80                              | 192                               | 0.87                                     | 260                        | 0.83                              | 262                               | 0.86                                     |
| Solar Water Heat w/Gas Backup | 181                        | 0.01                              | 181                               | 0.01                                     | 188                        | 0.00                              | 184                               | 0.00                                     |
| Dryer                         | 14                         | 0.45                              | 14                                | 0.48                                     | 13                         | 0.43                              | 13                                | 0.44                                     |
| Range/Oven                    | 23                         | 0.86                              | 23                                | 0.91                                     | 24                         | 0.73                              | 24                                | 0.74                                     |
| Pool Heat                     | 146                        | 0.03                              | 164                               | 0.02                                     | 164                        | 0.04                              | 164                               | 0.04                                     |
| Spa Heat                      | 60                         | 0.06                              | 71                                | 0.06                                     | 36                         | 0.05                              | 35                                | 0.05                                     |
| Miscellaneous                 | 16                         | 0.11                              | 16                                | 0.11                                     | 17                         | 0.10                              | 17                                | 0.10                                     |

Source: 2019 California Residential Appliance Saturation Survey

**Table 35: Gas Household UECs by Home Age by Gas Utility and Residence Type**

|                        | New Dwelling Household UEC | New Dwelling Count | Old Dwelling Household UEC | Old Dwelling Count |
|------------------------|----------------------------|--------------------|----------------------------|--------------------|
| All                    | 337                        | 1,254              | 379                        | 22,352             |
| All PG&E               | 363                        | 582                | 419                        | 9,756              |
| Single Family PG&E     | 441                        | 421                | 482                        | 7,315              |
| Multifamily PG&E       | 266                        | 161                | 260                        | 2,441              |
| All SDG&E              | 350                        | 147                | 284                        | 2,618              |
| Single Family SDG&E    | 547                        | 104                | 325                        | 1,899              |
| Multifamily SDG&E      | 189                        | 43                 | 201                        | 719                |
| All SoCalGas           | 308                        | 525                | 366                        | 9,978              |
| Single Family SoCalGas | 395                        | 341                | 432                        | 7,189              |
| Multifamily SoCalGas   | 151                        | 184                | 245                        | 2,789              |

Source: 2019 California Residential Appliance Saturation Survey

**Table 36: Gas UECs by Gas Utility for All Households and for Homes with Gas Account Data**

|                               | PG&E All Homes UEC | PG&E All Homes Saturation | PG&E Homes w/Gas Data UEC | PG&E Homes w/Gas Data Saturation | SoCalGas All Homes UEC | SoCalGas All Homes Saturation | SoCalGas Homes w/Gas Data UEC | SoCalGas Homes w/Gas Data Saturation | SDG&E All Homes UEC | SDG&E All Homes Saturation | SDG&E Homes w/Gas Data UEC | SDG&E Homes w/Gas Data Saturation |
|-------------------------------|--------------------|---------------------------|---------------------------|----------------------------------|------------------------|-------------------------------|-------------------------------|--------------------------------------|---------------------|----------------------------|----------------------------|-----------------------------------|
| All Household UEC             | 402                | 13,480 homes              | 416                       | 10,338 homes                     | 358                    | 12,922 homes                  | 363                           | 10,503 homes                         | 280                 | 3,629 homes                | 287                        | 2,765 homes                       |
| Primary Heat                  | 202                | 0.78                      | 207                       | 0.79                             | 127                    | 0.76                          | 128                           | 0.76                                 | 100                 | 0.74                       | 101                        | 0.75                              |
| Auxiliary Heat                | 77                 | 0.02                      | 77                        | 0.02                             | 40                     | 0.03                          | 40                            | 0.03                                 | 30                  | 0.02                       | 30                         | 0.02                              |
| Conv. Gas Water Heat          | 258                | 0.86                      | 259                       | 0.89                             | 264                    | 0.83                          | 267                           | 0.84                                 | 205                 | 0.88                       | 208                        | 0.88                              |
| Solar Water Heat w/Gas Backup | 211                | 0.00                      | 218                       | 0.00                             | 195                    | 0.00                          | 196                           | 0.00                                 | 165                 | 0.01                       | 164                        | 0.01                              |
| Dryer                         | 13                 | 0.28                      | 13                        | 0.30                             | 13                     | 0.54                          | 13                            | 0.54                                 | 10                  | 0.55                       | 10                         | 0.57                              |
| Range/Oven                    | 22                 | 0.62                      | 22                        | 0.63                             | 26                     | 0.83                          | 26                            | 0.84                                 | 18                  | 0.75                       | 18                         | 0.77                              |
| Pool Heat                     | 148                | 0.02                      | 139                       | 0.03                             | 176                    | 0.05                          | 180                           | 0.05                                 | 134                 | 0.04                       | 134                        | 0.04                              |
| Spa Heat                      | 34                 | 0.03                      | 34                        | 0.03                             | 38                     | 0.07                          | 39                            | 0.07                                 | 37                  | 0.07                       | 37                         | 0.08                              |
| Miscellaneous                 | 18                 | 0.08                      | 17                        | 0.08                             | 17                     | 0.11                          | 18                            | 0.11                                 | 14                  | 0.15                       | 14                         | 0.16                              |

Source: 2019 California Residential Appliance Saturation Survey

**Table 37: Gas UECs for Forecasting Climate Zones 1-4**

|                               | Zone 1 All Homes UEC | Zone 1 All Homes Saturation | Zone 1 Homes w/Gas Data UEC | Zone 1 Homes w/Gas Data Saturation | Zone 2 All Homes UEC | Zone 2 All Homes Saturation | Zone 2 Homes w/Gas Data UEC | Zone 2 Homes w/Gas Data Saturation | Zone 3 All Homes UEC | Zone 3 All Homes Saturation | Zone 3 Homes w/Gas Data UEC | Zone 3 Homes w/Gas Data Saturation | Zone 4 All Homes UEC | Zone 4 All Homes Saturation | Zone 4 Homes w/Gas Data UEC | Zone 4 Homes w/Gas Data Saturation |
|-------------------------------|----------------------|-----------------------------|-----------------------------|------------------------------------|----------------------|-----------------------------|-----------------------------|------------------------------------|----------------------|-----------------------------|-----------------------------|------------------------------------|----------------------|-----------------------------|-----------------------------|------------------------------------|
| All Household UEC             | 369                  | 6,370 homes                 | 397                         | 4,756 homes                        | 438                  | 1,461 homes                 | 470                         | 1,037 homes                        | 407                  | 302 homes                   | 448                         | 203 homes                          | 401                  | 1,963 homes                 | 412                         | 1,478 homes                        |
| Primary Heat                  | 189                  | 0.78                        | 193                         | 0.81                               | 240                  | 0.73                        | 261                         | 0.72                               | 186                  | 0.89                        | 208                         | 0.91                               | 208                  | 0.77                        | 209                         | 0.80                               |
| Auxiliary Heat                | 63                   | 0.01                        | 61                          | 0.01                               | 89                   | 0.05                        | 88                          | 0.07                               | 74                   | 0.01                        | 73                          | 0.00                               | 84                   | 0.03                        | 84                          | 0.04                               |
| Conv. Gas Water Heat          | 247                  | 0.81                        | 248                         | 0.88                               | 273                  | 0.86                        | 278                         | 0.90                               | 236                  | 0.95                        | 247                         | 0.98                               | 247                  | 0.90                        | 246                         | 0.92                               |
| Solar Water Heat w/Gas Backup | 209                  | 0.00                        | 197                         | 0.00                               | 207                  | 0.00                        | 224                         | 0.00                               | .                    | 0.00                        | .                           | 0.00                               | 194                  | 0.00                        | 194                         | 0.00                               |
| Dryer                         | 12                   | 0.30                        | 12                          | 0.33                               | 13                   | 0.28                        | 13                          | 0.30                               | 9                    | 0.52                        | 9                           | 0.61                               | 13                   | 0.21                        | 14                          | 0.21                               |
| Range/Oven                    | 20                   | 0.64                        | 20                          | 0.66                               | 21                   | 0.58                        | 22                          | 0.58                               | 18                   | 0.64                        | 18                          | 0.63                               | 21                   | 0.53                        | 21                          | 0.56                               |
| Pool Heat                     | 148                  | 0.03                        | 136                         | 0.03                               | 138                  | 0.04                        | 130                         | 0.05                               | 117                  | 0.00                        | 117                         | 0.01                               | 164                  | 0.02                        | 167                         | 0.02                               |
| Spa Heat                      | 35                   | 0.03                        | 35                          | 0.03                               | 35                   | 0.02                        | 35                          | 0.03                               | 32                   | 0.00                        | 32                          | 0.00                               | 32                   | 0.03                        | 32                          | 0.04                               |
| Miscellaneous                 | 16                   | 0.07                        | 16                          | 0.07                               | 18                   | 0.09                        | 19                          | 0.09                               | 16                   | 0.05                        | 16                          | 0.05                               | 17                   | 0.07                        | 17                          | 0.08                               |

Source: 2019 California Residential Appliance Saturation Survey

**Table 38: Gas UECs for Forecasting Climate Zones 5-8**

|                               | Zone 5 All Homes UEC | Zone 5 All Homes Saturation | Zone 5 Homes w/Gas Data UEC | Zone 5 Homes w/Gas Data Saturation | Zone 6 All Homes UEC | Zone 6 All Homes Saturation | Zone 6 Homes w/Gas Data UEC | Zone 6 Homes w/Gas Data Saturation | Zone 7 All Homes UEC | Zone 7 All Homes Saturation | Zone 7 Homes w/Gas Data UEC | Zone 7 Homes w/Gas Data Saturation | Zone 8 All Homes UEC | Zone 8 All Homes Saturation | Zone 8 Homes w/Gas Data UEC | Zone 8 Homes w/Gas Data Saturation |
|-------------------------------|----------------------|-----------------------------|-----------------------------|------------------------------------|----------------------|-----------------------------|-----------------------------|------------------------------------|----------------------|-----------------------------|-----------------------------|------------------------------------|----------------------|-----------------------------|-----------------------------|------------------------------------|
| All Household UEC             | 411                  | 1,359 homes                 | 420                         | 978 homes                          | 445                  | 1,227 homes                 | 497                         | 870 homes                          | 330                  | 6,734 homes                 | 348                         | 4,963 homes                        | 406                  | 1,121 homes                 | 402                         | 875 homes                          |
| Primary Heat                  | 203                  | 0.69                        | 205                         | 0.69                               | 213                  | 0.78                        | 222                         | 0.86                               | 108                  | 0.73                        | 110                         | 0.75                               | 143                  | 0.80                        | 143                         | 0.80                               |
| Auxiliary Heat                | 74                   | 0.03                        | 74                          | 0.04                               | 65                   | 0.02                        | 63                          | 0.02                               | 32                   | 0.02                        | 33                          | 0.03                               | 47                   | 0.04                        | 47                          | 0.05                               |
| Conv. Gas Water Heat          | 308                  | 0.78                        | 310                         | 0.80                               | 298                  | 0.84                        | 303                         | 0.90                               | 259                  | 0.81                        | 260                         | 0.86                               | 279                  | 0.88                        | 276                         | 0.87                               |
| Solar Water Heat w/Gas Backup | 272                  | 0.00                        | 272                         | 0.00                               | 203                  | 0.00                        | 215                         | 0.00                               | 196                  | 0.00                        | 188                         | 0.00                               | 226                  | 0.00                        | 228                         | 0.00                               |
| Dryer                         | 18                   | 0.29                        | 18                          | 0.32                               | 14                   | 0.40                        | 15                          | 0.46                               | 13                   | 0.55                        | 13                          | 0.58                               | 14                   | 0.52                        | 14                          | 0.48                               |
| Range/Oven                    | 35                   | 0.57                        | 35                          | 0.57                               | 27                   | 0.76                        | 29                          | 0.77                               | 26                   | 0.83                        | 26                          | 0.85                               | 23                   | 0.84                        | 24                          | 0.81                               |
| Pool Heat                     | 70                   | 0.02                        | 198                         | 0.01                               | 202                  | 0.01                        | 199                         | 0.01                               | 180                  | 0.04                        | 185                         | 0.05                               | 188                  | 0.07                        | 191                         | 0.07                               |
| Spa Heat                      | 38                   | 0.02                        | 46                          | 0.01                               | 44                   | 0.02                        | 45                          | 0.02                               | 43                   | 0.06                        | 43                          | 0.06                               | 34                   | 0.09                        | 34                          | 0.11                               |
| Miscellaneous                 | 20                   | 0.09                        | 20                          | 0.08                               | 22                   | 0.09                        | 22                          | 0.12                               | 17                   | 0.12                        | 17                          | 0.12                               | 18                   | 0.12                        | 17                          | 0.14                               |

Source: 2019 California Residential Appliance Saturation Survey

**Table 39: Gas UECs for Forecasting Climate Zones 9-12**

|                               | Zone 9 All Homes UEC | Zone 9 All Homes Saturation | Zone 9 Homes w/Gas Data UEC | Zone 9 Homes w/Gas Data Saturation | Zone 10 All Homes UEC | Zone 10 All Homes Saturation | Zone 10 Homes w/Gas Data UEC | Zone 10 Homes w/Gas Data Saturation | Zone 11 All Homes UEC | Zone 11 All Homes Saturation | Zone 11 Homes w/Gas Data UEC | Zone 11 Homes w/Gas Data Saturation | Zone 12 All Homes UEC | Zone 12 All Homes Saturation | Zone 12 Homes w/Gas Data UEC | Zone 12 Homes w/Gas Data Saturation |
|-------------------------------|----------------------|-----------------------------|-----------------------------|------------------------------------|-----------------------|------------------------------|------------------------------|-------------------------------------|-----------------------|------------------------------|------------------------------|-------------------------------------|-----------------------|------------------------------|------------------------------|-------------------------------------|
| All Household UEC             | 430                  | 572 homes                   | 415                         | 434 homes                          | 360                   | 1,378 homes                  | 373                          | 854 homes                           | 363                   | 1,552 homes                  | 379                          | 1,113 homes                         | 279                   | 4,210 homes                  | 287                          | 2,765 homes                         |
| Primary Heat                  | 223                  | 0.77                        | 201                         | 0.75                               | 132                   | 0.84                         | 136                          | 0.85                                | 134                   | 0.86                         | 137                          | 0.87                                | 100                   | 0.74                         | 101                          | 0.75                                |
| Auxiliary Heat                | 91                   | 0.00                        | 91                          | 0.01                               | 39                    | 0.02                         | 36                           | 0.02                                | 47                    | 0.03                         | 49                           | 0.04                                | 30                    | 0.03                         | 30                           | 0.02                                |
| Conv. Gas Water Heat          | 268                  | 0.93                        | 275                         | 0.95                               | 230                   | 0.90                         | 229                          | 0.93                                | 220                   | 0.91                         | 228                          | 0.92                                | 206                   | 0.86                         | 208                          | 0.88                                |
| Solar Water Heat w/Gas Backup | 278                  | 0.00                        | 278                         | 0.00                               | 199                   | 0.00                         | 199                          | 0.00                                | 109                   | 0.00                         | .                            | 0.00                                | 165                   | 0.01                         | 164                          | 0.01                                |
| Dryer                         | 14                   | 0.55                        | 14                          | 0.54                               | 13                    | 0.60                         | 11                           | 0.63                                | 12                    | 0.57                         | 12                           | 0.57                                | 10                    | 0.56                         | 10                           | 0.57                                |
| Range/Oven                    | 21                   | 0.80                        | 21                          | 0.80                               | 22                    | 0.78                         | 22                           | 0.77                                | 23                    | 0.83                         | 25                           | 0.87                                | 18                    | 0.74                         | 18                           | 0.77                                |
| Pool Heat                     | 143                  | 0.00                        | 138                         | 0.00                               | 167                   | 0.08                         | 168                          | 0.09                                | 155                   | 0.10                         | 157                          | 0.10                                | 138                   | 0.04                         | 134                          | 0.04                                |
| Spa Heat                      | 30                   | 0.05                        | 29                          | 0.05                               | 37                    | 0.09                         | 37                           | 0.11                                | 31                    | 0.13                         | 30                           | 0.14                                | 36                    | 0.07                         | 37                           | 0.08                                |
| Miscellaneous                 | 17                   | 0.10                        | 17                          | 0.05                               | 15                    | 0.09                         | 15                           | 0.10                                | 15                    | 0.16                         | 15                           | 0.13                                | 14                    | 0.17                         | 14                           | 0.16                                |

Source: 2019 California Residential Appliance Saturation Survey

**Table 40: Gas UECs for Forecasting Climate Zones 13, 16, and 17**

|                                  | <b>Zone 13<br/>All<br/>Homes<br/>UEC</b> | <b>Zone 13 All<br/>Homes<br/>Saturation</b> | <b>Zone 13<br/>Homes<br/>w/Gas<br/>Data<br/>UEC</b> | <b>Zone 13<br/>Homes<br/>w/Gas Data<br/>Saturation</b> | <b>Zone 16<br/>All<br/>Homes<br/>UEC</b> | <b>Zone 16 All<br/>Homes<br/>Saturation</b> | <b>Zone 16<br/>Homes<br/>w/Gas<br/>Data UEC</b> | <b>Zone 16<br/>Homes w/Gas<br/>Data<br/>Saturation</b> | <b>Zone 17<br/>All<br/>Homes<br/>UEC</b> | <b>Zone 17<br/>All Homes<br/>Saturation</b> | <b>Zone 17<br/>Homes<br/>w/Gas<br/>Data UEC</b> | <b>Zone 17<br/>Homes<br/>w/Gas Data<br/>Saturation</b> |
|----------------------------------|--|---|---|--|--|---|---|--|--|---|---|--|
| All Household UEC                | 390                                      | 1,992 homes                                 | 417   | 1,558 homes  | 351                                      | 1,480 homes                                 | 346   | 1,087 homes  | 326                                      | 861 homes                                   | 329   | 635 homes  |
| Primary Heat                     | 211                                      | 0.74  | 220   | 0.78   | 128                                      | 0.62  | 128   | 0.62   | 111                                      | 0.75  | 106   | 0.77   |
| Auxiliary Heat                   | 70                                       | 0.03  | 67  | 0.02   | 32                                       | 0.02  | 32  | 0.03   | 43                                       | 0.01  | 49  | 0.00   |
| Conv. Gas Water Heat             | 249                                      | 0.86  | 251   | 0.89   | 323                                      | 0.72  | 319   | 0.72   | 304                                      | 0.65  | 304   | 0.68   |
| Solar Water Heat<br>w/Gas Backup | 179                                      | 0.00  | 179   | 0.00   | 309                                      | 0.00  | 309   | 0.00   | 222                                      | 0.00  | 222   | 0.00   |
| Dryer                            | 12                                       | 0.16  | 11  | 0.18   | 15                                       | 0.42  | 15  | 0.42   | 17                                       | 0.44  | 17  | 0.49   |
| Range/Oven                       | 20                                       | 0.64  | 20  | 0.65   | 27                                       | 0.87  | 28  | 0.87   | 30                                       | 0.87  | 31  | 0.87   |
| Pool Heat                        | 128                                      | 0.03  | 127   | 0.04   | 203                                      | 0.04  | 201   | 0.03   | 205                                      | 0.04  | 199   | 0.02   |
| Spa Heat                         | 29                                       | 0.03  | 29  | 0.04   | 55                                       | 0.03  | 53  | 0.03   | 44                                       | 0.05  | 38  | 0.04   |
| Miscellaneous                    | 16                                       | 0.09  | 16  | 0.09   | 24                                       | 0.05  | 24  | 0.05   | 21                                       | 0.15  | 21  | 0.17   |

Source: 2019 California Residential Appliance Saturation Survey

# CHAPTER 3:

## Load Profiles

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### Electric Load Profiles

Load profiles are estimates of customers' electric usage at the hour level. These estimates require samples of energy use recorded in intervals of 60 minutes or less. Advanced metering infrastructure (AMI) offers the ability to collect such data for most customers, which results in high sample sizes that yield high-quality load profiles.

Four utilities provided electric interval data for the *2019 RASS*: PG&E, SCE, SDG&E, and SMUD. The load profiling sample size for these four utilities combined is roughly 27,800 households (actual sample sizes vary from day-to-day), which represents about 11 million residential customers.

This section presents electric load profiles estimated for three categories of interest: Net Energy Metered (NEM) versus Non-NEM households, Single Family versus Multifamily homes, and by Electric Utility.

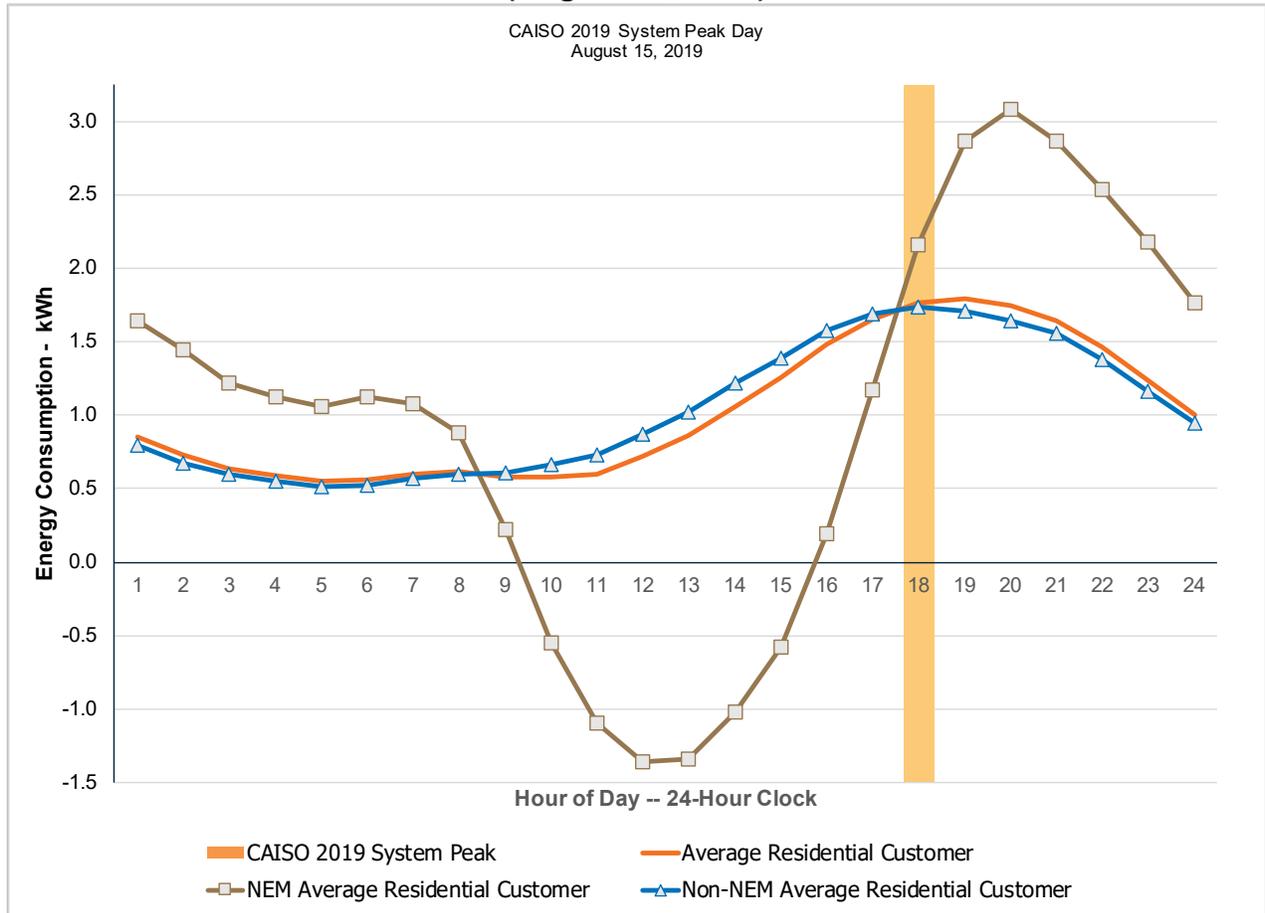
The linear graphs in this section illustrate energy use on the day of the 2019 California Independent System Operator (California ISO) system peak (August 15, 2019, a Thursday). While utilities do not necessarily peak on the same day or at the same time as the California ISO, this day of the year is when the state's infrastructure and energy resources are most strained due to high energy use. In these graphs the orange line represents average residential energy use from the grid, the vertical band highlights the peak hour, and these are the same from one graph to the next. The hours of the day are presented in the 24-hour clock format.

**Figure 1** illustrates the difference in energy consumption from the grid between net-metered (brown line with the squares) and non-net-metered (blue line with the triangles) residential customers on the day of the California ISO system peak. The orange line represents the average of all residential customers.

Earlier in the day, from midnight to about 8 in the morning, NEM customers have higher energy use than average customers. This finding indicates that on average NEM customers use more energy (perhaps from larger houses, EVs, electric water heaters, swimming pools, and so forth), but a substantial portion of this energy is produced onsite rather than provided by the grid. At around 9 in the morning, solar production starts to ramp up, resulting in a pronounced drop in energy use from the grid. In this graph, negative values represent exports to the grid from NEM households. These exports are maximized at noon, when NEM households exported an average of 1.4 kWh to the grid. As solar production declines later in the day and energy use increases for all households (kids return from school, air conditioning is turned on), NEM households' electric use from the grid increases and returns to a higher level of energy use than non-NEM households. About 6 p.m. (Hour 18 in the **Figure 1**), the time of the California ISO system peak, the grid energy use of NEM households is, on average, 0.4 kWh higher than for the non-NEM counterparts. This difference is greatest at 8 p.m.

(Hour 20 in **Figure 1**), when NEM households have an average use of 3.1 kWh per household, compared to 1.6 kWh per non-NEM household.

**Figure 1: Net-Metered and Non-Net-Metered Electric Load Profiles (August 15, 2019)**



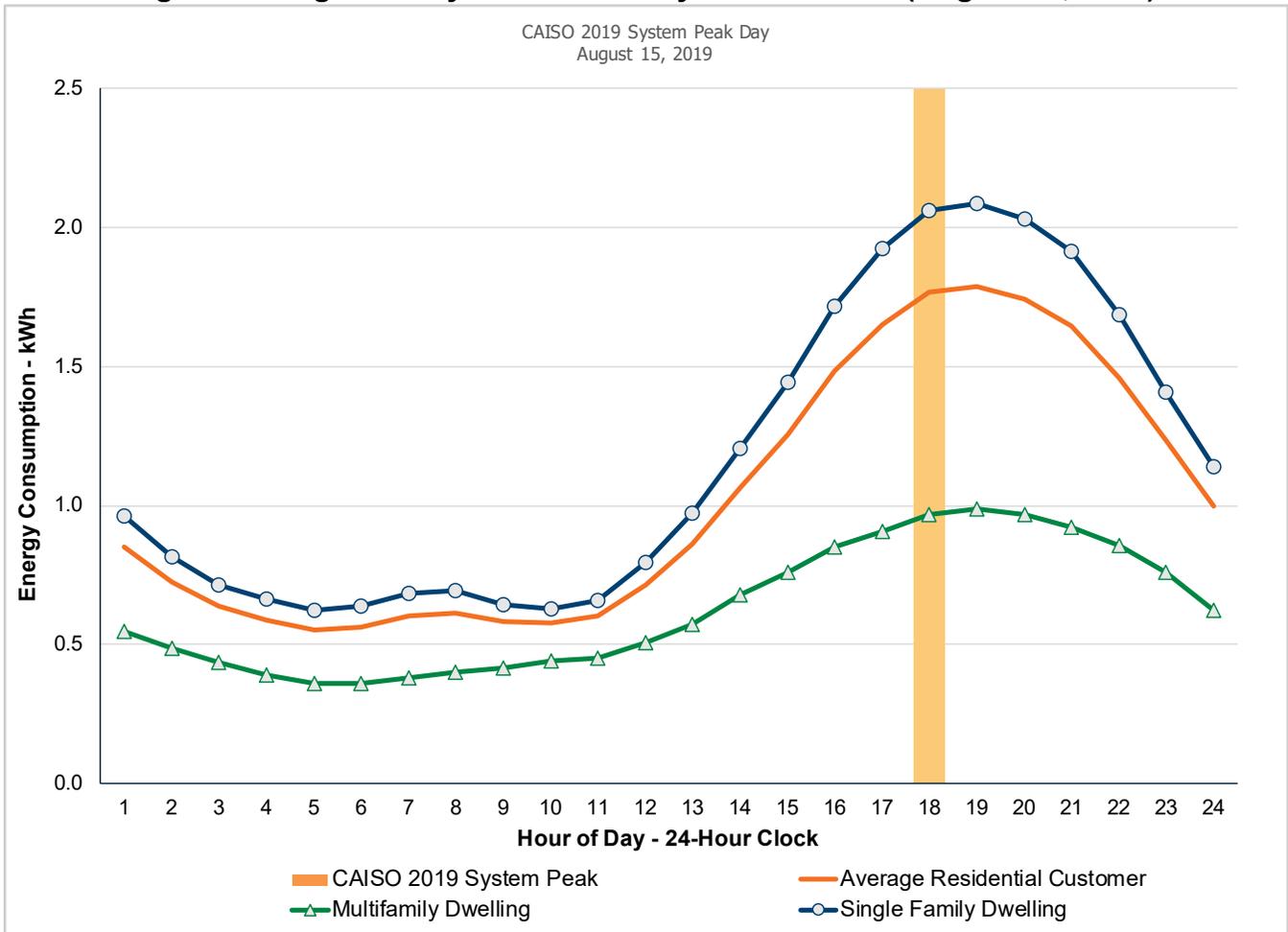
Source: 2019 California Residential Appliance Saturation Survey

DNV GL estimated that NEM households used an average of 22.6 kWh of energy from the grid on August 15, 2019, compared to an average of 24.7 kWh for non-NEM households. While the total energy use of NEM households is larger, their energy use from the grid is, on average, lower than that of non-NEM households.

**Figure 2** illustrates the difference in energy consumption from the grid between households in multifamily homes (green line with triangles) and households in single-family homes (blue line with circles) on the day of the California ISO system peak. The average of all residential customers is represented by the orange line.

As expected, multifamily homes use less energy than single-family homes. The multifamily homes are smaller on average and benefit from shared walls, which reduces the associated need for space conditioning. Other factors, such as less electronics or amenities, fewer occupants, and lower levels of income may contribute to this effect. The overall average is driven by single-family homes. There are more single-family homes than multifamily homes.

**Figure 2: Single-Family and Multifamily Load Profiles (August 15, 2019)**



Source: 2019 California Residential Appliance Saturation Survey

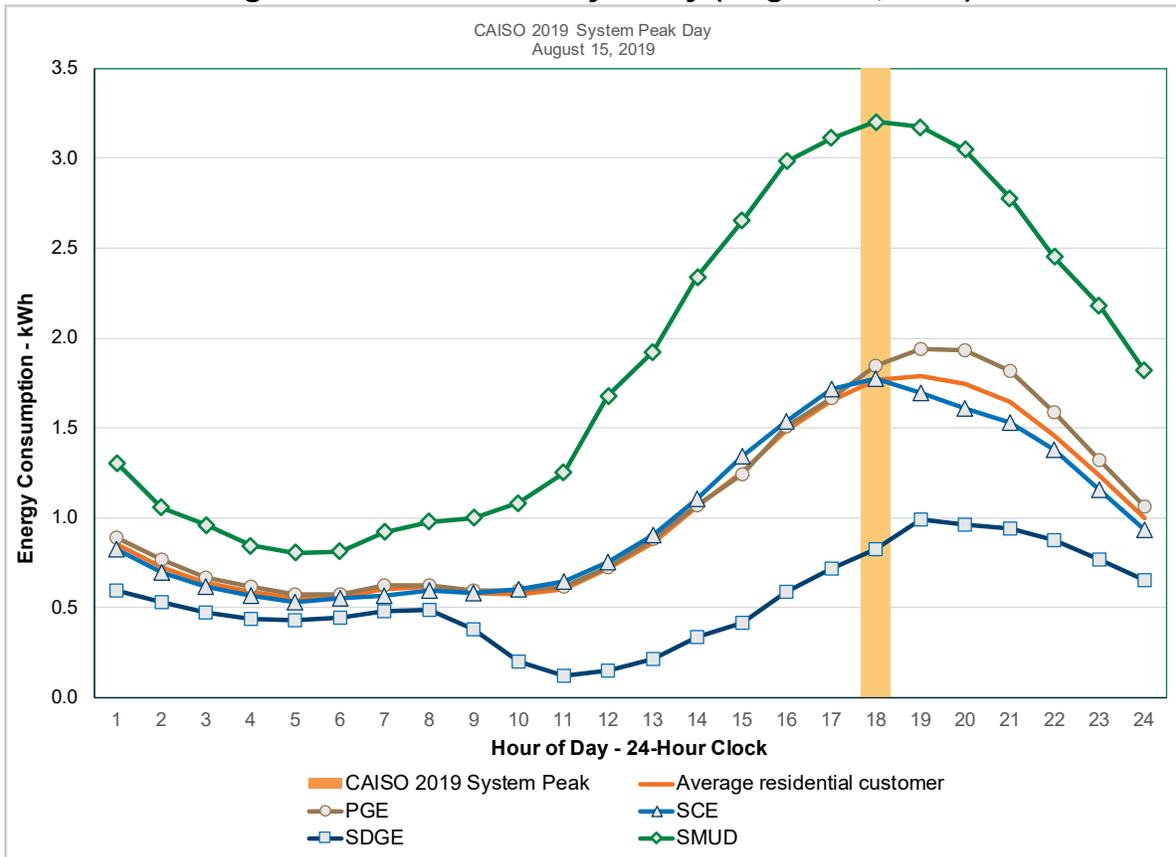
**Figure 3** illustrates the difference in average energy consumption from the grid between households for each of the four electric utilities that provided hourly electric consumption data for the RASS study. The orange line represents the average profile of all households.

PG&E and SCE’s load profiles are similar. These two utilities are the largest in the state and account for 83 percent of the customers represented in the overall average profile. As such, they drive this average.

SDG&E’s load profile clearly shows the effect of the highest solar penetration of the four utilities represented in these load profiles. SDG&E accounts for 12 percent of the customers represented in the overall average profile.

SMUD’s load profile shows that, on average, SMUD customers have higher energy use from the grid than the other three utilities. SMUD accounts for 5 percent of the customers represented in the overall average profile.

**Figure 3: Load Profiles by Utility (August 15, 2019)**



Source: 2019 California Residential Appliance Saturation Survey

## Gas Daily Use

Unlike electricity, for which hourly analysis is common, gas use is often tracked and analyzed at the daily level. This level of tracking is appropriate because gas does not experience extreme hourly price changes the way electricity does and because in many instances, gas meters are set to record intervals that are defined by volume and not by time. For example, if gas meters are set to record increments of 100 cubic feet, Household 1 may record three such units in one day, while Household 2 may take 4 days to record a unit. It does not mean that Household 2 did not use gas for 4 days – only that the gas volume used each day was, on average, about 25 cubic feet. For Household 2, the consumption recorded is not an accurate reflection of daily use.

Analogous to electricity, gas does have peak days. While in California electricity peak use is driven by hot weather in most areas, gas experiences winter peaks driven by cold weather, and summer peaks driven by hot weather that translate into increased gas demand for electric generation. For this section, the research team used the daily estimates produced by the gas RASS analysis to select the week of February 18-24, 2019, as the cold-driven average peak gas use in the study period.

Three utilities provided gas interval data for the *2019 RASS*: PG&E, SDG&E, and Southern California Gas Company (SoCalGas). The gas daily use sample size for these three utilities combined is nearly 24,600 households (actual sample sizes vary from day to day),

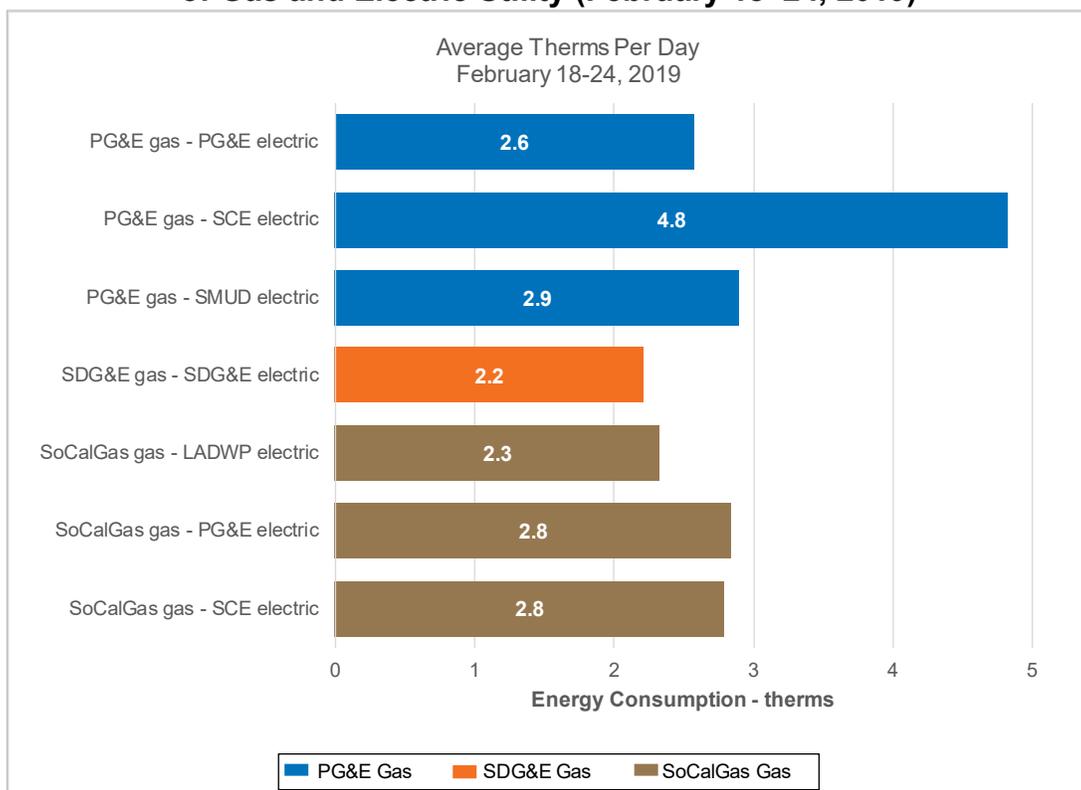
representing about 10 million residential customers in the five electric service territories included in the RASS.

This section presents daily gas use averages estimated for three categories of interest: utility, single-family versus multifamily homes, and for NEM versus non-NEM households.

**Figure 4** shows the average daily therms used the week of February 18–24 for the combinations of gas and electric utilities represented in the RASS. SDG&E (gas and electric) and the combination of SoCalGas with LADWP electric have the lowest gas use (2.2 therms and 2.3 therms per day, respectively). The highest average gas use is for the combination of PG&E gas with SCE electric (4.8 therms per day).

Cold weather drives gas use, which is why it is expected that households in milder weather use less gas. During the peak week, the average SDG&E gas customer used 76 percent of the gas used by the average household that has PG&E gas with SMUD electric , and less than half of the average household that has PG&E gas with SCE electric .

**Figure 4: Peak Week Average Daily Gas Use by Combinations of Gas and Electric Utility (February 18–24, 2019)**

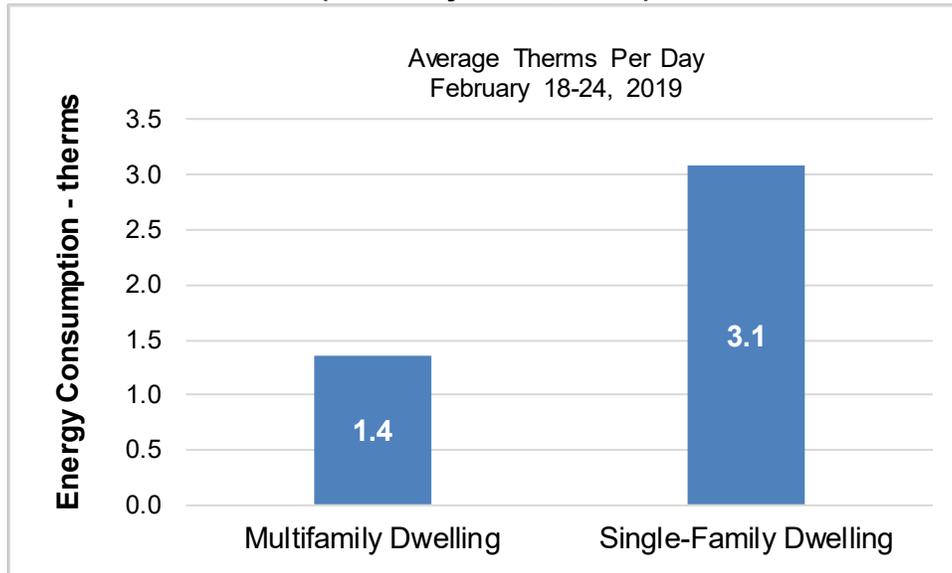


Source: 2019 California Residential Appliance Saturation Survey

**Figure 5** shows the average daily therms by dwelling type for the peak week. As described earlier, multifamily homes use less energy on average than single-family homes. The multifamily dwellings are smaller on average and benefit from shared walls, which reduces the need for space conditioning. Other factors, such as less amenities (for example, less likelihood of having laundry within the unit), fewer occupants, and lower levels of income may contribute to this effect. **Figure 5** shows how large this difference is. For the week with the highest use

in the 12 months analyzed, average single-family dwellings used more than double (about 227 percent) the multifamily dwellings in the same period.

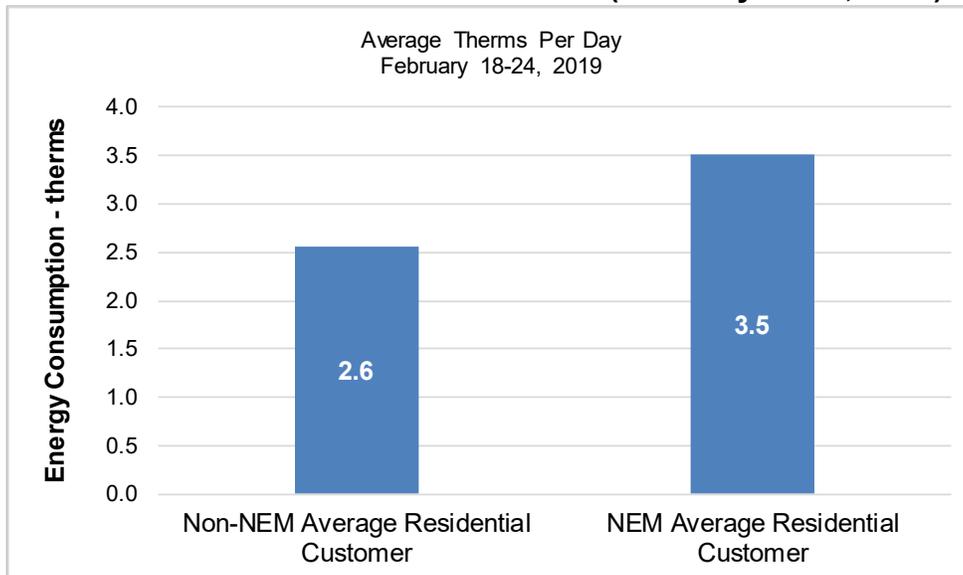
**Figure 5: Peak Week Average Daily Gas Use by Dwelling Type (February 18-24, 2019)**



Source: 2019 California Residential Appliance Saturation Survey

**Figure 6** illustrates the difference in gas use among NEM and non-NEM households. While gas use does not directly depend on electricity use, there is a strong correlation between the use of both fuels. Electric interval data show that net-metered customers use more electricity than their non-net-metered counterparts. This usage pattern is true of gas too. NEM households used 37 percent more gas this peak week than the average non-NEM household.

**Figure 6: Peak Week Average Daily Gas Use for NEM and Non-NEM Residential Customers (February 18-24, 2019)**



Source: 2019 California Residential Appliance Saturation Survey

| <b>Acronym</b> | <b>Definition</b>  |
|----------------|--|
| AC             | Air conditioning — cooling system to control the humidity, ventilation, and temperature in a building.   |
| ACS            | American Community Survey — a survey conducted by the U.S. Census Bureau.  |
| AMI            | Advanced metering infrastructure — an integrated system of smart meters and other equipment that support two-way communication between the utility and the customer. Smart meters can record energy usage in short intervals throughout the day.   |
| CAC            | central air conditioning — a system where air is cooled at a central location and distributed to and from rooms by one or more fans and ductwork.  |
| California ISO | California Independent System Operator — entity that oversees the operation of California's bulk electric power system, transmission lines, and electricity market generated and transmitted by its member utilities in California.  |
| CARE           | California Alternative Rates for Energy — is a program that provides discounts on electric and natural gas bills to low-income households.   |
| CDA            | conditional demand analysis — a statistical technique that combines utility consumption data with weather information and household survey data to produce energy consumption estimates by end use or equipment.   |
| CDD            | Cooling degree days — are a measure of how much (in degrees) and for how long (in days) the air temperature was above a certain reference temperature (i.e. 65°F). CDD are used in calculations of energy consumption for cooling a building.  |
| CEC            | California Energy Commission — established in 1975 and based in Sacramento, the CEC is primary energy policy and planning agency for California. It is committed to reducing energy costs, curtailing greenhouse gas emissions, and ensuring a safe, resilient, and reliable supply of energy. |
| CFL            | compact fluorescent lamp — a fluorescent bulb designed to fit into a standard household light fixture. CFLs use less energy than the predecessors, incandescent bulbs.   |
| DDN            | degree-day normalization — statistical method of estimating annual energy consumption for normal weather conditions.   |
| DEER           | Database for Energy Efficient Resources — database that provides information on the incremental energy savings associated with installing energy-efficient measures or equipment compared to what equipment is commonly installed.   |

| <b>Acronym</b> | <b>Definition</b>   |
|----------------|---|
| DLP            | digital light processing — the use of micromirrors to reflect light and color onto a screen. These micromirrors are positioned in a semiconductor chip and are very small.  |
| DVR            | digital video recorder — a consumer electronics device designed for recording video in a digital format within a mass storage device such as USB flash drive, hard disk drive, or any other storage device.                                   |
| End Use        | A category of equipment or appliance that uses energy and provides a benefit or a service to the user, (for example, space heating, space cooling, refrigerators).  |
| EV             | electric vehicle — a vehicle, often an automobile, that uses one or more electric motors to create movement.  |
| F              | Fahrenheit — a temperature scale based on 32 degrees for the freezing point of water and 212 degrees for the boiling point of water.  |
| FCZ            | forecasting climate zones — geographic areas defined by the CEC to assist energy forecasting and planning and sometimes are also called electricity demand forecast zones. The FCZs are specific to electricity providers.                    |
| FERA           | Family Electric Rate Assistance Program — provides discounts on energy bills to income qualified households. FERA income allowances are slightly higher than CARE allowances.   |
| HDD            | Heating degree days — are a measure of how much (in degrees) and for how long (in days) the air temperature was below a certain reference temperature (i.e. 65°F). HDD are used in calculations of energy consumption for heating a building. |
| IOU            | investor-owned utilities — private electricity and natural gas providers whose stock is publicly traded. IOU energy rates are regulated, usually by the state’s utility commission.   |
| LADWP          | Los Angeles Department of Water and Power — a publicly owned electric and water utility serving residential and commercial customers in Los Angeles and surrounding communities.  |
| LCD            | liquid crystal display — a type of electrically generated image shown on a thin, flat panel. LCD screens are found in consumer electronics like laptops, tablets, and smartphones.  |
| LED            | Light-emitting diode — an electronic device that glows when a voltage is applied. Energy-saving LED bulbs are often used instead of CFLs or other light fixtures.   |
| NAC            | normalized annual consumption — an estimate of yearly energy consumption that has variations in weather effects removed.  |

| <b>Acronym</b> | <b>Definition</b>   |
|----------------|---|
| NEM            | Net-Energy Metering — billing mechanism that allows customers to generate energy onsite to meet their energy needs and receive a financial benefit for any excess energy sent to their utility.   |
| OLED           | organic light-emitting display — a display technology based on the use of an organic substance to produce light. OLED screens are found in consumer electronics like TVs, smartphones, tablets, and watches.  |
| PC             | personal computer — a multipurpose computer whose size, capabilities, and price make it feasible for individual use.  |
| PG&E           | Pacific Gas and Electric Company — an investor-owned electric and natural gas utility serving residential and commercial customers in Northern and Central California.  |
| POU            | Publicly owned utility — are publicly-run electric and natural gas providers. POUs include government-run (federal, state, or municipal) and public utility districts that operate independently of city or county government. Unlike IOUs, publicly owned utilities do not issue stock or have shareholders. |
| PV             | Photovoltaic — PV devices, like those found in solar power panels, generate electricity directly from sunlight via an electronic process that occurs naturally in certain types of materials.   |
| RAC            | room air conditioning — cooling provided to rooms rather than the entire home or business.  |
| RASS           | Residential Appliance Saturation Study — a comprehensive survey of California residents to collect information about characteristics of their homes, their appliances and heating and cooling equipment, use of solar or electric vehicles, and general energy use.   |
| SAE            | statistically adjusted engineering — a method of analyzing energy savings that uses statistical modeling and engineering estimates of energy savings.   |
| SAS            | statistical analysis system — a software suite that can manipulate, manage, and retrieve data from a variety of sources and perform statistical analysis on it.   |
| SCE            | Southern California Edison Company — an investor-owned electric utility serving residential and commercial customers in Southern California.  |
| SDG&E or SDGE  | San Diego Gas & Electric Company — an investor-owned electric and natural gas utility serving residential and commercial customers in San Diego and surrounding areas.  |
| SMUD           | Sacramento Municipal Utility District — a community-owned electric utility serving Sacramento County and parts of Placer County.  |

| <b>Acronym</b> | <b>Definition</b>   |
|----------------|---|
| SoCalGas       | Southern California Gas Company — an investor-owned natural gas utility based in Los Angeles serving residential and commercial customers. SoCalGas is a subsidiary of Sempra Energy, based in San Diego. |
| T24            | Title 24 — California building standards code, a set of standards for new construction and existing buildings.  |
| UEC            | unit energy consumption — the amount of energy a single appliance is estimated to use in a year.  |
| USPS           | United States Postal Service  |
| VEE            | Validation, editing, and estimation — processing information to assess the quality, edit information, and estimate missing values.  |