CALIFORNIA ENERGY COMMISSION

California Energy Commission

CONSULTANT REPORT

2019 California Residential Appliance Saturation Study (RASS)

Executive Summary

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

DNV·GL

July 2021 | CEC-200-2021-005-ES

California Energy Commission

Primary Authors:

Claire Palmgren, Project Manager
Bob Ramirez, Project Sponsor
Miriam Goldberg, Ph.D.
Craig Williamson

DNV GL Energy Insights USA, Inc.
155 Grand Avenue, Suite 600
Oakland, CA 94612
www.dnvgl.com/energy

Contract Number: 800-16-004

Prepared for:

California Energy Commission

Glen Sharp

Le-Huy Nguyen

Contract Managers

Le-Huy Nguyen

Project Manager

Amanda Poletti

Office Manager

Data Integration and Policy Office

Siva Gunda

Deputy Director

Energy Assessments Division

Drew Bohan

Executive Director

ACKNOWLEDGEMENTS

Los Angeles Department of Water and Power (LADWP)

- Joseph Lee, Rockeish McKenzie

Pacific Gas and Electric (PG&E)

- Brian Smith

Sacramento Municipal Utility District (SMUD)

- Thomas Adkins, Shannon McCann

San Diego Gas & Electric (SDG&E)

- Tim Vonder

Southern California Edison (SCE)

- Reginald Wilkins

Southern California Gas Company (SoCalGas)

- Christine Otis

APPRISE, Inc.

- David Carroll, Dan Bausch

Business Economic Analysis and Research (BEAR)

- Ken Parris

GC Green, Inc.

- Rick Halperin, Elizabeth Perez

Other DNV GL Energy Insights staff

- Jarred Metoyer, Paula Ham-Su, Robert Langton, Mikisha Doop, Tim Hennessy, Amber Watkins, Micaela Brown, Soofia Gilbert, Noel Stevens

ABSTRACT

From 2018 to 2020, the California Energy Commission funded and administered a Residential Appliance Saturation Study that updates the *2009 Residential Appliance Saturation Study*, 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 9 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 data, household energy consumption data, and weather information to calculate average annual consumption estimates per appliance. The *2019 Residential Appliance Saturation Study* 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

Please use the following citation for this report:

DNV GL Energy Insights USA, Inc. 2020. *2019 California Residential Appliance Saturation Study*. California Energy Commission. Publication Number: CEC-200-2021-005-ES.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

EXECUTIVE SUMMARY

This executive summary presents key findings from the *2019 California Residential Appliance Saturation Study* (*2019 RASS*) that was sponsored by the California Energy Commission (CEC). The study yielded unit energy consumption (UEC) estimates, the amount of energy a single appliance is estimated to use in a year, for 28 electric and 9 natural gas residential end uses and appliance saturations for households within the California territories of the participating utilities.

The executive summary is a companion document to a project overview and a thorough methods and results report that includes detailed energy consumption tables from the conditional demand analysis along with a series of tables which display the survey results in a comprehensive format.

The sections of this project overview include:

- Study overview.
- UEC and appliance saturation summaries. Presents electric and natural gas results from the conditional demand analysis performed on the RASS data.
- Fuel shares. Shows how the proportion of fuel type for equipment varies.
- Hourly electric load profiles and daily gas loads summary.

Study Overview

From 2018 to 2020, the 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 at 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 Californian households. The survey asked households to provide information on appliances, equipment, and general usage patterns. The *2019 RASS* questionnaire used the 2009 survey as a starting point with updates to reflect changes in available energy-consuming and generation-storage technologies in households including new questions about electric vehicles, miscellaneous electronic appliances, photovoltaic (PV) systems, and battery storage systems. The team implemented a smaller and more focused nonresponse follow-up recruitment effort 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 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 (CDA), 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 individually and master-metered households. Survey and CDA results were weighted to provide population-level estimates representative of the participating utilities that allow comparison across utility service territories, 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 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.

Unit Energy Consumption and Appliance Saturation Summaries

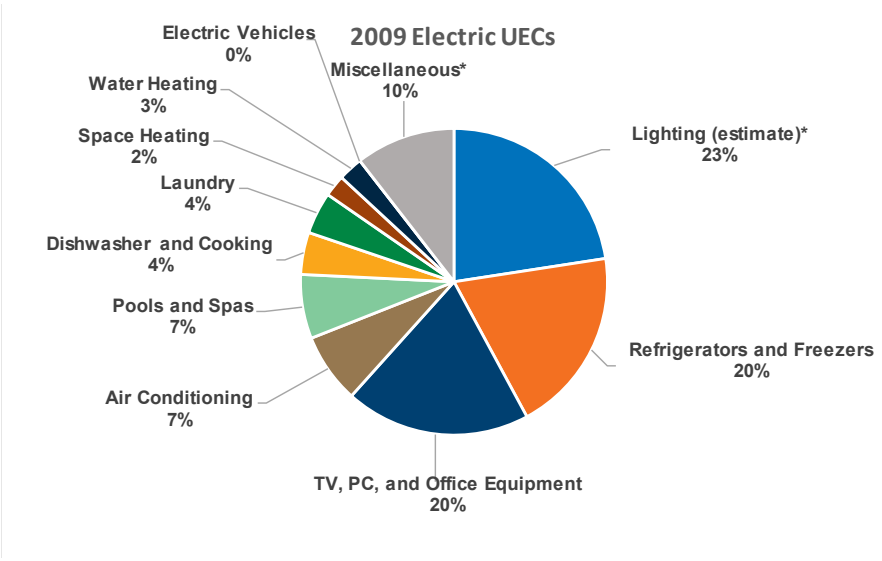
The conditional demand analysis used normalized annual consumption based on interval data from October 2018 through September 2019 to produce UEC estimates for electric and natural gas end uses in households. UECs were calculated for the 39,682 individually metered households in the study. This section presents key results for electric and natural gas end uses.

Electricity Consumption and Unit Energy Consumption

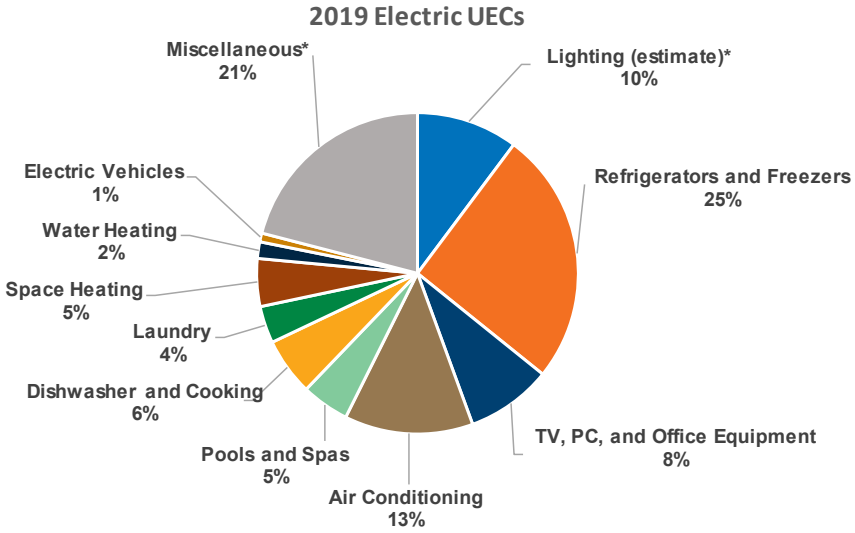
The average annual electricity consumption in California was 6,174 kilowatt-hours (kWh) per household, based on the *2019 RASS* normalized interval data. This amount was a decrease of nearly 2 percent compared to the 6,296 kWh per household reported in the *2009 RASS*. **Figure ES-1** breaks down the 2019 annual household electricity consumption by end use and compares it to the 2009 consumption by end use.

Figure ES-1: Statewide Electricity Consumption per Household

2009 RASS: 6,296 kWh per Household



2019 RASS: 6,174 kWh per Household



*Note: An estimate of 489 kWh per household (8 percent of the total consumption) was designated as interior lighting and was combined with exterior lighting consumption for the lighting category. This number comes from other lighting studies[1] that are better able to pinpoint this estimate than a conditional demand model as was used for the RASS. This approach is the same as used in *2009 RASS* but the estimate in 2009 was 1,200 kWh for interior lighting. Since the estimated energy used for the combination of lighting and miscellaneous was relatively stable over the two RASS studies, the estimates in 2019 indicated a shift in consumption from lighting to other end uses in the miscellaneous category.

Source: 2019 California Residential Appliance Saturation Survey

1 Interior lighting UEC estimated from *2019 RASS* lamp type results, DNV GL California lighting studies, and *2012 California Lighting and Appliance Saturation Study* (*CLASS 2012*), November 24, 2014

Table ES-1 and **Table ES-2** present electric UECs with saturation estimates by electric utility and by dwelling type, respectively. **Table ES-1** shows the following changes by utility for household UECs: PG&E decreased by 3 percent, relative to the *2009 RASS*, SDG&E 12 percent, LADWP 8 percent, and SCE less than 1 percent. SMUD was not included in the *2009 RASS* and has the highest overall household UEC but is also the only utility with no coastal customers.

Table ES-2 shows the following changes by dwelling type for household UECs with mobile homes increasing 4 percent, multifamily (townhomes, 2 – 4 unit apartments, and 5+unit apartments) increasing about 2 percent, and single-family dwellings decreasing less than 1 percent compared to *2009 RASS* results.

Table ES-1: Electric UECs and Appliance Saturation Summaries by Electric Utility

	PG&E UEC	PG&E Saturation	SCE UEC	SCE Saturation	SDG&E UEC	SDG&E Saturation	SMUD UEC	SMUD Saturation	LADWP UEC	LADWP Saturation
Household Total UEC	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
Primary Conventional Space Heating	1,302	16%	635	13%	541	19%	1,329	18%	452	14%
Primary Heat Pump Space Heating	1,163	3%	565	4%	433	5%	1,160	10%	542	6%
Auxiliary Space Heating	655	9%	123	6%	90	6%	776	8%	.	.
Furnace Fan	171	65%	101	67%	90	61%	201	79%	73	46%
Attic Fan	133	2%	171	2%	145	2%	159	2%	136	1%
Central Air Conditioning	1,132	51%	1,344	68%	599	54%	1,194	89%	1,021	52%
Room Air Conditioning	682	13%	665	18%	374	15%	849	7%	529	29%
Evaporative Cooling	809	10%	1,109	12%	525	8%	801	13%	587	9%
Water Heating	2,071	7%	1,443	4%	1,290	6%	2,677	8%	1,538	5%
Solar Water Heating	1,325	0%	916	0%	1,392	0%	1,396	0%	1,301	0%
Dryer	511	46%	491	20%	420	24%	602	59%	438	17%
Clothes Washer	82	81%	95	79%	83	78%	112	81%	89	62%
Dishwasher	81	69%	89	67%	79	72%	92	76%	80	51%
First Refrigerator	1,121	100%	1,145	100%	1,044	100%	1,398	99%	1,083	100%
Additional Refrigerator	1,080	27%	1,093	30%	922	26%	1,442	24%	1,062	20%
Freezer	858	20%	836	16%	722	14%	950	22%	798	10%
Pool Pump	2,775	8%	2,939	11%	2,723	8%	3,468	14%	2,898	7%
Spa	319	7%	314	10%	332	11%	305	9%	243	4%
Outdoor Lighting	214	62%	229	61%	225	62%	275	67%	219	46%
Range/Oven	344	58%	359	37%	335	52%	433	58%	328	36%
Television	442	63%	508	64%	397	64%	543	66%	404	65%
Spa Electric Heat	1,102	5%	911	3%	985	5%	1,023	5%	822	2%
Microwave	145	87%	155	87%	139	90%	174	91%	146	82%
Home Office Equipment	47	16%	50	15%	55	19%	59	17%	54	19%
Personal Computer	274	81%	269	83%	268	86%	308	79%	268	80%
Well Pump	1,321	7%	1,418	2%	1,101	2%	1,776	1%	1,828	1%
Electric Vehicle	929	6%	1,142	6%	772	6%	1,632	2%	719	6%
Miscellaneous	1,772	100%	1,804	100%	1,700	100%	2,097	100%	1,582	100%
Utility Averages	***PG&E***		***SCE***		***SDG&E***		***SMUD***		***LADWP***	
Average Dwelling Size	*1,586*		*1,595*		*1,620*		*1,559*		*1,363*	
Average Number of Residents	*2.8*		*3.0*		*2.8*		*3.3*		*2.7*	
Percent Single-Family	*64.5%*		*62.7%*		*54.7%*		*70.5%*		*36.1%*	
Percent of Population	*38.3%*		*36.0%*		*10.2%*		*4.3%*		*11.2%*	

Source: 2019 California Residential Appliance Saturation Survey.

Table ES-2: Electric UECs and Appliance Saturation Summaries by Dwelling Type

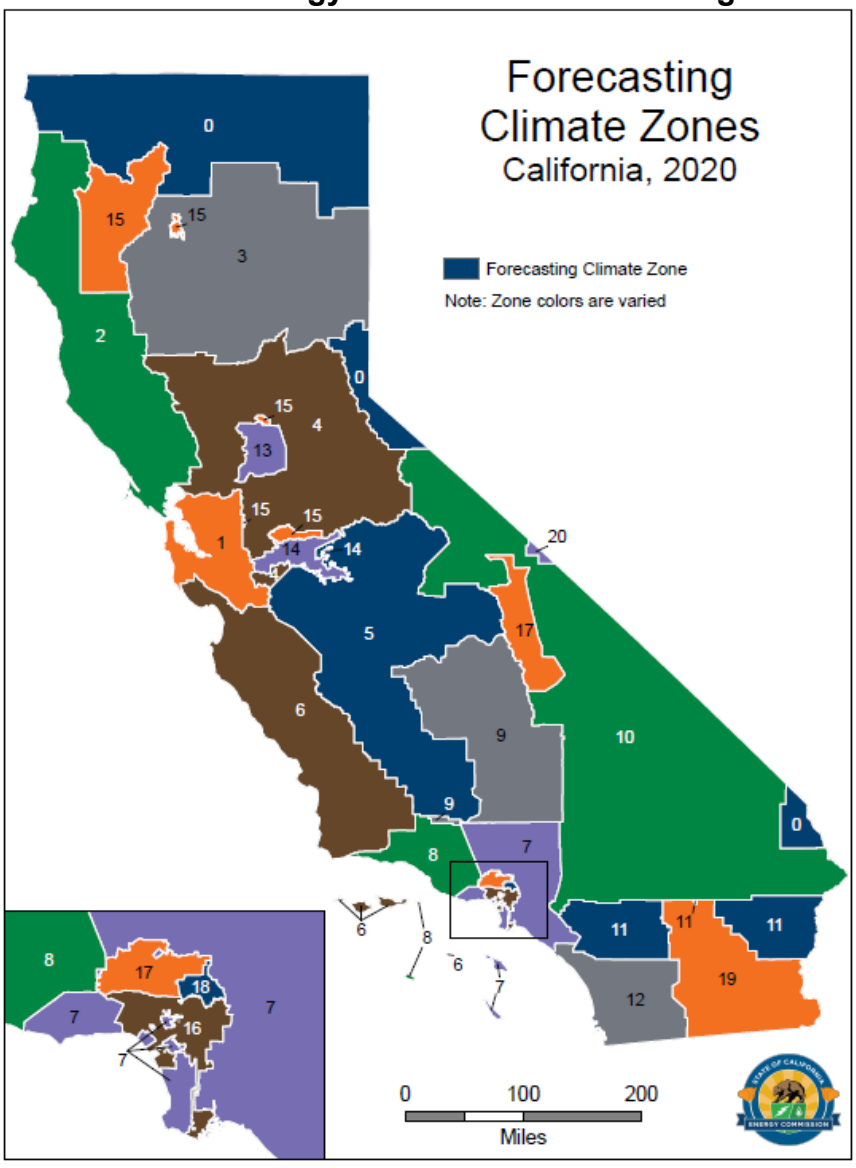
	All UEC	All Saturation	Single-Family UEC	Single-Family Saturation	Multifamily UEC	Multifamily Saturation	Mobile Home UEC	Mobile Home Saturation
Household Total UEC	6,174	39,682 homes	7,553	26,263 homes	4,022	12,583 homes	5,798	836 homes
Primary Conventional Space Heating	953	15%	1,509	10%	622	23%	1,193	6%
Primary Heat Pump Space Heating	768	4%	1,221	3%	493	7%	980	1%
Auxiliary Space Heating	489	7%	825	8%	117	7%	528	6%
Furnace Fan	130	64%	159	76%	55	45%	116	63%
Attic Fan	152	2%	133	3%	182	1%	442	3%
Central Air Conditioning	1,163	59%	1,372	66%	698	48%	1,246	53%
Room Air Conditioning	620	17%	828	14%	354	20%	1,026	29%
Evaporative Cooling	890	10%	1,001	12%	497	7%	1,488	27%
Water Heating	1,792	6%	2,539	4%	1,168	8%	2,107	5%
Solar Water Heating	1,295	0%	1,297	0%	1,258	0%	.	.
Dryer	502	32%	552	35%	396	25%	478	40%
Clothes Washer	89	78%	94	94%	74	51%	73	92%
Dishwasher	84	67%	93	74%	69	56%	51	53%
First Refrigerator	1,130	100%	1,209	100%	1,010	100%	1,034	100%
Additional Refrigerator	1,081	27%	1,161	38%	604	10%	1,110	20%
Freezer	840	17%	853	23%	781	7%	818	30%
Pool Pump	2,895	9%	2,895	15%	.	0%	.	0%
Spa	314	8%	322	13%	129	1%	106	4%
Outdoor Lighting	224	60%	251	76%	138	36%	164	53%
Range/Oven	350	47%	404	43%	285	54%	269	31%
Television	462	64%	483	66%	418	61%	571	68%
Spa Electric Heat	1,015	4%	1,032	6%	683	0%	679	3%
Microwave	150	87%	157	90%	137	82%	136	91%
Home Office Equipment	51	16%	53	19%	47	13%	24	6%
Personal Computer	272	82%	298	86%	230	76%	180	68%
Well Pump	1,346	4%	1,358	5%	1,371	1%	1,121	10%
Electric Vehicle	971	6%	1,062	6%	686	4%	901	1%
Miscellaneous	1,769	100%	2,099	100%	1,264	100%	1,473	100%
Dwelling Type Averages	***All Types***		***Single Family***		***Multifamily***		***Mobile Homes***	
Average Dwelling Size	*1,567*		*1,888*		*1,074*		*1,308*	
Average Number of Residents	*2.9*		*3.1*		*2.6*		*2.3*	
Percent of Population	*100.0%*		*59.9%*		*38.1%*		*2.0%*	

Source: 2019 California Residential Appliance Saturation Survey.

Figure ES-2 is a map of the CEC's Forecasting Climate Zones. These zones were used to expand the conditional demand analysis modeling results and provide regional summaries by climate. Comparisons to the *2009 RASS* are difficult, given the changes in geography covered by the forecasting climate zones and moving from 16 to 20 zones.

- Zones 1 through 6 are served by PG&E with some SoCalGas overlap.
- Zones 7 through 11 are served by SCE/SoCalGas.
- Zone 12 is served by SDG&E with some SoCalGas overlap.
- Zone 13 is served by SMUD.
- Zones 16 and 17 are served by LADWP/SoCalGas.
- Zones 14, 15, and 18 through 20 are served by electric utilities not included in the RASS.

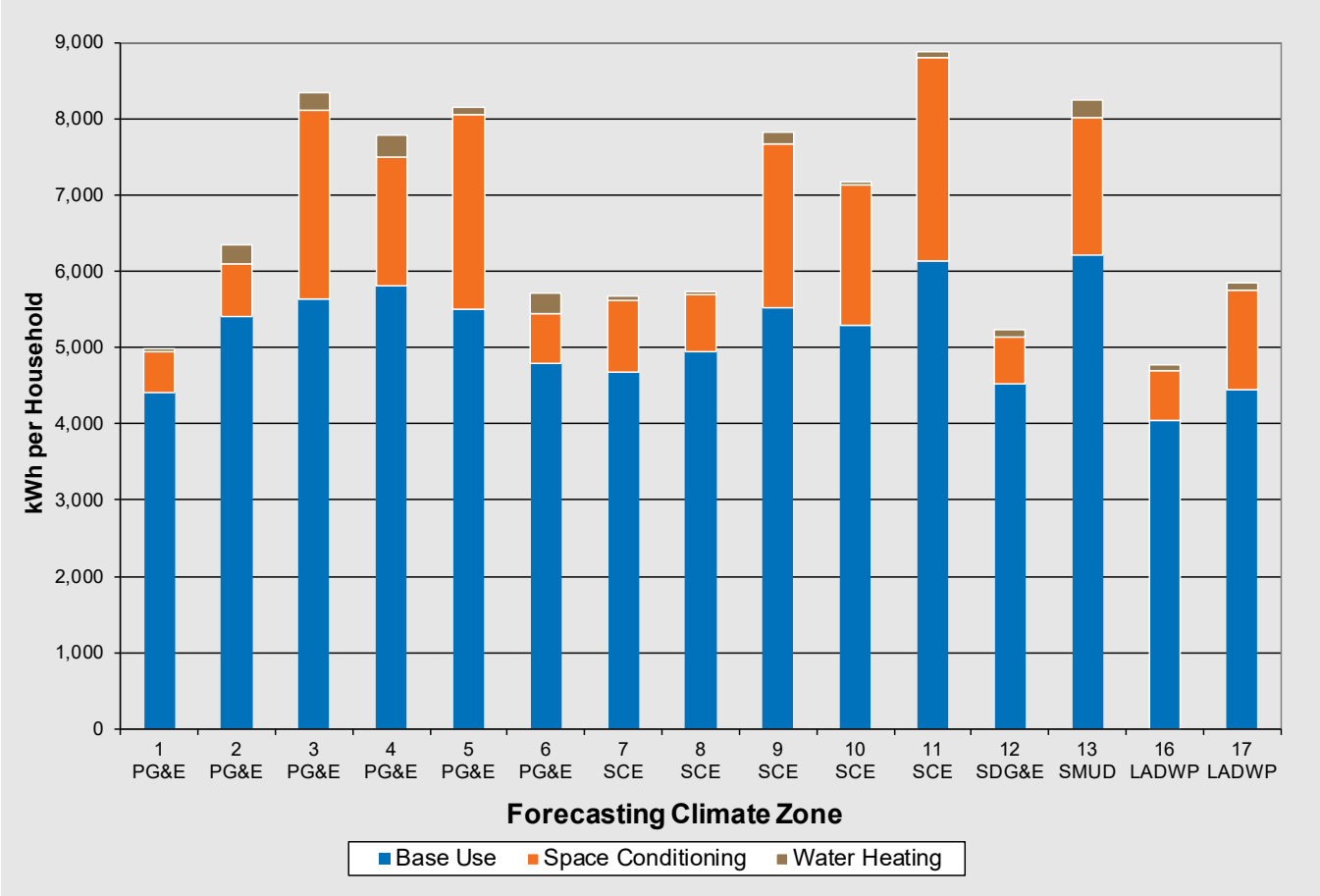
Figure ES-2: California Energy Commission Forecasting Climate Zones



Source: CEC

Figure ES-3 shows that base electricity consumption and space conditioning vary by CEC forecasting climate zone. The important 2019 trends are that base usage is the majority of consumption in all forecasting climate zones and logically the zones in the hotter central valley (3,4,5,9,13) and desert (10,11) have higher annual electric UECs driven by space conditioning.

Figure ES-3: Electric UECs by Forecasting Climate Zone



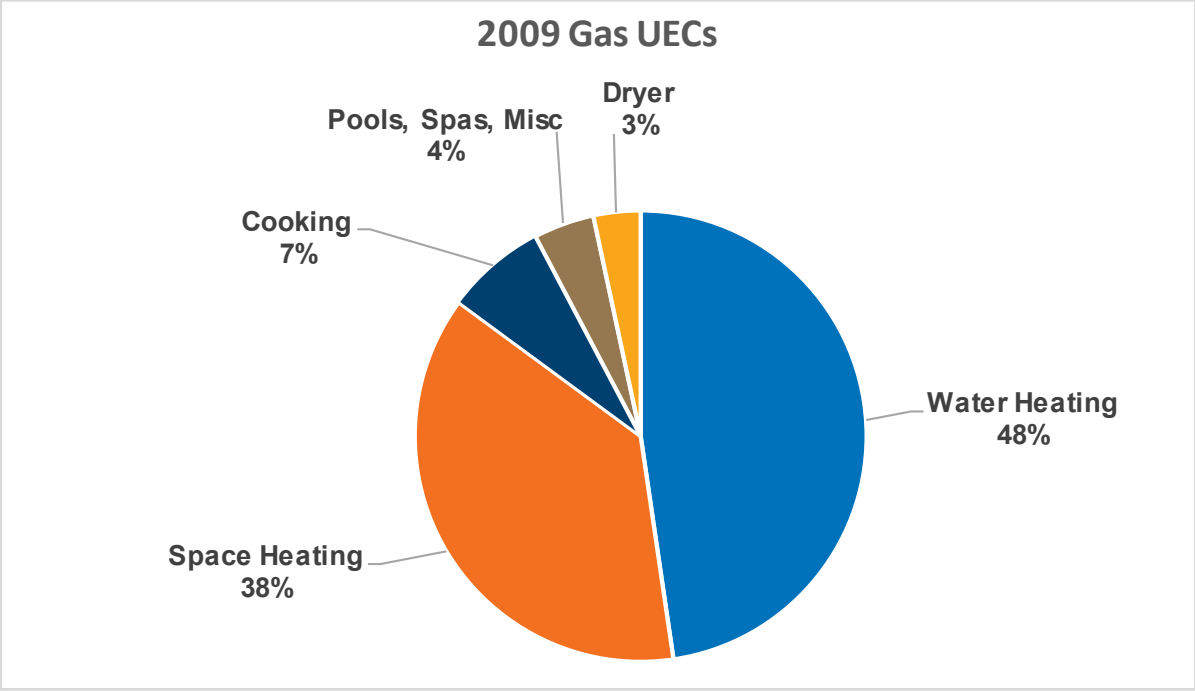
Source: 2019 California Residential Appliance Saturation Survey

Natural Gas Consumption and UECs

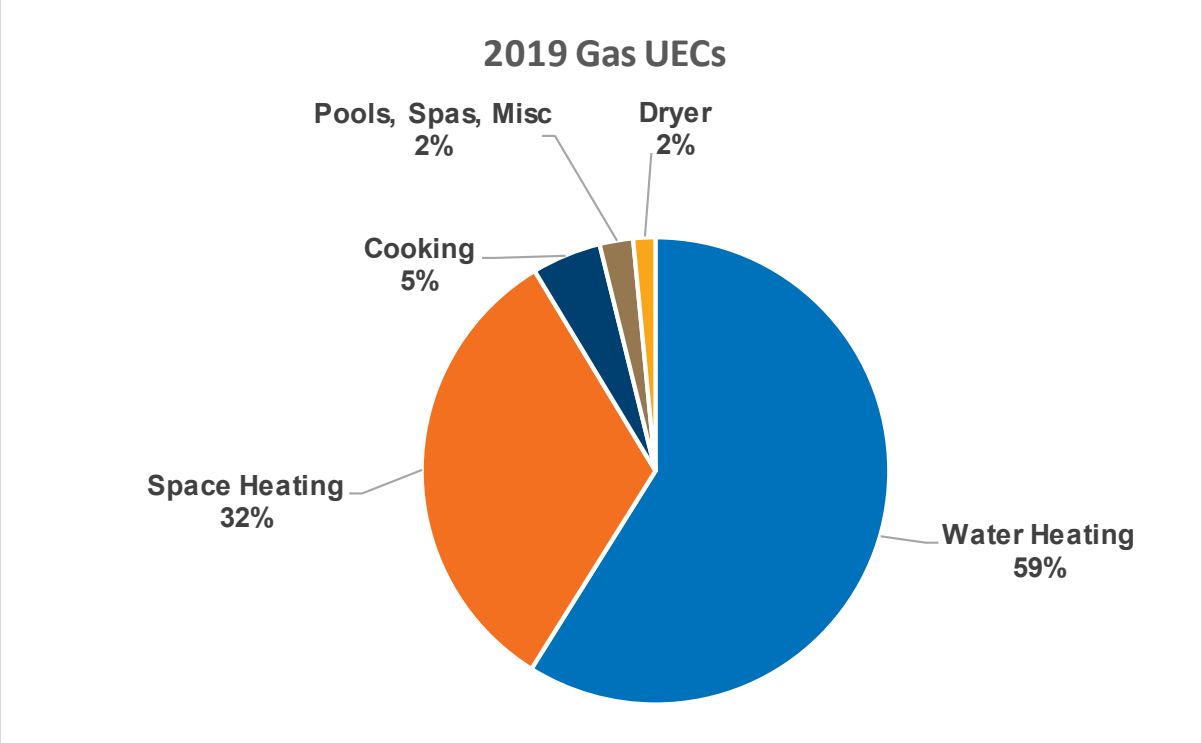
The average annual natural gas consumption in California households for which interval data was available (72 percent of the study population) was 360 therms per household, as calculated from *2019 RASS* interval data. The research team obtained gas interval data from PG&E, SDG&E, and SoCalGas. Natural gas UECs were calculated for 85 percent of the study population, as the estimates were made for all households identified as having a natural gas line to their home. The household natural gas UEC of 360 therms was relatively close to 354 therms per household reported in the *2009 RASS*. **Figure ES-4** breaks down the 2019 annual household natural gas consumption by end use and compares it to the 2009 consumption by end use. Compared to the *2009 RASS*, consumption for water heating increased by 11 percent to 59 percent, whereas space heating decreased by 6 percent to 32 percent.

Figure ES-4: Statewide Natural Gas Consumption per Household

2009 RASS: 354 therms per household



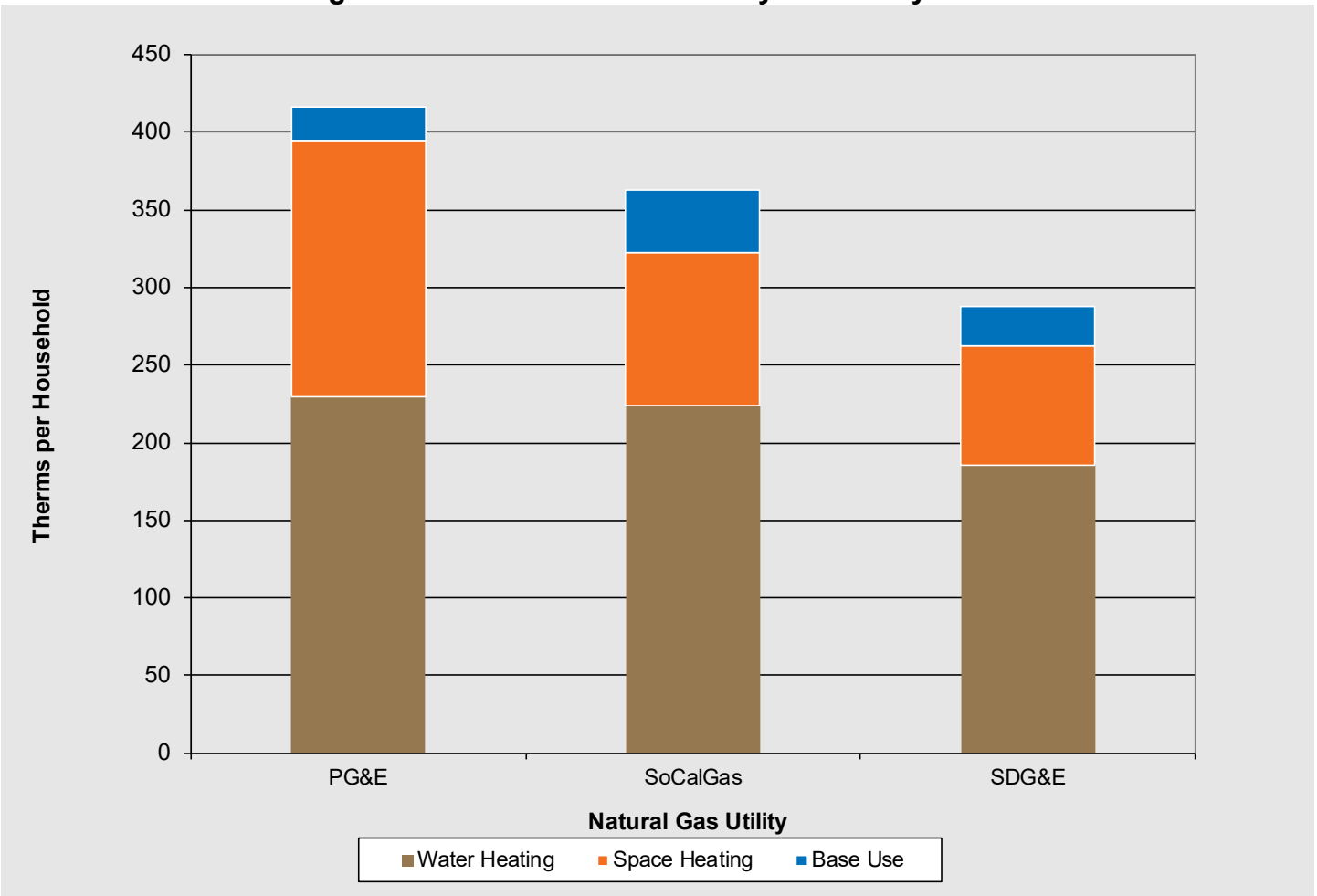
2019 RASS: 360 therms per household



Source: 2019 California Residential Appliance Saturation Survey.

PG&E has the largest natural gas consumption, along with the highest consumption attributed to space heating compared to the other two gas utilities, as shown in **Figure ES-5**.

Figure ES-5: Natural Gas UECs by Gas Utility



Source: 2019 California Residential Appliance Saturation Survey

Table ES-3 and **Table ES-4** present natural gas UECs with saturation estimates for households for which interval data were available, by gas utility and dwelling type, respectively. The bottom row in each table represents the household natural gas UEC for all households in the study population that were identified as having natural gas service. The study sample was based on the electric population of the participating utilities, so the natural gas consumption results do not fully represent statewide gas consumption.

Table ES-3 depicts an increase of 11 percent in the household natural gas UEC of 363 therms for households served by SoCalGas from the 328 therms reported in the *2009 RASS*. The other two gas utilities had less dramatic changes for household natural gas UECs, with SDG&E having a decrease of 4 percent and PG&E having an increase of 3 percent.

Table ES-3: Natural Gas UECs and Appliance Saturation Summaries by Gas Utility

	All UEC	All Saturation of Homes with Gas Data	PG&E UEC	PG&E Saturation of Homes with Gas Data	SDG&E UEC	SDG&E Saturation of Homes with Gas Data	SoCalGas UEC	SoCalGas Saturation of Homes with Gas Data
Household Total UEC	377	23,606 homes	416	10,338 homes	287	2,765 homes	363	10,503 homes
Primary Heat	158	77%	207	79%	101	75%	128	76%
Auxiliary Heat	53	2%	77	2%	30	2%	40	3%
Water Heating	258	86%	259	89%	208	88%	267	84%
Solar Water Heat	183	<1%	218	<1%	164	1%	196	<1%
Dryer	13	45%	13	30%	10	57%	13	54%
Range/Oven	24	75%	22	63%	18	77%	26	84%
Pool Heating	164	4%	139	3%	134	4%	180	5%
Spa Heating	37	5%	34	3%	37	8%	39	7%
Miscellaneous	17	10%	17	8%	14	16%	18	11%
	All Homes		*PG&E*		*SDG&E*		*SoCalGas*	
Household Total UEC for All Homes with Gas Service	*360*		*402*		*280*		*358*	

Source: 2019 California Residential Appliance Saturation Survey.

Table ES-4 presents natural gas UECs by dwelling type. The household natural gas UEC for multifamily homes increased by 22 percent from the results from the *2009 RASS*. Household gas consumption for mobile homes dropped by 15 percent, and for single-family homes, consumption increased by 4 percent.

Table ES-4: Natural Gas UECs and Appliance Saturation by Dwelling Type

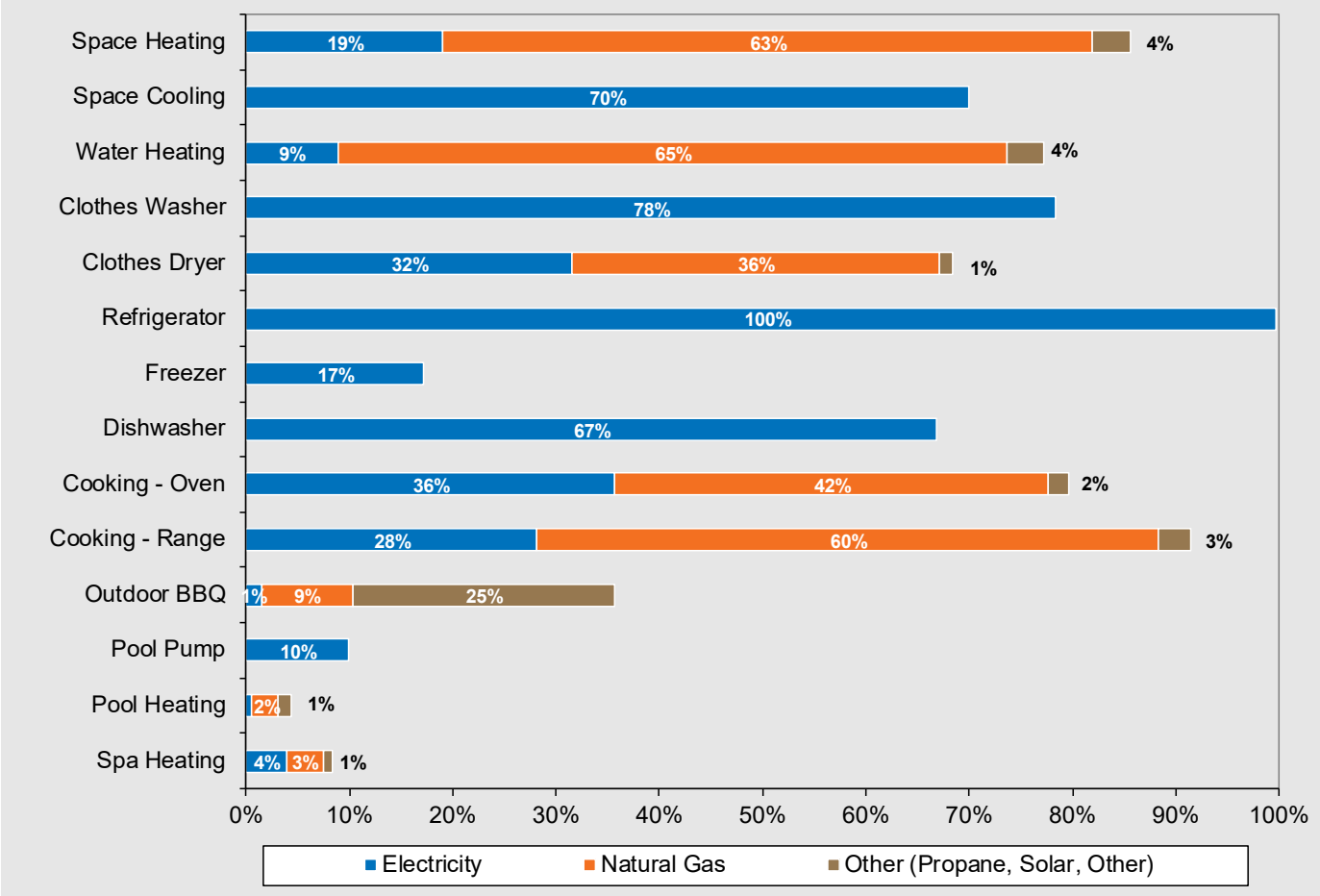
	Single-Family UEC	Single-Family Saturation of Homes with Gas Data	Multifamily UEC	Multifamily Saturation of Homes with Gas Data	Mobile Home UEC	Mobile Home Saturation of Homes with Gas Data
Household Total UEC	443	17,269 homes	241	5,999 homes	300	338 homes
Primary Heat	191	83%	67	63%	136	73%
Auxiliary Heat	59	2%	43	3%	37	<1%
Water Heating	260	94%	252	69%	257	85%
Solar Water Heat	184	<1%	166	0%	174	<1%
Dryer	12	53%	18	28%	17	35%
Range/Oven	25	77%	23	71%	20	82%
Pool Heating	163	5%	178	1%	181	1%
Spa Heating	38	8%	28	1%	38	<1%
Miscellaneous	17	12%	18	6%	27	5%
	Single Family		**Multifamily**		**Mobile Home**	
Household Total UEC for All Homes with Gas Service	434		226		324	

Source: 2019 California Residential Appliance Saturation Survey.

Fuel Shares of End Uses

The saturations of fuel type by major household end uses are presented in **Figure ES-6** for all individually metered households in the study sample. Several changes are noted when compared to the results from the *2009 RASS*. There was an increase in electric space heating by 14 percent, while natural gas and other fuels decreased. Water heating and cooking remain majority gas with slight increases of electric systems. Additional figures follow looking at the fuel shares for specific end uses.

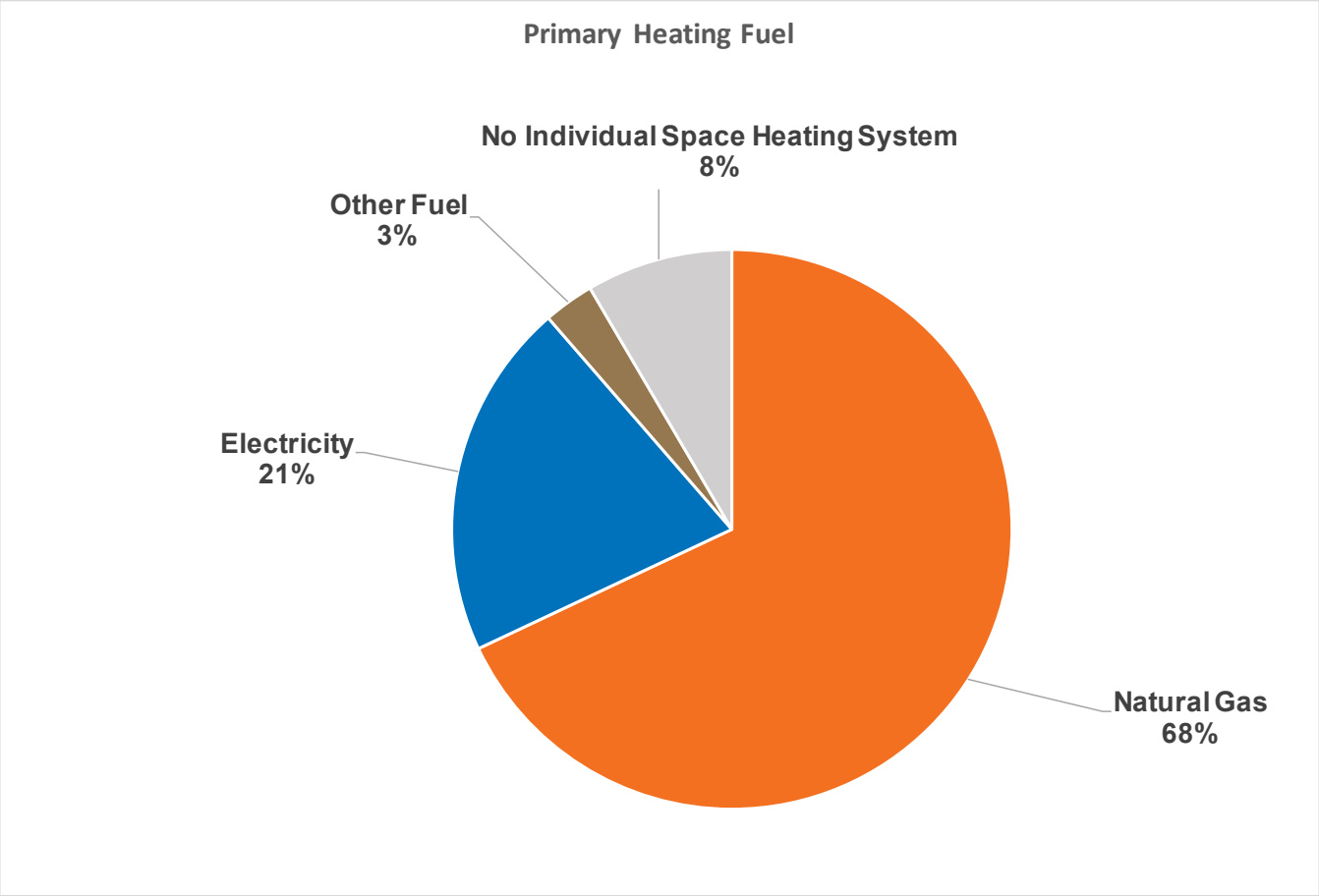
Figure ES-6: Combined Electric, Natural Gas, and Other Fuel Saturations



Source: 2019 California Residential Appliance Saturation Survey

Space heating systems are fueled primarily by natural gas for households in the study, as shown in **Figure ES-7**. The No Individual Space Heating System category includes households that do not have space heating or households that are heated by a central building system that serves multiple apartments or dwellings. Compared to the *2009 RASS*, the proportion of electric space heating systems has increased by 16 percent, and natural gas decreased by 10 percent with other fuels decreasing as well, and the same proportion not having a space heating system. The Other fuel category includes mostly propane with a small amount of wood or something else, as reported by the respondent.

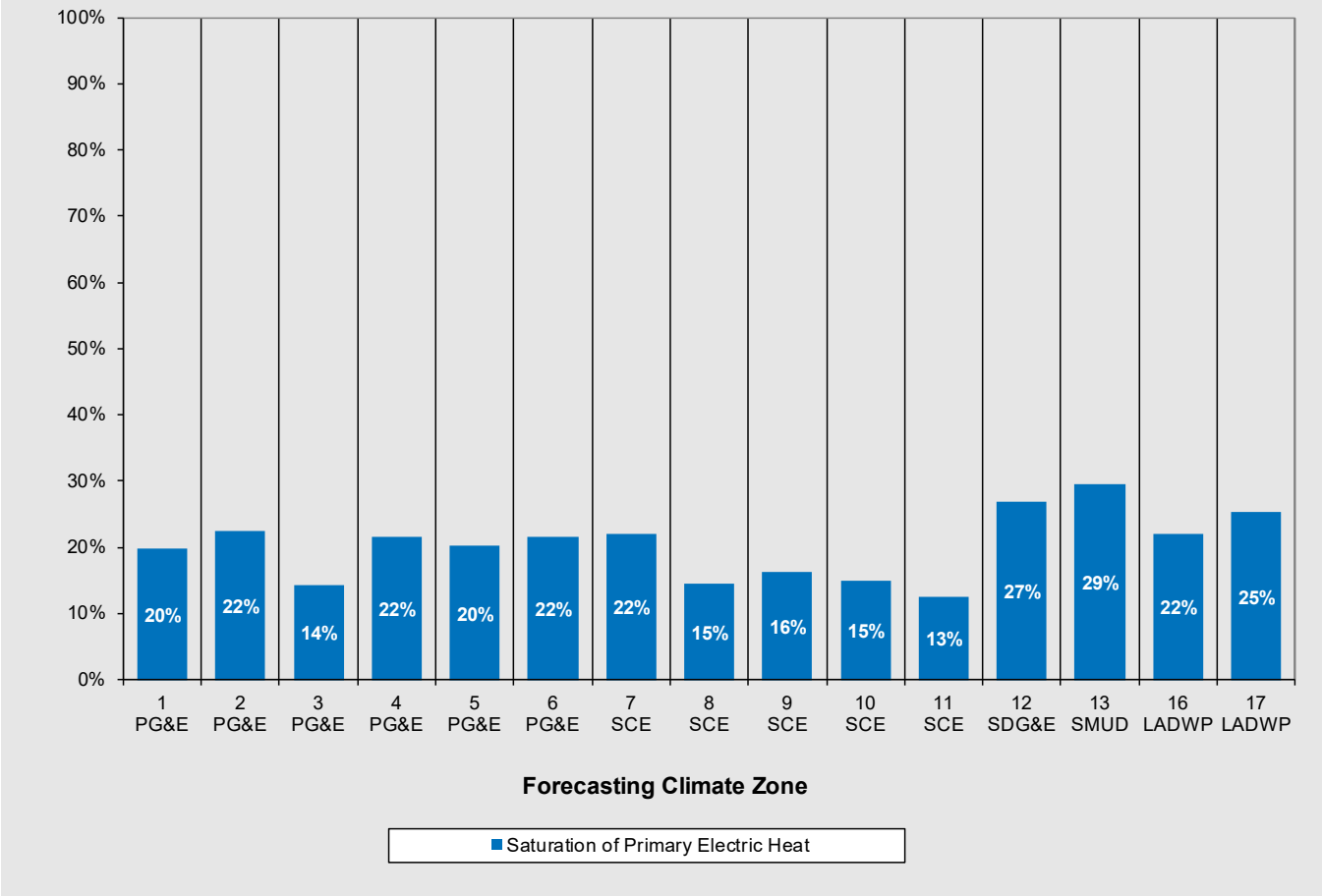
Figure ES-7: Primary Space Heating Fuel



Source: 2019 California Residential Appliance Saturation Survey.

Figure ES-8 presents shares of electric space heating by forecasting climate zones. Zone 13 (SMUD) with 29 percent has the highest proportion, followed by Zone 12 (SDG&E) at 27 percent and Zone 17 (LADWP) at 25 percent.

Figure ES-8: Saturation of Electric Space Heating by Forecasting Climate Zone



Source: 2019 California Residential Appliance Saturation Survey.

LIST OF ACRONYMS AND RELATED DEFINITIONS

Acronym	Definition
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 the 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.

Acronym	Definition
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.
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.

Acronym	Definition
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.
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.

Acronym	Definition
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.
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.