



# Deemed Energy Savings: 2022 Year-End Report

## GoGreen Home Energy Financing | Q3 2016 – Q4 2022

### Introduction

This report estimates deemed energy savings from the GoGreen Home Energy Financing Program (GoGreen Home), administered by the California Alternative Energy and Advanced Transportation Financing Authority (CAEATFA), for the 2,800 standard loans<sup>1</sup> and 496 marketplace microloans<sup>2</sup> enrolled from program inception in the third quarter of 2016 through December 31, 2022.<sup>3</sup>

This report is produced on a bi-annual basis. Visit the [CAEATFA website](https://www.caefatfa.com) to view previous Deemed Energy Savings Reports, quarterly reports and monthly data summaries for GoGreen Home, and please direct any questions to [gogreen@treasurer.ca.gov](mailto:gogreen@treasurer.ca.gov).

### 2022 Highlights

- Total annual gas savings<sup>4</sup> increased by 96% in 2022 compared with 2021. This can be attributed to a significant increase in the number of decarbonization measures installed: in 2022, the number of heat pumps installed (284) was 75% greater than in all previous years combined (162).
  - Heat pump technologies have a stronger effect on GHG reductions than many energy efficiency measures; this influx of heat pump upgrades made by customers through the program has had a significant impact on emissions reduced through GoGreen Home.
- Total annual electric savings<sup>4</sup> increased marginally (7%) in 2022. This reflects the large number of decarbonization measures that have been installed, thus shifting hundreds of homes from gas fuel usage to electric and increasing the overall use of electricity compared with natural gas in line with California’s climate and energy goals.
- Each dollar of private capital invested in an energy upgrade through the program has contributed to a greater reduction of carbon emissions in 2022 compared with prior years. In 2021, GoGreen Home loans resulted in an average reduction of 441 pounds of CO<sub>2</sub>e per \$10,000 of customer investment; in 2022 this average increased 22%, to 538 pounds of CO<sub>2</sub>e per \$10,000.
- Each dollar of private capital has also led to greater reductions of energy usage in 2022. Total BTUs saved (gas and electric) per dollar invested increased by 20% from 2021 (366 BTUs) to 2022 (440 BTUs).

<sup>1</sup> “Standard loans” refers to traditional loans for amounts up to \$50,000, enrolled by eight credit union lenders participating in GoGreen Home (as of 12/31/22). These 2,800 projects include 406 projects that contained decarbonization/fuel switching measures, which are reported on in their own section. The average size of a standard loan during the reporting period was roughly \$17,500.

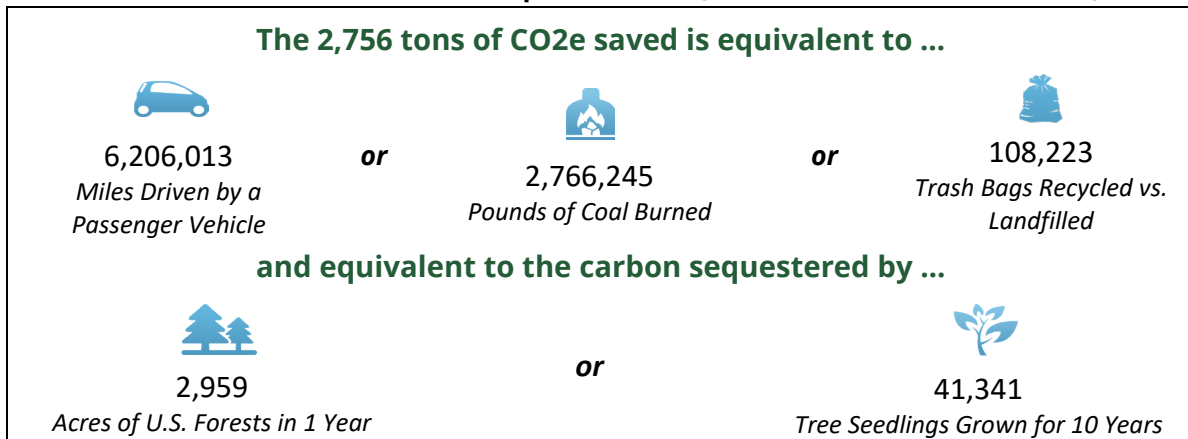
<sup>2</sup> “Marketplace microloans” refers to loans offered at point-of-sale for appliance purchases via the SoCalGas online utility marketplace for amounts up to \$5,000, enrolled by one fintech lender participating in GoGreen Home (as of 12/31/22). The average size of a marketplace microloan during the reporting period was roughly \$1,460. New marketplace microloan enrollments were paused in June 2022 and resumed in March 2023.

<sup>3</sup> In August 2021, through Decision 21-08-006, the California Public Utilities Commission required that CAEATFA begin reporting on “annual estimated energy savings from installed measures funded through CHEEF programs.” Reporting for GoGreen Business will begin after loan volume has increased.

<sup>4</sup> Definitions are based on the [“Energy Efficiency Over Time: Measuring and Valuing Lifetime Energy Savings in Policy and Planning”](#) report from the American Council for an Energy-Efficient Economy. “Total annual savings” evaluates the savings in a particular year from measures installed in that year, plus the savings persisting from measures installed in prior years.

- Savings were estimated using CAEATFA’s Deemed Energy Savings Methodology version 3.0. Improvements made to the methodology include updates to measure characterizations in alignment with the [California Electronic Technical Reference Manual](#) (eTRM)<sup>5</sup>, incorporation of a measure’s effective useful life, and application of GHG savings based on the most recent California utility emission rates according to available Power Content Labels.
  - Except where otherwise mentioned, the deemed savings included in this report represent total annual savings and are not indicative of cumulative savings through the life of the program. For more information, please review the Appendix at the end of the report.
- Cumulative GHG savings increased by 79% in 2022 (2,756 tons) compared with 2021 (1,534 tons). As with the rise in deemed gas savings, the increase in GHGs averted is attributed to the greater number of heat pump projects installed in 2022. See Table 1 for GHG reduction equivalencies.
  - Net GHG reductions from decarbonization measures (heat pump projects and induction ranges) were 350% greater in 2022 (297 tons) than in 2021 (66 tons).

**1. Cumulative GHG Reduction Equivalencies<sup>6</sup> (All measures, standard loans)**



**Notes on Methodology 3.0**

These deemed estimates combine assumptions for pre-project baseline conditions and post-project efficient conditions with known factors for each individual project, such as climate zone, to produce an estimated annualized energy savings value for each eligible measure included in the report. The primary source for deemed measure characterizations used in this report is the California eTRM; additional references and information on the model are provided in the Appendix.

Methodology updates implemented in this report include:

- Measures’ effective useful life (EUL)<sup>7</sup> and revision effective dates have been defined for characterized measures and will take effect on energy savings as measures expire past their useful life. Further details are in the Appendix.

<sup>5</sup> The California eTRM is an official source of energy efficiency data owned and funded by California utilities.

<sup>6</sup> GHG reduction equivalency values are calculated via the U.S. Environmental Protection Agency’s [Greenhouse Gas Equivalencies Calculator](#), based on 2,756 US tons of CO<sub>2</sub>e saved (combined GHG reduction estimates for electric and gas savings, including decarbonization measures). These values reflect the cumulative savings that have persisted over the Program’s lifetime.

<sup>7</sup> According to the CA eTRM, "The EUL describes an estimate of the median number of years that the measures installed under the program are still in place and operable." This definition aligns with the CA Energy Efficiency Policy Manual.

- Electricity emission rates by utility have been updated for 2021 and 2022 measures based on 2021 Power Content Labels. Because utility emission rates are released a year after they take effect, CAEATFA will update the related values for 2022 as they become available.
- The starting date of the date ranges for calculating the savings of a measure was adjusted from installation date to the date the loan was enrolled in the GoGreen Home program. This is to ensure consistency with CAEATFA’s other data reporting practices. Because measures are always enrolled into the program after installation is complete (typically within just a few weeks), using the enrollment date means that our estimated savings lean towards the conservative side; the likely actual savings may be slightly higher.

**Other methodology notes include:**

- Decarbonization measures (which switch the customer’s fuel source from gas to electric for the installed measure) are reported separately from cumulative data on overall gas and electric usage so as not to skew the larger data set, as these measures result in the displacement of gas consumption in exchange for increased electric consumption.
- Deemed energy savings for standard GoGreen Home loans and marketplace microloans are reported separately, as microloans are significantly smaller than standard projects and thus skew the data significantly when combined.

**Future Reporting on Energy Savings**

This report is not intended to replace an analysis of actual energy savings using measured or metered data. Because of limitations with the Investor-Owned Utilities (IOUs)’ ability to share actual energy usage data and challenges around data security, CAEATFA is providing these deemed estimates as the first step towards reporting energy savings generated by projects undertaken through GoGreen Home loans. CAEATFA hopes to conduct a normalized metered energy consumption (NMEC) analysis using actual pre- and post-project metered data in the future if data sharing with the IOUs can be achieved.

Going forward, CAEATFA will continue to refine these deemed estimates by further improving calculations, updating assumptions, incorporating measures that are currently excluded, and (if possible) comparing them with a sampling of pre- and post-project actual savings data from the IOUs when the IOUs make such data available. Some estimates and values will change as these improvements are made; CAEATFA will release new versions of this report as needed to reflect updated calculations and make clear which version the related estimates are using.

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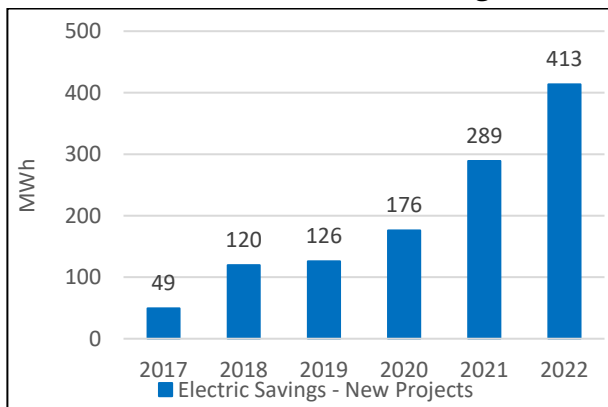
**Deemed Energy Savings – Efficiency Measures Excluding Fuel Switch (Standard Loans)**

The charts on pages 5-6 report on deemed annual electric savings, gas savings, GHG reductions, and peak demand savings for the **2,664 projects** that were not marketplace microloans or decarbonization-only projects.<sup>8</sup> These savings do not include those derived from decarbonization/fuel switching measures for the projects that installed both standard and decarbonization measures.<sup>9</sup> Reporting on decarbonization projects can be found on pages 7-8 and marketplace microloan reporting on pages 10-11.

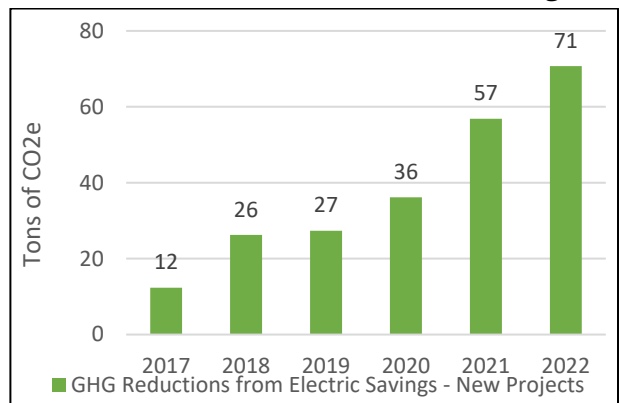
**2. Total Annual Energy Savings through December 31, 2022**

Electric Savings	Gas Savings	GHG Reductions	Peak Demand Savings
1,176,942 kWh	89,991 Therms	755 Tons CO <sub>2</sub> e	1,542 kW

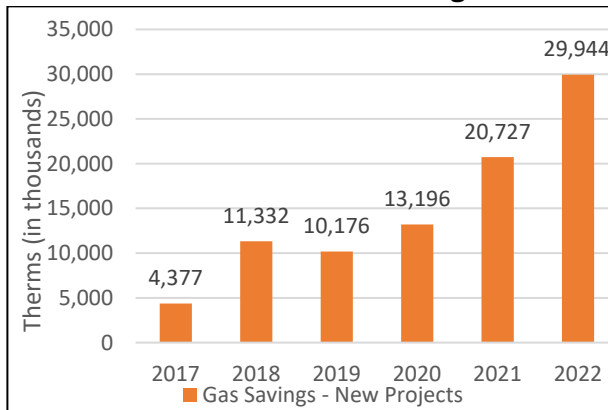
**3. Deemed Electric Savings**



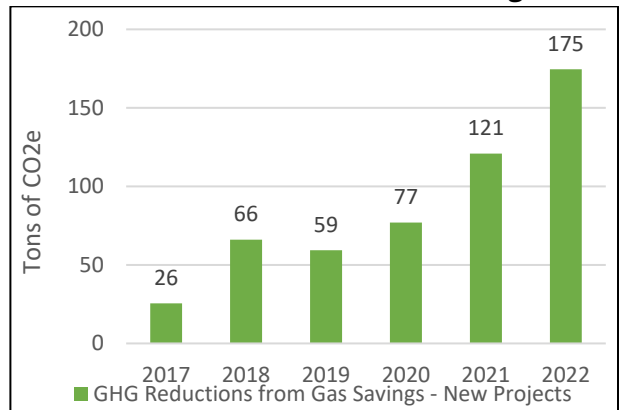
**4. GHG Reductions from Electric Savings<sup>10</sup>**



**5. Deemed Gas Savings**



**6. GHG Reductions from Gas Savings<sup>11</sup>**



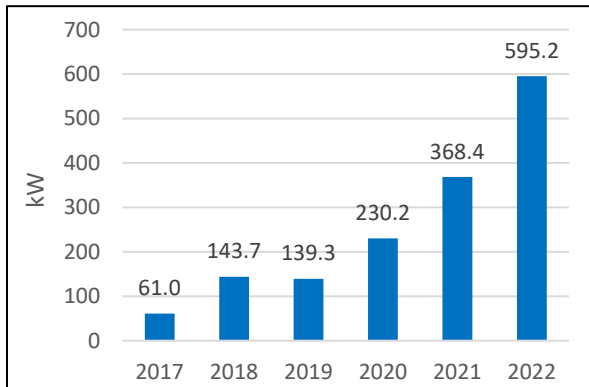
<sup>8</sup> For readability, savings from 2016 are represented in the numerical totals on tables but are not visually shown in the bar charts.

<sup>9</sup> Decarbonization/fuel substitution measures, such as heat pumps, always result in negative electric savings and positive gas savings, which skews the overall data significantly when included alongside other measures. For this reason, these measures are reported on only in their own section beginning on page 6.

<sup>10</sup> GHG reductions for electric savings are based on Annual Power Content Labels for 2021 sourced from the [California Energy Commission](https://www.energy.ca.gov/). Calculations assume that the borrower is part of the base rate plan offered by their IOU(s).

<sup>11</sup> GHG reductions for gas savings are based on CO<sub>2</sub> emissions coefficient data from the [U.S. Energy Information Administration](https://www.eia.gov/).

### 7. Electric Peak Demand Savings<sup>12</sup>



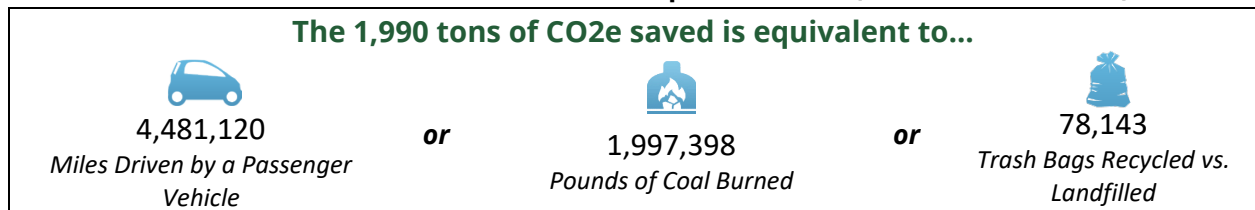
### 8. Total Annual Energy Savings by IOU Territory through December 31, 2022<sup>13</sup>

	Electric Savings	Gas Savings
Pacific Gas & Electric	47%	64%
Southern California Edison	48%	N/A
Southern California Gas	N/A	34%
San Diego Gas & Electric	6%	2%






### 9. Average Savings by Project in 2022

<b>Average Electric Savings</b>	408 kWh per project <i>-6% est. annual electric usage change per property<sup>14</sup></i>
<b>Average Gas Savings</b>	29 Therms per project <i>-7% est. annual gas usage change per property<sup>14</sup></i>
<b>Average GHG Reductions</b>	0.24 Tons CO <sub>2</sub> e per project
<b>Average Peak Electric Demand Savings</b>	0.59 kW per project

### 10. Cumulative GHG Reduction Equivalencies<sup>15</sup> (Standard measures)



### 11. Total Annual Energy Savings by Top 5 Measures Installed through December 31, 2022

 <b>HVAC Equipment</b>	 <b>Windows</b>	 <b>HVAC Ductwork</b>	 <b>Insulation</b>	 <b>Cool Roofs</b>
548,332 kWh 29,414 Therms 1,878 Projects	311,208 kWh 6,203 Therms 594 Projects	77,509 kWh 19,530 Therms 574 Projects	33,393 kWh 16,311 Therms 493 Projects	111,229 kWh 346 Projects

<sup>12</sup> Electric peak demand savings are estimated for each electric measure using pre-determined values from the California eTRM and other sources. For more information, please see the Appendix.

<sup>13</sup> Gas savings are not reported for Southern California Edison because the utility offers very limited gas service. Similarly, there are no electric savings reported for Southern California Gas because they do not offer electric service.

<sup>14</sup> Estimates are based on California household energy consumption figures from the [U.S. Energy Information Administration](https://www.eia.gov).

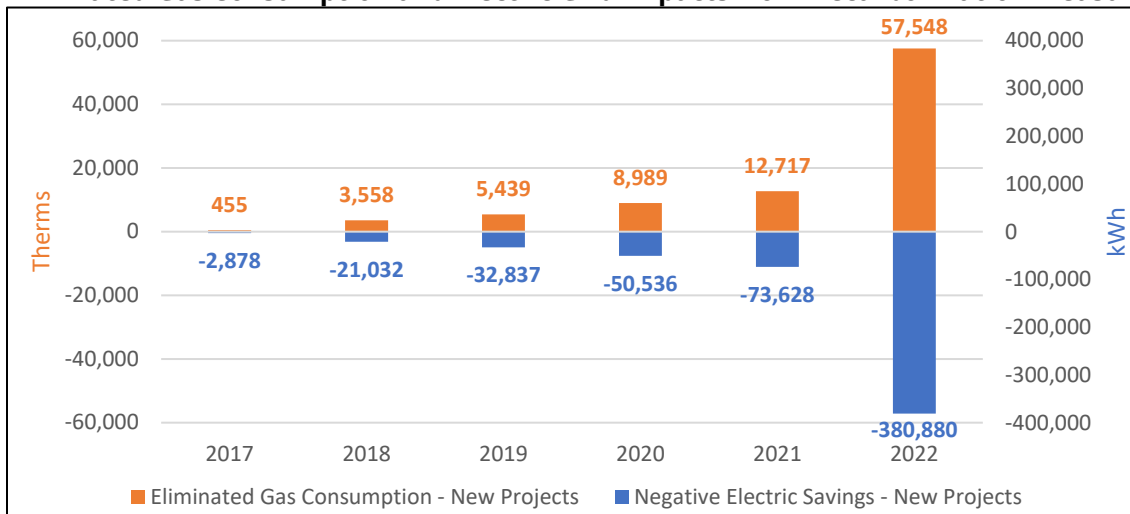
<sup>15</sup> GHG reduction equivalency values are calculated via the U.S. Environmental Protection Agency's [Greenhouse Gas Equivalencies Calculator](https://www.epa.gov/greenhouse-gas-equivalencies-calculator), based on 1,990 U.S. tons of CO<sub>2</sub>e saved (combined GHG reduction estimates for electric and gas savings, not including decarbonization measures). These values reflect the cumulative savings that have persisted over the Program's lifetime.

**Deemed Energy Savings – Decarbonization/Fuel Substitution Measures (Standard Loans)**

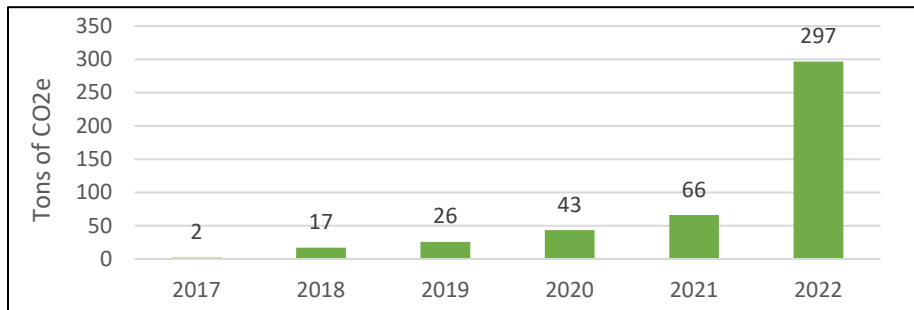
Decarbonization measures contribute to the State’s goal of greenhouse gas reduction by substituting gas-fueled measures with electric-fueled measures that can more readily take advantage of clean power sources. The tables below provide estimated energy savings and GHG emissions reductions for the **406 projects** that installed decarbonization measures (heat pumps, ductless mini splits with heat pumps, heat pump water heaters, and induction ranges) through GoGreen Home during the reporting period. Because these measures switch the customer’s fuel source from gas to electric, they result in eliminated gas consumption and increased electric usage, which skews data when included with other measures. For this reason, energy savings data for these measures is reported separately here.

During 2022, GoGreen Home facilitated financing for a higher number of projects with decarbonization measures than in previous years, resulting in significant increases in gas savings. The estimated GHG reductions from these measures in 2022 is 3.5 times greater than reductions from the same measures in 2021. This is in large part due to the high savings impact of installing decarbonization measures like heat pumps. Through its lifecycle, a single heat pump installed through the program saves approximately 200 therms of gas, equal to about 1 ton of net carbon emissions. 284 Heat pumps were installed in 2022 under the GoGreen Home program.

**12. Eliminated Gas Consumption and Electric Grid Impacts from Decarbonization Measures<sup>16</sup>**



**13. Net GHG Reductions from Decarbonization Measures<sup>17</sup>**



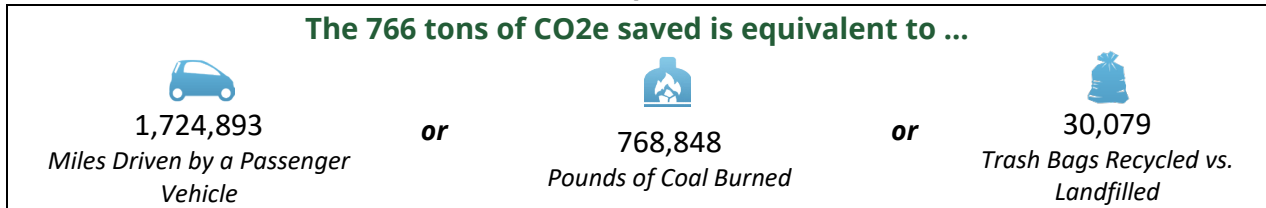
<sup>16</sup> The eliminated gas consumption in therms and increased electric consumption in kWh are both reported here to demonstrate the grid impacts, both positive and negative, from decarbonization/fuel substitution measures.

<sup>17</sup> Data in this chart reflects the net value of GHG reductions resulting from eliminated gas consumption from decarbonization measures minus the GHG impact from new electric consumption generated by those measures.

**14. Average and Total Annual Gas Savings and Net GHG Reductions  
from Decarbonization Measures**

Gas Savings		Net GHG Reductions	
226 therms <i>Average per Project</i>	57,548 therms <i>Total Annual Savings 2022</i>	1.16 Tons of CO <sub>2</sub> e <i>Average per Project</i>	297 Tons of CO <sub>2</sub> e <i>Total Annual Savings 2022</i>

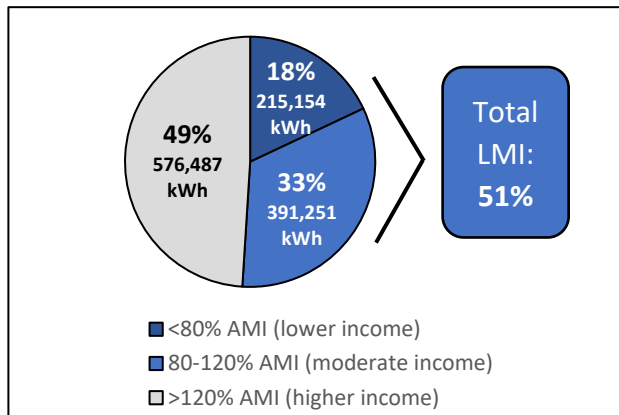
**15. Cumulative Net GHG Reduction Equivalencies for Decarbonization Measures<sup>18</sup>**



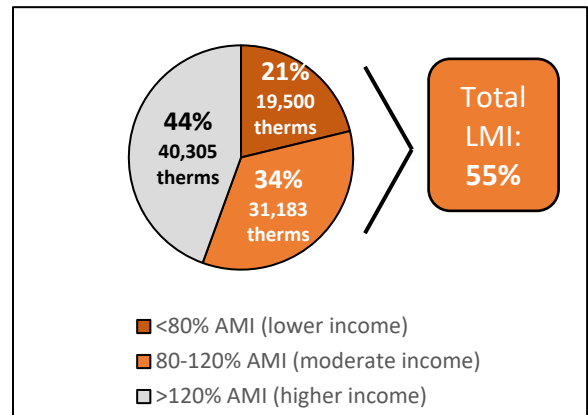
**Deemed Energy Savings – Underserved Borrowers (Standard Loans, Standard Measures)**

The below tables break down the energy savings estimates by income level<sup>19</sup> of each property’s census tract for the **2,664 projects** that were not marketplace microloans and did not include decarbonization/fuel switching measures. During the reporting period, properties in census tracts with lower incomes (<80% of the Area Median Income [AMI]) accounted for 17% of loan dollars enrolled; moderate incomes (80-120% AMI) accounted for 34% of loan dollars enrolled; and higher incomes (>120% AMI) accounted for 47% of loan dollars enrolled.

**16. Breakdown of Electric Savings by Income Level**



**17. Breakdown of Gas Savings by Income Level**



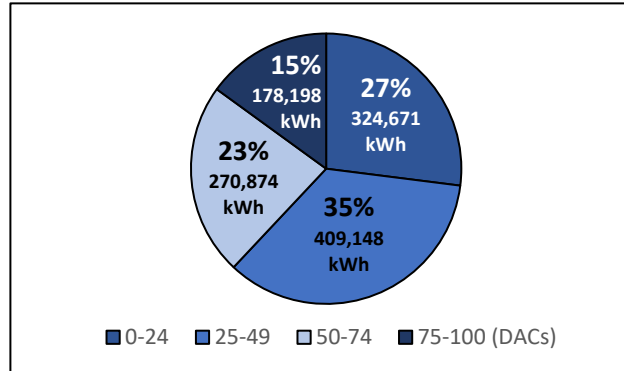
<sup>18</sup> GHG reduction equivalency values are calculated via the U.S. Environmental Protection Agency’s [Greenhouse Gas Equivalencies Calculator](#), based on 766 U.S. tons of CO<sub>2</sub>e saved (combined GHG reduction estimates for electric and gas savings from decarbonization measures). These values reflect the cumulative savings that have persisted over the Program’s lifetime.

<sup>19</sup> Low-to-Moderate Income (LMI) census tracts, for the purpose of this reporting, includes tracts with a median income that falls below 120% of the Area Median Income (AMI).

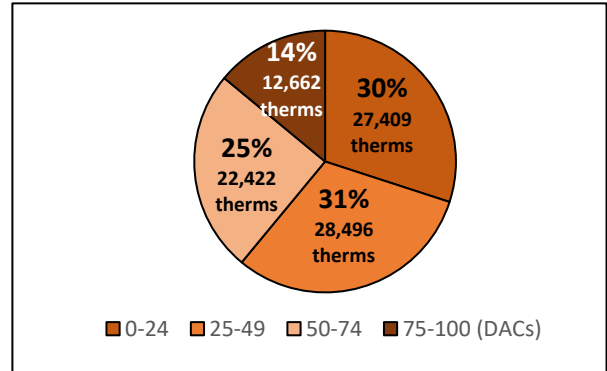


The below tables break down the energy savings estimates by CalEnviroScreen score<sup>20</sup> of each property's census tract for the **2,664 projects** that were not marketplace microloans and did not include decarbonization/fuel switching measures. During the reporting period, properties in census tracts with CalEnviroScreen scores between 0-24 accounted for 27% of loan dollars enrolled; scores between 25-49 accounted for 33% of loan dollars enrolled; scores between 50-74 accounted for 24% of loan dollars enrolled; and scores between 75-100 accounted for 15% of loan dollars enrolled.

**18. Breakdown of Electric Savings by CalEnviroScreen Quartile**



**19. Breakdown of Gas Savings by CalEnviroScreen Quartile**



**Deemed Energy Savings – Marketplace Microloans**

This section reports on the **496 marketplace microloans** enrolled through a product that finances customer purchases from the SoCalGas online utility marketplace. Microloans are limited to \$5,000 and are reported separately so as not to skew data presented for standard loans. They launched in the third quarter of 2021 and were only available in SoCalGas territory, which means that only gas measures were available to finance during the reporting period. At the end of Q2, Enervee, the SoCalGas Marketplace implementer, temporarily paused offering new microloans. Enervee relaunched its product on the SoCalGas Marketplace and launched on the Enervee marketplace serving Southern California Edison customers in March 2023.

**20. Total Annual Energy Savings and GHG Reductions – Q3 2021-Q4 2022**

	Electric Savings	Gas Savings
<b>Energy Savings</b>	13,875 kWh	2,440 Therms
<b>GHG Reductions</b>	3.2 Tons of CO2e	14.2 Tons of CO2e

**21. Average Savings by Project**

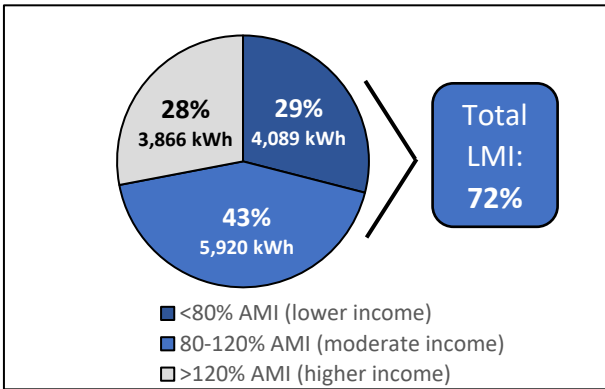
Electric Savings	Gas Savings	Greenhouse Gas Reductions
28 kWh per project	4.9 Therms per project	0.04 Tons CO2e per project

<sup>20</sup> CAEATFA reports loans for properties in tracts scoring in the top [CalEnviroScreen](#) quartile (75-100%) as loans for projects in disadvantaged communities (DACs). CalEnviroScreen is a pollution burden mapping tool that uses environmental, health, and socioeconomic data to produce scores for every census tract in California; CAEATFA is reporting loans for properties in tracts scoring in the top quartile (75-100%) as loans for projects in disadvantaged communities (DACs).

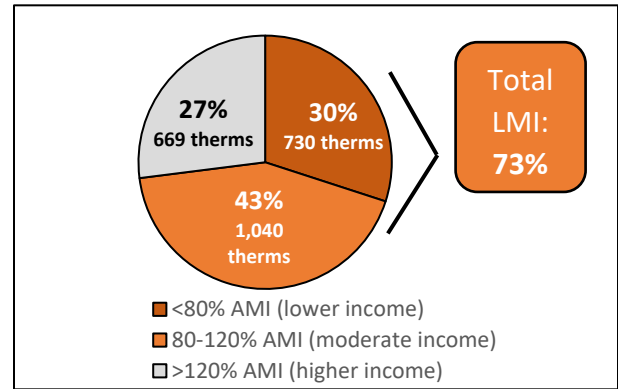
Deemed Energy Savings – Underserved Borrowers (Marketplace Microloans)

The below tables break down the energy savings estimates by income level of each property’s census tract for the **496 marketplace microloans** enrolled in GoGreen Home. During the reporting period, properties in census tracts with lower incomes (<80% AMI) accounted for 18% of microloan dollars enrolled; moderate incomes (80-120% AMI) accounted for 40% of microloan dollars enrolled; and higher incomes (>120% AMI) accounted for 42% of microloan dollars enrolled.

**22. Breakdown of Electric Savings by Income Level**

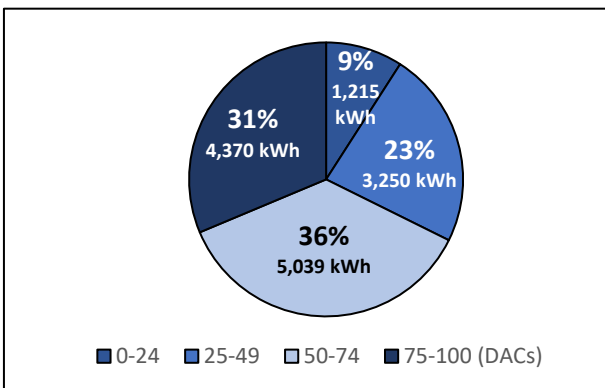


**23. Breakdown of Gas Savings by Income Level**

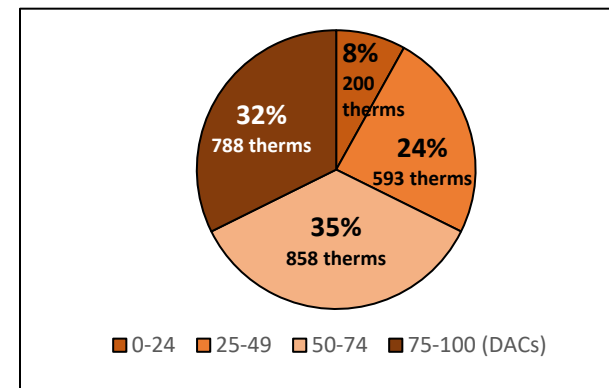


The below tables break down the energy savings estimates by CalEnviroScreen score of each property’s census tract for the **496 marketplace microloans** enrolled in GoGreen Home. During the reporting period, properties in census tracts with CalEnviroScreen scores between 0-24 accounted for 11% of microloan dollars enrolled; scores between 25-49 accounted for 29% of microloan dollars enrolled; scores between 50-74 accounted for 34% of microloan dollars enrolled; and scores between 75-100 accounted for 26% of microloan dollars enrolled.

**24. Breakdown of Electric Savings by CalEnviroScreen Quartile**



**25. Breakdown of Gas Savings by CalEnviroScreen Quartile**



## Appendix

### **Model Summary**

The model for energy savings calculations presented in this report is developed by CAEATFA's contracted Technical Advisor, Energy Futures Group (EFG). Pre-project equipment efficiency is assumed to be typical existing or at-code performance levels, often as prescribed by the California eTRM. Post-project efficiency is based on the typical performance of the equipment installed; while make and model information is not collected for each installed measure, the methodology for this report incorporates expected performance based on the GoGreen Home efficiency requirements for the measure.

Annualized energy savings estimates for each eligible energy efficiency measure are calculated by:

1. Identifying pre-project baseline condition assumptions relevant to the measure, such as SEER level of a pre-existing HVAC unit, based on sources including the California eTRM
2. Identifying post-project efficient condition assumptions relevant to the measure, such as the incorporation of R-38 insulation, using the same source that provided the pre-project baseline
3. Factoring in known variables, such as climate zone, building size, and operating characteristics

The basis for the energy savings estimates is the California eTRM, unless noted otherwise. Building characteristics such as square footage and heating system capacity, based on the CPUC's California DEER (Database for Energy Efficiency Resources) 2020 Single Family Building Prototypes, are used when applicable to quantify savings on a household basis. Finally, project-specific inputs including unit quantity and climate zone are incorporated.

### **Measures Included**

GoGreen Home has 58 eligible energy efficiency measures, and 52 of these measures have been installed on at least one project. Deemed energy savings have been characterized for 33 out of the 52 installed measure types, and these 33 measure types comprise the majority of measures actually installed through the program to date. In total, 99% of all measures installed through the program (5,825 out of the total 5,901 installed measure types) are currently reflected in this report. Measures will continue to be added to the deemed estimates as they are installed more frequently and as additional deemed measure characterizations become available.

The 19 measure types that were installed on at least one GoGreen Home project but were not characterized for deemed estimates in this report were excluded for the following reasons:

- Seldom-installed measures (16 measure types, 44 projects) – These measure types were utilized on very few projects. Many of these measures, such as window film, were only installed once during the reporting period.
- MERV air filter upgrade (18 projects) – No known deemed measure characterization is available. This measure may be added to a future version of the report pending additional means to characterize this measure.
- Tankless on-demand electric water heater (7 projects) – No known deemed measure characterization is available for California. This measure may be added to a future version of this report pending conversion from another state's technical reference manual or additional means to characterize this measure.
- Other measures qualifying through IOU, REN or CCA programs (10 projects) – Borrowers may include measures in their projects that are not on the GoGreen Home eligible measure list

provided the measure qualifies for an IOU, REN or CCA energy efficiency or demand response program. However, these measures vary each time they are enrolled and thus cannot be evaluated for energy savings estimates.

### Calculation Descriptions

The table below summarizes the calculations and considerations made to develop the estimates presented in this report:

Calculation	Description
Deemed Electric Savings	Combined amount of estimated electric energy savings as calculated for each installed measure.
Deemed Gas Savings	Combined amount of estimated gas energy savings as calculated for each installed measure.
Greenhouse Gas Reductions from Electric Savings	Estimated GHG reductions resulting from the deemed electric energy savings. GHG emissions factor calculated from the CO <sub>2</sub> emissions rate on the 2020 IOU power content labels. <sup>21</sup>
Greenhouse Gas Reductions from Gas Savings	Estimated GHG reductions resulting from the deemed gas energy savings. GHG emissions factor assumes a CO <sub>2</sub> emissions rate of 11.662 pounds of CO <sub>2</sub> per Therm. <sup>22</sup>
Peak Electric Demand Savings	Estimated reduction of electrical demand, at the time of system peak. <sup>23</sup>
Energy Savings by Measure (Gas and Electric)	Total amount of deemed energy savings associated with the most frequently installed measures in GoGreen Home.
Energy Savings by IOU (Gas and Electric)	Total amount of deemed energy savings from measures installed in projects enrolled within the four IOU territories.
Energy Savings by CalEnviroScreen Score (Gas and Electric)	Percentage of deemed energy savings broken down by CalEnviroScreen score quartile, based on the census tract in which each project was installed.
Energy Savings by Income Level (Gas and Electric)	Percentage of deemed energy savings broken down by income level, based on the census tract in which each project was installed. <sup>24</sup>

Note that energy savings estimates for fuel switching measures (heat pump technologies for space and water heating) are also calculated using the methods described in the table but are reported separately due to the significant reduction in gas use/increase in electric use that result from these projects. The model is also built to account for the EUL of all measures, and savings will “roll off” when end-of-life is reached, but this is not yet reflected in this report. Currently none of the measures have an EUL shorter than the time since Program inception in 2016. The shortest measure life is 9.0 years for smart thermostats, air purifiers, and evaporative coolers.

<sup>21</sup> Power content labels are sourced from the [California Energy Commission](#). Calculations assume that the borrower is part of the base rate plan offered by their IOU(s).

<sup>22</sup> Based on CO<sub>2</sub> emissions coefficient data from the [U.S. Energy Information Administration](#).

<sup>23</sup> Values for peak demand savings estimates are derived from the California eTRM and other sources that inform measure characterization throughout the report.

<sup>24</sup> Low-to-Moderate Income (LMI) census tracts are those with median incomes that fall below 120% of the Area Median Income (AMI).

### **Property and Installation Quantity Assumptions**

Property qualities that influence calculations of deemed energy savings, such as the size of and stories within a building and the areas of attics and walls, are based on the CPUC's DEER 2020 prototypes for single family buildings, which can be reviewed in the [CPUC's READI database](#). Estimates for other area sizes needed for these calculations, including roofs and floors, were informed by data provided in the DEER 2020 prototypes. This data was then combined with [climate zone data](#) and [average heating/cooling data](#) from the U.S. Energy Information Administration. Throughout the report, the most frequently used property assumptions are cooled/heated building area and cooling/heating capacity.

Contractors self-report the quantity of measures installed per project (e.g., 10 windows). It is expected that some contractors over- or under-report the total number of units installed in some circumstances where it is difficult to track, such as units of insulation. Energy savings calculations thus limit the use of self-reported quantities to measures where unit quantities are easily identified and reported. Contractor-reported unit quantities are only used for estimating the savings from appliances, lighting products, and windows. All other measures are assumed to be a unit of quantity of 1.0 (such as an A/C unit) or are assumed to apply to the whole building (such as attic insulation).

### **Sources**

The below sources were used to develop the measure characterizations and assumptions that contributed to the calculation of deemed energy savings throughout this report:

- [Berkeley Lab RESFEN Window Analysis Tool](#)
- [California eTRM](#)
- [California Municipal Utilities Association Savings Estimation TRM](#)
- [California Public Utilities Commission Remote Ex-Ante Database Interface \(READI\)](#)
- [Indiana TRM v2.2](#) (see Duct Insulation in the measure characterization assumptions table below for more information on how this source was used)
- [Oak Ridge National Laboratory Cool Roof Calculator](#)
- [University of Texas at Austin School of Architecture](#) (see Air Sealing in the measure characterization assumptions table below for more information on how this source was used)

Some sources, such as the DEER 2020 prototypes, are updated on an annual basis and will be reflected in the next version of the report.

## Measure Characterization Assumptions

Measure Name	Source	Baseline Condition	Efficient Condition	Assumptions	Fuel Savings
Air Cleaner/Purifier	<a href="#">California eTRM Measure ID SWAP008-01</a>	Standard, air cleaner, 100-150 CADR	Efficient, room air cleaner, 100-150 CADR, ENERGY STAR +30% (2.6 CADR/watt)	Single family, normal replacement.	Electric
Air Sealing	Custom, based on <a href="#">methodology from University of Texas at Austin</a> <sup>25</sup>	Moderate leakage, 1.0 ACH (winter) and 0.7 ACH (summer) at atmospheric pressure	15-30% improvement in ACH	Single family, add-on equipment. DEER 2020 building prototype floor area, central AC with gas furnace. Savings are calculated by climate zone using an air-change per hour (ACH) method published by University of Texas School of Architecture.	Both
Attic Insulation	<a href="#">California eTRM Measure ID SWBE006-01</a>	Customer existing insulation	R-38 insulation added to existing insulation level	Single family, add-on equipment. DEER 2020 building prototype attic area, central AC with gas furnace.	Both
Central Air Conditioning Unit	<a href="#">California eTRM Measure ID SWHC049-02</a>	Residential central AC, SEER <= 14	Residential central AC, SEER 14-18	Single family, accelerated replacement, split system, < 45 kBtu/hr, DEER 2020 building prototype cooling capacity. Savings for HV-AC14 (14 SEER) based on 50% of HV-AC15 (15 SEER). Savings for HV-CACS are the average of HV-AC14 through HV-AC18.	Electric
Central Heating (Furnace) and Air Conditioning System <sup>26</sup>	Calculated			Sum of HV-CACS and HV-FURR	Both
Clothes Dryer (Electric)	<a href="#">California eTRM Measure ID SWAP003-03</a>	Standard-size clothes dryer, electric, vented	ENERGY STAR basic tier, standard-size electric clothes dryer, vented	Single family, normal replacement.	Electric

<sup>25</sup> A California-specific resource for the measure characterization of air sealing is not available, so estimates are based on the air infiltration methodology outlined by the University of Texas, which was applied to California by using DEER 2020 building prototypes and climate zone hourly weather data.

<sup>26</sup> HV-CHAC is the sum of HV-CACS and HV-FURR.

Clothes Dryer (Gas)	<a href="#">California eTRM Measure ID SWAP003-03</a>	Standard-size clothes dryer, gas, vented	ENERGY STAR basic and advanced tier, standard-size electric clothes dryer, vented	Single family, normal replacement.	Gas
Clothes Washer	<a href="#">California eTRM Measure ID SWAP004-02</a>	Standard clothes washer, front or top loading, dwelling	ENERGY STAR front and top loading washer	Single family, normal replacement. Savings are the average of front and top loading washers.	Both
Convection Gas Oven	<a href="#">California eTRM Measure ID SWAP017-02</a>	Standard efficiency residential gas oven with preheat energy consumption > 2200 Btu and cooking efficiency < 30%	High energy efficiency residential gas oven with preheat energy consumption <= 2200 Btu and cooking efficiency >= 30%	Single family, normal replacement.	Gas
Cool Roof	<a href="#">Oak Ridge National Laboratory Cool Roof Calculator</a>	Flat black roof	Cool roof with solar reflectance = 85 and infrared emittance = 43	Electric savings calculated from ORNL Cool Roof Calculator tool for city within/nearest the respective climate zone. Cool roof performance of SR-85 and IE-43 assumed based on average of CRRC product database. Existing conditions assumed R-20 ceiling and SEER 13 (3.28 COP) air conditioning system. Peak demand savings calculated using the load factor from Radiant Barrier (BE-RADB).	Electric
Dishwasher	<a href="#">California eTRM Measure ID SWAP006-03</a>	Standard residential dishwasher, 307 kWh annual energy use	Efficient residential dishwasher, <= 199 kWh annual energy use	Single family, normal replacement.	Both
Duct Insulation	Custom, based on <a href="#">methodology from Indiana TRM v2.2</a> <sup>27</sup>	Uninsulated ducts (25%) and R-4.2 duct insulation (75%), with average duct leakage, in unconditioned attic	R-8 duct insulation, with average duct leakage, in unconditioned attic	Single family, add-on equipment. Electric and gas savings calculations performed according to the Indiana TRM v2.2. Custom equivalent full-load hours (EFLH) for cooling and heating were calculated for each California climate zone. DEER 2020 building prototype cooling and heating capacity. Peak demand savings calculated using the load factor from HV-CACS.	Both

<sup>27</sup> A California-specific resource for the measure characterization of duct insulation is not available, so estimates are based on the methodology used in the Indiana TRM v2.2, which was applied to California using climate zones and associated heating/cooling degree days.

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Duct Optimization	<a href="#">California eTRM Measure ID SWSV013-02</a>	Existing open cavity return (50% total leakage)	Return duct (15% total leakage)	Residential mobile home, building weatherization, DEER 2020 building prototype cooling capacity, central AC with gas furnace.	Both
Duct Sealing	<a href="#">California eTRM Measure ID SWSV001-04</a>	Existing residential duct system, 24-40% leakage, central AC with gas furnace, building year < 2006	Ducts sealed and tested to 12% leakage	Single family, building year < 2006, average of 24% and 40% existing leakage, duct seal and test to 12% leakage, DEER 2020 building prototype cooling capacity central A/C with gas furnace.	Both
Evaporative Cooling	<a href="#">California READI Measure ID D03-407</a>	13 SEER (11.09 EER) Split System Air Conditioner	Direct-Indirect Evaporative Cooler	Single family, normal replacement.	Electric
Freezer	<a href="#">California eTRM Measure ID SWAP001-02</a>	Standard upright freezer, automatic defrost, medium (13 - 16 cu ft)	ENERGY STAR upright freezer, automatic defrost, medium (13 - 16 cu ft)	Single family, normal replacement.	Electric
Floor Insulation	<a href="#">California eTRM Measure ID SWWB006-03</a>	Vented, unconditioned crawl space	Unvented, conditioned crawl space insulated to R-19	Single family, add-on equipment. DEER 2020 building prototype floor area, central AC with gas furnace. Savings for climate zones 1-14 and 16 are calculated using cooling degree days and heating degree days for each climate zone.	Both
Furnace - Residential Central Heating	<a href="#">California eTRM Measure ID SWHC031-0</a>	Existing residential furnace, AFUE 80%	Residential furnace 92-97% AFUE with variable speed ECM fan	Single family, normal replacement, 92-97% AFUE, replacing 80% AFUE furnace. Savings for HV-FR80 (80-89% AFUE) based on 50% of HV-FR90 (92% AFUE). Savings for HV-FURR are the average of HV-FR80, HV-FR90, HV-FR94, and HV-FR96.	Both
Heat Pump	<a href="#">California eTRM Measure ID SWHC045-01</a>	Residential SEER-rated split AC SEER = 13 and gas furnace with AFUE 80%	Residential heat pump with SEER 15-18 and HSPF >= 8.7	Fuel switch. Single family, normal replacement, DEER 2020 building prototype cooling capacity. Electric savings for HV-HP14 (14 SEER) are extrapolated from HV-HP15 (15 SEER) and HV-HP-16 (16 SEER), and gas savings are equal to HV-HP15. Savings for HV-HPMP are the average of HV-HP14 through HV-HP18.	Both



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Heat Pump Water Heater	<a href="#">California eTRM Measure ID SWWH025-04</a>	Storage natural gas water heater, 40-60 gal, UEF = 0.56-0.61	ENERGY STAR heat pump water heater, 45-75 gal, UEF = 3.31-3.33	Fuel switch. Single family, normal replacement.	Gas
Induction Range or Cooktop	<a href="#">California eTRM Measure ID SWAP013-01</a>	Natural gas cooktop, 50% with natural gas oven and 50% with no oven	Induction Cooktop, 50% with electric range	Fuel switch. Single family, normal replacement.	Gas
LED Lighting	<a href="#">California Municipal Utilities Association Savings Estimation TRM</a>	Unweighted average halogen and CFL interior and exterior lamps	Unweighted average LED interior and exterior lamps	Single family, normal replacement, savings per lamp.	Electric
Mini Split Ductless AC System	<a href="#">California eTRM Measure ID SWHC050-02</a>	Room A/C, EER 9.0	Mini-split ductless HP, SEER 18-21	Single family, accelerated replacement, DEER 2020 building prototype cooling capacity.	Electric
Mini Split with Heat Pump	<a href="#">California eTRM Measure ID SWHC044-02</a>	Standard efficiency wall furnace (AFUE = 67%) and window AC (EER = 11)	Ductless mini-split heat pump (SEER 15-18, HSPF 8.7-9.4)	Fuel switch. Single family, normal replacement, DEER 2020 building prototype cooling capacity.	Both
Pool Pump Motor	<a href="#">California eTRM Measure ID SWRE002-01</a>	100% two speed pool pump	Variable-speed pool pump	Single family, normal replacement, self-install.	Electric
Radiant Barrier	<a href="#">California Municipal Utilities Association Savings Estimation TRM</a>	Attic with no radiant barrier	Radiant barrier installed in attic	Single family, add-on equipment. 13 SEER air conditioning and 78% AFUE central furnace.	Both
Refrigerator	<a href="#">California eTRM Measure ID SWAP001-02</a>	Standard bottom freezer, with ice, large (>= 16.5 cu ft)	ENERGY STAR bottom freezer with ice	Single family, normal replacement, large (>= 16.5 cu ft).	Electric

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Smart Thermostat	<a href="#">California eTRM Measure ID SWHC039-03</a>	Non-programmable or programmable thermostat, DX w/ gas heat	Smart thermostat DX w/ gas heat	Single family, normal replacement, central AC with gas furnace.	Both
Tank Storage Water Heater (Gas)	<a href="#">California eTRM Measure ID SWWH012-02</a>	Residential storage water heater, 40-50 gal, medium-high draw, EF = 0.58	ENERGY STAR water heater, 40-50 gal, medium-high draw, UEF >= 0.80	Single family, accelerated replacement.	Gas
Tankless On-Demand Water Heater (Gas)	<a href="#">California eTRM Measure ID SWWH013-02</a>	Residential storage water heater, 40 gal, 0.60 UEF	Residential instantaneous water heater, <= 200 kBtu/hr, 0.87-0.95 UEF	Single family, accelerated replacement, medium draw. Savings are the average of 0.87 UEF and 0.95 UEF.	Gas
Wall Insulation	<a href="#">California eTRM Measure ID SWBE007-01</a>	2x4 Wall with R-0 Insulation	Wall Blow-In R-0 to R-13 Insulation	Single family, add-on equipment. DEER 2020 building prototype wall area, central AC with gas furnace. The California eTRM only provides an existing condition scenario of uninsulated walls. Savings are derated by 50% to account for homes that already have partially insulated walls.	Both
Whole House Fan	<a href="#">California eTRM Measure ID SWHC030-01</a>	No whole house fan	Whole house fan, 1.5-3.0 CFM/ft2, ECM motor	Single family, add-on equipment. Airflow >= 1.5 CFM/ft2 per Title 24. No savings for climate zone 1.	Electric
Windows	<a href="#">Berkeley Lab RESFEN Window Analysis Tool</a>	37% single pane, non-metal frame, clear, U-factor 0.88, SHGC 0.64; 63% double pane, non-metal frame, clear, U-factor 0.52, SHGC 0.57	ENERGY STAR, 2-pane, non-metal frame, low-E, U-factor 0.28, SHGC 0.20-0.50 by climate zone	Single family, accelerated replacement. Savings calculated by climate zone using LBNL RESFEN. Equal orientation, existing 1-story house, 300 sq. ft. total window area (16.7% of floor area), typical shading assumed. Unit savings assume typical window size of 30" x 48".	Both