# **Emission Factors and Data Tables**



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# Table T-3.1. Average Transit and Vehicle Mode Share of All Trips by California Core-Based Statistical Area

	Mode	Mode Share	
Core-Based Statistical Area	Transit	Vehicle	
Los Angeles-Long Beach-Anaheim	4.23%	94.19%	
Riverside-San Bernardino-Ontario	1.37%	96.88%	
Sacramento-Roseville-Arden-Arcade	2.90%	95.04%	
San Diego-Carlsbad	2.40%	94.85%	
San Francisco-Oakland-Hayward	11.38%	86.96%	
San Jose-Sunnyvale-Santa Clara	6.69%	91.32%	

Source: Federal Highway Administration. 2017. National Household Travel Survey – 2017 Table Designer. Travel Day PMT by TRPTRANS by HH\_CBSA. Available: https://nhts.ornl.gov/. Accessed: January 2021.

#### Table T-8.1. Reduction in Employee Commute Vehicle Miles Traveled by Place Type

Place Type	Reduction in Employee Commute VMT
Urban	-8%
Suburban	-4%
Rural	—

Source: San Diego Association of Governments (SANDAG). 2019. Mobility Management VMT Reduction Calculator Tool – Design Document. June. Available: https://www.icommutesd.com/docs/default-source/planning/tool-design-document\_final\_7-17-19.pdf?sfvrsn=ec39eb3b\_2. Accessed: January 2021

— = measure not applicable in this place type; VMT = vehicle miles traveled.

# Table T-9.1. Average Transit Mode Share of Work Trips by California Core-Based Statistical Area

Core-Based Statistical Area	Transit Mode Share of Work Trips
Los Angeles-Long Beach-Anaheim	5.39%
Riverside-San Bernardino-Ontario	1.12%
Sacramento-Roseville-Arden-Arcade	5.44%
San Diego-Carlsbad	4.74%
San Francisco-Oakland-Hayward	25.60%
San Jose-Sunnyvale-Santa Clara	6.11%

Source: Federal Highway Administration. 2017. National Household Travel Survey – 2017 Table Designer. WRKTRANS by HH\_CBSA. Available: https://nhts.ornl.gov/. Accessed: January 2021.

# Table T-10.1. Average One-Way Bicycle and Vehicle Trip Length of All Trips by California Core-Based Statistical Area

	Trip Length (miles)	
Core-Based Statistical Area	Bicycle	Vehicle
Los Angeles-Long Beach-Anaheim	1.7	9.7
Riverside-San Bernardino-Ontario	2.2	11.7
Sacramento-Roseville-Arden-Arcade	2.9	10.9
San Diego-Carlsbad	2.0	19.1
San Francisco-Oakland-Hayward	2.1	12.4
San Jose-Sunnyvale-Santa Clara	2.8	11.5

Source: Federal Highway Administration. 2017. National Household Travel Survey – 2017 Table Designer. Travel Day PT by TRPTRANS by HH\_CBSA. Available: https://nhts.ornl.gov/. Accessed: January 2021.

# Table T-10.2. Average Bicycle and Vehicle Mode Share of Work Trips by California Core-Based Statistical Area

	Mode Share	
Core-Based Statistical Area	Bicycle	Vehicle
Los Angeles-Long Beach-Anaheim	1.0%	90.7%
Riverside-San Bernardino-Ontario	0.4%	95.3%
Sacramento-Roseville-Arden-Arcade	2.2%	89.5%
San Diego-Carlsbad	1.3%	91.8%
San Francisco-Oakland-Hayward	2.8%	67.1%
San Jose-Sunnyvale-Santa Clara	4.1%	86.6%

Source: Federal Highway Administration. 2017. National Household Travel Survey – 2017 Table Designer. Workers by WRKTRANS by HH\_CBSA. Available: https://nhts.ornl.gov/. Accessed: January 2021.

## Table T-11.1. Average One-Way Vehicle Commute Trip<sup>1</sup> Length by California Core-Based Statistical Area

Core-Based Statistical Area	Vehicle Trip Length (miles)
Los Angeles-Long Beach-Anaheim	14.07
Riverside-San Bernardino-Ontario	18.62
Sacramento-Roseville-Arden-Arcade	14.23
San Diego-Carlsbad	14.52
San Francisco-Oakland-Hayward	15.63
San Jose-Sunnyvale-Santa Clara	12.44

Source: Federal Highway Administration. 2017. National Household Travel Survey – 2017 Table Designer. Travel Day VT by HH\_CBSA by TRPTRANS by TRIPPURP. Available: https://nhts.ornl.gov/. Accessed: January 2021.

<sup>1</sup>Trips included in this dataset were for work-related trips (HBW).

#### Table T-16.1. Typical Monthly Parking Prices by Facility Type

Facility Type	Monthly Cost per Space
Suburban, Surface	\$36
Urban, Surface	\$65
Urban, Structure	\$133
Urban, Underground	\$191

Source: Litman. 2020b. Parking Requirement Impacts on Housing Affordability. June. Available: https://www.vtpi.org/park-hou.pdf. Accessed: January 2021.

#### Table T-19.1. Active Transportation Adjustment Factors

Average Daily Traffic (vehicle trips per day)	One-way Facility Length <sup>1</sup>	Adjustment Factor for a Population > 250,000 or a Non-university Town with Population < 250,000	Adjustment Factor for a University Town with Population <250,000
	≤1	0.0019	0.0104
1 to 12,000	1.02 to 2	0.0029	0.0155
	>2	0.0038	0.0207
10.001	≤1	0.0014	0.0073
12,001 to 24,000	1.02 to 2	0.0020	0.0109
24,000	>2	0.0027	0.0145
24,001 to 30,000	≤1	0.0010	0.0052
	1.02 to 2	0.0014	0.0078
	>2	0.0019	0.0104

Source: California Air Resources Board. 2020. Quantification Methodology for the Strategic Growth Council's

Affordable Housing and Sustainable Communities Program. September. Available:

https://ww2.arb.ca.gov/sites/default/files/classic/cc/capandtrade/auctionproceeds/draft\_sgc\_ahsc\_qm\_091620.pdf. Accessed: January 2021.

< = less than; > = greater than;  $\leq$  = less than or equal to

<sup>1</sup>Measurements of bike facilities should not include the length of crosswalks.

Table T-19.2.	Key Destination	Credits <sup>1,2</sup>
---------------	-----------------	------------------------

Number of Key Destinations <sup>3</sup>	Credit within ½ Mile of Facility	Credit Within ¼ Mile of Facility
0 to 2	0.0000	0.000
3	0.0005	0.001
4 to 6	0.0010	0.002
≥ 7	0.0015	0.003

Source: California Air Resources Board. 2020. Quantification Methodology for the California Natural Resource Agency's Urban Greening Grant Program. March. Available:

https://ww2.arb.ca.gov/sites/default/files/classic/cc/capandtrade/auctionproceeds/cnra\_ug\_finalqm.pdf. Accessed: January 2021.

 $\geq$  = greater than or equal to

<sup>1</sup> The largest value from either credit column that matches the project activities should be used. For example, if there are 3 activity centers within <sup>1</sup>/<sub>4</sub> mile of the facility and 7 activity centers within <sup>1</sup>/<sub>2</sub> mile of the facility, the correct value to use is 0.0015.

<sup>2</sup> These metrics should be evaluated for the project location site and surrounding area which can extend a distance not to exceed a  $\frac{1}{2}$  mile. If a shopping center has multiple activity centers, each of those activity centers would count individually. For example, if a bank, grocery store, and post office are all located in a shopping center, they would be input as three activity centers for the purposes of this quantification methodology.

<sup>3</sup> Key destination examples: banks, post offices, grocery stores, medical centers, pharmacies, office parks, places of worship, public libraries, schools, universities, colleges, and light rail stations (park & ride).

#### Table T-19.3. Growth Factor Adjustment

Facility Type	Growth Factor Adjustment
New Class I bike path <sup>1</sup> or Class IV bikeway <sup>2</sup>	1.54
New Class II bike lane <sup>3</sup>	1.0
Conversion from Class II to IV	0.54

Source: California Air Resources Board. 2020. Quantification Methodology for the Strategic Growth Council's Affordable Housing and Sustainable Communities Program. September. Available:

https://ww2.arb.ca.gov/sites/default/files/classic/cc/capandtrade/auctionproceeds/sgc\_ahsc\_qm\_022521.pdf. Accessed: March 2021.

<sup>1</sup> Class I bike paths are physically separated from motor vehicle traffic.

<sup>2</sup> Class IV bikeways are protected on-street bikeways, also called cycle tracks.

<sup>3</sup> Class II bike lanes are striped bicycle lanes that provide exclusive use to bicycles on a roadway.

County	Days	County	Days	County	Days	County	Days
Alameda	302	Kern	333	Placer	291	San Joaquin	314
Alpine	291	Kings	328	Plumas	292	San Luis Obispo	321
Amador	302	Lake	298	Riverside	337	San Mateo	295
Butte	294	Los Angeles	332	Sacramento	307	Solano	309
Calaveras	304	Lassen	309	San Benito	315	Stanislaus	319
Contra Costa	307	Madera	314	San Bernardino	333	Sutter	304
Colusa	309	Marin	296	Santa Barbara	328	Tehama	297
Del Norte	252	Mariposa	307	Santa Clara	307	Trinity	277
El Dorado	295	Mendocino	279	Santa Cruz	304	Tulare	314
Fresno	320	Merced	316	San Diego	323	Tuolumne	299
Glenn	304	Modoc	287	San Francisco	301	Ventura	334

#### Table T-19.4. Bike Facility Default Days of Use per Year by County

County	Days	County	Days	County	Days	County	Days
Humboldt	262	Mono	311	Shasta	283	Yolo	311
Imperial	353	Monterey	310	Sierra	301	Yuba	293
Inyo	331	Orange	335	Siskiyou	280	Statewide	311

## Table T-19.4. Bike Facility Default Days of Use per Year by County (cont.)

Source: National Oceanic and Atmospheric Administration (NOAA). 2021. Global Historical Climatology Network – Daily (GHCN-Daily), Version 3. 2015-2019 average of days per year with precipitation >0.1 inches. Available: https://www.ncei.noaa.gov/access/search/data-search/daily-summaries?bbox=38.922,-120.071,38.338,-119.547&place=County:1276&dataTypes=PRCP&startDate=2015-01-01T00:00:00&endDate=2019-01-01T23:59:59. Accessed: May 2021.

#### Table T-20.1. Bicycle Mode Share of All Trips by California Core-Based Statistical Area

Core-Based Statistical Area	Bicycle Mode Share
Los Angeles-Long Beach-Anaheim	0.18%
Riverside-San Bernardino-Ontario	0.06%
Sacramento-Roseville-Arden-Arcade	0.56%
San Diego-Carlsbad	0.23%
San Francisco-Oakland-Hayward	0.47%
San Jose-Sunnyvale-Santa Clara	0.79%

Source: Federal Highway Administration. 2017. National Household Travel Survey – 2017 Table Designer. Travel Day PT by TRPTRANS by HH CBSA. Available: https://nhts.ornl.gov/. Accessed: January 2021.

#### Table T-26.1. Transit Bus Fuel Economy by Fuel Type

Fuel Type	Fuel Economy	Unit
Gasoline	0.21261	gal/mile
Diesel	0.15691	gal/mile
Natural gas <sup>1</sup>	0.24890	gal/mile
Electric <sup>2</sup>	2.39132	kWh/mile

Sources: California Air Resources Board. 2020. EMFAC2017 v1.0.3. August. Available:

https://arb.ca.gov/emfac/emissions-inventory. Accessed: January 2021.

U.S. Department of Energy (U.S. DOE). 2021. Fuel Economy Datasets for All Model Years (1984-2021). January. Available: https://www.fueleconomy.gov. Accessed: January 2021.

gal = gallon; kwh = kilowatt hour

<sup>1</sup> Natural gas fuel economy is based on a conversion of natural gas fuel consumption to gallons of diesel equivalent.

<sup>2</sup> Scaled from diesel equivalent based on energy efficiency ratio (EER) of 2.5 and assumption of 38.1 kWh electricity per gallon of diesel.

### Table T-30.1. Battery Electric Vehicle Efficiency by Vehicle Type

Vehicle Type <sup>1</sup>	BEV Efficiency (kWh/mile)
Light-duty automobile (LDA)	0.33
Light-duty truck (LDT)	0.38
Light-heavy duty truck 1 (LHDT1)	1.47
Light-heavy duty truck 2 (LHDT2)	1.67
Medium-heavy duty truck (MHDT)	1.56
Heavy-heavy duty truck (HHDT)	2.33

Sources: California Air Resources Board. 2020b. EMFAC2017 v1.0.3. August. Available: https://arb.ca.gov/emfac/emissions-inventory. Accessed: January 2021.

California Air Resources Board. 2020c. Unofficial electronic version of the Low Carbon Fuel Standard Regulation. Available: https://ww2.arb.ca.gov/sites/default/files/2020-07/2020\_lcfs\_fro\_oal-approved\_unofficial\_06302020.pdf. Accessed: January 2021.

U.S. Department of Energy (U.S. DOE). 2021. Fuel Economy Datasets for All Model Years (1984-2021). January.

Available: https://www.fueleconomy.gov. Accessed: January 2021.

kWh = kilowatt-hours; BEV = battery electric vehicle

<sup>1</sup> Vehicles listed reflect a subset of the EMFAC vehicle categories.

		F	uel Efficiency	,	Ene	ergy Density	/	C	arbon Intensity	Emission	
Vehicle	Fuel	Value	Units	Ref	Value	Units	Ref	Value	Units	Ref	(g CO <sub>2</sub> e/mile) <sup>11</sup>
LDA	Gasoline	30.3	mpg	1	115.8	MJ/gal	7	93.2	g CO <sub>2</sub> e/MJ	5	356.2
	Gasoline hybrid	45.5	mpg	2	115.8	MJ/gal	7	93.2	g CO <sub>2</sub> e/MJ	5	237.2
	Flex fuel (E85)	22.7	mpg	3	86.7	MJ/gal	6	66.8	g CO <sub>2</sub> e/MJ	9	255.1
	PHEV <sup>10</sup>	_	_	_	_	_			—	_	173.0
	BEV	0.327	kWh/mile	4	3.6	MJ/kWh	7	82.9	g CO <sub>2</sub> e/MJ	7	97.6
LDT1	Gasoline	25.9	mpg	1	115.8	MJ/gal	5	93.2	g CO <sub>2</sub> e/MJ	5	416.9
	Gasoline hybrid	38.9	mpg	2	115.8	MJ/gal	5	93.2	g CO <sub>2</sub> e/MJ	5	277.4
	Flex fuel (E85)	19.4	mpg	3	86.7	MJ/gal	6	66.8	g CO <sub>2</sub> e/MJ	9	298.5
	PHEV <sup>10</sup>	_	_	_	_	_			—	—	202.6
	BEV	0.383	kWh/mile	4	3.6	MJ/kWh	7	82.9	g CO <sub>2</sub> e/MJ	7	114.3
LDT2	Gasoline	23.8	mpg	1	115.8	MJ/gal	5	93.2	g CO <sub>2</sub> e/MJ	5	453.5
	Composite Diesel <sup>1,2</sup>	23.8	mpg	1, 3	130.5	MJ/gal	5, 8	45.4	g CO2e/MJ	5, 9	248.9
	Diesel	34.9	mpg	1	134.5	MJ/gal	5	94.2	g CO <sub>2</sub> e/MJ	5	363.0
MDV	Gasoline	19.4	mpg	1	115.8	MJ/gal	5	93.2	g CO <sub>2</sub> e/MJ	5	556.3
	Composite Diesel <sup>1,2</sup>	19.4	mpg	1, 3	130.5	MJ/gal	5, 8	45.4	g CO2e/MJ	5, 9	305.4
	Diesel	26.4	mpg	1	134.5	MJ/gal	5	94.2	g CO <sub>2</sub> e/MJ	5	479.9
LHDT1	Gasoline	9.2	mpg	1	115.8	MJ/gal	5	93.2	g CO <sub>2</sub> e/MJ	5	1,173.1
	Composite Diesel <sup>1,2</sup>	9.2	mpg	1, 3	130.5	MJ/gal	5, 8	45.4	g CO2e/MJ	5, 9	664.0
	Diesel	18.9	mpg	1	134.5	MJ/gal	5	94.2	g CO <sub>2</sub> e/MJ	5	670.4
	BEV	1.47	kWh/mile	4	3.6	MJ/kWh	7	82.9	g CO <sub>2</sub> e/MJ	7	438.7
LHDT2	Gasoline	8.1	mpg	1	115.8	MJ/gal	5	93.2	g CO <sub>2</sub> e/MJ	5	1,332.4
	Composite Diesel <sup>1,2</sup>	8.1	mpg	1, 3	130.5	MJ/gal	5, 8	45.4	g CO2e/MJ	5, 9	731.4
	Diesel	17.1	mpg	1	134.5	MJ/gal	5	94.2	g CO <sub>2</sub> e/MJ	5	740.9
	BEV	1.67	kWh/mile	4	3.6	MJ/kWh	7	82.9	g CO <sub>2</sub> e/MJ	7	498.4

# Table T-30.2. Vehicle Fuel Efficiency, Energy Density, and Well-to-Wheels Carbon Intensity and Emission Factor by Vehicle Category and Fuel Type

Table T-30.2. Vehicle Fuel Efficiency, Energy Density, and Well-to-Wheels Carbon Intensity and Emission Factor by Vehicle Category and Fuel Type (cont.)

		F	uel Efficiency	,	Ene	ergy Density	/	C	arbon Intensity	Emission		
Vehicle	Fuel	Value	Units	Ref	Value	Units	Ref	Value	Units	Ref	(g CO <sub>2</sub> e/mile) <sup>11</sup>	
MHDT	Gasoline	4.9	mpg	1	115.8	MJ/gal	5	93.2	g CO <sub>2</sub> e/MJ	5	2,202.6	
	Composite Diesel <sup>1,2</sup>	9.4 mpg		1, 3	130.5	).5 MJ/gal <sup>5</sup>		45.4	5.4 g CO2e/MJ		630.3	
	Diesel	9.4 mpg		1	134.5	MJ/gal	5	94.2	g CO <sub>2</sub> e/MJ	5	1347.9	
	BEV	1.56	kWh/mile	4	3.6	MJ/kWh	7	93.8	g CO <sub>2</sub> e/MJ	7	526.8	
HHDT	Composite Diesel <sup>1,2</sup>	6.3	mpg	1, 3	130.5	MJ/gal	5, 8	45.4	gCO2e/MJ	4, 9	940.4	
	Diesel	6.3	mpg	1	134.5	5 MJ/gal ⁵		94.2	g CO <sub>2</sub> e/MJ	5	2011.1	
	Natural gas	5.9	mpgde	3	134.5	MJ/gal	5	32.7	g CO <sub>2</sub> e/MJ	9	745.4	
	BEV	2.33	kWh/mile	4	3.6	MJ/kWh	7	93.8 g CO <sub>2</sub> e/MJ		7	786.8	

Sources: See footnotes.

LDA = light-duty automobile; light-duty truck 1 (LDT1); light-duty truck 2 (LDT2); MDV = medium-duty vehicle; light-heavy duty truck 1 (LHDT1); light-heavy duty truck 2 (LHDT2); MHDT = medium-heavy duty truck; HHDV = heavy-heavy duty vehicle; MJ = megajoules; mpg = miles per gallon; mpgde = miles per gallon of diesel equivalent; gal = gallon; kWh = kilowatt-hours; CO<sub>2</sub>e = carbon dioxide equivalent; g = grams; ref = reference

<sup>1</sup> California Air Resources Board. 2020a. EMFAC2017 v1.0.3. August. Available: https://arb.ca.gov/emfac/emissions-inventory. Accessed: January 2021.

Statewide analysis for the year 2021.

<sup>2</sup> U.S. Department of Energy (U.S. DOE). 2021. Fuel Economy Datasets for All Model Years (1984-2021). January. Available: https://www.fueleconomy.gov. Accessed: January 2021.

Assumes 50% improvement vs. gasoline, based on comparison of gasoline and hybrid Toyota Camry and Corolla.

<sup>3</sup> Scaled from gasoline equivalent based on energy density values.

<sup>4</sup> U.S. DOE 2021. Scaled from gasoline or diesel equivalent based on energy efficiency ratio (EER) of 2.5 and assumption of 33.7 kWh electricity per gallon gasoline or 38.1 kWh electricity per gallon diesel.

<sup>5</sup> Gasoline value reflects California Reformulated Gasoline (RFG), which consists of a blend of California Reformulated Gasoline Blendstock for Oxygenate Blending (CARBOB) and 10% ethanol. California Air Resources Board. 2020b. Unofficial electronic version of the Low Carbon Fuel Standard Regulation. Available: https://ww2.arb.ca.gov/sites/default/files/2020-07/2020\_lcfs\_fro\_oal-approved\_unofficial\_06302020.pdf. Accessed: January 2021.

<sup>6</sup> Assumes 85% denatured ethanol and 15% California reformulated gasoline (CaRFG).

<sup>7</sup> California Air Resources Board. 2020c. California Climate Investments Quantification Methodology Emission Factor Database and Documentation. August. Available: https://ww2.arb.ca.gov/resources/documents/cci-quantification-benefits-and-reporting-materials. Accessed: January 2021.

<sup>8</sup> Assumes 80% diesel and 20% FAME Biodiesel

<sup>9</sup> California Air Resources Board. 2019. LCFS Pathway Certified Carbon Intensities. Available: https://ww2.arb.ca.gov/resources/documents/lcfs-pathway-certified-carbon-intensities. Accessed: January 2021.

<sup>10</sup> CARB 2020a. Can be calculated as 46% BEV and 54% gasoline hybrid, based on eVMT fraction. See Equation A2 for further instruction.

<sup>11</sup> Where fuel efficiency is measured in miles per gallon, the emission factor is calculated as (fuel efficiency \* energy density \* carbon intensity). Where fuel efficiency is measured in kilowatt-hours per mile, the emission factor is calculated as ((1/fuel efficiency) \* energy density \* carbon intensity).

<sup>12</sup> Composite diesel is a blend of conventional fossil diesel (6%), biodiesel (16%), and renewable diesel (78%). The percentages are based on the percent of total volume blended into diesel sold in California (CARB 2020c).

### Figure E-1.1. California Energy Commission Electricity Demand Forecast Zones



Note: This figure is intended to provide a general depiction of the forecast zones as not all details can be clearly depicted at this scale. Those interested in additional detail should refer directly to the interactive version of this map, available on CEC's website at the following URL: https://cecgis-caenergy.opendata.arcgis.com/datasets/86fef50f6f344fabbe545e58aec83edd\_0/data?geometry=-165.327%2C31.004%2C-72.427%2C43.220.

Source: California Energy Commission (CEC). 2017. California Electricity Demand Forecast Zones. Available: https://cecgis-caenergy.opendata.arcgis.com/datasets/86fef50f6f344fabbe545e58aec83edd\_0/data?geometry=-165.327%2C31.004%2C-72.427%2C43.220. Accessed: June 2021.





Note: The CEC has an online climate zone search tool available at the following URL: https://www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/climate-zone-toolmaps-and.

Source: California Energy Commission (CEC). 2020. Building Climate Zones. August. Available: https://caenergy.maps.arcgis.com/home/item.html?id=eaf3158767674e6cb14f4407186d3607. Accessed: January 2021.

EDFZ Name	EDFZ	Residential (RASS) Proxy Zone	Commercial Proxy Zones
Other-A	0-A	4	4
Other-B	0-B	2	2
Other-C	0-C	3	3
Other-D	0-D	3	3
Other-E	0-E	10	10
Other-F	0-F	3	3
Other-G	0-G	3	3
Other-H	0-H	4	4
Greater Bay Area	1	—	
North Coast	2	—	
North Valley	3	—	
Central Valley	4	—	
Southern Valley	5	—	—
Central Coast	6	—	—
LA Metro	7	—	
Big Creek West	8	—	—
Big Creek East	9	—	—
Northeast	10	—	—
Eastern	11	—	—
SDG&E	12	—	—
SMUD Service Territory	13	—	—
Turlock Irrigation District	14	4	
Rest of BANC Control Area	15	3	
LADWP Coastal	16	—	—
LADWP Inland	17	—	—
Burbank/Glendale	18	17	_
Imperial Irrigation District	19	11	—
Valley Electric	20	10	10

#### Table E-1.1. Proxy Zones to Use for Electric Demand Forecast Zones

Source: California Energy Commission (CEC). 2017. California Electricity Demand Forecast Zones. Available: https://cecgis-caenergy.opendata.arcgis.com/datasets/86fef50f6f344fabbe545e58aec83edd\_0/data?geometry=-165.327%2C31.004%2C-72.427%2C43.220. Accessed: June 2021.

- = N/A. EDFZ is already included in the RASS or commercial end use forecast. Numbers only listed for missing zones.

EDFZ = Electricity Demand Forecast Zone; RASS = Residential Appliance Saturation Study; LA = Los Angeles; LADWP = Los Angeles Department of Water and Power; BANC = Balancing Authority of California; SDG&E = San Diego Gas & Electric; SMUD = Sacramento Municipal Utility District

	Electricity Reduction by EDFZ <sup>2</sup>																			
Non-Residential Building Type <sup>1</sup>	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	State
Arena	0.44%	0.43%	0.50%	0.43%	0.50%	0.41%	0.85%	0.86%	0.83%	0.85%	0.86%	0.83%	0.44%	0.54%	0.53%	0.68%	0.70%	0.42%	0.68%	0.61%
Automobile Care Center	0.44%	0.43%	0.50%	0.43%	0.50%	0.41%	0.85%	0.86%	0.83%	0.85%	0.86%	0.83%	0.44%	0.54%	0.53%	0.68%	0.70%	0.42%	0.68%	0.61%
Bank (with Drive-Through)	0.44%	0.43%	0.50%	0.43%	0.50%	0.41%	0.85%	0.86%	0.83%	0.85%	0.86%	0.83%	0.44%	0.54%	0.53%	0.68%	0.70%	0.42%	0.68%	0.61%
Convenience Market (24 hour)	0.37%	0.39%	0.46%	0.39%	0.46%	0.39%	0.35%	0.35%	0.38%	0.35%	0.35%	0.35%	0.39%	0.49%	0.47%	0.36%	0.36%	0.34%	0.24%	0.39%
Convenience Market with Gas Pumps	0.37%	0.39%	0.46%	0.39%	0.46%	0.39%	0.35%	0.35%	0.38%	0.35%	0.35%	0.35%	0.39%	0.49%	0.47%	0.36%	0.36%	0.34%	0.24%	0.39%
Day-Care Center	0.80%	0.80%	0.81%	0.80%	0.81%	0.80%	0.86%	0.86%	0.87%	0.86%	0.86%	0.84%	0.87%	0.79%	0.79%	0.76%	0.78%	0.85%	0.95%	0.85%
Discount Club	0.71%	0.71%	0.77%	0.73%	0.77%	0.71%	0.79%	0.79%	0.80%	0.79%	0.79%	0.81%	0.76%	0.79%	0.78%	0.65%	0.66%	0.72%	0.77%	0.75%
Electronic Superstore	0.71%	0.71%	0.77%	0.73%	0.77%	0.71%	0.79%	0.79%	0.80%	0.79%	0.79%	0.81%	0.76%	0.79%	0.78%	0.65%	0.66%	0.72%	0.77%	0.75%
Elementary School	0.80%	0.80%	0.81%	0.80%	0.81%	0.80%	0.86%	0.86%	0.87%	0.86%	0.86%	0.84%	0.87%	0.79%	0.79%	0.76%	0.78%	0.85%	0.95%	0.85%
Fast Food Restaurant w/o Drive Thru	0.34%	0.36%	0.41%	0.36%	0.41%	0.36%	0.53%	0.54%	0.52%	0.50%	0.51%	0.51%	0.39%	0.43%	0.42%	0.48%	0.50%	0.47%	0.44%	0.44%
Fast Food Restaurant with Drive Thru	0.34%	0.36%	0.41%	0.36%	0.41%	0.36%	0.53%	0.54%	0.52%	0.50%	0.51%	0.51%	0.39%	0.43%	0.42%	0.48%	0.50%	0.47%	0.44%	0.44%
Free-Standing Discount store	0.71%	0.71%	0.77%	0.73%	0.77%	0.71%	0.79%	0.79%	0.80%	0.79%	0.79%	0.81%	0.76%	0.79%	0.78%	0.65%	0.66%	0.72%	0.77%	0.75%
Free-Standing Discount Superstore	0.71%	0.71%	0.77%	0.73%	0.77%	0.71%	0.79%	0.79%	0.80%	0.79%	0.79%	0.81%	0.76%	0.79%	0.78%	0.65%	0.66%	0.72%	0.77%	0.75%
Gasoline/Service Station	0.44%	0.43%	0.50%	0.43%	0.50%	0.41%	0.85%	0.86%	0.83%	0.85%	0.86%	0.83%	0.44%	0.54%	0.53%	0.68%	0.70%	0.42%	0.68%	0.61%
General Heavy Industry	0.44%	0.43%	0.50%	0.43%	0.50%	0.41%	0.85%	0.86%	0.83%	0.85%	0.86%	0.83%	0.44%	0.54%	0.53%	0.68%	0.70%	0.42%	0.68%	0.61%
General Light Industry	0.44%	0.43%	0.50%	0.43%	0.50%	0.41%	0.85%	0.86%	0.83%	0.85%	0.86%	0.83%	0.44%	0.54%	0.53%	0.68%	0.70%	0.42%	0.68%	0.61%
General Office Building	0.65%	0.65%	0.69%	0.66%	0.69%	0.65%	0.81%	0.81%	0.81%	0.81%	0.81%	0.78%	0.67%	0.69%	0.68%	0.73%	0.73%	0.65%	0.62%	0.71%
Government (Civic Center)	0.65%	0.65%	0.69%	0.66%	0.69%	0.65%	0.81%	0.81%	0.81%	0.81%	0.81%	0.78%	0.67%	0.69%	0.68%	0.73%	0.73%	0.65%	0.62%	0.71%
Government Office Building	0.65%	0.65%	0.69%	0.66%	0.69%	0.65%	0.81%	0.81%	0.81%	0.81%	0.81%	0.78%	0.67%	0.69%	0.68%	0.73%	0.73%	0.65%	0.62%	0.71%
Hardware/Paint Store	0.71%	0.71%	0.77%	0.73%	0.77%	0.71%	0.79%	0.79%	0.80%	0.79%	0.79%	0.81%	0.76%	0.79%	0.78%	0.65%	0.66%	0.72%	0.77%	0.75%
Health Club	0.44%	0.43%	0.50%	0.43%	0.50%	0.41%	0.85%	0.86%	0.83%	0.85%	0.86%	0.83%	0.44%	0.54%	0.53%	0.68%	0.70%	0.42%	0.68%	0.61%
High School	0.80%	0.80%	0.81%	0.80%	0.81%	0.80%	0.86%	0.86%	0.87%	0.86%	0.86%	0.84%	0.87%	0.79%	0.79%	0.76%	0.78%	0.85%	0.95%	0.85%
High Turnover (Sit Down Restaurant)	0.34%	0.36%	0.41%	0.36%	0.41%	0.36%	0.53%	0.54%	0.52%	0.50%	0.51%	0.51%	0.39%	0.43%	0.42%	0.48%	0.50%	0.47%	0.44%	0.44%
Home Improvement Superstore	0.71%	0.71%	0.77%	0.73%	0.77%	0.71%	0.79%	0.79%	0.80%	0.79%	0.79%	0.81%	0.76%	0.79%	0.78%	0.65%	0.66%	0.72%	0.77%	0.75%
Hospital	0.45%	0.46%	0.51%	0.47%	0.51%	0.47%	0.66%	0.65%	0.66%	0.66%	0.66%	0.69%	0.55%	0.55%	0.55%	0.46%	0.50%	0.47%	0.85%	0.55%
Hotel	0.49%	0.49%	0.49%	0.47%	0.49%	0.48%	0.76%	0.76%	0.78%	0.79%	0.79%	0.69%	0.54%	0.53%	0.53%	0.72%	0.72%	0.59%	0.83%	0.67%
Industrial Park	0.65%	0.65%	0.69%	0.66%	0.69%	0.65%	0.81%	0.81%	0.81%	0.81%	0.81%	0.78%	0.67%	0.69%	0.68%	0.73%	0.73%	0.65%	0.62%	0.71%
Junior College (2yr)	0.83%	0.83%	0.84%	0.83%	0.84%	0.82%	0.79%	0.78%	0.80%	0.79%	0.79%	0.78%	0.83%	0.84%	0.84%	0.64%	0.67%	0.65%	0.87%	0.78%

# Table E-1.2. Non-Residential Electricity Reduction for 1 Percent Improvement over 2019 Title 24 Requirements

# Table E-1.2. Non-Residential Electricity Reduction for 1 Percent Improvement over 2019 Title 24 Requirements (cont.)

	Electricity Reduction by EDFZ <sup>2</sup>																			
Non-Residential Building Type <sup>1</sup>	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	State
Junior High School	0.80%	0.80%	0.81%	0.80%	0.81%	0.80%	0.86%	0.86%	0.87%	0.86%	0.86%	0.84%	0.87%	0.79%	0.79%	0.76%	0.78%	0.85%	0.95%	0.85%
Library	0.44%	0.43%	0.50%	0.43%	0.50%	0.41%	0.85%	0.86%	0.83%	0.85%	0.86%	0.83%	0.44%	0.54%	0.53%	0.68%	0.70%	0.42%	0.68%	0.61%
Manufacturing	0.44%	0.43%	0.50%	0.43%	0.50%	0.41%	0.85%	0.86%	0.83%	0.85%	0.86%	0.83%	0.44%	0.54%	0.53%	0.68%	0.70%	0.42%	0.68%	0.61%
Medical Office Building	0.65%	0.65%	0.69%	0.66%	0.69%	0.65%	0.81%	0.81%	0.81%	0.81%	0.81%	0.78%	0.67%	0.69%	0.68%	0.73%	0.73%	0.65%	0.62%	0.71%
Motel	0.49%	0.49%	0.49%	0.47%	0.49%	0.48%	0.76%	0.76%	0.78%	0.79%	0.79%	0.69%	0.54%	0.53%	0.53%	0.72%	0.72%	0.59%	0.83%	0.67%
Movie Theater (No Matinee)	0.44%	0.43%	0.50%	0.43%	0.50%	0.41%	0.85%	0.86%	0.83%	0.85%	0.86%	0.83%	0.44%	0.54%	0.53%	0.68%	0.70%	0.42%	0.68%	0.61%
Office Park	0.65%	0.65%	0.69%	0.66%	0.69%	0.65%	0.81%	0.81%	0.81%	0.81%	0.81%	0.78%	0.67%	0.69%	0.68%	0.73%	0.73%	0.65%	0.62%	0.71%
Pharmacy/Drugstore w/o Drive Thru	0.71%	0.71%	0.77%	0.73%	0.77%	0.71%	0.79%	0.79%	0.80%	0.79%	0.79%	0.81%	0.76%	0.79%	0.78%	0.65%	0.66%	0.72%	0.77%	0.75%
Pharmacy/Drugstore with Drive Thru	0.71%	0.71%	0.77%	0.73%	0.77%	0.71%	0.79%	0.79%	0.80%	0.79%	0.79%	0.81%	0.76%	0.79%	0.78%	0.65%	0.66%	0.72%	0.77%	0.75%
Place of Worship	0.44%	0.43%	0.50%	0.43%	0.50%	0.41%	0.85%	0.86%	0.83%	0.85%	0.86%	0.83%	0.44%	0.54%	0.53%	0.68%	0.70%	0.42%	0.68%	0.61%
Quality Restaurant	0.34%	0.36%	0.41%	0.36%	0.41%	0.36%	0.53%	0.54%	0.52%	0.50%	0.51%	0.51%	0.39%	0.43%	0.42%	0.48%	0.50%	0.47%	0.44%	0.44%
Racquet Club	0.44%	0.43%	0.50%	0.43%	0.50%	0.41%	0.85%	0.86%	0.83%	0.85%	0.86%	0.83%	0.44%	0.54%	0.53%	0.68%	0.70%	0.42%	0.68%	0.61%
Refrigerated Warehouse-No Rail	0.08%	0.08%	0.09%	0.08%	0.09%	0.08%	0.10%	0.11%	0.09%	0.08%	0.08%	0.09%	0.08%	0.10%	0.10%	0.09%	0.10%	0.18%	0.09%	0.09%
Refrigerated Warehouse-Rail	0.08%	0.08%	0.09%	0.08%	0.09%	0.08%	0.10%	0.11%	0.09%	0.08%	0.08%	0.09%	0.08%	0.10%	0.10%	0.09%	0.10%	0.18%	0.09%	0.09%
Regional Shopping Center	0.71%	0.71%	0.77%	0.73%	0.77%	0.71%	0.79%	0.79%	0.80%	0.79%	0.79%	0.81%	0.76%	0.79%	0.78%	0.65%	0.66%	0.72%	0.77%	0.75%
Research & Development	0.65%	0.65%	0.69%	0.66%	0.69%	0.65%	0.81%	0.81%	0.81%	0.81%	0.81%	0.78%	0.67%	0.69%	0.68%	0.73%	0.73%	0.65%	0.62%	0.71%
Strip Mall	0.71%	0.71%	0.77%	0.73%	0.77%	0.71%	0.79%	0.79%	0.80%	0.79%	0.79%	0.81%	0.76%	0.79%	0.78%	0.65%	0.66%	0.72%	0.77%	0.75%
Supermarket	0.37%	0.39%	0.46%	0.39%	0.46%	0.39%	0.35%	0.35%	0.38%	0.35%	0.35%	0.35%	0.39%	0.49%	0.47%	0.36%	0.36%	0.34%	0.24%	0.39%
University/College (4yr)	0.83%	0.83%	0.84%	0.83%	0.84%	0.82%	0.79%	0.78%	0.80%	0.79%	0.79%	0.78%	0.83%	0.84%	0.84%	0.64%	0.67%	0.65%	0.87%	0.78%
Unrefrigerated Warehouse-No Rail	0.35%	0.37%	0.37%	0.35%	0.37%	0.36%	0.67%	0.67%	0.62%	0.65%	0.65%	0.67%	0.47%	0.47%	0.46%	0.54%	0.54%	0.58%	0.33%	0.46%
Unrefrigerated Warehouse-Rail	0.35%	0.37%	0.37%	0.35%	0.37%	0.36%	0.67%	0.67%	0.62%	0.65%	0.65%	0.67%	0.47%	0.47%	0.46%	0.54%	0.54%	0.58%	0.33%	0.46%

Source: ICF calculations; California Energy Commission (CEC). 2021. Excel database with the 2018-2030 Uncalibrated Commercial Sector Forecast, provided to ICF. January 21, 2021.

EDFZ = Electricity Demand Forecast Zone; yr = year

<sup>1</sup> The 12 building types used by the commercial end use forecast have been cross walked to the 49 non-residential land use types in CalEEMod, as shown in Table E-1.6.

<sup>2</sup> Data for some EDFZ were not available in the commercial end use forecast, and a representative EDFZ was assumed (refer to Table E-1.1).

# Table E-1.3. Non-Residential Natural Gas Reduction for 1 Percent Improvement over 2019 Title 24 Requirements

	Natural Gas Reduction by EDFZ <sup>2</sup>																			
Non-Residential Building Type <sup>1</sup>	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	State
Arena	0.42%	0.42%	0.40%	0.41%	0.40%	0.42%	0.38%	0.37%	0.42%	0.39%	0.39%	0.51%	0.42%	0.39%	0.38%	0.38%	0.38%	0.38%	0.21%	0.40%
Automobile Care Center	0.42%	0.42%	0.40%	0.41%	0.40%	0.42%	0.38%	0.37%	0.42%	0.39%	0.39%	0.51%	0.42%	0.39%	0.38%	0.38%	0.38%	0.38%	0.21%	0.40%
Bank (with Drive-Through)	0.42%	0.42%	0.40%	0.41%	0.40%	0.42%	0.38%	0.37%	0.42%	0.39%	0.39%	0.51%	0.42%	0.39%	0.38%	0.38%	0.38%	0.38%	0.21%	0.40%
Convenience Market (24 hour)	0.76%	0.78%	0.69%	0.72%	0.68%	0.75%	0.18%	0.17%	0.27%	0.20%	0.19%	0.34%	0.49%	0.67%	0.67%	0.17%	0.18%	0.36%	0.17%	0.51%
Convenience Market with Gas Pumps	0.76%	0.78%	0.69%	0.72%	0.68%	0.75%	0.18%	0.17%	0.27%	0.20%	0.19%	0.34%	0.49%	0.67%	0.67%	0.17%	0.18%	0.36%	0.17%	0.51%
Day-Care Center	0.99%	0.99%	0.99%	0.99%	0.99%	0.99%	0.51%	0.52%	0.65%	0.58%	0.58%	0.55%	0.98%	0.99%	0.99%	0.50%	0.50%	0.70%	0.35%	0.83%
Discount Club	0.98%	0.98%	0.99%	0.99%	0.99%	0.98%	0.24%	0.23%	0.31%	0.24%	0.23%	0.29%	0.99%	0.99%	0.99%	0.24%	0.23%	0.41%	0.44%	0.68%
Electronic Superstore	0.98%	0.98%	0.99%	0.99%	0.99%	0.98%	0.24%	0.23%	0.31%	0.24%	0.23%	0.29%	0.99%	0.99%	0.99%	0.24%	0.23%	0.41%	0.44%	0.68%
Elementary School	0.99%	0.99%	0.99%	0.99%	0.99%	0.99%	0.51%	0.52%	0.65%	0.58%	0.58%	0.55%	0.98%	0.99%	0.99%	0.50%	0.50%	0.70%	0.35%	0.83%
Fast Food Restaurant w/o Drive Thru	0.17%	0.21%	0.22%	0.22%	0.22%	0.19%	0.18%	0.18%	0.20%	0.19%	0.19%	0.16%	0.23%	0.22%	0.22%	0.18%	0.18%	0.16%	0.13%	0.19%
Fast Food Restaurant with Drive Thru	0.17%	0.21%	0.22%	0.22%	0.22%	0.19%	0.18%	0.18%	0.20%	0.19%	0.19%	0.16%	0.23%	0.22%	0.22%	0.18%	0.18%	0.16%	0.13%	0.19%
Free-Standing Discount store	0.98%	0.98%	0.99%	0.99%	0.99%	0.98%	0.24%	0.23%	0.31%	0.24%	0.23%	0.29%	0.99%	0.99%	0.99%	0.24%	0.23%	0.41%	0.44%	0.68%
Free-Standing Discount Superstore	0.98%	0.98%	0.99%	0.99%	0.99%	0.98%	0.24%	0.23%	0.31%	0.24%	0.23%	0.29%	0.99%	0.99%	0.99%	0.24%	0.23%	0.41%	0.44%	0.68%
Gasoline/Service Station	0.42%	0.42%	0.40%	0.41%	0.40%	0.42%	0.38%	0.37%	0.42%	0.39%	0.39%	0.51%	0.42%	0.39%	0.38%	0.38%	0.38%	0.38%	0.21%	0.40%
General Heavy Industry	0.42%	0.42%	0.40%	0.41%	0.40%	0.42%	0.38%	0.37%	0.42%	0.39%	0.39%	0.51%	0.42%	0.39%	0.38%	0.38%	0.38%	0.38%	0.21%	0.40%
General Light Industry	0.42%	0.42%	0.40%	0.41%	0.40%	0.42%	0.38%	0.37%	0.42%	0.39%	0.39%	0.51%	0.42%	0.39%	0.38%	0.38%	0.38%	0.38%	0.21%	0.40%
General Office Building	0.79%	0.79%	0.87%	0.83%	0.88%	0.78%	0.79%	0.80%	0.85%	0.81%	0.81%	0.88%	0.86%	0.87%	0.86%	0.78%	0.78%	0.49%	0.51%	0.82%
Government (Civic Center)	0.79%	0.79%	0.87%	0.83%	0.88%	0.78%	0.79%	0.80%	0.85%	0.81%	0.81%	0.88%	0.86%	0.87%	0.86%	0.78%	0.78%	0.49%	0.51%	0.82%
Government Office Building	0.79%	0.79%	0.87%	0.83%	0.88%	0.78%	0.79%	0.80%	0.85%	0.81%	0.81%	0.88%	0.86%	0.87%	0.86%	0.78%	0.78%	0.49%	0.51%	0.82%
Hardware/Paint Store	0.98%	0.98%	0.99%	0.99%	0.99%	0.98%	0.24%	0.23%	0.31%	0.24%	0.23%	0.29%	0.99%	0.99%	0.99%	0.24%	0.23%	0.41%	0.44%	0.68%
Health Club	0.42%	0.42%	0.40%	0.41%	0.40%	0.42%	0.38%	0.37%	0.42%	0.39%	0.39%	0.51%	0.42%	0.39%	0.38%	0.38%	0.38%	0.38%	0.21%	0.40%
High School	0.99%	0.99%	0.99%	0.99%	0.99%	0.99%	0.51%	0.52%	0.65%	0.58%	0.58%	0.55%	0.98%	0.99%	0.99%	0.50%	0.50%	0.70%	0.35%	0.83%
High Turnover (Sit Down Restaurant)	0.17%	0.21%	0.22%	0.22%	0.22%	0.19%	0.18%	0.18%	0.20%	0.19%	0.19%	0.16%	0.23%	0.22%	0.22%	0.18%	0.18%	0.16%	0.13%	0.19%
Home Improvement Superstore	0.98%	0.98%	0.99%	0.99%	0.99%	0.98%	0.24%	0.23%	0.31%	0.24%	0.23%	0.29%	0.99%	0.99%	0.99%	0.24%	0.23%	0.41%	0.44%	0.68%
Hospital	0.75%	0.76%	0.71%	0.73%	0.70%	0.74%	0.65%	0.66%	0.69%	0.69%	0.69%	0.80%	0.69%	0.70%	0.70%	0.63%	0.61%	0.70%	0.69%	0.70%
Hotel	0.89%	0.89%	0.92%	0.92%	0.92%	0.88%	0.51%	0.51%	0.60%	0.53%	0.53%	0.78%	0.96%	0.91%	0.92%	0.52%	0.49%	0.76%	0.63%	0.76%
Industrial Park	0.79%	0.79%	0.87%	0.83%	0.88%	0.78%	0.79%	0.80%	0.85%	0.81%	0.81%	0.88%	0.86%	0.87%	0.86%	0.78%	0.78%	0.49%	0.51%	0.82%
Junior College (2yr)	0.96%	0.96%	0.88%	0.96%	0.86%	0.96%	0.85%	0.85%	0.87%	0.87%	0.87%	0.91%	0.96%	0.85%	0.92%	0.84%	0.85%	0.86%	0.71%	0.88%
Junior High School	0.99%	0.99%	0.99%	0.99%	0.99%	0.99%	0.51%	0.52%	0.65%	0.58%	0.58%	0.55%	0.98%	0.99%	0.99%	0.50%	0.50%	0.70%	0.35%	0.83%

	Natural Gas Reduction by EDFZ <sup>2</sup>																			
Non-Residential Building Type <sup>1</sup>	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	State
Library	0.42%	0.42%	0.40%	0.41%	0.40%	0.42%	0.38%	0.37%	0.42%	0.39%	0.39%	0.51%	0.42%	0.39%	0.38%	0.38%	0.38%	0.38%	0.21%	0.40%
Manufacturing	0.42%	0.42%	0.40%	0.41%	0.40%	0.42%	0.38%	0.37%	0.42%	0.39%	0.39%	0.51%	0.42%	0.39%	0.38%	0.38%	0.38%	0.38%	0.21%	0.40%
Medical Office Building	0.79%	0.79%	0.87%	0.83%	0.88%	0.78%	0.79%	0.80%	0.85%	0.81%	0.81%	0.88%	0.86%	0.87%	0.86%	0.78%	0.78%	0.49%	0.51%	0.82%
Motel	0.89%	0.89%	0.92%	0.92%	0.92%	0.88%	0.51%	0.51%	0.60%	0.53%	0.53%	0.78%	0.96%	0.91%	0.92%	0.52%	0.49%	0.76%	0.63%	0.76%
Movie Theater (No Matinee)	0.42%	0.42%	0.40%	0.41%	0.40%	0.42%	0.38%	0.37%	0.42%	0.39%	0.39%	0.51%	0.42%	0.39%	0.38%	0.38%	0.38%	0.38%	0.21%	0.40%
Office Park	0.79%	0.79%	0.87%	0.83%	0.88%	0.78%	0.79%	0.80%	0.85%	0.81%	0.81%	0.88%	0.86%	0.87%	0.86%	0.78%	0.78%	0.49%	0.51%	0.82%
Pharmacy/Drugstore w/o Drive Thru	0.98%	0.98%	0.99%	0.99%	0.99%	0.98%	0.24%	0.23%	0.31%	0.24%	0.23%	0.29%	0.99%	0.99%	0.99%	0.24%	0.23%	0.41%	0.44%	0.68%
Pharmacy/Drugstore with Drive Thru	0.98%	0.98%	0.99%	0.99%	0.99%	0.98%	0.24%	0.23%	0.31%	0.24%	0.23%	0.29%	0.99%	0.99%	0.99%	0.24%	0.23%	0.41%	0.44%	0.68%
Place of Worship	0.42%	0.42%	0.40%	0.41%	0.40%	0.42%	0.38%	0.37%	0.42%	0.39%	0.39%	0.51%	0.42%	0.39%	0.38%	0.38%	0.38%	0.38%	0.21%	0.40%
Quality Restaurant	0.17%	0.21%	0.22%	0.22%	0.22%	0.19%	0.18%	0.18%	0.20%	0.19%	0.19%	0.16%	0.23%	0.22%	0.22%	0.18%	0.18%	0.16%	0.13%	0.19%
Racquet Club	0.42%	0.42%	0.40%	0.41%	0.40%	0.42%	0.38%	0.37%	0.42%	0.39%	0.39%	0.51%	0.42%	0.39%	0.38%	0.38%	0.38%	0.38%	0.21%	0.40%
Refrigerated Warehouse-No Rail	0.24%	0.27%	0.58%	0.16%	0.57%	0.26%	0.02%	0.02%	0.03%	0.02%	0.02%	0.02%	0.05%	0.54%	0.39%	0.01%	0.01%	0.02%	0.03%	0.06%
Refrigerated Warehouse-Rail	0.24%	0.27%	0.58%	0.16%	0.57%	0.26%	0.02%	0.02%	0.03%	0.02%	0.02%	0.02%	0.05%	0.54%	0.39%	0.01%	0.01%	0.02%	0.03%	0.06%
Regional Shopping Center	0.98%	0.98%	0.99%	0.99%	0.99%	0.98%	0.24%	0.23%	0.31%	0.24%	0.23%	0.29%	0.99%	0.99%	0.99%	0.24%	0.23%	0.41%	0.44%	0.68%
Research & Development	0.79%	0.79%	0.87%	0.83%	0.88%	0.78%	0.79%	0.80%	0.85%	0.81%	0.81%	0.88%	0.86%	0.87%	0.86%	0.78%	0.78%	0.49%	0.51%	0.82%
Strip Mall	0.98%	0.98%	0.99%	0.99%	0.99%	0.98%	0.24%	0.23%	0.31%	0.24%	0.23%	0.29%	0.99%	0.99%	0.99%	0.24%	0.23%	0.41%	0.44%	0.68%
Supermarket	0.76%	0.78%	0.69%	0.72%	0.68%	0.75%	0.18%	0.17%	0.27%	0.20%	0.19%	0.34%	0.49%	0.67%	0.67%	0.17%	0.18%	0.36%	0.17%	0.51%
University/College (4yr)	0.96%	0.96%	0.88%	0.96%	0.86%	0.96%	0.85%	0.85%	0.87%	0.87%	0.87%	0.91%	0.96%	0.85%	0.92%	0.84%	0.85%	0.86%	0.71%	0.88%
Unrefrigerated Warehouse-No Rail	0.84%	0.87%	0.84%	0.85%	0.84%	0.86%	0.04%	0.04%	0.08%	0.04%	0.04%	0.04%	0.76%	0.83%	0.83%	0.04%	0.04%	0.06%	0.05%	0.21%
Unrefrigerated Warehouse-Rail	0.84%	0.87%	0.84%	0.85%	0.84%	0.86%	0.04%	0.04%	0.08%	0.04%	0.04%	0.04%	0.76%	0.83%	0.83%	0.04%	0.04%	0.06%	0.05%	0.21%

# Table E-1.3. Non-Residential Natural Gas Reduction for 1 Percent Improvement over 2019 Title 24 Requirements (cont.)

Source: ICF calculations; California Energy Commission (CEC). 2021. Excel database with the 2018-2030 Uncalibrated Commercial Sector Forecast, provided to ICF. January 21, 2021.

EDFZ = Electricity Demand Forecast Zone; yr = year

<sup>1</sup> The 12 building types used by the commercial end use forecast have been cross walked to the 49 non-residential land use types in CalEEMod, as shown in Table E-1.6.

<sup>2</sup> Data for some EDFZ were not available in the commercial end use forecast, and a representative EDFZ was assumed (refer to Table E-1.1).

# Table E-1.4. Residential Electricity Reduction for 1 Percent Improvement over 2019 Title 24 Requirements

	Electricity Reduction by EDFZ <sup>2</sup>															
Housing Type <sup>1</sup>	1	2	3	4	5	6	7	8	9	10	11	12	13	16	17	State
Single Family Housing	0.14%	0.15%	0.33%	0.26%	0.34%	0.15%	0.22%	0.17%	0.31%	0.32%	0.34%	0.18%	0.24%	0.20%	0.26%	0.23%
Apartments Low Rise	0.11%	0.12%	0.28%	0.24%	0.31%	0.11%	0.16%	0.15%	0.24%	0.28%	0.41%	0.11%	0.27%	0.12%	0.20%	0.27%
Apartments Mid Rise	0.13%	0.14%	0.24%	0.27%	0.32%	0.13%	0.17%	0.15%	0.31%	0.27%	0.36%	0.15%	0.27%	0.13%	0.22%	0.29%
Apartments High Rise	0.13%	0.14%	0.24%	0.27%	0.32%	0.13%	0.17%	0.15%	0.31%	0.27%	0.36%	0.15%	0.27%	0.13%	0.22%	0.29%
Condo/Townhouse	0.10%	0.12%	0.22%	0.22%	0.27%	0.10%	0.16%	0.15%	0.26%	0.24%	0.40%	0.12%	0.29%	0.10%	0.24%	0.24%
Condo/Townhouse High Rise	0.13%	0.14%	0.24%	0.27%	0.32%	0.13%	0.17%	0.15%	0.31%	0.27%	0.36%	0.15%	0.27%	0.13%	0.22%	0.29%
Mobile Home Park	0.20%	0.19%	0.38%	0.28%	0.34%	0.16%	0.23%	0.11%	0.32%	0.31%	0.39%	0.21%	0.27%	0.19%	0.27%	0.35%
Retirement Community	0.11%	0.12%	0.28%	0.24%	0.31%	0.11%	0.16%	0.15%	0.24%	0.28%	0.41%	0.11%	0.27%	0.12%	0.20%	0.27%
Congregate Care	0.13%	0.14%	0.24%	0.27%	0.32%	0.13%	0.17%	0.15%	0.31%	0.27%	0.36%	0.15%	0.27%	0.13%	0.22%	0.29%

Source: ICF calculations; California Energy Commission. 2020. Excel database with the 2019 Residential Appliance Saturation Study (RASS), provided to ICF. November 13, 2020.

EDFZ = Electricity Demand Forecast Zone

<sup>1</sup> The five housing types used by the RASS have been cross walked to the nine residential land use types in CalEEMod, as shown in Table E-1.6.

<sup>2</sup> Data for some EDFZ were not available in the RASS, and a representative EDFZ was assumed (refer to Table E-1.1).

#### Table E-1.5. Residential Natural Gas Reduction for 1 Percent Improvement over 2019 Title 24 Requirements

	Natural Gas Reduction by EDFZ <sup>2</sup>															
Housing Type <sup>1</sup>	1	2	3	4	5	6	7	8	9	10	11	12	13	16	17	State
Single Family Housing	0.94%	0.95%	0.95%	0.95%	0.94%	0.94%	0.88%	0.89%	0.93%	0.89%	0.86%	0.91%	0.95%	0.88%	0.88%	0.92%
Apartments Low Rise	0.94%	0.94%	0.95%	0.93%	0.92%	0.91%	0.87%	0.88%	0.91%	0.89%	0.90%	0.90%	0.91%	0.89%	0.88%	0.91%
Apartments Mid Rise	0.93%	0.98%	0.95%	0.96%	0.95%	0.93%	0.87%	0.88%	0.96%	0.91%	0.90%	0.91%	0.96%	0.84%	0.81%	0.90%
Apartments High Rise	0.93%	0.98%	0.95%	0.96%	0.95%	0.93%	0.87%	0.88%	0.96%	0.91%	0.90%	0.91%	0.96%	0.84%	0.81%	0.90%
Condo/Townhouse	0.94%	0.97%	0.98%	0.94%	0.92%	0.93%	0.89%	0.90%	0.94%	0.89%	0.90%	0.92%	0.95%	0.89%	0.89%	0.92%
Condo/Townhouse High Rise	0.93%	0.98%	0.95%	0.96%	0.95%	0.93%	0.87%	0.88%	0.96%	0.91%	0.90%	0.91%	0.96%	0.84%	0.81%	0.90%
Mobile Home Park	0.92%	0.95%	0.92%	0.92%	0.92%	0.93%	0.92%	0.93%	0.93%	0.94%	0.91%	0.92%	0.94%	0.94%	0.88%	0.92%
Retirement Community	0.94%	0.94%	0.95%	0.93%	0.92%	0.91%	0.87%	0.88%	0.91%	0.89%	0.90%	0.90%	0.91%	0.89%	0.88%	0.91%
Congregate Care	0.93%	0.98%	0.95%	0.96%	0.95%	0.93%	0.87%	0.88%	0.96%	0.91%	0.90%	0.91%	0.96%	0.84%	0.81%	0.90%

Source: ICF calculations; California Energy Commission. 2020. Excel database with the 2019 Residential Appliance Saturation Study (RASS), provided to ICF. November 13, 2020.

EDFZ = Electricity Demand Forecast Zone

<sup>1</sup> The five housing types used by the RASS have been cross walked to the nine residential land use types in CalEEMod, as shown in Table E-1.6.

<sup>2</sup> Data for some EDFZ were not available in the RASS, and a representative EDFZ was assumed (refer to Table E-1.1).

Table E-1.6. Residential Appliance Saturation Study/Commercial End Use Forecas	st
to CalEEMod Land Use Type Mapping	

Land Use Type <sup>1</sup>	Mapped Land Use Type <sup>2</sup>
College	Junior college (2yr), University/college (4yr)
Grocery	Convenience market (24 hour), Convenience market with gas pumps, Supermarket
Hospital	Hospital
Hotel/motel	Hotel, Motel
Large office	General office building, Government (civic center), Government office building, Industrial park, Medical office building, Office park, Research & development
Miscellaneous	Arena, automobile care center, Bank (with drive-through), Gasoline/service station, General heavy industry, General light industry, Health club, Library, Manufacturing, Movie theater (no matinee), Place of worship, Racquet club
Refg. Warehouse	Refrigerated warehouse
Restaurant	Fast food restaurant w/o drive thru, Fast food restaurant with drive thru, High turnover (sit down restaurant), Quality restaurant
Retail	Discount club, Electronic superstore, Free-standing discount store, Free-standing discount superstore, Hardware/paint store, Home improvement superstore, Pharmacy/drugstore, Regional shopping center, Strip mall
Schools	Day-care center, Elementary school, High school, Junior high school
Small office	n/a
Warehouse	Unrefrigerated warehouse
Single family detached	Single family housing
Apartment or condo (2- 4 units)	Apartments low rise, Retirement community
Apartment or condo (5+ units)	Apartments mid rise, Apartments high rise, Condo/townhome high rise, Congregate care
Townhome, duplex, or row house	Condo/townhouse
Mobile home	Mobile home park

RASS = Residential Appliance Saturation Study; Refg. = refrigerated; yr = year; n/a = no mapped land use type <sup>1</sup> Excludes land use types with zero energy consumption in the commercial end use forecast and RASS.

<sup>2</sup> The commercial end use forecast and RASS land use types were mapped to those analyzed in the California Emissions Estimator Model (CalEEMod).

# Table E-2.1. Electricity Reduction of ENERGY STAR Appliance compared to Conventional Appliance

Appliance Type	Electricity Reduction (%)
Commercial Refrigerator	-20%
Residential Refrigerator	-9%
Clothes Washer	-25%
Dishwasher	-12%
Ceiling Fan	-60%

Sources: ENERGY STAR. 2014. Refrigerators – Overview. September. Available: https://www.energystar.gov/products/appliances/refrigerators. Accessed: January 2021.

ENERGY STAR. 2016. Dishwashers – Overview. January. Available:

https://www.energystar.gov/products/appliances/dishwashers. Accessed: January 2021.

ENERGY STAR. 2017. Commercial Refrigerators & Freezers – Overview. March. Available: https://www.energystar.gov/products/commercial\_food\_service\_equipment/commercial\_refrigerators\_freezers. Accessed: January 2021

ENERGY STAR. 2018a. Clothes Washers – Overview. February. Available: https://www.energystar.gov/products/appliances/clothes\_washers?qt-consumers\_product\_tab=2#qtconsumers\_product\_tab. Accessed: January 2021.

ENERGY STAR. 2018b. Ceiling Fans – Overview. June. Available:

https://www.energystar.gov/products/lighting\_fans/ceiling\_fans. Accessed: January 2021.

	Commercial Refrigerator Percent of Total Building Electricity by EDFZ <sup>2</sup>													
Non-Residential Building Type <sup>1</sup>	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Arena	1%	2%	1%	2%	1%	2%	<1%	<1%	<1%	<1%	<1%	<1%	2%	2%
Automobile Care Center	1%	2%	1%	2%	1%	2%	<1%	<1%	<1%	<1%	<1%	<1%	2%	2%
Bank (with Drive-Through)	1%	2%	1%	2%	1%	2%	<1%	<1%	<1%	<1%	<1%	<1%	2%	2%
Convenience Market (24 hour)	23%	23%	21%	23%	20%	23%	57%	57%	52%	56%	57%	55%	27%	23%
Convenience Market with Gas Pumps	23%	23%	21%	23%	20%	23%	57%	57%	52%	56%	57%	55%	27%	23%
Day-Care Center	3%	3%	3%	3%	3%	3%	1%	1%	2%	2%	2%	1%	2%	3%
Discount Club	2%	2%	1%	2%	1%	2%	2%	2%	2%	2%	2%	2%	2%	1%
Electronic Superstore	2%	2%	1%	2%	1%	2%	2%	2%	2%	2%	2%	2%	2%	1%
Elementary School	3%	3%	3%	3%	3%	3%	1%	1%	2%	2%	2%	1%	2%	3%
Fast Food Restaurant w/o Drive Thru	13%	12%	12%	13%	12%	13%	24%	24%	23%	26%	26%	22%	15%	14%
Fast Food Restaurant with Drive Thru	13%	12%	12%	13%	12%	13%	24%	24%	23%	26%	26%	22%	15%	14%
Free-Standing Discount store	2%	2%	1%	2%	1%	2%	2%	2%	2%	2%	2%	2%	2%	1%
Free-Standing Discount Superstore	2%	2%	1%	2%	1%	2%	2%	2%	2%	2%	2%	2%	2%	1%
Gasoline/Service Station	1%	2%	1%	2%	1%	2%	<1%	<1%	<1%	<1%	<1%	<1%	2%	2%
General Heavy Industry	1%	2%	1%	2%	1%	2%	<1%	<1%	<1%	<1%	<1%	<1%	2%	2%
General Light Industry	1%	2%	1%	2%	1%	2%	<1%	<1%	<1%	<1%	<1%	<1%	2%	2%
General Office Building	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%
Government (Civic Center)	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%
Government Office Building	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%
Hardware/Paint Store	2%	2%	1%	2%	1%	2%	2%	2%	2%	2%	2%	2%	2%	1%
Health Club	1%	2%	1%	2%	1%	2%	<1%	<1%	<1%	<1%	<1%	<1%	2%	2%
High School	3%	3%	3%	3%	3%	3%	1%	1%	2%	2%	2%	1%	2%	3%
High Turnover (Sit Down Restaurant)	13%	12%	12%	13%	12%	13%	24%	24%	23%	26%	26%	22%	15%	14%
Home Improvement Superstore	2%	2%	1%	2%	1%	2%	2%	2%	2%	2%	2%	2%	2%	1%
Hospital	<1%	<1%	<1%	<1%	<1%	<1%	1%	1%	<1%	1%	1%	2%	<1%	<1%
Hotel	4%	4%	4%	4%	4%	4%	8%	8%	7%	8%	8%	10%	5%	5%
Industrial Park	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%
Junior College (2yr)	<1%	<1%	<1%	<1%	<1%	<1%	4%	4%	3%	4%	4%	3%	<1%	<1%

# Table E-2.2. Non-Residential Percent of Total Building Electricity for Commercial Refrigerators

15	16	17	18	19	State
2%	<1%	<1%	<1%	<1%	<1%
2%	<1%	<1%	<1%	<1%	<1%
2%	<1%	<1%	<1%	<1%	<1%
24%	55%	55%	50%	45%	35%
24%	55%	55%	50%	45%	35%
3%	1%	1%	<1%	1%	2%
1%	2%	2%	2%	2%	2%
1%	2%	2%	2%	2%	2%
3%	1%	1%	<1%	1%	2%
14%	19%	20%	19%	16%	17%
14%	19%	20%	19%	16%	17%
1%	2%	2%	2%	2%	2%
1%	2%	2%	2%	2%	2%
2%	<1%	<1%	<1%	<1%	<1%
2%	<1%	<1%	<1%	<1%	<1%
2%	<1%	<1%	<1%	<1%	<1%
<1%	<1%	<1%	<1%	<1%	<1%
<1%	<1%	<1%	<1%	<1%	<1%
<1%	<1%	<1%	<1%	<1%	<1%
1%	2%	2%	2%	2%	2%
2%	<1%	<1%	<1%	<1%	<1%
3%	1%	1%	<1%	1%	2%
14%	19%	20%	19%	16%	17%
1%	2%	2%	2%	2%	2%
<1%	<1%	<1%	<1%	9%	1%
5%	8%	8%	7%	3%	7%
<1%	<1%	<1%	<1%	<1%	<1%
<1%	3%	2%	3%	5%	3%

# Table E-2.2. Non-Residential Percent of Total Building Electricity for Commercial Refrigerators (cont.)

	Commercial Refrigerator Percent of Total Building Electricity by EDFZ <sup>2</sup>													
Non-Residential Building Type <sup>1</sup>	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Junior High School	3%	3%	3%	3%	3%	3%	1%	1%	2%	2%	2%	1%	2%	3%
Library	1%	2%	1%	2%	1%	2%	<1%	<1%	<1%	<1%	<1%	<1%	2%	2%
Manufacturing	1%	2%	1%	2%	1%	2%	<1%	<1%	<1%	<1%	<1%	<1%	2%	2%
Medical Office Building	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%
Motel	4%	4%	4%	4%	4%	4%	8%	8%	7%	8%	8%	10%	5%	5%
Movie Theater (No Matinee)	1%	2%	1%	2%	1%	2%	<1%	<1%	<1%	<1%	<1%	<1%	2%	2%
Office Park	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%
Pharmacy/Drugstore w/o Drive Thru	2%	2%	1%	2%	1%	2%	2%	2%	2%	2%	2%	2%	2%	1%
Pharmacy/Drugstore with Drive Thru	2%	2%	1%	2%	1%	2%	2%	2%	2%	2%	2%	2%	2%	1%
Place of Worship	1%	2%	1%	2%	1%	2%	<1%	<1%	<1%	<1%	<1%	<1%	2%	2%
Quality Restaurant	13%	12%	12%	13%	12%	13%	24%	24%	23%	26%	26%	22%	15%	14%
Racquet Club	1%	2%	1%	2%	1%	2%	<1%	<1%	<1%	<1%	<1%	<1%	2%	2%
Refrigerated Warehouse-No Rail	64%	64%	64%	64%	64%	64%	80%	79%	81%	83%	83%	82%	72%	71%
Refrigerated Warehouse-Rail	64%	64%	64%	64%	64%	64%	80%	79%	81%	83%	83%	82%	72%	71%
Regional Shopping Center	2%	2%	1%	2%	1%	2%	2%	2%	2%	2%	2%	2%	2%	1%
Research & Development	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%	<1%
Strip Mall	2%	2%	1%	2%	1%	2%	2%	2%	2%	2%	2%	2%	2%	1%
Supermarket	23%	23%	21%	23%	20%	23%	57%	57%	52%	56%	57%	55%	27%	23%
University/College (4yr)	<1%	<1%	<1%	<1%	<1%	<1%	4%	4%	3%	4%	4%	3%	<1%	<1%
Unrefrigerated Warehouse-No Rail	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Unrefrigerated Warehouse-Rail	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

Source: ICF calculations; California Energy Commission (CEC). 2021. Excel database with the 2018-2030 Uncalibrated Commercial Sector Forecast, provided to ICF. January 21, 2021.

EDFZ = Electricity Demand Forecast Zone; yr = year

<sup>1</sup> The 12 building types used by the commercial end use forecast have been cross walked to the 49 non-residential land use types in CalEEMod, as shown in Table E-1.6.

<sup>2</sup> Data for some EDFZ were not available in the commercial end use forecast, and a representative EDFZ was assumed (refer to Table E-1.1).

15	16	17	18	19	State
3%	1%	1%	<1%	1%	2%
2%	<1%	<1%	<1%	<1%	<1%
2%	<1%	<1%	<1%	<1%	<1%
<1%	<1%	<1%	<1%	<1%	<1%
5%	8%	8%	7%	3%	7%
2%	<1%	<1%	<1%	<1%	<1%
<1%	<1%	<1%	<1%	<1%	<1%
1%	2%	2%	2%	2%	2%
1%	2%	2%	2%	2%	2%
2%	<1%	<1%	<1%	<1%	<1%
14%	19%	20%	19%	16%	17%
2%	<1%	<1%	<1%	<1%	<1%
71%	78%	78%	52%	73%	72%
71%	78%	78%	52%	73%	72%
1%	2%	2%	2%	2%	2%
<1%	<1%	<1%	<1%	<1%	<1%
1%	2%	2%	2%	2%	2%
24%	55%	55%	50%	45%	35%
<1%	3%	2%	3%	5%	3%
0%	0%	0%	0%	0%	0%
0%	0%	0%	0%	0%	0%

# Table E-2.3. Residential Percent of Total Building Electricity by Appliance

	Percent of Total Electricity by Appliance by EDFZ <sup>2</sup>															
Housing Type <sup>1</sup>	1	2	3	4	5	6	7	8	9	10	11	12	13	16	17	State
Refrigerator																
Single Family Housing	18%	18%	14%	15%	13%	18%	17%	17%	15%	15%	13%	18%	16%	18%	15%	16%
Apartments Low Rise	26%	29%	22%	25%	21%	27%	28%	26%	25%	23%	17%	27%	25%	27%	28%	26%
Apartments Mid Rise	28%	29%	25%	24%	22%	29%	28%	29%	22%	24%	21%	28%	24%	30%	27%	27%
Apartments High Rise	28%	29%	25%	24%	22%	29%	28%	29%	22%	24%	21%	28%	24%	30%	27%	27%
Condo/Townhouse	24%	24%	24%	22%	22%	26%	24%	24%	22%	24%	17%	26%	21%	27%	23%	24%
Condo/Townhouse High Rise	28%	29%	25%	24%	22%	29%	28%	29%	22%	24%	21%	28%	24%	30%	27%	27%
Mobile Home Park	23%	21%	15%	17%	16%	23%	22%	28%	17%	18%	17%	21%	21%	25%	20%	19%
Retirement Community	26%	29%	22%	25%	21%	27%	28%	26%	25%	23%	17%	27%	25%	27%	28%	26%
Congregate Care	28%	29%	25%	24%	22%	29%	28%	29%	22%	24%	21%	28%	24%	30%	27%	27%
Clothes Washer																
Single Family Housing	1.1%	0.8%	0.7%	0.8%	0.9%	1.0%	1.2%	1.1%	0.9%	1.0%	0.9%	1.1%	0.9%	1.1%	1.1%	1.0%
Apartments Low Rise	1.0%	1.0%	1.0%	0.6%	0.8%	0.9%	1.0%	1.0%	0.9%	1.0%	0.6%	1.0%	0.6%	1.0%	0.5%	0.9%
Apartments Mid Rise	0.6%	0.6%	0.7%	0.6%	0.6%	0.5%	0.5%	0.6%	0.7%	0.6%	0.5%	0.6%	0.7%	0.5%	0.6%	0.6%
Apartments High Rise	0.6%	0.6%	0.7%	0.6%	0.6%	0.5%	0.5%	0.6%	0.7%	0.6%	0.5%	0.6%	0.7%	0.5%	0.6%	0.6%
Condo/Townhouse	1.3%	1.1%	0.8%	1.1%	1.1%	1.4%	1.3%	1.2%	1.2%	1.3%	0.8%	1.2%	1.0%	1.3%	1.6%	1.2%
Condo/Townhouse High Rise	0.6%	0.6%	0.7%	0.6%	0.6%	0.5%	0.5%	0.6%	0.7%	0.6%	0.5%	0.6%	0.7%	0.5%	0.6%	0.6%
Mobile Home Park	1.5%	1.1%	0.9%	0.8%	0.8%	1.0%	1.1%	1.3%	0.9%	0.8%	0.8%	0.9%	0.9%	0.6%	1.3%	0.9%
Retirement Community	1.0%	1.0%	1.0%	0.6%	0.8%	0.9%	1.0%	1.0%	0.9%	1.0%	0.6%	1.0%	0.6%	1.0%	0.5%	0.9%
Congregate Care	0.6%	0.6%	0.7%	0.6%	0.6%	0.5%	0.5%	0.6%	0.7%	0.6%	0.5%	0.6%	0.7%	0.5%	0.6%	0.6%
Dishwasher																
Single Family Housing	1.1%	0.9%	0.6%	0.8%	0.7%	0.9%	0.9%	1.0%	0.7%	0.8%	0.8%	1.0%	0.9%	0.8%	0.8%	0.9%
Apartments Low Rise	1.0%	0.9%	1.0%	0.7%	0.8%	0.9%	0.8%	1.1%	0.8%	1.0%	0.7%	1.1%	0.8%	0.6%	0.6%	0.9%
Apartments Mid Rise	1.0%	0.7%	0.9%	0.7%	0.7%	0.8%	0.9%	0.7%	0.9%	0.9%	0.8%	1.0%	0.9%	0.8%	1.1%	0.9%
Apartments High Rise	1.0%	0.7%	0.9%	0.7%	0.7%	0.8%	0.9%	0.7%	0.9%	0.9%	0.8%	1.0%	0.9%	0.8%	1.1%	0.9%
Condo/Townhouse	1.2%	1.0%	0.6%	0.9%	0.8%	1.3%	1.1%	1.2%	0.8%	0.9%	0.7%	1.2%	0.8%	0.7%	1.1%	1.1%
Condo/Townhouse High Rise	1.0%	0.7%	0.9%	0.7%	0.7%	0.8%	0.9%	0.7%	0.9%	0.9%	0.8%	1.0%	0.9%	0.8%	1.1%	0.9%
Mobile Home Park	0.8%	0.6%	0.4%	0.6%	0.4%	0.8%	0.6%	0.6%	0.5%	0.4%	0.5%	0.8%	0.6%	0.3%	0.6%	0.6%
Retirement Community	1.0%	0.9%	1.0%	0.7%	0.8%	0.9%	0.8%	1.1%	0.8%	1.0%	0.7%	1.1%	0.8%	0.6%	0.6%	0.9%

# Table E-2.3. Residential Percent of Total Building Electricity by Appliance (cont.)

						Perce	nt of Total El	ectricity by A	ppliance by	EDFZ <sup>2</sup>						
Housing Type <sup>1</sup>	1	2	3	4	5	6	7	8	9	10	11	12	13	16	17	State
Congregate Care	1.0%	0.7%	0.9%	0.7%	0.7%	0.8%	0.9%	0.7%	0.9%	0.9%	0.8%	1.0%	0.9%	0.8%	1.1%	0.9%
Ceiling Fan																
Single Family Housing	1.3%	1.2%	0.9%	1.0%	0.9%	1.3%	1.2%	1.3%	0.9%	1.1%	0.9%	1.3%	0.9%	1.2%	1.0%	1.1%
Apartments Low Rise	2.2%	2.4%	1.8%	1.9%	1.7%	2.6%	2.2%	2.1%	1.8%	1.8%	1.2%	2.4%	1.7%	2.3%	2.3%	2.1%
Apartments Mid Rise	2.4%	2.6%	1.7%	1.8%	1.7%	2.8%	2.3%	2.4%	1.6%	1.9%	1.5%	2.5%	1.7%	2.5%	2.1%	2.3%
Apartments High Rise	2.4%	2.6%	1.7%	1.8%	1.7%	2.8%	2.3%	2.4%	1.6%	1.9%	1.5%	2.5%	1.7%	2.5%	2.1%	2.3%
Condo/Townhouse	1.9%	2.0%	1.6%	1.6%	1.5%	2.3%	1.8%	1.9%	1.6%	1.7%	1.1%	2.0%	1.3%	2.1%	1.6%	1.8%
Condo/Townhouse High Rise	2.4%	2.6%	1.7%	1.8%	1.7%	2.8%	2.3%	2.4%	1.6%	1.9%	1.5%	2.5%	1.7%	2.5%	2.1%	2.3%
Mobile Home Park	2.0%	1.5%	1.1%	1.2%	1.2%	1.8%	1.7%	2.3%	1.2%	1.5%	1.2%	1.8%	1.5%	1.9%	1.7%	1.4%
Retirement Community	2.2%	2.4%	1.8%	1.9%	1.7%	2.6%	2.2%	2.1%	1.8%	1.8%	1.2%	2.4%	1.7%	2.3%	2.3%	2.1%
Congregate Care	2.4%	2.6%	1.7%	1.8%	1.7%	2.8%	2.3%	2.4%	1.6%	1.9%	1.5%	2.5%	1.7%	2.5%	2.1%	2.3%

Source: ICF calculations; California Energy Commission (CEC). 2020. Excel database with the 2019 Residential Appliance Saturation Study (RASS), provided to ICF. November 13, 2020.

EDFZ = Electricity Demand Forecast Zone

<sup>1</sup> The five housing types used by the RASS have been cross walked to the nine residential land use types in CalEEMod, as shown in Table E-1.6.

<sup>2</sup> Data for some EDFZ were not available in the RASS, and a representative EDFZ was assumed (refer to Table E-1.1).

Table E-3-A.1. Average	Annual Fu	el Use anc	l Savings by	y Boiler ˈ	Type for	Residential
Boilers						

		Annual Fuel Use	
AFUE by Boiler Type <sup>1, 2</sup>	Total (MMBtu/yr) <sup>3</sup>	Savings (MMBtu/yr)	Change (%)
Gas-fired⁴ Hot Water Boi	ler		
84% (Standard)	82.1	—	—
85%	81.1	1.0	-1.2%
90%	75.2	6.9	-8.4%
92%	73.6	8.5	-10.4%
96% (Max Tech)	70.6	11.5	-14.0%
Gas-fired Steam Boiler			
82% (Standard)	83.9	—	—
83% (Max Tech)	82.9	1.0	-1.2%
Oil-fired Hot Water Boile	r		
86% (Standard)	84.3	—	—
91% (Max Tech)	80.1	4.2	-5.0%
Oil-fired Steam Boiler			
85% (Standard)	82.9	—	—
86% (Max Tech)	81.9	1.0	-1.2%

Source: U.S. Department of Energy (U.S. DOE). 2015. Technical Support Document: Energy Efficiency Program for Consumer Products and Commercial and Industrial Equipment: Residential Boilers. March. Available: https://www.regulations.gov/docketBrowser?rpp=25&so=DESC&sb=commentDueDate&po=0&dct=SR%2BO&D=EERE -2012-BT-STD-0047. Accessed: January 2021.

AFUE = Annual fuel utilization efficiency; MMBtu = one million British Thermal Units; yr = year

<sup>1</sup> "Standard" refers to the minimum AFUE required by the 2016 Conservation Standards for Residential Boilers.

<sup>2</sup> "Max Tech" refers to the maximum technologically feasible improvement in energy efficiency determined by DOE for each type of boiler.

<sup>3</sup> The average annual fuel use is based on historical consumption data.

<sup>4</sup> Gas-fired boilers refer to boilers that use natural gas and/or propane as fuel.

Table E-3-B.1. Average Annual Fuel Use and Savings for Boilers Installed Be	efore
January 10, 2023 for Commercial and Industrial Boilers	

		Annual Fuel Use	
CE or TE by Boiler Type <sup>1, 2</sup>	Total (MMBtu/yr) <sup>3</sup>	Savings (MMBtu/yr)	Change (%)
Gas-fired Hot Water Boiler (	≥300,000 Btu/hr and	≤2,500,000 Btu/hr)	
80% TE (Standard)	907.7	_	_
81% TE	896.3	11.4	-1.3%
82% TE	885.2	22.6	-2.5%
84% TE	863.7	44	-4.8%
85% TE	853.4	54.4	-6.0%
93% TE	815.7	92	-10.1%
95% TE	797.3	110.4	-12.2%
99% TE (Max Tech)	762.9	144.8	-16.0%
Gas-fired Hot Water Boiler (	≥2,500,000 Btu/hr aı	nd ≤10,000,000 Btu/hr)	)
82% CE (Standard)	6,008.8	—	—
83% CE	5,929.9	78.9	-1.3%
84% CE	5,853.1	155.7	-2.6%
85% CE	5,778.3	230.5	-3.8%
94% CE	5,442.5	566.3	-9.4%
97% CE (Max Tech)	5,252.2	756.6	-12.6%
Oil-fired Hot Water Boiler (≥	300,000 Btu/hr and	≤2,500,000 Btu/hr)	
82% TE (Standard)	807.3	—	—
83% TE	797.4	9.9	-1.2%
84% TE	787.8	19.5	-2.4%
85% TE	778.4	28.9	-3.6%
87% TE	760.2	47.1	-5.8%
88% TE	751.5	55.8	-6.9%
97% TE (Max Tech)	709.5	97.8	-12.1%
Oil-fired Hot Water Boiler (≥	2,500,000 Btu/hr an	d ≤10,000,000 Btu/hr)	
84% CE (Standard)	3,119.1	—	—
86% CE	3,047.7	71.4	-2.3%
88% CE	2,979.5	139.6	-4.5%
89% CE	2,946.5	172.6	-5.5%
97% CE (Max Tech)	2,854.2	264.9	-8.5%
Gas-fired Steam Boiler (≥30	0,000 Btu/hr and $\leq 2$	,500,000 Btu/hr)	
77% TE (Standard)	787.0	—	—
78% TE	776.7	10.3	-1.3%
79% TE	766.7	20.3	-2.6%
80% TE	757	30	-3.8%
81% TE	747.4	39.6	-5.0%
83% TE (Max Tech)	729.1	57.9	-7.4%

-			
		Annual Fuel Use	
CE or TE by Boiler Type <sup>1, 2</sup>	Total (MMBtu/yr) <sup>3</sup>	Savings (MMBtu/yr)	Change (%)
Gas-fired Steam Boiler (≥2,			
77% TE (Standard)	4,956.9	—	—
78% TE	4,892.1	64.8	-1.3%
79% TE	4,829.0	127.9	-2.6%
80% TE	4,767.5	189.4	-3.8%
81% TE	4,707.6	249.3	-5.0%
82% TE	4,649.1	307.8	-6.2%
84% TE (Max Tech)	4,536.4	420.5	-8.5%
Oil-fired Steam Boiler (≥300	),000 Btu/hr and ≤2,	500,000 Btu/hr)	
81% TE (Standard)	845.7	—	_
83% TE	825.0	20.7	-2.4%
84% TE	815.0	30.7	-3.6%
86% TE (Max Tech)	795.8	49.9	-5.9%
Oil-fired Steam Boiler (≥2,5	00,000 Btu/hr and $\leq$	10,000,000 Btu/hr)	
81% TE (Standard)	3,730.3	_	_
83% TE	3,639.0	91.3	-2.4%
85% TE	3,552.1	178.2	-4.8%
87% (Max Tech)	3,469.2	261.1	-7.0%

# Table E-3-B.1. Average Annual Fuel Use and Savings for Boilers Installed Before January 10, 2023 for Commercial and Industrial Boilers (cont.)

Source: U.S. Department of Energy (U.S. DOE). 2016. Technical Support Document: Energy Efficiency Program for Consumer Products and Commercial and Industrial Equipment: Commercial Packaged Boilers. December. Available: https://www.regulations.gov/docket?D=EERE-2013-BT-STD-0030. Accessed: January 2021.

CE = combustion efficiency; MMBtu = one million British Thermal Unit; TE = thermal efficiency; yr = year; Btu = British Thermal Unit;  $\geq$  = greater than or equal to;  $\leq$  = less than or equal to

<sup>1</sup> "Standard" refers to the minimum CE or TE required by the 2012 Conservation Standards for Commercial Packaged Boilers.

<sup>2</sup> "Max Tech" refers to the maximum technologically feasible improvement in energy efficiency determined by DOE for each type of boiler.

<sup>3</sup> The average annual fuel use is based on historical consumption data.

Table E-3-B.2.	Average	Annual F	Jel Use	and S	Savings	for B	Boilers I	nstalled	On or
After January 1	10, 2023								

		Annual Fuel Use	
CE or TE by Boiler Type <sup>1, 2</sup>	Total (MMBtu/yr) <sup>3</sup>	Savings (MMBtu/yr)	Change (%)
Gas-fired Hot Water Boiler (	≥300,000 Btu/hr and	l ≤2,500,000 Btu/hr)	
84% TE (Standard)	863.7	—	
85% TE	853.4	10.3	-1.2%
93% TE	815.7	48.0	-5.6%
95% TE	797.3	66.4	-7.7%
99% TE (Max Tech)	762.9	100.8	-11.7%
Gas-fired Hot Water Boiler (	≥2,500,000 Btu/hr a	nd ≤10,000,000 Btu/hr	)
85% CE (Standard)	5,778.3	—	—
94% CE	5,442.5	335.8	-5.8%
97% CE (Max Tech)	5,252.2	526.1	-9.1%
Oil-fired Hot Water Boiler (≥	300,000 Btu/hr and	≤2,500,000 Btu/hr)	
87% TE (Standard)	760.2	—	—
88% TE	751.5	8.7	-1.1%
97% TE (Max Tech)	709.5	50.7	-6.7%
Oil-fired Hot Water Boiler (≥	2,500,000 Btu/hr an	d ≤10,000,000 Btu/hr)	
88% CE (Standard)	2,979.5	—	
89% CE	2,946.5	33.0	-1.1%
97% CE (Max Tech)	2,854.2	125.3	-4.2%
Gas-fired Steam Boiler (≥30	0,000 Btu/hr and $\leq$ 2	2,500,000 Btu/hr)	
81% TE (Standard)	747.4	—	—
83% TE (Max Tech)	729.1	18.3	-2.4%
Gas-fired Steam Boiler (≥2,	500,000 Btu/hr and ≤	≤10,000,000 Btu/hr)	
82% TE (Standard)	4,649.1	—	
84% TE (Max Tech)	4,536.4	112.7	-2.4%
Oil-fired Steam Boiler (≥300	),000 Btu/hr and $\leq 2$ ,	500,000 Btu/hr)	
84% TE (Standard)	815.0	—	
86% TE (Max Tech)	795.8	19.2	-2.4%
Oil-fired Steam Boiler (≥2,5	00,000 Btu/hr and $\leq$	10,000,000 Btu/hr)	
81% TE (Standard)	3,730.3	_	_
83% TE	3,639.0	91.3	-2.4%
85% TE	3,552.1	178.2	-4.8%
87% (Max Tech)	3,469.2	261.1	-7.0%

Source: U.S. Department of Energy (U.S. DOE). 2016. Technical Support Document: Energy Efficiency Program for Consumer Products and Commercial and Industrial Equipment: Commercial Packaged Boilers. December. Available: https://www.regulations.gov/docket?D=EERE-2013-BT-STD-0030. Accessed: January 2021.

CE = combustion efficiency; MMBtu = one million British Thermal Units; TE = thermal efficiency; yr = year; Btu = British Thermal Unit;  $\geq$  = greater than or equal to;  $\leq$  = less than or equal to

<sup>1</sup> "Standard" refers to the minimum CE or TE required by the 2020 Conservation Standards for Commercial Packaged Boilers.

<sup>2</sup> "Max Tech" refers to the maximum technologically feasible improvement in energy efficiency determined by DOE for each type of boiler.

<sup>3</sup> The average annual fuel use is based on historical consumption data.

Ratio	Height (ft)	Width (ft)	Neighboring Building Types Represented
0.2	19.7	98.4	Two-story single-family homes across a residential street
1	19.7	19.7	Two-story single-family homes across small backyards
2	19.7	9.8	Two-story single-family homes on the same street side
10	98.4	9.8	Adjacent 10-story office buildings on the same street side

## Table E-4.1. Canyon Aspect Ratios

Source: Levinson, R. 2019. Using Solar Availability Factors to Adjust Cool-Wall Energy Savings for Shading and Reflection by Neighboring Buildings. March. Available: https://escholarship.org/content/qt0hf5m90n/qt0hf5m90n.pdf. Accessed: January 2021.

ft = foot

### Table E-4.2. Solar Availability Factors by Canyon Aspect Ratio

	Conventional Neighboring Wall (albedo = 0.25)				Cool Neighboring Wall (albedo = 0.60)			
Ratio	North	East	South	West	North	East	South	West
0.2	0.92	0.92	0.95	0.92	1.02	0.95	0.96	0.95
1	0.67	0.62	0.7	0.62	0.94	0.72	0.75	0.72
2	0.47	0.42	0.49	0.42	0.73	0.52	0.55	0.52
10	0.13	0.11	0.13	0.11	0.22	0.15	0.16	0.15

Source: Levinson, R. 2019. Using Solar Availability Factors to Adjust Cool-Wall Energy Savings for Shading and Reflection by Neighboring Buildings. March. Available: https://escholarship.org/content/qt0hf5m90n/qt0hf5m90n.pdf. Accessed: January 2021.

# Table E-4.3. Greenhouse Gas Intensity Factor by California Electricity Provider by Year (2017–2031)<sup>1</sup>

					Intensity Fa	ctor per Total	Energy Delive	ered (lb CO <sub>2</sub> e	per MWh)
Electricity Provider	2019	2020	2021	2022	2023	2024	2025	2026	2027
Alameda Municipal Power	455	0 <sup>2</sup>	0	0	0	0	0	0	0
Apple Valley Choice Energy	655	655	655	595	595	595	595	526	526
Bear Valley Electric Service	914	914	914	567	567	567	567	483	483
Burbank Water & Power	1,132	1,008	932	902	884	669	398	224	221
Baldwin Park Resident Owned Utility District	3	585	585	598	598	598	598	526	526
Central Coast Community Energy	12	137	509	542	528	448	388	313	235
City of Anaheim Public Utilities Department	1,037	965	982	1001	985	937	756	568	469
City of Commerce	4	4	4	600	600	600	600	518	518
City of Palo Alto Utilities Department	0	0	0	0	0	0	0	0	0
City of Riverside	875	788	792	791	789	789	602	451	441
City of Vernon Municipal Light Department	707	713	567	545	504	508	456	416	420
CleanPowerSF	46	19	132	122	108	94	80	9	9
Clean Energy Alliance	3	964	964	545	544	544	544	449	449
Clean Power Alliance	361	474	474	432	432	432	431	416	416
Desert Community Energy	534	47	85	85	81	76	72	68	65
Glendale Water and Power	1027	948	951	785	790	693	550	346	357
Imperial Irrigation District	459	183	192	189	219	223	225	264	268
Lancaster Choice Energy	618	618	618	600	600	600	600	516	516
Los Angeles Department of Water & Power	694	694	694	694	694	694	694	694	694
MCE	190	292	292	151	151	150	150	184	184
Merced Irrigation District	455	293	293	403	403	403	403	405	405
Modesto Irrigation District	480	503	455	467	474	481	490	394	408
Pacific Gas and Electric Company	2066	206	206	206	206	206	206	206	206
PacifiCorp	1,501	1,292	1,188	1,228	1,254	1029	978	967	930
Pasadena Water and Power	1,030	869	875	869	869	465	82	71	68
Peninsula Clean Energy	102	102	0	0	0	0	0	0	0
Pico Rivera Innovative Municipal Energy	687	687	686	595	594	594	594	527	527
Pioneer Community Energy	767	767	767	624	623	623	623	482	482
Pomona Choice Energy	3	618	618	598	598	598	598	517	517
Rancho Mirage Energy Authority	648	648	647	591	591	591	591	526	526
Redding Electric Utility	377	374	339	339	337	341	350	161	166
Redwood Coast Energy Authority	64	317	408	231	181	226	226	200	200
Roseville Electric	530	532	474	473	473	448	394	377	360
Sacramento Municipal Utility District	376	375	360	344	329	314	297	280	269
San Diego Community Power	4	4	4	583	583	582	582	486	486
San Diego Gas & Electric	591	542	542	542	542	542	541	47	47
San Francisco Public Utilities Commission	0	0	0	0	0	0	0	0	0
San Jacinto Power	583	643	643	583	583	582	582	486	486
San Jose Clean Energy	811	811	810	390	390	390	390	363	363
Silicon Valley Clean Energy	2	2	2	6	5	5	5	5	4

2028	2029	2030	2031
0	0	0	0
526	526	334	334
483	483	435	435
216	218	236	236
526	526	336	336
159	83	8	8
311	304	276	271
518	518	331	331
0	25	75	75
432	415	398	398
426	321	326	326
9	9	0	0
449	449	431	431
416	416	332	332
62	60	58	58
370	285	304	304
277	251	249	249
516	516	333	333
694	694	694	694
184	184	247	247
405	405	391	391
385	368	373	373
206	206	206	206
808	784	724	722
68	71	64	64
0	0	0	0
527	527	335	335
482	482	391	391
517	517	333	332
526	526	328	328
173	175	181	181
200	200	244	244
343	325	309	309
254	239	224	210
486	486	324	324
46	46	171	171
0	0	0	0
486	486	324	324
363	363	311	311
4	4	3	3

#### Table E-4.3. Greenhouse Gas Intensity Factor by California Electricity Provider by Year (2017–2031) (cont.)<sup>1</sup>

		Intensity Factor per Total Energy Delivered (lb CO2e per MWh)											
Electricity Provider	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Silicon Valley Power	389	357	310	168	187	205	224	224	227	232	239	155	155
Sonoma Clean Power	41	78	122	117	112	107	102	96	91	86	81	76	76
Southern California Edison	534	393	393	351	351	351	351	348	348	348	348	263	263
Turlock Irrigation District	589	702	610	563	694	704	581	547	296	291	336	348	286
Valley Clean Energy	206	961	961	639	639	639	639	520	520	519	519	391	391
Western Community Energy	3	534	534	397	397	330	330	330	330	393	393	392	392
Statewide Average <sup>7</sup>	455	448	430	411	393	375	355	335	321	303	285	268	250

Sources: ICF calculations; California Utilities. 2021. Excel database of GHG emission factors for delivered electricity, provided to the Sacramento Metropolitan Air Quality Management District and ICF. January through March 2021; U.S. Environmental Protection Agency. 2021. Emissions & Generation Resource Integrated Database (eGRID). Last Revised: February 23, 2021. Available: https://www.epa.gov/egrid. Accessed: February 24, 2021.

Ib = pounds; MWh = megawatt-hour;  $CO_2e$  = carbon dioxide equivalent

<sup>1</sup> All electricity providers gave an emission factor for at least one reported year. Emission factors for remaining years were calculated according to the following method, except where noted below.

• If an electricity provider gave data up until a year before 2045, all years between the last year of data given and 2045 were held constant at the values for the last year of data given. For example, Burbank Water & Power provided emission factors through 2030. Emission factors for years 2031 through 2045 were held constant at value provided for 2030.

• If an electricity provider gave factors for CO<sub>2</sub>, but not CH<sub>4</sub> or N<sub>2</sub>O, statewide average emission factors for CH<sub>4</sub> and N<sub>2</sub>O were assumed to calculate CO<sub>2</sub>e emission factors for the utility.

Users should consult their local electricity provider for updated emission factors available at the time of their analysis before proceeding with the defaults provided in this table.

<sup>2</sup> The electricity provider indicated that it began deriving carbon-free power beginning in 2020. This factor was held constant into all future years.

<sup>3</sup> The electricity provider began service in 2020.

<sup>4</sup> The electricity provider is not expected to begin service until 2022.

<sup>5</sup> The electricity providers' GHG emissions reported in their IRP filing change to positive in 2029 and 2030. This may be because they have not yet developed a plan to achieve carbon-free (or negative) power after 2029.

<sup>6</sup> 2018 value (data for 2019 not available).

<sup>7</sup> CO<sub>2</sub>, CH<sub>4</sub>, and N<sub>2</sub>O emission factors for 2019 obtained from USEPA eGRID2019. Future year emission factors were calculated based on the 2019 intensity factors divided by the percent of energy delivered from non-renewable sources in that same year (68%). The calculated non-renewable source emission factors were multiplied by the projected percentage of energy delivered from non-renewable sources in future years is per the requirements of Senate Bill 100: 33% RPS by 2020, 44% RPS by 2024, 50% RPS by 2026, 52% RPS by 2027, 60% RPS by 2030, and 100% carbon-free electricity for 2045. Percentages for non-Senate Bill 100 target years were interpolated.

	Intensity Factor per Total Energy Delivered (lb CO <sub>2</sub> e per MWh)													
Electricity Provider	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
Alameda Municipal Power	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Apple Valley Choice Energy	333	333	333	333	333	333	333	333	333	333	333	333	333	332
Bear Valley Electric Service	435	435	435	435	435	435	435	434	434	434	434	434	434	434
Burbank Water & Power	236	236	236	236	236	236	236	236	236	236	236	236	236	236
Baldwin Park Resident Owned Utility District	336	336	335	335	335	335	335	335	335	335	335	335	335	335
Central Coast Community Energy	8	8	7	7	7	7	7	7	7	7	7	7	7	7
City of Anaheim Public Utilities Department	267	267	267	267	267	267	267	267	267	267	267	267	267	267
City of Commerce	331	331	331	331	331	330	330	330	330	330	330	330	330	330
City of Palo Alto Utilities Department	7	7	7	7	7	7	7	7	7	7	7	7	7	7
City of Riverside	398	398	398	398	398	398	398	398	398	398	398	398	398	398
City of Vernon Municipal Light Department	326	326	326	326	326	326	326	326	326	326	326	326	326	326
CleanPowerSF	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clean Energy Alliance	431	431	431	430	430	430	430	430	430	430	430	430	430	430
Clean Power Alliance	332	332	332	331	331	331	331	331	331	331	331	331	331	331
Desert Community Energy	58	58	58	58	58	58	57	57	57	57	57	57	57	57
Glendale Water and Power	304	304	304	304	304	304	304	304	304	304	304	304	304	304
Imperial Irrigation District	249	249	249	249	249	249	249	249	249	249	249	249	249	249
Lancaster Choice Energy	333	333	333	333	333	333	333	333	332	332	332	332	332	332
Los Angeles Department of Water & Power	694	694	694	694	694	694	694	694	694	694	694	694	694	694
MCE	247	247	247	247	247	247	247	247	247	247	246	246	246	246
Merced Irrigation District	391	391	391	391	391	391	391	391	391	391	390	390	390	390
Modesto Irrigation District	373	373	373	373	373	373	373	373	373	373	373	373	373	373
Pacific Gas and Electric Company	206	206	206	206	206	206	206	206	206	206	206	206	206	206
PacifiCorp	711	706	704	684	686	616	536	499	463	483	479	331	304	304
Pasadena Water and Power	64	64	64	64	64	64	62	62	62	62	62	62	62	62
Peninsula Clean Energy	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pico Rivera Innovative Municipal Energy	335	335	335	335	335	335	335	335	335	335	335	334	334	334
Pioneer Community Energy	391	391	391	391	391	391	391	391	391	391	390	390	390	390

# Table E-4.4. Greenhouse Gas Intensity Factor by California Electricity Provider by Year (2032–2045)<sup>1</sup>

	Intensity Factor per Total Energy Delivered (lb CO <sub>2</sub> e per MWh)													
Electricity Provider	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
Pomona Choice Energy	332	332	332	332	332	332	332	332	332	332	332	331	331	331
Rancho Mirage Energy Authority	328	328	328	328	328	328	328	328	328	327	327	327	327	327
Redding Electric Utility	181	181	181	181	181	181	181	181	181	181	181	181	181	181
Redwood Coast Energy Authority	243	243	243	243	243	243	243	243	243	243	243	243	243	242
Roseville Electric	309	309	309	309	309	309	309	309	309	309	309	309	309	309
Sacramento Municipal Utility District	195	180	165	150	135	120	106	91	76	61	46	31	16	2
San Diego Community Power	324	324	324	324	324	324	324	324	324	324	324	323	323	323
San Diego Gas & Electric	171	171	171	170	170	170	170	170	170	170	170	170	170	170
San Francisco Public Utilities Commission	0	0	0	0	0	0	0	0	0	0	0	0	0	0
San Jacinto Power	324	324	324	324	324	324	324	324	324	324	324	323	323	323
San Jose Clean Energy	311	311	311	311	311	311	310	310	310	310	310	310	310	310
Silicon Valley Clean Energy	3	3	3	3	3	2	2	2	2	2	2	2	2	2
Silicon Valley Power	155	155	155	155	155	155	155	155	155	155	155	155	155	155
Sonoma Clean Power	76	76	76	76	76	76	76	75	75	75	75	75	75	75
Southern California Edison	263	263	263	263	263	263	263	263	263	263	263	263	263	263
Turlock Irrigation District	263	263	263	263	263	263	263	263	263	263	263	263	263	263
Valley Clean Energy	391	391	391	391	391	391	391	391	391	391	390	390	390	390
Western Community Energy	378	378	378	378	378	378	378	378	377	377	377	377	377	377
Statewide Average <sup>2</sup>	232	214	196	178	161	143	125	107	89	71	54	36	18	0

#### Table E-4.4. Greenhouse Gas Intensity Factor by California Electricity Provider by Year (2032–2045) (cont.)<sup>1</sup>

Sources: ICF calculations; California Utilities. 2021. Excel database of GHG emission factors for delivered electricity, provided to the Sacramento Metropolitan Air Quality Management District and ICF. January through March 2021; U.S. Environmental Protection Agency. 2021. Emissions & Generation Resource Integrated Database (eGRID). Last Revised: February 23, 2021. Available: https://www.epa.gov/egrid. Accessed: February 24, 2021.

Ib = pounds; MWh = megawatt-hour;  $CO_2e$  = carbon dioxide equivalent

<sup>1</sup> All electricity providers gave an emission factor for at least one reported year. Emission factors for remaining years were calculated according to the following method, except where noted below.

• If an electricity provider gave data up until a year before 2045, all years between the last year of data given and 2045 were held constant at the values for the last year of data given. For example, Burbank Water & Power provided emission factors through 2030. Emission factors for years 2031 through 2045 were held constant at value provided for 2030.

• If electricity provider gave factors for CO<sub>2</sub>, but not CH<sub>4</sub> or N<sub>2</sub>O, statewide average emission factors for CH<sub>4</sub> and N<sub>2</sub>O were assumed to calculate CO<sub>2</sub>e emission factors for the utility.

Users should consult their local electricity provider for updated emission factors available at the time of their analysis before proceeding with the defaults provided in this table.

<sup>2</sup> CO<sub>2</sub>, CH<sub>4</sub>, and N<sub>2</sub>O emission factors for 2019 obtained from USEPA eGRID2019. Future year emission factors were calculated based on the 2019 intensity factors divided by the percent of energy delivered from non-renewable sources in that same year (68%). The calculated non-renewable source emission factors were multiplied by the projected percentage of energy delivered from non-renewable sources in each future year. The percentages of energy delivered from renewable sources in future years is per the requirements of Senate Bill 100: 33% RPS by 2020, 44% RPS by 2024, 50% RPS by 2026, 52% RPS by 2027, 60% RPS by 2030, and 100% carbon-free electricity for 2045. Percentages for non-Senate Bill 100 target years were interpolated.

	Emission Factor by Lo	and Use Type (lb/MMBtu)
Pollutant	Residential	Non-Residential
TOG	0.011	0.011
ROG	0.005	0.005
SO <sub>2</sub>	0.001	0.001
NO <sub>x</sub> <sup>1</sup>	0.092	0.098
PM10	0.007	0.007
PM2.5	0.007	0.007
СО	0.039	0.082
$CO_2$	116.977	117.647
$CH_4$	0.010	0.010
$N_2O$	0.000	0.002
CO <sub>2</sub> e	117.325	118.549

### Table E-4.5. Natural Gas Emission Factors

Sources: U.S. Environmental Protection Agency. 1998. AP 42, Fifth Edition, Volume I. Chapter 1: External Combustion Sources. 1.4, Natural Gas Combustion. July. Available: https://www3.epa.gov/ttnchie1/ap42/ch01/final/c01s04.pdf. Accessed: January 2021.

U.S. Environmental Protection Agency. 2020. Emission Factors for Greenhouse Gas Inventories. March. Available: https://www.epa.gov/sites/production/files/2020-04/documents/ghg-emission-factors-hub.pdf. Accessed: March 2021.

TOG = total organic gases; ROG = reactive organic gases; CO = carbon monoxide; SO<sub>2</sub> = sulfur dioxide; NOx = nitrogen oxides; PM10 = particulate matter less than or equal to 10 microns; PM2.5 = particulate matter less than or equal to 2.5 microns; CO<sub>2</sub> = carbon dioxide; CH<sub>4</sub> = methane; N<sub>2</sub>O = nitrous oxide; CO<sub>2</sub> = carbon dioxide equivalent; lb = pound; MMBtu = one million British Thermal Units

<sup>1</sup> Both BAAQMD Regulation 9 Rule 6 and SCAQMD Rule 1121 require that natural gas water heaters limit NO<sub>x</sub> emissions to 10 nanograms per joule, which equates to 0.023 lb/MMBtu, lower than the generic value of 0.092 lb/MMBtu provided above. Users with a project in BAAQMD or SCAQMD territory that are calculating the NO<sub>x</sub> reduction associated with Measure E-11, Install Alternative Type of Water Heater in Place of Gas Storage Tank Heater in Residences, should use the value of 0.023 lb/MMBtu.

	Elec	tricity Sc	ivings (k	Wh/yr/K	Gas Savings (therm/yr/KSF)						
Building Type	Bakersfield	Fresno	Los Angeles	Sacramento	San Francisco	Bakersfield	Fresno	Los Angeles	Sacramento	San Francisco	
Office <sup>3</sup>	106.9	122.9	36.9	126.7	62.9	0.1	0.2	0.0	0.2	0.0	
Residential <sup>₄</sup>	12.2	31.7	-14.6	37.6	-23.2	7.7	7.9	3.4	8.2	5.2	

# Table E-5.1. Changes in Energy Use of Green Roof Compared to Dark Roof by Building Type and City<sup>1</sup>

Source: Sailor, D., Brass, B., Peck, S. 2008. Green Roof Energy Calculator. Available:

https://sustainability.asu.edu/urban-climate/green-roof-calculator/. Accessed: January 2021.

kWh = kilowatt-hour; KSF = thousand square feet; yr = year

<sup>1</sup> The Green Roof Energy calculator was run for the above building types and cities using conservative values for the remaining tool inputs: growing media depth (2 inches), leaf area index (0.5), irrigation (no), green roof coverage (50%), remaining roof material (dark). A "dark roof" is defined as having an albedo of 0.15.

<sup>2</sup> Negative electricity savings represent an increase in electricity use.

<sup>3</sup> The office building defined for the Green Roof Energy Calculator is a 3-story medium office building with a floor area of 53.6 KSF.

<sup>4</sup> The residential building defined for the Green Roof Energy Calculator is a 4-story midrise apartment complex with a floor area of 33.6 KSF.

Lamp Type	Typical Power Rating (W)	Source Efficacy (LPW)						
High-pressure sodium	70-400	80-120						

55-180

20-400

70-400

20-70

25-32

70-250

40-250

### Table E-7.1. Outdoor Lighting Power Consumption and Efficacy by Lamp Type<sup>1</sup>

Source: California Lighting Technology Center. 2015. 2013 Title 24, Part 6 Outdoor Lighting Guide. University of
California, Davis. March. Available: https://cltc.ucdavis.edu/sites/default/files/files/publication/2013-title-24-outdoor-
ighting-guide-mar15.pdf. Accessed: January 2021.

CFL = compact fluorescent lamp; LED = light emitting diode; LPW = lumens per watt; W = watts

<sup>1</sup> Values are based on lamp sizes typically used in outdoor applications. These numbers are subject to change as technologies improve. Source efficacy is based on initial lumen output; system efficacy depends on the specifications of the luminaires and ballasts or drivers employed. Some outdoor applications may be best served by products with characteristics that fall outside of the ranges listed in this table.

# Table E-10-B.1. Estimated Electricity Generation from Typical PV Systems

### (kilowatt-hours per year)<sup>1</sup>

Low-pressure sodium

Ceramic metal halide

Metal halide

Induction

Linear fluorescent

CFL

LED

Air District	Major City	Zip Code	3 kW	5 kW	10 kW
Amador County	lone	95640	4,696	7,827	15,655
Antelope Valley	Lancaster	93534	5,410	9,017	18,034
Bay Area	San Francisco	94163	4,646	7,744	9,292
Butte County	Chico	95926	4,514	7,524	9,028
Calaveras County	Rancho Calaveras	95252	4,714	7,857	9,428
Colusa County	Colusa	95932	4,641	7,735	9,282
El Dorado County	South Lake Tahoe	96150	5,181	8,635	10,362
Feather River	Yuba City	95991	4,637	7,729	9,274
Glenn County	Orland	95963	4,578	7,630	9,156
Great Basin Unified	Bishop	93514	5,462	9,104	10,924
Imperial County	El Centro	92243	5,191	8,652	10,382
Kern County	Bakersfield	93301	5,000	8,334	10,000
Lake County	Lakeport	95453	4,610	7,684	9,220
Lassen County	Susanville	96130	4,804	8,007	9,608

130-170

75-110

40-70

80-85

80-100

50-85

Up to 130
Air District	Major City	Zip Code	3 kW	5 kW	10 kW
Mariposa County	Mariposa	95338	4,835	8,059	9,670
Mendocino County	Ukiah	95482	4,508	7,514	9,016
Modoc County	Alturas	96101	4,651	7,752	9,302
Mojave Desert	Victorville	92392	5,429	9,049	10,858
Monterey Bay	Monterey	93940	4,629	7,715	9,258
North Coast Unified	Eureka	95501	3,974	6,624	7,948
Northern Sierra	Grass Valley	95949	4,600	7,667	9,200
Northern Sonoma County	Healdsburg	95448	4,638	7,730	9,276
Placer County	Roseville	95678	4,608	7,680	9,216
Sacramento Metro	Sacramento	95864	4,713	7,855	9,426
San Diego County	San Diego	92182	4,999	8,332	9,998
San Joaquin Valley	Fresno	93650	4,819	8,032	9,638
San Luis Obispo County	San Luis Obispo	93405	4,993	8,322	9,986
Santa Barbara County	Santa Barbara	93101	4,923	8,205	9,846
Shasta County	Redding	96001	4,340	7,234	8,680
Siskiyou County	Yreka	96097	4,490	7,484	8,980
South Coast	Los Angeles	90071	4,984	8,307	9,968
Tehama County	Red Bluff	96080	4,513	7,522	9,026
Tuolumne County	Sonora	95370	4,827	8,045	9,654
Ventura County	Oxnard	93030	4,965	8,275	9,930
Yolo-Solano	Davis	95616	4,759	7,932	9,518

# Table E-10-B.1. Estimated Electricity Generation from Typical PV Systems (kilowatt-hours per year) (cont.)<sup>1</sup>

Source: National Renewable Energy Laboratory (NREL). 2017. NREL's PVWatts® Calculator. August. Available: https://pvwatts.nrel.gov/index.php. Accessed: January 2021.

kW = kilowatt; PV = photovoltaic

<sup>1</sup>Default inputs for system information were used to run the simulation.

		Energy (Therm/yr/du for NG and kWh/yr/du for electricity)								
			Electric	Solar Water	Solar Water					
		Storage	Storage	Heater w/ NG	Heater w/					
<b>EDFZ</b> <sup>1</sup>	Housing Type <sup>2</sup>	Tank	Tank	Backup <sup>3</sup>	Electric Backup <sup>3</sup>					
	Single Family Housing	255	2,309	210	1,319					
	Apartments Low Rise	236	1,249	_						
	Apartments Mid Rise	234	1,139	_	_					
	Apartments High Rise	234	1,139	_						
1	Condo/Townhouse	245	1,626	_	_					
	Condo/Townhouse High Rise	234	1,139	_						
	Mobile Home Park	245	2,761	_						
	Retirement Community	236	1,249	_						
	, Congregate Care	234	1,139	_						
	Single Family Housing	279	2,381	180	1,400					
	Apartments Low Rise	217	1,014	—	_					
	Apartments Mid Rise	211	1,203	—	_					
	Apartments High Rise	211	1,203	—	_					
2	Condo/Townhouse	238	1,280	—	_					
	Condo/Townhouse High Rise	211	1,203	—	—					
	Mobile Home Park	257	1,790	_	_					
	Retirement Community	217	1,014	_	_					
	Congregate Care	211	1,203	_	_					
	Single Family Housing	239	2,327		1,750					
	Apartments Low Rise	218	836							
	Apartments Mid Rise	188	917							
	Apartments High Rise	188	917	—	—					
3	Condo/Townhouse	214	1,228	—						
	Condo/Townhouse High Rise	188	917	—	—					
	Mobile Home Park	223	2,349	—	—					
	Retirement Community	218	836	—						
	Congregate Care	188	917	—	—					
	Single Family Housing	248	2,502	187	1,238					
	Apartments Low Rise	247	1,316	—	—					
	Apartments Mid Rise	244	1,299	—	—					
	Apartments High Rise	244	1,299	—	—					
4	Condo/Townhouse	250	1,308	—	—					
	Condo/Townhouse High Rise	244	1,299	—	—					
	Mobile Home Park	228	2,258	—	—					
	Retirement Community	247	1,316	—	—					
	Congregate Care	244	1,299	_	_					

#### Table E-12.1. Energy Consumption by Type of Water Heater, Electricity Demand Forecast Zone, and Housing Type

		Energy (T	herm/yr/du fo	r NG and kWh/yr,	/du for electricity)
		NG	Electric	Solar Water	Solar Water
		Storage	Storage	Heater w/ NG	Heater w/
EDFZ'	Housing Type <sup>2</sup>	Tank	Tank	Backup	Electric Backup <sup>3</sup>
	Single Family Housing	309	2,344	2/2	2,077
	Apartments Low Rise	365			
	Apartments Mid Rise	356	1,521	_	—
	Apartments High Rise	356	1,521	—	—
5	Condo/Townhouse	352		—	—
	Condo/Townhouse High Rise	356	1,521	—	—
	Mobile Home Park	290	1,749	—	—
	Retirement Community	365	—	—	—
	Congregate Care	356	1,521	—	—
	Single Family Housing	265	2,373	203	1,750
	Apartments Low Rise	352	915	—	—
	Apartments Mid Rise	358	783	—	—
	Apartments High Rise	358	783	—	—
6	Condo/Townhouse	352	1,995	—	904
	Condo/Townhouse High Rise	358	783	—	—
	Mobile Home Park	258	2,015	—	—
	Retirement Community	352	915	—	—
	Congregate Care	358	783	—	—
	Single Family Housing	260	2,676	244	483
	Apartments Low Rise	246	1,238	181	—
	Apartments Mid Rise	245	1,148	—	—
	Apartments High Rise	245	1,148	—	—
7	Condo/Townhouse	255	1,233	—	1,475
	Condo/Townhouse High Rise	245	1,148		
	Mobile Home Park	251	2,046	174	_
	Retirement Community	246	1,238	181	_
	Congregate Care	245	1,148	_	_
	Single Family Housing	272	1,935	213	
	Apartments Low Rise	286	1,097	—	_
	Apartments Mid Rise	282	1,076	_	_
	Apartments High Rise	282	1,076	_	_
8	Condo/Townhouse	273	1,057	_	
	Condo/Townhouse High Rise	282	1,076	_	_
	Mobile Home Park	245	, 	_	_
	Retirement Community	286	1,097	_	_
	, Congregate Care	282	, 1,076	_	_

# Table E-12.1. Energy Consumption by Type of Water Heater, Electricity Demand Forecast Zone, and Housing Type (cont.)

		Energy (T	herm/yr/du fo	r NG and kWh/y	r/du for electricity)
		NG	Electric	Solar Water	Solar Water
		Storage	Storage	Heater w/	Heater w/
EDFZ	Housing Type <sup>2</sup>	Tank	Tank	NG Backup <sup>3</sup>	Electric Backup <sup>3</sup>
	Single Family Housing	272	2,466	278	1,385
	Apartments Low Rise	265	898	—	—
	Apartments Mid Rise	266	1,512	—	—
	Apartments High Rise	266	1,512	—	—
9	Condo/Townhouse	267	1,473	—	—
	Condo/Townhouse High Rise	266	1,512	—	—
	Mobile Home Park	262	3,008	—	—
	Retirement Community	265	898	—	—
	Congregate Care	266	1,512		
	Single Family Housing	231	2,091	199	739
	Apartments Low Rise	204	1,373	—	—
	Apartments Mid Rise	197	1,154	—	—
	Apartments High Rise	197	1,154	—	—
10	Condo/Townhouse	210	1,143	—	—
	Condo/Townhouse High Rise	197	1,154	_	_
	Mobile Home Park	224	2,280	—	—
	Retirement Community	204	1,373	—	—
	Congregate Care	197	1,154	—	—
	Single Family Housing	224	2,595	_	_
	Apartments Low Rise	172	1,297	—	—
	Apartments Mid Rise	194	1,366	—	—
	Apartments High Rise	194	1,366	—	—
11	Condo/Townhouse	182	1,400	109	—
	Condo/Townhouse High Rise	194	1,366	—	—
	Mobile Home Park	218	2,055	—	—
	Retirement Community	172	1,297	—	_
	Congregate Care	194	1,366		_
	Single Family Housing	210	2,156	174	1,332
	Apartments Low Rise	203	1,011	220	_
	Apartments Mid Rise	200	1,027	154	—
	Apartments High Rise	200	1,027	154	—
12	Condo/Townhouse	204	1,310	164	_
	Condo/Townhouse High Rise	200	1,027	154	_
	Mobile Home Park	203	1,867	_	_
	Retirement Community	203	1,011	220	_
	, Congregate Care	200	, 1,027	154	_

# Table E-12.1. Energy Consumption by Type of Water Heater, Electricity Demand Forecast Zone, and Housing Type (cont.)

		Energy (T	herm/yr/du fo	r NG and kWh/y	r/du for electricity)
		NG	Electric	Solar Water	Solar Water
		Storage	Storage	Heater w/	Heater w/
	Housing Type <sup>2</sup>	Tank	Tank	NG Backup <sup>3</sup>	Electric Backup <sup>3</sup>
	Single Family Housing	241	2,803	179	1,479
	Apartments Low Rise	263	1,575	—	—
	Apartments Mid Rise	278	1,608	—	—
	Apartments High Rise	278	1,608	—	—
13	Condo/Townhouse	256	1,790	—	—
	Condo/Townhouse High Rise	278	1,608	—	—
	Mobile Home Park	229	2,256	_	—
	Retirement Community	263	1,575	—	—
	Congregate Care	278	1,608		
	Single Family Housing	359	1,895	331	1,301
	Apartments Low Rise	286	1,640	—	—
	Apartments Mid Rise	267	932	—	—
	Apartments High Rise	267	932	_	_
16	Condo/Townhouse	296	740	_	_
	Condo/Townhouse High Rise	267	932	_	_
	Mobile Home Park	319		_	_
	Retirement Community	286	1,640	_	_
	Congregate Care	267	932	_	_
	Single Family Housing	290	2,734	232	
	Apartments Low Rise	332		—	—
	Apartments Mid Rise	330	1,202	—	—
	Apartments High Rise	330	1,202	_	_
17	Condo/Townhouse	348	1,664	229	_
	Condo/Townhouse High Rise	330	1,202	_	_
	Mobile Home Park	294		—	—
	Retirement Community	332		_	_
	, Congregate Care	330	1,202	_	_
	Single Family Housing	250	2,338	195	1,291
	Apartments Low Rise	238	1,215	220	
	Apartments Mid Rise	245	1,131	_	_
	Apartments High Rise	245	1,131		
State	Condo/Townhouse	244	, 1 <i>.</i> 344	167	1,190
	Condo/Townhouse High Rise	245	1.131		
	Mobile Home Park	232	2.120	174	_
	Retirement Community	238	1,215	220	_
	Congregate Care	245	1,131		

# Table E-12.1. Energy Consumption by Type of Water Heater, Electricity Demand Forecast Zone, and Housing Type (cont.)

Source: ICF calculations; California Energy Commission (CEC). 2020. Excel database with the 2019 Residential Appliance Saturation Study (RASS), provided to ICF. November 13, 2020.

EDFZ = Electricity Demand Forecast Zone; kWh = kilowatt-hour; NG = natural gas; yr = year; du = dwelling unit; — = no data <sup>1</sup> Data for some EDFZ were not available in the RASS, and a representative EDFZ was assumed (refer to Table E-1.1).

<sup>2</sup> The five housing types used by the RASS have been cross walked to the nine residential land use types in CalEEMod, as shown in Table E-1.6.

<sup>3</sup> The sample size in the RASS for solar water heater data was limited. Accordingly, the data should be used with caution.

#### Table E-14.1. Woodstove and Fireplace Usage

		Wood Stoves									
Housing	Air District	Convent- ional	Catalytic	Non- catalytic	Pellet	Wood Mass (lb/yr)	Hr/day	Days/yr	Wood	Natural Gas	Propane
М	Amador County APCD	0%	5%	5%	0%	3,019	3	82	35%	55%	0%
м	Antelope Valley AQMD	0%	5%	5%	0%	3,019	3	82	35%	55%	0%
Μ	Bay Area AQMD	0%	0%	0%	0%	0	0	0	0%	51%	0%
м	Butte County AQMD	0%	9%	9%	0%	3,019	7	150	39%	43%	0%
м	Calaveras County AQMD	0%	5%	5%	0%	3,019	3	82	35%	55%	0%
Μ	Colusa County APCD	0%	5%	5%	0%	3,019	3	82	35%	55%	0%
Μ	El Dorado County AQMD	0%	5%	5%	0%	3,019	3	82	35%	55%	0%
Μ	Feather River AQMD	0%	5%	5%	0%	3,019	3	82	35%	55%	0%
м	Glenn County APCD	0%	5%	5%	0%	3,019	3	82	35%	55%	0%
Μ	Great Basin UAPCD	0%	5%	5%	0%	3,019	3	82	35%	55%	0%
Μ	Imperial County APCD	0%	0%	0%	0%	0	0	0	0%	55%	0%
Μ	Kern County APCD	0%	5%	5%	0%	3,019	3	82	35%	55%	0%
Μ	Lake County AQMD	70%	15%	10%	5%	3,019	12	82	35%	0%	55%
Μ	Lassen County APCD	0%	5%	5%	0%	3,019	3	82	35%	55%	0%
м	Mariposa County APCD	0%	5%	5%	0%	3,019	3	82	35%	55%	0%
Μ	Mendocino County AQMD	0%	20%	20%	0%	4,896	3	117	5%	5%	0%
Μ	Modoc County APCD	0%	5%	5%	0%	3,019	3	82	35%	55%	0%
м	Mojave Desert AQMD	0%	5%	5%	0%	3,019	3	82	35%	55%	0%
Μ	Monterey Bay ARD	0%	0%	0%	0%	0	0	120	0%	100%	0%
Μ	North Coast Unified APCD	0%	5%	5%	0%	3,019	3	82	35%	55%	0%
Μ	Northern Sierra AQMD	0%	5%	5%	0%	3,019	3	82	35%	55%	0%
Μ	Northern Sonoma County APCD	0%	5%	5%	0%	3,019	3	82	35%	55%	0%
Μ	Placer County APCD	0%	0%	0%	0%	0	0	0	0%	30%	0%
Μ	Sacramento Metropolitan AQMD	0%	0%	0%	0%	0	0	0	0%	0%	0%
Μ	San Diego County APCD	0%	5%	5%	0%	3,019	3	82	35%	55%	0%
м	San Joaquin Valley APCD	0%	5%	5%	0%	3,019	3	82	0%	50%	0%
м	San Luis Obispo County APCD	0%	0%	0%	0%	2,016	8	60	0%	0%	0%
м	Santa Barbara County APCD	0%	0%	0%	0%	1,400	3	82	0%	0%	0%

Fireplaces			
None	Wood Mass (lb/yr)	Hr/day	Days/yr
10%	3,078	3	82
10%	3,078	3	82
49%	0	4	9
18%	5,158	4	150
10%	3,078	3	82
10%	3,078	3	82
10%	3,078	3	82
10%	3,078	3	82
10%	3,078	3	82
10%	3,078	3	82
45%	2,080	3	4
10%	3,078	3	82
10%	3,078	12	82
10%	3,078	3	82
10%	3,078	3	82
90%	4,992	3	117
10%	3,078	3	82
10%	3,078	3	82
0%	0	0	0
10%	3,078	3	82
10%	3,078	3	82
10%	3,078	3	82
70%	0	0	0
100%	0	0	0
10%	3,078	3	82
50%	3,078	3	82
100%	0	0	0
100%	417	3	82

# Table E-14.1. Woodstove and Fireplace Usage (cont.)

Housing	Air District	Convent- ional	Catalytic	Non- catalytic	Pellet	Wood Mass (lb/yr)	Hr/day	Days/yr	Wood	Natural Gas	Propane
м	Shasta County AQMD	0%	5%	5%	0%	3,019	3	82	35%	55%	0%
Μ	Siskiyou County APCD	0%	5%	5%	0%	3,019	3	82	35%	55%	0%
Μ	South Coast AQMD	0%	5%	5%	0%	1,000	3	25	5%	85%	0%
Μ	Tehama County APCD	0%	30%	30%	0%	4,558	3	82	20%	20%	0%
м	Tuolumne County APCD	0%	5%	5%	0%	3,019	3	82	35%	55%	0%
Μ	Ventura County APCD	0%	0%	0%	0%	0	0	0	0%	0%	0%
Μ	Yolo/Solano AQMD	0%	0%	0%	0%	0	0	0	0%	0%	0%
Μ	Statewide	2%	5%	5%	0%	2,380	3	70	23%	44%	2%
S	Amador County APCD	0%	5%	5%	0%	3,019	3	82	35%	55%	0%
S	Antelope Valley AQMD	0%	5%	5%	0%	3,019	3	82	35%	55%	0%
S	Bay Area AQMD	0%	0%	0%	0%	0	0	0	0%	51%	0%
S	Butte County AQMD	0%	9%	9%	0%	3,019	7	150	39%	43%	0%
S	Calaveras County AQMD	0%	5%	5%	0%	3,019	3	82	35%	55%	0%
S	Colusa County APCD	0%	5%	5%	0%	3,019	3	82	35%	55%	0%
S	El Dorado County AQMD	0%	5%	5%	0%	3,019	3	82	35%	55%	0%
S	Feather River AQMD	0%	5%	5%	0%	3,019	3	82	35%	55%	0%
S	Glenn County APCD	0%	5%	5%	0%	3,019	3	82	35%	55%	0%
S	Great Basin UAPCD	0%	5%	5%	0%	3,019	3	82	35%	55%	0%
S	Imperial County APCD	0%	0%	0%	0%	0	0	0	0%	55%	0%
S	Kern County APCD	0%	5%	5%	0%	3,019	3	82	35%	55%	0%
S	Lake County AQMD	70%	15%	10%	5%	3,019	12	82	35%	0%	55%
S	Lassen County APCD	0%	5%	5%	0%	3,019	3	82	35%	55%	0%
S	Mariposa County APCD	0%	5%	5%	0%	3,019	3	82	35%	55%	0%
S	Mendocino County AQMD	0%	20%	20%	0%	4,896	3	117	5%	5%	0%
S	Modoc County APCD	0%	5%	5%	0%	3,019	3	82	35%	55%	0%
S	Mojave Desert AQMD	0%	5%	5%	0%	3,019	3	82	35%	55%	0%
S	Monterey Bay ARD	0%	0%	0%	0%	0	0	120	0%	100%	0%
S	North Coast Unified APCD	0%	5%	5%	0%	3,019	3	82	35%	55%	0%

Fireplaces			
None	Wood Mass (lb/yr)	Hr/day	Days/yr
10%	3,078	3	82
10%	3,078	3	82
10%	1,019	3	25
60%	4,558	3	82
10%	3,078	3	82
100%	0	0	0
100%	0	0	0
31%	2,456	3	65
10%	3,078	3	82
10%	3,078	3	82
49%	0	4	9
18%	5,158	4	150
10%	3,078	3	82
10%	3,078	3	82
10%	3,078	3	82
10%	3,078	3	82
10%	3,078	3	82
10%	3,078	3	82
45%	2,080	3	4
10%	3,078	3	82
10%	3,078	12	82
10%	3,078	3	82
10%	3,078	3	82
90%	4,992	3	117
10%	3,078	3	82
10%	3,078	3	82
0%	0	0	0
10%	3,078	3	82

#### Table E-14.1. Woodstove and Fireplace Usage (cont.)

		Wood Stoves									
Housing	Air District	Convent- ional	Catalytic	Non- catalytic	Pellet	Wood Mass (lb/yr)	Hr/day	Days/ yr	Wood	Natural Gas	Propane
S	Northern Sierra AQMD	0%	5%	5%	0%	3,019	3	82	35%	55%	0%
S	Northern Sonoma County APCD	0%	5%	5%	0%	3,019	3	82	35%	55%	0%
S	Placer County APCD	0%	0%	0%	0%	0	0	0	0%	30%	0%
S	Sacramento Metropolitan AQMD	0%	0%	0%	0%	0	0	0	0%	0%	0%
S	San Diego County APCD	0%	5%	5%	0%	3,019	3	82	35%	55%	0%
S	San Joaquin Valley APCD	0%	5%	5%	0%	3,019	3	82	0%	50%	0%
S	San Luis Obispo County APCD	0%	0%	0%	0%	2,016	8	60	0%	0%	0%
S	Santa Barbara County APCD	0%	0%	0%	0%	1,400	3	82	0%	0%	0%
S	Shasta County AQMD	0%	5%	5%	0%	3,019	3	82	35%	55%	0%
S	Siskiyou County APCD	0%	5%	5%	0%	3,019	3	82	35%	55%	0%
S	South Coast AQMD	0%	5%	5%	0%	1,000	3	25	5%	85%	0%
S	Tehama County APCD	0%	30%	30%	0%	4,558	3	82	20%	20%	0%
S	Tuolumne County APCD	0%	5%	5%	0%	3,019	3	82	35%	55%	0%
S	Ventura County APCD	0%	0%	0%	0%	0	0	0	0%	0%	0%
S	Yolo/Solano AQMD	0%	0%	0%	0%	0	0	0	0%	0%	0%
S	Statewide	2%	5%	5%	0%	2,380	3	70	23%	44%	2%

Source: California Air Districts. 2021. Excel database of hearth usage and inventory statistics, provided to the Sacramento Metropolitan Air Quality Management District and ICF. April 1, 2021.

M = multi-family housing; S = single-family housing; Ib = pound; yr = year; hr = hour; APCD = air pollution control district; AQMD = air quality management district; ARD = air resources district

Fireplaces			
None	Wood Mass (lb/yr)	Hr/day	Days/yr
10%	3,078	3	82
10%	3,078	3	82
70%	0	0	0
100%	0	0	0
10%	3,078	3	82
50%	3,078	3	82
100%	0	0	0
100%	417	3	82
10%	3,078	3	82
10%	3,078	3	82
10%	1,019	3	25
60%	4,558	3	82
10%	3,078	3	82
100%	0	0	0
100%	0	0	0
31%	2,456	3	65

Туре	TOG	ROG	со	SO <sub>2</sub>	NO <sub>x</sub>	PM10	PM2.5	CO <sub>2</sub> (BIO)	CO <sub>2</sub> (NBIO)	CH₄	N <sub>2</sub> O	CO <sub>2</sub> e
Woodstoves Conventional	83	53	230.8	0.4	2.8	30.6	29.5	2,952	0	30	0	3,792
Woodstoves Catalytic	26.6	15	104.4	0.4	2	20.44	19.6	2,952	0	11.6	0	3,277
Woodstoves Noncatalytic	28	12	140.8	0.4	2	14.6	14.1	2,952	0	16	0	3,400
Woodstoves Pellet	0.07	0.04	15.9	0.3	3.8	3.1	2.9	2,952	0	16	0	3,400
Wood Fireplace	229	229	252.6	0.4	2.6	34.6	34.6	3,400	0	0	0.3	3,480
Natural Gas Fireplace (lb/MMBtu)	0.0108	0.0054	0.0392	0.0006	0.0922	0.0075	0.0075	0	11	0.0022	0.0002	117.1
Propane Fireplace (lb/MMBtu)	0.0109	0.0109	0.0820	0.0000	0.1421	0.0077	0.0077	0	135	0.0066	0.0013	136.1

#### Table E-14.2. Woodstove and Fireplace Emission Factors (pound per ton of dry wood burned, unless noted)

Sources: California Air Resources Board (CARB). 2011. Section 7.1, Residential Wood Combustion. Revised October 2015. Available: https://ww3.arb.ca.gov/ei/areasrc/fullpdf/full7-1\_2011.pdf. Accessed: March 2021.

U.S. Environmental Protection Agency. 1996a. Report on Revisions to 5<sup>th</sup> Edition AP-42. Section 1.10 Residential Wood Stoves. July. Available: https://www3.epa.gov/ttnchie1/ap42/ch01/bgdocs/b01s10.pdf. Accessed: January 2021.

U.S. Environmental Protection Agency. 1996b. Report on Revisions to 5<sup>th</sup> Edition AP-42. Section 1.9 Residential Fireplaces. July. Available: https://www3.epa.gov/ttnchie1/ap42/ch01/bgdocs/b01s09.pdf. Accessed: January 2021.

U.S. Environmental Protection Agency. 2015. Standards of Performance for New Residential Wood Heaters, New Residential Hydronic Heaters and Forced-Air Furnaces. March. Available: https://www.govinfo.gov/content/pkg/FR-2015-03-16/pdf/2015-03733.pdf. Accessed: January 2021.

U.S. Environmental Protection Agency. 2020. Emission Factors for Greenhouse Gas Inventories. March. Available: https://www.epa.gov/sites/production/files/2020-04/documents/ghg-emission-factors-hub.pdf. Accessed: March 2021. TOG = total organic gases; ROG = reactive organic gases; CO = carbon monoxide; SO<sub>2</sub> = sulfur dioxide; NOx = nitrogen oxides; PM10 = particulate matter less than or equal to 10 microns; PM2.5 = particulate matter less than or equal to 10 microns; CO<sub>2</sub> = carbon dioxide; CH<sub>4</sub> = methane; N<sub>2</sub>O = nitrous oxide; BIO = biogenic; NBIO = non-biogenic; Ib = pound; MMBtu = one million British Thermal Units

					Natura	l Gas (Thei	rm/yr/DU)							Elect	ricity (kWh	/yr/DU)				
Electricity Demand Forecast Zone <sup>2</sup>	Housing Type <sup>3</sup>	Water Heater	Primary Heat	Range/ Oven	Dryer	Misc.	Aux. Heat	Pool Heat	Spa Heat	Solar Water Heater w/ NG Backup	Water Heater	Primary Heat	Range/ Oven	Dryer	Misc.	Aux. Heat	Pool Heat	Spa Heat	Solar Water Heater w/ Elec. Backup	Heat Pump
	Single Family Housing	255	245	21	11	16	80	168	38	210	2,266	1,485	390	488	1,496	529	_	1,319	1,050	1,190
	Apartments Low Rise	235	93	17	18	16	54	196	—	—	1,282	923	275	389	761	174	—	—	—	732
	Apartments Mid Rise	232	65	14	14	25	52	167	—	—	1,146	757	246	334	563	165	—		—	593
	Apartments High Rise	232	65	14	14	25	52	167	_	_	1,146	757	246	334	563	165	_		_	593
1	Condo/Townhouse	242	103	19	17	16	53	142	29	_	1,580	1,075	329	387	965	160	_		1,163	755
	Condo/Townhouse High Rise	232	65	14	14	25	52	167	_	_	1,146	757	246	334	563	165	_	_	_	593
	Mobile Home Park	246	144	18	17	16	75	182	27	_	2,761	1,314	278	419	714		_	_	228	834
	Retirement Community	235	93	17	18	16	54	196	_	_	1,282	923	275	389	761	174	_	_	_	732
	Congregate Care	232	65	14	14	25	52	167	_	_	1,146	757	246	334	563	165	_	_	_	593
	Single Family Housing	278	289	20	12	20	109	202	47	180	2,445	2,073	379	553	1,572	827		1,400	1,394	1,564
	Apartments Low Rise	214	72	15	15	—	62	217	—	—	1,003	877	252	475	496	169	—		—	1,089
	Apartments Mid Rise	208	56	12	13	14	67	—	—	—	1,226	1,082	172	337	405	269	—		—	630
	Apartments High Rise	208	56	12	13	14	67	—	—	—	1,226	1,082	172	337	405	269	—	—	—	630
2	Condo/Townhouse	234	108	13	15	15	78	—	—	—	1,216	1,204	241	424	771	238	—	—	1,290	1,063
	Condo/Townhouse High Rise	208	56	12	13	14	67	—	—	—	1,226	1,082	172	337	405	269	—		—	630
	Mobile Home Park	259	227	15	15		96	200	—	—	1,790	1,324	208	504	895	—	—		633	1,142
	Retirement Community	214	72	15	15		62	217	—	—	1,003	877	252	475	496	169	—		—	1,089
	Congregate Care	208	56	12	13	14	67	_	_	—	1,226	1,082	172	337	405	269	—		—	630
	Single Family Housing	237	183	19	12	16	73	93	31	—	2,353	1,592	328	565	1,374	774	—	1,750	1,260	1,414
	Apartments Low Rise	215	55	21	13	—	—	—	—	—	836	670	115	541	647	160	—	—	—	707
	Apartments Mid Rise	181	37	15	14	14	—	—	—	—	917	667	247	543	529	—	—	—	—	736
	Apartments High Rise	181	37	15	14	14	—	—	—	—	917	667	247	543	529		—		—	736
3	Condo/Townhouse	221	72	5	21	16		—	—	—	1,228	2,158	295	494	776	504	—		—	706
	Condo/Townhouse High Rise	181	37	15	14	14	—	—	—	—	917	667	247	543	529		—		—	736
	Mobile Home Park	228	122	11	15	—	77	178	25	—	2,271	1,451	250	554	812	579	—	—	727	1,104
	Retirement Community	215	55	21	13	—	—	—	—	—	836	670	115	541	647	160	—	—	—	707
	Congregate Care	181	37	15	14	14	_	—	—	—	917	667	247	543	529	—		_	—	736

					Natura	l Gas (Ther	rm/yr/DU)							Elect	ricity (kWh	/yr/DU)				
Electricity Demand Forecast Zone <sup>2</sup>	Housing Type <sup>3</sup>	Water Heater	Primary Heat	Range/ Oven	Dryer	Misc.	Aux. Heat	Pool Heat	Spa Heat	Solar Water Heater w/ NG Backup	Water Heater	Primary Heat	Range/ Oven	Dryer	Misc.	Aux. Heat	Pool Heat	Spa Heat	Solar Water Heater w/ Elec. Backup	Heat Pump
	Single Family Housing	246	241	20	11	17	83	140	33	187	2,528	1,953	358	565	1,607	756	_	1,238	1,162	1,603
	Apartments Low Rise	239	68	13	15	17	53	205	_		1,545	1,205	294	494	621	222		—	—	756
	Apartments Mid Rise	244	61	12	15	17	54	197	_		1,543	1,062	240	406	601	183		_	_	1,014
	Apartments High Rise	244	61	12	15	17	54	197	—		1,543	1,062	240	406	601	183		—	—	1,014
4	Condo/Townhouse	250	87	23	17	17	—	—	37		1,308	956	306	462	891	193		—	3	718
	Condo/Townhouse High Rise	244	61	12	15	17	54	197	_		1,543	1,062	240	406	601	183		_	_	1,014
	Mobile Home Park	230	171	16	14	194		179	_		2,237	1,344	289	488	933	720		_	1,331	1,509
	Retirement Community	239	68	13	15	17	53	205	_	_	1,545	1,205	294	494	621	222		_	_	756
	Congregate Care	244	61	12	15	17	54	197	_	_	1,543	1,062	240	406	601	183		_	_	1,014
	Single Family Housing	307	244	30	15	20	80	161	46	272	2,419	1,690	362	586	1,517	548		2,077	1,076	1,230
	Apartments Low Rise	355	105	35	23	24	75	309	—	—	738	624	273	517	640	121	—	—	—	424
	Apartments Mid Rise	364	99	25	22	25	66	290	—	—	1,479	682	262	405	595	199	—	—	—	557
	Apartments High Rise	364	99	25	22	25	66	290	—		1,479	682	262	405	595	199	—	—	—	557
5	Condo/Townhouse	349	92	24	29	25	65	222	32	—	_	622	378	488	733	—	—	—	—	610
	Condo/Townhouse High Rise	364	99	25	22	25	66	290	—	—	1,479	682	262	405	595	199	—	—	—	557
	Mobile Home Park	289	205	24	18	20	66	225	56		1,749	922	176	499	871	386	_	_	127	1,580
	Retirement Community	355	105	35	23	24	75	309	_		738	624	273	517	640	121	_	_	_	424
	Congregate Care	364	99	25	22	25	66	290	_	—	1,479	682	262	405	595	199	_	—	—	557
	Single Family Housing	264	254	21	12	17	89	186	46	203	2,444	1,848	346	523	1,388	674		1,750	1,249	1,584
	Apartments Low Rise	348	107	32	25	21	97	319	—		941	1,548	245	402	430	215	—	—	—	563
	Apartments Mid Rise	368	111	29	22	24	113	299	—		818	969	200	312	434	181	—	—	—	525
	Apartments High Rise	368	111	29	22	24	113	299	—	—	818	969	200	312	434	181	—	—	—	525
6	Condo/Townhouse	353	131	25	25	23	69	229	_		1,995	1,267	277	385	689	243	_	904	766	776
	Condo/Townhouse High Rise	368	111	29	22	24	113	299	_		818	969	200	312	434	181	_	_	_	525
	Mobile Home Park	251	244	17	18	115	_	_	_		2,015	1,565	185	390	908	525	_	_	991	_
	Retirement Community	348	107	32	25	21	97	319	_	_	941	1,548	245	402	430	215		_	_	563
	Congregate Care	368	111	29	22	24	113	299	_		818	969	200	312	434	181	_	_	_	525

					Natura	l Gas (The	rm/yr/DU)							Elect	ricity (kWh	/yr/DU)				
Electricity Demand Forecast Zone <sup>2</sup>	Housing Type <sup>3</sup>	Water Heater	Primary Heat	Range/ Oven	Dryer	Misc.	Aux. Heat	Pool Heat	Spa Heat	Solar Water Heater w/ NG Backup	Water Heater	Primary Heat	Range/ Oven	Dryer	Misc.	Aux. Heat	Pool Heat	Spa Heat	Solar Water Heater w/ Elec. Backup	Heat Pump
	Single Family Housing	260	136	24	12	17	39	168	36	244	2,810	972	411	528	1,552	375		483	993	713
	Apartments Low Rise	246	43	23	17	37	25	200	_	181	1,185	538	293	441	665	92		_	_	330
	Apartments Mid Rise	244	42	19	17	17	27	188	_	_	1,164	451	243	360	594	99		_	_	392
	Apartments High Rise	244	42	19	17	17	27	188	_	_	1,164	451	243	360	594	99		_	_	392
7	Condo/Townhouse	253	57	21	19	17	30	148	31	_	1,365	609	292	422	953	125		1,475	405	413
	Condo/Townhouse High Rise	244	42	19	17	17	27	188	_		1,164	451	243	360	594	99		_	_	392
	Mobile Home Park	250	115	17	16	17	30	_	_	174	2,046	806	172	416	786	_		_	17	211
	Retirement Community	246	43	23	17	37	25	200		181	1,185	538	293	441	665	92		_	_	330
	Congregate Care	244	42	19	17	17	27	188			1,164	451	243	360	594	99	—	—	—	392
	Single Family Housing	273	173	22	12	17	51	188	41	213	2,014	1,052	383	515	1,483	486		_	1,044	702
	Apartments Low Rise	284	56	29	19	17	52	_	_	_	1,130	524	271	387	735	112	_	_	_	586
	Apartments Mid Rise	278	54	15	18	101	48	217	_	_	1,090	582	226	311	522	68		_	_	355
	Apartments High Rise	278	54	15	18	101	48	217	—	—	1,090	582	226	311	522	68		—	—	355
8	Condo/Townhouse	269	78	20	20	18	31	176	26	—	1,049	768	268	487	890	121		—	—	831
	Condo/Townhouse High Rise	278	54	15	18	101	48	217	—	—	1,090	582	226	311	522	68	—	—	—	355
	Mobile Home Park	243	121	15	16	—	51	—		—	_	—	154	361	670	—	—	—	—	325
	Retirement Community	284	56	29	19	17	52	—		—	1,130	524	271	387	735	112	—	—	—	586
	Congregate Care	278	54	15	18	101	48	217			1,090	582	226	311	522	68				355
	Single Family Housing	268	222	23	14	17	90	144	32	278	2,434	1,765	372	614	1,517	699		1,385	1,172	1,646
	Apartments Low Rise	272	63	24	23	_	_	—	—	—	898	529	314	529	630	_	—	_	—	376
	Apartments Mid Rise	267	65	9	16	—	—	—	_	—	1,354	923	280	417	629	390		—	—	998
	Apartments High Rise	267	65	9	16	—	—	—		—	1,354	923	280	417	629	390	—	—	—	998
9	Condo/Townhouse	263	77	16	17	19	54	—		—	1,473	1,209	303	483	689	_	—	—	1,030	527
	Condo/Townhouse High Rise	267	65	9	16	—	—	—	—	—	1,354	923	280	417	629	390	—	—	—	998
	Mobile Home Park	262	207	22	17	17	—	—	106	—	2,667	1,037	281	564	976	—		—	446	1,276
	Retirement Community	272	63	24	23	_	_	_	_	_	898	529	314	529	630	_		_	_	376
	Congregate Care	267	65	9	16	_	_		_		1,354	923	280	417	629	390			_	998

					Natura	l Gas (Ther	·m/yr/DU)							Elect	ricity (kWh	/yr/DU)				
Electricity Demand Forecast Zone <sup>2</sup>	Housing Type <sup>3</sup>	Water Heater	Primary Heat	Range/ Oven	Dryer	Misc.	Aux. Heat	Pool Heat	Spa Heat	Solar Water Heater w/ NG Backup	Water Heater	Primary Heat	Range/ Oven	Dryer	Misc.	Aux. Heat	Pool Heat	Spa Heat	Solar Water Heater w/ Elec. Backup	Heat Pump
	Single Family Housing	231	136	22	12	15	39	152	32	199	2,120	982	386	546	1,391	129		739	1,025	823
	Apartments Low Rise	203	34	17	14	14	23	170	_	_	1,529	813	389	431	612	160	_	_	_	515
	Apartments Mid Rise	197	37	16	14	14	36	_	_	_	1,138	678	280	375	598	99	_	_	_	477
	Apartments High Rise	197	37	16	14	14	36	_	_	_	1,138	678	280	375	598	99	_	_	_	477
10	Condo/Townhouse	211	48	18	14	14	27	157	22	—	1,143	987	320	392	832	—	—	_	—	807
	Condo/Townhouse High Rise	197	37	16	14	14	36	_	_	_	1,138	678	280	375	598	99	_	_	_	477
	Mobile Home Park	224	113	12	15		_	_	_	_	2,280	580	310	415	750		_	_	_	_
	Retirement Community	203	34	17	14	14	23	170	—	—	1,529	813	389	431	612	160	—	—	—	515
	Congregate Care	197	37	16	14	14	36	—	_	—	1,138	678	280	375	598	99	—	—	—	477
	Single Family Housing	222	152	21	10	15	45	146	33	—	2,647	1,389	422	559	1,709	143	—	—	916	1,045
	Apartments Low Rise	175	46	14	16	15	32	195	—	—	1,297	612	280	480	962	—	—	—	—	408
	Apartments Mid Rise	198	36	13	14	15	25	184	—	—	1,366	512	296	437	832	70	—	—	—	397
	Apartments High Rise	198	36	13	14	15	25	184	—	—	1,366	512	296	437	832	70	—	—	—	397
11	Condo/Townhouse	182	51	14	14	15	19	94	43	109	1,261	828	354	506	1,181	198	—	—	—	1,009
	Condo/Townhouse High Rise	198	36	13	14	15	25	184	—	—	1,366	512	296	437	832	70	—	—	—	397
	Mobile Home Park	217	114	15	15	15	—	168	23	—	2,055	999	215	456	956	161	—	—	528	495
	Retirement Community	175	46	14	16	15	32	195	_		1,297	612	280	480	962				_	408
	Congregate Care	198	36	13	14	15	25	184	_	_	1,366	512	296	437	832	70	_	_	_	397
	Single Family Housing	210	118	17	10	14	36	122	31	174	2,235	933	375	498	1,442	252		1,332	985	778
	Apartments Low Rise	199	39	17	14	14	24	163	—	220	1,002	405	246	420	622	97	—	—	—	337
	Apartments Mid Rise	198	38	12	13	14	22	170	—	154	1,134	410	228	352	524	88	—	—	—	346
	Apartments High Rise	198	38	12	13	14	22	170	—	154	1,134	410	228	352	524	88	—	—	—	346
12	Condo/Townhouse	202	51	15	14	14	25	_	28	164	1,321	556	283	398	869	114	_	_	1,067	378
	Condo/Townhouse High Rise	198	38	12	13	14	22	170	_	154	1,134	410	228	352	524	88	_	_	_	346
	Mobile Home Park	201	100	14	14	14	43	156	22	_	1,867	1,011	211	432	840	_	_	_	1,785	680
	Retirement Community	199	39	17	14	14	24	163	—	220	1,002	405	246	420	622	97	—	_	—	337
	Congregate Care	198	38	12	13	14	22	170	_	154	1,134	410	228	352	524	88	_	_	_	346

					Natural	Gas (Ther	m/yr/DU)							Elect	ricity (kWh	/yr/DU)				
Electricity Demand Forecast Zone <sup>2</sup>	Housing Type <sup>3</sup>	Water Heater	Primary Heat	Range/ Oven	Dryer	Misc.	Aux. Heat	Pool Heat	Spa Heat	Solar Water Heater w/ NG Backup	Water Heater	Primary Heat	Range/ Oven	Dryer	Misc.	Aux. Heat	Pool Heat	Spa Heat	Solar Water Heater w/ Elec. Backup	Heat Pump
	Single Family Housing	240	232	18	11	15	77	123	31	179	2,845	1,877	407	617	1,753	767	_	1,479	1,245	1,501
	Apartments Low Rise	260	66	16	20	15	53	212	—	—	1,589	1,117	253	544	673	202	—	—		1,002
	Apartments Mid Rise	277	65	18	18	20	57	_	_	_	1,584	979	246	457	654	205	_	_	_	870
	Apartments High Rise	277	65	18	18	20	57	—	—	—	1,584	979	246	457	654	205	—		—	870
13	Condo/Townhouse	253	90	18	17	18	63	172	29	_	1,726	1,456	314	514	1,000	230	_	_	1,620	1,279
	Condo/Townhouse High Rise	277	65	18	18	20	57			_	1,584	979	246	457	654	205	_		_	870
	Mobile Home Park	229	186	11	13	15	_	171		_	2,256	_	145	517	932		_		655	685
	Retirement Community	260	66	16	20	15	53	212	—	—	1,589	1,117	253	544	673	202	—		—	1,002
	Congregate Care	277	65	18	18	20	57	—	—	—	1,584	979	246	457	654	205	—	—	—	870
	Single Family Housing	363	196	31	16	26	53	247	61	331	2,509	1,062	400	512	1,603	—	—	1,301	1,047	787
	Apartments Low Rise	285	58	25	21	19	29	—	—	—	1,640	521	311	619	740	—	—	—		861
	Apartments Mid Rise	268	48	20	17	35	31	239	—	—	1,052	350	262	365	560	—	—	—		397
	Apartments High Rise	268	48	20	17	35	31	239	—	—	1,052	350	262	365	560	—	—	—		397
16	Condo/Townhouse	297	74	25	19	20	29	169	31	—	968	658	369	441	916	—	—	—	35	361
	Condo/Townhouse High Rise	268	48	20	17	35	31	239	—	—	1,052	350	262	365	560	—	—	—		397
	Mobile Home Park	301	118	16	22	—	—	—	—	—		_	—	457	693	—	—	—		—
	Retirement Community	285	58	25	21	19	29	—	—	—	1,640	521	311	619	740	—	—	—	_	861
	Congregate Care	268	48	20	17	35	31	239	_	—	1,052	350	262	365	560	—	—			397
	Single Family Housing	290	153	27	13	21	46	172	37	232	2,529	783	407	556	1,513	—	—		1,144	845
	Apartments Low Rise	325	63	29	22	—	—	_	_	—		983	332	440	558	—	—		_	260
	Apartments Mid Rise	328	57	30	29	24	40	244	—	—	1,182	457	266	343	586	—	—	—		290
	Apartments High Rise	328	57	30	29	24	40	244	—	—	1,182	457	266	343	586	—	—	—	—	290
17	Condo/Townhouse	345	85	33	24	23	42	_	38	229	1,815	864	361	441	984	_	_		_	569
	Condo/Townhouse High Rise	328	57	30	29	24	40	244	—	—	1,182	457	266	343	586	_	—	_	—	290
	Mobile Home Park	294	121	32	16	_	_		_	_		_	256	_	710	_	_	_		_
	Retirement Community	325	63	29	22	—	—		—	—		983	332	440	558	—	—	—		260
	Congregate Care	328	57	30	29	24	40	244	_	_	1,182	457	266	343	586	_	_	_	_	290

					Natura	Gas (Ther	m/yr/DU)							Elect	ricity (kWh,	/yr/DU)				
Electricity Demand Forecast Zone <sup>2</sup>	Housing Type <sup>3</sup>	Water Heater	Primary Heat	Range/ Oven	Dryer	Misc.	Aux. Heat	Pool Heat	Spa Heat	Solar Water Heater w/ NG Backup	Water Heater	Primary Heat	Range/ Oven	Dryer	Misc.	Aux. Heat	Pool Heat	Spa Heat	Solar Water Heater w/ Elec. Backup	Heat Pump
	Single Family Housing	254	191	22	12	17	64	162	36	210	2,473	1,507	384	544	1,535	663		1,395	1,114	1,198
	Apartments Low Rise	244	65	21	17	20	43	216		201	1,220	751	275	439	678	132	—		—	561
	Apartments Mid Rise	248	54	18	17	22	38	201	—	154	1,195	619	241	360	568	136	—	—	—	490
	Apartments High Rise	248	54	18	17	22	38	201		154	1,195	619	241	360	568	136	—	—	—	490
Statewide	Condo/Townhouse	247	79	20	18	17	41	167	31	167	1,402	888	305	424	915	191	_	1,190	912	704
	Condo/Townhouse High Rise	248	54	18	17	22	38	201		154	1,195	619	241	360	568	136	_		_	490
	Mobile Home Park	238	148	16	16	32	58	181	38	174	2,136	1,208	228	486	864	530	—	—	763	1,000
	Retirement Community	244	65	21	17	20	43	216		201	1,220	751	275	439	678	132	_		—	561
	Congregate Care	248	54	18	17	22	38	201		154	1,195	619	241	360	568	136				490

Source: ICF calculations; California Energy Commission. 2020. Excel database with the 2019 Residential Appliance Saturation Study (RASS), provided to ICF. November 13, 2020.

EDFZ = Electricity Demand Forecast Zone; yr = year; du = dwelling unit; kWh = kilowatt-hour; --- = no data

<sup>1</sup> The sample size in the RASS data for several end uses and housing types was limited. Accordingly, the data should be used with caution.

<sup>2</sup> Data for some EDFZ were not available in the RASS, and a representative EDFZ was assumed (refer to Table E-1.1).

<sup>3</sup> The five housing types used by the RASS have been cross walked to the nine residential land use types in CalEEMod, as shown in Table E-1.6.

			Nat	ural Gas (Tl	herm/yr/KS	F)				Electricity (k	‹Wh/yr/KSI	F)				Na	itural Gas (1	Therm/yr/K	SF)				Electricity	(kWh/yr/KS	SF)	
Building Type	EDE71	Water Heater	Primary Heat	Cooking	Cooling	Misc	Refrig	Water Heater	Primary Heat	Cooking	Cooling	Misc	Refrig	FDF71	Water Heater	Primary Heat	Cooking	Cooling	Misc	Refrig	Water Heater	Primary Heat	Cooking	Cooling	Misc	Refrig
Areng		42	136	1	6	252	Kenng.	52	40	6	1 033	5 703	162		42	131	1	7	245		51	49	11	1 058	5 551	159
Automobile Care Center		42	136	1	6	252	_	52	40	6	1.033	5 703	162		42	131	1	7	245	_	51	49	11	1 058	5 551	159
Bank		42	136	1	6	252	_	52	40	6	1 033	5 703	162		42	131	1	7	245	_	51	49	11	1 058	5 551	159
(with Drive-Through)			100	·	Ū	202		01	10	0	1,000	0,, 00	102		12	101	·	,	210		01	.,		1,000	0,001	107
Convenience Market (24 hour)		16	184	1	7	63	—	253	606	84	2,466	19,227	12,001		15	207	1	5	61	_	259	702	81	3,436	18,605	11,745
Convenience Market with Gas Pumps		16	184	1	7	63	—	253	606	84	2,466	19,227	12,001		15	207	1	5	61	—	259	702	81	3,436	18,605	11,745
Day-Care Center		13	393	4	<1		—	427	77	34	105	430	124		12	422	4	<1	_	—	449	75	34	126	430	125
Discount Club		<1	53	<1	2	1	_	35	118	9	413	1,811	135		<1	61	<1	2	1	_	35	132	9	450	1,756	132
Electronic Superstore		<1	53	<1	2	1	_	35	118	9	413	1,811	135		<1	61	<1	2	1	_	35	132	9	450	1,756	132
Elementary School		13	393	4	<1	_	_	427	77	34	105	430	124		12	422	4	<1	_	_	449	75	34	126	430	125
Fast Food Restaurant w/o Drive Thru		137	90	1,031	8	84	—	93	804	5,459	3,211	17,827	5,732		129	131	974	12	80	—	82	1,171	5,156	3,825	16,835	5,416
Fast Food Restaurant with Drive Thru	1	137	90	1,031	8	84	—	93	804	5,459	3,211	17,827	5,732	2	129	131	974	12	80	—	82	1,171	5,156	3,825	16,835	5,416
Free-Standing Discount store		<1	53	<1	2	1	—	35	118	9	413	1,811	135		<1	61	<1	2	1	—	35	132	9	450	1,756	132
Free-Standing Discount Superstore		<1	53	<1	2	1	—	35	118	9	413	1,811	135		<1	61	<1	2	1	—	35	132	9	450	1,756	132
Gasoline/Service Station		42	136	1	6	252	_	52	40	6	1,033	5,703	162		42	131	1	7	245	—	51	49	11	1,058	5,551	159
General Heavy Industry		42	136	1	6	252	—	52	40	6	1,033	5,703	162		42	131	1	7	245	—	51	49	11	1,058	5,551	159
General Light Industry		42	136	1	6	252	_	52	40	6	1,033	5,703	162		42	131	1	7	245	—	51	49	11	1,058	5,551	159
General Office Building		1	168	<1	18	50	_	82	385	28	2,934	5,800	14		1	169	<1	14	49	—	83	438	27	3,089	5,714	14
Government (Civic Center)		1	168	<1	18	50	—	82	385	28	2,934	5,800	14		1	169	<1	14	49	—	83	438	27	3,089	5,714	14
Government Office Building		1	168	<1	18	50	—	82	385	28	2,934	5,800	14		1	169	<1	14	49	—	83	438	27	3,089	5,714	14
Hardware/Paint Store		<1	53	<1	2	1	_	35	118	9	413	1,811	135		<1	61	<1	2	1	_	35	132	9	450	1,756	132
Health Club		42	136	1	6	252	_	52	40	6	1,033	5,703	162		42	131	1	7	245	_	51	49	11	1,058	5,551	159
High School		13	393	4	<1	_		427	77	34	105	430	124		12	422	4	<1	_	_	449	75	34	126	430	125

			Nat	ural Gas (Tl	nerm/yr/KS	iF)				Electricity (k	Wh/yr/KSI	=)				Na	itural Gas (1	Therm/yr/K	SF)				Electricity	(kWh/yr/KS	F)	
Building Type	FDF7 <sup>1</sup>	Water Heater	Primary Heat	Cooking	Cooling	Misc	Refria	Water Heater	Primary Heat	Cooking	Cooling	Misc	Refrig	FDF7 <sup>1</sup>	Water Heater	Primary Heat	Cooking	Cooling	Misc	Refria	Water Heater	Primary Heat	Cooking	Cooling	Misc	Refrig
High Turnover		137	90	1.031	8	84		93	804	5.459	3.211	17.827	5.732		129	131	974	12	80		82	1,171	5.156	3.825	16.835	5.416
(Sit Down Restaurant)		107	, 0	1,001	Ū	01		, 0	001	0,10,	0,211	1, ,02,	0,, 02		127	101	<i>,,</i> ,,	12	00		02	1,1,1,1	0,100	0,020	10,000	0,110
Home Improvement Superstore		<1	53	<1	2	1	—	35	118	9	413	1,811	135		<1	61	<1	2	1	—	35	132	9	450	1,756	132
Hospital		284	260	9	7	177	_	13	3	101	6,250	19,922	135		282	284	9	7	175	_	14	2	100	7,043	19,727	134
Hotel		67	190	14	10	20	_	52	183	20	477	2,847	264		67	179	13	11	18		54	210	20	455	2,798	263
Industrial Park		1	168	<1	18	50	_	82	385	28	2,934	5,800	14		1	169	<1	14	49	_	83	438	27	3,089	5,714	14
Junior College (2yr)		9	366	1	5	14	_	117	190	18	1,082	596	18		9	353	1	5	14	_	117	202	18	1,087	596	18
Junior High School		13	393	4	<1	_	_	427	77	34	105	430	124		12	422	4	<1			449	75	34	126	430	125
Library		42	136	1	6	252	_	52	40	6	1,033	5,703	162		42	131	1	7	245		51	49	11	1,058	5,551	159
Manufacturing		42	136	1	6	252	_	52	40	6	1,033	5,703	162		42	131	1	7	245	—	51	49	11	1,058	5,551	159
Medical Office Building		1	168	<1	18	50	—	82	385	28	2,934	5,800	14		1	169	<1	14	49	—	83	438	27	3,089	5,714	14
Motel		67	190	14	10	20	—	52	183	20	477	2,847	264		67	179	13	11	18		54	210	20	455	2,798	263
Movie Theater (No Matinee)		42	136	1	6	252	—	52	40	6	1,033	5,703	162		42	131	1	7	245	—	51	49	11	1,058	5,551	159
Office Park		1	168	<1	18	50	_	82	385	28	2,934	5,800	14		1	169	<1	14	49	—	83	438	27	3,089	5,714	14
Pharmacy/Drugstore w/o Drive Thru		<1	53	<1	2	1	—	35	118	9	413	1,811	135		<1	61	<1	2	1	—	35	132	9	450	1,756	132
Pharmacy/Drugstore with Drive Thru		<1	53	<1	2	1	—	35	118	9	413	1,811	135		<1	61	<1	2	1	_	35	132	9	450	1,756	132
Place of Worship		42	136	1	6	252	_	52	40	6	1,033	5,703	162		42	131	1	7	245	_	51	49	11	1,058	5,551	159
Quality Restaurant		137	90	1,031	8	84	_	93	804	5,459	3,211	17,827	5,732		129	131	974	12	80	_	82	1,171	5,156	3,825	16,835	5,416
Racquet Club		42	136	1	6	252	_	52	40	6	1,033	5,703	162		42	131	1	7	245	_	51	49	11	1,058	5,551	159
Refrigerated Warehouse- No Rail		<1	4	<1	—	8	7	6	14	<1	28	6,364	14,769		<1	5	<1	—	8	7	6	16	<1	48	6,253	14,673
Refrigerated Warehouse- Rail		<1	4	<1	_	8	7	6	14	<1	28	6,364	14,769		<1	5	<1	—	8	7	6	16	<1	48	6,253	14,673
Regional Shopping Center		<1	53	<1	2	1	_	35	118	9	413	1,811	135		<1	61	<1	2	1	—	35	132	9	450	1,756	132
Research & Development		1	168	<1	18	50	_	82	385	28	2,934	5,800	14		1	169	<1	14	49	_	83	438	27	3,089	5,714	14

			Nat	ural Gas (T	nerm/yr/KS	F)				Electricity (k	Wh/yr/KSF	=)				Na	itural Gas (	Therm/yr/K	SF)				Electricity	(kWh/yr/KS	iF)	
Building Type	FDF71	Water Heater	Primary Heat	Cooking	Cooling	Misc	Refrig	Water Heater	Primary Heat	Cooking	Cooling	Misc	Refrig		Water Heater	Primary Heat	Cooking	Cooling	Misc	Refrig	Water Heater	Primary Heat	Cooking	Cooling	Misc	Refrig
Strip Mall			52		n	1	Kenig.	25	118	o	412	1 811	125			61		2	1	Kenig.	25	122	o	450	1 756	122
			104		-	1	_	050	110	, ,	413	1,011	10.001		15	007		2	(1	_	050	700	,	450	1,750	11 745
Supermarket		10	184	I	/	63		253	606	84	2,466	19,227	12,001		15	207	I	5	01	_	259	/02	81	3,436	18,605	11,/45
University/College (4yr)		9	366	1	5	14	_	117	190	18	1,082	596	18		9	353	1	5	14	—	117	202	18	1,087	596	18
Unrefrigerated Warehouse-No Rail		<1	42	<1	2	8	—	2	286	<1	383	6,354	—		<1	49	<1	3	8	—	2	351	<1	657	6,222	—
Unrefrigerated Warehouse-Rail		<1	42	<1	2	8	—	2	286	<1	383	6,354	—		<1	49	<1	3	8	—	2	351	<1	657	6,222	
Arena		31	130	1	4	244	—	193	264	15	2,550	5,569	161		36	130	1	5	244	—	136	171	9	1,147	5,555	160
Automobile Care Center		31	130	1	4	244		193	264	15	2,550	5,569	161		36	130	1	5	244	_	136	171	9	1,147	5,555	160
Bank (with Drive-Through)		31	130	1	4	244	—	193	264	15	2,550	5,569	161		36	130	1	5	244	—	136	171	9	1,147	5,555	160
Convenience Market (24 hour)		21	188	1	24	61	42	118	237	80	9,140	18,400	11,925		19	191	1	8	60	25	179	385	79	3,650	18,247	12,001
Convenience Market with Gas Pumps		21	188	1	24	61	42	118	237	80	9,140	18,400	11,925		19	191	1	8	60	25	179	385	79	3,650	18,247	12,001
Day-Care Center		23	425	4	1	—	—	179	72	34	236	429	130		19	409	4	<1	<1	—	291	63	34	143	429	130
Discount Club		1	93	<1	2	1	—	14	416	9	1,972	1,732	132		16	68	<1	2	1	—	23	248	9	816	1,719	131
Electronic Superstore		1	93	<1	2	1	_	14	416	9	1,972	1,732	132		16	68	<1	2	1	_	23	248	9	816	1,719	131
Elementary School	3	23	425	4	1	_	_	179	72	34	236	429	130	4	19	409	4	<1	<1	_	291	63	34	143	429	130
Fast Food Restaurant w/o Drive Thru		114	174	928	1	76	—	263	338	4,918	6,231	16,105	5,303		115	145	883	3	72	_	174	603	4,684	3,282	15,344	5,074
Fast Food Restaurant with Drive Thru		114	174	928	1	76	—	263	338	4,918	6,231	16,105	5,303		115	145	883	3	72	—	174	603	4,684	3,282	15,344	5,074
Free-Standing Discount store		1	93	<1	2	1	—	14	416	9	1,972	1,732	132		16	68	<1	2	1	—	23	248	9	816	1,719	131
Free-Standing Discount Superstore		1	93	<1	2	1	—	14	416	9	1,972	1,732	132		16	68	<1	2	1	—	23	248	9	816	1,719	131
Gasoline/Service Station		31	130	1	4	244	_	193	264	15	2,550	5,569	161		36	130	1	5	244	_	136	171	9	1,147	5,555	160
General Heavy Industry		31	130	1	4	244	—	193	264	15	2,550	5,569	161		36	130	1	5	244	—	136	171	9	1,147	5,555	160
General Light Industry		31	130	1	4	244	_	193	264	15	2,550	5,569	161		36	130	1	5	244	_	136	171	9	1,147	5,555	160
General Office Building		1	291	<1	50	49	_	15	146	27	4,926	5,646	13		1	219	<1	20	48	_	50	292	27	3,207	5,605	13

			Nat	ural Gas (Th	nerm/yr/KS	F)				Electricity (k	Wh/yr/KSF	<sup>-</sup> )				Na	ıtural Gas (1	Therm/yr/K	SF)				Electricity	(kWh/yr/KS	SF)	
Building Type	FDF7 <sup>1</sup>	Water Heater	Primary Heat	Cooking	Cooling	Misc	Refrig	Water Heater	Primary Heat	Cooking	Cooling	Misc	Refrig	FDF7 <sup>1</sup>	Water Heater	Primary Heat	Cooking	Cooling	Misc	Refrig	Water Heater	Primary Heat	Cooking	Cooling	Misc	Refrig
Covernment		1	201		50	40	Konig.	15	144	07	4.026	5 6 4 6	12		1	210	<1	20	40	Konig.	50	202	07	2 207	5 405	12
(Civic Center)		I	291	<1	50	49	—	15	140	27	4,920	3,040	13		I	219	<1	20	48		50	292	27	3,207	5,605	13
Government Office Building		1	291	<1	50	49	—	15	146	27	4,926	5,646	13		1	219	<1	20	48	—	50	292	27	3,207	5,605	13
Hardware/Paint Store		1	93	<1	2	1	—	14	416	9	1,972	1,732	132		16	68	<1	2	1	_	23	248	9	816	1,719	131
Health Club		31	130	1	4	244	—	193	264	15	2,550	5,569	161		36	130	1	5	244	—	136	171	9	1,147	5,555	160
High School		23	425	4	1	—	—	179	72	34	236	429	130		19	409	4	<1	<1	—	291	63	34	143	429	130
High Turnover (Sit Down Restaurant)		114	174	928	1	76	_	263	338	4,918	6,231	16,105	5,303		115	145	883	3	72	—	174	603	4,684	3,282	15,344	5,074
Home Improvement Superstore		1	93	<1	2	1	—	14	416	9	1,972	1,732	132		16	68	<1	2	1	—	23	248	9	816	1,719	131
Hospital		217	228	9	<1	174	_	226	152	99	9,658	19,656	136		239	240	9	3	172	_	153	79	98	7,115	19,508	135
Hotel		86	243	13	2	16	—	5	106	20	614	2,769	260		78	212	9	4	16	_	102	143	20	323	2,743	260
Industrial Park		1	291	<1	50	49	—	15	146	27	4,926	5,646	13		1	219	<1	20	48	_	50	292	27	3,207	5,605	13
Junior College (2yr)		11	92	1	7	14	—	46	57	18	1,444	596	18		10	319	<1	7	14	—	70	123	18	1,214	596	18
Junior High School		23	425	4	1	—	—	179	72	34	236	429	130		19	409	4	<1	<1	—	291	63	34	143	429	130
Library		31	130	1	4	244	—	193	264	15	2,550	5,569	161		36	130	1	5	244	—	136	171	9	1,147	5,555	160
Manufacturing		31	130	1	4	244	—	193	264	15	2,550	5,569	161		36	130	1	5	244	—	136	171	9	1,147	5,555	160
Medical Office Building		1	291	<1	50	49	_	15	146	27	4,926	5,646	13		1	219	<1	20	48	_	50	292	27	3,207	5,605	13
Motel		86	243	13	2	16	_	5	106	20	614	2,769	260		78	212	9	4	16	_	102	143	20	323	2,743	260
Movie Theater (No Matinee)		31	130	1	4	244	—	193	264	15	2,550	5,569	161		36	130	1	5	244	—	136	171	9	1,147	5,555	160
Office Park		1	291	<1	50	49	_	15	146	27	4,926	5,646	13		1	219	<1	20	48	_	50	292	27	3,207	5,605	13
Pharmacy/Drugstore w/o Drive Thru		1	93	<1	2	1	—	14	416	9	1,972	1,732	132		16	68	<1	2	1	_	23	248	9	816	1,719	131
Pharmacy/Drugstore with Drive Thru		1	93	<1	2	1	—	14	416	9	1,972	1,732	132		16	68	<1	2	1	_	23	248	9	816	1,719	131
Place of Worship		31	130	1	4	244	_	193	264	15	2,550	5,569	161		36	130	1	5	244	_	136	171	9	1,147	5,555	160
Quality Restaurant		114	174	928	1	76	_	263	338	4,918	6,231	16,105	5,303		115	145	883	3	72	_	174	603	4,684	3,282	15,344	5,074
Racquet Club		31	130	1	4	244	_	193	264	15	2,550	5,569	161		36	130	1	5	244	_	136	171	9	1,147	5,555	160

Fast Food Restaurant with

Free-Standing Discount

Drive Thru

store

<1

\_\_\_\_

4,776

6,342

2,095

#### Natural Gas (Therm/yr/KSF) Electricity (kWh/yr/KSF) Natural Gas (Therm/yr/KSF) Water Primary Primary Water Water Primary **Building Type** EDFZ<sup>1</sup> Heater EDFZ<sup>1</sup> Cooking Cooling Misc. Refrig. Heat Cooking Cooling Misc. Refrig. Heater Heat Cooking Cooling Misc. Heat Heater Refrigerated Warehouse-<1 <1 <1 6,225 14,860 <1 <1 No Rail Refrigerated Warehouse-<1 <1 6,225 14,860 <1 <1 <1 Rail **Regional Shopping** <1 1,972 1,732 <1 \_\_\_\_ Center <1 4,926 5,646 <1 Research & Development \_\_\_\_ 1,732 <1 1,972 <1 Strip Mall \_\_\_\_ Supermarket 9,140 18,400 11,925 University/College (4yr) 1,444 <1 \_\_\_\_ Unrefrigerated 6,236 <1 <1 <1 <1 <1 \_\_\_\_ \_ Warehouse-No Rail Unrefrigerated <1 <1 <1 6,236 <1 <1 \_ \_\_\_\_ Warehouse-Rail 5,573 2,674 Arena \_\_\_\_ 5,573 Automobile Care Center 2,674 \_\_\_\_\_ Bank 2,674 5,573 \_\_\_\_\_ (with Drive-Through) **Convenience** Market 9,488 18,433 11,954 (24 hour) Convenience Market with 9,488 18,433 11,954 Gas Pumps <1 Day-Care Center \_\_\_\_\_ \_\_\_\_ \_\_\_\_ <1 2,095 1,735 <1 Discount Club <1 \_\_\_\_ <1 2,095 1,735 <1 **Electronic Superstore** <1 **Elementary School** <1 \_\_\_\_ \_\_\_\_ \_\_\_\_ Fast Food Restaurant w/o 4,776 5,197 6,342 15,654 Drive Thru

5,197

<1

15,654

1,735

<1

			Electricity	(kWh/yr/KS	§F)	
Refrig.	Water Heater	Primary Heat	Cooking	Cooling	Misc.	Refrig.
7	7	17	<1	51	6,563	15,631
7	7	17	<1	51	6,563	15,631
_	23	248	9	816	1,719	131
_	50	292	27	3,207	5,605	13
_	23	248	9	816	1,719	131
25	179	385	79	3,650	18,247	12,001
—	70	123	18	1,214	596	18
—	3	447	<1	414	6,610	—
_	3	447	<1	414	6,610	—
	51	40	11	1,069	5,564	160
—	51	40	11	1,069	5,564	160
—	51	40	11	1,069	5,564	160
—	259	542	80	3,356	18,439	11,678
—	259	542	80	3,356	18,439	11,678
—	447	72	34	116	430	125
_	35	119	9	493	1,736	130
—	35	119	9	493	1,736	130
—	447	72	34	116	430	125
	85	790	4,944	4,072	16,186	5,317
_	85	790	4,944	4,072	16,186	5,317
_	35	119	9	493	1,736	130

			Natural Gas (Therm/yr/KSF) ater Primary							Electricity (k	Wh/yr/KSF	=)				Na	tural Gas (1	herm/yr/K	SF)				Electricity	(kWh/yr/KS	F)	
Building Type	EDE71	Water Heater	Primary Heat	Cooking	Cooling	Misc	Refrig	Water Heater	Primary Heat	Cooking	Cooling	Misc	Refria	EDE71	Water Heater	Primary Heat	Cooking	Cooling	Misc	Refrig	Water Heater	Primary Heat	Cooking	Cooling	Misc	Refrig
Free-Standing Discount Superstore		1	94	<1	2	1		13	425	9	2,095	1,735	132		<1	56	<1	2	1		35	119	9	493	1,736	130
Gasoline/Service Station		31	130	1	5	244	_	200	256	15	2,674	5,573	161		42	126	1	7	246	_	51	40	11	1,069	5,564	160
General Heavy Industry		31	130	1	5	244	_	200	256	15	2,674	5,573	161		42	126	1	7	246	_	51	40	11	1,069	5,564	160
General Light Industry		31	130	1	5	244	_	200	256	15	2,674	5,573	161		42	126	1	7	246	_	51	40	11	1,069	5,564	160
General Office Building		1	297	<1	52	49		12	129	27	5,059	5,660	13		1	162	<1	14	49		83	422	27	3,128	5,653	14
Government (Civic Center)		1	297	<1	52	49	_	12	129	27	5,059	5,660	13		1	162	<1	14	49	—	83	422	27	3,128	5,653	14
Government Office Building		1	297	<1	52	49	—	12	129	27	5,059	5,660	13		1	162	<1	14	49	—	83	422	27	3,128	5,653	14
Hardware/Paint Store		1	94	<1	2	1	_	13	425	9	2,095	1,735	132		<1	56	<1	2	1	_	35	119	9	493	1,736	130
Health Club		31	130	1	5	244	_	200	256	15	2,674	5,573	161		42	126	1	7	246	_	51	40	11	1,069	5,564	160
High School		24	423	4	1	_	_	163	70	34	236	429	130		12	394	4	<1	_	_	447	72	34	116	430	125
High Turnover (Sit Down Restaurant)		113	164	900		74	—	257	258	4,776	6,342	15,654	5,197		129	88	933	12	76	_	85	790	4,944	4,072	16,186	5,317
Home Improvement Superstore		1	94	<1	2	1	—	13	425	9	2,095	1,735	132		<1	56	<1	2	1	_	35	119	9	493	1,736	130
Hospital		215	219	9	—	174	_	237	153	99	9,901	19,677	136		284	228	9	7	174	_	14	2	99	7,567	19,644	135
Hotel		87	240	13	<1	16	—	2	94	20	622	2,770	260		68	149	13	11	17	—	55	165	20	416	2,762	262
Industrial Park		1	297	<1	52	49	—	12	129	27	5,059	5,660	13		1	162	<1	14	49	—	83	422	27	3,128	5,653	14
Junior College (2yr)		11	74	1	7	14	—	43	48	18	1,446	597	18		9	329	1	5	14	—	120	178	18	1,026	596	18
Junior High School		24	423	4	1	—	_	163	70	34	236	429	130		12	394	4	<1	_	_	447	72	34	116	430	125
Library		31	130	1	5	244	—	200	256	15	2,674	5,573	161		42	126	1	7	246	—	51	40	11	1,069	5,564	160
Manufacturing		31	130	1	5	244	_	200	256	15	2,674	5,573	161		42	126	1	7	246	_	51	40	11	1,069	5,564	160
Medical Office Building		1	297	<1	52	49	_	12	129	27	5,059	5,660	13		1	162	<1	14	49	_	83	422	27	3,128	5,653	14
Motel		87	240	13	<1	16	_	2	94	20	622	2,770	260		68	149	13	11	17	_	55	165	20	416	2,762	262
Movie Theater (No Matinee)		31	130	1	5	244	—	200	256	15	2,674	5,573	161		42	126	1	7	246	—	51	40	11	1,069	5,564	160
Office Park		1	297	<1	52	49	_	12	129	27	5,059	5,660	13		1	162	<1	14	49	—	83	422	27	3,128	5,653	14

			Nat	ural Gas (Tl	herm/yr/KS	F)				Electricity (k	Wh/yr/KSF	·)				Na	ıtural Gas (1	Therm/yr/K	SF)				Electricity	(kWh/yr/KS	F)	
Building Type	<b>EDFZ</b> <sup>1</sup>	Water Heater	Primary Heat	Cooking	Cooling	Misc.	Refrig.	Water Heater	Primary Heat	Cooking	Cooling	Misc.	Refrig.	<b>EDFZ</b> <sup>1</sup>	Water Heater	Primary Heat	Cooking	Cooling	Misc.	Refrig.	Water Heater	Primary Heat	Cooking	Cooling	Misc.	Refrig.
Pharmacy/Drugstore w/o Drive Thru		1	94	<1	2	1	_	13	425	9	2,095	1,735	132		<1	56	<1	2	1	_	35	119	9	493	1,736	130
Pharmacy/Drugstore with Drive Thru		1	94	<1	2	1	—	13	425	9	2,095	1,735	132		<1	56	<1	2	1	_	35	119	9	493	1,736	130
Place of Worship		31	130	1	5	244	_	200	256	15	2,674	5,573	161		42	126	1	7	246	_	51	40	11	1,069	5,564	160
Quality Restaurant		113	164	900	_	74	_	257	258	4,776	6,342	15,654	5,197		129	88	933	12	76	_	85	790	4,944	4,072	16,186	5,317
Racquet Club		31	130	1	5	244	_	200	256	15	2,674	5,573	161		42	126	1	7	246	_	51	40	11	1,069	5,564	160
Refrigerated Warehouse- No Rail		<1	14	<1	8	8	8	7	16	—	79	6,563	15,671		<1	5	<1	—	8	8	7	16	<1	49	6,563	15,373
Refrigerated Warehouse- Rail		<1	14	<1	8	8	8	7	16	—	79	6,563	15,671		<1	5	<1	—	8	8	7	16	<1	49	6,563	15,373
Regional Shopping Center		1	94	<1	2	1	_	13	425	9	2,095	1,735	132		<1	56	<1	2	1	_	35	119	9	493	1,736	130
Research & Development		1	297	<1	52	49	_	12	129	27	5,059	5,660	13		1	162	<1	14	49	_	83	422	27	3,128	5,653	14
Strip Mall		1	94	<1	2	1	—	13	425	9	2,095	1,735	132		<1	56	<1	2	1	_	35	119	9	493	1,736	130
Supermarket		21	180	1	25	61	45	110	204	80	9,488	18,433	11,954		15	164	1	6	61	_	259	542	80	3,356	18,439	11,678
University/College (4yr)		11	74	1	7	14	—	43	48	18	1,446	597	18		9	329	1	5	14	_	120	178	18	1,026	596	18
Unrefrigerated Warehouse-No Rail		<1	36	<1	8	8	—	3	383	<1	662	6,562	—		1	48	<1	3	8	—	2	347	<1	709	6,562	_
Unrefrigerated Warehouse-Rail		<1	36	<1	8	8	—	3	383	<1	662	6,562	—		1	48	<1	3	8	_	2	347	<1	709	6,562	_
Arena		29	89	3	43	263	1	94	490	15	2,363	909	50		28	92	3	38	265	1	85	490	15	2,209	812	50
Automobile Care Center		29	89	3	43	263	1	94	490	15	2,363	909	50		28	92	3	38	265	1	85	490	15	2,209	812	50
Bank (with Drive- Through)		29	89	3	43	263	1	94	490	15	2,363	909	50		28	92	3	38	265	1	85	490	15	2,209	812	50
Convenience Market (24 hour)	7	6	23	5	2	132	1	32	290	43	417	1,849	18,389	8	5	22	5	2	133	—	31	263	42	290	1,830	18,451
Convenience Market with Gas Pumps		6	23	5	2	132	1	32	290	43	417	1,849	18,389		5	22	5	2	133	_	31	263	42	290	1,830	18,451
Day-Care Center		16	81	1	9	102		58	95	55	856	384	88		16	85	1	10	102		51	97	55	824	381	86
Discount Club		2	6	<1	7	41	4	33	60	35	1,262	1,287	216		1	6	<1	7	42	4	32	59	35	1,193	1,281	213

		Natural Gas (Therm/yr/KSF)								Electricity (k	Wh/yr/KSF	=)				Na	itural Gas (1	Therm/yr/K	SF)				Electricity	(kWh/yr/KS	F)	
Building Type	FDF7 <sup>1</sup>	Water Heater	Primary Heat	Cooking	Cooling	Misc	Refrig	Water Heater	Primary Heat	Cooking	Cooling	Misc	Refrig	FDF7 <sup>1</sup>	Water Heater	Primary Heat	Cooking	Cooling	Misc	Refrig	Water Heater	Primary Heat	Cooking	Cooling	Misc	Refrig
Electronic Superstore		2	6	<1	7	41	4	33	60	35	1,262	1.287	216		1	6	<1	7	42	4	32	59	35	1,193	1.281	213
' Elementary School		16	81	1	9	102	_	58	95	55	, 856	, 384	88		16	85	1	10	102		51	97	55	, 824	, 381	86
Fast Food Restaurant w/o Drive Thru		116	46	855	49	81	5	46	386	1,841	3,427	5,399	8,281		113	45	857	48	82	5	44	379	1,750	3,246	5,352	8,150
Fast Food Restaurant with Drive Thru		116	46	855	49	81	5	46	386	1,841	3,427	5,399	8,281		113	45	857	48	82	5	44	379	1,750	3,246	5,352	8,150
Free-Standing Discount store		2	6	<1	7	41	4	33	60	35	1,262	1,287	216		1	6	<1	7	42	4	32	59	35	1,193	1,281	213
Free-Standing Discount Superstore		2	6	<1	7	41	4	33	60	35	1,262	1,287	216		1	6	<1	7	42	4	32	59	35	1,193	1,281	213
Gasoline/Service Station		29	89	3	43	263	1	94	490	15	2,363	909	50		28	92	3	38	265	1	85	490	15	2,209	812	50
General Heavy Industry		29	89	3	43	263	1	94	490	15	2,363	909	50		28	92	3	38	265	1	85	490	15	2,209	812	50
General Light Industry		29	89	3	43	263	1	94	490	15	2,363	909	50		28	92	3	38	265	1	85	490	15	2,209	812	50
General Office Building		27	150	1	23	52	<1	71	594	13	3,699	2,381	16		26	163	1	23	52	<1	70	630	12	3,661	2,352	14
Government (Civic Center)		27	150	1	23	52	<1	71	594	13	3,699	2,381	16		26	163	1	23	52	<1	70	630	12	3,661	2,352	14
Government Office Building		27	150	1	23	52	<1	71	594	13	3,699	2,381	16		26	163	1	23	52	<1	70	630	12	3,661	2,352	14
Hardware/Paint Store		2	6	<1	7	41	4	33	60	35	1,262	1,287	216		1	6	<1	7	42	4	32	59	35	1,193	1,281	213
Health Club		29	89	3	43	263	1	94	490	15	2,363	909	50		28	92	3	38	265	1	85	490	15	2,209	812	50
High School		16	81	1	9	102	_	58	95	55	856	384	88		16	85	1	10	102	_	51	97	55	824	381	86
High Turnover (Sit Down Restaurant)		116	46	855	49	81	5	46	386	1,841	3,427	5,399	8,281		113	45	857	48	82	5	44	379	1,750	3,246	5,352	8,150
Home Improvement Superstore		2	6	<1	7	41	4	33	60	35	1,262	1,287	216		1	6	<1	7	42	4	32	59	35	1,193	1,281	213
Hospital		188	156	9	13	180	<1	414	802	98	7,640	8,052	330		183	163	9	16	181	_	354	796	98	7,290	8,043	322
Hotel		75	72	25		117	_	199	3,830	70	2,663	1,838	1,172		74	76	25	—	117	—	199	3,890	69	2,602	1,832	1,167
Industrial Park		27	150	1	23	52	<1	71	594	13	3,699	2,381	16		26	163	1	23	52	<1	70	630	12	3,661	2,352	14
Junior College (2yr)		51	360	1	11	75	<1	353	1,078	70	2,488	1,462	403		49	361	1	11	75	—	333	996	69	2,178	1,444	387
Junior High School		16	81	1	9	102	_	58	95	55	856	384	88		16	85	1	10	102	_	51	97	55	824	381	86
Library		29	89	3	43	263	1	94	490	15	2,363	909	50		28	92	3	38	265	1	85	490	15	2,209	812	50

(with Drive-Through)

#### Natural Gas (Therm/yr/KSF) Electricity (kWh/yr/KSF) Natural Gas (Therm/yr/KSF) Primary Water Primary Water Water Primary EDFZ<sup>1</sup> Heater EDFZ<sup>1</sup> **Building Type** Cooking Cooling Misc. Refrig. Heat Cooking Cooling Misc. Refrig. Heater Cooking Cooling Misc. Heat Heater Heat Manufacturing 2,363 Medical Office Building <1 3,699 2,381 3,830 1,838 Motel 2,663 1,172 \_\_\_\_ \_\_\_\_\_ \_\_\_\_\_ Movie Theater 2,363 (No Matinee) Office Park 3,699 2,381 <1 Pharmacy/Drugstore w/o <1 1,262 1,287 <1 Drive Thru Pharmacy/Drugstore with <1 1,262 1,287 <1 Drive Thru Place of Worship 2,363 **Quality Restaurant** 1,841 3,427 5,399 8,281 Racquet Club 2,363 Refrigerated Warehouse-<1 <1 1,664 15,484 <1 \_\_\_\_ \_\_\_\_ No Rail Refrigerated Warehouse-<1 <1 1,664 15,484 <1 \_\_\_\_ \_\_\_\_ Rail **Regional Shopping** 1,287 <1 1,262 <1 Center **Research & Development** <1 3,699 2,381 Strip Mall 1,287 <1 1,262 <1 1,849 18,389 Supermarket University/College (4yr) <1 1,078 2,488 1,462 Unrefrigerated 1,251 <1 <1 <1 \_\_\_\_ \_\_\_\_ Warehouse-No Rail 1,251 Unrefrigerated <1 <1 <1 \_ \_\_\_\_ Warehouse-Rail 2,870 1,226 Arena Automobile Care Center 1,226 2,870 Bank 1,226 2,870

			Electricity	(kWh/yr/KS	SF)	
Refrig.	Water Heater	Primary Heat	Cooking	Cooling	Misc.	Refrig.
1	85	490	15	2,209	812	50
<1	70	630	12	3,661	2,352	14
_	199	3,890	69	2,602	1,832	1,167
1	85	490	15	2,209	812	50
<1	70	630	12	3,661	2,352	14
4	32	59	35	1,193	1,281	213
4	32	59	35	1,193	1,281	213
1	85	490	15	2,209	812	50
5	44	379	1,750	3,246	5,352	8,150
1	85	490	15	2,209	812	50
56	9	1	<1	77	1,656	14,520
56	9	1	<1	77	1,656	14,520
4	32	59	35	1,193	1,281	213
<1	70	630	12	3,661	2,352	14
4	32	59	35	1,193	1,281	213
_	31	263	42	290	1,830	18,451
_	333	996	69	2,178	1,444	387
—	9	25	<1	118	1,242	—
—	9	25	<1	118	1,242	_
1	118	404	15	2,491	913	54
1	118	404	15	2,491	913	54
1	118	404	15	2,491	913	54

			Nat	ural Gas (Th	nerm/yr/KS	F)				Electricity (k	wh/yr/KSF	=)				Na	itural Gas (1	Therm/yr/K	SF)				Electricity	(kWh/yr/KS	SF)	
Building Type	EDFZ <sup>1</sup>	Water Heater	Primary Heat	Cooking	Cooling	Misc.	Refria.	Water Heater	Primary Heat	Cooking	Cooling	Misc.	Refria.	EDFZ <sup>1</sup>	Water Heater	Primary Heat	Cooking	Cooling	Misc.	Refria.	Water Heater	Primary Heat	Cookina	Cooling	Misc.	Refria.
Convenience Market		7	37	5	6	126	5	36	395	47	1 460	2 628	17 583		7	22	5	5	130	<1	32	286	42	909	1 989	18 138
(24 hour)		,	07	5	0	120	5	00	0,0		1,400	2,020	17,000		,	~~~	5	5	100		02	200	72	/0/	1,,0,	10,100
Convenience Market with Gas Pumps		7	37	5	6	126	5	36	395	47	1,460	2,628	17,583		7	22	5	5	130	<1	32	286	42	909	1,989	18,138
Day-Care Center		17	152	2	7	91	_	89	191	55	1,062	391	99		16	118	1	6	99	_	102	145	55	1,052	418	100
Discount Club		2	7	<1	10	38	3	35	72	33	1,839	1,304	211		2	3	<1	10	41	4	40	35	35	1,589	1,313	218
Electronic Superstore		2	7	<1	10	38	3	35	72	33	1,839	1,304	211		2	3	<1	10	41	4	40	35	35	1,589	1,313	218
Elementary School		17	152	2	7	91	—	89	191	55	1,062	391	99		16	118	1	6	99	—	102	145	55	1,052	418	100
Fast Food Restaurant w/o Drive Thru		129	75	866	39	81	5	63	559	2,665	4,172	6,421	8,407		128	46	839	44	80	5	40	415	2,243	3,460	5,538	9,070
Fast Food Restaurant with Drive Thru		129	75	866	39	81	5	63	559	2,665	4,172	6,421	8,407		128	46	839	44	80	5	40	415	2,243	3,460	5,538	9,070
Free-Standing Discount store		2	7	<1	10	38	3	35	72	33	1,839	1,304	211		2	3	<1	10	41	4	40	35	35	1,589	1,313	218
Free-Standing Discount Superstore		2	7	<1	10	38	3	35	72	33	1,839	1,304	211		2	3	<1	10	41	4	40	35	35	1,589	1,313	218
Gasoline/Service Station		34	103	2	49	260	1	128	503	15	2,870	1,226	76		36	76	3	54	259	1	118	404	15	2,491	913	54
General Heavy Industry		34	103	2	49	260	1	128	503	15	2,870	1,226	76		36	76	3	54	259	1	118	404	15	2,491	913	54
General Light Industry		34	103	2	49	260	1	128	503	15	2,870	1,226	76		36	76	3	54	259	1	118	404	15	2,491	913	54
General Office Building		25	258	1	30	52	<1	64	838	15	4,239	2,482	15		28	168	1	25	52	<1	86	731	12	3,604	2,406	15
Government (Civic Center)		25	258	1	30	52	<1	64	838	15	4,239	2,482	15		28	168	1	25	52	<1	86	731	12	3,604	2,406	15
Government Office Building		25	258	1	30	52	<1	64	838	15	4,239	2,482	15		28	168	1	25	52	<1	86	731	12	3,604	2,406	15
Hardware/Paint Store		2	7	<1	10	38	3	35	72	33	1,839	1,304	211		2	3	<1	10	41	4	40	35	35	1,589	1,313	218
Health Club		34	103	2	49	260	1	128	503	15	2,870	1,226	76		36	76	3	54	259	1	118	404	15	2,491	913	54
High School		17	152	2	7	91	_	89	191	55	1,062	391	99		16	118	1	6	99	_	102	145	55	1,052	418	100
High Turnover (Sit Down Restaurant)		129	75	866	39	81	5	63	559	2,665	4,172	6,421	8,407		128	46	839	44	80	5	40	415	2,243	3,460	5,538	9,070
Home Improvement Superstore		2	7	<1	10	38	3	35	72	33	1,839	1,304	211		2	3	<1	10	41	4	40	35	35	1,589	1,313	218
Hospital		206	218	9	4	178	_	593	1,051	101	8,315	9,011	306		197	215	9	6	179	_	507	1,232	98	7,844	8,108	347

	Natural Gas (Therm/yr/KSF)								Electricity (k	Wh/yr/KSF	=)				Na	tural Gas (	Therm/yr/KS	SF)				Electricity	(kWh/yr/KS	F)	
Building Type	Water EDFZ <sup>1</sup> Heater	Primary Heat	Cooking	Coolina	Misc.	Refria.	Water Heater	Primary Heat	Cookina	Cooling	Misc.	Refria.	EDFZ <sup>1</sup>	Water Heater	Primary Heat	Cooking	Cooling	Misc.	Refria.	Water Heater	Primary Heat	Cooking	Coolina	Misc.	Refria.
Hotel	79	102	23	<1	98	_	160	4,156	69	2,953	1,759	1,035		78	82	24	<1	115	_	232	5,338	69	3,299	1,844	1,213
Industrial Park	25	258	1	30	52	<1	64	838	15	4,239	2,482	15		28	168	1	25	52	<1	86	731	12	3,604	2,406	15
Junior College (2yr)	45	328	1	15	58	_	350	1,034	63	2,367	1,230	315		52	416	1	17	73	_	536	1,650	68	2,286	1,516	422
Junior High School	17	152	2	7	91	_	89	191	55	1,062	391	99		16	118	1	6	99	_	102	145	55	1,052	418	100
Library	34	103	2	49	260	1	128	503	15	2,870	1,226	76		36	76	3	54	259	1	118	404	15	2,491	913	54
Manufacturing	34	103	2	49	260	1	128	503	15	2,870	1,226	76		36	76	3	54	259	1	118	404	15	2,491	913	54
Medical Office Building	25	258	1	30	52	<1	64	838	15	4,239	2,482	15		28	168	1	25	52	<1	86	731	12	3,604	2,406	15
Motel	79	102	23	<1	98	_	160	4,156	69	2,953	1,759	1,035		78	82	24	<1	115		232	5,338	69	3,299	1,844	1,213
Movie Theater (No Matinee)	34	103	2	49	260	1	128	503	15	2,870	1,226	76		36	76	3	54	259	1	118	404	15	2,491	913	54
Office Park	25	258	1	30	52	<1	64	838	15	4,239	2,482	15		28	168	1	25	52	<1	86	731	12	3,604	2,406	15
Pharmacy/Drugstore w/o Drive Thru	2	7	<1	10	38	3	35	72	33	1,839	1,304	211		2	3	<1	10	41	4	40	35	35	1,589	1,313	218
Pharmacy/Drugstore with Drive Thru	2	7	<1	10	38	3	35	72	33	1,839	1,304	211		2	3	<1	10	41	4	40	35	35	1,589	1,313	218
Place of Worship	34	103	2	49	260	1	128	503	15	2,870	1,226	76		36	76	3	54	259	1	118	404	15	2,491	913	54
Quality Restaurant	129	75	866	39	81	5	63	559	2,665	4,172	6,421	8,407		128	46	839	44	80	5	40	415	2,243	3,460	5,538	9,070
Racquet Club	34	103	2	49	260	1	128	503	15	2,870	1,226	76		36	76	3	54	259	1	118	404	15	2,491	913	54
Refrigerated Warehouse- No Rail	1	2	<1	2	159	59	3	4	<1	100	2,052	18,137		4	<1	<1	_	184	75	11	1	<1	96	1,755	18,119
Refrigerated Warehouse- Rail	1	2	<1	2	159	59	3	4	<1	100	2,052	18,137		4	<1	<1	—	184	75	11	1	<1	96	1,755	18,119
Regional Shopping Center	2	7	<1	10	38	3	35	72	33	1,839	1,304	211		2	3	<1	10	41	4	40	35	35	1,589	1,313	218
Research & Development	25	258	1	30	52	<1	64	838	15	4,239	2,482	15		28	168	1	25	52	<1	86	731	12	3,604	2,406	15
Strip Mall	2	7	<1	10	38	3	35	72	33	1,839	1,304	211		2	3	<1	10	41	4	40	35	35	1,589	1,313	218
Supermarket	7	37	5	6	126	5	36	395	47	1,460	2,628	17,583		7	22	5	5	130	<1	32	286	42	909	1,989	18,138
University/College (4yr)	45	328	1	15	58	_	350	1,034	63	2,367	1,230	315		52	416	1	17	73	_	536	1,650	68	2,286	1,516	422
Unrefrigerated Warehouse-No Rail	4	8	<1	2	152	—	11	121	<1	190	1,742	—		5	2	<1	1	182	—	14	32	<1	110	1,304	—

		Natural Gas (Therm/yr/KSF)						Electricity (k	wh/yr/KSF	=)				Na	itural Gas (1	ſherm/yr/K	SF)				Electricity	(kWh/yr/KS	SF)			
Building Type	FDF7 <sup>1</sup>	Water Heater	Primary Heat	Cooking	Cooling	Misc	Refrig	Water Heater	Primary Heat	Cooking	Cooling	Misc	Refrig	FDF7 <sup>1</sup>	Water Heater	Primary Heat	Cooking	Cooling	Misc	Refrig	Water Heater	Primary Heat	Cooking	Cooling	Misc	Refrig
		ricarci		- Cooking	cooming	1.50	Kenig.		101	- Cooking	too	1 7 10	Kenig.		_		Gooking	cooming	100	Konig.			cooking	110	1.00.4	Konig.
Unretrigerated Warehouse-Rail		4	8	<1	2	152			121	<1	190	1,/42			5	2	<		182		14	32	<1	110	1,304	
Arena		36	76	3	55	259	1	118	406	15	2,540	875	52		32	162	3	13	193	<1	80	608	47	1,835	938	48
Automobile Care Center		36	76	3	55	259	1	118	406	15	2,540	875	52		32	162	3	13	193	<1	80	608	47	1,835	938	48
Bank (with Drive-Through)		36	76	3	55	259	1	118	406	15	2,540	875	52	12	32	162	3	13	193	<1	80	608	47	1,835	938	48
Convenience Market (24 hour)		7	20	5	5	131	—	31	252	42	899	1,875	18,180		5	56	24	1	97	—	45	184	492	479	1,793	16,782
Convenience Market with Gas Pumps		7	20	5	5	131	—	31	252	42	899	1,875	18,180		5	56	24	1	97	—	45	184	492	479	1,793	16,782
Day-Care Center		16	116	1	6	100	_	99	137	55	1,067	420	99		12	71	1	4	70		180	299	171	936	446	84
Discount Club		2	2	<1	10	41	4	40	31	35	1,611	1,311	218		1	7	<1	5	30	1	49	20	24	1,090	904	176
Electronic Superstore		2	2	<1	10	41	4	40	31	35	1,611	1,311	218		1	7	<1	5	30	1	49	20	24	1,090	904	176
Elementary School		16	116	1	6	100	—	99	137	55	1,067	420	99		12	71	1	4	70	—	180	299	171	936	446	84
Fast Food Restaurant w/o Drive Thru		127	44	839	45	80	5	39	392	2,199	3,515	5,451	9,121		99	74	890	4	57	1	170	470	3,641	2,812	5,370	7,874
Fast Food Restaurant with Drive Thru	11	127	44	839	45	80	5	39	392	2,199	3,515	5,451	9,121		99	74	890	4	57	1	170	470	3,641	2,812	5,370	7,874
Free-Standing Discount store		2	2	<1	10	41	4	40	31	35	1,611	1,311	218		1	7	<1	5	30	1	49	20	24	1,090	904	176
Free-Standing Discount Superstore		2	2	<1	10	41	4	40	31	35	1,611	1,311	218		1	7	<1	5	30	1	49	20	24	1,090	904	176
Gasoline/Service Station		36	76	3	55	259	1	118	406	15	2,540	875	52		32	162	3	13	193	<1	80	608	47	1,835	938	48
General Heavy Industry		36	76	3	55	259	1	118	406	15	2,540	875	52		32	162	3	13	193	<1	80	608	47	1,835	938	48
General Light Industry		36	76	3	55	259	1	118	406	15	2,540	875	52		32	162	3	13	193	<1	80	608	47	1,835	938	48
General Office Building		29	169	1	25	52	<1	86	731	12	3,629	2,396	15		25	230	1	26	39	<1	108	646	30	2,664	2,328	36
Government (Civic Center)		29	169	1	25	52	<1	86	731	12	3,629	2,396	15		25	230	1	26	39	<1	108	646	30	2,664	2,328	36
Government Office Building		29	169	1	25	52	<1	86	731	12	3,629	2,396	15		25	230	1	26	39	<1	108	646	30	2,664	2,328	36
Hardware/Paint Store		2	2	<1	10	41	4	40	31	35	1,611	1,311	218		1	7	<1	5	30	1	49	20	24	1,090	904	176
Health Club		36	76	3	55	259	1	118	406	15	2,540	875	52		32	162	3	13	193	<1	80	608	47	1,835	938	48

	Natural Gas (Therm/yr/KSF)								Electricity (k	Wh/yr/KSF	=)				Na	ıtural Gas (1	Therm/yr/K	SF)				Electricity	(kWh/yr/KS	SF)	
Building Type	Water EDFZ <sup>1</sup> Heater	Primary Heat	Cooking	Cooling	Misc.	Refrig.	Water Heater	Primary Heat	Cooking	Cooling	Misc.	Refrig.	EDFZ <sup>1</sup>	Water Heater	Primary Heat	Cooking	Cooling	Misc.	Refrig.	Water Heater	Primary Heat	Cooking	Cooling	Misc.	Refrig.
High School	16	116	1	6	100	_	99	137	55	1,067	420	99		12	71	1	4	70	_	180	299	171	936	446	84
High Turnover (Sit Down Restaurant)	127	44	839	45	80	5	39	392	2,199	3,515	5,451	9,121		99	74	890	4	57	1	170	470	3,641	2,812	5,370	7,874
Home Improvement Superstore	2	2	<1	10	41	4	40	31	35	1,611	1,311	218		1	7	<1	5	30	1	49	20	24	1,090	904	176
Hospital	196	211	9	6	179	_	520	1,255	98	7,939	8,024	351		221	111	9	204	126		1,593	2,670	202	5,658	6,328	452
Hotel	78	81	24	_	116	_	233	5,394	69	3,353	1,850	1,227		85	259	15	<1	83	_	33	2,013	235	2,307	2,038	1,135
Industrial Park	29	169	1	25	52	<1	86	731	12	3,629	2,396	15		25	230	1	26	39	<1	108	646	30	2,664	2,328	36
Junior College (2yr)	53	418	1	18	74	_	540	1,675	69	2,307	1,534	429		33	432	1	103	53	_	1,280	2,459	158	1,915	1,741	367
Junior High School	16	116	1	6	100	—	99	137	55	1,067	420	99		12	71	1	4	70	_	180	299	171	936	446	84
Library	36	76	3	55	259	1	118	406	15	2,540	875	52		32	162	3	13	193	<1	80	608	47	1,835	938	48
Manufacturing	36	76	3	55	259	1	118	406	15	2,540	875	52		32	162	3	13	193	<1	80	608	47	1,835	938	48
Medical Office Building	29	169	1	25	52	<1	86	731	12	3,629	2,396	15		25	230	1	26	39	<1	108	646	30	2,664	2,328	36
Motel	78	81	24	_	116	_	233	5,394	69	3,353	1,850	1,227		85	259	15	<1	83	_	33	2,013	235	2,307	2,038	1,135
Movie Theater (No Matinee)	36	76	3	55	259	1	118	406	15	2,540	875	52		32	162	3	13	193	<1	80	608	47	1,835	938	48
Office Park	29	169	1	25	52	<1	86	731	12	3,629	2,396	15		25	230	1	26	39	<1	108	646	30	2,664	2,328	36
Pharmacy/Drugstore w/o Drive Thru	2	2	<1	10	41	4	40	31	35	1,611	1,311	218		1	7	<1	5	30	1	49	20	24	1,090	904	176
Pharmacy/Drugstore with Drive Thru	2	2	<1	10	41	4	40	31	35	1,611	1,311	218		1	7	<1	5	30	1	49	20	24	1,090	904	176
Place of Worship	36	76	3	55	259	1	118	406	15	2,540	875	52		32	162	3	13	193	<1	80	608	47	1,835	938	48
Quality Restaurant	127	44	839	45	80	5	39	392	2,199	3,515	5,451	9,121		99	74	890	4	57	1	170	470	3,641	2,812	5,370	7,874
Racquet Club	36	76	3	55	259	1	118	406	15	2,540	875	52		32	162	3	13	193	<1	80	608	47	1,835	938	48
Refrigerated Warehouse- No Rail	4	<]	<1	—	185	75	11	1	<1	96	1,746	18,101		4	<]	<1	_	123	68	12	2	<1	67	1,544	16,519
Refrigerated Warehouse- Rail	4	<1	<1	—	185	75	11	1	<1	96	1,746	18,101		4	<1	<1	—	123	68	12	2	<1	67	1,544	16,519
Regional Shopping Center	2	2	<1	10	41	4	40	31	35	1,611	1,311	218		1	7	<1	5	30	1	49	20	24	1,090	904	176
Research & Development	29	169	1	25	52	<1	86	731	12	3,629	2,396	15		25	230	1	26	39	<1	108	646	30	2,664	2,328	36

#### Natural Gas (Therm/yr/KSF) Electricity (kWh/yr/KSF) Natural Gas (Therm/yr/KSF) Primary Water Primary Water Water Primary EDFZ<sup>1</sup> Heater EDFZ<sup>1</sup> **Building Type** Cooking Cooling Misc. Refrig. Heat Cooking Cooling Misc. Refrig. Heater Heat Cooking Cooling Misc. Heat Heater Strip Mall <1 1,611 1,311 <1 Supermarket 1,875 18,180 \_\_\_\_\_ 1,534 University/College (4yr) 1,675 2,307 \_ Unrefrigerated 1,288 <1 <1 <1 \_\_\_\_ \_\_\_\_ Warehouse-No Rail Unrefrigerated <1 <1 1,288 <1 \_\_\_\_ \_\_\_\_ Warehouse-Rail 4,668 Arena \_\_\_\_ \_\_\_\_ \_\_\_\_ Automobile Care Center 4,668 \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_ Bank 4,668 \_\_\_\_ \_\_\_\_ (with Drive-Through) 3,764 **Convenience** Market 14,809 12,946 <1 (24 hour) Convenience Market with <1 3,764 14,809 12,946 Gas Pumps 2,940 <1 Day-Care Center \_\_\_\_ \_\_\_\_ 1,498 Discount Club <1 <1 1,367 <1 \_\_\_\_\_ 1,498 <1 **Electronic Superstore** <1 <1 1,367 \_\_\_\_ 2,940 **Elementary School** <1 \_\_\_\_ Fast Food Restaurant w/o 4,833 4,041 12,650 5,830 \_ Drive Thru Fast Food Restaurant with 4,833 4,041 12,650 5,830 \_ Drive Thru Free-Standing Discount <1 <1 1,367 1,498 <1 store Free-Standing Discount <1 <1 1,367 1,498 <1 Superstore Gasoline/Service Station 4,668 \_\_\_\_\_ \_\_\_\_ \_\_\_\_ General Heavy Industry 4,668 \_\_\_\_ \_\_\_\_ General Light Industry 4,668 \_\_\_\_ \_\_\_\_ General Office Building <1 4,356 4,969 <1 \_\_\_\_\_ \_\_\_\_\_

			Electricity	(kWh/yr/KS	SF)	
Refrig.	Water Heater	Primary Heat	Cooking	Cooling	Misc.	Refrig.
1	49	20	24	1,090	904	176
_	45	184	492	479	1,793	16,782
_	1,280	2,459	158	1,915	1,741	367
—	33	28	<1	133	1,158	_
_	33	28	<1	133	1,158	_
	201	246	15	2,352	4,226	154
_	201	246	15	2,352	4,226	154
—	201	246	15	2,352	4,226	154
40	107	188	71	8,026	12,948	11,137
40	107	188	71	8,026	12,948	11,137
—	164	72	34	242	449	132
—	12	429	8	1,878	1,308	123
_	12	429	8	1,878	1,308	123
_	164	72	34	242	449	132
—	148	183	3,621	4,433	9,442	4,176
—	148	183	3,621	4,433	9,442	4,176
—	12	429	8	1,878	1,308	123
_	12	429	8	1,878	1,308	123
_	201	246	15	2,352	4,226	154
—	201	246	15	2,352	4,226	154
—	201	246	15	2,352	4,226	154
_	11	81	24	4,424	4,233	12

		Natural Gas (Therm/yr/KSF)							Electricity (k	Wh/yr/KSF	=)				Na	itural Gas (	Therm/yr/K	SF)				Electricity	(kWh/yr/KS	F)		
Building Type	EDFZ <sup>1</sup>	Water Heater	Primary Heat	Cooking	Cooling	Misc.	Refriq.	Water Heater	Primary Heat	Cooking	Cooling	Misc.	Refrig.	EDFZ <sup>1</sup>	Water Heater	Primary Heat	Cooking	Cooling	Misc.	Refriq.	Water Heater	Primary Heat	Cooking	Cooling	Misc.	Refriq.
Government (Civic Center)		1	285	<1	_	46	_	14	395	29	4,356	4,969	15		1	236	<1	42	42	_	11	81	24	4,424	4,233	12
Government Office Building		1	285	<1	—	46	—	14	395	29	4,356	4,969	15		1	236	<1	42	42	_	11	81	24	4,424	4,233	12
Hardware/Paint Store		60	27	<1	<1	1	—	9	306	9	1,367	1,498	141		1	76	<1	2	1	_	12	429	8	1,878	1,308	123
Health Club		31	135	1	_	229	_	204	113	_	862	4,668	171		28	111	1	4	226	_	201	246	15	2,352	4,226	154
High School		24	197	4	_	<1	—	192	2,940	35	217	455	139		23	398	4	1		_	164	72	34	242	449	132
High Turnover (Sit Down Restaurant)		140	134	865	—	65	—	118	506	4,833	4,041	12,650	5,830		95	109	651	—	54	—	148	183	3,621	4,433	9,442	4,176
Home Improvement Superstore		60	27	<1	<1	1	—	9	306	9	1,367	1,498	141		1	76	<1	2	1	—	12	429	8	1,878	1,308	123
Hospital		217	170	9		161	—	279	292	104	9,484	16,339	147		209	203	9	—	170	—	250	139	102	9,273	15,907	140
Hotel		96	357	3	_	15	—	_	259	21	495	2,341	287		82	199	12	<1	15	—	2	92	19	534	2,083	253
Industrial Park		1	285	<1	_	46	_	14	395	29	4,356	4,969	15		1	236	<1	42	42	_	11	81	24	4,424	4,233	12
Junior College (2yr)		13	296	_	24	13	_	3	50	19	1,372	518	20		11	63	1	7	14	_	63	44	18	1,515	504	18
Junior High School		24	197	4	_	<1	_	192	2,940	35	217	455	139		23	398	4	1	_	_	164	72	34	242	449	132
Library		31	135	1	_	229	_	204	113	_	862	4,668	171		28	111	1	4	226	_	201	246	15	2,352	4,226	154
Manufacturing		31	135	1		229	_	204	113	_	862	4,668	171		28	111	1	4	226	_	201	246	15	2,352	4,226	154
Medical Office Building		1	285	<1	_	46	_	14	395	29	4,356	4,969	15		1	236	<1	42	42	_	11	81	24	4,424	4,233	12
Motel		96	357	3		15	_	_	259	21	495	2,341	287		82	199	12	<1	15	_	2	92	19	534	2,083	253
Movie Theater (No Matinee)		31	135	1	—	229	—	204	113		862	4,668	171		28	111	1	4	226	—	201	246	15	2,352	4,226	154
Office Park		1	285	<1		46	_	14	395	29	4,356	4,969	15		1	236	<1	42	42	_	11	81	24	4,424	4,233	12
Pharmacy/Drugstore w/o Drive Thru		60	27	<1	<1	1	—	9	306	9	1,367	1,498	141		1	76	<1	2	1	—	12	429	8	1,878	1,308	123
Pharmacy/Drugstore with Drive Thru		60	27	<1	<1	1	—	9	306	9	1,367	1,498	141		1	76	<1	2	1	—	12	429	8	1,878	1,308	123
Place of Worship		31	135	1		229	—	204	113	—	862	4,668	171		28	111	1	4	226	_	201	246	15	2,352	4,226	154
Quality Restaurant		140	134	865		65	_	118	506	4,833	4,041	12,650	5,830		95	109	651	—	54	_	148	183	3,621	4,433	9,442	4,176
Racquet Club		31	135	1		229	—	204	113	—	862	4,668	171		28	111	1	4	226	_	201	246	15	2,352	4,226	154

Table E-15.2. Commercial Energy Consumption by End Use	e, <sup>1</sup> Electricity Demand Forecast Zone, and Building Type (cont.)
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		Natural Gas (Therm/yr/KSF)								Electricity (k	wh/yr/KSI	=)				Na	atural Gas (1	Therm/yr/K	SF)				Electricity	(kWh/yr/KS	SF)	
Building Type	EDFZ	Water Heater	Primary Heat	Cooking	Cooling	Misc.	Refrig.	Water Heater	Primary Heat	Cooking	Cooling	Misc.	Refrig.	EDFZ <sup>1</sup>	Water Heater	Primary Heat	Cooking	Cooling	Misc.	Refrig.	Water Heater	Primary Heat	Cooking	Cooling	Misc.	Refrig.
Refrigerated Warehouse- No Rail		<1	3	<1	<1	52	8	6	8	<1	117	4,305	15,847		<1	15	<1	5	9	8	8	18	_	62	4,595	17,064
Refrigerated Warehouse- Rail		<1	3	<1	<1	52	8	6	8	<1	117	4,305	15,847		<1	15	<1	5	9	8	8	18		62	4,595	17,064
Regional Shopping Center		60	27	<1	<1	1	—	9	306	9	1,367	1,498	141		1	76	<1	2	1	—	12	429	8	1,878	1,308	123
Research & Development		1	285	<1	_	46	_	14	395	29	4,356	4,969	15		1	236	<1	42	42	_	11	81	24	4,424	4,233	12
Strip Mall		60	27	<1	<1	1	_	9	306	9	1,367	1,498	141		1	76	<1	2	1	_	12	429	8	1,878	1,308	123
Supermarket		22	78	1	<1	55	45	117	184	82	3,764	14,809	12,946		19	151	1	23	53	40	107	188	71	8,026	12,948	11,137
University/College (4yr)		13	296	—	24	13	—	3	50	19	1,372	518	20		11	63	1	7	14	—	63	44	18	1,515	504	18
Unrefrigerated Warehouse-No Rail		<1	25	<1	—	8	_	3	328	<1	758	4,279	_		<1	32	<1	6	8	—	3	372	—	521	3,934	_
Unrefrigerated Warehouse-Rail		<1	25	<1		8		3	328	<1	758	4,279	_		<1	32	<1	6	8	_	3	372	—	521	3,934	_
Arena		28	110	1	4	227		198	240	11	2,130	4,241	154		23	69	2	43	215	1	79	379	12	1,996	2,220	39
Automobile Care Center		28	110	1	4	227	_	198	240	11	2,130	4,241	154		23	69	2	43	215	1	79	379	12	1,996	2,220	39
Bank (with Drive-Through)		28	110	1	4	227	—	198	240	11	2,130	4,241	154		23	69	2	43	215	1	79	379	12	1,996	2,220	39
Convenience Market (24 hour)		19	150	1	17	53	38	116	200	72	6,949	13,007	11,303		4	17	4	2	109	_	24	179	32	367	1,654	13,782
Convenience Market with Gas Pumps		19	150	1	17	53	38	116	200	72	6,949	13,007	11,303		4	17	4	2	109	—	24	179	32	367	1,654	13,782
Day-Care Center	15	23	388	4	1	<1	_	178	64	34	231	449	132	14	16	77	1	7	98		51	82	51	894	1,130	81
Discount Club	15	12	69	<1	1	1	_	13	395	8	1,649	1,315	123	10	1	4	<1	7	34	3	24	28	27	1,249	2,867	162
Electronic Superstore		12	69	<1	1	1	_	13	395	8	1,649	1,315	123		1	4	<1	7	34	3	24	28	27	1,249	2,867	162
Elementary School		23	388	4	1	<1	_	178	64	34	231	449	132		16	77	1	7	98	_	51	82	51	894	1,130	81
Fast Food Restaurant w/o Drive Thru		94	105	645	<1	53		142	199	3,590	4,116	9,362	4,145		90	37	702	48	67	4	35	268	1,279	3,254	8,965	6,236
Fast Food Restaurant with Drive Thru		94	105	645	<1	53	_	142	199	3,590	4,116	9,362	4,145		90	37	702	48	67	4	35	268	1,279	3,254	8,965	6,236
Free-Standing Discount store		12	69	<1	1	1	—	13	395	8	1,649	1,315	123		1	4	<1	7	34	3	24	28	27	1,249	2,867	162

		Natural Gas (Therm/yr/KSF)							Electricity (k	wh/yr/KSF	=)				Na	itural Gas (	Therm/yr/K	SF)				Electricity	(kWh/yr/KS	iF)		
Building Type	<b>EDFZ</b> <sup>1</sup>	Water Heater	Primary Heat	Cooking	Cooling	Misc.	Refriq.	Water Heater	Primary Heat	Cooking	Cooling	Misc.	Refriq.	EDFZ <sup>1</sup>	Water Heater	Primary Heat	Cooking	Cooling	Misc.	Refrig.	Water Heater	Primary Heat	Cooking	Cooling	Misc.	Refriq.
Free-Standing Discount Superstore		12	69	<1	1	1	_	13	395	8	1,649	1,315	123		1	4	<1	7	34	3	24	28	27	1,249	2,867	162
Gasoline/Service Station		28	110	1	4	227	—	198	240	11	2,130	4,241	154		23	69	2	43	215	1	79	379	12	1,996	2,220	39
General Heavy Industry		28	110	1	4	227	—	198	240	11	2,130	4,241	154		23	69	2	43	215	1	79	379	12	1,996	2,220	39
General Light Industry		28	110	1	4	227	—	198	240	11	2,130	4,241	154		23	69	2	43	215	1	79	379	12	1,996	2,220	39
General Office Building		1	234	<1	39	43	—	13	83	25	4,208	4,327	13		20	119	1	18	43	<1	46	396	9	3,103	2,714	11
Government (Civic Center)		1	234	<1	39	43	—	13	83	25	4,208	4,327	13		20	119	1	18	43	<1	46	396	9	3,103	2,714	11
Government Office Building		1	234	<1	39	43	—	13	83	25	4,208	4,327	13		20	119	1	18	43	<1	46	396	9	3,103	2,714	11
Hardware/Paint Store		12	69	<1	1	1	_	13	395	8	1,649	1,315	123		1	4	<1	7	34	3	24	28	27	1,249	2,867	162
Health Club		28	110	1	4	227	—	198	240	11	2,130	4,241	154		23	69	2	43	215	1	79	379	12	1,996	2,220	39
High School		23	388	4	1	<1	_	178	64	34	231	449	132		16	77	1	7	98	_	51	82	51	894	1,130	81
High Turnover (Sit Down Restaurant)		94	105	645	<1	53	—	142	199	3,590	4,116	9,362	4,145		90	37	702	48	67	4	35	268	1,279	3,254	8,965	6,236
Home Improvement Superstore		12	69	<1	1	1	—	13	395	8	1,649	1,315	123		1	4	<1	7	34	3	24	28	27	1,249	2,867	162
Hospital		210	204	9	<1	170	_	245	124	101	8,897	15,857	140		184	121	9	14	181	_	290	610	93	8,688	18,450	297
Hotel		82	201	10	1	15		8	93	19	502	2,076	253		60	66	20	_	96	_	145	2,805	54	2,226	2,059	903
Industrial Park		1	234	<1	39	43		13	83	25	4,208	4,327	13		20	119	1	18	43	<1	46	396	9	3,103	2,714	11
Junior College (2yr)		11	140	1	8	14	_	40	51	18	1,481	505	18		43	364	1	4	75	—	276	682	65	3,268	3,761	362
Junior High School		23	388	4	1	<1	—	178	64	34	231	449	132		16	77	1	7	98	—	51	82	51	894	1,130	81
Library		28	110	1	4	227	—	198	240	11	2,130	4,241	154		23	69	2	43	215	1	79	379	12	1,996	2,220	39
Manufacturing		28	110	1	4	227	—	198	240	11	2,130	4,241	154		23	69	2	43	215	1	79	379	12	1,996	2,220	39
Medical Office Building		1	234	<1	39	43	—	13	83	25	4,208	4,327	13		20	119	1	18	43	<1	46	396	9	3,103	2,714	11
Motel		82	201	10	1	15	_	8	93	19	502	2,076	253		60	66	20	—	96	_	145	2,805	54	2,226	2,059	903
Movie Theater (No Matinee)		28	110	1	4	227	_	198	240	11	2,130	4,241	154		23	69	2	43	215	1	79	379	12	1,996	2,220	39
Office Park		1	234	<1	39	43	_	13	83	25	4,208	4,327	13		20	119	1	18	43	<1	46	396	9	3,103	2,714	11

		Natural Gas (Therm/yr/KSF)							Electricity (kWh/yr/KSF)							Na	atural Gas (1	Therm/yr/K	SF)		Electricity (kWh/yr/KSF)						
Building Type	EDFZ <sup>1</sup>	Water Heater	Primary Heat	Cooking	Cooling	Misc.	Refria.	Water Heater	Primary Heat	Cooking	Cooling	Misc.	Refria.	EDFZ <sup>1</sup>	Water Heater	Primary Heat	Cookina	Cooling	Misc.	Refria.	Water Heater	Primary Heat	Cookina	Cooling	Misc.	Refria.	
Pharmacy/Drugstore w/o Drive Thru		12	69	<1	1	1		13	395	8	1,649	1,315	123		1	4	<1	7	34	3	24	28	27	1,249	2,867	162	
Pharmacy/Drugstore with Drive Thru		12	69	<1	1	1	_	13	395	8	1,649	1,315	123		1	4	<1	7	34	3	24	28	27	1,249	2,867	162	
Place of Worship		28	110	1	4	227	_	198	240	11	2,130	4,241	154		23	69	2	43	215	1	79	379	12	1,996	2,220	39	
Quality Restaurant		94	105	645	<1	53		142	199	3,590	4,116	9,362	4,145		90	37	702	48	67	4	35	268	1,279	3,254	8,965	6,236	
Racquet Club		28	110	1	4	227	_	198	240	11	2,130	4,241	154		23	69	2	43	215	1	79	379	12	1,996	2,220	39	
Refrigerated Warehouse- No Rail		<1	13	<1	3	18	8	8	17	<1	61	4,537	16,845		3	<1	<1	_	150	57	7	<1	<1	68	1,931	13,133	
Refrigerated Warehouse- Rail		<1	13	<1	3	18	8	8	17	<1	61	4,537	16,845		3	<1	<1	—	150	57	7	<1	<1	68	1,931	13,133	
Regional Shopping Center		12	69	<1	1	1	—	13	395	8	1,649	1,315	123		1	4	<1	7	34	3	24	28	27	1,249	2,867	162	
Research & Development		1	234	<1	39	43		13	83	25	4,208	4,327	13		20	119	1	18	43	<1	46	396	9	3,103	2,714	11	
Strip Mall		12	69	<1	1	1	—	13	395	8	1,649	1,315	123		1	4	<1	7	34	3	24	28	27	1,249	2,867	162	
Supermarket		19	150	1	17	53	38	116	200	72	6,949	13,007	11,303		4	17	4	2	109	_	24	179	32	367	1,654	13,782	
University/College (4yr)		11	140	1	8	14	—	40	51	18	1,481	505	18		43	364	1	4	75	—	276	682	65	3,268	3,761	362	
Unrefrigerated Warehouse-No Rail		<1	33	<1	6	8	—	3	393	<1	487	4,060			3	2	<1	1	152	—	7	21	<1	120	1,905	—	
Unrefrigerated Warehouse-Rail		<1	33	<1	6	8	—	3	393	<1	487	4,060	—		3	2	<1	1	152	—	7	21	<1	120	1,905	_	
Arena		26	57	2	50	214	1	79	268	12	2,533	2,164	40		23	93	2	12	206	<1	141	443	14	2,753	10,260	46	
Automobile Care Center		26	57	2	50	214	1	79	268	12	2,533	2,164	40		23	93	2	12	206	<1	141	443	14	2,753	10,260	46	
Bank (with Drive-Through)		26	57	2	50	214	1	79	268	12	2,533	2,164	40		23	93	2	12	206	<1	141	443	14	2,753	10,260	46	
Convenience Market (24 hour)	17	5	17	4	3	108	—	22	158	32	666	1,650	13,737	18	5	75	5		102	36	26	348	61	1,082	3,498	13,311	
Convenience Market with Gas Pumps		5	17	4	3	108	_	22	158	32	666	1,650	13,737		5	75	5	—	102	36	26	348	61	1,082	3,498	13,311	
Day-Care Center		16	75	1	11	100	—	37	82	52	1,077	1,066	78		15	156	1	57	98	<1	107	887	72	2,397	1,135	109	
Discount Club		1	2	<1	8	34	3	26	12	27	1,520	2,796	164		3	18	<1	3	32	1	8	118	25	1,770	1,932	197	

	Natural Gas (Therm/yr/KSF)							Electricity (kWh/yr/KSF)							Natural Gas (Therm/yr/KSF)							Electricity (kWh/yr/KSF)						
Building Type	EDEZ <sup>1</sup> Heater	Primary Heat	Cooking	Cooling	Misc	Refrig	Water Heater	Primary Heat	Cooking	Cooling	Misc	Refrig	FDF7 <sup>1</sup>	Water Heater	Primary Heat	Cooking	Cooling	Misc	Refrig	Water Heater	Primary Heat	Cooking	Cooling	Misc	Refrig			
Electronic Superstore	1	2	<1	8	34	3	26	12	27	1,520	2,796	164		3	18	<1	3	32	1	8	118	25	1.770	1,932	197			
Elementary School	16	75	1	11	100		37	82	52	, 1,077	, 1,066	78		15	156	1	57	98	<1	107	887	72	, 2,397	, 1,135	109			
Fast Food Restaurant w/o Drive Thru	92	33	698	44	67	4	29	270	1,390	4,098	8,344	6,443		90	55	755	16	64	2	66	233	1,739	4,338	10,345	6,772			
Fast Food Restaurant with Drive Thru	92	33	698	44	67	4	29	270	1,390	4,098	8,344	6,443		90	55	755	16	64	2	66	233	1,739	4,338	10,345	6,772			
Free-Standing Discount store	1	2	<1	8	34	3	26	12	27	1,520	2,796	164		3	18	<1	3	32	1	8	118	25	1,770	1,932	197			
Free-Standing Discount Superstore	1	2	<1	8	34	3	26	12	27	1,520	2,796	164		3	18	<1	3	32	1	8	118	25	1,770	1,932	197			
Gasoline/Service Station	26	57	2	50	214	1	79	268	12	2,533	2,164	40		23	93	2	12	206	<1	141	443	14	2,753	10,260	46			
General Heavy Industry	26	57	2	50	214	1	79	268	12	2,533	2,164	40		23	93	2	12	206	<1	141	443	14	2,753	10,260	46			
General Light Industry	26	57	2	50	214	1	79	268	12	2,533	2,164	40		23	93	2	12	206	<1	141	443	14	2,753	10,260	46			
General Office Building	21	120	1	18	43	<1	49	411	9	3,032	2,608	11		30	11	1	<1	41	<1	13	46	17	3,240	5,482	29			
Government (Civic Center)	21	120	1	18	43	<1	49	411	9	3,032	2,608	11		30	11	1	<1	41	<1	13	46	17	3,240	5,482	29			
Government Office Building	21	120	1	18	43	<1	49	411	9	3,032	2,608	11		30	11	1	<1	41	<1	13	46	17	3,240	5,482	29			
Hardware/Paint Store	1	2	<1	8	34	3	26	12	27	1,520	2,796	164		3	18	<1	3	32	1	8	118	25	1,770	1,932	197			
Health Club	26	57	2	50	214	1	79	268	12	2,533	2,164	40		23	93	2	12	206	<1	141	443	14	2,753	10,260	46			
High School	16	75	1	11	100	_	37	82	52	1,077	1,066	78		15	156	1	57	98	<1	107	887	72	2,397	1,135	109			
High Turnover (Sit Down Restaurant)	92	33	698	44	67	4	29	270	1,390	4,098	8,344	6,443		90	55	755	16	64	2	66	233	1,739	4,338	10,345	6,772			
Home Improvement Superstore	1	2	<1	8	34	3	26	12	27	1,520	2,796	164		3	18	<1	3	32	1	8	118	25	1,770	1,932	197			
Hospital	187	99	9	6	180	_	341	492	92	10,138	16,824	305		178	230	10	12	167	1	1,241	497	98	7,896	19,788	358			
Hotel	60	52	20	_	96	_	155	2,418	54	2,450	2,030	922		72	238	14	_	85	_	6	3,116	124	1,467	4,319	956			
Industrial Park	21	120	1	18	43	<1	49	411	9	3,032	2,608	11		30	11	1	<1	41	<1	13	46	17	3,240	5,482	29			
Junior College (2yr)	43	388	1	13	76		182	360	66	3,894	3,546	347		52	422	1	5	74	2	36	491	80	3,253	4,385	521			
Junior High School	16	75	1	11	100		37	82	52	1,077	1,066	78		15	156	1	57	98	<1	107	887	72	2,397	1,135	109			
Library	26	57	2	50	214	1	79	268	12	2,533	2,164	40		23	93	2	12	206	<1	141	443	14	2,753	10,260	46			

#### Natural Gas (Therm/yr/KSF) Electricity (kWh/yr/KSF) Natural Gas (Therm/yr/KSF) Primary Water Primary Water Water Primary EDFZ<sup>1</sup> Heater EDFZ<sup>1</sup> **Building Type** Cooking Cooling Misc. Refrig. Cooking Cooling Misc. Refrig. Heater Cooking Cooling Misc. Heat Heater Heat Heat Manufacturing 2,533 2,164 Medical Office Building <1 3,032 2,608 <1 2,030 Motel 2,418 2,450 \_\_\_\_ \_\_\_\_\_ \_\_\_\_ 2,533 Movie Theater 2,164 (No Matinee) Office Park 3,032 2,608 <1 <1 Pharmacy/Drugstore w/o 2,796 <1 1,520 <1 Drive Thru Pharmacy/Drugstore with <1 1,520 2,796 <1 Drive Thru Place of Worship 2,533 2,164 **Quality Restaurant** 1,390 4,098 8,344 6,443 Racquet Club 2,533 2,164 Refrigerated Warehouse-1,896 12,896 <1 <1 <1 <1 <1 <1 \_\_\_\_ \_\_\_\_ No Rail 1,896 Refrigerated Warehouse-<1 <1 <1 <1 12,896 <1 <1 \_ Rail **Regional Shopping** <1 1,520 2,796 <1 Center Research & Development <1 3,032 2,608 <1 1,520 2,796 Strip Mall <1 <1 1,650 13,737 Supermarket \_\_\_\_ \_\_\_\_ University/College (4yr) 3,894 3,546 \_\_\_\_ Unrefrigerated <1 <1 1,860 <1 \_\_\_\_ \_\_\_\_ Warehouse-No Rail Unrefrigerated 1,860 <1 <1 <1 \_\_\_\_ \_\_\_\_ Warehouse-Rail 12,990 8,428 Arena \_\_\_\_ \_ 12,990 8,428 Automobile Care Center \_ State Bank 12,990 8,428

#### Table E-15.2. Commercial Energy Consumption by End Use,<sup>1</sup> Electricity Demand Forecast Zone, and Building Type (cont.)

\_\_\_\_

(with Drive-Through)

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	Electricity (kWh/yr/KSF)													
Refrig.	Water Heater	Primary Heat	Cooking	Cooling	Misc.	Refrig.								
<1	141	443	14	2,753	10,260	46								
<1	13	46	17	3,240	5,482	29								
	6	3,116	124	1,467	4,319	956								
<1	141	443	14	2,753	10,260	46								
<1	13	46	17	3,240	5,482	29								
1	8	118	25	1,770	1,932	197								
1	8	118	25	1,770	1,932	197								
<1	141	443	14	2,753	10,260	46								
2	66	233	1,739	4,338	10,345	6,772								
<1	141	443	14	2,753	10,260	46								
65	7	<1	<1	109	2,911	5,213								
65	7	<1	<1	109	2,911	5,213								
1	8	118	25	1,770	1,932	197								
<1	13	46	17	3,240	5,482	29								
1	8	118	25	1,770	1,932	197								
36	26	348	61	1,082	3,498	13,311								
2	36	491	80	3,253	4,385	521								
—	7	47	<1	761	2,087	—								
_	7	47	<1	761	2,087	_								
<1	132	334	17	2,603	3,968	102								
<1	132	334	17	2,603	3,968	102								
<1	132	334	17	2,603	3,968	102								

		Natural Gas (Therm/yr/KSF)							Electricity (kWh/yr/KSF)							Natural Gas (Therm/yr/KSF)								Electricity (kWh/yr/KSF)			
Building Type	EDFZ <sup>1</sup>	Water Heater	Primary Heat	Cookina	Coolina	Misc.	Refria.	Water Heater	Primary Heat	Cookina	Coolina	Misc.	Refria.	EDFZ <sup>1</sup>	Water Heater	Primary Heat	Cookina	Coolina	Misc.	Refria.	Water Heater	Primary Heat	Cookina	Coolina	Misc.	Refria.	
Convenience Market (24 hour)		7	31	6		131	42	96	249	520	2,495	10,826	16,764		12	95	4	7	91	17	100	308	109	3,123	9,564	14,306	
Convenience Market with Gas Pumps		7	31	6	—	131	42	96	249	520	2,495	10,826	16,764		12	95	4	7	91	17	100	308	109	3,123	9,564	14,306	
Day-Care Center		20	32	1		96	_	139	1,730	397	9,644	45	198		18	232	2	6	50	<1	179	382	70	1,130	513	115	
Discount Club		1	27	<1	2	38	_	10	175	24	6,035	2,601	301		6	36	<1	4	20	1	26	168	20	1,594	1,695	171	
Electronic Superstore		1	27	<1	2	38	—	10	175	24	6,035	2,601	301		6	36	<1	4	20	1	26	168	20	1,594	1,695	171	
Elementary School		20	32	1		96	—	139	1,730	397	9,644	45	198		18	232	2	6	50	<1	179	382	70	1,130	513	115	
Fast Food Restaurant w/o Drive Thru		74	60	849	—	78	—	194	257	7,180	11,975	19,627	10,585		112	87	840	20	72	2	110	446	3,574	4,413	11,064	6,691	
Fast Food Restaurant with Drive Thru		74	60	849	—	78	—	194	257	7,180	11,975	19,627	10,585		112	87	840	20	72	2	110	446	3,574	4,413	11,064	6,691	
Free-Standing Discount store		1	27	<1	2	38	—	10	175	24	6,035	2,601	301		6	36	<1	4	20	1	26	168	20	1,594	1,695	171	
Free-Standing Discount Superstore		1	27	<1	2	38	—	10	175	24	6,035	2,601	301		6	36	<1	4	20	1	26	168	20	1,594	1,695	171	
Gasoline/Service Station		27	42	2		254	_	305	929	75	12,990	8,428	47		32	105	2	21	239	<1	132	334	17	2,603	3,968	102	
General Heavy Industry		27	42	2		254	_	305	929	75	12,990	8,428	47		32	105	2	21	239	<1	132	334	17	2,603	3,968	102	
General Light Industry		27	42	2		254	—	305	929	75	12,990	8,428	47		32	105	2	21	239	<1	132	334	17	2,603	3,968	102	
General Office Building		47	8	1		51	—	20	51	366	10,998	11,371	58		15	182	1	23	47	<1	51	392	39	4,063	4,428	18	
Government (Civic Center)		47	8	1	—	51	—	20	51	366	10,998	11,371	58		15	182	1	23	47	<1	51	392	39	4,063	4,428	18	
Government Office Building		47	8	1	—	51	—	20	51	366	10,998	11,371	58		15	182	1	23	47	<1	51	392	39	4,063	4,428	18	
Hardware/Paint Store		1	27	<1	2	38	_	10	175	24	6,035	2,601	301		6	36	<1	4	20	1	26	168	20	1,594	1,695	171	
Health Club		27	42	2		254	_	305	929	75	12,990	8,428	47		32	105	2	21	239	<1	132	334	17	2,603	3,968	102	
High School		20	32	1	_	96	_	139	1,730	397	9,644	45	198		18	232	2	6	50	<1	179	382	70	1,130	513	115	
High Turnover (Sit Down Restaurant)		74	60	849	_	78	—	194	257	7,180	11,975	19,627	10,585		112	87	840	20	72	2	110	446	3,574	4,413	11,064	6,691	
Home Improvement Superstore		1	27	<1	2	38	—	10	175	24	6,035	2,601	301		6	36	<1	4	20	1	26	168	20	1,594	1,695	171	
University/College (4yr)

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1,428

1,684

12,069

1,183

#### Natural Gas (Therm/yr/KSF) Electricity (kWh/yr/KSF) Natural Gas (Therm/yr/KSF) Water Primary Primary Water Water Primary EDFZ<sup>1</sup> Heater EDFZ<sup>1</sup> **Building Type** Cooking Cooling Misc. Refrig. Heat Cooking Cooling Misc. Refrig. Heater Cooking Cooling Misc. Heat Heater Heat 1,725 1,043 14,329 2,899 Hospital \_\_\_\_ Hotel 1,650 1,322 3,475 \_ 10,998 11,371 Industrial Park \_\_\_\_ \_\_\_\_ 1,428 1,684 12,069 1,183 Junior College (2yr) \_\_\_\_ 1,730 9,644 Junior High School \_\_\_\_ 12,990 8,428 Library \_\_\_\_ \_\_\_\_ 12,990 8,428 Manufacturing \_\_\_\_\_ \_\_\_\_ Medical Office Building 10,998 11,371 \_\_\_\_ Motel 1,650 1,322 3,475 \_\_\_\_ \_\_\_\_\_ Movie Theater 12,990 8,428 \_\_\_\_ (No Matinee) Office Park 10,998 11,371 Pharmacy/Drugstore w/o <1 6,035 2,601 <1 \_ Drive Thru Pharmacy/Drugstore with <1 6,035 2,601 <1 \_\_\_\_ Drive Thru Place of Worship 12,990 8,428 \_ **Quality Restaurant** 7,180 11,975 19,627 10,585 \_\_\_\_ \_\_\_\_ Racquet Club 12,990 8,428 \_\_\_\_ \_\_\_\_ Refrigerated Warehouse-<1 <1 <1 3,803 15,490 <1 \_\_\_\_ \_ No Rail Refrigerated Warehouse-3,803 15,490 <1 <1 <1 <1 \_\_\_\_ \_\_\_\_ Rail **Regional Shopping** <1 6,035 2,601 <1 \_\_\_\_ Center 10,998 11,371 **Research & Development** \_ \_ Strip Mall <1 6,035 2,601 <1 \_\_\_\_ 2,495 Supermarket 10,826 16,764

### Table E-15.2. Commercial Energy Consumption by End Use,<sup>1</sup> Electricity Demand Forecast Zone, and Building Type (cont.)

	Electricity (kWh/yr/KSF)													
Refrig.	Water Heater	Primary Heat	Cooking	Cooling	Misc.	Refrig.								
<1	474	572	154	8,470	14,157	379								
_	114	1,892	122	1,644	2,255	653								
<1	51	392	39	4,063	4,428	18								
<1	255	673	135	2,510	1,361	258								
<1	179	382	70	1,130	513	115								
<1	132	334	17	2,603	3,968	102								
<1	132	334	17	2,603	3,968	102								
<1	51	392	39	4,063	4,428	18								
_	114	1,892	122	1,644	2,255	653								
<1	132	334	17	2,603	3,968	102								
<1	51	392	39	4,063	4,428	18								
1	26	168	20	1,594	1,695	171								
1	26	168	20	1,594	1,695	171								
<1	132	334	17	2,603	3,968	102								
2	110	446	3,574	4,413	11,064	6,691								
<1	132	334	17	2,603	3,968	102								
34	8	8	<1	77	3,838	15,176								
34	8	8	<1	77	3,838	15,176								
1	26	168	20	1,594	1,695	171								
<1	51	392	39	4,063	4,428	18								
1	26	168	20	1,594	1,695	171								
17	100	308	109	3,123	9,564	14,306								
<1	255	673	135	2,510	1,361	258								

Table E-15.2. Commercial Energy Consumption by End Use	<sup>1</sup> Electricity Demand Forecast Zone, and	d Building Type (cont.)
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			Nat	ural Gas (Tł	nerm/yr/KS	F)		Electricity (kWh/yr/KSF)					Natural Gas (Therm/yr/KSF)					Electricity (kWh/yr/KSF)								
Building Type	EDFZ <sup>1</sup>	Water Heater	Primary Heat	Cooking	Cooling	Misc.	Refrig.	Water Heater	Primary Heat	Cooking	Cooling	Misc.	Refrig.	<b>EDFZ</b> <sup>1</sup>	Water Heater	Primary Heat	Cooking	Cooling	Misc.	Refrig.	Water Heater	Primary Heat	Cooking	Cooling	Misc.	Refrig.
Unrefrigerated Warehouse-No Rail		5	5	<1	—	181	—	11	63	<1	1,459	7,338	—		2	20	<1	3	91	_	8	194	<1	448	3,789	—
Unrefrigerated Warehouse-Rail		5	5	<1		181	—	11	63	<1	1,459	7,338	—		2	20	<1	3	91	—	8	194	<1	448	3,789	_

Source: ICF calculations; California Energy Commission (CEC). 2021. Excel database with the 2018-2030 Uncalibrated Commercial Sector Forecast, provided to ICF. January 21, 2021.

EDFZ = Electricity Demand Forecast Zone; yr = year; yr = year; KSF = thousand square feet

<sup>1</sup> The sample size in the commercial end use forecast data for several end uses and building types was limited. Accordingly, the data should be used with caution.

<sup>2</sup> Data for some EDFZ were not available in the commercial end use forecast, and a representative EDFZ was assumed (refer to Table E-1.1).

<sup>3</sup> The 12 building types used by the commercial end use forecast have been cross walked to the 49 non-residential land types in CalEEMod, as shown in Table E-1.6.

	Water Energ	gy Intensity Factor	s (kWh per AF)	
Hydrologic Region <sup>1</sup>	Extraction + Conveyance	Pre- Treatment <sup>2</sup>	Distribution	Total
North Coast	54	144	163	362
San Francisco Bay	233	144	318	695
Central Coast	449	144	163	757
South Coast	1,591	144	163	1,898
Sacramento River	45	144	18	207
San Joaquin River	90	144	18	252
Tulare Lake	263	144	18	425
North Lahontan	43	144	18	205
South Lahontan	724	144	163	1,031
Colorado River	105	144	18	267

# Table W-1.1. Water Energy Intensity Factors by Hydrologic Region and Process

Source: ICF calculations; Navigant 2014. Water-Energy Calculator. Version 1.05. Prepared for the California Public Utilities Commission.

kWh = kilowatt-hours; AF = acre feet

<sup>1</sup> See Figure W-1.1.

<sup>2</sup> Pre-treatment factor assumes conventional treatment.





Source: California Department of Water Resources (DWR). 2021. Hydrologic Regions. Available: https://atlasdwr.opendata.arcgis.com/datasets/2a572a181e094020bdaeb5203162de15\_0/explore?location=35.989124%2C-119.270000%2C5.96. Accessed: July 2021.

End-Use/Fixture (z)	% of Indoor Water Use <sup>1</sup>
Toilet	24%
Showerhead	19%
Bathroom and Kitchen Faucet	19%
Dishwashers	1%
Clothes Washers	16%
Leaks & Other	18%
Bath	3%

### Table W-4.1. Residential Water Consumption Percentages by End Use

Source: Water Research Foundation 2016. Residential End Uses of Water, Version 2. Available:

https://www.waterrf.org/research/projects/residential-end-uses-water-version-2. Accessed: January 2021

<sup>1</sup> Indoor water use percentages calculated based on data from the Water Research Foundation 2016.

	0	office	Н	otel	Rest	aurant	Groce	ry Store	Non-0 Reta	Grocery I Store	K-12	School	nool Other	
End-Use/Fixture (z)	Total <sup>1</sup>	Indoor <sup>2</sup>												
Restroom	26%		51%	—	34%	—	17%		26%	—	20%	_	20%	—
Toilets	_	48%	_	46%		27%	—	26%		46%	—	51%		37%
(72% of Restroom)														
Urinals		11%		11%		6%	_	6%		11%	_	12%		9%
(17% of Restroom)														
Faucets		3%		3%		1%	_	1%		3%	_	3%		2%
(4% of Restroom)														
Showers		5%		4%		3%	_	2%		4%	_	5%		4%
(7% of Restroom)														
Kitchen	3%	<u> </u>	10%	<u> </u>	46%		9%		4%		2%		1%	<u> </u>
Faucets	_	4%	_	7%		29%	_	11%	_	6%	_	4%	_	1%
(57% of Kitchen)														
Dishwashers	_	2%	_	3%		12%	_	5%	_	2%	_	2%	_	1%
(24% of Kitchen)														
Ice Making	_	1%	_	2%		10%	_	4%	_	2%	_	1%	_	0%
(19% of Kitchen)														
Laundry	0%	0%	14%	18%	0%	0%	0%	0%	0%	0%	0%	0%	1%	3%
Other	10%	26%	5%	6%	12%	13%	22%	46%	11%	27%	6%	21%	17%	44%
Landscaping	38%	_	10%	_	6%	_	3%		38%	_	72%	_	61%	
Cooling	23%	_	10%	_	2%	_	49%	_	21%	_	*3	_	*3	_
Total⁴	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

#### Table W-4.2. Non-Residential Water Consumption Percentages by End Use

Source: Pacific Institute. 2003. Waste Not, Want Not: The Potential for Urban Water Conservation in California. November. Available: https://pacinst.org/wp-content/uploads/2013/02/waste\_not\_want\_not\_full\_report3.pdf. Accessed: January 2021.

<sup>1</sup> Water end-use data from Figures E-1, E-2, E-5, E-6, E-7, E-8, and E-9 of Appendix E of the Pacific Institute report.

<sup>2</sup> Indoor end-use data calculated based on the total water use data for the relevant building category and Figure 4-3 and Figure 4-4 of the Pacific Institute report. Figure 4-3 shows the breakdown of restroom water use by end-use in the commercial & industry sector. Figure 4-4 shows the breakdown of kitchen water-use by end-use in the commercial & industry sector; it was assumed that all end-uses except dishwashing and ice making are associated with faucet water use.

<sup>3</sup> No data.

<sup>4</sup> Totals may not add to 100% due to rounding.

End-Use/Fixture (z)	Existing Rate <sup>1</sup>	Reduced Rate	Applicable Standards <sup>2</sup>	Units
Toilet	1.28	—	—	gal/flush
Showerhead	1.8	—	—	gal/min @ 80 psi
Bathroom Faucet	1.2	—	_	gal/min @ 60 psi
Kitchen Faucet	1.8	1.5	2019 GBC Voluntary	gal/min @ 60 psi
Dishwashers				
Standard	5.0	3.5 or 4.25	EnergyStar or 2019 GBC Voluntary	gal/cycle
Compact	3.5	3.1 or 3.5	EnergyStar or 2019 GBC Voluntary	gal/cycle
Clothes Washers				
Top-loading, Compact	12.0	4.2	EnergyStar	gal/cycle/ft³
Top-loading, Standard	6.5	4.3	EnergyStar	gal/cycle/ft <sup>3</sup>
Front-loading, Compact	8.3	4.2	EnergyStar	gal/cycle/ft <sup>3</sup>
Front-loading, Standard	4.7	3.2	EnergyStar	gal/cycle/ft³

#### Table W-4.3. Residential Baseline and Reduced Flow Rates for End Uses

Sources: 2019 California Green Building Standards Code. Title 24, Part 11. Available: https://codes.iccsafe.org/content/CAGBSC2019. Accessed: January 2021.

EnergyStar. Clothes Washers Key Product Criteria. Available: https://www.energystar.gov/products/appliances/clothes\_washers/key\_product\_criteria. Accessed: January 2021.

EnergyStar. Commercial Dishwashers Key Product Criteria. Available:

https://www.energystar.gov/products/commercial\_food\_service\_equipment/commercial\_dishwashers/key\_product\_criteria. Accessed: January 2021.

EnergyStar. Commercial Kitchen Equipment Calculator. Available: http://www.energystar.gov/buildings/sites/default/uploads/files/commercial\_kitchen\_equipment\_calculator.xlsx. Accessed: January 2021.

EnergyStar. Dishwashers Key Product Criteria. Available: https://www.energystar.gov/products/appliances/dishwashers/key\_product\_criteria. Accessed: January 2021.

gal = gallons; min = minute; psi = pounds per square inch = ft<sup>3</sup> = cubic feet; GBC = Green Building Code; @ = at

<sup>1</sup> Existing rates are calculated from (1) the 2019 Green Building Code Mandatory Measures – for toilet, showerhead, faucets; and (2) California Code of Regulations, Title 20, Division 2, Article 4, 1605.1. Federal and State Standards for Federally-Regulated Appliances – for dishwashers and clothes washers.

<sup>2</sup> 2019 GBC = 2019 California Green Building Code, voluntary measures

End-Use/Fixture (z)	Existing Rate <sup>1</sup>	Reduced Rate	Applicable Standards <sup>2</sup>	Units
Toilet	1.28	1.12	2019 GBC Voluntary	gal/flush
Urinals				
Wall-Mounted	0.125	0.11	2019 GBC Voluntary	gal/flush
Floor-Mounted	0.5	0.44	2019 GBC Voluntary	gal/flush
Showerhead	1.8	_	2019 GBC Voluntary	gal/min. @ 80 psi
Bathroom Faucet	0.5	0.35	2019 GBC Voluntary	gal/min. @ 60 psi
Kitchen Faucet	1.8	1.6	2019 GBC Voluntary	gal/min. @ 60 psi
Dishwashers - High Temperature				
Under Counter	1.09	0.86	2019 GBC Voluntary	gal/rack
Single Tank Door	1.29	0.89	2019 GBC Voluntary	gal/rack
Single Tank Conveyor	0.87	0.70	2019 GBC Voluntary	gal/rack
Multi-Tank Conveyor	0.97	0.54	2019 GBC Voluntary	gal/rack
Dishwashers - Low Temperature				
Under Counter	1.73	1.19	2019 GBC Voluntary	gal/rack
Single Tank Door	2.1	1.18	2019 GBC Voluntary	gal/rack
Single Tank Conveyor	1.31	0.79	2019 GBC Voluntary	gal/rack
Multi-Tank Conveyor	1.04	0.54	2019 GBC Voluntary	gal/rack
Clothes Washer				
Top-loading	8.8	7.9	2019 GBC Voluntary	gal/cycle/ft³
Front-loading	4.1	3.7 or 4.0	2019 GBC Voluntary or EnergyStar	gal/cycle/ft <sup>3</sup>

### Table W-4.4. Non-Residential Baseline and Reduced Flow Rates for End Uses

Sources: 2019 California Green Building Standards Code. Title 24, Part 11. Available: https://codes.iccsafe.org/content/CAGBSC2019. Accessed: January 2021.

EnergyStar. Clothes Washers Key Product Criteria. Available: https://www.energystar.gov/products/appliances/clothes\_washers/key\_product\_criteria. Accessed: January 2021.

gal = gallons; min = minute; psi = pounds per square inch = ft<sup>3</sup> = cubic feet; GBC = Green Building Code; @ = at

<sup>1</sup> Baseline rates are calculated from (1) the 2019 Green Building Code Mandatory Measures (and 2019 California Plumbing Code) – for toilet, urinal, showerhead, faucets; (2) EnergyStar calculator for commercial kitchen equipment – for dishwashers, and (3) California Code of Regulations, Title 20, Division 2, Article 4, 1605.1. Federal and State Standards for Federally-Regulated Appliances – for clothes washers.

<sup>2</sup> 2019 GBC = 2019 California Green Building Code, voluntary measures

Equipment	Tech Type	Average HP	Load Factor
Chainsaws	G2	2	0.70
Chainsaws Preempt	G2	2	0.70
Chippers/Stump Grinders	G4	5	0.78
Lawn Mowers	G4	4	0.36
Leaf Blowers/Vacuums	G2	2	0.94
Leaf Blowers/Vacuums	G4	4	0.94
Other Lawn & Garden Equipment	G4	6	0.58
Riding Mowers	G4	21	0.38
Tillers	G2	1	0.40
Tillers	G4	4	0.40
Trimmers/Edgers/Brush Cutters	G2	1	0.91
Trimmers/Edgers/Brush Cutters	G4	2	0.91
Wood Splitters	G4	7	0.69

### Table LL-1.1. Landscape Equipment Horsepower and Load Factors by Equipment Type

Source: California Air Resources Board (CARB). 2020. 2020 Emissions Model for Small Off-Road Engines—SORE2020. Version 1.1. September. Available: https://ww2.arb.ca.gov/our-work/programs/mobile-source-emissionsinventory/msei-announcements. Database queried by Ramboll and provided electronically to ICF. September 2021. HP = horsepower; G2 = two-stroke gasoline; G4= four-stroke gasoline

County	Single-Family	Multi-Family	County	Single-Family	Multi-Family
Alameda	0.25	0.26	Placer	0.26	0.28
Alpine	0.19	0.29	Plumas	0.26	0.35
Amador	0.26	0.33	Riverside	0.26	0.23
Butte	0.23	0.29	Sacramento	0.25	0.26
Calaveras	0.24	0.31	San Benito	0.26	0.23
Colusa	0.27	0.26	San Bernardino	0.26	0.22
Contra Costa	0.25	0.26	San Diego	0.25	0.27
Del Norte	0.24	0.31	San Francisco	0.20	0.32
El Dorado	0.26	0.29	San Joaquin	0.25	0.23
Fresno	0.26	0.23	San Luis Obispo	0.26	0.31
Glenn	0.26	0.27	San Mateo	0.26	0.26
Humboldt	0.25	0.33	Santa Barbara	0.26	0.26
Imperial	0.27	0.21	Santa Clara	0.26	0.25
Inyo	0.23	0.33	Santa Cruz	0.26	0.28
Kern	0.26	0.23	Shasta	0.25	0.30
Kings	0.26	0.24	Sierra	0.24	0.32
Lake	0.24	0.31	Siskiyou	0.24	0.33
Lassen	0.24	0.32	Solano	0.26	0.26
Los Angeles	0.27	0.25	Sonoma	0.25	0.29
Madera	0.26	0.23	Stanislaus	0.26	0.23
Marin	0.25	0.31	Sutter	0.25	0.24
Mariposa	0.24	0.35	Tehama	0.25	0.29
Mendocino	0.26	0.31	Trinity	0.24	0.35
Merced	0.26	0.22	Tulare	0.26	0.22
Modoc	0.22	0.31	Tuolumne	0.25	0.33
Mono	0.21	0.31	Ventura	0.27	0.25
Monterey	0.26	0.22	Yolo	0.26	0.27
Napa	0.25	0.27	Yuba	0.26	0.26
Nevada	0.26	0.33	All counties (statewide)	0.26	0.25
Orange	0.27	0.25			

### Table S-1.1. Annual Residential Waste Disposal Rates by Location

Source: CalRecycle. n.d. Residential Waste Stream by Material Type. Available:

https://www2.calrecycle.ca.gov/WasteCharacterization/ResidentialStreams. Accessed: April 2021.

Business Type	Tons/employee/year
Arts, Entertainment, & Recreation	1.94
Durable Wholesale & Trucking	0.57
Education	0.38
Hotels & Lodging	1.40
Manufacturing -Electronic Equipment	0.31
Manufacturing - Food & Nondurable Wholesale	1.23
Manufacturing - All Other	0.44
Medical & Health	0.57
Public Administration	0.30
Restaurants	1.57
Retail Trade - Food & Beverage Stores	0.94
Retail Trade - All Other	1.74
Services - Management, Administrative, Support, & Social	0.60
Services - Professional, Technical, & Financial	1.61
Services - Repair & Personal	0.85
Not Elsewhere Classified <sup>1</sup>	0.46
Multifamily (administrative services)	0.74

### Table S-1.2. Annual Statewide Non-Residential Waste Disposal Rates by Business Type

Source: CalRecycle. n.d. Business Group Waste Stream Calculator. Available

https://www2.calrecycle.ca.gov/WasteCharacterization/BusinessGroupCalculator. Accessed: January 2021.

<sup>1</sup> Represents a large and varied business group, ranging from farming through resource extraction, utilities, and transportation to waste management.

# Table S-1.3. Waste Profile by Building Type

	Material															
Building Type	Mixed Paper (general)	Glass	Mixed Metals	Mixed Electronics	Mixed Plastics	Food Waste	Yard Trimmings	Mixed Organics	Mixed MSW	Carpet	Concrete	Asphalt Concrete	Asphalt Shingles	Dimensional Lumber	Fly Ash	Tires
Arts, Entertainment, & Recreation	21%	3%	2%	0%	14%	34%	12%	5%	6%	1%	2%	0%	0%	1%	1%	0%
Durable Wholesale & Trucking	26%	2%	4%	1%	14%	10%	3%	3%	29%	0%	2%	0%	2%	5%	0%	0%
Education	33%	0%	2%	0%	13%	34%	5%	4%	5%	3%	0%	0%	0%	0%	0%	0%
Hotels & Lodging	22%	7%	4%	0%	11%	32%	6%	4%	10%	0%	0%	2%	0%	0%	1%	0%
Manufacturing -Electronic Equipment	30%	0%	4%	2%	19%	11%	3%	5%	23%	0%	0%	0%	0%	2%	0%	0%
Manufacturing - Food & Nondurable Wholesale	23%	1%	2%	1%	17%	38%	4%	4%	10%	0%	0%	0%	0%	1%	0%	0%
Manufacturing - All Other	25%	1%	8%	1%	14%	7%	3%	6%	30%	0%	0%	0%	0%	5%	0%	0%
Medical & Health	26%	0%	2%	0%	9%	22%	4%	25%	10%	2%	0%	0%	0%	0%	0%	0%
Public Administration	35%	1%	7%	0%	13%	17%	3%	5%	16%	1%	2%	0%	0%	1%	0%	0%
Restaurants	26%	3%	2%	0%	12%	51%	2%	1%	2%	0%	0%	0%	0%	0%	1%	0%
Retail Trade - Food & Beverage Stores	28%	2%	2%	0%	16%	42%	1%	2%	5%	1%	1%	0%	0%	0%	0%	0%
Retail Trade - All Other	26%	2%	6%	0%	14%	18%	3%	7%	22%	2%	0%	0%	0%	0%	0%	0%
Services - Management, Administrative, Support, & Social	24%	1%	4%	2%	11%	25%	9%	8%	14%	1%	0%	0%	0%	1%	0%	0%
Services - Professional, Technical, & Financial	29%	1%	4%	2%	13%	8%	7%	5%	24%	1%	2%	1%	1%	1%	0%	0%

### Table S-1.3. Waste Profile by Building Type (cont.)

	_							Mat	erial							
Building Type	Mixed Paper (general)	Glass	Mixed Metals	Mixed Electronics	Mixed Plastics	Food Waste	Yard Trimmings	Mixed Organics	Mixed MSW	Carpet	Concrete	Asphalt Concrete	Asphalt Shingles	Dimensional Lumber	Fly Ash	Tires
Services - Repair & Personal	30%	3%	9%	1%	15%	7%	4%	5%	21%	1%	0%	0%	2%	1%	0%	1%
Not Elsewhere Classified <sup>1</sup>	28%	5%	3%	0%	12%	16%	11%	9%	15%	0%	1%	0%	0%	1%	0%	0%
Multi Family	19%	9%	0%	1%	10%	25%	4%	1%	31%	0%	0%	0%	0%	0%	0%	0%
Single Family	20%	2%	4%	1%	14%	20%	8%	2%	28%	1%	0%	0%	0%	1%	0%	0%

Sources: CalRecycle. n.d. Business Group Waste Stream Calculator. Available https://www2.calrecycle.ca.gov/WasteCharacterization/BusinessGroupCalculator.

CalRecycle. 2020. 2018 Facility-Based Characterization of Solid Waste in California. https://www2.calrecycle.ca.gov/WasteCharacterization/Study. Accessed: January 2021.

<sup>1</sup> Represents a large and varied business group, ranging from farming through resource extraction, utilities, and transportation to waste management.

		MT	Accumulation	MT
Air Basin'	Cover lype	C/ha	Period (Yr)	C/ha/yr
Great Basin Valleys	Broadleat Forest	94.2	60	1.57
Great Basin Valleys	Coniter Forest	118.4	60	1.97
Great Basin Valleys	Grassland	6.5	20	0.32
Great Basin Valleys	Mixed Forest (Conifer Broadleaf)	111.2	60	1.85
Great Basin Valleys	Shrubland	5.6	35	0.16
Lake County	Broadleaf Forest	134.0	60	2.23
Lake County	Conifer Forest	171.9	60	2.87
Lake County	Grassland	7.2	20	0.36
Lake County	Mixed Forest (Conifer Broadleaf)	131.0	60	2.18
Lake County	Shrubland	76.0	35	2.17
Lake Tahoe	Broadleaf Forest	101.5	60	1.69
Lake Tahoe	Conifer Forest	203.6	60	3.39
Lake Tahoe	Grassland	6.1	20	0.31
Lake Tahoe	Mixed Forest (Conifer Broadleaf)	181.6	60	3.03
Lake Tahoe	Shrubland	66.1	35	1.89
Mojave Desert	Broadleaf Forest	97.7	60	1.63
Mojave Desert	Conifer Forest	113.1	60	1.89
Mojave Desert	Grassland	6.3	20	0.31
Mojave Desert	Mixed Forest (Conifer Broadleaf)	107.3	60	1.79
Mojave Desert	Shrubland	6.9	35	0.20
Mountain Counties	Broadleaf Forest	99.2	60	1.65
Mountain Counties	Conifer Forest	183.5	60	3.06
Mountain Counties	Grassland	5.8	20	0.29
Mountain Counties	Mixed Forest (Conifer Broadleaf)	169.2	60	2.82
Mountain Counties	Shrubland	62.1	35	1.77
North Central Coast	Broadleaf Forest	92.9	60	1.55
North Central Coast	Conifer Forest	152.4	60	2.54
North Central Coast	Grassland	5.7	20	0.29
North Central Coast	Mixed Forest (Conifer Broadleaf)	113.1	60	1.88
North Central Coast	Shrubland	68.9	35	1.97
North Coast	Broadleaf Forest	92.9	60	1.55
North Coast	Conifer Forest	152.4	60	2.54
North Coast	Grassland	5.7	20	0.29
North Coast	Mixed Forest (Conifer Broadleaf)	113.1	60	1.88
North Coast	Shrubland	68.9	35	1.97
Northeast Plateau	Broadleaf Forest	102.9	60	1.72
Northeast Plateau	Conifer Forest	167.7	60	2.80
Northeast Plateau	Grassland	6.6	20	0.33

Mixed Forest (Conifer Broadleaf)

Northeast Plateau

# Table N-1.1 Above- and Below-ground Biomass Carbon Accumulation (metric tons) per Hectare by Land Cover Type and Air Basin

60

2.33

139.6

Air Droin	CoverTure	MT	Accumulation	MT
Northoast Platoau	Shrubland			
Sacramento Vallev	Broadleaf Forest	1123	60	1.87
Sacramento Valley	Conifer Forest	168.5	60	2.81
Sacramento Valley	Grassland	6 7	20	0.33
Sacramento Valley	Mixed Forest (Conifer Broadleaf)	157.7	60	2.63
Sacramento Valley	Shrubland	73 5	35	2.00
Salton Sea	Broadleaf Forest	82.2	60	1.37
Salton Sea	Conifer Forest	108.0	60	1.80
Salton Sea	Grassland	5.9	20	0.30
Salton Sea	Mixed Forest (Conifer Broadleaf)	103.0	60	1.72
Salton Sea	Shrubland	18.8	35	0.54
San Dieao County	Broadleaf Forest	104.3	60	1.74
San Diego County	Conifer Forest	104.6	60	1.74
San Diego County	Grassland	6.6	20	0.33
San Diego County	Mixed Forest (Conifer Broadleaf)	93.4	60	1.56
San Diego County	Shrubland	56.0	35	1.60
San Francisco Bay	Broadleaf Forest	130.3	60	2.17
San Francisco Bay	Conifer Forest	178.8	60	2.98
San Francisco Bay	Grassland	6.3	20	0.31
San Francisco Bay	Mixed Forest (Conifer Broadleaf)	123.7	60	2.06
San Francisco Bay	Shrubland	65.3	35	1.86
San Joaquin Valley	Broadleaf Forest	90.3	60	1.50
San Joaquin Valley	Conifer Forest	154.5	60	2.57
San Joaquin Valley	Grassland	5.9	20	0.29
San Joaquin Valley	Mixed Forest (Conifer Broadleaf)	138.1	60	2.30
San Joaquin Valley	Shrubland	51.3	35	1.46
South Central Coast	Broadleaf Forest	99.0	60	1.65
South Central Coast	Conifer Forest	104.2	60	1.74
South Central Coast	Grassland	6.0	20	0.30
South Central Coast	Mixed Forest (Conifer Broadleaf)	103.9	60	1.73
South Central Coast	Shrubland	54.1	35	1.55
South Coast	Broadleaf Forest	91.1	60	1.52
South Coast	Conifer Forest	118.1	60	1.97
South Coast	Grassland	6.5	20	0.33
South Coast	Mixed Forest (Conifer Broadleaf)	98.2	60	1.64
South Coast	Shrubland	59.8	35	1.71

# Table N-1.1 Above- and Belowground Biomass Carbon Accumulation (metric tons) per Hectare by Land Cover Type and Air Basin (cont.)

Source: California Air Resources Board (CARB). 2021. Carbon Accumulation Values for Major Cover Types for Each California Air Basin. Database provided to ICF in March 2021.

MT = metric tons; C = carbon; ha = hectare; yr = year

<sup>1</sup> Refer to Figure N-1.1 for a graphic illustrating the air basin boundaries.

### Figure N-1.1. California Air Basins



Source: California Air Resources Board (CARB). 2021. California Air Basin Map. Available: https://www.arb.ca.gov/ei/maps/statemap/abmap.htm. Accessed: July 2021.

		Soil Carbon Accumulation (MT C/ha/yr <sup>1,2</sup> )				
Soil Type	- IPCC Soil Classification	Conversion to Cropland	Conversion to Grazing Land	Conversion to Forest		
Alfisols	High Activity Clay Soils	1.85	2.37	2.53		
Andisols	Volcanic Soils	6.20	7.95	8.49		
Aquic	Wetland Soils	2.40	3.08	3.29		
Aridisols	High Activity Clay Soils	1.85	2.37	2.53		
Entisols	Low Activity Clay Soils	1.25	1.60	1.71		
Gelisols	Low Activity Clay Soils	1.25	1.60	1.71		
Inceptisols	High Activity Clay Soils	1.85	2.37	2.53		
Mollisols	High Activity Clay Soils	1.85	2.37	2.53		
Oxisols	Low Activity Clay Soils	1.25	1.60	1.71		
>70% Sand	Sandy Soils	0.80	1.03	1.10		
Spodosols	Spodic Soils	4.30	5.51	5.89		
Ultisols	Low Activity Clay Soils	1.25	1.60	1.71		
Vertisols	High Activity Clay Soils	1.85	2.37	2.53		
Histosol	N/A	0.00	0.00	0.00		

# Table N-1.2. Annualized Soil Carbon Accumulation (metric tons) per Hectare by Soil Type and Land Use Type

Sources: California Air Resources Board. 2020. Benefits Calculator Tool, Agricultural Land Conservation, California Climate Investments. Available: https://ww2.arb.ca.gov/resources/documents/cci-quantification-benefits-and-reporting-materials. Accessed: March 2021.

MT = metric tons; C = carbon; ha = hectare; IPCC = Intergovernmental Panel on Climate Change; yr = year <sup>1</sup>Assumes a soil carbon accumulation period of 20 years.

<sup>2</sup> Based on a carbon stock change factor of 1 for cropland, 1.28 for grazing land, and 1.37 for forest (California Air Resources Board 2020).

Equipment	HP	Equipment	HP
Aerial Lifts (CNG)	19	Pavers (Diesel)	81
Aerial Lifts (Diesel)	46	Paving Equipment (Diesel)	89
Aerial Lifts (Gasoline)	33	Paving Equipment (Gasoline)	8
Air Compressors (Diesel)	37	Plate Compactors (Diesel)	8
Air Compressors (Gasoline)	6	Plate Compactors (Gasoline)	6
Bore/Drill Rigs (Diesel)	83	Pressure Washers (Diesel)	14
Bore/Drill Rigs (Gasoline)	17	Pressure Washers (Gasoline)	7
Cement and Mortar Mixers (Diesel)	10	Pumps (Diesel)	11
Cement and Mortar Mixers (Gasoline)	7	Pumps (Gasoline)	6
Concrete/Industrial Saws (Diesel)	33	Rollers (Diesel)	36
Concrete/Industrial Saws (Gasoline)	10	Rollers (Gasoline)	12
Cranes (Diesel)	367	Rough Terrain Forklifts (Diesel)	96
Cranes (Gasoline)	74	Rough Terrain Forklifts (Gasoline)	85
Crawler Tractors (Diesel)	87	Rubber Tired Dozers (Diesel)	367
Crushing/Proc. Equipment (Gasoline)	12	Rubber Tired Loaders (Diesel)	150
Dumpers/Tenders (Diesel)	16	Rubber Tired Loaders (Gasoline)	72
Dumpers/Tenders (Gasoline)	9	Scrapers (Diesel)	423
Excavators (Diesel)	36	Signal Boards (Diesel)	6
Forklifts (CNG)	70	Signal Boards (Gasoline)	8
Forklifts (Diesel)	82	Skid Steer Loaders (Diesel)	71
Forklifts (Gasoline)	70	Skid Steer Loaders (Gasoline)	19
Generator Sets (CNG)	83	Surfacing Equipment (Diesel)	399
Generator Sets (Diesel)	14	Surfacing Equipment (Gasoline)	8
Generator Sets (Gasoline)	11	Sweepers/Scrubbers (Diesel)	36
Graders (Diesel)	148	Sweepers/Scrubbers (Gasoline)	13
Off-Highway Tractors (Diesel)	38	Tractors/Loaders/Backhoes (Diesel)	84
Off-Highway Trucks (Diesel)	376	Tractors/Loaders/Backhoes (Gasoline)	63
Other Construction Equipment (Diesel)	82	Trenchers (Diesel)	40
Other Construction Equipment (Gasoline)	126	Trenchers (Gasoline)	15
Other General Industrial Equipment (Diesel)	35	Welders (Diesel)	46
Other General Industrial Equipment (Gasoline)	11	Welders (Gasoline)	16
Other Material Handling Equipment (Diesel)	93		
Other Material Handling Equipment (Gasoline)	54		

# Table C-1-B.1. Average Horsepower for Diesel, Gasoline, and Compressed Natural Gas Equipment

Source: California Air Resources Board (CARB). 2021. OFFROAD2017 – ORION. Available: https://arb.ca.gov/emfac/emissions-inventory. Database queried by Ramboll and provided electronically to ICF. September 2021.

CNG = compressed natural gas; HP = horsepower

County	Trip Length (mi)	County	Trip Length (mi)
Alameda	11.98	Placer	13.71
Alpine	16.99	Plumas	19.06
Amador	23.12	Riverside	16.91
Butte	10.41	Sacramento	11.08
Calaveras	22.56	San Benito	21.19
Colusa	26.70	San Bernardino	15.29
Contra Costa	14.21	San Diego	11.80
Del Norte	9.05	San Francisco	9.51
El Dorado	16.21	San Joaquin	18.80
Fresno	11.35	San Luis Obispo	10.58
Glenn	19.61	San Mateo	10.89
Humboldt	10.76	Santa Barbara	7.57
Imperial	9.68	Santa Clara	10.14
Inyo	16.01	Santa Cruz	12.98
Kern	12.05	Shasta	9.63
Kings	14.18	Sierra	28.04
Lake	15.32	Siskiyou	14.04
Lassen	14.81	Solano	16.15
Los Angeles	12.04	Sonoma	11.58
Madera	16.95	Stanislaus	15.62
Marin	11.98	Sutter	13.24
Mariposa	26.94	Tehama	15.24
Mendocino	11.94	Trinity	29.35
Merced	17.47	Tulare	11.58
Modoc	12.73	Tuolumne	14.50
Mono	16.03	Ventura	13.56
Monterey	10.41	Yolo	12.41
Napa	12.32	Yuba	17.85
Nevada	14.13	All counties (statewide)	12.64
Orange	11.54		

Table C-3.1. Av	verage Home-	Based-Work	Trip Lengt	h by Califor	nia County

Source: 2015 California Statewide Travel Demand Model (CSTDM).

mi = miles

Refrigerant Name	Trade/Common Name (if one exists)	GWP
R-717	Ammonia	0
R-1234ze(E)	Solstice® ze	1
R-1224yd(Z)	AMOLEA™ 1224yd	1
R-744	CO <sub>2</sub>	1
R-1234zd(E)	Solstice® zd	1
R-514A	Opteon™ XP30	2
R-290	Propane	4
R-600a	Isobutane	5
R-170	Ethane	6
R-601	Pentane	11
R-161	HFC-161	12
R-123	HCFC-123	77
R-225ca	HCFC-225ca	122
R-152a	HFC-152a	124
R-454B	Opteon™ XL41	466
R-225cb	HCFC-225cb	595
R-450A	Solstice® N13	601
R-124	HCFC-124	609
R-513A	Opteon™ XP10	631
R-32	HFC-32	675
R-452B	Opteon™ XL55	676
R-141b	HCFC-141b	725
R-466A	_	733
R-365mfc	HFC-365mfc	794
R-401C	Suva® MP-52	933
R-245fa	HFC-245fa	1,030
R-416A	FRIGC FR-12	1,085
R-401A	MP39	1,183
R-401B	MP66	1,288
R-414B	Hot Shot™	1,362
R-448A	Solstice® N40	1,387
R-449A	Opteon™ XP40	1,397
R-134a	HFC-134a	1,430
R-414A	GHX4	1,478
R-426A	RS-24	1,508
R-420A	Choice® Refrigerant	1,536
Free Zone	_	1,569
R-409A	FX-56	1,585
R-411A	_	1,597
Freeze 12	_	1,606
R-407D	_	1,627

# Table R-1.1 Global Warming Potentials of Commonly Used Refrigerants

Refrigerant Name	Trade/Common Name (if one exists)	GWP
R-4310mee	HFC-43-10mee, HFC-4310mee, R-43-10mee	1,640
R-411B	_	1,705
G2018C	_	1,731
R-453A	RS-70, RS-44b	1,765
R-407C	_	1,774
R-437A	MO49 Plus	1,805
R-417C	Hot Shot™ 2	1,809
R-22	HCFC-22, Freon	1,810
R-407F	_	1,825
R-442AF	RS-50	1,888
GHG-HP	_	1,893
R-406A	_	1,938
R-413A	MO49	2,053
R-434A	RS-45	2,070
R-410A	Puron®, AZ-20	2,088
R-407A	KLEA® 60	2,107
R-427A	_	2,138
R-452A	Opteon™ XP44	2,141
R-410B	AC9100	2,229
R-438A	MO99	2,265
R-423A	39TC	2,280
R-142b	HCFC-142b	2,310
R-417A	MO59, NU22	2,346
NARM-502	_	2,375
GHG-X5	_	2,377
R-402B	HP-81	2,416
R-424A	RS-44	2,440
R-422B	NU-22B	2,526
R-421A	_	2,631
R-422D	MO29	2,730
R-402A	HP-80	2,788
R-407B	_	2,804
R-422C	One Shot™	3,085
R-422A	_	3,143
R-421B	Choice® 421B	3,190
R-227ea	HFC-227ea	3,220
R-408A	FX-10	3,432
R-125	HFC-125	3,500
R-428A	RS-52	3,607
Isceon® MO89	_	3,805
R-404A	HP-62	3,900

# Table R-1.1 Global Warming Potentials of Commonly Used Refrigerants (cont.)

Refrigerant Name	Trade/Common Name (if one exists)	GWP
R-507	AZ-50	3,985
R-403B	_	4,458
R-143a	HFC-143a	4,470
R-502	_	4,657
R-11	CFC-11	4,750
R-113	CFC-113	6,130
EP-88	_	6,427
R-13b1	Halon 1301	7,140
R-115	CFC-115	7,370
R-14	PFC-14, CF4	7,390
R-500	_	8,077
R-218	PFC-218	8,830
R-236fa	HFC-236fa	9,810
R-114	CFC-114	10,000
R-12	CFC-12	10,900
R-116	PFC-116	12,200
R-508B	_	13,396
R-13	CFC-13	14,400
R-503	_	14,560
R-23	HFC-23	14,800

Table R-1.1 Global Warming Potentials of Commonly Used Refrigerants (cont.)

Sources: California Air Resource Board (CARB). 2020. Refrigerant Management Program: Service Technicians & Contractors. Available: https://ww2.arb.ca.gov/our-work/programs/refrigerant-management-program/rmp-service-technicians-contractors. Accessed: January 2021.

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— = no common name; R= refrigerant; HFC = hydrofluorocarbon; PFC = perfluorocarbon; CFC = Chlorofluorocarbons; GHG = greenhouse gas; GWP = global warming potential

		Refrigerant	Leak	Service	Total Leak
Land Use Type	Equipment Type	Charge (kg)	Rate	Kate	Rate'
Single Family Housing	Household refrigerators and/or freezers	0.15	0.6%	0.0%	0.6%
Apartments Low Rise	Household refrigerators and/or freezers	0.15	0.6%	0.0%	0.6%
Apartments Mid Rise	Household refrigerators and/or freezers	0.15	0.6%	0.0%	0.6%
Apartments High Rise	Household refrigerators and/or freezers	0.15	0.6%	0.0%	0.6%
Condo/Townhouse	Household refrigerators and/or freezers	0.15	0.6%	0.0%	0.6%
Condo/Townhouse High Rise	Household refrigerators and/or freezers	0.15	0.6%	0.0%	0.6%
Mobile Home Park	Household refrigerators and/or freezers	0.15	0.6%	0.0%	0.6%
Retirement Community	Household refrigerators and/or freezers	0.04	0.6%	0.0%	0.6%
Congregate Care	Household refrigerators and/or freezers	0.04	0.6%	0.0%	0.6%
User Defined Residential	Household refrigerators and/or freezers	0.15	0.6%	0.0%	0.6%
Day-Care Center	Household refrigerators and/or freezers	0.15	0.6%	0.0%	0.6%
Elementary School	Household refrigerators and/or freezers	0.15	0.6%	0.0%	0.6%
Junior High School	Household refrigerators and/or freezers	0.15	0.6%	0.0%	0.6%
High School	Household refrigerators and/or freezers	0.15	0.6%	0.0%	0.6%
Junior College (2yr)	Household refrigerators and/or freezers	0.15	0.6%	0.0%	0.6%
University/College (4yr)	Household refrigerators and/or freezers	0.15	0.6%	0.0%	0.6%
Library	Household refrigerators and/or freezers	0.15	0.6%	0.0%	0.6%
Place of Worship	Household refrigerators and/or freezers	0.15	0.6%	0.0%	0.6%
User Defined Educational	Household refrigerators and/or freezers	0.15	0.6%	0.0%	0.6%
City Park	Stand-alone retail refrigerators and freezers	0.40	1.0%	0.0%	1.0%
Golf Course	Stand-alone retail refrigerators and freezers	0.40	1.0%	0.0%	1.0%
Recreational Swimming Pool	Stand-alone retail refrigerators and freezers	0.40	1.0%	0.0%	1.0%
Racquet Club	Stand-alone retail refrigerators and freezers	0.40	1.0%	0.0%	1.0%
Health Club	Stand-alone retail refrigerators and freezers	0.40	1.0%	0.0%	1.0%
Movie Theater (No Matinee)	Stand-alone retail refrigerators and freezers	0.40	1.0%	0.0%	1.0%
Arena	Stand-alone retail refrigerators and freezers	0.40	1.0%	0.0%	1.0%
Quality Restaurant	Other commercial A/C and heat pumps	13.00	4.0%	4.0%	8.0%

# Table R-1.2. Charge Size, Service Rate, and Leak Rate for Various Equipment Types by Land Use Type

	Fouriement Type	Refrigerant	Leak	Service	Total Leak
High Turnover (Sit Down Kestaurant)	Other commercial A/C and heat pumps	13.00	4.0%	4.0%	8.0%
Fast Food Restaurant with Drive Ihru	Other commercial A/C and heat pumps	13.00	4.0%	4.0%	8.0%
Fast Food Restaurant w/o Drive Thru	Other commercial A/C and heat pumps	13.00	4.0%	4.0%	8.0%
Hotel	Other commercial A/C and heat pumps	13.00	4.0%	4.0%	8.0%
Motel	Other commercial A/C and heat pumps	13.00	4.0%	4.0%	8.0%
User Defined Recreational	Other commercial A/C and heat pumps	13.00	4.0%	4.0%	8.0%
Free-Standing Discount store	Stand-alone retail refrigerators and freezers	0.40	1.0%	0.0%	1.0%
Free-Standing Discount Superstore	Stand-alone retail refrigerators and freezers	0.40	1.0%	0.0%	1.0%
Discount Club	Stand-alone retail refrigerators and freezers	0.40	1.0%	0.0%	1.0%
Regional Shopping Center	Stand-alone retail refrigerators and freezers	0.40	1.0%	0.0%	1.0%
Electronic Superstore	Stand-alone retail refrigerators and freezers	0.40	1.0%	0.0%	1.0%
Home Improvement Superstore	Stand-alone retail refrigerators and freezers	0.40	1.0%	0.0%	1.0%
Strip Mall	Stand-alone retail refrigerators and freezers	0.40	1.0%	0.0%	1.0%
Hardware/Paint Store	Stand-alone retail refrigerators and freezers	0.40	1.0%	0.0%	1.0%
Supermarket	Supermarket refrigeration and condensing units	1,360.0	16.5%	16.5%	33.0%
Convenience Market (24 hour)	Supermarket refrigeration and condensing units	1,360.0	16.5%	16.5%	33.0%
Convenience Market with Gas Pumps	Supermarket refrigeration and condensing units	1,360.0	16.5%	16.5%	33.0%
Automobile Care Center	Supermarket refrigeration and condensing units	1,360.0	16.5%	16.5%	33.0%
Gasoline/Service Station	Supermarket refrigeration and condensing units	1,360.0	16.5%	16.5%	33.0%
User Defined Retail	Supermarket refrigeration and condensing units	1,360.0	16.5%	16.5%	33.0%
Bank (with Drive-Through)	Household refrigerators and/or freezers	0.15	0.6%	0.0%	0.6%
General Office Building	Household refrigerators and/or freezers	0.15	0.6%	0.0%	0.6%
Office Park	Household refrigerators and/or freezers	0.15	0.6%	0.0%	0.6%
Research & Development	Household refrigerators and/or freezers	0.15	0.6%	0.0%	0.6%
Government Office Building	Household refrigerators and/or freezers	0.15	0.6%	0.0%	0.6%
Government (Civic Center)	Household refrigerators and/or freezers	0.15	0.6%	0.0%	0.6%
Pharmacy/Drugstore with Drive Thru	Household refrigerators and/or freezers	0.15	0.6%	0.0%	0.6%
Pharmacy/Drugstore w/o Drive Thru	Household refrigerators and/or freezers	0.15	0.6%	0.0%	0.6%

# Table R-1.2. Charge Size, Service Rate, and Leak Rate for Various Equipment Types by Land Use Type (cont.)

Land Use Type	Equipment Type	Refrigerant Charge (kg)	Leak Rate	Service Rate	Total Leak Rate <sup>1</sup>
Medical Office Building	Household refrigerators and/or freezers	0.15	0.6%	0.0%	0.6%
Hospital	Household refrigerators and/or freezers	0.15	0.6%	0.0%	0.6%
User Defined Commercial	Other commercial A/C and heat pumps	13.0	4.0%	4.0%	8.0%
Unrefrigerated Warehouse-No Rail	Cold storage	565.0	7.5%	7.5%	15.0%
Unrefrigerated Warehouse-Rail	Cold storage	565.0	7.5%	7.5%	15.0%
Refrigerated Warehouse-No Rail	Cold storage	565.0	7.5%	7.5%	15.0%
Refrigerated Warehouse-Rail	Cold storage	565.0	7.5%	7.5%	15.0%
General Light Industry	Other commercial A/C and heat pumps	13.0	4.0%	4.0%	8.0%
General Heavy Industry	Other commercial A/C and heat pumps	13.0	4.0%	4.0%	8.0%
Industrial Park	Other commercial A/C and heat pumps	13.0	4.0%	4.0%	8.0%
Manufacturing	Other commercial A/C and heat pumps	13.0	4.0%	4.0%	8.0%
User Defined Industrial	Other commercial A/C and heat pumps	13.0	4.0%	4.0%	8.0%

### Table R-1.2. Charge Size, Service Rate, and Leak Rate for Various Equipment Types by Land Use Type (cont.)

Source: U.S. Environmental Protection Agency. 2016. Accounting Tool to Support Federal Reporting of Hydrofluorocarbon Emissions: Supporting Documentation. October 2016. Available: https://www.epa.gov/sites/production/files/2015-09/documents/hfc\_emissions\_accounting\_tool\_supporting\_documentation.pdf. Accessed: January 2021.

A/C = air conditioning; yr = year

<sup>1</sup> Total leak rate is the sum of the operational leak rate and the service leak rate. This total value would only occur in those years in which servicing is required, which may not be every year of the equipment life.

### Table R-1.3. Charge Size, Service Rate, and Leak Rate for Various Equipment Types by Land Use Type

Land Use Type	Equipment Type	Refrigerant Charge (kg)	Leak Rate	Service Rate	Total Leak Rate <sup>1</sup>
Single Family Housing	Average room A/C & Other residential A/C and heat pumps	2.75	2.5%	2.5%	5.0%
Apartments Low Rise	Average room A/C & Other residential A/C and heat pumps	2.75	2.5%	2.5%	5.0%
Apartments Mid Rise	Average room A/C & Other residential A/C and heat pumps	2.75	2.5%	2.5%	5.0%
Apartments High Rise	Average room A/C & Other residential A/C and heat pumps	2.75	2.5%	2.5%	5.0%
Condo/Townhouse	Average room A/C & Other residential A/C and heat pumps	2.75	2.5%	2.5%	5.0%
Condo/Townhouse High Rise	Average room A/C & Other residential A/C and heat pumps	2.75	2.5%	2.5%	5.0%
Mobile Home Park	Average room A/C & Other residential A/C and heat pumps	2.75	2.5%	2.5%	5.0%

Land Use Type	Equipment Type	Refrigerant Charge (kg)	Leak Rate	Service Rate	Total Leak Rate <sup>1</sup>
Retirement Community	Average room A/C & Other residential A/C and heat pumps	2.75	2.5%	2.5%	5.0%
Congregate Care	Average room A/C & Other residential A/C and heat pumps	2.75	2.5%	2.5%	5.0%
User Defined Residential	Average room A/C & Other residential A/C and heat pumps	2.75	2.5%	2.5%	5.0%
Day-Care Center	Stand-alone retail refrigerators and freezers	0.40	1.0%	0.0%	1.0%
Elementary School	Stand-alone retail refrigerators and freezers	0.40	1.0%	0.0%	1.0%
Junior High School	Stand-alone retail refrigerators and freezers	0.40	1.0%	0.0%	1.0%
High School	Stand-alone retail refrigerators and freezers	0.40	1.0%	0.0%	1.0%
Junior College (2yr)	Stand-alone retail refrigerators and freezers	0.40	1.0%	0.0%	1.0%
University/College (4yr)	Stand-alone retail refrigerators and freezers	0.40	1.0%	0.0%	1.0%
Library	Stand-alone retail refrigerators and freezers	0.40	1.0%	0.0%	1.0%
Place of Worship	Stand-alone retail refrigerators and freezers	0.40	1.0%	0.0%	1.0%
User Defined Educational	Stand-alone retail refrigerators and freezers	0.40	1.0%	0.0%	1.0%
City Park	Other commercial A/C and heat pumps	13.00	4.0%	4.0%	8.0%
Golf Course	Other commercial A/C and heat pumps	13.00	4.0%	4.0%	8.0%
Recreational Swimming Pool	Other commercial A/C and heat pumps	13.00	4.0%	4.0%	8.0%
Racquet Club	Other commercial A/C and heat pumps	13.00	4.0%	4.0%	8.0%
Health Club	Other commercial A/C and heat pumps	13.00	4.0%	4.0%	8.0%
Movie Theater (No Matinee)	Other commercial A/C and heat pumps	13.00	4.0%	4.0%	8.0%
Arena	Other commercial A/C and heat pumps	13.00	4.0%	4.0%	8.0%
Quality Restaurant	Walk-in refrigerators and freezers	10.00	7.5%	7.5%	15.0%
High Turnover (Sit Down Restaurant)	Walk-in refrigerators and freezers	10.00	7.5%	7.5%	15.0%
Fast Food Restaurant with Drive Thru	Walk-in refrigerators and freezers	10.00	7.5%	7.5%	15.0%
Fast Food Restaurant w/o Drive Thru	Walk-in refrigerators and freezers	10.00	7.5%	7.5%	15.0%
Hotel	Walk-in refrigerators and freezers	10.00	7.5%	7.5%	15.0%
Motel	Walk-in refrigerators and freezers	10.00	7.5%	7.5%	15.0%
User Defined Recreational	Walk-in refrigerators and freezers	10.00	7.5%	7.5%	15.0%

# Table R-1.3. Charge Size, Service Rate, and Leak Rate for Various Equipment Types by Land Use Type (cont.)

Land Use Type	Equipment Type	Refrigerant Charge (kg)	Leak Rate	Service Rate	Total Leak Rate <sup>1</sup>
Free-Standing Discount store	Other commercial A/C and heat pumps	13.00	4.0%	4.0%	8.0%
Free-Standing Discount Superstore	Other commercial A/C and heat pumps	13.00	4.0%	4.0%	8.0%
Discount Club	Other commercial A/C and heat pumps	13.00	4.0%	4.0%	8.0%
Regional Shopping Center	Other commercial A/C and heat pumps	13.00	4.0%	4.0%	8.0%
Electronic Superstore	Other commercial A/C and heat pumps	13.00	4.0%	4.0%	8.0%
Home Improvement Superstore	Other commercial A/C and heat pumps	13.00	4.0%	4.0%	8.0%
Strip Mall	Other commercial A/C and heat pumps	13.00	4.0%	4.0%	8.0%
Hardware/Paint Store	Other commercial A/C and heat pumps	13.00	4.0%	4.0%	8.0%
Supermarket	Other commercial A/C and heat pumps	13.00	4.0%	4.0%	8.0%
Convenience Market (24 hour)	Other commercial A/C and heat pumps	13.00	4.0%	4.0%	8.0%
Convenience Market with Gas Pumps	Other commercial A/C and heat pumps	13.00	4.0%	4.0%	8.0%
Automobile Care Center	Other commercial A/C and heat pumps	13.00	4.0%	4.0%	8.0%
Gasoline/Service Station	Other commercial A/C and heat pumps	13.00	4.0%	4.0%	8.0%
User Defined Retail	Other commercial A/C and heat pumps	13.00	4.0%	4.0%	8.0%
Bank (with Drive-Through)	Other commercial A/C and heat pumps	13.00	4.0%	4.0%	8.0%
General Office Building	Other commercial A/C and heat pumps	13.00	4.0%	4.0%	8.0%
Office Park	Other commercial A/C and heat pumps	13.00	4.0%	4.0%	8.0%
Research & Development	Other commercial A/C and heat pumps	13.00	4.0%	4.0%	8.0%
Government Office Building	Other commercial A/C and heat pumps	13.00	4.0%	4.0%	8.0%
Government (Civic Center)	Other commercial A/C and heat pumps	13.00	4.0%	4.0%	8.0%
Pharmacy/Drugstore with Drive Thru	Other commercial A/C and heat pumps	13.00	4.0%	4.0%	8.0%
Pharmacy/Drugstore w/o Drive Thru	Other commercial A/C and heat pumps	13.00	4.0%	4.0%	8.0%
Medical Office Building	Other commercial A/C and heat pumps	13.00	4.0%	4.0%	8.0%
Hospital	Stand-alone retail refrigerators and freezers	0.40	1.0%	0.0%	1.0%

### Table R-1.3. Charge Size, Service Rate, and Leak Rate for Various Equipment Types by Land Use Type (cont.)

Source: U.S. Environmental Protection Agency. 2016. Accounting Tool to Support Federal Reporting of Hydrofluorocarbon Emissions: Supporting Documentation. October 2016. Available: https://www.epa.gov/sites/production/files/2015-09/documents/hfc\_emissions\_accounting\_tool\_supporting\_documentation.pdf. Accessed: January 2021.

A/C = air conditioning; yr = year

<sup>1</sup> Total leak rate is the sum of the operational leak rate and the service leak rate. This total value would only occur in those years in which servicing is required, which may not be every year of the equipment life.

Land Use Type	Equipment Type	Refrigerant Charge (kg)	Leak Rate	Service Rate	Total Leak Rate <sup>1</sup>
Day-Care Center	Walk-in refrigerators and freezers	10.00	7.5%	7.5%	15.0%
Elementary School	Walk-in refrigerators and freezers	10.00	7.5%	7.5%	15.0%
Junior High School	Walk-in refrigerators and freezers	10.00	7.5%	7.5%	15.0%
High School	Walk-in refrigerators and freezers	10.00	7.5%	7.5%	15.0%
Junior College (2yr)	Walk-in refrigerators and freezers	10.00	7.5%	7.5%	15.0%
University/College (4yr)	Walk-in refrigerators and freezers	10.00	7.5%	7.5%	15.0%
Library	Walk-in refrigerators and freezers	10.00	7.5%	7.5%	15.0%
Place of Worship	Walk-in refrigerators and freezers	10.00	7.5%	7.5%	15.0%
User Defined Educational	Walk-in refrigerators and freezers	10.00	7.5%	7.5%	15.0%
Movie Theater (No Matinee)	Walk-in refrigerators and freezers	10.00	7.5%	7.5%	15.0%
Arena	Walk-in refrigerators and freezers	10.00	7.5%	7.5%	15.0%
Quality Restaurant	Household refrigerators and/or freezers	0.00	0.6%	0.0%	0.6%
High Turnover (Sit Down Restaurant)	Household refrigerators and/or freezers	0.00	0.6%	0.0%	0.6%
Fast Food Restaurant with Drive Thru	Household refrigerators and/or freezers	0.00	0.6%	0.0%	0.6%
Fast Food Restaurant w/o Drive Thru	Household refrigerators and/or freezers	0.00	0.6%	0.0%	0.6%
Hotel	Household refrigerators and/or freezers	0.00	0.6%	0.0%	0.6%
Motel	Household refrigerators and/or freezers	0.00	0.6%	0.0%	0.6%
User Defined Recreational	Household refrigerators and/or freezers	0.00	0.6%	0.0%	0.6%
Free-Standing Discount Superstore	Walk-in refrigerators and freezers	10.00	7.5%	7.5%	15.0%
Strip Mall	Walk-in refrigerators and freezers	10.00	7.5%	7.5%	15.0%
Hospital	Walk-in refrigerators and freezers	10.00	7.5%	7.5%	15.0%

### Table R-1.4. Charge Size, Service Rate, and Leak Rate for Various Equipment Types by Land Use Type

Source: U.S. Environmental Protection Agency. 2016. Accounting Tool to Support Federal Reporting of Hydrofluorocarbon Emissions: Supporting Documentation. October 2016. Available: https://www.epa.gov/sites/production/files/2015-09/documents/hfc\_emissions\_accounting\_tool\_supporting\_documentation.pdf. Accessed: January 2021.

A/C = air conditioning; yr = year

<sup>1</sup> Total leak rate is the sum of the operational leak rate and the service leak rate. This total value would only occur in those years in which servicing is required, which may not be every year of the equipment life.

land Use Type	Equipment Type	Refrigerant Charge (kg)	Leak Rate	Service Rate	Total Leak Rate <sup>1</sup>
			4.0%	4.0%	
Day-Care Center	Other commercial A/C and neat pumps	13.00	4.0%	4.0%	8.0%
Elementary School	Other commercial A/C and heat pumps	13.00	4.0%	4.0%	8.0%
Junior High School	Other commercial A/C and heat pumps	13.00	4.0%	4.0%	8.0%
High School	Other commercial A/C and heat pumps	13.00	4.0%	4.0%	8.0%
Junior College (2yr)	Other commercial A/C and heat pumps	13.00	4.0%	4.0%	8.0%
University/College (4yr)	Other commercial A/C and heat pumps	13.00	4.0%	4.0%	8.0%
Library	Other commercial A/C and heat pumps	13.00	4.0%	4.0%	8.0%
Place of Worship	Other commercial A/C and heat pumps	13.00	4.0%	4.0%	8.0%
User Defined Educational	Other commercial A/C and heat pumps	13.00	4.0%	4.0%	8.0%
Hospital	Chillers	500.00	2.0%	2.0%	4.0%

### Table R-1.5. Charge Size, Service Rate, and Leak Rate for Various Equipment Types by Land Use Type

Source: U.S. Environmental Protection Agency. 2016. Accounting Tool to Support Federal Reporting of Hydrofluorocarbon Emissions: Supporting Documentation. October 2016. Available: https://www.epa.gov/sites/production/files/2015-09/documents/hfc\_emissions\_accounting\_tool\_supporting\_documentation.pdf. Accessed: January 2021.

#### A/C = air conditioning; yr = year

<sup>1</sup> Total leak rate is the sum of the operational leak rate and the service leak rate. This total value would only occur in those years in which servicing is required, which may not be every year of the equipment life.