

Field Research Findings: Home Energy Audits and Upgrades Among Hispanics in California's Central Valley

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Contents

- I. Executive Summary 3
- II. Introduction 5
- III. Study 1 8
 - Methods..... 8
 - Results..... 12
 - Discussion and Recommendations 18
- IV. Study 2 20
 - Methods..... 20
 - Experiment Execution 23
 - Conclusion..... 24
- V. Study 3 25
 - Methods..... 25
 - Household Basics and Technical Audit Results 27
 - Interview Results..... 34
 - Discussion and Recommendations 44
- VI. References 48

I. Executive Summary

This report presents the findings of field research conducted in 2017 to understand how Hispanic households approach energy efficiency upgrades, their implementation, and their financing. The field research is part of a larger project, EPC-14-037, funded by the California Energy Commission with match funding provided by Energy Upgrade California and the Center for Sustainable Energy. The field research was developed based on previous phases of the project, including a literature review, market characterization, focus groups, semi-structured interviews and online experiments; the findings of these activities are published at www.energycenter.org/sociocultural.

We conducted our field research in partnership with the Central Valley Energy Tune-Up (CVETU) program, which provides no-cost home energy audits to Pacific Gas and Electric customers in California's Central Valley. The studies were designed as follows.

- **Study 1:** An experiment testing the impact of imagery in the CVETU audit recruitment brochure on audit sign-ups
- **Study 2:** An experiment testing the impact of providing do-it-yourself (DIY) tips and Property Assessed Clean Energy (PACE) financing information on the likelihood to conduct upgrades post-audit
- **Study 3:** Interviews with audit recipients about upgrade activity, motivations and barriers

In Study 1, CVETU canvassers distributed two different versions of the program brochure during their normal door-to-door recruitment efforts. Our analysis of 704 records in our sample revealed that using brochures with imagery of modest houses and families that appeared Hispanic (as opposed to imagery of large homes and non-Hispanic, Caucasian families) had a positive impact on audit sign-up rates among those in census tracts with high concentration of Hispanics. Although the research did not explore the effect of such imagery on enrollments for home energy *upgrade* programs, it would be a logical strategy to test given the relatively low effort and cost to update marketing materials.

Study 2 was designed to explore the impact of facilitating DIY work and PACE financing. Audit recipients who agreed to participate in the study were to be randomly assigned to one of two groups. The treatment group would receive links to a webpage providing videos with DIY tips for energy efficiency projects and contact information for local PACE providers, in addition to the standard report CVETU provides after the audit. The control group would only receive their standard report. At the end of the study, both groups were to be surveyed to measure energy efficiency upgrade activities and intentions. The study did achieve the sample size needed for analysis; thus, there were no measured results. A program may have better success in implementing a similar experiment in the future if it incorporates it into its standard protocol and does not require participants to opt in to the study.

Study 3 was designed as an alternative method for exploring DIY, PACE and other topics related to home energy efficiency upgrades among CVETU audit recipients. We conducted 30 phone interviews with self-identified Hispanic audit participants; the interviews took place between four and ten months after their audits. Our findings include the following.

- A few had completed, or planned, major upgrades based on the audit recommendations. Others had made minor upgrades such as weather-stripping or light bulb replacements.
- Few of the owner-occupied households seemed to think they had an “efficiency problem” before they did the audit. Many did not believe they had an actionable energy problem even after the audit, either because they perceived no lack of efficiency, or did not have the means, time, attention, or desire to do more.
- Some indicated the audit recommendations were not clear enough, or they needed more information on how to take action. While the audit report provides much of this guidance, the report may not have suited some homeowners’ learning styles.
- Many mentioned the infrared thermographic images as being useful; these images seemed to be one of the most memorable aspects of the audit.
- Many interviewees had trusted networks of people who knew how to do home repairs and improvements in general, even if they were not efficiency specialists.
- Most households were not interested in financing energy efficiency upgrades.

Recommendations based on Study 3 findings include the following.

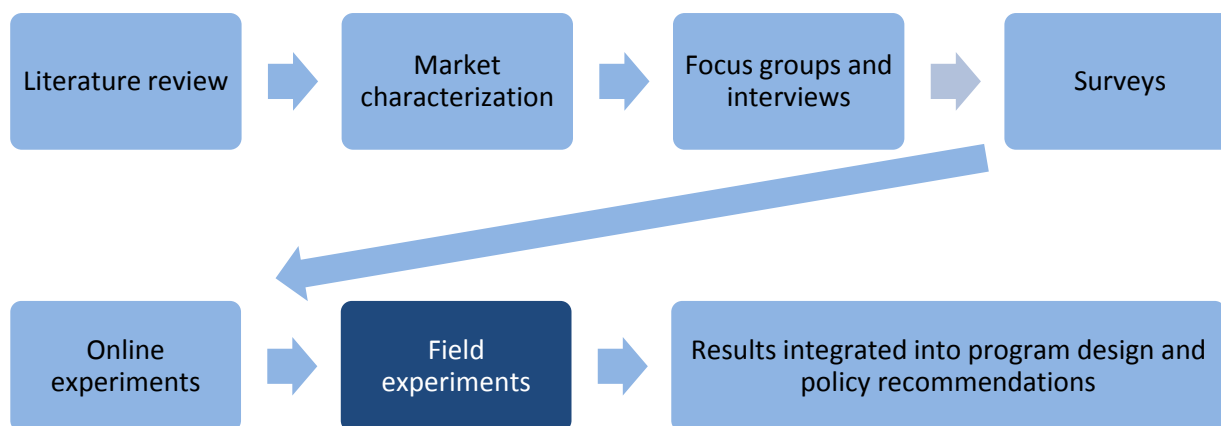
- Find opportunities to shift expectations about housing conditions.
- Use a personal touch to address household-specific concerns.
- Provide recommendations for behavior changes and simple, low-cost measures.
- Consider a phased approach to energy efficiency upgrade programs.
- Facilitate upgrade work by a broader network of contractors, handymen or DIY homeowners.
- Conduct background research in real homes to help integrate energy improvements with other household-level concerns.

II. Introduction

Estimates of cost effectiveness primarily drive the current policy framework used to assess the potential for and likelihood of adoption of residential energy efficiency measures. While an important component of the equation, cost effectiveness calculations alone fail to accurately predict adoption and market potential, as they do not capture the multitude of factors influencing the decision-making process of individual market actors. In recognition of this limitation, the California Energy Commission funded a series of projects designed to explore how sociocultural factors influence adoption of home energy efficiency measures. This report summarizes the findings from a series of field experiments conducted during March to August 2017 for one of those projects, EPC-14-037, which focuses on Hispanic¹ owners of single-family homes. Match funding for this project was provided by Energy Upgrade California® and the Center for Sustainable Energy (CSE). CSE leads the research team, which also includes Research Into Action, Ghoulem Research, Edward Vine and Dena Gromet.

Earlier research conducted for the project – including a literature review, market characterization, focus groups, semi-structured interviews, surveys and online experiments – informed these field experiments, as shown in Figure 1. Findings for each of these research activities are published at www.energycenter.org/sociocultural.

Figure 1. Research phases of EPC-14-037



We conducted our field experiments in partnership with the Central Valley Energy Tune-Up (CVETU) program, which provides approximately 500 no-cost home energy audits per month for residents of eight counties in California’s Central Valley.² The program is administered by the City of Fresno and implemented by ConSol; it is funded by Pacific Gas & Electric (PG&E).

To recruit participants, the program deploys several canvassers to walk door-to-door in eligible neighborhoods and explain the benefits of the audit. Canvassers are typically bilingual (English and

¹ For simplicity, this report uses the term “Hispanic” to refer to those who identify as either Hispanic or Latino.

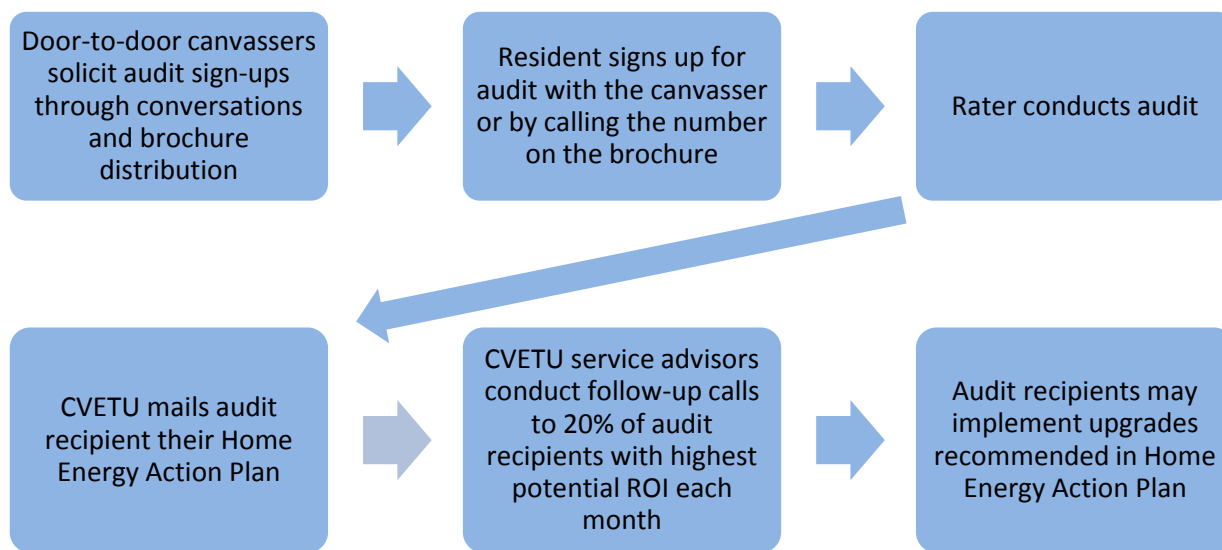
² CVETU is available to PG&E customers in the following counties: Fresno, Kern, Kings, Madera, Merced, San Joaquin, Stanislaus and Tulare. More information is available at www.cvetu.com.

Spanish) and are highly effective at their jobs: program administrators estimated a conversion rate of 60-90% among households where a decision maker was home and available to talk to the canvasser. The canvasser distributes a brochure during their recruitment pitch or leaves the brochure at the home if nobody is available to speak with them. Residents can sign up for an audit during their conversation with the canvasser or by later calling the phone number listed on the brochure. Tenants interested in an audit must secure permission from their landlord to participate.

During CVETU's standard audit (which represents most program activity), a rater spends approximately 90 minutes in the home visually inspecting the building envelope and mechanical systems, taking infrared pictures and conducting blower door testing to measure air leakage. Approximately one week after the audit, the program mails audit recipients a Home Energy Action Plan (Appendix A) in their preferred language (English or Spanish). The action plan includes recommended energy efficiency upgrades such as air sealing, duct replacement, insulation or HVAC replacements. It also provides tips for researching contractors, pictures (including infrared images) of key areas of the building envelope and mechanical systems, cost estimates for making improvements, estimated utility bill savings, simple payback periods, information on utility incentives and financing options, and information on going solar.

Each month, CVETU service advisors place follow-up calls to audit recipients with that month's top 20% projected return on investment (ROI) based on the recommended upgrades. The advisors further explain the action plan and help residents take their next step to making upgrades – whether that is prioritizing their upgrades, hiring a contractor, or finding financing or rebates.

Figure 2. CVETU Program Workflow



Ideally, audits spur residents to complete their recommended energy efficiency upgrades. However, it is challenging to track this activity for a few reasons. First, energy efficiency upgrades include a myriad of different activities: everything from changing a light bulb or an air conditioner filter to replacing an entire HVAC system or retrofitting a building envelope. In theory, mechanical system upgrades could be

tracked through local permit activity, but it is estimated that only 10-38% of residential HVAC replacements are permitted (CEC 2008, DNV GL 2014). Some major retrofits could be identified through rebate programs such as Energy Upgrade California® Home Upgrade, but given requirements to use participating contractors and include certain measures in the project, many projects do not fit within this program. Finally, several factors – financial barriers, busy schedules, an overwhelming number of choices (LBNL 2010), lack of information, lifespan of existing equipment – can delay the execution of home improvement projects by several months or even years, making it difficult to track them as a result of a particular audit. CVETU attempts to track some upgrade activity through its service advisor phone calls, but the program does not have the resources to conduct a comprehensive evaluation of upgrades attributed to its audits.

Although the precise conversion rates from audit to upgrades are unknown, CVETU’s high level of activity across the Central Valley and the willing cooperation of the program implementers provided us an excellent opportunity to develop a better understanding of how Hispanic households in this region think about and approach energy efficiency upgrades, their implementation, and their financing. Our field research was designed to leverage the program’s existing operations to further explore findings from our previous research phases. Our first two studies were designed as experiments, as originally envisioned for the project. When the second experiment failed to meet a sample size required for analysis, we added a third non-experimental study to collect qualitative data from audit recipients. The three studies are as follows.

- **Study 1:** An experiment testing the impact of imagery in the CVETU audit recruitment brochure on audit sign-ups
- **Study 2:** An experiment testing the impact of providing do-it-yourself (DIY) tips and Property Assessed Clean Energy (PACE³) financing information on the likelihood to conduct upgrades post-audit
- **Study 3:** Interviews with audit recipients about upgrade activity, motivations and barriers

The following sections explain the design and findings of each field study.

³ Property Assessed Clean Energy (PACE) financing is a means of financing energy efficiency or renewable energy improvements on private residential or commercial property. PACE programs allow local governments, state governments, or other inter-jurisdictional authorities, when authorized by state law, to fund the up-front cost of energy improvements, which are paid back over time by the property owners. PACE program participants repay their improvement costs through property assessments, which are secured by the property itself and paid as an addition to the owners' property tax bills. The debt obligation may be transferred with property ownership. <https://energy.gov/eere/slsc/property-assessed-clean-energy-programs>

III. Study 1

Study 1 used an experimental design executed within the door-to-door recruitment and enrollment phase of CVETU. Previous feedback from our focus groups with Hispanic homeowners revealed they were less receptive to energy efficiency program marketing that displayed images that did not resonate with their experience. When we showed Hispanic participants an ad featuring Caucasian homeowners with a large new home, they could not identify with the home in the image because it did not look like their home. One participant said, “It looks like they are in their big house – they could save, but I couldn’t” (Research Into Action and CSE 2016).

This experiment tested the impact of imagery on Hispanic homeowners’ likelihood to sign up for an energy audit. Door-to-door canvassers distributed two versions of the program brochure: CVETU’s existing program brochure (old brochure; see Figure 3) that featured images of a large home and a family that appeared to be non-Hispanic Caucasian and a second version (new brochure; see Figure 4) that had images of more modest homes and families that appeared Hispanic.

Methods

Experimental Design

The experiment was a randomized control trial consisting of two groups. The control group consisted of households that received the old brochure, and the experimental group consisted of households that received the new brochure. The hypothesis was that a brochure with imagery tailored for a Hispanic audience would result in a higher rate of audit sign-ups among this cohort.

Canvasser Training

CVETU’s door-to-door canvassers implemented the experiment and collected the data during their normal operations. CSE’s research team conducted an in-person training with nine canvassers in Fresno in early March 2017, a week before the fielding started, where we:

- Explained the purpose of the research;
- Instructed them on how to distribute the brochure, giving the new brochure to even-numbered houses and the old brochure to odd-numbered houses to ensure randomization;
- Instructed them to clearly present the brochure when talking to the household decision maker to ensure the brochure was viewed and played a part in the decision-making process;
- Trained them to fill in a data collection form to record the brochure version distributed to each home, whether they spoke to a decision maker, whether the decision maker signed up for the audit, and other key metrics (see Appendix B).

Figure 3: Old Brochure (Two Sides)

Tune-Up Your Home and Start Saving Energy Today!

Central Valley ENERGY TUNE-UP

Common Cents

Saving money with a Home Energy Tune-Up Program makes a whole lot of cents.

PG&E Pacific Gas and Electric Company

Central Valley ENERGY TUNE-UP

855-621-3733

PG&E Pacific Gas and Electric Company

This program is funded by California utility customers and administered by PG&E under the auspices of the California Public Utilities Commission.

What Have You Got to Lose?

How About a Third of Your Energy Bill!

If you're like most Central Valley homeowners, your house is leaking heated air in the winter and cool air in the summer... and you probably don't even know it. Even newer homes are susceptible to duct failure, air leaks, and poor insulation. The best way to ensure your home is as efficient as possible is to let Central Valley Energy Tune-Up, a program sponsored by PG&E and the City of Fresno, take a look.

www.cvetu.com



"Shut the door... are you trying to cool the whole neighborhood?"

Remember when your grandpa would yell at you to stop leaving the door open? He didn't want all that cool air to escape his house. It makes sense when you think about it. You're paying to heat your home in the winter and cool your home in the summer. Why would you want to lose a good portion of it to the great outdoors? Unfortunately, a good deal of Central Valley homes have leaks, poor duct work, and insufficient insulation.

So how much energy is your home wasting? Read on, and you'll learn how to find out for yourself – with absolutely no cost and no obligation!

Sponsored by your friends at PG&E

What's So Good About This Program?

The Home Energy Tune-Up Program is funded by California utility customers and administered by PG&E under the auspices of the California Public Utilities Commission, so there's absolutely no out-of-pocket cost to participants. What's more, because it is run through PG&E, you can be assured that there will be no selling of products or services of any kind – there will only be recommendations on how you can increase the efficiency of your home and by extension, potentially decrease your energy bill. Basically, you'll learn how you can spend a little to save a lot!

In addition, you will learn how to tune-up your home so that it delivers:

- Better Indoor Air Quality
- Healthier Environment
- Greater Year-Round Comfort
- Higher Home Resale Value

Central Valley ENERGY TUNE-UP

Step 1: Sign up by today by visiting www.cvetu.com or by calling 855-621-3733

Step 2: CVET representatives will contact you and determine your needs based on your home's energy usage

Step 3: Depending on what your energy profile shows, they'll schedule one of the following services:

- Standard In-Home Survey or
- Whole-House Home Energy Survey

Step 4: You'll receive a report showing where your home could use improvement and recommendations on addressing those deficient areas

Step 5: You'll be free to follow all, some, or none of the recommendations made in the survey report, allowing you to save as much energy as you wish

Additional Ways You Can Save:

- PG&E Rebates
- Energy Upgrade California Rebates
- Federal Tax Credits

PG&E Customers Living in Fresno, Kings, Kern, Tulare, and Madera Counties are Eligible!

www.cvetu.com

Figure 4: New Brochure (Two Sides)

Central Valley ENERGY TUNE-UP

Tune-Up Your Home and Start Saving Energy Today!

Common Cents
Saving money with a Home Energy Tune-Up Program makes a whole lot of cents.

PG&E Pacific Gas and Electric Company

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855-621-3733

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Incentives

Each canvasser received \$50 for attending the training and agreeing to participate in the research study. In addition, they received one dollar for each home they visited and reported complete data on during the study period.

Eligible Population and Sample Size

To more effectively target Hispanic households, we provided canvassers with online and paper maps highlighting census tracts within Fresno, Kern and Tulare counties with high rates of Hispanics and single-family homes. The maps showed top priority areas where at least 75% of homeowners identified as having Hispanic, Latino or Spanish origin in the census and second priority areas with 60-75% Hispanics. We calculated we would need a sample of 1,028 homes for the experiment to accurately detect differences between the control and the experiment group⁴.

Experiment Timeline

Experimental treatment and data collection began March 13, 2017 and ended on April 18, 2017. The canvassers emailed copies of their completed data collection forms to our research team periodically throughout the study. A few weeks after the treatment period, CVETU provided a list of homes that completed an audit between March 2 and May 26, 2017 to provide insights on households that signed up by calling the number on the brochure (and thus were not flagged in the canvassers' records as signing up).

Data Cleaning

Before conducting the analysis, we first cleaned the data to remove records that were not "useful". We deemed a record was useful if:

- It contained a valid street address (verifiable via a Google search);
- A brochure type (new/old) was marked; and
- The home had not been previously audited.

Records that did not meet these criteria were removed from the sample; 777 records remained.

We then wanted to filter the data to include only Hispanic households. To identify Hispanic origin, we intended to compare the residents' last names to a list of last names for which at least 85% of people self-identify as Hispanic/Latino, according to American Community Survey data. For residents who

⁴ We estimated approximately half of the homes visited would be Hispanic households and thus be eligible to be part of the control or experimental group; therefore, the estimated incidence rate for the control group was 25%. Using an alpha (statistical significance) of 0.1 and a power level of 80%, we needed 1,028 homes to sign up for a total of 514 samples each in the control and experimental groups.

received the brochure from the canvasser, we could determine last names through the canvassers’ data collection forms. For homes where a brochure was left at the door, we searched the appropriate county assessor parcel database to find the owner’s last name. However, the address match process failed to find a matching parcel for more than half of the street addresses in the sample.

Because of the large gap in last name data, we shifted our focus from Hispanic households to homes in census tracts with high percentages of Hispanics. We classified census tracts where the percent of Hispanics was at least 75% as “high Hispanic” census tracts; we classified those with 74% or less as “non-high Hispanic”. Using this classification, 91% of the 777 homes were in high Hispanic census tracts. According to census data, the average concentration of Hispanics in our high Hispanic tracts was 93% with a standard deviation of 4.9%, while our non-high Hispanic tracts had an average of 51% Hispanics with a 5% standard deviation. Only homes in high Hispanic census tracts were used to analyze the effectiveness of the two brochures. The large and significant difference in the concentration of Hispanics between high Hispanic and non-Hispanic tracts tells us we can be confident that the homes included in the study are likely Hispanic households and thus the results accurately describe intended target population. The final sample size was 704.

Results

The 704 records were collected by a total of four canvassers. Table 1 provides an overview of the homes in the sample.

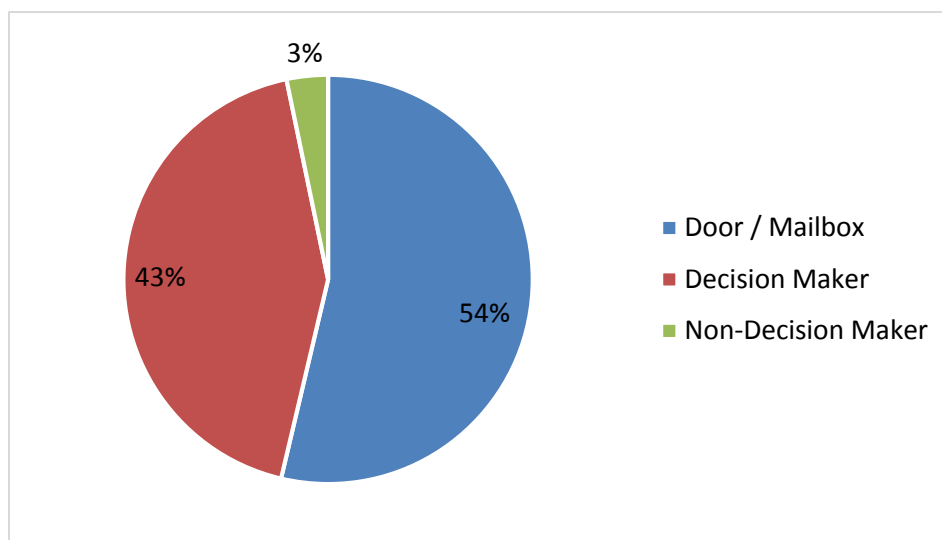
Table 1. Summary statistics of homes, brochure types, canvasser outreach methods and audit sign-ups.

| Category | Count |
|---|-------|
| Total homes in sample | 704 |
| Homes that received old brochure | 364 |
| Homes that received new brochure | 340 |
| Homes where canvasser talked and gave brochure to decision maker | 303 |
| Homes where canvasser gave brochure to non-decision maker | 23 |
| Homes where brochure was left at door/mailbox | 378 |
| Homes that signed up for audit with canvasser | 268 |
| Homes that signed up for audit by calling number on brochure ⁵ | 11 |
| Homes that didn’t sign up for audit | 425 |

⁵ Homes that signed up for an audit by calling the number on the brochure were determined by reviewing CVETU’s list of completed audits. Homes that had completed an audit but had not been reported by the canvassers as an audit sign-up were determined to have enrolled by calling the number on the brochure. It is possible that some homes could have signed up by calling the number on the brochure, but then later canceled their appointment; these homes would have been counted as homes that didn’t sign up for an audit. We anticipate this number would be low, given that the resident made the effort to call and sign up for the audit – demonstrating a higher level of interest/commitment compared to those who simply said “yes” to the canvasser standing at the door.

In nearly half of the homes visited, the canvasser spoke with a decision maker (43%) or non-decision maker (3%). In 54% of the cases, the canvasser left a brochure at the door or mailbox (Figure 4).

Figure 5: Who Brochures Were Left With



Potential Sources of Bias

Field experiments are a valuable research approach but they are more difficult to control than laboratory research, so deviations from the ideal are common. A famous example is the Hawthorne effect – i.e., the alteration of behavior by the subjects of a study due to their awareness of being observed – but projects can deviate in several other ways as well (Adair 1984, Zelditch 1962). In this case, we found that the canvassers did not strictly apply the distribution protocol of assigning new brochures to even addresses and old brochures to odd addresses, potentially threatening the validity of the experiment. This could have been due in part to simple logistics – e.g., running out of one type of the brochure while out in the field – or other reasons. Table 2 shows the distribution of brochure types by addresses; only eight percent of records deviated from the protocol and the brochure type was statistically dependent on the house number, as intended.

Table 2: House Address Number and Brochure Type

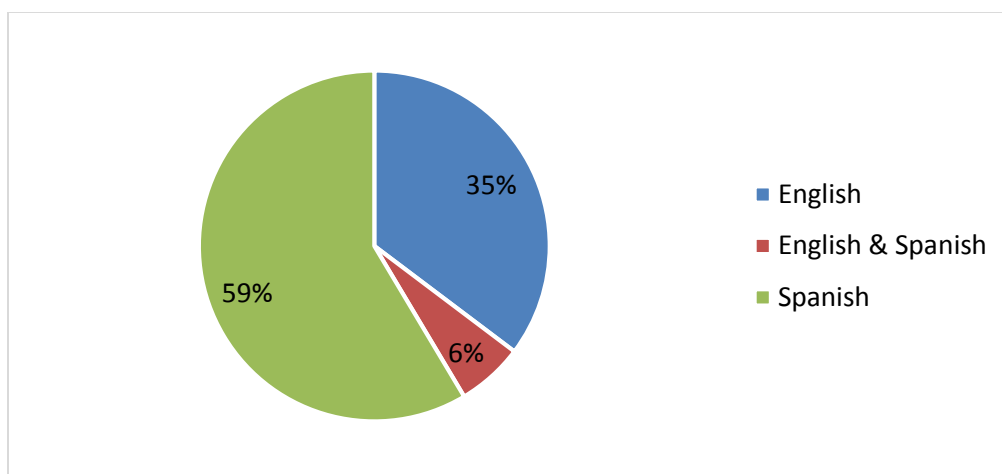
| | New Brochure | Old Brochure |
|-----------------------------|--------------|--------------|
| Even Address Numbers | 292 | 14 |
| Odd Address Numbers | 48 | 350 |

N=704, Pearson chi2(1) = 481.4592, Pr = 0.000

Although only a relatively small percentage of records did not adhere to the distribution protocol, we continued to explore other possible threats to validity. In reviewing the data, we observed that some canvassers conducted most of their visits almost exclusively in one language (English or Spanish). While that alone is not a problem, we also found that the language of the interaction was statistically correlated with the type of brochure that they provided the resident. Therefore, we first examined whether *language* affected audit sign-up rates before evaluating the effect of the brochure.

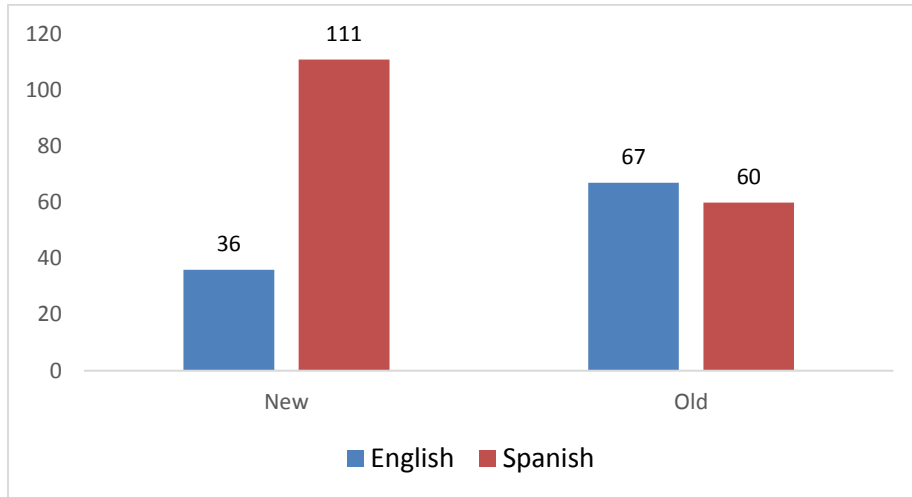
Because the study took place in predominately Hispanic areas, it's not surprising that 59% of the conversations were conducted in Spanish (Figure 6). A conversation could only take place when an individual was home to receive the brochure so we only have information about the language in 292 of 704 cases (41% of the sample).

Figure 6: Language Spoken During Recruitment Conversation (N=292)



Even though the brochure type was statistically associated with the house address number, we also found a statistically significant relationship between the language of the interaction and the brochure left with the homeowner. When a conversation was conducted in Spanish, the resident was almost twice as likely to receive the new brochure than when the recruitment was done in English (Figure 7). Eighteen samples where both English and Spanish was spoken during recruitment were excluded for simplicity to focus only on those where there was a clear language distinction.

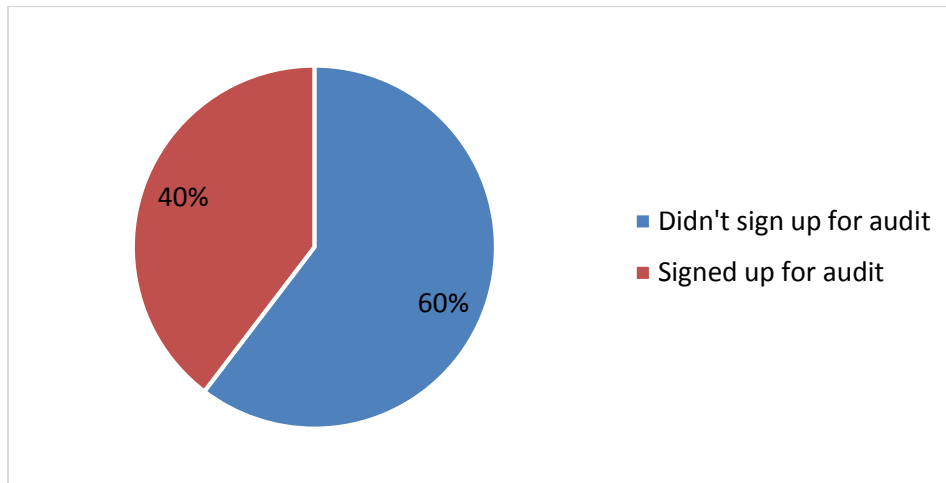
Figure 7: Primary Language of Conversation and Brochure Provided



N=274, Pearson $\chi^2(1) = 23.2044$ Pr = 0.000

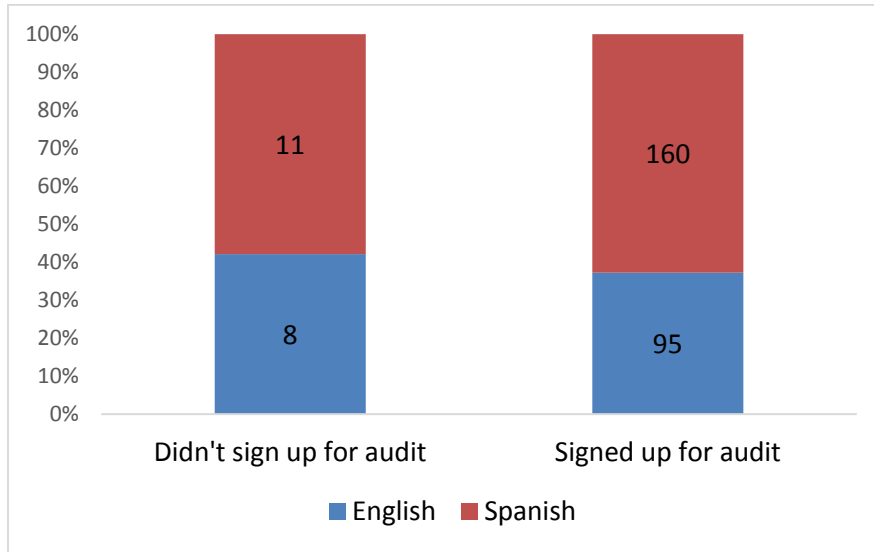
A threat to validity for the experiment exists if the language of the conversation was not independent of the choice to sign up for an audit. All those who signed up for an audit via the canvasser (even if they did not go through with it) and all those who completed an audit, per the data provided by CVETU, (even if they did not sign up while the canvasser was at their door) were combined to measure the total audit sign-up rate (Figure 8).

Figure 8: Audit Sign-Up Rates



When we examined the relationship between the recruitment language and audit sign-up rates, we found that the two were statistically independent (Figure 9). Thus, despite our observation of a salient relationship between the language of interaction and the type of brochure received, language alone was not associated with the choice to sign up for an audit. This provides reassurance that the potential bias from violations of the protocol was not likely to affect the audit sign-up rates, allowing us to examine the effects of the brochure.

Figure 9: Audit Sign-up Rates by Recruitment Language



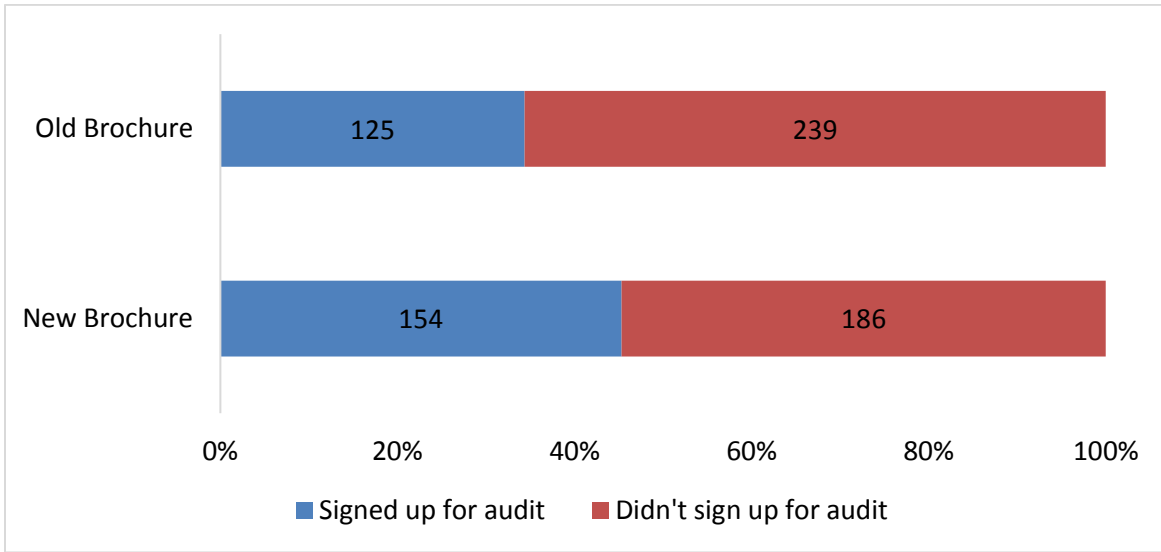
N=274, Pearson $\chi^2(1) = 0.1773$, Pr = 0.674

Effect of Brochure on Audit Sign-Ups and Completions

An ideal way to measure the effect of the different brochures without the influence of the canvassers' personal interactions would have been to compare the sign-up rates only among those who received the brochure at their door or mailbox. Unfortunately, of the 378 homes that were left a brochure at the door, only 11 or 2.9% completed an audit during the study period. Thus, the sample size was too small to detect differences in treatment effect.

Instead, we examined the effect of the brochure type on the entire sample of 704 and found a statistically significant difference in audit sign-up rates (Figure 10). Those who received the new brochure were 11 percentage points more likely to sign up for an audit than those who received the old brochure. Because this included all the instances where a brochure was left at the door and no one called to schedule an audit, the total sign-up rates appear low compared to the sign-up rates for in-person interactions.

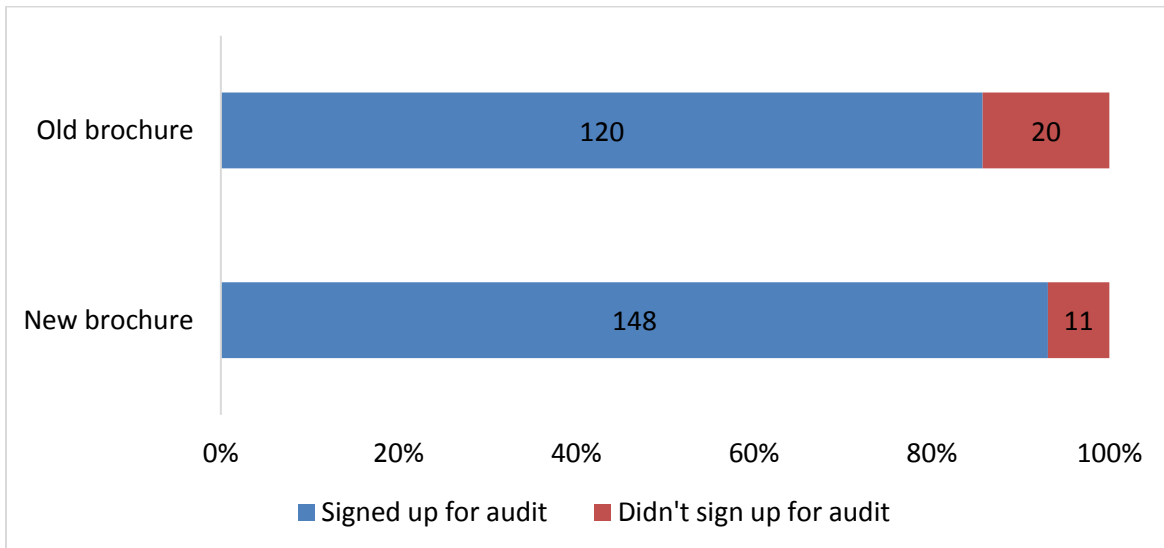
Figure 10: Audit Sign-Ups by Brochure Type



N=704, Pearson $\chi^2(1) = 8.8158$ Pr = 0.003

Over 96% of all audit sign-ups occurred during the in-person interactions with canvassers, thus we examined sign-up rates for the subset of decision makers that received the recruitment pitch. A test of independence shows that the rate of sign-up refusal fell from 14% (with the old brochure) to under 7% (with the new brochure), a statistically marginally significant difference (Figure 11).

Figure 11: Canvasser Assisted Audit Sign-ups

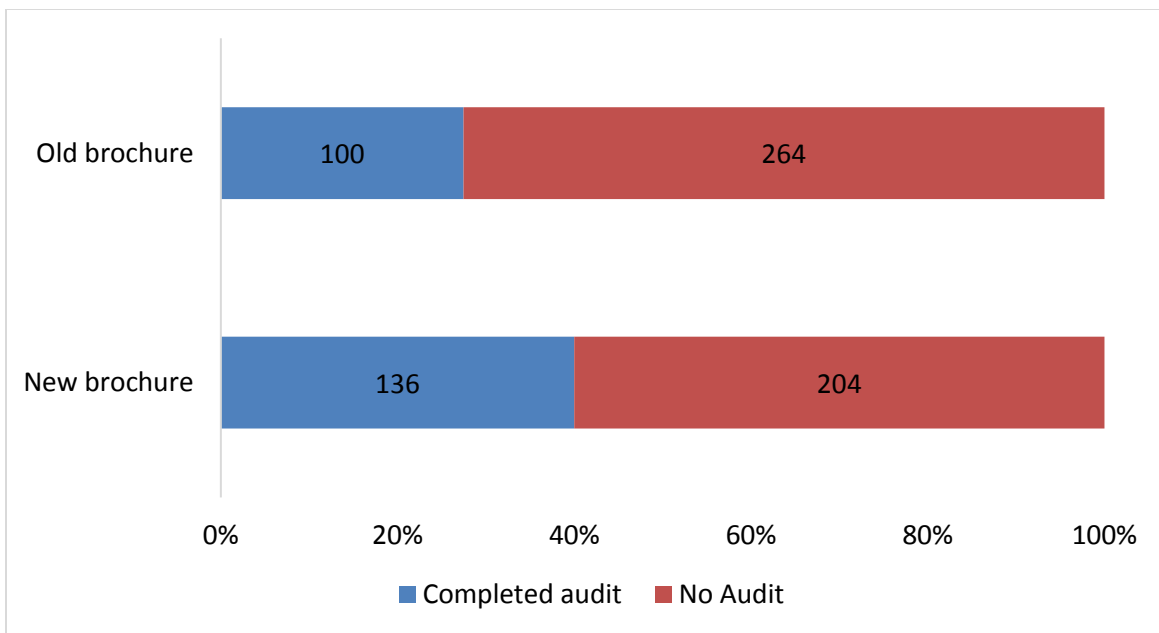


N=303, Pearson $\chi^2(1) = 4.0642$ Pr = 0.044

Though sign-up rates are important, and our hypothesis was to test whether the different imagery on the brochures could boost audit sign-up rates, the goal of the program is to *complete* audits. Thus, we

further examined the data and looked only those individuals for whom CVETU provided an audit completion date. To allow sufficient time for people to book and complete their audit appointments, CSE asked for data on audit completions from the beginning of the data collection period through five weeks after data collection ended.⁶ Based on this analysis, there was a 17% attrition rate between audit sign-ups with a canvasser and audit completion. When comparing audit completion rate by brochure type we found that individuals who received the new brochure were statistically more likely to sign up for an audit and complete that audit than those who received the old brochure (40% vs. 27%), regardless of whether they signed up via a canvasser or over the phone (Figure 12).

Figure 12: Audit Completion Rates by Brochure Type



N=704, Pearson $\chi^2(1) = 12.3800$ Pr = 0.000

The differences in audit completion rates between the two brochure types are greater than the differences in audit sign-up rates. This suggests that the new imagery may not only prompt more individuals to sign up for an audit but may also improve the likelihood that they will complete the audit process.

Discussion and Recommendations

The results of the experiment are promising. We find evidence that the new brochure including imagery of Hispanic families and modest-looking housing positively impacts audit sign-up rates among those in Central Valley census tracts with high concentration of Hispanics. Though the difference may seem small

⁶ It is possible that some homes postponed or rescheduled their audits until after May 26, 2017 – or five weeks after the last homes in our sample received a visit from a canvasser. Homes that scheduled their audits after this date would not be counted as completed audits in our study.

for a program that already enjoys high enrollment rates, there is some indication that the revised imagery may also help lower rates of attrition from audit sign-up to completion. However, given that attrition rates between sign-ups and completions were not the focus of this study, more research is needed to verify this conclusion.

The findings suggest that it may be worthwhile for audit programs targeting areas with high concentrations of Hispanic residents to use similar imagery in their marketing collateral to increase enrollment rates. Although the research did not explore the effect of such imagery on enrollments for home energy *upgrade* programs, nor did it explore the effects in other regions of the state or nation, it would be a logical strategy to test given the relatively low effort and cost to update marketing materials. Programs can identify neighborhoods with high concentrations of Hispanic residents through census data; appropriate pictures can be purchased through stock photography sites or acquired from actual program participants who had a good experience and agree to release their images for marketing purposes.

IV. Study 2

This study focused on finding mechanisms to boost a household’s likelihood of adopting energy efficiency measures. In previous survey work for this project, we found that Hispanic homeowners in Fresno and San Diego counties were over 20% less likely to hire a contractor to complete home improvements or repair projects. Hispanics were also more likely to conduct DIY projects or use unpaid help from family or friends than non-Hispanic homeowners. On the topic of costs, Hispanic respondents – and foreign-born Hispanics in particular – were more likely to consider a large purchase if they knew there was financing available. Yet we found that foreign-born Hispanics reported more trouble accessing credit (CSE 2017). This motivated us to explore PACE financing, which is based on home equity rather than personal credit, as a potential solution.

We embedded an experimental design into the CVETU program to test whether providing links to DIY instructional videos and information on PACE financing options (in addition to the standard action plan provided by CVETU) would increase adoption of energy efficiency measures.

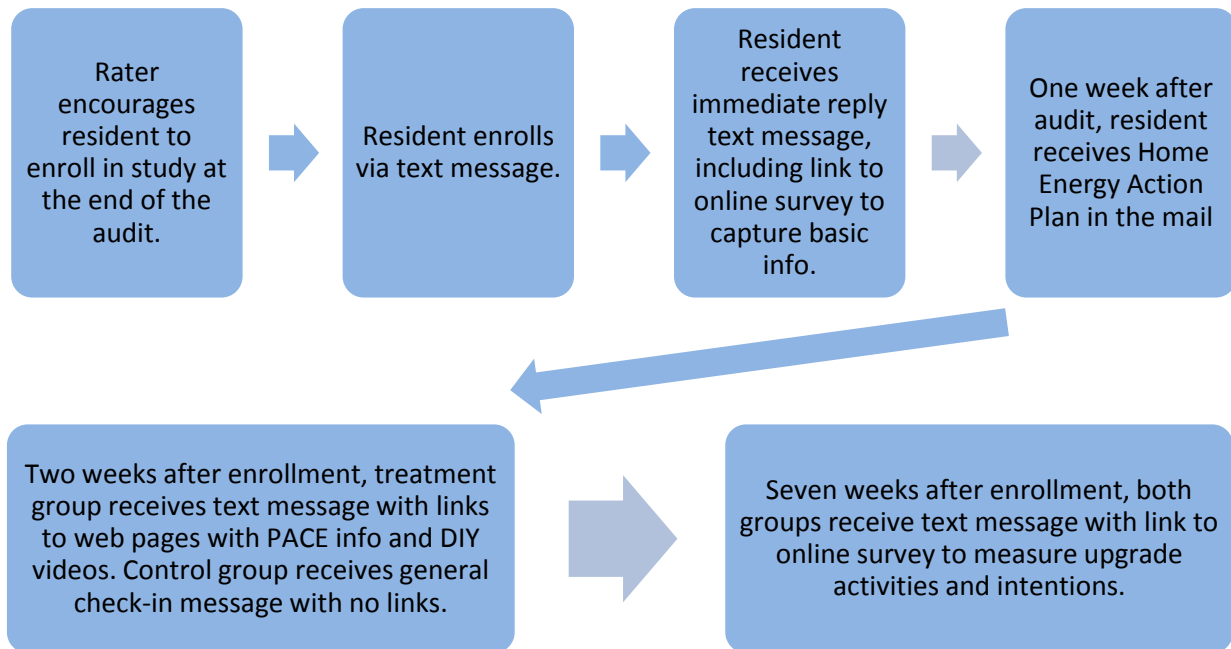
Methods

Experimental Design

CVETU raters recruited audit recipients for the study. Enrollment was accomplished by texting a keyword to a 5-digit number. There were two keywords, “ENERGY” and “UPGRADE”, which determined whether the participant was assigned to the treatment group or the control group. The rater carried a stack of randomly-mixed flyers, each with a keyword printed on it (see Figure 14), each available in Spanish or English. The version of flyer given to the resident determined which keyword they used to enroll.

Immediately after enrolling in the study, the participant received a reply text message with an inquiry about their preferred language: English or Spanish. They were then provided a link to a four-question survey used to confirm their street address, the name of their rater, home ownership status and their phone number (used as a unique identifier). The second text message series was sent two weeks after enrollment and introduced the experimental treatment. Those in the treatment group were provided a link to a mobile-optimized website containing DIY instructional videos and contact information for local PACE providers; those in the control group were simply told they would receive a final text message in a few weeks. The third and final series of text messages, sent seven weeks after enrollment, contained an invite to a final survey which measured the dependent variable of performing an upgrade or having high intention to perform an upgrade within a year. Those in the treatment group were also asked about their interactions with the DIY/PACE website. The full text message script and survey instruments are included in Appendices C, D and E. Figure 13 shows an overview of the experiment.

Figure 13. Experiment Process



We opted to use a text message platform for enrollment for two reasons. First, we believed that sending a one-word text message would be a simpler, quicker enrollment method as compared to logging on to a website or asking the raters to collect email addresses. Second, CVETU staff had reported that most audit recipients declined to share their email addresses with the program – whether due to general reluctance or an actual lack of email access – whereas nearly every participating household provided a phone number. Because the treatment required internet access, this limited our sample to those with smart phones with internet access. Furthermore, the text message platform (Trumpia) did not allow us to easily collect data from participants in a useful format, so we opted to use an online survey platform (Survey Gizmo) to collect data – another driver for the smart phone requirement. In 2016, 75% of Hispanic adults had a smart phone (Pew 2017).

Rater Training

CSE provided an in-person training for the raters in early March 2017. Raters were trained to briefly explain the study to audit recipients, provide *one* copy of the flyer, explain the incentives and the fact that data would only be reported in aggregate form, and encourage them to enroll in the experiment (i.e., send the text message) while they were in the home. The raters practiced their enrollment pitches during the training session.

Figure 14: Flyers Containing Key Word for Group Assignment

Rater first name: _____

We need your help to better understand how local residents view home improvements and energy efficiency.



The Center for Sustainable Energy (CSE), an independent non-profit organization based in California, is conducting a short research study. Participants will receive a few text message surveys over the coming two months, starting today. Your responses will be kept confidential and will never be associated with your name, address or phone number. Results will be based on combined data from all participants. Your time commitment will be approximately 5-10 minutes total over the next two months.

To participate, text ENERGY to 77453 within 24 hours of your assessment
Participants who complete the study have the chance to win one of ten \$100 Walmart gift cards

Your participation is voluntary and you may terminate your participation in the study at any time and for any reason. You must have a smart phone with internet access to participate. Standard text messaging rates apply. If you would like to discuss this study with the Research Manager, please contact Laura Parsons at (858) 244-7288 or laura.parsons@energycenter.org.

Thank you for your willingness to participate in our study. Your responses are very important and will help local organizations better serve residents like you.

Accelerating the transition to a sustainable world powered by clean energy 

Rater first name: _____

We need your help to better understand how local residents view home improvements and energy efficiency.



The Center for Sustainable Energy (CSE), an independent non-profit organization based in California, is conducting a short research study. Participants will receive a few text message surveys over the coming two months, starting today. Your responses will be kept confidential and will never be associated with your name, address or phone number. Results will be based on combined data from all participants. Your time commitment will be approximately 5-10 minutes total over the next two months.

To participate, text UPGRADE to 77453 within 24 hours of your assessment
Participants who complete the study have the chance to win one of ten \$100 Walmart gift cards

Your participation is voluntary and you may terminate your participation in the study at any time and for any reason. You must have a smart phone with internet access to participate. Standard text messaging rates apply. If you would like to discuss this study with the Research Manager, please contact Laura Parsons at (858) 244-7288 or laura.parsons@energycenter.org.

Thank you for your willingness to participate in our study. Your responses are very important and will help local organizations better serve residents like you.

Accelerating the transition to a sustainable world powered by clean energy 

Incentives

We paid each rater \$50 upfront for attending the training and agreeing to take part in the enrollment effort; we paid an additional two dollars per study participant enrolled. Study participants were offered the chance to win one of ten \$100 Walmart gift cards if they completed the entire protocol.

Eligible Population and Sample Size

This experiment focused on Hispanic households. The canvassers implementing Study 1 were already recruiting homes from areas with high concentrations of Hispanics, so the audits taking place during this study were anticipated to be primarily Hispanic.

We estimated that CTVEU would need to conduct 700 audits per month during the study period to achieve our desired sample size of 406, to be split evenly between control and treatment groups.⁷ We understood this was an aggressive goal and it was likely we might be unable to achieve the desired sample size.

Experiment Execution

The experiment failed to meet the desired enrollment rate needed to calculate measurable results. After the first week of low enrollments, we increased the raters' incentive from \$2 to \$5 per enrollment. Regardless, the increased incentive was not sufficient to boost signups. After the first two weeks, it became apparent that we would not reach the desired enrollment rate via the raters. Therefore, in addition to asking the raters to continue recruitment efforts, the research team called audit recipients to encourage them to sign up for the study; the call was presumably a "second touch" after the rater had already attempted recruitment while in the home. After 28 calls, the research team determined this was not a successful approach and abandoned it. The experiment ran to completion, so that those who completed the seven-week long process could claim their incentive as promised. Twenty-one homeowners enrolled in the experiment; only four completed the final survey to evaluate the effect of the treatment.

We contacted some of the raters to solicit feedback about the process to identify the key problems to enrolling participants for this research. They reported that using a texting campaign was not a suitable tool for this audience primarily because many of the individuals who live in this region are first-generation Hispanics⁸ and many of them do not have smart phones and/or do not know how to text.

Raters also noted that participants seemed hesitant to sign up while the auditor was still in the home. They noted that participants thought the incentive was enticing, however, the two-month timeline and lack of a guarantee that they would receive any incentive made it ineffective as a recruitment tool. We encountered similar problems during the phone recruitment attempt. We found it was difficult to explain the purpose of the exercise, and the kind of information respondents would be receiving, without revealing the experimental treatment. It was also difficult to get people to send a text while they were on the phone. And similarly, while people said the gift card was enticing, the seven-week timeline was unattractive and they ultimately declined to participate.

As mentioned previously, we knew that the desired sample size might be difficult to achieve due to the short time in the field and the increased volume of audits required to meet the goal. However, it was

⁷ The assumed estimated incidence rate of the control group was 20%. Using an alpha (statistical significance) of 0.1 and a power level of 80% to achieve a treatment effect size of 10% (difference in incidence: 20% to 30%), 203 completed experiments were needed in each group or a total of 406. We estimated that 50% of audit recipients would enroll in the study and only half of those would complete the full experiment; thus, the auditors would have to introduce the study to at least 1,624 Hispanic homeowners. Given that CVETU completes approximately 500 audits a month, assuming that approximately 60% would be conducted with Hispanic homes and with only three months to run the field experiment, we calculated that CTVEU would need to increase the number of audits completed to 700 per month during the study period to achieve the necessary interactions and sample size.

⁸ "First generation" refers to individuals who are foreign born or born outside the U.S.

not possible to extend the time in the field nor was it desirable to shorten the seven-week timeline between audit and final survey, given that study participants likely would not have had a chance to begin any home upgrades recommended by CVETU.

Conclusion

The experiment faced several insurmountable problems. The platforms and tools chosen for this research project did not meet the needs of customers due to technology limitations and the timeline, though compressed for fielding purposes, was too long to be attractive to customers as an optional activity.

We recommend that any project wishing to use tools like a texting campaign allow sufficient time to test the platform to ensure it can meet all communication requirements. In the case that the experiment requires participants to have access to internet or smart phones, the experiment should have some flexibility for participation through other means as a contingency in case the target population has any technological limitations.

Since we were unable to describe the project in detail without revealing too much about the experimental treatment, it was difficult for potential participants to understand what they were being asked to do. This communication gap did not allow us to build the confidence and trust to convince potential participants to sign up. If similar experimentation is conducted in the future, it may be more effective for a program to include survey participation in their program requirements, eliminating the need for a separate enrollment / opt-in process. The program could select a random subset of participants to receive additional DIY, PACE or other resources – i.e., create a treatment group to compare against a control group. If the treatment is determined to increase adoption of energy efficiency upgrades as measured by the surveys, it could then be applied as a standard program component for all participants.

V. Study 3

When it became clear that our second field experiment would not yield results, we designed a third study that would still allow us to explore Hispanic homeowners' perspectives on DIY work and PACE financing. Resource constraints prohibited us from creating and executing another experimental design; instead we conducted a non-experimental investigation, interviewing CVETU audit recipients about their experiences, and their thoughts and actions with respect to the energy efficiency upgrades recommended through this audit. Interviews focused on three main topics: response to recommendations, how any upgrades done were completed (e.g., DIY, somebody in their network, or another contractor), and financing of any of the recommended or prior upgrades, especially whether they considered a PACE loan.

This section describes methods, results, and insights from the 30 phone interviews completed with these audit recipients. Only households where the interviewee identified as Hispanic or Latino were interviewed.⁹ Within this demographic, we distinguished households that elected Spanish versus English for their home energy audit and report. Our study targets homeowners. Nevertheless, we included a few renters among the interviewees, given that renter-occupied homes are an important and often-neglected segment.

Methods

This section provides an overview of the interview sample list, fielding, interview questions, and characteristics of the final interview sample.

Sample List and Interview Fielding

At our request, CVETU provided a list of audit recipients from September 2016 through February 2017. These dates were selected to allow a reasonable amount of time within which the household could have completed recommendations, while keeping the experience of the audit within recall. From this list of over 3,000 households, we selected a likely-Hispanic sample for the phone interview call list using a surname-based algorithm. Households were assigned to either a Spanish-speaking or English-only speaking interviewer based on the whether the household had requested audit materials in Spanish versus English. We also removed households that were clearly renters. Most calls were made during business hours. Thirty interviews were completed, all between July 21 and August 2, 2017. Post-screening, interviews took 11 minutes on average and (except two) were recorded and transcribed for analysis. Appendix F provides further details on sample selection. Table 3 summarizes basic sample disposition and interview characteristics.

⁹ This “Latino/Hispanic only” approach was selected to give as much information as possible about this group versus attempting a comparative approach to other ethnic or racial identities, given the limited sample and the non-statistical, interview-centered, data collection.

Table 3: Summary of Basic Sample Disposition and Interview Characteristics.

| | English Interviews | Spanish Interviews | All |
|--|---------------------------|---------------------------|------------|
| Unique numbers dialed (n) | 179 | 129 | 308 |
| Agreed to interview (n) | 14 | 21 | 35 |
| Completed interview (n) | 13 | 17 | 30 |
| Completion rate¹⁰ | 7.3% | 13.2% | 9.7% |
| Average recorded interview length (minutes) | 11.4 | 10.6 | 11.2 |
| Rentals (n) | 3 | 3 | 6 |
| Percent male respondents | 23% | 12% | 16% |

Interview Guide

We prepared and tested an interview guide in English and Spanish. Table 4 summarizes the main topics covered in this guide. The interviews were designed to be social scientific and conversational, within resource limitations and the information available.¹¹ This allowed respondents leeway to map their paths in more detail and inject explanations and emotions, and interviewers to pursue interesting avenues, versus stricter question-and-answer survey format. To keep the dialogue comfortable, we avoided delicate topics such as income or education, and tread lightly on questions about whether anybody in the household was born outside the United States. Interviewers reacted conversationally and echoed interviewee responses, where appropriate, to help signal that they were listening. Interviewers recorded observations about the conversation and the interviewee (e.g., whether the interviewee seemed to be male or female) to supplement the recording and transcription.

¹⁰ Number of interviews/number of unique numbers dialed.

¹¹ In particular, the interviews did not have audit information other than the date of the audit and whether the report was in Spanish or English. Our target length for the interviews was no more than 15 minutes and the interviews were conducted by phone. By “social scientific and conversational,” we mean that the questions were relatively open-ended and asked without aiming for completely parallel results and without planning for concerted tallies.

Table 4: Summary of Interview Topics and Structure.

| Topic | Details |
|---|---|
| Screening | Latino/Hispanic-identifying household; respondent remembered audit and/or audit report; still lived at the audited home. |
| Preliminaries | Incentive offer (\$25 gift card to Amazon.com or Target), legal request for permission to record, owner/renter. |
| Motivations for audit | What led the household to complete an audit? |
| What did they remember about the audit and its follow-up? | What recommendations did they receive, what happened during the in-home portion of the audit, any follow-up with CVETU ¹² , their perception of report. |
| Response to audit recommendations | Responses to audit recommendations: what recommendations did they do, consider, not do, and why? ¹³ |
| How they completed recommended upgrades, if they did any | If they completed one of the audit recommendations, how did they do the work—including they did the work themselves, whether they hired somebody to do it and if so, how did they find that person, and what research they did? |
| Probes about recommendations they were considering, and upgrades of any sort they had done | Are they considering doing any (or any additional) recommendations? If so, what are their thoughts on how they will do it? What other home upgrades have they done, or are they considering doing? How do they usually do home upgrade work, e.g., themselves, hiring a contractor, etc.? |
| Loans and financing | Did they consider or elect financing for this work, particularly a PACE loan? Are the familiar with the various types of PACE loans? Or how else do they/might they finance? What are their attitudes towards loans for home energy upgrades? |
| Feedback on audit process | Was there additional information that they would have liked to receive? Do they have recommendations to improve the audit experience? |
| Ending demographics | Basic characteristics in terms of monthly energy bills, number of occupants, whether any occupant was born outside US |

Household Basics and Technical Audit Results

The Households and Homes

To protect the privacy of the households we interviewed, household street addresses were not used in the analysis.¹⁴ As mentioned above, for reasons of interviewee comfort, we did not ask households

¹² CVETU makes follow-up phone calls to audit recipients in limited cases, and provides contact phone numbers in the audit report.

¹³ At the time of the interview, the interviewer did not have the audit report; these were received only after the interviews were completed, only for households who completed an audit.

¹⁴ The physical addresses were used in interviews to verify that the correct household had been reached, but were rescinded in the data transfer for the analysis.

about their income. Rather, to understand basic household economic and environmental conditions, we used two main sources:

- (1) a low-resolution photo of each home incorporated onto the cover of each Home Energy Action Plan in combination with basic information about the house from the audit (house size, year built, air tightness and other physical metrics etc.), as included in Energy Action Plan; and
- (2) statistical data on the demographics of the 5-digit ZIP code in which the house was located.

All interviewee homes were located within five Central Valley counties, as shown in Table 5. The majority were in Kern County or Fresno County. Economically, Kern County industry is dominated by agriculture, oil production, and manufacturing. Fresno County is the top agricultural county in the United States in terms of revenues.

Table 5: Interviewee Home Location, by County and Audit Language.

| County | English | Spanish | All |
|--------------------|----------------|----------------|------------|
| Fresno | 4 | 6 | 10 |
| Kern | 3 | 8 | 11 |
| Kings | 2 | 0 | 2 |
| Merced | 2 | 1 | 3 |
| San Joaquin | 2 | 2 | 4 |
| Total | 13 | 17 | 30 |

The homes of the individuals we interviewed were in ZIP codes that had higher proportions of Hispanics,¹⁵ lower median household income, and very low median home value compared to the rest of California, as shown in Table 6. In six of the ZIP codes included in our sample, over 60% of the population are Latino or Hispanic, according to Census Bureau statistics, speaking to high levels of ethnic segregation. Economic segregation is high as well. In Lamont, for example, where six of the interviewed households are located, the median household income (\$35.7K) for 2015 is 43% lower than the statewide median household income. The median 2015 value for homes or condos in Lamont is estimated at \$104K, compared to the California median of \$449K.

¹⁵ Except one, where the proportion was equal to that of the state (38 percent).

Table 6: Demographic Characteristics of ZIP Codes for Interviewed Households.

| Location by ZIP Code | Number of Interviewees | Percentage Hispanic or Latino ¹⁶ | Median Household Income, in USD (2015) ¹⁷ | Median House or Condo Value, in USD (2015) ¹⁸ |
|----------------------------|------------------------|---|--|--|
| Atwater (95301) | 1 | 49 | \$47,829 | \$130,308 |
| Bakersfield (93306) | 4 | 57 | 57,688 | 361,800 |
| Corcoran (93212) | 2 | 63 | 40,256 | 109,800 |
| Fresno (93702) | 1 | 75 | 41,531 | 89,500 |
| Fresno (93704) | 1 | 38 | 53,889 | 205,100 |
| Fresno (93722) | 7 | 44 | 41,531 | 178,200 |
| Fresno (93727) | 1 | 43 | 62,666 | 197,200 |
| Lamont (93241) | 6 | 95 | 35,609 | 104,437 |
| Los Banos (93635) | 2 | 64 | 44,292 | 167,000 |
| McFarland (93250) | 1 | 90 | 34,032 | 122,300 |
| Stockton (95205) | 1 | 69 | 44,797 | 106,600 |
| Tracy (95376) | 3 | 43 | 76,310 | 247,400 |
| California Overall | n/a | 38 | \$61,818 | \$449,100 |

Figure 14 shows ZIP code-level median home values graphically. The highest ZIP-level median home value, for the Bakersfield ZIP code 93306, is just \$362K, 19% lower than the statewide median, and median home values hover around \$100K (+/- 20%) for five ZIP codes in the sample (encompassing 11 interviewed households). Home values can vary substantially within a ZIP code, but the low home values shown in the figure underscore that, contrary to what might be assumed, owning a home in the areas covered in our interviews is not an indicator of absolute wealth. Average housing-cost burden¹⁹ in California is considerably higher for Hispanics (57%) vs. white non-Hispanics (48% average) (Housing and Community Development 2017). In addition, Hispanic households in California – especially those headed by a foreign-born Hispanic householder – have a higher tendency to be “crowded” than non-Hispanic white households, according to analysis of 1990 and 2000 Census Data (Moller et al. 2002).²⁰ And as one of the experts interviewed earlier in the project suggested, owning a home does not necessarily imply high credit scores or comfort with financing products. Some of the interviewees have middle incomes per their own rendering, but – understanding that home value does not necessarily translate to income levels – our impression from the conversations was that many were low-income.

¹⁶ Data on percentage Latino or Hispanic are from the 2010 U.S. Census, retrieved from American Fact Finder, www.factfinder.census.gov.

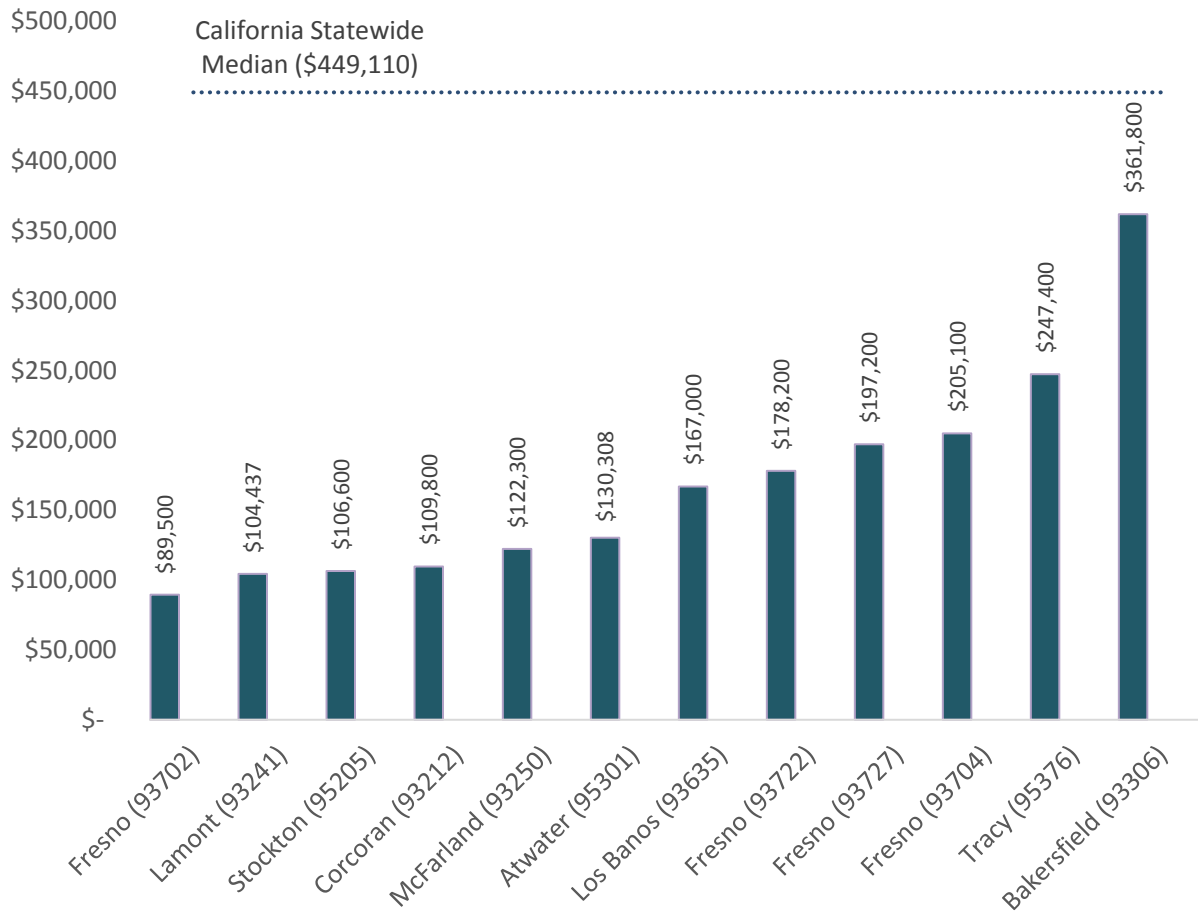
¹⁷ From Census Bureau “QuickFacts” data for median family income 2011-2015, in 2015 dollars.

¹⁸ Estimates are from www.city-data.com (as of 2 September 2017).

¹⁹ Following the U.S. HUD definition, the coted report defines housing-cost burdened as paying more than 30% of income toward housing costs.

²⁰ Crowded is defined as more than one person per room.

Figure 14: Median Home or Condo Value in 2015 for ZIP Codes in which Interviewees Lived.



Audit Results Overview for Interviewed Households

Our research is not focused on the audit itself, but rather uses the context of the audit to explore how Hispanic audit recipients think about the energy efficiency upgrades and recommendations, and how they pursue these upgrades in terms of implementation and financing, if at all. This section provides a basic description of the audit results for the interviewed households, including the technical recommendations that interviewees received.

As noted above, many of the audit recipients live in ZIP Codes with low housing values and low median household income relative to other homes in California. While there was clearly variety in terms of income, house value, and upward mobility, housing conditions were sometimes poor, as judged by the audit photos, audit measurements, and interviewee descriptions.

Table 7 summarizes, overall and by audit language preference, annual energy costs, home floor area, year built, and measured infiltration for interviewee homes averaged across households.²¹ On average,

²¹ These data are drawn from the Home Energy Action Plan.

the houses are 40 years old, with a median construction year of 1981. Thus, half the homes were built before California’s building energy codes were firmly in place.²² Overall, the houses are small relative to modern construction practices, with half of 1,148 square feet or smaller. Interviewees who preferred Spanish language for their audit results had older homes on average versus English-preference homes (1971 vs. 1982). Their group average annual energy costs were 14% lower, with slightly (6%) smaller average home size.

The action plans reported an average annual energy cost of about \$2,000 per year for our interviewees. The end use expense of top concern for most households was air conditioning, which was in any case top of mind, given that the interviews were conducted in mid-summer. This does not mean heating performance and costs were not an issue, at least for some households, and several mentioned that their homes did not retain heat or coolth. Average monthly energy costs across households ranged from \$74 to \$283.²³

Table 7: Basic House Characteristics by Preferred Language for Audit: Average Values across Interviewed Households.

| | English | Spanish | All |
|---|----------------|----------------|-----------------------------|
| Annual Energy Costs | \$2,213 | \$1,904 | \$2,043 (median \$2,010) |
| Floor Area (square feet) | 1,292 | 1,209 | 1,246 (median 1148) |
| Year Built | 1,982 | 1,971 | 1,976 (median 1981) |
| Infiltration (ACHn)²⁴ | 0.49 | 0.49 | 0.49 (median 0.46) |

Table 8 lists the major recommendations made to the interviewed households, as compiled from their Home Energy Action Plans. All households received at least two recommendations. Air sealing was recommended in all 30 cases.²⁵ Attic insulation and a 15 SEER air conditioner were also recommended in at least half the cases. In addition to these major upgrade recommendations, report sometimes included simpler, smaller, recommendations (without any estimates of costs or savings), particularly to install a water heater blanket, lower the water heater temperature, and to install CFLs or LEDs in place of higher-

²² The California Building Energy Efficiency Standards (Title 24, Part 6) was first issued in 1978.

²³ These are the total annual costs divided by 12 months, compared across households; for many households, summer costs might be considerably higher than the average monthly cost.

²⁴ In almost all cases, the audit included a blower door test to measure infiltration, reported as natural Air Changes per Hour (ACHn). Each Home Energy Action Plan explained this measurement and compared it the recommended target of 0.35 ACHn. Homes that leak too much waste energy, while homes that leak too little without supplemental mechanical ventilation have higher risk for indoor air quality problems.

²⁵ In most cases, this recommendation was based on a blower door test; homes with ACH greater than 0.35 – for our sample, all homes for which measurements were taken received a recommendation for whole house air sealing. In two cases, the recommendation was based on visual inspection.

wattage lamps. In addition, according to the interviewees, some auditors made recommendations in person, e.g., for behavioral conservation measures.

Table 8: Major Upgrades Recommended in Audits of Interviewed Households.

| Measure | Number of Times Recommended (among n=30 households) |
|-----------------------------------|--|
| Air sealing | 30 |
| Attic insulation | 21 |
| Air conditioner (15 SEER) | 15 |
| Evaporative cooler | 14 |
| Window low-e film | 12 |
| Wall insulation | 10 |
| Duct sealing | 5 |
| Water heater (gas storage) | 5 |
| Floor insulation | 4 |
| Windows, high-efficiency | 2 |
| Duct replacement | 1 |
| Oven | 1 |
| Variable speed pool pump | 1 |

Table 9 summarizes the financial estimates given in the Home Energy Action Plans, averaging across households for interviews conducted in English, in Spanish, and in total.²⁶ The report includes estimates of annual savings from the package of recommended upgrades, upgrade costs with and without financial incentives for which the household is eligible, the net difference in monthly costs figuring energy savings less retrofit costs, and payback in years. While actual cost-effectiveness depends on the end uses affected and the specific project costs, in general, households with lower expenses will have longer payback periods. The households with Spanish-language preference on average had bills that were 14% lower – and slightly smaller and older homes – than those with the default English language preference. Audit results showed correspondingly lower annual savings (and lower estimated project costs) for Spanish-preference households versus English-preference households.

²⁶ In all but two cases, interviews conducted in English had English-language home assessment reports, while those conducted in Spanish corresponded to Spanish-language reports. As documented on page 10 of the Home Energy Action Plans, financial estimates were based on the California Public Utility Commission’s DEER (Database of Energy Efficient Resources).

Table 9: Summary of Home Energy Action Plan Financial Estimates for Interviewed Households.²⁷

| | English Interviews | Spanish Interviews | All Interviews |
|---|--------------------|--------------------|----------------|
| Average Annual Savings | \$663 | \$547 | \$599 |
| Average Estimated Cost | \$5,205 | \$4,079 | \$4,584 |
| Average Estimated Cost after California Incentives | \$4,213 | \$3,339 | \$3,675 |
| Average Estimated Monthly Net Savings | \$10 | \$7 | \$9 |
| % with Estimated Monthly Net Savings > 0 | 62% | 59% | 60% |
| Average Payback (in years, including incentives) | 6.7 | 7.8 | 7.3 |
| Number of Households | 13 | 17 | 30 |

The average payback period for the recommended energy efficiency investments was slightly over seven years. These payback estimates incorporated all major upgrades, though some individual upgrades would pay back much more quickly than others. Overall estimated savings for the Spanish-speaking households was about 20% less than for English-preferring households (\$547 vs. \$663).

The Home Energy Action Plan included estimates of the net difference in monthly costs, considering expected savings from the upgrade less amortized upgrade costs. In 11 of the 30 cases we studied, this estimate was zero or less, i.e., monthly energy-related costs increased with the investment over the period tallied in the report. The average net difference (Average Estimated Monthly Net Savings, which is the average of the difference between energy cost savings versus upgrade investment costs) was \$9 per month, as shown in Table 9. Considered as a monetary investment, this presentation of the economics of recommended upgrades made it clear that savings could be quite marginal. Large investments for marginal (or no) monthly savings are little doubt unattractive for cash-strapped homes, as some of the interviewees indicated. Households with higher disposable income conceivably might more easily consider benefits other than energy costs, such as comfort and home value, as part of the benefits derived from recommendations. The results illustrate a common dilemma in home efficiency upgrades: return-on-investment for upgrades are generally best for households that have high energy costs.

²⁷The first four rows of the table, as well the data for Average Payback, are fields reported on page 10 of the Home Energy Action Plan for each of the homes in our final sample; see Appendix A for a sample of these reports. The figures for Payback and Monthly Cost assume 7% interest on a 10-year loan. The Estimated Monthly Net Savings for each household is the difference between the estimated Monthly Utility Bill Savings and the Estimated Monthly Upgrade Payment. Energy savings calculations assume average weather, thermostat settings and hot water use.

Interview Results

Audit Recollections and Reactions

All interviewees said that they remembered the audit, since this was one of the screening criteria. There was a wide variety of types of basic levels and types of reactions.

Recalled little about the audit, if anything at all.

In a few cases, the interviewee appeared to be barely, if at all, familiar with the audit or audit report, or to be very disengaged in answering questions (e.g., as if answering a service satisfaction survey, or very distracted). In some cases, the audit could have been nine months earlier, which can also account for low recollection.

Remembered the audit, or the report, but paid little attention to the recommendations.

In at least five cases, the interviewees said that the conclusion of the audit was that “everything was okay,” “todo está bien,” “there are no problems,” or something similar, and that appeared to be end of the engagement. This is a more interesting reaction than simple lack of attention, as discussed further below, since it speaks to expectations about the audit and what individuals saw as a “problem.” Others recalled the audit or the report, or both, but with an indication that they had at best only glanced at the report, or remembered only minor recommendations, such as they should change light bulbs.

Remembered they received something different than what the audit provided.

Three interviewees described direct installs of efficiency measures (e.g., light bulbs, low-flow showerheads, and weatherization measures) and even adjustments to the air conditioner. The CVETU audit itself does no such installation or adjustments, so the interviewee may have remembered the CVETU audit but conflated it with something else. PG&E offers such services and also co-brands CVETU.²⁸ Overall, there were a few times where the interviewee appeared to be talking about another home energy related experience, in addition to or instead of the CVETU audit; these may have been linked to the audit somehow (e.g., a contact provided by CVETU), or not.

Paid careful attention to the audit results but rejected doing any upgrades, at least for now.

In some cases, the interviewee seemed to have carefully considered the audit results but decided not to do anything, e.g., because they judged the costs too high, or they were moving. These cases are described further later in the report.

²⁸ There are also local agencies that conduct weatherization on low income housing, such as Fresno EOC in Fresno County, and CAP of Madera for Merced and Madera (Alex Vantaggiato of ConSol, Stockton, in personal communication to CSE).

Seriously considering doing an upgrade.

Some households were in the process of investigating specific upgrades, though they had not yet done anything. And others said they would revisit the question at some time in the future, e.g., at the beginning of next year.

Made an efficiency improvement recommended in the report.

Some households reported having completed at least one upgrade. Two had completed larger-scale insulation work. Most of the time, the upgrades mentioned were minor, such as changing light bulbs, installing blackout curtains, or adding weather-stripping or sealing other specific areas of infiltration.

Audit Motivations

CVETU actively recruits residents to sign up for and complete an audit for their home. People did not necessarily know what exactly to expect from the audit, with many interviewees saying they did the audit because somebody friendly said it was available, wouldn't cost them anything, and it could help them. For example, when asked why they undertook the audit, one said:

"Because the guy said it was free. That's why."

Still, even among those who were prompted to complete the audit by active recruitment, there were often latent concerns, especially about air conditioning costs. In this sense, the audit could have highlighted the fact that energy costs and comfort issues might often be reasonably actionable.

Some sought the audit actively. Asked what led him to do the energy audit, one interviewee said:

"Desperation. To build on this property is kind of questionable."

This homeowner proceeded to give a savvy technical assessment of what he saw the flaws of the original construction and on possible solutions to the energy flows within the space. In short, he knew how an energy audit might help him.

A few indicated that they hoped the audit would connect them to assistance in installing measures, e.g., a direct install program. For example:

"I read some of [the report] to see if I can find someone else where they can help you to do that, but they said since I already did it, that I can't do it again."

Reasons for Not Completing Upgrades

We used the interviews to try to understand not just what people did, but more importantly, how they viewed the upgrade recommendations that they received from CVETU. These conversations usually focused on the interviewees' explanations of why they did not complete, or often even consider, pursuing these upgrades, as detailed in the sections below.

“There are no problems.”

A common recollection of the audit and audit report was that there were no problems, or there were no recommendations, even though the report gave a minimum of two major recommendations in all cases. Sometimes, this could have been simply because the interviewee did not want to continue the conversation (e.g., was distracted), was thinking of a different experience, or did not recall the audit well enough to discuss it. But often this reaction seemed to have been that the interviewee considered there to be no problems: everything worked well enough and there was nothing that had to be done.

This “satisficing” (Simon 1990) result can be interpreted within the context of other household concerns, conditions, resources, and expectations – e.g., financial stress, comfort with the steps that would need to be taken to complete the work, time constraints, or living standards. In this context, some may have interpreted the audit as a basic energy inspection, e.g., to help reveal possible faults or risks.

For example, asked what their reaction was to the energy audit, and whether there were any problems discovered, one Spanish-speaking interviewee said:

“No porque pues tengo la energía pues, todo ésta bien. No, no tengo problema.”

“No, because I have energy, everything is fine. I have no problems”

The criteria for “fine” here was apparently having energy available in the home, in contrast, say, to non-electrified home or those that have been disconnected from the utility due to account issues.

Another interviewee indicated that while their bill is “very high, extremely high, every single month,” her assessment of the audit report was that it said “everything was fine.”²⁹ We heard something similar – often in exactly those words – from several different interviewees.

Another interviewee, one who had decided to do the audit at the encouragement of a canvasser, said:

“The house is like kind of new. It’s not that old that I need to change my insulation or something, you know. I think they were kind of crazy telling me that I needed to change my insulation.”³⁰

In this case, the upgrade recommendations did not make sense in the eyes of the interviewee, since the home itself was quite new.

Another explained that he was an “energy saver” anyway, giving examples of how attentive he was to conservative use of energy in his home. He said he had already done efficiency work (apparently weatherization), had built a patio to improve shading, and had no problems with things as they were. And, in fact, though he did receive several recommendations, the audit results reported in his action

²⁹ The average monthly bill for this household was \$151, slightly lower than the median monthly cost (\$168) among our sample, though little doubt unevenly distributed with higher bills in the summer months.

³⁰ The recommendations for this house were air sealing, an evaporative cooler, and attic insulation. [

plan bore out this perception that energy use was fairly low and that that there were no highly-problematic issues found.

“I still don’t know what to do.”

Some interviewees said that the recommendations were not clear enough, or that they need more information on how to go about doing it, e.g., indicating that the report did not provide the information about contractors, prices, or financing help that they were seeking. The report does provide such information (directly or via links), so it is unclear if these interviewees missed or misremembered it, or instead wanted different or more information, or assistance delivered in a different way. But overall, even if the recommendations were written clearly, accomplishing them is something else. In addition, the challenges are not just a matter of “understanding” in a basic sense, but also likely of learning style and expectations. In particular, some interviewees seem to have been seeking, or would have appreciated, a conversational approach. For people who have not done home upgrade work before, or who grew up elsewhere, there is nothing necessarily “natural” about pursuing, deciding about, or contracting for energy efficiency work.

As is, CVETU makes follow-up calls to the 20% of homes in which the energy savings opportunities identified by the audit are highest. All audit reports provide a CVETU contact number for further questions, but the CVETU follow-up call gives a “push” opportunity for households who are either generally hesitant or have specific questions to talk over options with an expert. The interviews suggest this personal follow-up is needed by several audit recipients.

The degree to which audit recipients understood the recommendations depended on their technical savvy and their reliance on the internet. For some, the recommendations seemed clear enough, with any questions resolvable by an internet search. However, others would have preferred, or needed, more basic information or help. One interviewee said:

“Este pues a mí me dijeron, por decir que me, que mi casa necesita insolación. Pero como no, no sé yo cómo, como funciona eso o que tengo que hacer porque pues yo, yo no tengo quien me ayude.”

“Well, they told me, let’s say, that my house needs insulation, but I don’t know how that works or what I have to do because, well, I don’t have anybody to help me.”

In some cases, the audit recipients may not have understood the terms or concepts used in the audit reports. There was some confusion about what “air sealing” meant and how to go about it:

“[If the report were to say] hire this kind of person to do this, that would be ...more direct and we probably would have known what to do better because ... we do need ... seals and stuff... I’m like, I don’t even know ... how to seal up the house and stuff like that.”

There was occasional, and understandable, confusion between insulation and weatherization, with interviewees sometimes using the term “insulation” to refer to various sealing measures. Interviewees

seemed to remember and react to the infrared images, which auditors may have often shown the occupants on the spot, in addition to including them in the Home Energy Action Plan.

Several mentioned that they found the actual visit more interesting than the report, especially because they could talk about specifics with the auditor, whereas they viewed the report as more general. Asked whether they followed any of the recommendations in the report, one interviewee said:

“No ...What he told me when he came to the house was interesting, but I didn’t see [in the report] what to do about it...”

In sum, energy problems are specific and sometimes complex, and despite the details included, the report may not have suited the learning style of some of the audit recipients. A disconnect between technical recommendations and knowing how to complete them is a common issue in home energy audits and advice, e.g., there is an emphasis on efficiency as a state but not home improvements as a process (Wilson et al. 2015). From a program-centric standpoint of conversions to upgrades, talking through some of the recommendations in person, and how and why to go about doing them, might have encouraged some upgrades, at least those at an appealing price point. The “I still don’t know what to do” reaction, however, may sometimes have been as basic as the acknowledgment that, whatever information one is given, there are still many choices and steps to take in making most home energy improvements.

“It doesn’t make sense in my circumstances.”

In most home energy audit framings, energy efficiency upgrades are presented as investments that benefit the occupant over time, with upfront or amortized payments that provide a stream of personal financial and other benefits in the future. This can be a logical framing in cases where there is a good sense of stability and predictability. A number of the households we spoke to did not have that sense, whether related to mobility or to finances.

Some interviewees were already planning on moving from the audited home, or did not expect to be in the home for a long time—for example saying they were occupying a starter home and expected to be elsewhere in ten years, i.e., a sense of upward mobility. One of these also described the dilemma of being middle income, too rich to qualify for low-income assistance and not rich enough to have the money for the upgrades or at least feel comfortable about spending it:

“I ended up calling some of these numbers on the pamphlets, but if you’re not low income you’re really are paying a lot of money for it... It may balance out over like maybe ten years from now if we did all those changes, but I don’t plan to be here ten years from now...”

So if you look at it, if you’re not poor, ...you’re kind of stuck in the middle. Clearly if I was rich, I wouldn’t be living in this area....

Yeah so honestly, I didn’t follow through because I was like I can’t afford this. This is crazy.”

Others pointed to uncertainties they had about the future or major changes in the past. For example, a woman in her 60s received an audit report that indicated moderately high energy costs (\$174/month on average)³¹ given the one-person occupancy and that she had solar panels. The audit report suggested annual potential savings of almost \$900 per year, though with a substantial investment. When asked about the audit report, she said that she did not pursue the recommendations other than changing light bulbs:

“I’m a widow so I really don’t use that much. ... only when my grandkids come over.”

Asked whether she planned to do any upgrades, she said:

“I don’t think I have the means, the money to do [upgrades] because I now live on my Social Security and in a small fashion...Whatever I have in the house, that’s the way it’s going to stay...My oldest daughter, she wants me to go with her, but I don’t know.... I don’t know what’s going to happen with my life.”

Nor did she experience particular performance problems in her home. She was fairly active in the maintenance of her home, calling in repair people to fix problems such as a broken fence. But the fixed income, apparent frugality, orientation towards others, uncertainty about near-term future in particular where she would be living, and possible exhaustion all speak against the effort and expense of non-essential, invisible investments. She had worked hard all her life, as she described it. This situation illustrates some of the real-world limitations that contrast with idealistic views of energy upgrades.

“I’m interested but I don’t want to spend the money right now.”

Asked whether there was anything in the report that they were interested in but was too expensive, one interviewee said:

“Yeah, our AC is too small for the house and it’s like five grand though. So we just don’t have the money ... We’re not trying to get any loans right now. We got too much.”

For this household, it is not about whether they could get a loan, or whether the upgrade appeals, but whether it is worth the extra stress acquiring, holding, and paying off additional debt.

Another interviewee, speaking in Spanish, explained that her home is very uncomfortable in both summer and winter, but they cannot do anything about it:

“Pues ya ahorita no me acuerdo pero si, como la casa se calienta bien feo y como no tengo aire acondicionado no, no está funcionando bien pues que en tiempo de frío hace mucho frío y en tiempo de calor hace mucho calor.”

“The house warms up very badly because I don’t have an air conditioner, no, it’s not working well. In times of cold weather, it is very cold and in hot weather, it is very hot.”

³¹ Incidentally, her description of energy bills was considerably lower, citing \$98 in the summer months, and \$50 and under in other months. The source of the discrepancy is not clear but may have to do with solar panels (apparently leased), or possibly with separate bills for natural gas versus electricity.

They know they need insulation, but do not want to install it because they cannot afford it. She explains further:

“It was very good information, but I only see the expenses, and well, there is no time. One can’t do it.”

“That’s not how I’d use my money.”

One of the known challenges of getting people to invest in energy efficiency in their homes is that the value of efficiency, per se, is usually not visible, and sometimes not even palpable. Even for people who track their energy bills, modest efficiency investments tend to bring hardly-visible benefits. Asked by the interviewer what upgrade options she might undertake for her home if money was not an issue, one just said:

“I’d buy a bigger house rather than upgrade this one.”

As suggested by the above conversation, individuals are not necessarily “committed” to the homes they occupy, and thus may have no interest in investment.

“I need something that the audit doesn’t give me.”

Some interviewees said they needed assistance that was outside the scope of the what the CVETU audits provided, explaining, for example, calls they had made to try to get direct install or financial assistance for upgrades.

Some had basic issues with equipment, but did not have the means or perhaps the impetus to repair. One Spanish-speaking interviewee said:

“Las personas que vinieron acá dijeron que el aire acondicionado no estaba trabajando, porque casi no lo usamos, porque dicen que adentro está como roto o algo y no pudieron ayudarnos con eso, teníamos que pagar para que nos ayudaran con eso. No usamos el aire, señora, no lo estamos usando ahorita, este, el aire acondicionado, eso no lo usamos, pero ese fue el problema que hubo.”

“The people who came and checked said the air conditioning was not working. We seldom used it. They said that it has a malfunction inside and they really could not help us with that. We don’t use the air, Miss. We don’t use it right now, the air conditioning, we don’t use it and that was the problem we had.”

This individual further explained that both she and her husband had gotten sick. They used a portable air conditioner, “one of those ones that uses a lot of energy,” but that’s all they could do at the moment.

“I’m a renter.”

Though renters were not a main target of our interviews, we completed interviews for six renters. None of these renters mentioned doing any upgrades in reaction to the audit, though some said they provided, or would provide, the action plan to the landlord.

“I learned not to do something that I would have done.”

According to popular industry knowledge, one of the first energy efficiency upgrades that homeowners think of doing is improving the windows, in particular, replacing single-pane windows with double-pane windows. This is a visible upgrade that is heavily marketed and provides aesthetic benefits, so the propensity to think of windows as a first option is not surprising. A few interviewees that we spoke to mentioned this as a desire or rough plan they had, prior to the receiving the CVETU assessment, or even as something they would do in a future house. The CVETU assessments rarely recommended window upgrades (only once in our sample of 30), other than installing low-E film. One homeowner said that he was grateful that the report had convinced him not to upgrade windows, which he had been planning to do, at a cost he estimated at \$12,000, and another expressed some regret that they had replaced windows.

“I have solar so these upgrades don’t seem compelling.”

Two of the 30 interviewees said that they had installed solar panels, and a few others said that they had or were considering doing so. The two who had installed solar said that their energy costs were low. One said they paid just \$11 month for electricity, and another said their monthly energy bills ranged from \$28 to \$98 net.³² While these homes might not function efficiently, or necessarily even be very comfortable, both of these households noted that their bills were not high enough to be very compelling to pursue major efficiency upgrades.

One contractor interviewed earlier in the project suggested that there were situations where households in the Fresno area found it easier to install rooftop solar than to pursue efficiency upgrades. In particular, rooftop solar is often a market package, where installers sometimes offer financing, and credit requirements may be lower than for other home upgrade loans. In addition, solar may appear to solve several problems at once, versus a riskier piecemeal approach generally required by efficiency upgrades. The Home Energy Action Plan boilerplate included a discussion of adding solar panels, in addition to the efficiency recommendations and discussion.

Upgrades Completed and Motivations

The major upgrade recommendations interviewees reported having completed was adding insulation, in two separate cases. In one of these cases, the insulation was completed by a contractor the homeowner

³² These estimates are not reflected in the bill estimates used in the report.

found through CVETU resources. In another, a friend installed attic insulation. Another said they added a “suncooler” (in Spanish) in response to the audit, because they had air conditioning.³³

In several cases, households said that they had proceeded with local air sealing and circulation projects, including door vents and weather-stripping. Others said that had replaced some light bulbs or added blackout curtains. A few households mentioned behavioral changes, such as increasing the air conditioning setpoint. Some auditors made such behavior change recommendations while they were in the home.

Several mentioned that they may do some of the recommended upgrades in the future, when they have more money available or have the time to pursue them. And it seemed clear that some interviewees felt that their understanding of their home was better after the audit, especially if they had some conversations with the auditor.

DIY vs. Hiring Contractors

When interviewees talked about doing upgrades to their home that were not of the regular DIY-type (e.g., applying weather-stripping) that they would do on their own, they overwhelmingly mentioned relying on family members or others in their network who could do the work or could refer them to somebody who could. For example:

“Honestly, because we have our family in construction, it’s very easy for me to say hey, do you know somebody who can do this?”

Comments like this were common. This referral or known-party approach was clearly the main path to finding somebody who could do the work, versus looking up contractors through a Google search or on a utility web site. Nobody mentioned the phone book, Yelp, or Angie’s List. Only a few said they would look up a contractor.

Within this networked approach, there are various possibilities. Some connections are licensed contractors or professionals, with the advantages of being known quantities, trustworthy, or willing to give a good deal. Others may be more generally handy but not necessarily specialists or licensed contractors – potentially leading to quality issues with certain energy efficiency upgrades. One interviewee mentioned, for example, a case where an acquaintance had done a casual repair for her using material she bought, but the repair was done poorly. And some connections may just give advice about where to go and what to look out for in pursuing any upgrade.

The household surveys conducted for San Diego and Fresno counties earlier in this project found that foreign-born Hispanic households were much more likely to use DIY or unpaid help than U.S.-born non-Hispanic respondents, while participation in construction trades were roughly equal (CSE 2017). The interviews, though not strictly comparative, reveal a high likelihood to rely on a network connection to pursue home upgrades – whether using one’s personal network to conduct the upgrade or simply to get a referral to a trusted professional. One of the contractors interviewed as an expert earlier in the project

³³ It is not clear what a “suncooler” is; it may be a shading device or low-e window film.

noted this networked approach with some frustration, since he found he was being called on to “advise” for no or little fee, with the actual work being done by somebody within the homeowner’s network, for cheaper, on the basis of that advice (Moezzi 2016). This reliance may be largely about the existence and importance of strong social networks, a strong interest in saving money on upgrade costs, and a social rather than “market” approach to getting things done.

Financing

Recommendations for relatively expensive energy efficiency upgrades are often offered with the expectation that households will see them as financial investments that pay off in energy savings over time, and thus may merit an initial investment upfront, even if this investment is financed.

There was a variety of reactions to the question of using a loan to finance. In general, most households were not interested in financing energy efficiency upgrades: e.g., only 20% seemed to be willing to consider taking out a loan for such work. A few said that they didn’t want to take on more debt of any kind:

“I know I needed it, but if it’s going to cost me money, I couldn’t do it. I can’t afford [attic insulation] right now. I almost lost my house already. I [had] to get a loan for it. So I’m paying on my loan right now ...it’s hard for me to do anything with my house.”

And later:

“Don’t send anybody out here helping me on the house because it’s going to cost me money.”

Nor, in this case, did they even want to spend the funds for weather-stripping the doors. That is, in some cases, the thought of spending money on the house is unappealing. Loans are not truly a solution when monthly expenses are an issue, as one Spanish-speaking interviewee noted:

“If I get a loan, I have to start paying for it.”

Similarly, one woman explained that they rarely used the air conditioning, which worked poorly, but described why they could not repair it and why a loan would not help at this point:

“We don’t have the money. I got sick and barely started working again and this month I got an injury at work...My husband was also sick...We don’t have the money to get it fixed... When we have the money, we will fix it... If I get a loan, I have to start paying for it....I am not ready to fix it.”

While a loan may be a non-starter for this family, they are burdened with a monthly energy bill of \$200-300 for their large household.

Others preferred to pay cash. Only a few households seemed to be familiar with PACE loans. One household had already taken out a HERO loan for windows replacements, prior to the CVETU audit; another mentioned an Opportunity Loan and a CaliforniaFIRST loan.³⁴

At least one actively considered a HERO loan but rejected it because they felt the rates were too high for people of their income level:

“We have tried the HERO loan except their interest rates are super high for us because we wouldn’t be considered low income. So then we wouldn’t be considered low income so they’d charge us a lot.”

Language

Over half of our interviewees preferred to talk in Spanish (or in one case, Mixtec) versus English. Some of those who were not fluent in English mentioned that language barriers limited their ability to find contractors or find additional information on pursuing upgrades – perhaps particularly in understanding written information.

Discussion and Recommendations

Policies to encourage energy efficiency upgrades in homes in the United States and elsewhere are generally based on the premise that homeowners want to save energy and money by doing upgrades but are impeded by lack of capital, inadequate returns on investment, and various uncertainties about what to do and how to do it (Wilson et al. 2015).

But few of the owner-occupied households seemed to think they had an “efficiency problem” before they did the audit. Overall, there seemed to be little aspiration among our interviewees for an energy efficient house, *per se*. Most did the audit because they were encouraged to do it, without any prior curiosity or impetus. In some cases, the house might function well with respect to energy use, providing acceptable or comfortable conditions at moderate costs. In others, there could be functional problems and high energy costs that were not recognized as such by the household. For example, a household might pay \$300 in energy bills each month in the summer, and not like doing so, but “that’s what it costs.” A few had completed, or planned, major upgrades based on the audit recommendations. Others had made minor upgrades such as weather-stripping or light bulb replacements.

By most accounts from our interviewees, these audits were useful. However, as is commonly found in home energy audit programs, the recommended upgrades were not often perceived as both actionable and compelling (Ingle et al. 2012; Wilson et al. 2015). Nor did many of the households seem to think they had an actionable energy problem even after the audit, either because they perceived no lack of efficiency, or did not have the means, time, attention, or desire to do more.

As mentioned at the outset, our study was not intended to evaluate the audits. In our case, between four and ten months had passed since the audit took place. That is not a long time given the expected

³⁴ HERO and CaliforniaFIRST are examples of PACE programs.

pace of home upgrades, and some of the recommendations may be completed in the future, where there is more time, money, or the ability to synchronize with a related home improvement.

Our interviewees contrast with those in most home energy audit programs for several reasons. First, we only selected interviewees who identified as Latino or Hispanic. Over half of these interviewees were interviewed in Spanish and had requested audit materials in Spanish. Second, although we did not directly collect economic information from the interviewees, the median household incomes and median home value in the ZIP codes in which these interviewees resided were lower, often far lower, than the California statewide medians. In most home energy audit programs, participants tend to have middle or high incomes (Sanquist et al. 2010). The households studied in these interviews are generally poorer, sometimes much poorer, than the “average” consumer considered in thinking about, or conducting, home energy audit programs. They often appeared to live in poorer quality homes than the average home. Many were not comfortable speaking English. And quite a few described various problems they were having in their finances or health, sometimes with an undercurrent of precariousness or instability. So, while many clearly could have benefited from energy efficiency improvements in their home, achieving this seemed even harder than in the middle-to-upper income household typically considered in energy efficiency program logic. What did seem clear, however, is that many interviewees had trusted networks of people who knew how to do home repairs and improvements in general, even if they were not efficiency specialists.

The audits themselves clearly played an educational role for some households, especially where there were technical conversations between auditor and occupants. Our interviews did not focus on understanding these educational aspects, but some of the interviewees’ comments are consistent with an earlier conversation we had with one of the raters who works with the CVETU program. The rater described examples of his efforts to educate homeowners during the audit visit, giving two illustrations. Even in new houses, for example, occupants might try to save money by using portable electric resistance heaters rather than using the central heater. “Sometimes, when households try to save money, they end up spending more money,” he noted. He explains to the occupants that electric resistance heating is expensive, and that it would be cheaper to heat their whole house with gas due to differences in fuel costs. Context-specific behavioral recommendations are usually missed by efficiency-oriented information, which focus on the technical characteristics of the home and equipment rather than on how the household uses the energy systems in their homes (Ingle et al. 2012).

The second educational example was explaining in graphic detail what insulation does and why more might be needed if some is already present. He sometimes gives the homeowner an explanation that compares insulation to a kitchen sponge, where the thickness of the sponge limits its ability to absorb water, in parallel to the thickness of the insulation and its ability to absorb heat. Since homeowners don’t necessarily think much about insulation and the details of how it works, this kind of explanation might be a useful complement to a technical recommendation to increase wall, floor, or attic insulation to R-13, etc.

Also speaking to graphic or visceral understanding, many of the interviewees we spoke to mentioned the infrared thermographic images as being useful. Several of these images were included in the Home

Energy Action Plans, and auditors seem to have often shown them to residents during the inspection, e.g., to illustrate areas that needed insulation or air sealing. These infrared images seemed to be one of the most memorable aspects of the audit. This interest echoes that found in earlier studies (e.g., Ingle et al. 2012). One study, for example, found that UK households (n=87) were five times more likely to install draft-proofing in their home after they had seen a thermal image (Goodhew et al. 2015).

Reflecting on the household interview data analyzed above, in combination with results from earlier in the project, it seems warranted to start with a big, if still speculative, picture. People inhabiting poor-performing or poor-quality homes may have low expectations of comfort and functionality. They may have frustratingly high bills that are sometimes difficult to pay. They may often be highly uncomfortable or be faced with poor indoor air quality. They may spend a good deal of effort trying to control energy costs. At the same time, they may not envision that improving the energy performance of their home is achievable much less feasible. If they are low-income, busy with more pressing needs, not versed in contracting and financing, and only lightly touched by energy efficiency education, the problem goes beyond “hard to reach” to the salience and relevance of what the energy efficiency world offers.

From the standpoint of improving energy use in Hispanic households, the results of these interviews, in combination with earlier project results leads us to the following recommendations.

- **Find opportunities to shift expectations about housing conditions.** Households may suffer from lower-quality indoor conditions or unnecessarily high bills because they do not see these as problems or at least not as “fixable” problems. Realistic demonstrations or testimonials about what weather sealing, adding insulation and changing to more efficient light bulbs, for instance, can help household see upgrades as compelling and possible.
- **Use a personal touch to address household-specific concerns.** Standard reports are helpful for some, but do not account for varied learning styles and unique household concerns. A personal conversation, whether with a rater while conducting an audit or via follow-up call or visit with experienced program staff, can be useful to many homeowners. The rater or program staff can gauge a household’s appetite for hiring a contractor or taking on financing, for example, and tailor messaging appropriately. Furthermore, including infrared images in the discussion can be particularly compelling in engaging the homeowner. This personal approach can be resource intensive and programs need to evaluate the costs vs. the impact on energy savings and other benefits.
- **Provide recommendations for behavior changes and simple, low-cost measures.** Many lower-income or otherwise resource-conservative households may work hard to save energy in the home. Recommendations for large upgrades may be a non-starter for these households, given that they have relatively low bills to begin with, not much capital or willingness to take on financing, or simply have other priorities for using their disposable income. Good customized behavioral, or combination behavioral-technical recommendations, may help households save energy, expend less effort and money in saving energy, or improve home conditions.
- **Consider a phased approach to energy efficiency upgrade programs.** Whole-house retrofit programs such as Energy Upgrade California® Home Upgrade require fundamental envelope

upgrades to be included in projects. If a homeowner can afford to layer in additional upgrades, such as a high efficiency HVAC or water heater, the rebate amount grows. As we observed through these interviews, lack of capital (often paired with a reluctance or inability to access credit) or other life circumstances often prohibit homeowners from taking on such large projects. Allowing homeowners to access rebates for more manageable-sized upgrades over the course of several years may better suit Hispanic (and other) households.

- **Facilitate upgrade work by a broader network of contractors, handymen or DIY homeowners.** Our research indicates that Hispanic homeowners are likely to use their personal networks to accomplish home improvement work – whether that is a true DIY approach or asking their personal contacts for recommendations for contractors (who may or may not be licensed or formally trained in the relevant specialty). Energy efficiency upgrade programs may better reach this population by acknowledging that many are not inclined to use unfamiliar contractors on the program participation list. Programs may consider offering low-cost mentoring or equipment lending libraries to facilitate work performed by this sector. Of course, quality assurance, specifically related to indoor air quality and combustion safety, and legal requirements for licensed contractors to perform certain projects are key considerations; not all upgrades are appropriate for this approach.
- **Conduct background research in real homes to help integrate energy improvements with other household-level concerns.** Research efforts that go into Hispanic (or any other) homes and assess housing quality, air quality, and health conditions in combination with energy performance could provide essential background for improving energy use, social, and health simultaneously. As attention to local considerations, disadvantaged communities, and climate change resilience begin to merge, this integration can help ensure that energy programs address multiple priorities and do as much good as possible.

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Appendix A: Home Energy Action Plan

The English version of a sample CVETU Home Energy Action Plan begins on the following page. Action plans are provided in Spanish to households that prefer Spanish.

Your Personal Home Energy Action Plan



Home Energy Rater

| | |
|------------------------|----------------------|
| Name | Joe Rater |
| Company | Rater Services, Inc. |
| Evaluation Date | 8/4/2015 @ 12:00 PM |



ENERGY & ENVIRONMENTAL SOLUTIONS

This program is funded by California utility customers and administered by PG&E under the auspices of the California Public Utilities Commission.



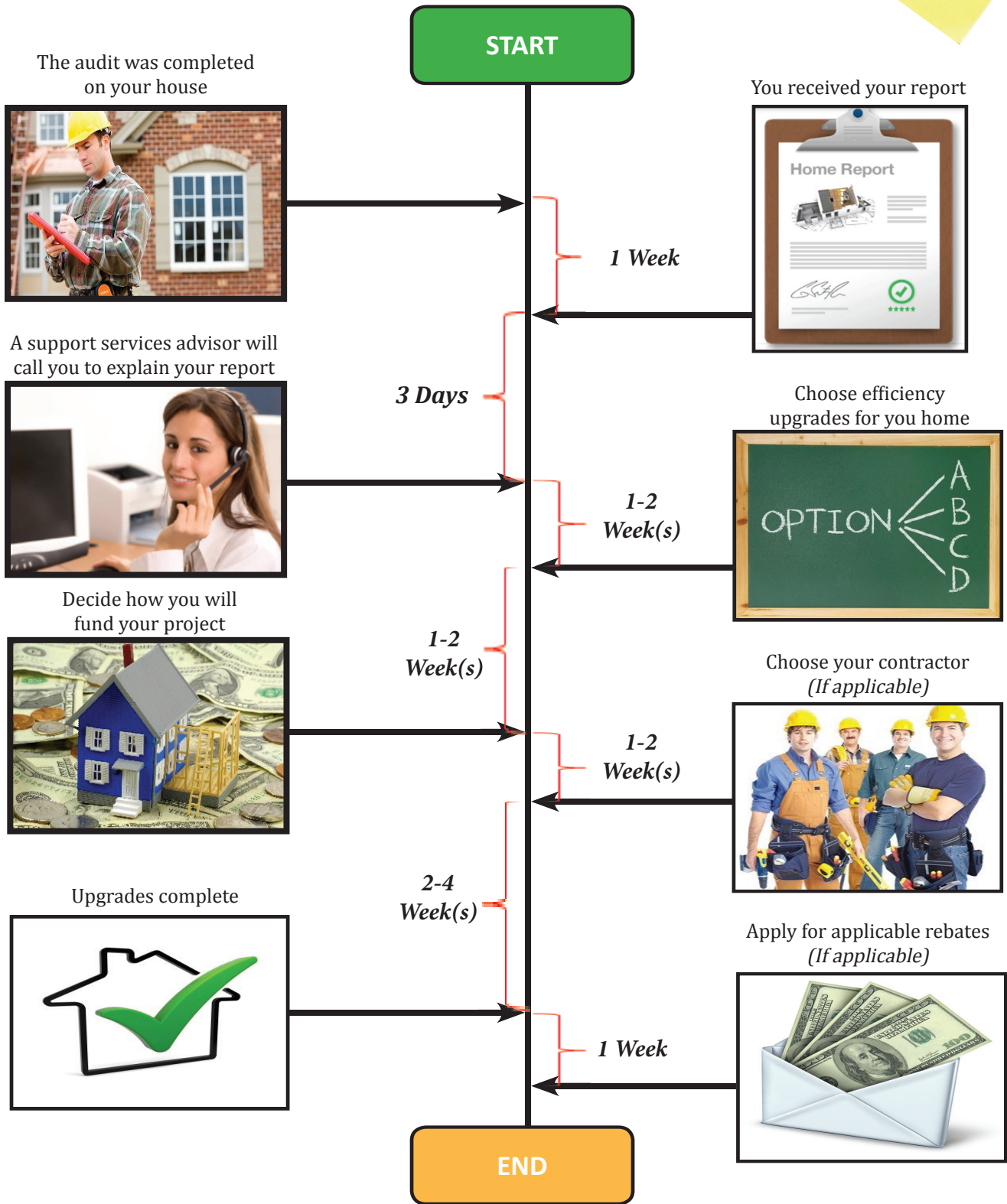
Central Valley
ENERGY
TUNE-UP



Pacific Gas and Electric Company[®]



SUPPORT SERVICES PROGRAM TIMELINE



Approximately 8-12 Week(s)

Please contact us at **866-388-3637** if you have any questions or need additional information.

Times are estimates and only provided as a guide. HETU Support Services is available to guide you thru every step in the process.





The Central Valley Energy Tune-Up Program, supported by the City of Fresno and sponsored by PG&E, provides you an unbiased plan to free you from high energy bills. The steps below are intended to empower you to reduce the energy use in your home and to lower your monthly utility bills. Our energy savings estimates indicate that you can save up to **\$1,298** per year by implementing all of the recommended measures in your Energy Efficiency (EE) Action Plan outlined below under Step 1.

Step 1: What should I do?

- 1) Whole Building Air Sealing/30% reduction
- 2) R-6 Duct Replacement/6% Leakage
- 3) Install R-38 Attic Insulation & Air Seal Attic
- 4) Install R-19 Floor Insulation
- 5) Install a 15.0 SEER/12.7 EER A/C Unit

(See customized improvements & costs page for additional energy and cost savings detail on these recommendations)

Step 2: Where can I go for contractors, equipment, or other information?

• Contractors:

- o In order to be eligible for PG&E Home Upgrade Rebates, you must use a PG&E Home Upgrade Participating Contractor. For a list of Participating Contractors, go to www.pge.com/homeupgrade
- o There are several popular on-line contractor referral services such as **Angie's List**, **Home Advisor**, **Redbeacon.com** presented by The Home Depot, and others that homeowners can use to help find a qualified contractor, or
- o Some homeowners are more comfortable using the "tried and true" method of calling using the Yellow Pages,
- o Either way, homeowners should **always** get a **minimum** of three (3) quotes, ask for and check references, and insist on proper building permits being pulled and included in the price. Permits are designed to insure quality job performance. **Failure to have permits pulled for upgrades where they are required by State law can result in poor installation quality and reduced energy cost savings.**

• Do-it-Yourself:

- o Some items in the homeowner report may be suitable for do-it-yourself repair or installation. If the homeowner wants to do these upgrades themselves, they can consult with their local home improvement store such as Home Depot, Lowe's, True Value Hardware, Ace Hardware, or others to get the right materials and advice for completing the job.



YOUR PERSONAL HOME ENERGY EFFICIENCY (EE) ACTION PLAN

Step 3: How do I pay for it?

• Rebates & Incentives:

Pacific Gas & Electric Company (PG&E) offers rebates up to \$500 for qualifying individual improvements and incentives up to \$3,000 when enrolling in the statewide, Energy Upgrade California™ Home Upgrade program.

Rebates when installing individual improvements include, but are not limited to:

- High efficiency refrigerator
- High efficiency clothes washer
- Variable-Speed pool filtration pump
- ENERGY STAR® high efficiency gas storage water heater

Incentives when installing a combination of improvements and enrolling in the statewide, Energy Upgrade California™ Home Upgrade program include, but are not limited to:

- Whole building air sealing
- Attic insulation & air sealing
- HVAC duct improvement
- High efficiency HVAC equipment
- High efficiency windows
- Wall insulation
- Floor insulation
- High efficiency water heater
- Combustion safety testing (required)
- Low-flow showerhead (recommended)

For details please visit PG&E's Home Upgrade website: www.pge.com/homeupgrade

• Loan Programs:

- o Educational Employees Credit Union Energy Efficient Loan (www.myeecu.org/home/loans-credit-cards/personal/energyloan)
- o HERO Financing Program (www.heroprogram.com)
- o FHA PowerSaver Loan (<http://www.neighborsfinancial.com/home-loans/loan-programs/#powersaver>)
- o Golden State Finance Authority Loan Product (www.gsfahome.org/programs/energy/overview.shtml)

(See more detailed information in the folder provided to you by your rater or accompanying this report)

Step 4: Want more energy saving ideas for your home?

You can take advantage of Central Valley's Energy Tune-Up no-cost online home audit by going to <http://www.hea.com/hea-web/HETRegistration.jsp?prepareForm=true> and sign up. You will create an energy profile account for your home and learn about low-cost energy reduction techniques specific for your home. You'll also receive monthly energy reports via email so you can track your energy savings.

Step 5: Who can I call with additional questions?

Please contact us at **866-388-3637** if you have any questions or need additional information.





INTRODUCTION:

Thank you for the opportunity to provide you with an Energy Assessment of your home. In this report, you will find:

- Information on your home's current energy usage.
- Recommendations for improving your home's energy efficiency features.
- Information on how to take advantage of important rebates, incentives, and financing opportunities.

The recommendations in this HETU Standard report are intended to provide you with options to reduce the energy usage in your home.

Please note, if you are interested in participating in the Energy Upgrade California (EUC) program, you can take advantage of the more comprehensive Whole House (HERS II) Energy Assessment. This level of assessment is needed for qualification in the EUC program and can be leveraged by a certified EUC contractor in order to obtain a more detailed energy usage and savings analysis of your home. Thank you again for the opportunity to visit your home.



Building Details

| | |
|---|------------|
| Current Home Owner | John Smith |
| Year Built | 1984 |
| Total Finished Floor Area (ft²) | 1750 |



What is in the home?

| | |
|-----------------------------------|--------------------|
| Attic Insulation (R-Value) | R-19 (pre-1991) |
| Air Conditioner Efficiency | 10 SEER (pre-2005) |
| Furnace Efficiency | 78% (post-1978) |
| Windows | Double Pane/Metal |

WORST

BEST

YOU

NONE

Attic Insulation

R-49+

YOU

8.0 SEER

Air Conditioner

15.0 SEER+

YOU

65% AFUE

Furnace

92% AFUE+

YOU

SINGLE PANE/METAL FRAME

Windows

DOUBLE PANE/WOOD OR VINYL FRAME

YOU

LEAKY

Home Tightness

TIGHT

A large percentage of the energy used (up to 50%) in homes in the Central Valley goes to cooling and heating of home's during extremely hot summers and cold winters. Although upgrading equipment is very important, fixing leaks in the shell of the home should be your first step. The rater conducted a Blower Door diagnostic test on your home's shell to test for leakiness that typically translates to an inefficient system and wasted money on energy bills. The leakage level is explained below.

Test Results

The blower door test performed on your home revealed **0.85** natural air changes per hour (ACH_n), or equal to an approximately **3.0** square foot hole in your home, 24 hours/day, 7 days a week.

ACH_n is a measure of how many times the air within your home is replaced in an hour. A recommended target for air sealing is 0.35 ACH_n, meaning your home is leaking at **59%** more than the recommended target.





MECHANICAL EQUIPMENT & INSULATION

As part of the Home Energy Assessment conducted on your home, the rater evaluated your home's Mechanical Heating, Ventilation & Air Conditioning (HVAC) system, HVAC ducting, water heater and attic insulation.

HVAC Equipment (1)



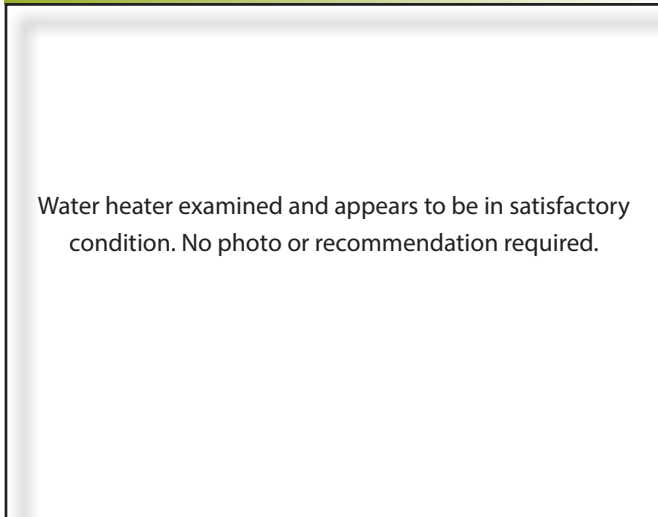
HVAC Ducting (2)



Recommendation:

(1) The existing air conditioner appears to be outdated and could be inefficient. It is recommended to upgrade the existing air conditioner with a high efficiency air conditioner that has a SEER rating of 15.0 SEER or higher. High efficiency air conditioners use less energy than inefficient air conditioners saving money on utility bill costs. (2) The HVAC ducting appears to be the original duct work and has areas where the duct insulation is missing, which suggest the duct work could be leaking conditioned air outside the conditioned space. It is recommended to contact a contractor to replace the HVAC duct work with R-6 duct insulation or greater and seal the duct work to 6% duct leakage or less. Doing either of these improvements could reduce your energy bill costs, while increasing the comfort of your home.

Water Heater (3)



Water heater examined and appears to be in satisfactory condition. No photo or recommendation required.

Attic Insulation (4)



Recommendation:

(4) The attic appears to have thin attic insulation installed. It is recommended to add more insulation in the attic to where the entire attic area has an effective attic insulation R-value level of R-38 or better, but first seal or caulk around all corner joints and electrical or plumbing penetrations leading inside your home. Increasing attic insulation and sealing penetrations could reduce the amount of conditioned air needed to heat or cool your home allowing rooms to be more comfortable, while saving you money on your utility bills.



INFRARED CAMERA IMAGES OF YOUR HOME



As part of your Home Energy Assessment, our rater took infrared camera images of your home. The infrared camera images demonstrate areas in your walls and ceiling that are not properly insulated or sealed and are thus allowing hot air to infiltrate **into** your home in the summer and warm air to infiltrate **out** of your home in the winter, wasting energy and money. Here is how to interpret the IR images below:

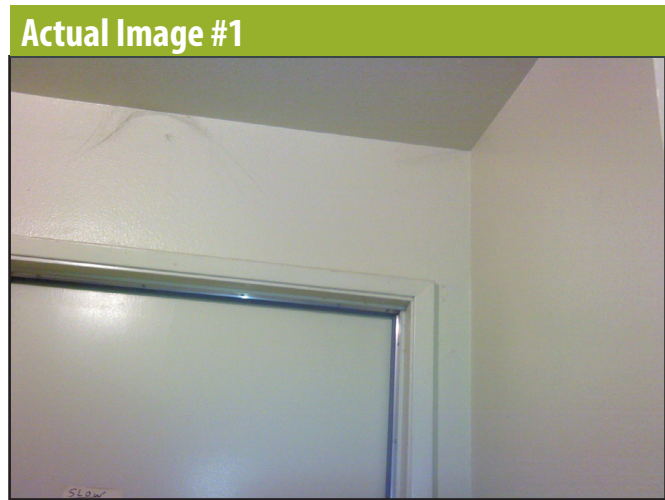
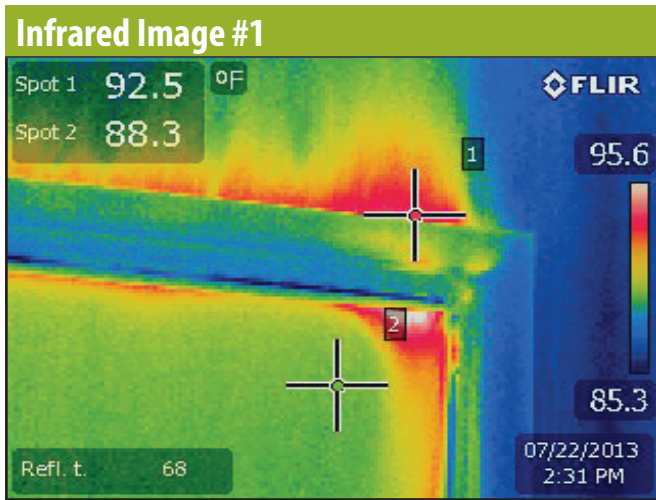
Summer/Spring Months:

- **Orange** areas indicate warm spots
- **Red** areas indicate warmer or hotter spots

Winter/Fall Months:

- **Green** areas indicate cool spots
- **Blue** areas show cooler or colder spots

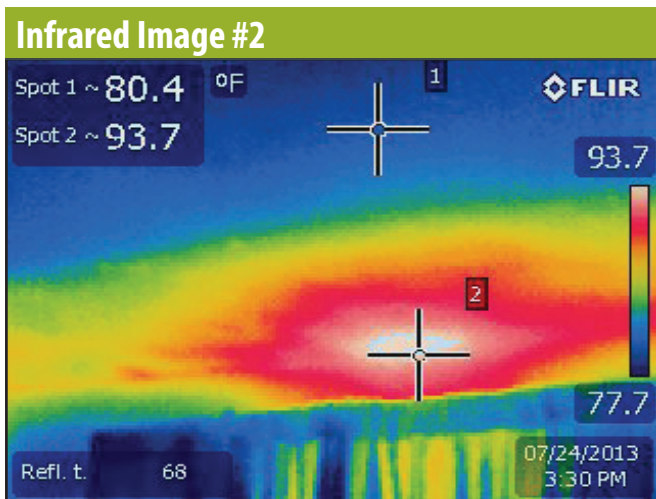
These are areas in your home where you may need to better insulate or seal, however some images may be limited and/or not too clear if the temperature from inside the house to the outside is minimal:



Garage door appears to show air infiltration around the edges and trim work of the door during the blower door test.

Recommendation:

Install new weather stripping around the edges and seal along the edges of the trim work around the garage door. Installing weather stripping and sealing could reduce conditioned air from escaping rooms allowing them to become more comfortable, while saving you money on your utility bills.



Ceiling in the living room appears to show areas with thin or missing attic insulation.

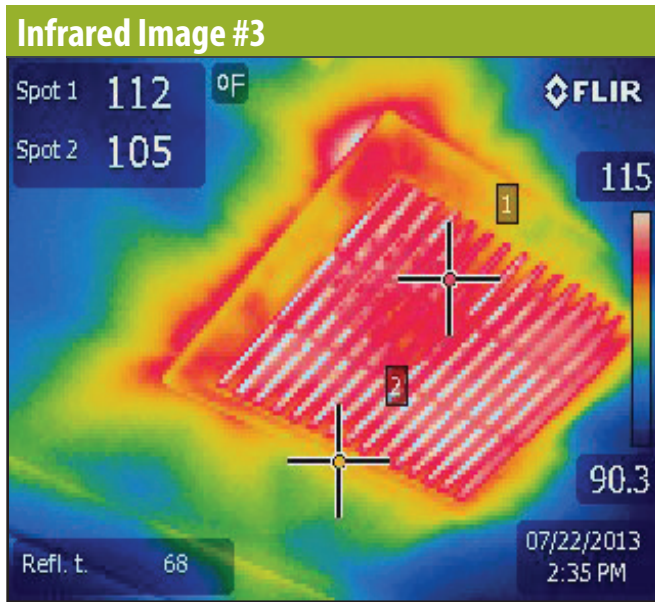
Recommendation:

Add more insulation in the attic to achieve an insulation R-value level of R-38 level or better, but first seal or caulk around all corner joints and electrical or plumbing penetrations leading inside your home. Increasing attic insulation and sealing penetrations could reduce the amount of conditioned air needed to heat or cool your home allowing rooms to be more comfortable, while saving you money on your utility bills.





INFRARED CAMERA IMAGES OF YOUR HOME



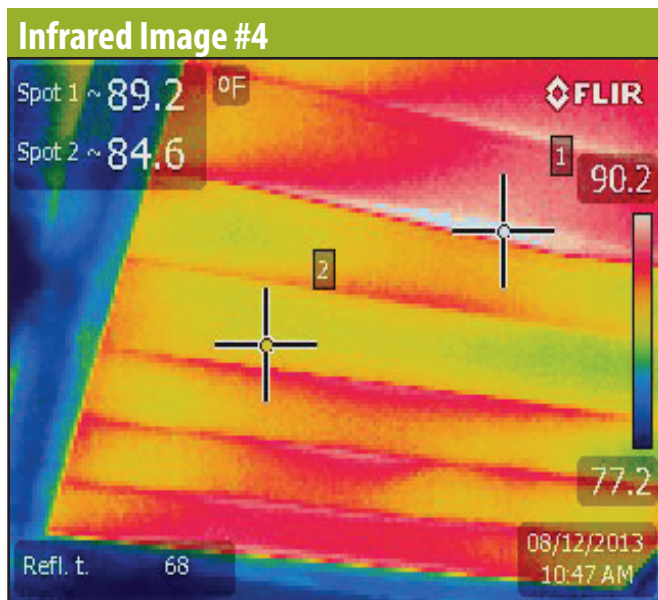
Exhaust fan appears to show air infiltration through the vent which could be contributed to an ineffective or missing damper.

Recommendation:

Repair the damper in the exhaust fan to where the damper can open and close effectively or install a new fan with a damper installed. Dampers that open and close effectively could reduce conditioned air from escaping rooms allowing them to become more comfortable, while saving you money on your utility bills.

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YOUR PERSONAL HOME ENERGY EFFICIENCY ACTION PLAN



Whole house fan appears to show a lot of air infiltration through the fan during the blower door test. This could be contributing as to why there was a high level of air infiltration that was recorded during the blower door test.

Recommendation:

Install an air infiltration barrier over the whole house fan when the fan is not in use. Installing an air infiltration barrier could reduce conditioned air from escaping rooms allowing them to become more comfortable, while saving you money on your utility bills.

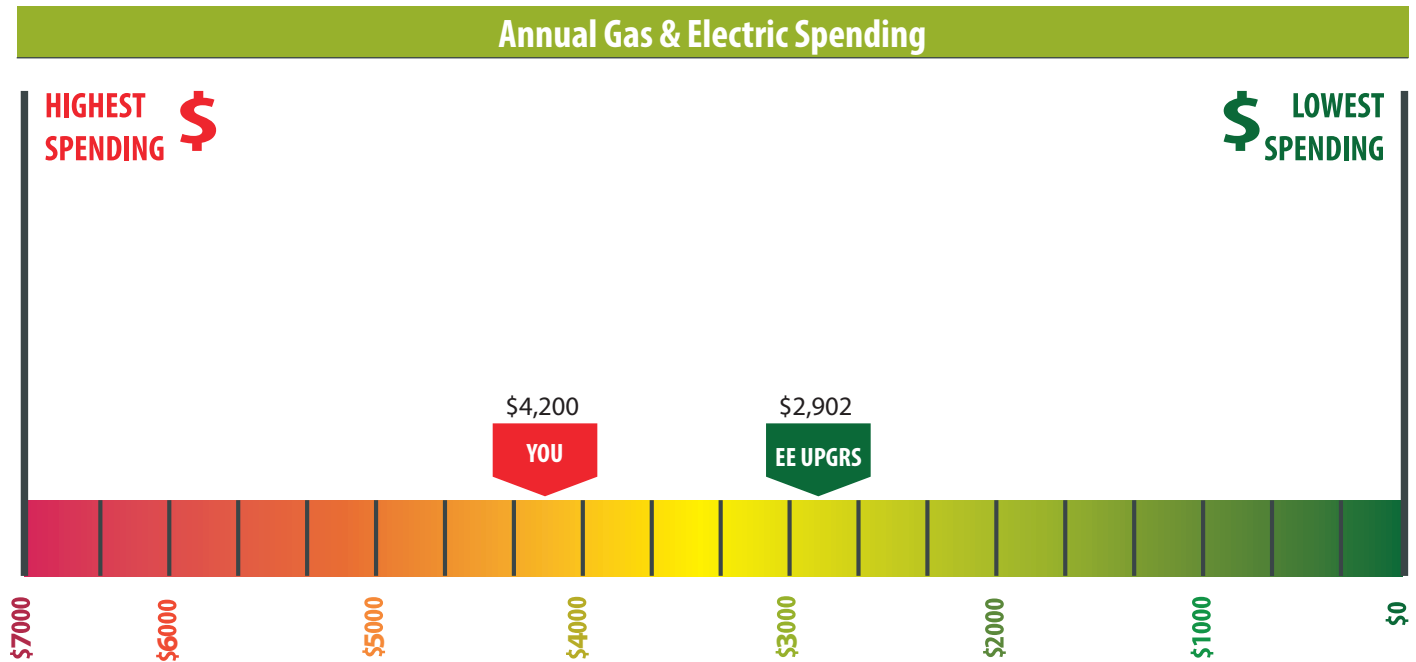


WHAT CAN YOU DO TO IMPROVE ENERGY EFFICIENCY IN YOUR HOME?



Based on our energy assessment of your home and your feedback, we have assembled your EE Action Plan designed to help you save money on your utility bills. Your EE Action Plan concentrates on installing Advanced Evaporative Cooler(s), air sealing your home's building envelope, increasing insulation in the attic, and/or additional cost effective ways to save energy.

Using the results of your home assessment and previous utility bills, an improvement package has been created to demonstrate the predicted annual utility bill savings that can be achieved if you choose to improve your home with this option. In some cases, but not all, your estimated utility bill savings may be minimal if your home is already equipped with a Solar PV system or your existing utility bills are low.



Rater Comments

- HVAC return air filter was dirty. Recommend to change the air filter and continue changing it every 30-60 Days. Changing the air filter regularly could help keep clean air filtering through your home and possibly extend the life of your HVAC system.
- Incandescent light bulbs were installed. Recommend to replace all incandescent light bulbs with ENERGY STAR® labeled CFLs. Installing CFL bulbs can last as much as 10 times longer and use 75% less energy than incandescent light bulbs, saving money on utility bill costs.
- Water heater has no insulation blanket installed. Recommend to install a water heater blanket. Follow the manufacturer's installation instructions to avoid safety hazards or have a professional install the water heater blanket. Also, once a blanket is installed...lower the water heater temperature to gain additional energy savings.
- Attic area appeared to have inadequate attic ventilation. It is recommended to install solar powered attic fan(s) in the attic to help increase attic ventilation. Installing solar powered attic fan(s) can help reduce radiant heat build-up during the summer months and moisture in the winter months, allowing HVAC ducting to work more effectively and save money on utility bill costs.

YOUR PERSONAL HOME ENERGY EFFICIENCY ACTION PLAN | ConSol.wv





YOUR CUSTOMIZED IMPROVEMENTS & COSTS

Through our Home Energy Assessment, the rater asked you if there are certain energy improvements you would consider using to upgrade your home. The information below shows those improvements and other cost effective improvements to upgrade your home with their estimated costs and predicted utility bill savings.

| Energy Improvements | | |
|--|----------|-------|
| Estimated Utility Bill Savings: 30.9% | Cost | % |
| Whole Building Air Sealing/30% reduction | \$875 | 1.1% |
| R-6 Duct Replacement/6% Leakage | \$2,188 | 15.0% |
| R-38 Attic Insulation & Air Seal Attic | \$2,083 | 1.2% |
| R-19 Floor Insulation | \$1,820 | 6.1% |
| 15.0 SEER/12.7 EER A/C Unit | \$5,192 | 7.5% |
| | | |
| | | |
| Estimated Total Cost | \$12,157 | |
| Energy Upgrade CA Incentives | \$3,000* | |
| Estimated Final Costs | \$9,157 | |
| Financing % | 7% | |
| Estimated Monthly Upgrade Payment | \$106 | |
| Estimated Savings & Payback | | |
| Annual Utility Bill Savings | \$1,298 | |
| Monthly Utility Bill Savings | \$108 | |
| Estimated Monthly Net Savings | \$2 | |
| Estimated Simple Payback Period (Years) | 7.1 | |

*This is an estimate of potential rebates. Work with a participating contractor to determine final rebate amounts. For a list of Participating Contractors, go to www.pge.com/homeupgrade.

The Estimated Final Costs are for informational purposes only and there is no guarantee that the actual installation costs will be the same as the estimated final costs even if the recommended equipment and products are installed. The "Estimated Monthly Upgrade Payment" is an estimate of the monthly cost to finance improvements at 7% interest (based on a 10-year loan). Interest rates may vary depending upon home owner loan eligibility and the financing options available in your area.

The information contained in this report, including but not limited to estimates of energy savings which assumes average weather, thermostat settings and quantities of hot water for a typical household, is for general information purposes only. Actual energy use and savings will vary. Estimates of costs for energy efficiency improvements are based on the California Public Utility Commission's Database of Energy Efficient Resources or DEER. Actual costs for improvements are likely to vary from these costs. In addition, the DEER costs do not take into account every aspect of your home that may increase the cost of work. The information is provided by ConSol; we make no representations or warranties of any kind, express or implied, about the completeness, accuracy, reliability, suitability or availability with respect to the information, products, services, or related graphics contained in this report for any purpose. Any reliance you place on such information is therefore strictly at your own risk. In no event will we be liable for any loss or damage including without limitation, indirect or consequential loss or damage, or any loss or damage whatsoever arising from loss of data or profits arising out of, or in connection with, the use of this report.





The Central Valley Energy Tune-Up (CVETU) Program, supported by the City of Fresno and sponsored by PG&E, provides you an unbiased plan to free you from high energy bills. Before considering installing a Photovoltaic (PV) solar system, CVETU strongly encourages home owners to evaluate making your home more energy efficient. ***The most cost-effective approach is to REDUCE AND THEN PRODUCE!!*** Significant cost effective energy efficiency gains can be achieved through the application of common insulation and weatherization techniques, and by replacing inefficient lighting, appliances, and heating, ventilation, and air conditioning (HVAC) equipment with readily available products.

About Solar

When considering installing a renewable energy system at your home or business, there are different options available to meet your energy needs. Determining which option will be best for you depends on a variety of considerations such as costs, feasibility and your ultimate goal for pursuing renewable energy. To learn more about each of the options and how they work, please visit PG&E's site:

<http://www.pge.com/en/myhome/saveenergymoney/solarenergy/about/index.page>

Why go Solar

Using renewable energy to power your home or business not only can lower your energy costs over time, but also generates power free of harmful carbon dioxide emissions and other greenhouse gases. To learn more about the financial and environmental benefits of installing solar, please visit PG&E's site:

<http://www.pge.com//myhome/saveenergymoney/solarenergy/whygosolar/>

Solar Options

When considering installing a solar PV system, it is important to understand the different options available. The following are the 3 most common options for pursuing a solar PV installation:

Solar Purchase

As more people have decided to pursue solar PV systems, the purchase price of solar panels has come down. The federal tax credit covers 30% of the solar system cost, and in some states there are additional local and utility rebates to offset retail price. You own the solar system and its expected useful life is 30+ years. On average, top tier electricity prices have increased every year for the last 30 years. When you choose solar, you lock in low electricity prices and as utility rates continue to rise in the future, your investment becomes increasingly valuable.

Solar Lease

A "Solar Lease" is when someone else owns the solar energy equipment (usually the leasing company and you pay a monthly payment to lease it for the lease term (usually 10-15 years). These lease payments may be wholly or partially balanced by lower electric utility bills. When the lease payment is less than the utility bill savings from the leased solar electric production, then you are saving money. Solar leases are often pursued by home owners because there is little to no money down required.





SOLAR AND RENEWABLES (CONT.)

Solar Purchase Power Agreement (PPA)

A solar PPA is a type of solar financing where someone else owns and maintains the solar system on your property, and you simply pay for the solar energy it produces, much like you pay your existing utility for power now. Sometimes a PPA's rate is flat and sometimes it's calculated to rise slightly over the years, but unlike utility rates, your PPA rate is pre-negotiated for the lifetime of the agreement (usually 15 to 20 years). Similar to a solar lease, a solar PPA is often attractive to home owners because there is little to no upfront cost.

Many of the larger solar providers now offer solar purchase, lease, and PPA options. Deciding on which solar option to pursue is based on many variables and should be carefully considered by a home owner before moving forward.

Finding a Solar Contractor

Selecting the right contractor is one of the most important decisions you'll need to make when installing a generating system. Below are some tips to help you make an informed decision:

- Interview a **minimum** of three potential contractors and obtain written bids from each one for comparison.
- Verify that the contractor's license is current and active with the Contractors State License Board (CSLB). It is also important to make sure they hold the proper type of license required to get the job done.
- Ensure all quotes for the project are in writing and only sign after fully understanding the terms and making sure the costs are within reason.
- Never provide more than 10% of the system cost for an up-front deposit and do not make final payment until the system is installed and operating properly.
- Do not hesitate to ask the contractor questions about their business, the system or anything you may not understand.
- Request references from previous customers to ensure they are satisfied and the systems are performing properly.

For additional tips and information about hiring a contractor, visit the Contractors' State License Board website (<http://www.cslb.ca.gov>). You can also check with your local Better Business Bureau (www.bbb.org) to see if the contractor you are exploring has any active complaints against them.

Incentives & Financial Resources

Updated incentive information from PG&E is available at the following location:

<http://www.pge.com/en/myhome/saveenergymoney/solarenergy/incentives/index.page>

Who can I call with additional questions?

Please contact us at **866-388-3637** if you have any questions or need additional information.





Insulation (Attic, Wall, and/or Floor)

Insulation is rated in R-Value; R-value is the capacity of an insulating material to resist heat flow. The higher the R-value, the greater the insulating power. Insulation should be installed with special attention paid to avoid gaps, voids, compression, and wind intrusion.

Whole Building Air Sealing/Air Sealing to 0.35 ACHn

To minimize airflow through cracks and holes in the walls, ceiling and floor infiltration, envelope caulking and sealing is performed. A home that is not sealed for air infiltration will be uncomfortable due to drafts and will use up to 30% more energy than a relatively airtight home. In addition, good caulking and sealing will reduce dust and dirt that can enter homes through cracks and holes. The average CA home has a natural air-change rate of about three times the recommended target for air sealing of 0.35 air changes per hour (ACHn)¹. This target of 0.35 air changes per hour (ACHn) roughly means that all of the air in the home is exchanged with outdoor air, naturally, approximately every three hours through leaks in the envelope.

HVAC Duct Sealing/10% Leakage

Estimates of average duct leakage in California range from 25-40%, meaning that the duct system leaks up to 40% of the air that is distributed through it. As duct systems are generally in the attic or crawlspace of our homes, many of us may have no idea how much they are leaking air and wasting energy. Duct systems must be sealed prior to changing a furnace or AC unit. The minimum requirement is to seal duct systems to less than 10% leakage; the goal is to seal the duct system so that there is no leakage!

Carbon Monoxide Detector

A CO Detector is a device that detects the presence of the carbon monoxide (CO) gas in order to prevent carbon monoxide poisoning. If carbon monoxide poison is not detected it could lead to health issues or risks, even death.

Combustion Safety Testing

A Combustion Safety Test is a test to ensure that all combustion (gas) appliances (furnace, water heater, kitchen appliances, etc.) are operating safely and to prevent combustion gas build-up inside the home which, if not detected, could lead to health issues or risks.

Low Flow Showerheads

Water-efficient fixtures help reduce water use and save money on water and energy bills. Typical Low-Flow fixtures use 2.5 gallons of water per minute (gpm) or less. Older fixtures before 1992 had flow rates of 5.5 gpm.

Evaporative Cooler

An evaporative cooler produces cool air by combining a natural process - water evaporation - with a simple, reliable air-moving system. Fresh outside air is pulled through moist pads, where it is cooled by evaporation and circulated through a house or building by a large blower. As this happens, the temperature of the outside air can be lowered by as much as 30 degrees. Because of the San Joaquin Valley's low summertime humidity, an evaporative cooler can be a smart choice to reduce cooling costs and improve comfort. Evaporative coolers typically use up to 75% less electricity than a central air conditioning system, and have the added benefit of increasing comfort by adding moisture, and effectively trapping airborne dust and pollution. Evaporative coolers have been around for a long time, but the newer advanced coolers provide even greater comfort and efficiency than the "swamp coolers" of the past. More information on advanced evaporative coolers can be found on PG&E's website: <http://www.pge.com/myhome/saveenergymoney/savingtips/evap/>

15.0 SEER/12.7 EER ENERGY STAR® Air Conditioner

The efficiency of air conditioners is rated by the Seasonal Energy Efficiency Ratio (SEER). The higher the unit's SEER rating, the more energy efficient it is. Standard homes require at least 13 SEER.

92% AFUE Furnace

AFUE stands for Annual Fuel Utilization Efficiency. A furnace's AFUE is a measure of how efficiently it converts fuel to heat for the home. For example, many furnaces manufactured 20 years ago had a 78% AFUE or less. 92% AFUE means that 92% of the fuel used by the furnace is converted to heat and supplied to the house, while 10% is wasted as exhaust out the chimney.

High Efficiency 0.32/0.25 Low-E Windows

Energy efficient windows can reduce unwanted heat gain through the windows during the summers and reduce heat loss through the windows during the winters, saving energy. Windows have values associated with the window's performance: the solar heat gain coefficient (SHGC) and U-factor. The U-factor is a measure of the insulating property of the window: the lower the U-factor, the better it will insulate against heat loss. The SHGC is a measure of the amount of solar heat the window will transmit. SHGC values range from 0 to 1, the lower the number the better the window protects against solar heat transmission into the home.



Appendix B: Study 1 Data Collection Form

The data collection form used by CVETU canvassers in Study 1 is shown on the following page.

Appendix C: Study 2 Text Message Script (English Version)

Immediate Reply to Enrollment:

“Welcome! Msg&Data rates may apply. Reply HELP for help, STOP to OptOut.”¹

“Thank you for enrolling in our study about home energy upgrades! To continue in English text 1. Para continuar en español texto 2.”

“Thank you for enrolling in our study. Please access this link to answer 4 questions: [Web link]”

Enrollment + 2 weeks:

Treatment group:

“Hi, this is the CSE energy study team. You should’ve received your Home Energy Action Plan from Central Valley Energy Tune-Up program.”

“We created a website that can help you with doing energy efficiency projects yourself. It has also information about financing projects.”

“Please check out this website to learn more about DIY projects and financing: [Web link]”

“That’s all for now. We will send you a text message with a link to our final study questions in 5 weeks.”

Control group:

“Hi, this is the CSE energy study team. You should’ve received your Home Energy Action Plan from Central Valley Energy Tune-Up program.”

“That’s all for now. We will send you a text message with a link to our final study questions in 5 weeks.”

Enrollment + 7 weeks:

“Hi, it’s the CSE energy study team. Just answer our 10 short questions to complete the study. Go to this link: [Web link]”

Reminder if the link is not clicked within 24 hours:

“Hi, it’s the CSE energy study team. Please answer our 10 short questions to complete the study. Go to this link: [Web link]”

¹ The prompt to opt out was included at the end of every text message.

Appendix D: Study 2 Enrollment Survey

1) Thank you for enrolling in our study about home energy upgrades! Please enter the first name of the rater who did your home energy assessment.

2) To verify your home is eligible for our energy study, please enter your full address (including city and ZIP code).

Example: 10 Main Street, Fresno, 93708

3) Do you own or rent your house?*

Own

Rent

4) Please enter your 10 digit mobile phone number so we can link your responses to the different parts of this survey:*

Appendix E: Study 2 Post-Treatment Survey

1. Before we start, please enter your 10 digit mobile phone number so we can link your responses to the previous part of the survey.*

2) Did you read the Home Energy Action Plan that was sent to you after the home energy assessment?*

Yes

No

Did not receive report

3) About 5 weeks ago we sent you a link to a website with information on DIY projects and financing. Did you review the website?*

Yes, both DIY and financing sections

Yes, the DIY section

Yes, the financing section

No

I could not access the website

Logic: Show/hide trigger exists.

4) After your home energy assessment, did you add insulation or air sealing?*

Yes

No

Logic: Hidden unless: Question "After your home energy assessment, did you add insulation or air sealing?" #4 is one of the following answers ("No")

5) How likely are you to install insulation or air sealing in the next year?*

Very likely

Somewhat likely

Undecided

Not very likely

Not at all likely

Logic: Show/hide trigger exists.

6) After your home energy assessment did you upgrade your HVAC system or windows to be more efficient?*

Yes

No

Logic: Hidden unless: Question "After your home energy assessment did you upgrade your HVAC system or windows to be more efficient?" #6 is one of the following answers ("No")

7) How likely are you to upgrade your HVAC system or windows in the next year?*

Very likely

Somewhat likely

Undecided

Not very likely

Not at all likely

8) Did you use or will you use PACE financing for an upgrade?*

I used it

I will use it

No

9) Did you perform or will you perform a Do-It-Yourself energy efficiency upgrade?*

I performed DIY

I will perform DIY

No

10) After your home energy assessment, did you contact a contractor about doing an energy efficiency upgrade?*

Yes

No

11) How do you prefer to describe your racial/ethnic identity?*

White/Non-Hispanic

Hispanic

Black/African American

Asian

Other

Appendix F: Study 3 Sampling and Fielding Details

At our request, CVETU provided a list of their audit recipients for the months of September 2016 through February 2017. This period was estimated to be sufficient to yield 40 complete interviews of Hispanic/Latino audit recipients. The CVETU list included contact name, audited home address, phone number, and an indicator of whether the audit report had been requested in Spanish versus English. To obtain the final sample call list, we screened the 3,208 records received from CVETU according to criteria designed to produce a list of households likely to identify as Hispanic or Latino homeowners, removing renter households where that could be clearly identified, as well as removing records with missing or lower-quality contact information.¹ We then randomly sampled records from each month to produce a final call list of 500 records. Using the stated audit language preference recorded in the CVETU list, we divided the sample into English and Spanish speakers, and assigned interviewers accordingly.

We sent postcards to the households in the final call list, notifying them that they might be receiving a phone call inviting them to participate in a short interview about their experience with the CVETU audit, in return for which they would receive a \$25 gift card to Target or Amazon.² Interviews began several days after the postcards were mailed, and took place between July 21 and August 2, 2017. We anticipated conducting a maximum of 40 interviews and completed 30. This total was deemed sufficient based on on-going review of the results. **Error! Reference source not found.** (in the body of the report) summarizes the sample disposition by language and overall. The complete rate relative to unique numbers dialed was 9.4%, which was about as expected. Attrition was due to disconnected or changed numbers, no answer, refusal (whether absolute or time-related), and the respondent not remembering the audit or not having been involved in the audit.

Interviewers explained the purpose of the interview and asked interviewees who passed the screening criteria for their permission to be recorded.³ The recorded interviews were transcribed, translated to English in the case of Spanish interviews, and analyzed. For each of the 30 interviews completed, the Center for Sustainable Energy requested, and received from CVETU, a copy of the Home Energy Action Plan that had been mailed to the home energy assessment recipient. These reports include basic house description, a list of major recommendations, scaled comparisons of several energy-related home characteristics (e.g., annual expenditures, infiltration measurement), infrared and related photographs

¹ To identify Hispanic/Latino households, we compared last names with those for which at least 75% self-identified as Hispanic in the U.S. Census. Those that did not match were labeled "Non-Hispanic" and filtered out. To screen out households that clearly seemed to be renters, we removed records where there was a second phone number for a landlord. We geocoded street addresses and city names to append ZIP codes. Those records for which we could not identify a ZIP code were filtered out, as were records without phone numbers. We also removed records where the household had received a HERS II full house rating rather than the standard CVETU in-home energy audit.

² Of the 30 completed interviews, 29 selected the Target gift card rather than the Amazon gift card.

³ Only two of the 30 interviewees declined to be recorded; this household's responses were summarized in the interviewer's notes. The screening criteria were: remembered having the CVETU audit, identifying as Hispanic/Latino, and still living at the address where the audit was conducted.

of various problem areas, a table of estimated costs and savings for the recommended upgrades, and a variety of other information such as recommendations for minor upgrades (e.g., light bulbs) and recommendations on where to look for loans and other information. Key data from these reports were used to create a home characteristics and audit-results data base, which we analyzed in conjunction with the interview data.

For analysis, we read each transcription carefully, identifying themes, patterns, and quotes that seemed to best illustrate perspectives and experiences of the interviewee. As noted above, our intent was more of a social scientific interview than a straight question-and-answer survey, and we analyzed the resulting data from a more interpretive, anthropological perspective as well.⁴ In particular, we tried to pull stories, read between the lines, and concentrate variety rather than focusing primarily on central tendencies or average responses.

⁴ Normally an anthropological interview would be in person, in context, and longer.