ENERGY UPGRADE MOUNTAIN VIEW

Final Report

June 2016

City of Mountain View

Acterra ACTION FOR A HEALTHY PLANET

HEA HOME ENERGY ANALYTICS

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June 24, 2016

Mr. Steve Attinger
Environmental Sustainability Coordinator
City of Mountain View
500 Castro Street
Mountain View, CA 94041-2010

Dear Steve,

Acterra is pleased to present you with this Final Report on the Energy Upgrade Mountain View (EUMV) program.

As the report details, the EUMV program created significant reductions in greenhouse gas emissions and corresponding savings in energy use — an average annual reduction in natural gas use of 16.4% and annual electricity savings of 5.5%. Over 2,000 residents signed up to participate, including approximately 14% of single-family homes in Mountain View.

Funded by the City of Mountain View through the use of Federal ARRA ("Stimulus") money and funds from the city's General Fund, the total cost of the program was $473,000. The program was carried out in three phases over 44 months, from April 2011 through December 2014. During EUMV-1, Home Energy Analytics (HEA) was the prime contractor, responsible for software analysis of residents' energy usage, online communication with residents and community outreach; Acterra was responsible for in-home energy assessments and community outreach. During EUMV-2 and EUMV-3, HEA remained responsible for energy usage analysis and online communications; Acterra continued with in-home assessments and took over all community outreach, including outreach to residents of multi-family housing.

Thanks are also due to the City of Mountain View staff in the Public Works Department and Finance and Administrative Services Department who assisted with publicizing the program and additional support. For further information about the program, please contact:

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Sincerely,

Adam C. Stern
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Executive Summary

The goal of Energy Upgrade Mountain View (EUMV) was to increase community awareness of household energy consumption and promote efficiency measures in support of the City of Mountain View's greenhouse gas (GHG) reduction goals.

In an effort to achieve cost-effective energy savings by leveraging the newly installed Smart Meter infrastructure provided by PG&E, the City selected the two-pronged approach of an innovative web-based service provided by Home Energy Analytics (HEA) coupled with an established community-based home energy efficiency program provided by Acterra, a local environmental education organization.

EUMV provided Mountain View residents with a customized, diagnostic approach, combining an online disaggregation of their home energy use patterns with personal assistance from Acterra's Energy Expert and trained volunteers. This enabled participants to focus on the energy waste specific to their homes, as opposed to the one-size-fits-all approach typically offered by Heating, Ventilation, and Air Conditioning (HVAC)-focused programs.

As shown in Table 1, EUMV launched in April 2011 and ran through three phases until December 2014, for a total duration of 44 months. EUMV-1 and EUMV-2 participants continued receiving program benefits through the end of the program.

The original goals of EUMV-1 were 1,500 sign-ups and a reduction of 2,537 metric tons of GHGs (as measured in carbon dioxide equivalent [CO_2e]), per year. Final results, by the end of EUMV-3, were 2,006 sign-ups and a yearly CO_2e reduction of 710 metric tons. Overall, a total of 1,366 metric tons of CO_2e were eliminated during the course of the program. Additionally, over the course of the program, participants achieved an average 16.4% reduction in natural gas usage, a 5.5% average reduction in electricity use, and an average 3.8% reduction in energy costs, for a total program savings of $64,526. Regarding ownership, the majority of participants, 90%, were homeowners. Regarding housing type, most participants (68%) lived in single-family homes (SFHs), while 27% lived in condos. Residents of SFHs saw the largest average savings of CO_2e, 1,158 lbs. per year. Fourteen percent of all Mountain View single-family homes registered for EUMV.

The **Program Background** section of this report reviews the phases of the program and includes a discussion of different treatments offered to participants. **Program Highlights & Significant Findings** provides a quick look at the most important outcomes and findings of the program. **Results & Analysis** highlights that this program was highly successful. It includes information on savings achieved, enrollment, outreach methods and customer satisfaction. It also includes tables on measured changes in GHGs and dollars. The **Conclusion** reviews our most important findings, and further savings details, including electricity and natural gas savings, are included in the **Appendices.**

Program Background

History and Funding

EUMV was created in response to some of the recommendations in the City of Mountain View's 2008 Environmental Sustainability Task Force Final Report. The Task Force created a list of practical recommendations for the City of Mountain View to enhance its environmental sustainability, and among these two identified the need for free audits of residential energy use and energy upgrades of residential buildings. With receipt of $719,000 in funding from the 2009 American Reinvestment and Recovery Act (ARRA, aka "Stimulus Program"), the City of Mountain View decided to allocate an initial $343,000 from this funding toward the Energy Upgrade Mountain View program. During the first phase (EUMV-1) from April 2011 through December 2012, EUMV was managed by High Energy Analytics (HEA), a software company that provided the online disaggregation of participants' Smart Meter data, along with automated recommendations for ways to cut home energy waste. HEA subcontracted with Acterra, a well-respected local non-profit environmental education organization, to offer in-home visits and partner with HEA on community outreach.

Acknowledging the success of EUMV-1 and noting that many more residents might benefit from the program, in spring 2013 the Mountain View City Council decided to extend the program for another year, from July 2013 through June 2014, allocating an additional $85,000 from the City's General Fund. This second phase (EUMV-2) was then managed by Acterra, which was solely responsible for community outreach, with HEA acting as the subcontractor providing the online software. A third phase (EUMV-3) was funded with $35,000 from the Mountain View City Council, and ran from July 2014 through December 2014. Table 1 summarizes the EUMV program timeline and costs.

Table 1: EUMV Program Timeline and Costs

Phase	Timeline	Cost	Funding Source
EUMV-1	April 2011 to December 2012	$343,000	Federal ARRA stimulus funds
EUMV-1 Extension (no new sign-ups)	January 2013 to June 2013	$10,000	City of Mountain View
EUMV-2	July 2013 to June 2014	$85,000	City of Mountain View
EUMV-3	July 2014 to December 2014	$35,000	City of Mountain View
Total Budget		**$473,000**	

Program Design

EUMV was designed to use Smart Meter data disaggregation to (1) educate users about their unique energy profile, (2) assign users to an appropriate treatment based on their specific profile, and (3) monitor users' changes in energy use. The assignment of participants to treatments varied between the two phases, mostly as a result of lessons learned during EUMV-1. During EUMV-1, home visits were offered primarily to residents with low energy use, because those were often low-income customers in small homes (some of whom did not have computers and therefore could not take advantage of the online program elements), and Acterra wanted to provide them with some amount of service. However, residents with low energy bills did not benefit greatly from the visit, as there were few changes for them to make. Conversely, higher energy users, especially those with recurring or variable loads, could be directly assisted by the home visits. Therefore, during EUMV-2, the in-home visits were mainly given to residents with high recurring and high variable energy use (see "Step 2" below for a definition of these categories).

For both phases, HEA analyzed the customer's home energy usage and identified patterns of high and low energy use. Based on this information, users were placed into different treatment groups by Acterra and assigned to specific "leak" categories. (The word "leak" is a metaphor: wasted energy is like water leaking from a dripping faucet.) Residents with high energy use were offered assistance via phone, email or in-home visits. Additionally, all participants received monthly emails tracking their energy use trends and reminding them of steps they could take for reducing identified "leaks." A more detailed explanation of the program is shown below in Steps 1-4. *(See also Figure 1.)* Finally, in both phases, residents without access to the Internet were offered free in-home audits from Acterra.

The following steps describe how participants engaged with the program during EUMV-2 and EUMV-3.

Step 1: Residents signed up online for an EUMV account and linked it to their PG&E online account. This enabled the HEA software to download and analyze the resident's energy use data.

Step 2: HEA's online software analyzed the resident's energy usage over the prior 12 months and began recording usage moving forward. Analysis included identifying four types of energy use patterns:

1. Base — electric and natural gas items that are "always on," such as chargers, electronics in standby mode, electric clocks, and natural gas water heaters.
2. Recurring — items that run on a predictable schedule, such as pool pumps or landscape lighting.
3. Variable — voluntary energy use caused by resident actions, such as turning on lights and other appliances.
4. Heating (both electric and natural gas) and Cooling (aka HVAC) — energy use correlated with cooler or warmer outdoor temperatures.

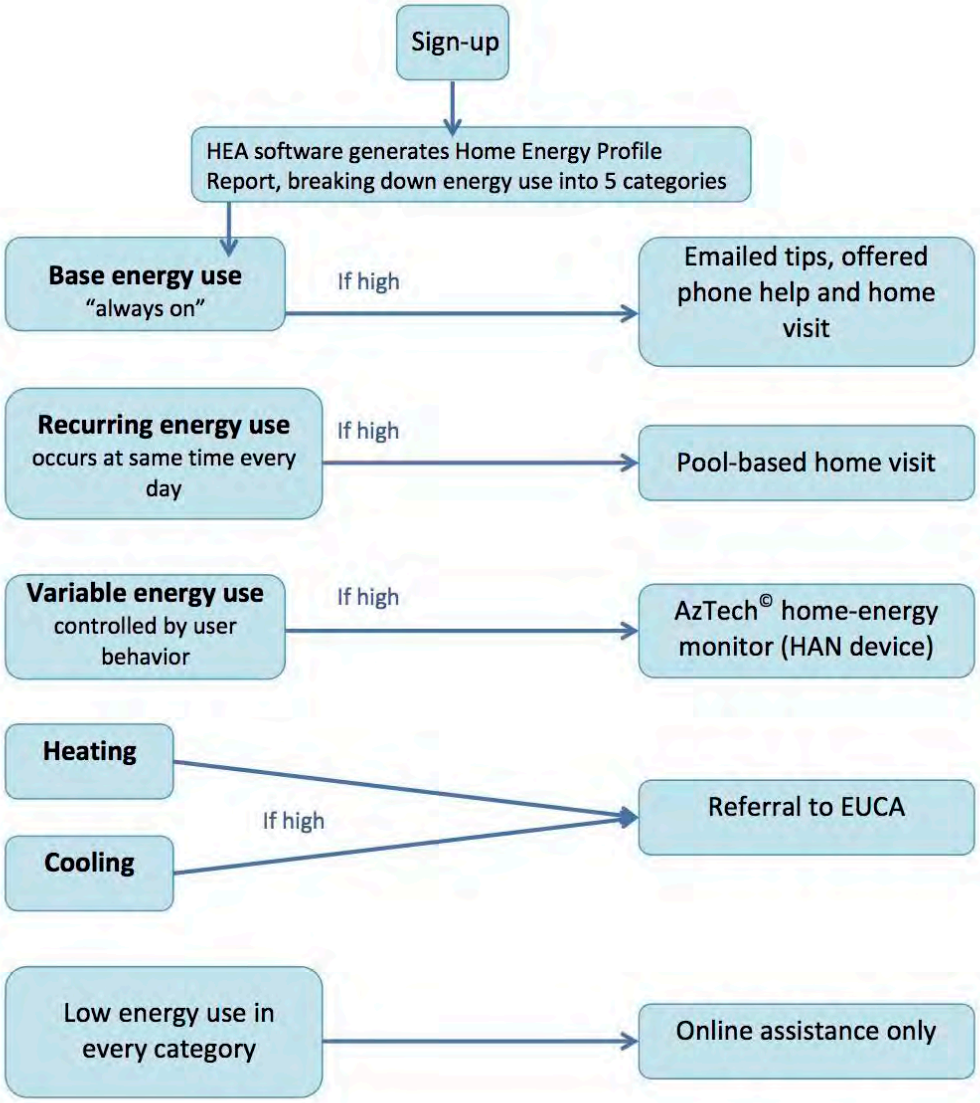
Step 3: Based on the trends in the above energy use patterns, residents were assigned to at least one of five different treatment categories. The categories were:

1. Low energy use — residents received online help only.
2. High base use —if their base usage was high, residents were offered assistance either via phone, email, or in-home visit.
3. High recurring use — residents were offered a "Pool House Call," where trained volunteers from Acterra visited the home and recommended appropriate pool pump or hot tub settings.
4. High variable use — residents were offered a free in-home energy monitor (a Home Area Network (HAN) device) that displayed their energy use in real time.
5. Heating and Cooling — If either of these categories were high, the resident was referred to Energy Upgrade California (EUCA) for assistance with larger home energy retrofits.

The online software presented users with a description of their energy use according to the categories above and offered suggestions for the areas of highest energy waste or "leaks." For each identified leak, residents were offered a series of recommendations with estimated savings (in dollars) based on their particular energy profile and given the opportunity to commit to completing one or more of them.

Step 4: Acterra followed up regularly with identified residents, offering appropriate advice and in-home visits where necessary. This follow up included detailed analysis of the resident's energy use by Acterra's on-staff Energy Expert. Residents also received monthly emails from HEA, tracking their energy use and reminding them of solutions identified by the online software.

Figure 1: EUMV Program Flow Diagram



Program Highlights and Significant Findings

Program Facts

- Goals
  - Increase community awareness of household energy consumption
  - Promote home energy-efficiency measures in support of the City's GHG reduction goals
- Duration: 44 months
- Phases: EUMV-1 (April 2011 through June 2013), EUMV-2 (July 2013 through June 2014), and EUMV-3 (July 2014 through December 2014)

Important Findings

- EUMV cost significantly less than traditional HVAC-focused programs, such as Energy Upgrade California, while providing similar or better savings. *(See Table 6 for details.)*
- High electric base loads (idle loads) are an important component of home energy consumption that is not currently addressed by statewide programs.
- Disaggregated energy data provides deep insights into potential energy savings.
- Residents of single-family homes experienced the greatest savings in every major category.
- Homeowners saved more on GHGs and natural gas, while renters saved more on cost and electricity.
- Participants using installed home energy monitors (Aztech© HAN devices) saved more electricity than the average EUMV participant. *(See caveats in Appendix B, Table 15.)*

Savings Data

- Cost Savings *(N.B.: includes effects of numerous PG&E rates changes.)*
  - 3.8% average reduction in energy costs for all participants, equating to $52 per participant per year
  - 19% reduction in energy bills for top-saving participants (top quartile), equating to $346 per top quartile participant per year
- Electricity Savings
  - 474 megawatt-hours (MWh) per year
  - 21.7 kilowatts (kW) of demand reduction (continuous savings) per year
  - 5.5% average reduction; 14.5% reduction for the top quartile, per year
- Natural Gas Savings
  - 97,888 therms per year
  - 16.4% average reduction; 32.6% reduction for the top quartile, per year
- Greatest Percentage of Savings
  - Natural gas heating: 19.1% per year
  - Electric cooling: 15.1% per year
  - Variable natural gas usage (e.g. pool heating): 88% per year

- GHG Savings
  - 710 metric tons of CO_2e per year
  - 1,366 metric tons of CO_2e over 44 months

*Note: **Average savings** for electricity and natural gas were computed from the usage of the 1,239 participants who were active throughout the program. Since this was a large sample size, the "average savings" numbers were then applied to the 1,576 participants who qualified for the program and experienced the same service in order to calculate the total "savings per year."*

Participant Demographics

- 2,006 Mountain View residents registered for the program
- 1,576 residents qualified for EUMV and received assistance (called "participants" in this report) [1]
- 1,239 participant accounts remained "active," allowing HEA to measure their specific savings throughout the program [2]
- 68% of participants lived in single-family homes
- 14% of all single-family homes in Mountain View registered for EUMV [3]

Successful Outreach Methods

- Messaging from the City was *far* more effective than messaging from other sources.
- Including simple but professional-looking flyers with residents' bi-monthly municipal utility bills was the most effective method to notify residents about the free EUMV program.
- The combined approach of municipal utility bill flyers, educational workshops, and offering free energy-efficiency devices to participants was the most successful approach overall to convince residents to sign up.
- In addition, some sign-ups clustered in neighborhoods where a "champion" helped spread word of the program among their neighbors.

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[1] *To qualify, participants needed to have been in their home for at least 1 year, have a Smart Meter, and not have solar PV.*

[2] *Participants provided access to their electric and natural gas Smart Meter data. HEA analyzed 12 months of historic energy use prior to registration and collected interval data for 1,239 participants through January 11, 2015. Prior to that date, 337 participants dropped out, moved, started charging an electric car, installed solar PV systems, or were excluded for some other problem related to the integrity of their data.*

[3] *A total of 1,278 EUMV registrants lived in single-family homes. It should be noted that 840 of these registrants (65%) were eligible to participate in the program. Many homes were disqualified because they had solar installed or otherwise did not meet the eligibility criteria. (See footnote 2, above.) According to City Data, there are a total of 9,147 single-family homes in Mountain View.*

Results and Analysis

Savings

HEA tracked energy changes across 12 categories:

1. Monthly electricity cost
2. Monthly natural gas cost
3. Monthly electricity use
4. Monthly natural gas use
5. Idle load—electricity used continuously ("always on")
6. Recurring electric use—electricity used at the same time every day ("scheduled")
7. Variable electric use—electricity that varied from day to day ("behavioral")
8. Electric cooling—electricity used for cooling (correlates with high outdoor temperatures)
9. Electric heating—electricity used for heating (correlates with low outdoor temperatures)
10. Natural gas base load—natural gas used continuously (year round)
11. Variable natural gas use—natural gas use that varied from day to day but did not correlate with outside temperatures
12. Natural gas heating—natural gas used for heating (correlates with low outdoor temperatures)

These categories of residential energy use were recorded for each home. To calculate savings, HEA compared the 12 months of historical energy data prior to registration with the most recent 12 months at the time of the final report. GHG savings are calculated using established estimates of CO_2e emissions due to electric and natural gas usage.[4] Cost savings are based on changes in energy bills, and include significant effects of numerous changes to PG&E rates during the program. EUMV's use of HEA's Smart Meter data disaggregation analysis enables low cost but detailed insights into changes in residential energy use.

On average, EUMV participants saved in every category, which reflects the benefits of this customized, diagnostic approach. After learning about their particular home energy

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[4] *For electricity we used 0.524 lbs/kWh, which has been PG&E's average emissions rate from 2002 through 2012 and the rate they used for ClimateSmart. While some recommend using smaller figures, we expect the California drought will make the past two years higher than normal, and that is when most of the EUMV savings occurred. For natural gas, we use 13.446 lbs/therm, again the figure PG&E used for ClimateSmart. This figure takes into account transmission losses from their system, which explains why it is higher than the U.S. Energy Information Administration's figure, and higher than other figures published by PG&E.*

profile, participants are assigned to specific treatments (e.g., Acterra in-home visit) and provided customized recommendations specific to the "worst" loads in their home. This allows participants to focus on the types of energy waste specific to their homes, as opposed to the one-size-fits-all approach typically offered by traditional home energy efficiency programs.

Table 2 shows GHG emissions savings, while Table 3 highlights cost savings. These tables show average and total savings for all users as well as for the top quartile of GHG savers. These savings are also examined in relation to home type (Table 4) and home ownership (Figure 4). Other savings data is included in Appendix B.

Table 2: Greenhouse Gas Emissions Savings

GHG Savings[5] (lbs. CO_2e)	**Active Participants** (1,239)	**Top Quartile**[6] (310)
Average yearly (per participant)	993	2,710
Total yearly	1,230,047	840,138
Total cumulative	2,366,820	1,631,436

As a result of the EUMV program, participants are reducing emissions of GHGs by 1,564,968 lbs. *each* year (710 metric tons). This is equivalent to saving the amount of energy used by 64 average American homes each year.[7] The top quartile of savers alone reduces GHG emissions by 840,138 lbs. each year. Over the course of the program, Mountain View reduced residential emissions by 3,011,515 lbs. (1,366 metric tons). This is equivalent to the energy consumed by 125 homes for one year.

Table 3: Cost Savings

Cost Savings ($)	**Active Participants** (1,239)	**Top Quartile** (310)
Average yearly (per participant)	3.8%	19.0%
Average yearly (per participant)	$52	$346
Total yearly[8]	$64,526	$107,150

On average, participants are saving $52 per year, or 3.8%, on their energy bills (but see discussion below, "An Important Caveat for Cost-Savings Analysis," on the effect of utility rate changes on these results). This equates to savings across all participants of

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[5] *A positive value indicates a savings. Negative values indicate an increase (in cost, etc.)*
[6] *This is the top 25% of the 1,239 participants with complete data sets.*
[7] *Equivalencies calculated according to the Environmental Protection Agency energy calculator: http://www.epa.gov/cleanenergy/energy-resources/calculator.html - results.*
[8] *Savings are higher for the top quartile than for all participants. This is because some participants did not save or actually increased their usage, lowering the average for the total. These results may also be confounded by the effect of changing energy rates. (See discussion in "An Important Caveat for Cost-Savings Analysis" in this document.)*

$64,526 each year. Residents with the highest savings, the top quartile, are saving $346 per year, or 19%. These residents represent a total savings of $107,150 each year. Residents who continue their energy-saving behavior will continue to see savings in years to come.

An Important Caveat for Cost-Savings Analysis

Estimates of cost savings by EUMV participants across the full 44 months was confounded by constantly changing electricity rates. Initial EUMV phase 1 analysis in January 2013 showed average cost savings of $169 per user, while the most recent analysis resulted in a much lower figure of $52 per user.

A significant reason for this reduction in savings is the many changes in PG&E electric rates over the course of the program (approximately ten rate changes). For example, top tier rates in 2010 were $0.50 per kWh. As of October 1, 2014, top tier rates were $0.33, *a decrease of 35%*. In contrast, during this same period, bottom tier rates *increased 22%*. These changes have confounded the cost-savings data, whereas the energy savings, measured in consistent units of kWhs and therms, is much more accurate.

If "average rates" ($0.15 per kWh and $1.10 per therm) are used for electricity and natural gas prices, the average user is saving $113 per year and the top quartile is saving $325 per year.

Table 4: Savings Based on Home Type

Home Type [9] (# of cases)	**Average Initial Annual Energy Cost**	**Total Cost Savings**	**Average Cost Savings per Resident per Year**	**Total GHG Savings** (lbs. CO_2e)	**Average Annual GHG Savings per Resident** (lbs. CO_2e)
Single-Family (840)	**$1,536**	**$62,795**	**$75**	**972,868**	**1,158**
Condo (338)	$1,004	$2,705	$8	221,893	656
Duplex (35)	$980	$-760 [10]	$-22	24,383	697
Apartment (25)	$672	$-376	$-15	10,186	407
Total (1,238)	$4,192	$64,526	$52	1,230,047	

[9] *One participant lived in a mobile home, and their savings are not included in this table, as the sample size is too small to be meaningful. As a result, the total shows as 1,238 rather than 1,239.*

[10] *Negative values in Table 4 indicate an increase in energy costs for Duplex and Apartment dwellers. As noted in the discussion about "An Important Caveat for Cost-Savings Analysis" in this document, the increased cost is likely due to increased PG&E rates for the lowest tier users.*

Figure 2: Average Initial Energy Costs by Housing Type

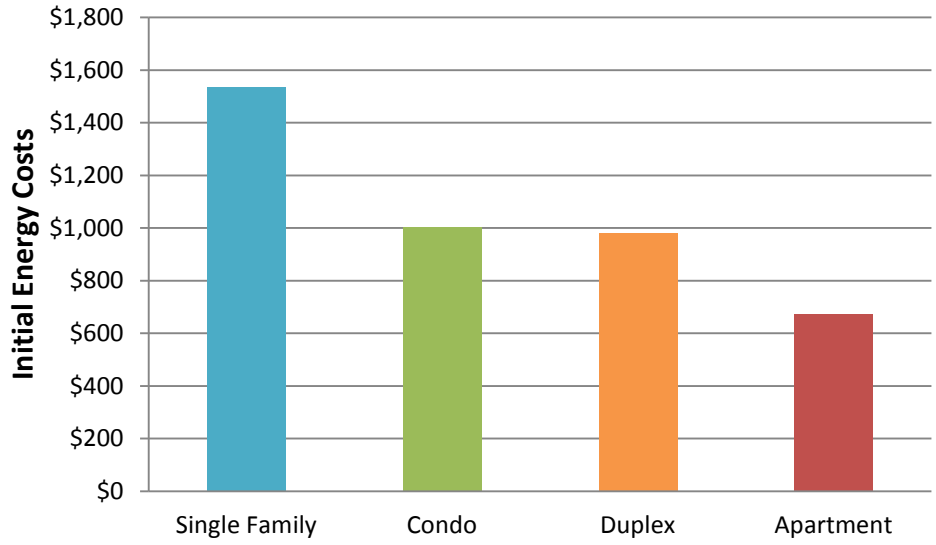


Figure 2 indicates that residents of single-family homes had the highest average energy costs during the year prior to entering EUMV. Residents of apartments had the lowest.

Figure 3: Differences in Average Savings by Housing Type

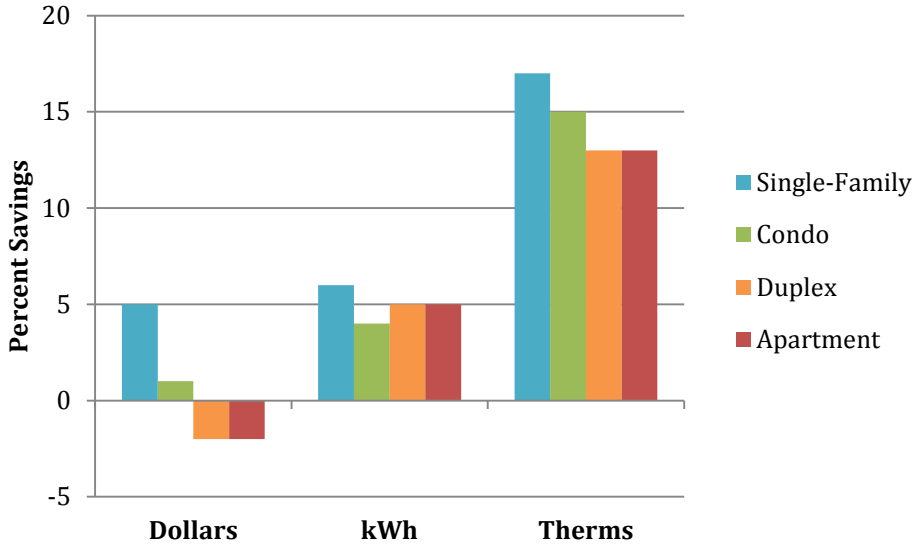


Figure 3 indicates that residents of single-family homes saved more money and energy than residents of other home types.

Residents of single-family homes saved more money than residents of other housing types. They also saved more natural gas and electricity (kWh) than other housing types (Figure 3). This is not surprising as these participants also spent more on their energy at the beginning of the program than any other demographic, indicating they used more energy at the beginning of the program. *(See Table 4 and Figure 2, s.)*

Surprisingly, renters saved more than homeowners on cost (dollars) and electricity (kWh). Both groups showed similar savings in natural gas (therms) usage (Figure 4). The difference in electricity savings likely reflects the idea that changes in behavioral use of electricity is the major way renters can alter their energy consumption. The higher cost savings is not proportional to the savings in electricity. This may be an effect of changes in energy rates.

Figure 4: Differences in Average Annual Savings between Homeowners and Renters

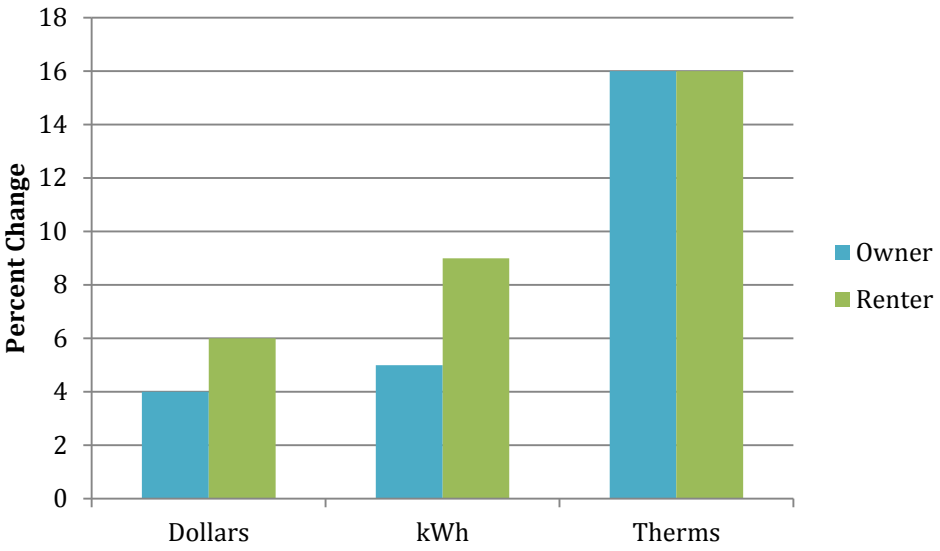


Figure 4 shows that renters had higher average savings for cost (dollars) and electricity (kWh) than homeowners. Natural gas (therms) savings were similar for both groups.

Significance of Idle Loads

Another key finding was that idle load (electric base load) accounts for 33% of the average electricity use in Mountain View homes. This type of energy use is typically the result of appliances, such as printers and TVs that are drawing continuous energy even if turned off. On average, homes across Mountain View use 208 “idle watts” (idleW) of electricity continuously — 24 hours a day — no matter whether the occupants are asleep, away at work, or on vacation. This 33% spent on idle loads indicates that this is an important target for home energy-efficiency programs. The attention paid to idle loads and solutions proposed by EUMV likely contributed to EUMV’s success and

cost-effectiveness. Reducing idle loads is cheap and easy using "Smart" power strips, timers, reconfiguring electronics, or just unplugging unused devices.

Table 5: Distribution of Idle Loads by Housing Type and Home Ownership

	Apartments		Condos		Duplex		Single-Family		Total
	Own	Rent	Own	Rent	Own	Rent	Own	Rent	
# Participants [11]	7	18	302	36	19	16	785	55	1,238
IdleW (min)	10	10	20	17	24	40	40	40	
IdleW (avg)	76	93	170	153	175	118	233	188	
IdleW (max)	225	175	705	493	417	237	1,301	777	

Effectiveness of Home Energy Monitor Treatment

Residents where home energy monitors were installed saved more electricity than the average participant without the devices. Home energy monitors are small devices that sit inside the resident's home and relay real-time energy data from the Smart Meter. During EUMV-2, a home energy monitor (an Aztech© device, using a home area network [HAN]) was offered to residents with high electric base and variable loads. The devices were installed in person by Acterra staff or trained volunteers, and the residents received a demonstration of how to use the device effectively. Because the energy monitors relay real-time energy use data, they provide constant feedback to residents about their energy use. For example, they can see how much more energy they use when they turn all their lights on versus just the room they are in. 25 home energy monitors were installed during EUMV-2. Unfortunately, data for 11 of these participants was not appropriate for analysis due to confounding factors, such as residents who added a hot tub or electric car. These changes removed people from the analysis because they significantly increased electricity use for a reason independent of the energy monitor installation. See Appendix B, Table 15 for detailed comparison data of energy monitor users and average users. Similar devices were installed during EUMV-1, with similar results. *(See January 2013 report for EUMV-1.)* In both cases, however, savings decreased over time, showing a "rebound" effect after high initial savings.

Comparison to Energy Upgrade California

The City of Mountain View was the first municipality to deploy advanced Smart Meter analytics to its entire residential community. While companies like FirstFuel and Retroficiency have demonstrated significant cost-effective energy savings in the commercial building sector using a similar approach, EUMV was the first program to demonstrate equivalent results in the residential sector.

[11] *One participant lived in a mobile home, and their savings are not included in this table, as the sample size is too small to be meaningful. As a result, the total shows as 1,238 rather than 1,239.*

The advantages of this approach are highlighted in Table 6 comparing EUMV results from 2011 to 2014 to Energy Upgrade California (EUCA) results from PG&E[12] from 2011 to 2013. The EUCA program implemented a more traditional residential energy-efficiency approach, utilizing high cost marketing, large incentives, complex energy modeling tools, in-home audits, and other activities designed primarily to encourage residents to complete high cost HVAC upgrades. Energy savings were remarkably consistent between EUMV and PG&E's regional EUCA program (with the notable exception of higher savings for EUMV's top quartile), but program costs were dramatically different.

Table 6: Comparison of Savings and Costs for EUMV and EUCA

Program Metric	EUMV (2011-2014)	EUCA by PG&E (2011-2012)
Total number of sign-ups	2,006	
Total number of participants	1,576	3,823
Active participants	1,239	1,625
Average electric savings (kWh)	301	203
Average natural gas savings (therms)	62	74
Average GHG savings (lbs. CO2e)	993	1,101
Total reduction in electricity use (all participants)	5.5%	5.4%
Total reduction in natural gas use (all participants)	16.4%	16.4%
Total reduction in electricity use (top quartile)	14.5%	7.2%
Total reduction in natural gas use (top quartile)	32.6%	19.9%
Total cost of program	$473,000	$25,310,500
Program cost per sign-up	**$236**	**$6,621**

Enrollment

EUMV's goal for enrollment was 1,500 registrations. Over the course of the program EUMV exceeded this goal by achieving a total of 2,006 sign-ups. Figure 5 illustrates the rate of sign-ups by month. The first increase in enrollment rate began in late January 2012, correlating with the publishing of an article in *The Voice. (See Appendix G, "Media Coverage of the EUMV Program," for details.)* Then, in March 2012, the enrollment slowed down.

However, starting July 2012, the rate of sign-ups significantly increased. This higher level of sign-ups continued throughout the rest of the program and coincides with the introduction of flyer flyers (on separate 8.5" x 11" sheets) in residents' municipal utility bills offering free educational workshops and free energy-saving devices to all participants. This combination of City utility bill flyers, free workshops, and free device-giveaways was the most successful form of outreach. *(See "Outreach," below for more information.)*

[12] *Source of EUCA results: 2010-2012 Whole House Retrofit Impact Study pages 5, 13, 32, 34, and 37.*

Figure 5: Program Enrollment by Month

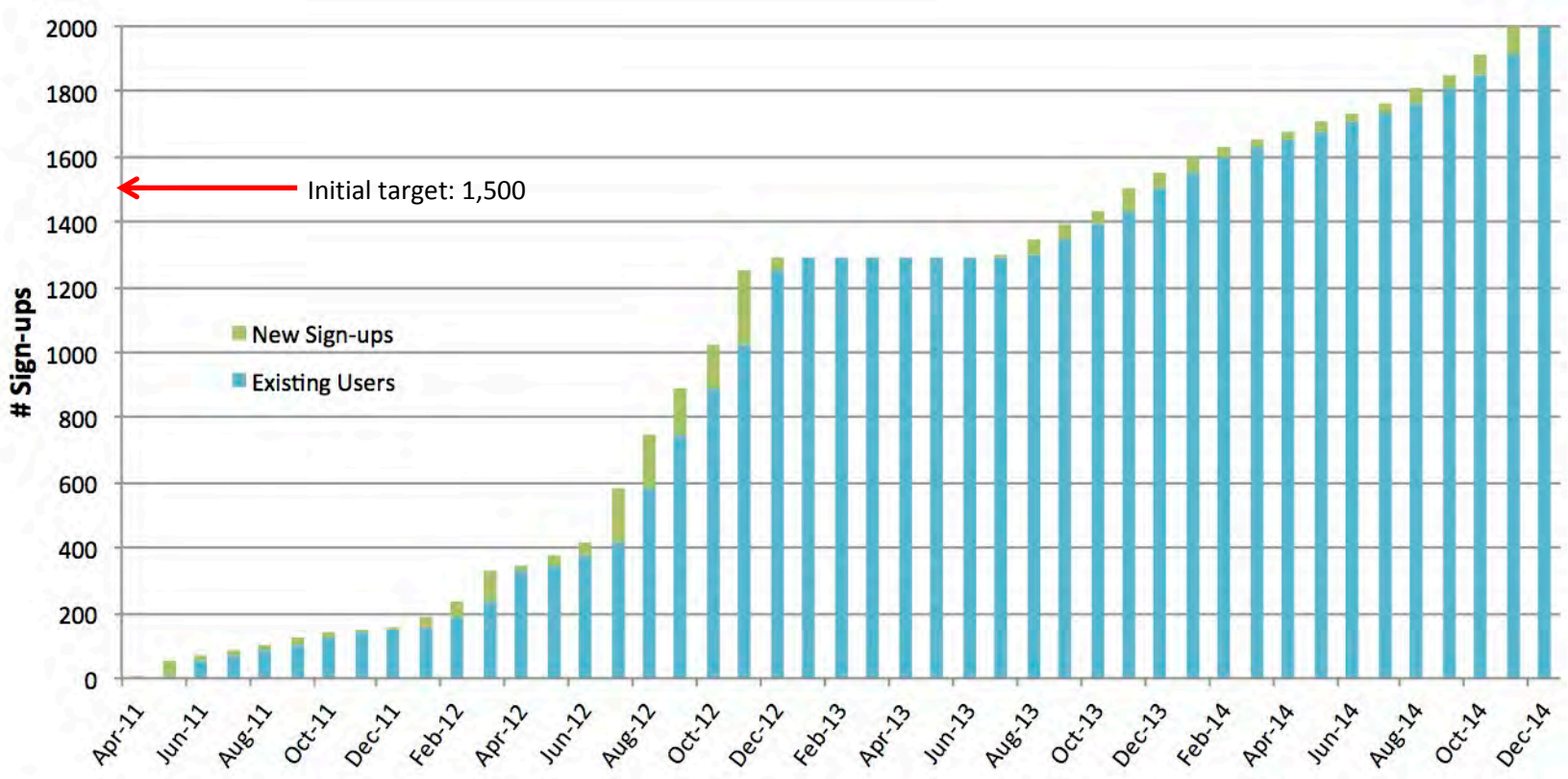


Figure 5 illustrates changes in EUMV enrollment over time. Note the jump in enrollment after July 2012, reflecting the adoption of EUMV's most effective outreach methods: a combination of municipal utility bill flyers, offering free energy-efficiency devices to enrollees, and holding free workshops. Also the lack of new sign-ups between December 2012 and June 2013 reflects the time the program was not accepting new sign-ups.

Outreach

The most successful outreach for the program was a combination of including flyers in Mountain View's bi-monthly City utility bills, offering free energy-efficient devices to all participants, and holding free, bi-monthly educational workshops.

City utility bill flyers took the form of a two-sided sheet of A4, colored paper (Appendix H). One side advertised the EUMV program while the other invited residents to a free community workshop about saving energy. In addition, the flyers offered residents a free energy-efficiency device with successful enrollment. The first version of the utility bill flyer included flashier professional-looking graphics, and was included with utility bills in late 2011. It resulted in very few sign-ups. The version that worked much better was less polished and lower cost. We concluded that the high quality version led residents to believe it was a commercially run program, whereas the more successful flyer reinforced that it was a city-run program.

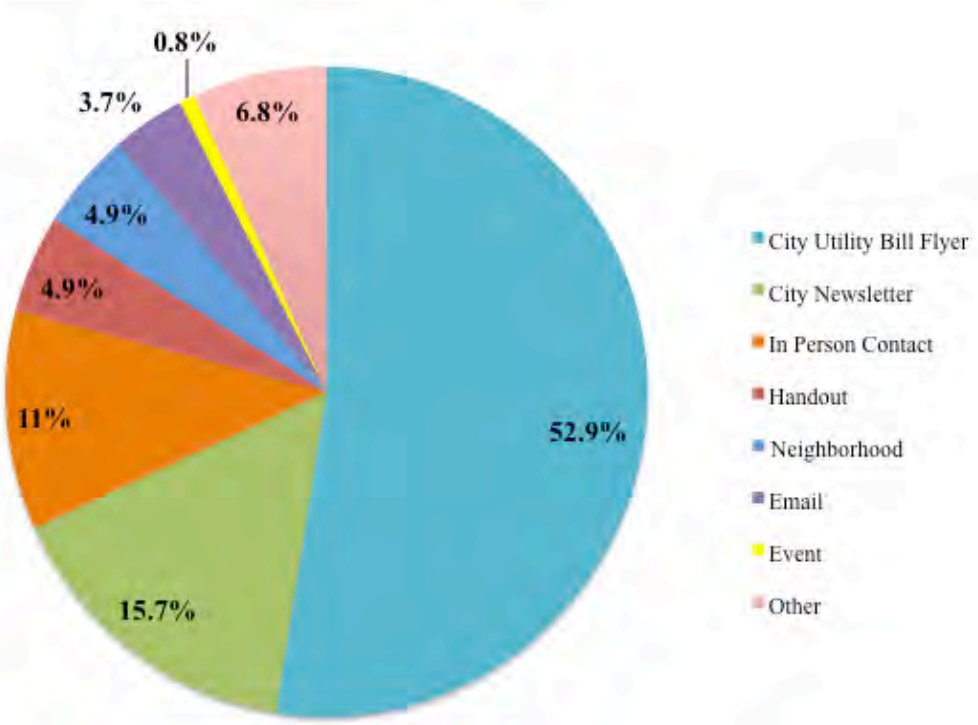
The energy efficiency devices were given to participants during the workshops and during business hours from the City's Public Works Department. The devices were "Smart" power strips or outlet timers. The free workshops, titled "Tame the Plug," were held bi-monthly at City Hall and were designed to encourage sign-ups. During the workshops, residents learned how EUMV worked, and they engaged in hands-on demonstrations of energy-saving light bulbs and other devices. The EUMV program received a lot of public appreciation for these educational workshops, which specifically excluded any commercial pitches from contractors.

Other forms of outreach included social media, both through the City and on EUMV's own Facebook page, attendance at community events such as Arbor Day and Farmers' Markets, visiting neighborhood association picnics, providing information at community service outlets such as the Senior Center, local churches, and schools, offering workshops at large apartment complexes, email marketing, and distributing flyers and postcards (Appendix I) in public locations. Most of these additional efforts produced insignificant sign-ups compared to the combination described above.

Figure 6 (next page) shows the percentage of sign-ups resulting from each outreach method. The majority of sign-ups clearly resulted from the City's utility bill flyers. The second most effective form of outreach (16%) was placing notices in the City's newsletter and local papers. Workshops and giveaways are not included in the analysis as both are secondary forms of encouragement that residents learned about from the utility bill flyers. For a complete list of outreach activities see Appendix F, "Outreach Report."

Finally, the program benefitted from excellent local press coverage, including a segment of CBS-TV5 news. Links to press coverage for EUMV can be found in Appendix G, "Media Coverage of the EUMV Program."

Figure 6: Effectiveness of Major Outreach Methods



Demographics

Distribution of Participants within Mountain View

Participants were distributed throughout the City of Mountain View, with a few clusters in Whisman Station, Cuesta Park, Old Mountain View, Blossom Valley, and Monte Loma neighborhoods (Figure 7). These were all areas where we had a neighborhood "champion" helping us spread the word about the program, indicating an important social component of outreach.

Figure 7: Location of Participants within Mountain View

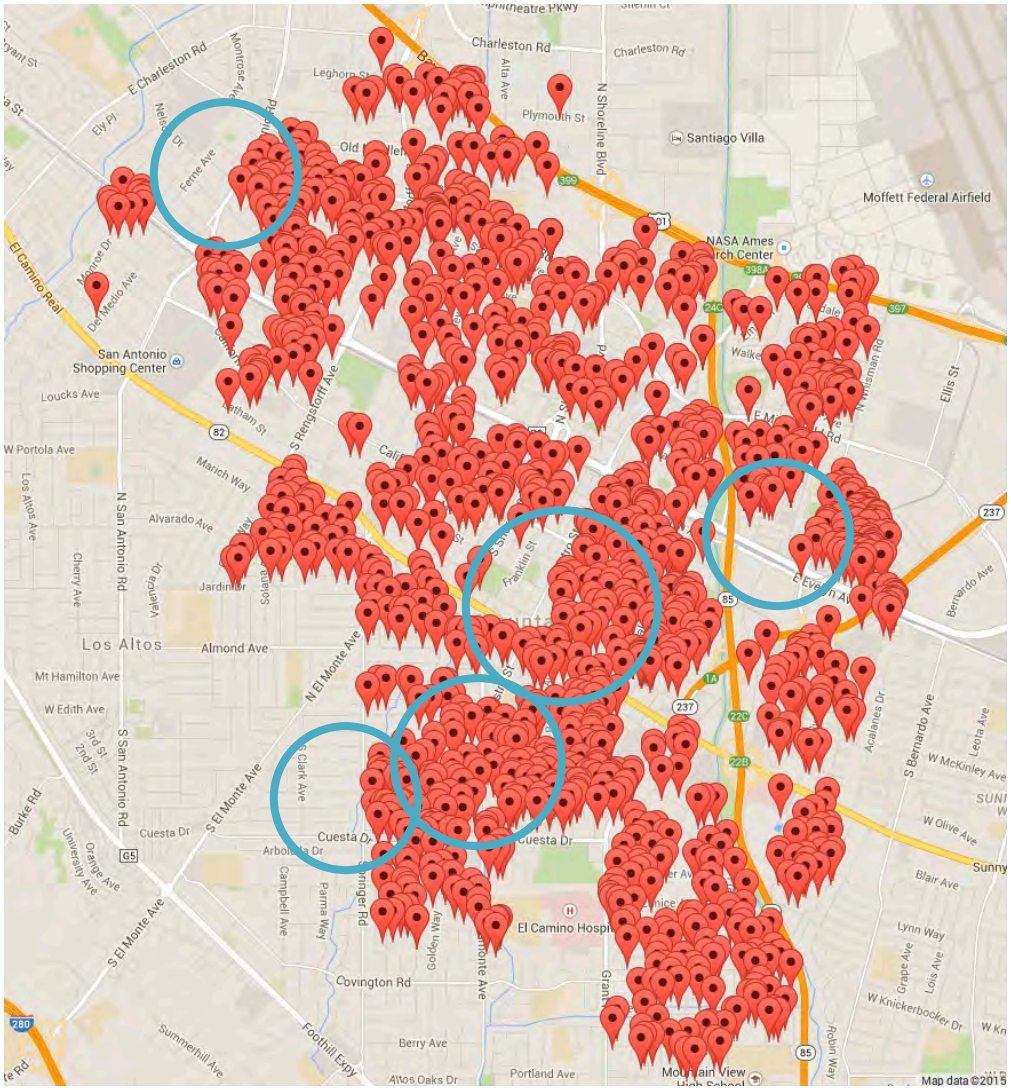


Figure 7 shows that EUMV participants were distributed broadly across Mountain View city boundaries.

Dwelling Type and Homeowners vs. Renters

Participants in the EUMV program were recruited from throughout the Mountain View community, with a special emphasis during EUMV-2 on residents of multi-family dwellings. Despite this, 68% of all participants lived in single-family residences, and 93% of these residents owned their homes. Table 7 and Figure 8 illustrate the breakdown of participants by type of residence.

Table 7: Distribution of EUMV Participants by Home Type

	Single Family	Condo	Duplex	Apartment	Mobile	Total
# Participants	840	338	35	25	1	1,239

Figure 8: Distribution of EUMV Participants by Home Type

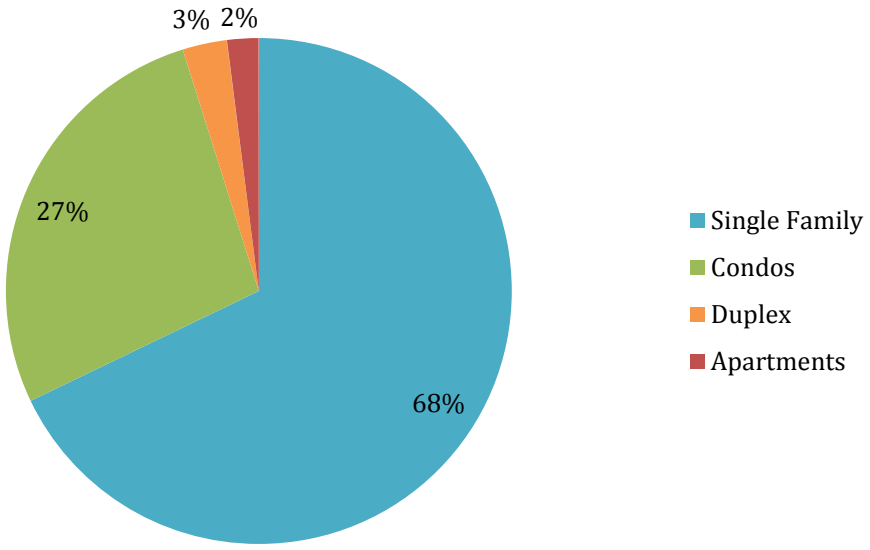


Figure 8 illustrates the percentage of EUMV participants living in each major type of dwelling. Residents of single-family homes were the largest demographic, with condo residents second.

While the program was offered to all residents, and despite a substantial outreach made to renters, the overwhelming majority of participants (90%) were homeowners (Figure 9). In contrast, homeowners make up only 41.8% of Mountain View's population.[13] Table 8 lists the number of participants in each residence type and indicates whether they were renters or owners. The largest group of renters (44%) lived in single-family homes.

[13] *This statistic is from the U.S. Census Bureau, http://quickfacts.census.gov/qfd/states/06/0649670.html*

Figure 9: EUMV Participant Homeowners and Renters

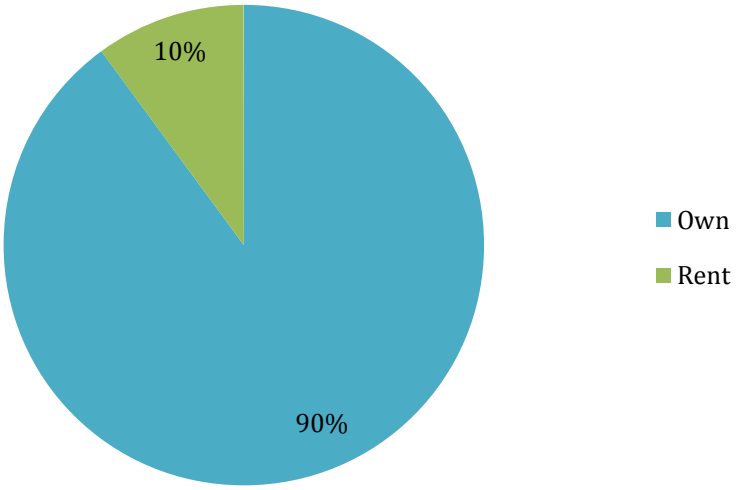


Figure 9 shows that the vast majority of EUMV participants were homeowners.

Table 8: Homeowners and Renters by Home Type

	Single-Family		Condo		Duplex		Mobile	Apartment		Total
	Own	Rent	Own	Rent	Own	Rent	Own	Own	Rent	
# Participants	785	55	302	36	19	16	1	7	18	1,239

Figure 10 shows that homeowners out numbered renters in every home category but Apartments. (The one mobile home in the study was owned by the resident, but not included in the chart.) Outreach efforts towards renters included free workshops at several apartment complexes, working directly with apartment managers and owners to publicize the program, using language on flyers clearly stating the program was available to renters, and identifying "influencers," people within the complexes who had already tried the program. Most likely, the lack of interest by renters may reflect the lack of control renters have over many of the items in their homes believed to contribute most to their energy use, e.g., refrigerators and HVAC systems. While there are several areas of home energy use that renters can control, many renters may have seen this lack of control as a barrier to joining the program.

Figure 10: Homeowners and Renters by Home Type

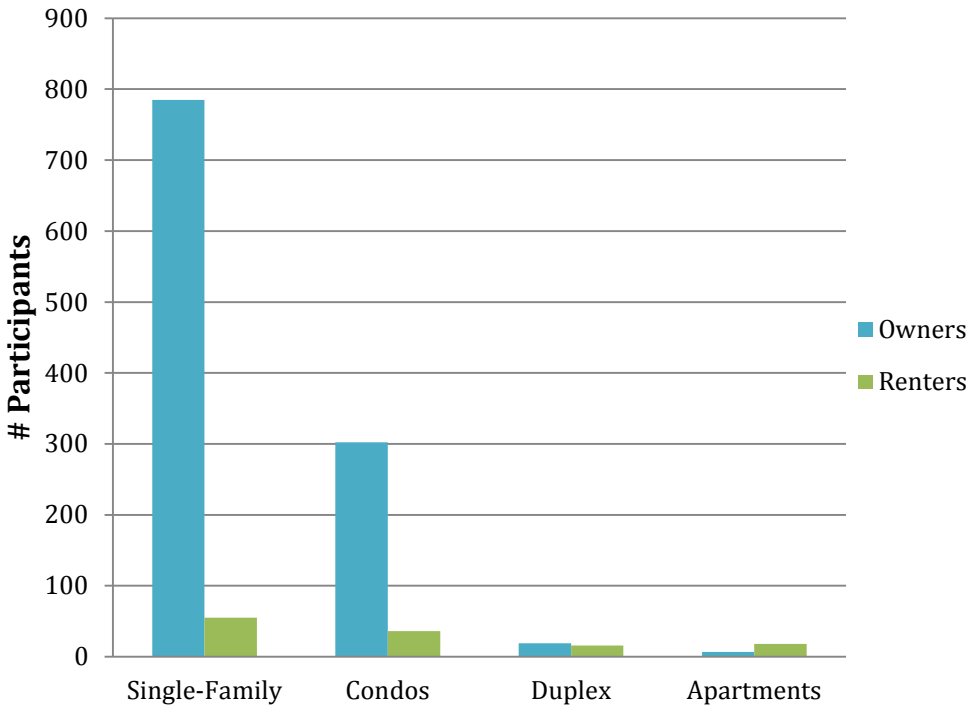


Figure 10 shows that residents of single-family homes and condos were far more likely to be homeowners. Residents of apartments were more likely to be renters. For duplex residents, the split was almost even.

Customer Satisfaction

All participants were given the opportunity to fill out a brief survey after completing their online data analysis. Unlike the question asking how they had heard of EUMV, the satisfaction survey was optional, so only 719 participants completed these surveys, equal to 58% of the 1,239 participants who completed the energy analysis.

Participants were asked to score four statements from 1 to 5, with 5 being the highest score and 1 being the lowest. The specific questions and results are shown in Table 9.

Table 9: Responses to Customer Satisfaction Survey

Survey Question	Score
1. I now have a better understanding of my energy use.	4.0
2. I now understand how to take some simple steps to reduce my energy	3.4
3. Learning about my energy use took a reasonable amount of time.	3.9
4. Information about my energy use was presented in a clear way.	4.0

The highest possible aggregate score from the survey is 20. EUMV achieved an average rating of 15.3. Eight percent (58 participants) of those who gave feedback gave a perfect score of 20. Only one participant gave the lowest possible score of 4; the next lowest scores were three 8's.

A similar survey was sent to participants via email at the end of the EUMV program. Participants were asked to rate their overall satisfaction with the program, on a scale of 1 to 10. The average response was 8.06 out of 10, indicating a high level of satisfaction with the EUMV program. Responses to other questions were similar to those above and are listed in full in Appendix C.

Conclusions

The Energy Upgrade Mountain View program was highly successful, attaining demonstrated and persistent energy savings by 1,576 participants during a program of 44 months. Moreover, the program was highly cost-effective in reducing both energy use and greenhouse gases, especially when compared with statewide programs, like the initial "home upgrade" phase of Energy Upgrade California. By offering residents a free program that gave them a diagnosis of *specifically* where their home was wasting energy (rather than generic recommendations), the EUMV program motivated participants to reduce energy waste and make continuous, persistent improvements. Broader adoption of such a diagnostic tool, followed by continuous, online monitoring and emailed reminders could result in significant savings on a state-wide and national scale.

The most significant findings were:

- Disaggregated energy data provides deep insights into potential energy savings.
- High electric base loads (idle loads) are an important component of home energy consumption, and they represent low hanging fruit for residential energy efficiency.

- EUMV cost significantly less than traditional HVAC-focused programs, such as the initial Energy Upgrade California program, while providing similar or better energy savings. *(See Table 6.)*
- Renters saved more than homeowners on cost and electricity use, while homeowners and renters realized equivalent savings in natural gas. *(See Figure 4.)*
- In terms of GHG emissions, natural gas savings had a much larger impact than electricity savings.
- Partnering with a city to utilize its communication channels is a highly effective method for enrolling participants.

Appendix A — Calculating and Estimating Changes in Energy Consumption

Each participant had to have a year's worth of PG&E data prior to enrolling to establish an energy consumption baseline. (Lacking 12 months of energy data was the primary cause of ineligibility, but residents were automatically notified when they had accumulated 12 months and most joined the program then.) This baseline was then used in determining energy consumption changes. For example, for each participant, electricity (kWh) savings were computed by comparing the prior year's data (the "rolling 12 month total") with the baseline 12 month total. This avoided issues related to seasonal usage patterns.

Additionally, the portion of energy used for heating or cooling was weather-normalized. Weather normalization was done using local (Mountain View) Heating Degree Days (HDD60s) and Cooling Degree Days (CDD70s). Degree Days are based on the approximate outside temperature at which a house can be expected to begin heating or cooling. Weather normalization allows for comparing changes in energy consumption without the effect of weather. In other words, if we had a colder December this year than we did last year, we will have more HDDs for December then we did last year. With a year or more of participation in EUMV, HEA's software was able to present the actual and accurate difference in energy consumption across all energy categories in the Home Energy Profile.

Some participants (250 people) did not have a year's worth of new data available for analysis at the end of the program. For these participants, partial year results were extrapolated conservatively using CDD/HDD proportionalities in a method developed together with Bevilacqua Knight Inc (BKi).[14] Results were not shown for participants until they had at least two months of new energy consumption data since their enrollment date.

Lacking standard, published methods for this type of residential smart meter evaluation, measurement, and verification (EM&V) analysis, HEA and its partners believe this is the most accurate approach available.

[14] http://www.bki.com/

Appendix B — Savings Data

All Users

Table 10 shows the types of yearly savings achieved across all users, and for the top quartile, by energy use (load) category. All electricity figures are in kWh per year; all natural gas figures are in therms per year. The top quartile is based on savings of GHGs.

Table 10: Comparison of Average Savings for All Participants and Top Quartile of Savers

	All Participants [15] (1,529)			Top Quartile (382)		
Energy Use Type	**Initial**	**Change**	**% Chg**	**Initial**	**Change**	**% Chg**
Electricity (kWh)	**5,453**	**-301**	**-5.50**	**6,661**	**-965**	**-14.50**
Electric Base	1,787	-92	-5.10	2,232	-273	-12.20
Electric Recurring	396	-31	-7.80	564	-119	-21.10
Electric Variable	2,720	-107	-3.90	3,221	-379	-11.80
Electric Cooling	171	-26	-15.10	221	-93	-42.00
Electric Heating	389	-39	-9.90	431	-66	-15.30
Natural Gas (therms)	**378**	**-62**	**-16.40**	**503**	**-164**	**-32.60**
Natural Gas Base	160	-7	-4.40	205	-31	-15.20
Natural Gas Variable	25	-22	-88.00	42	-40	-94.80[16]
Natural Gas Heating	197	-38	-19.10	261	-98	-37.70

[15] *As noted in the "Savings Data" section on page 10, average savings were computed for the 1,239 "Active" participants, and this number was then extrapolated to cover all the 1,529 participants.*

[16] *This large percentage change is an artifact of the small subset of users who exhibited variable gas usage. Most likely, this category was dominated by people who had been heating their pools.*

Savings by Home Type and Load Type

The treatment programs in Tables 11, 12, and 14 are abbreviated and defined as follows:

- HiHC: High Heating and/or Cooling loads (HVAC).
- HiPlug: High plug loads (base electric use).
- HiRec: High recurring electric loads (same time every day).
- HiVar: High Variable or behavioral energy use.
- Online: All participants who did not fall into one or more of the above categories.
- None/Unassigned: Participants did not progress far enough in the survey to be assigned to a specific treatment program.

The data types in Tables 11 and 12 are abbreviated and defined as follows:

- Count of AuditID: Number of participants included.
- Average of BaseChgA_kWh: Average change in kWhs of base electric load.
- Average of RecurChgA_kWh: Average change in kWhs of recurring electric load.
- Average of VarChgA_kWh: Average change in kWhs of variable electric load.
- Average of CoolChgA_kWh: Average change in kWhs of cooling electric load.
- Average of HeatChgA_kWh: Average change in kWhs of heating electric load.
- Average of BaseChgA_th: Average change in therms of base natural gas load.
- Average of VarChgA_th: Average change in therms of variable natural gas load.
- Average of HeatChgA_th: Average change in therms of heating natural gas load.

The data types in Table 14 are abbreviated and defined as follows:

- Count of AuditID: Number of participants included.
- Average of SqFt: Average size of home, in square feet.
- Average of CostChgA: Average annual cost change in dollars, with heating and cooling values adjusted (normalized) for weather changes.
- Average of WattsChg: Average continuous demand change in watts.
- Average of ElecChgA: Average annual electric change in kWhs, with heating and cooling values adjusted (normalized) for weather changes.
- Average of GasChgA: Average annual natural gas change in therms, with heating and cooling values adjusted (normalized) for weather changes.
- Average of AnnualGHGs: Average annual change in annual GHG emissions, in lbs. CO_2e.
- Average of CumGHGs: Average cumulative change in GHG emissions, in lbs. CO_2e, over the duration each participant was in the program.

Table 11: Load Savings for Duplexes, Mobile Homes, and Single-Family Residences

Green represents savings and red indicates an increase in usage. See the previous page for a definition of column headings. (SFR is an abbreviation for Single Family Residence.)

		Program						
homeTyp	Data	HiHC	HiPlug	HiRec	HiVar	Online	None	Grand Tot
duplex-own	Count of AuditID					11	8	19
	Average of BaseChgA_kWh					10	(63)	(21)
	Average of RecurChgA_kWh					(22)	55	11
	Average of VarChgA_kWh					238	(268)	25
	Average of CoolChgA_kWh					(101)	(31)	(72)
	Average of HeatChgA_kWh					(35)	6	(18)
	Average of BaseChgA_th					(14)	(23)	(18)
	Average of VarChgA_th					(7)	(12)	(9)
	Average of HeatChgA_th					(23)	(35)	(28)
duplex-rent	Count of AuditID		1			7	8	16
	Average of BaseChgA_kWh		(201)			63	(96)	(33)
	Average of RecurChgA_kWh		(80)			13	(25)	(12)
	Average of VarChgA_kWh		519			(22)	(240)	(97)
	Average of CoolChgA_kWh		158			(59)	58	13
	Average of HeatChgA_kWh		(353)			(12)	(265)	(160)
	Average of BaseChgA_th		(14)			(4)	(32)	(18)
	Average of VarChgA_th		0			(2)	(19)	(10)
	Average of HeatChgA_th		49			(38)	(19)	(23)
mobile-own	Count of AuditID						1	1
	Average of BaseChgA_kWh						(306)	(306)
	Average of RecurChgA_kWh						(140)	(140)
	Average of VarChgA_kWh						(692)	(692)
	Average of CoolChgA_kWh						11	11
	Average of HeatChgA_kWh						(241)	(241)
	Average of BaseChgA_th						0	0
	Average of VarChgA_th						0	0
	Average of HeatChgA_th						0	0
SFR-own	Count of AuditID	103	27	2	15	254	384	785
	Average of BaseChgA_kWh	(90)	(556)	172	(294)	(58)	(121)	(114)
	Average of RecurChgA_kWh	(26)	(136)	(887)	(60)	5	(39)	(29)
	Average of VarChgA_kWh	(118)	(14)	1,424	(375)	(58)	(172)	(122)
	Average of CoolChgA_kWh	(51)	(57)	2	(91)	(35)	(6)	(25)
	Average of HeatChgA_kWh	(15)	(56)	(139)	(122)	12	(62)	(33)
	Average of BaseChgA_th	(17)	(8)	55	(11)	(8)	(6)	(8)
	Average of VarChgA_th	(26)	(57)	(4)	(7)	(14)	(30)	(25)
	Average of HeatChgA_th	(64)	(54)	(10)	(36)	(38)	(43)	(44)
SFR-rent	Count of AuditID		1		3	25	26	55
	Average of BaseChgA_kWh		(1,399)		(1,023)	32	(235)	(178)
	Average of RecurChgA_kWh		(248)		72	(25)	(99)	(58)
	Average of VarChgA_kWh		(2,196)		404	(91)	(335)	(218)
	Average of CoolChgA_kWh		(410)		(39)	(74)	(7)	(46)
	Average of HeatChgA_kWh		331		(110)	(106)	(154)	(121)
	Average of BaseChgA_th		11		(23)	(20)	(13)	(16)
	Average of VarChgA_th		0		(43)	(14)	(13)	(15)
	Average of HeatChgA_th		(59)		(51)	(71)	(35)	(53)
Total Count of AuditID		103	35	3	31	460	607	1239
Total Average of BaseChgA_kWh		(90)	**(528)**	176	(318)	(52)	(86)	(92)
Total Average of RecurChgA_kWh		(26)	(127)	**(1,200)**	(76)	(6)	(37)	(31)
Total Average of VarChgA_kWh		(118)	(91)	842	**(395)**	(47)	(141)	(107)
Total Average of CoolChgA_kWh		(51)	(76)	5	(152)	(41)	(1)	(26)
Total Average of HeatChgA_kWh		(15)	(68)	(237)	(160)	(11)	(54)	(39)
Total Average of BaseChgA_th		(17)	(9)	36	(9)	(8)	(5)	(7)
Total Average of VarChgA_th		(26)	(45)	(3)	(12)	(14)	(26)	(22)
Total Average of HeatChgA_th		**(64)**	(44)	(7)	(31)	(35)	(35)	(38)

Table 12: Energy Load Savings for Apartments and Condos

Green represents savings and red indicates an increase in usage. See the prior "Savings by Home Type and Load Type" section for definitions of column and row headings.

		Program						
homeTyp	Data	HiHC	HiPlug	HiRec	HiVar	Online	None	Grand Tot
apt-own	Count of AuditID					2	5	7
	Average of BaseChgA_kWh					82	456	349
	Average of RecurChgA_kWh					(368)	(57)	(146)
	Average of VarChgA_kWh					(88)	(23)	(41)
	Average of CoolChgA_kWh					(11)	(121)	(90)
	Average of HeatChgA_kWh					(112)	(130)	(125)
	Average of BaseChgA_th					16	(16)	(7)
	Average of VarChgA_th					(38)	11	(3)
	Average of HeatChgA_th					(26)	11	0
apt-rent	Count of AuditID		1		1	7	9	18
	Average of BaseChgA_kWh		163		(173)	62	84	66
	Average of RecurChgA_kWh		(294)		(1,423)	(10)	(10)	(104)
	Average of VarChgA_kWh		445		(1,532)	(163)	257	5
	Average of CoolChgA_kWh		(30)		(458)	9	1	(23)
	Average of HeatChgA_kWh		3		(956)	(70)	(207)	(183)
	Average of BaseChgA_th		(80)		0	(7)	(2)	(8)
	Average of VarChgA_th		(33)		0	(1)	(9)	(7)
	Average of HeatChgA_th		10		0	(15)	(14)	(12)
condo-own	Count of AuditID		4		9	140	149	302
	Average of BaseChgA_kWh		(415)		(234)	(77)	(12)	(54)
	Average of RecurChgA_kWh		109		(11)	(9)	(32)	(19)
	Average of VarChgA_kWh		(172)		(694)	(45)	(58)	(73)
	Average of CoolChgA_kWh		(98)		(249)	(44)	32	(13)
	Average of HeatChgA_kWh		(270)		(85)	(25)	(14)	(25)
	Average of BaseChgA_th		(4)		(7)	(6)	1	(2)
	Average of VarChgA_th		(0)		(16)	(16)	(24)	(20)
	Average of HeatChgA_th		(20)		(22)	(24)	(22)	(23)
condo-rent	Count of AuditID		1	1	3	14	17	36
	Average of BaseChgA_kWh		(392)	184	(36)	(46)	28	(14)
	Average of RecurChgA_kWh		(582)	(1,825)	(45)	(76)	1	(100)
	Average of VarChgA_kWh		(900)	(322)	(21)	30	30	(10)
	Average of CoolChgA_kWh		(458)	11	(183)	(18)	(149)	(105)
	Average of HeatChgA_kWh		247	(433)	(359)	(57)	96	(12)
	Average of BaseChgA_th		4	0	6	(1)	1	1
	Average of VarChgA_th		0	0	(0)	(15)	(20)	(15)
	Average of HeatChgA_th		(15)	0	(22)	(34)	(10)	(20)
Total Count of AuditID		103	35	3	31	460	607	1239
Total Average of BaseChgA_kWh		(90)	**(528)**	176	(318)	(52)	(86)	(92)
Total Average of RecurChgA_kWh		(26)	(127)	**(1,200)**	(76)	(6)	(37)	(31)
Total Average of VarChgA_kWh		(118)	(91)	842	**(395)**	(47)	(141)	(107)
Total Average of CoolChgA_kWh		(51)	(76)	5	(152)	(41)	(1)	(26)
Total Average of HeatChgA_kWh		(15)	(68)	(237)	(160)	(11)	(54)	(39)
Total Average of BaseChgA_th		(17)	(9)	36	(9)	(8)	(5)	(7)
Total Average of VarChgA_th		(26)	(45)	(3)	(12)	(14)	(26)	(22)
Total Average of HeatChgA_th		**(64)**	(44)	(7)	(31)	(35)	(35)	(38)

Idle Load Savings

Table 13: Comparison of Idle Loads by Home Type and Ownership

	Single-Family		Condo		Duplex		Apartment		Total
Ownership Status	**Own**	**Rent**	**Own**	**Rent**	**Own**	**Rent**	**Own**	**Rent**	
# Participants	785	55	302	36	19	16	7	18	1,238
Idle Loads (W) [17]									
Minimum	40	40	20	17	24	40	10	10	
Average	233	188	170	153	175	118	76	93	
Maximum	1,301	777	705	493	417	237	225	175	

[17] *The unit for idle loads is watts, not kilowatt-hours. This is because idle load is measuring continuous energy use, rather than use over a set period of time.*

Figure 12: Comparison of Idle Loads by Home Type and Ownership

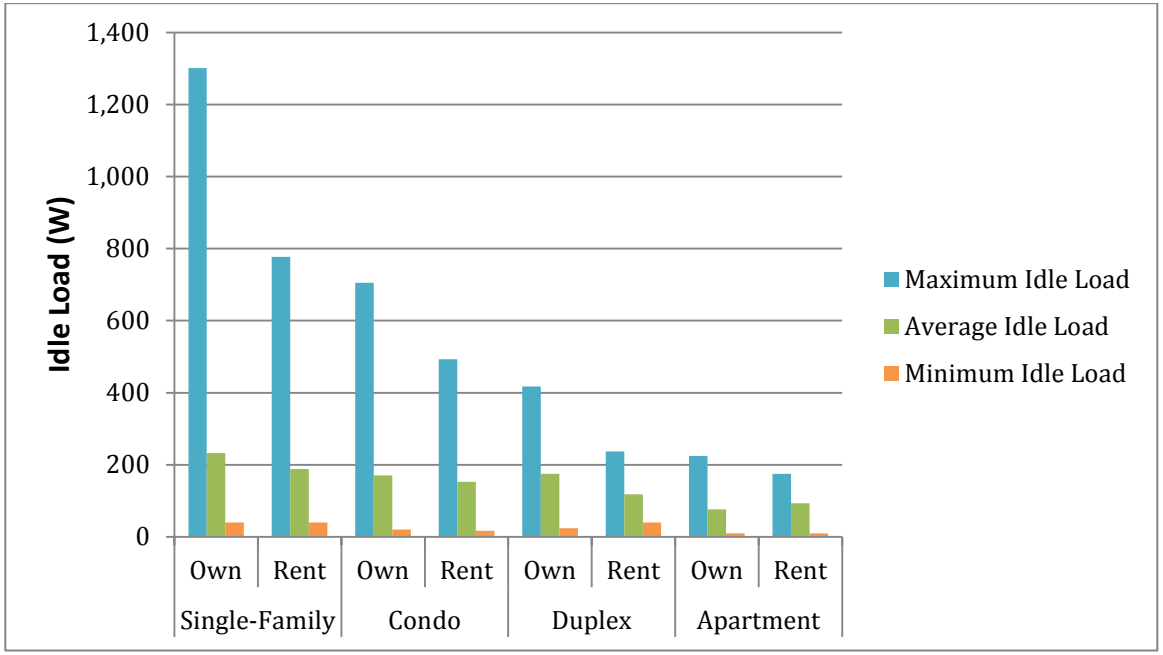


Figure 12 shows that single-family homes, whether owned or rented, had the highest maximum idle loads. Single-family homeowners had the highest average idle load and apartment dwellers the lowest. However, average idle loads were fairly similar across home types.

Savings by EUMV Phase

Table 14: Comparison of Load Type Savings between Phases of EUMV

Green represents savings and red indicates an increase in usage. See the prior "Savings by Home Type and Load Type" section for definitions of column and row headings.

		Program							
EUMV Phase	Data	HiHC	HiPlug	HiRec	HiVar	Online	Unassigned	Grand Total	
Phase 1	Count of AuditID	36	15	2	19	175	569	816	
	Average of SqFt	1,878	2,405	1,398	1,500	1,593	1,587	1,614	
	Average of CostChgA	($75)	($406)	($182)	($234)	($4)	($37)	($43)	
	Average of WattsChg	(12)	(77)	40	(16)	(14)	(10)	(12)	
	Average of ElecChgA	(284)	(1,399)	(1,016)	(1,237)	(207)	(331)	(345)	
	Average of GasChgA	(99)	(113)	(31)	(43)	(48)	(62)	(61)	
	Average of AnnualGHGs	(1,486)	(2,251)	(952)	(1,231)	(751)	(1,001)	(997)	
	Average of CumGHGs	(3,553)	(5,386)	(2,270)	(3,110)	(1,870)	(2,569)	(2,526)	
Phase 2	Count of AuditID	67	20	1	12	285	38	423	
	Average of SqFt	1,851	2,335	2,682	1,518	1,551	1,658	1,647	
	Average of CostChgA	($175)	($314)	$312	($235)	($35)	$36	($69)	
	Average of WattsChg	(38)	(57)	56	(25)	(10)	(3)	(16)	
	Average of ElecChgA	(307)	(490)	59	(939)	(162)	(97)	(216)	
	Average of GasChgA	(102)	(78)	126	(65)	(58)	(50)	(65)	
	Average of AnnualGHGs	(1,527)	(1,311)	1,724	(1,362)	(861)	(728)	(984)	
	Average of CumGHGs	(1,022)	(774)	1,437	(1,198)	(597)	(1,021)	(723)	Extended
Total Count of AuditID		103	35	3	31	460	607	**1239**	**1576**
Total Average of SqFt		1,861	2,365	1,826	1,507	1,567	1,592	1,625	1,625
Total Average of CostChgA		($140)	($354)	($17)	($235)	($23)	($32)	($52)	($82,077)
Total Average of WattsChg		(29)	(66)	45	(20)	(11)	(10)	(14)	(21,653)
Total Average of ElecChgA		(299)	(880)	(658)	(1,122)	(179)	(316)	(301)	(474,109)
Total Average of GasChgA		(101)	(93)	21	(52)	(54)	(61)	(62)	(97,888)
Total Average of AnnualGHGs		(1,513)	(1,714)	(60)	(1,282)	(819)	(984)	(993)	(1,564,612)
Total Average of CumGHGs		(1,907)	(2,750)	(1,034)	(2,370)	(1,081)	(2,472)	(1,910)	(3,010,580)

Home Energy Monitor Savings

Among all participants, the number who used a home energy monitor device (Aztech© HAN) was quite small (14), and the changes represent savings over only the initial six months of their participation. Follow-up analysis of the next six months showed a decrease in savings, and this data is not included in Table 15. This rebound effect was not found, however, among the larger set of EUMV participants who had been with the program over several years and demonstrated sustained savings.

Table 15: Comparison of Average Savings: All Active Participants vs. Home Energy Monitor Recipients

	All Active Participants (1,239)			Home Energy Monitor Users (14)		
Savings Categories	**Initial**	**Change**	**% Change**	**Initial**	**Change**	**% Change**
Electricity (kWh)	**5,453**	**-301**	**-5.50**	**9,213.17**	**-1,046.10**	**-11.35**
Electric Base	1,787	-92	-5.10	3,256.49	-302.05	-9.28
Electric Recurring	396	-31	-7.80	847.66	-203.54	-24.01
Electric Variable	2,720	-107	-3.90	4,307.65	-352.04	-8.17
Electric Cooling	171	-26	-15.10	408.67	-179.96	-44.03
Electric Heating	389	-39	-9.90	400.64	-19.49	-4.86
Natural Gas (therms)	**378**	**-62**	**-16.40**	**381.33**	**-58.60**	**-15.37**
Natural Gas Base	160	-7	-4.40	179.89	-17.99	-10.00
Natural Gas Variable	25	-22	-88.00	23.34	-20.69	-88.61
Natural Gas Heating	197	-38	-19.10	188.80	-30.49	-16.15
Annual GHG (lbs. CO_2e)	**N/A**	**-993**	**N/A**	**N/A**	**-16,036.00**	**N/A**

Appendix C — Customer Satisfaction

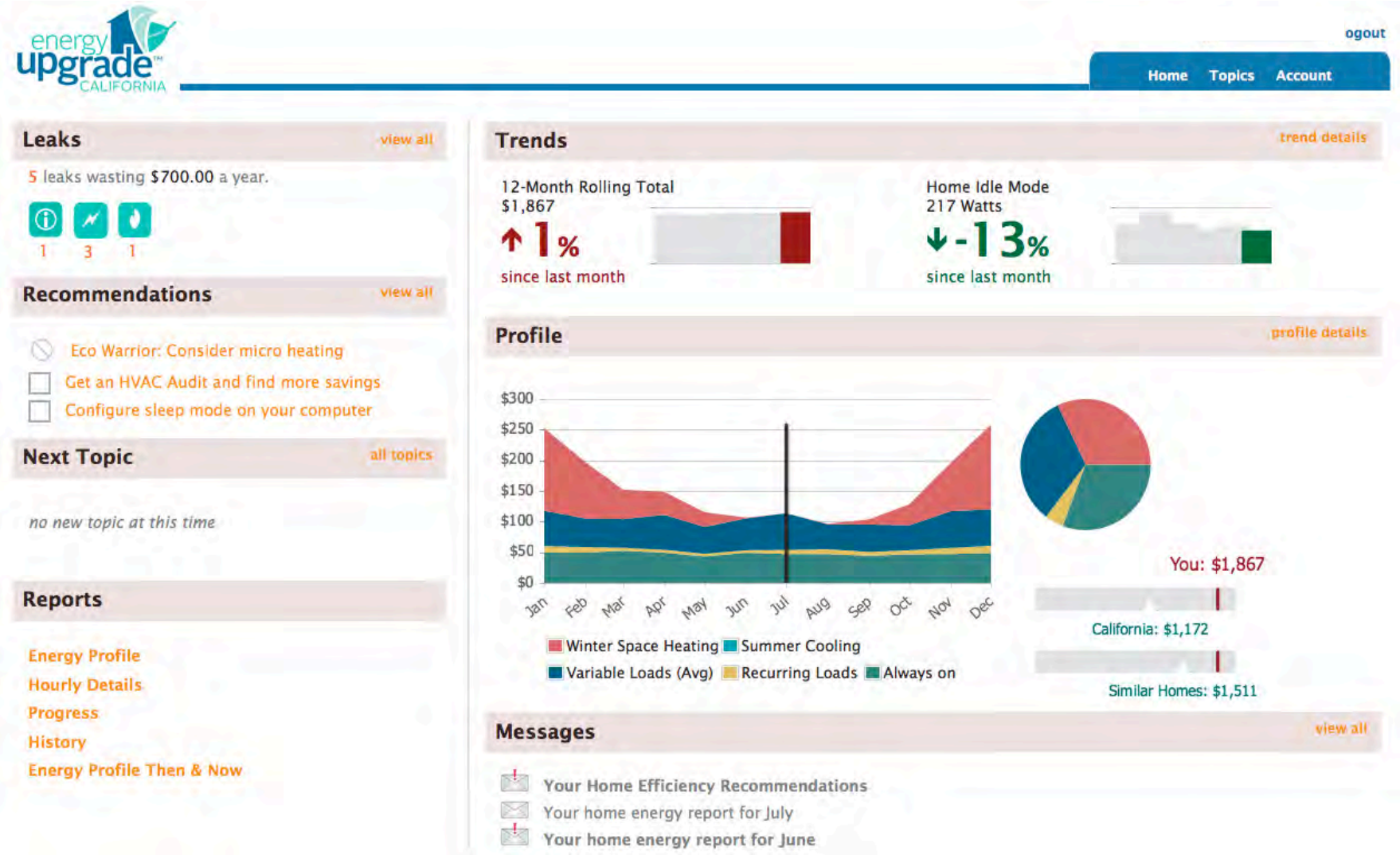
Table 16: Results of Emailed Customer Satisfaction Survey

Question	Average Response (211 responses)	% Strongly Agree or Agree[18]
1. On a scale of 1 to 10, with 10 being highest satisfaction, please rate your overall satisfaction with the EUMV program.	8.05/10	N/A
2. Please tell us if you agree or disagree with this statement: Learning about my home's energy use took a reasonable amount of time.	3.73/5	66.29%
3. Please tell us if you agree or disagree with this statement: The online information about my home's energy use was presented in a clear and concise way.	4.02/5	82.31%
5. Please tell us if you agree or disagree with this statement: I have learned simple steps for saving energy at home through my participation in this program.	3.90/5	74.61%
7. Please tell us if you agree or disagree with this statement: I would recommend this program to my friends and neighbors (assuming it restarts).	4.17/5	81.59%
8. Please tell us if you agree or disagree with this statement: The Energy Upgrade Mountain View program is a good use of my city's tax dollars.	4.10/5	80.00%

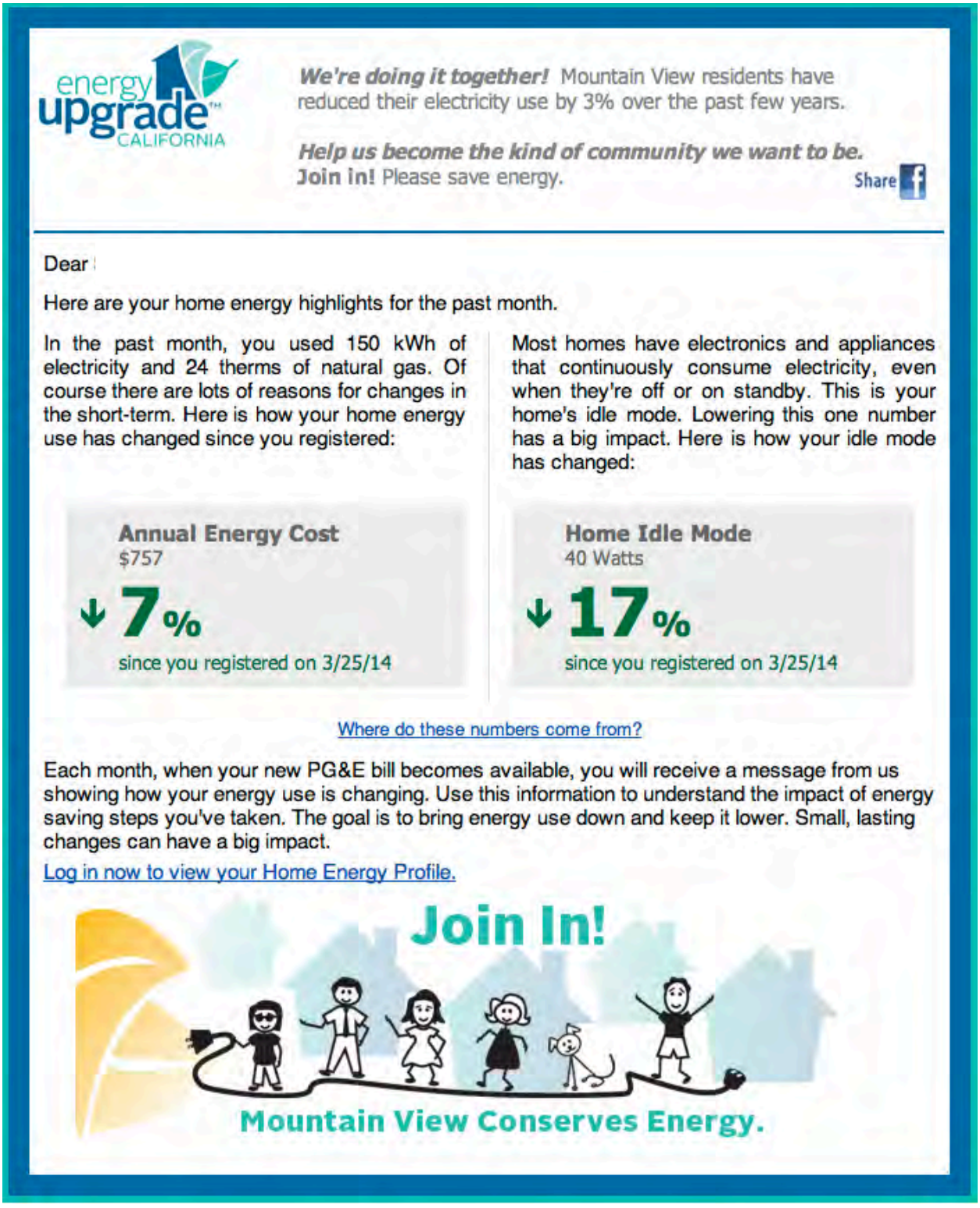
Question	Yes	No
4. Have you seen a reduction in your utility bill since starting the EUMV program?	68.75%	31.25%
6. Have you followed up with any of the commitments to change you made during this program? For example, installing efficient light bulbs, plugging electronics into a smart power strip, or getting rid of your second refrigerator.	82.65%	17.35%

[18] *Percent strongly agree or agree is the percentage of respondents who answered either "Strongly Agree" or "Agree" in the survey. Possible responses were: "Strongly Agree," "Agree," "Neutral," "Disagree," and "Strongly Disagree." This data is N/A for question 1 as that question was on the numerical 1 to 10 scale and did not include value labels for each number.*

Appendix D — Example of Participant HEA Home Page



Appendix E — Example of Monthly Emailed Energy-Savings Reports



energy upgrade™ CALIFORNIA

We're doing it together! Mountain View residents have reduced their electricity use by 3% over the past few years.

Help us become the kind of community we want to be.
Join in! Please save energy.

Share

Dear

Here are your home energy highlights for the past month.

In the past month, you used 150 kWh of electricity and 24 therms of natural gas. Of course there are lots of reasons for changes in the short-term. Here is how your home energy use has changed since you registered:

Annual Energy Cost
$757
↓ **7%**
since you registered on 3/25/14

Most homes have electronics and appliances that continuously consume electricity, even when they're off or on standby. This is your home's idle mode. Lowering this one number has a big impact. Here is how your idle mode has changed:

Home Idle Mode
40 Watts
↓ **17%**
since you registered on 3/25/14

Where do these numbers come from?

Each month, when your new PG&E bill becomes available, you will receive a message from us showing how your energy use is changing. Use this information to understand the impact of energy saving steps you've taken. The goal is to bring energy use down and keep it lower. Small, lasting changes can have a big impact.

Log in now to view your Home Energy Profile.

Appendix F — Marketing and Outreach Activities

This appendix highlights the marketing and outreach activities undertaken during the course of the EUMV program.

During the first year of EUMV-1 (April 2011–April 2012), the following marketing and outreach activities were undertaken, as detailed in an April 20, 2012 Staff Memorandum to Michael Fuller, Mountain View Public Works Director, from Steve Attinger, Mountain View Environmental Sustainability Coordinator:

Marketing Collateral

To facilitate outreach, the EUMV team produced the following pieces of marketing collateral: a comprehensive, user-friendly web site (www.EnergyUpgradeMV.org), a Facebook page, posters, pamphlets, flyers, door hangers, postcards, and business cards.

Outreach Channels and Events

To drive program participation, during the EUMV-1 period, the program team participated in a wide variety of community outreach activities, including:

Online

- Highlighting the program on the City's home page scrolling banner
- Featuring the program on the City's Environmental Sustainability web page
- Secured an article in the *Mountain View Voice* (published on 3/2/12)
- Arranged for a news story and article on CBS Channel 5 (aired on 3/21/12)
- Writing a series of blog articles for the "Mountain View Patch" web site
- Having a featured article on the "I Love MV" web site

Community Events

- Sending letters to all Neighborhood Association leaders
- Attending 3 Neighborhood Association meetings
- Distributing flyers at 25 Farmer's Market events
- Tabling at 3 Thursday Night Live events
- Tabling at the Spring Family Parade
- Attending 4 film nights hosted by the Mountain View Coalition for Sustainable Planning (MVCSP)
- Hosting a presentation by Rev. Sally Bingham, founder of California Interfaith Power and Light, which highlighted the imperative of lightening our individual carbon footprints
- Conducting focus groups with different resident populations to identify barriers to participation and to test outreach messages
- Conducting HouseCall "blitzes" at the Meadowood and Whisman Crossing multi-family complexes

Marketing/Advertising

- Writing 10 articles in 7 Neighborhood Association newsletters
- Including a flyer in a full run of almost 1,700 utility bills
- Distributing outreach materials to approximately 2,000 residences via neighborhood canvassing
- Highlighting the program in each edition of *The View* since April 2011
- Securing over 26,000 impressions of an ad on Facebook over 2 weeks
- Securing 775 impressions of an ad on Google over 2 months based on 50 targeted search phrases
- Running print and online ads in the *Mountain View Voice* in April 2012
- Running an ad in the *Fogster* classifieds
- Running a Public Service Announcement on KMVT starting in July 2011
- Contacting faith groups, including mailing 30 letters to local churches
- Working with local community organizations, including the Chamber of Commerce, Green Mountain View, and the Rotary Club

Schools

- Meeting with the superintendents of the Mountain View-Whisman and Mountain View-Los Altos school districts
- Meeting with faculty advisors, parent volunteers, and Environmental Club leaders at Los Altos High School and Mountain View High School
- Attending 8 Back-to-School nights at all Mountain View-Whisman schools
- Having EUMV highlighted:
  - in an announcement in all Mountain View-Whisman school district newsletters
  - in a letter to all teachers and staff in the Mountain View-Whisman school district
  - in an email to the Mountain View-Los Altos school district community
- Securing an announcement about a neighborhood walkathon event in the MVHS student newsletter to attract volunteers

Multi-Lingual

- Developing flyers in Spanish, Chinese, and Russian, and including multi-lingual links on the web site
- Distributing outreach materials to non-English-speaking populations through the City's Community Outreach program

During the 2012–13 fiscal year, other creative methods were adopted to call attention to the EUMV program, including a large weatherproof banner that was hung across Castro Street, Mountain View's "Main Street." During this time, EUMV also began to include flyers in the City's utility bill to advertise free workshops at the Mountain View City Hall to explain the EUMV program. The workshops included hands-on demonstrations of energy-saving devices and those who signed up for EUMV were give a free energy-saving socket timer valued at $10 retail.

Table 17 details outreach activities from July 1, 2013 through December 31, 2014, when Acterra served as the prime contractor for EUMV-2 and had full outreach responsibility:

Table 17: EUMV-2 Outreach Activities

Number	Type of Outreach	Comments
11 mailings of City utility bill inserts	Flyers were inserted into Mountain View's municipal utility bills, publicizing EUMV and the workshops	Approximately 1,700 households received an insert via each of these 11 mailings
11 workshops	Workshop at Mountain View City Hall to explain EUMV and do hands-on demonstrations of energy efficiency lights and devices. Attendees were welcomed by City Council members.	Workshops presented Sept. 2013 to Nov. 2014: 9/12/13 4/30/14 10/10/13 5/15/14 11/7/13 9/4/14 1/22/14 10/2/14 2/24/14 11/3/14 3/26/14
23 mass emailed messages	Email: to Neighborhood Association leaders, workshop participants, people met during tabling, etc.	The standard "open rate" for the non-profit industry ranges from 25.7% (MailChimp) to 32% (Constant Contact). For the messages in which Acterra kept records, the "open rate" was 40.9%.
4 messages	Targeted email to: -- hardware store owners -- "opinion leaders" including City Council members, Chamber of Commerce staff and officers, others --Green Certified businesses in Mountain View -- signed-up participants with high HVAC loads, referring them to EUCA	The response to these targeted messages was negligible
12 events	Tabling	Events attended July 2013-Nov. 2014: -- Downtown Thursday Nite Live -- Spring Parade -- Blossom Hill Neighborhood Association -- TEDx Women's Conference -- Environmental Fair, St. Francis High School -- Mtn. View Senior Center Conference -- Unitarian Church Green Fair -- Mountain View Arbor Day -- Girl Scouts Workshop -- El Camino Hospital Employee Fair -- Mtn. View Green Kids Conference -- Mtn. View Senior Resource Fair

Number	Type of Outreach	Comments
7 events	Neighborhood Association (NA) events, July 2013-Nov. 2014:	-- Old Mountain View NA -- Cuesta Park NA -- Monta Loma NA -- Martens/Carmelita NA -- Waverly Park NA -- Blossom Valley NA -- St. Francis Acres NA
16 phoning sessions	Calls to managers of multi-family residences (over 100 of the largest complexes) and to individual residents when known	These calls resulted in three scheduled workshops at multi-family sites, with negligible attendance
5 online posts	Message about EUMV sent to the Patch, an online community newspaper	No discernible response
224 letters sent	Letter about EUMV's "pool house call" service mailed to target group of residents with city pool permits	At least 9 "pool house calls" were completed
1 presentation	Presentation to small/medium business owners	This was a joint event between Mountain View and Cupertino
1 flyer distribution event	Flyers were distributed to local coffee shops, the Library, and the Community Center	Unknown response

Appendix G — Media Coverage of the EUMV Program

Peninsula Residents Get Free Energy Audits
CBS-Channel 5 News, San Francisco
March 21, 2012

One household's eye-opening energy audit: City's "Energy Upgrade" program makes free house calls
Mountain View Voice
February 29, 2012

Free program to reduce energy bills
Mountain View Voice
February 7, 2012

Got Power Strips?
ILoveMV.org
August 26, 2011

Appendix H — Example of EUMV Flyer in City Utility Bill

Front Page

CITY OF MOUNTAIN VIEW

energy upgrade™ CALIFORNIA in Mountain View

FREE HOME ENERGY REVIEW

— *Energy Upgrade Mountain View* —

www.EnergyUpgradeMV.org

Through this FREE City program, you will receive:

- A FREE energy-saving device…***if you sign up by January 19th***.
- A detailed *home energy analysis* and the ability to track your savings online.
- Customized recommendations and alerts to help you stop your energy "leaks."

Join more than 1,500 Mountain View homeowners & renters in saving money and decreasing our carbon footprint.

Did you know?

- Most electronic devices use energy even when you think they are "off." Find out how much energy your devices are *wasting* and how to stop it.
- If you have a pool, your pump could account for *33% of your electricity bill*. Learn about simple changes to substantially reduce this cost.
- Many EUMV participants have saved over *$600 per year* on their energy bills. *How much can YOU save?*

Eligibility: Mountain View residents who have lived in their home at least 1 year, have PG&E electricity and gas SmartMeters™ installed, and do not have a solar PV system.

Together we can
Tame the Plug!

Energy Upgrade Mountain View is a City-funded program to help residents reduce their energy bills. It is FREE to homeowners and renters and has been featured on CBS 5 News and in the Mountain View Voice. If you have questions about EUMV, please contact us at: eumv@acterra.org or 650-962-9876 x 380.

— over —

Back Page

Acterra ACTION FOR A HEALTHY PLANET

Come Learn How to *Tame the Plug!*

A FREE Home Energy Presentation

Join us for a **hands-on workshop** to learn how you can save energy and money in the home!

Wednesday, January 22, 2014, 7:00 pm

Council Chambers, 2nd Floor
Mountain View City Hall
500 Castro Street

To register for the workshop, or sign up for EUMV, visit

www.EnergyUpgradeMV.org

☞ ***Please sign up for EUMV before the workshop.*** ☜

(If that's not possible, please bring your PG&E bill and PG&E online account username/password to the workshop so we can help you sign up.)

"The program is such a wonderful service. I am grateful to the City for providing this opportunity for the residents."

— Jamsheed Agahi,
Mountain View Resident

"The Energy Upgrade Mountain View online tool is great. It showed us our energy use patterns and suggested changes we could make."

— Alison Barnsley,
Mountain View Resident

CITY OF MOUNTAIN VIEW

— over —

Appendix I — Example of General EUMV Flyer

CITY OF MOUNTAIN VIEW

Acterra ACTION FOR A HEALTHY PLANET

FREE HOME ENERGY REVIEW

Energy Upgrade Mountain View

www.EnergyUpgradeMV.org

Receive a Custom Home Energy Analysis!

Get a FREE Energy-Saving Timer

Track Your Energy Use and Savings Over Time

Receive Personalized Help Saving Energy in Your Home or Apartment

Create a Healthier Mountain View

Join us in Reducing Mountain View's Carbon Footprint!

Energy Upgrade Mountain View is a City-funded program to help residents reduce their energy bills.
It is FREE to HOMEOWNERS and RENTERS and has been featured on CBS 5 News and in the Mountain View Voice.
If you have questions about EUMV, feel free to contact us using the information below.

www.EnergyUpgradeMV.org | EUMV@acterra.org | 650.962.9876 x380

This flyer has been printed on chlorine-free, 100% post-consumer recycled paper made with 100% renewable energy.