THE RELATIONSHIP
BETWEEN THE EASY PROGRAM AND ENERGY CONSERVING BEHAVIOR:
MEASURING THE EFFECTIVENESS OF A HOME AUDIT PROGRAM

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Kelsey L. Zurcher
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SIGNATURE PAGE

THESIS: THE RELATIONSHIP BETWEEN THE EASY PROGRAM AND ENERGY CONSERVING BEHAVIOR: MEASURING THE EFFECTIVENESS OF A HOME AUDIT PROGRAM

AUTHOR: Kelsey L. Zurcher

DATE SUBMITTED: Fall 2017

College of Environmental Design

Dr. Kyle Brown Thesis Committee Chair
Landscape Architecture

Dr. Lin Wu Geography and Anthropology

Mrs. Marisa Creter San Gabriel Valley COG
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ABSTRACT

Southern California households use a significant amount of energy each year which produce greenhouse gases that contribute to pollution and global climate change. Educational home audit programs seek to decrease these environmental burdens by increasing the number of energy-conserving behaviors that residents utilize in their home. The Energy Assessment for Your Home Program (EASY) implemented by the San Gabriel Valley Council of Governments (SGVCOG) is one of these programs. This study evaluates the effectiveness of the EASY program through a survey. The results of this study reveal that while EASY is effective at increasing the energy-conserving purchasing behaviors of residents, the same cannot be said for curtailment behaviors. These results imply that there needs to be greater attention spent on educating residents of the no-cost behaviors they can implement to lessen their energy consumption.

In addition to these findings, the survey revealed that the most utilized purchasing behaviors among residents are low-cost upgrades such as changing light bulbs to LED bulbs, while higher-cost, more effective energy upgrades such as upgrading the home insulation or windows are the least utilized. The findings are consistent with the conclusion that most of the residents are economically motivated to make energy-efficient upgrades to their homes, and expresses that they would be most encouraged to implement more energy-conserving behaviors if they had more information on how to reduce their utility bills. With changes in the organization of the program, training of assessors, and marketing of EASY, the program can be more effective at lowering household energy. Ultimately, these findings are helpful to the SGVCOG and other organizations implementing similar programs by improving the effectiveness of their home energy audit programs.
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CHAPTER 1: Introduction

Household energy consumption accounts for 17.7% of the energy used in California (Energy Information Administration (EIA), 2017-a). This contributes to greenhouse gas emissions since two thirds of California households use natural gas to heat their homes, and 50% of their electricity consumption is generated through natural gas power plants (EIA, 2017-b). In response to this issue, many environmental programs in California target household energy consumption. Although California is ranked second lowest amongst states in the United States in terms of energy consumption per capita, there is still room for improvement (EIA, 2015). For California to continue leading the nation in decreasing energy consumption, it is crucial for its program managers to refine program organization and implementation strategies to create effective programs with lasting results. This study analyzes and evaluates an environmental program known as the Energy Assessments for Your home (EASY) program which is operated by the San Gabriel Valley Council of Governments (SGVCOG) in the California San Gabriel Valley region. The purpose of this program is to educate residents through tailored home energy audits to encourage energy-saving behaviors. This study uses a questionnaire to determine whether the tailored audit intervention strategy employed by EASY significantly increases the energy conservation behaviors of participants in the program, and where the program has room to improve in effectiveness. The outcome of this study clarifies how educational audit programs affect human behavior, which in turn will inform the program administrators of EASY, and other similar programs, on how to improve their program effectiveness.
Purpose

The overall purpose of this study is to answer a variety of research questions. These questions relate to the following limitations facing the EASY program: its impact on consumption behavior, which assesses program effectiveness, and knowledge of participant demographics, which could be used to guide and target marketing efforts. Specifically, this study seeks to answer these questions:

1) Is EASY effective at changing individual’s energy consumption behaviors?
2) What are the best ways to educate program participants about energy-conserving behavior so that the likelihood of them adopting new behaviors increases?
3) What are the best ways to market a free energy program to get more participants in the program?
4) Which demographic characteristics influence the San Gabriel Valley’s energy behaviors?

Ultimately, the answers to these questions can be used to improve the implementation and marketing of EASY. Before the methodology of the study is described, some background information of the SGVCOG and their EASY program will be addressed.

Energy Wise Partnership

The SGVCOG is a Joint Powers Authority between 31 cities located within the San Gabriel Valley (SGV). The SGVCOG implement the San Gabriel Valley Energy Wise Partnership (SGVEWP) which is a partnership between the SGVCOG, participating 29 cities (which are listed in Appendix A), as well as Southern California Edison (SCE), and the Southern California Gas company (SCG). This partnership funds a variety of
programs and energy efficiency projects that are intended to reduce municipal facility 
energy usage as well as community-wide energy usage. One of the SGVEWP’s programs 
is the aforementioned Energy Assessment Screening for Your Home Program (EASY). 
The EASY program is offered to most of the San Gabriel Valley. Its jurisdiction covers 
over 200 square miles, from La Canada Flintridge in the northwest, Montebello in the 
southwest, Claremont in the northeast and Diamond Bar in the southwest. The cities of 
Pasadena and Azusa are members of the SGVCOG, but operate their own municipal 
electrical utilities, and therefore are not a part of the SGVEWP. Since most of the cities 
within the San Gabriel Valley (SGV) are represented in the SGVEWP study area, this 
study will refer to this area as the SGV for the remainder of the thesis. In summation, the 
SGVCOG is part of the Energy Wise Partnership which contributes funds to implement 
the EASY program which operates in most of the cities located within the San Gabriel 
Valley.

EASY operates in a substantial area known for its diversity and increasing 
economic health. The SGV is a large area within Los Angeles County. According to the 
Los Angeles County Economic Development Corporation (LACEDC), if Los Angeles 
County were classified as a country, it would be the 20th largest in the world (2016). In 
fact, it has a population per square mile larger than 43 states in the United States 
(LACEDC, 2016). Los Angeles County is as diverse as it is dense. 45.5% of the 
population identifies as Hispanic, 28.4% identifies as Asian, and 20.5% identifies as 
White (LACEDC, 2016). This dense and diverse population allows the EASY program to 
reach a large group of different ethnicities. The program also operates in an economically 
growing area. When EASY first launched in March 2015, the economy had improved
significantly since the Great Recession, as there was a significant decline in home foreclosures. The improved economy provided people within the SGV the highest disposable income they had had within the past five to ten years, and as a result, consumer spending has slowly been increasing (LACEDC, 2016). This provides an environment where homeowners are more willing to invest in home improvement upgrades, which reduce their energy consumption and utility cost. Conclusively, EASY operates in an area where there is a dense and diverse population to reach, and in an economic climate that allows more people in the area to make pro-environmental changes to their homes.

EASY Program

The EASY program launched in March 2015, and since the start of this study, in December 2016, has since had over 200 SGV residents participate in the program. Figure 1 is a map displaying the number and distribution of EASY program participants by zip codes. This map shows that there have been participants of EASY in almost

Figure 1: Distribution of EASY participants
every SGV city. To schedule appointments, SGV residents can go online to the Energy Wise Partnership website, or they can sign up via a phone call to the SGVCOG office. This no-cost home audit consists of assessors (SGVCOG staff) meeting with participants in their home, and then asking participants a series of questions about their energy behaviors, and the existing conditions of their home. This auditing process is designed to educate participants of the specific purchasing and curtailment behaviors they can take to lower their energy consumption, and to provide them with the information of various incentives they can utilize to support them in implementing these behavior changes. Examples of these incentives include income-qualified programs, appliance rebates, and low interest home energy upgrade loans. The desired outcome is for participants to implement the maximum number of energy-saving recommendations they can, which in turn, will reduce their overall energy consumption.

The EASY assessment process has been standardized in a way that allows flexibility so that the participant can deviate from the process to engage in conversation about their energy interests. Typically, upon entering the home, the two SGVCOG assessors begin reviewing checklist questions with the participants. The audit checklist is composed of 8 sections: building materials, heating and cooling, lighting, kitchen appliances, laundry appliances, home and office electronics, indoor water usage, and an outdoor water usage section (see Appendix B to view the checklist). The different sections ensure that all energy consumptive aspects of a household are accounted for, and the general efficiency of the building envelope is reviewed. Responses are self-reported, and the assessors do not typically independently verify information unless requested (i.e. age of water heater, Energy Star rating of appliances, type and status of insulation). This
open-dialogue approach allows the assessor to tailor the assessment by meeting the personal, educational needs of the participant. For example, an assessor may ask the participant if their home has double-paned windows and if they are confused or unable to answer the question, the assessor can use this as an opportunity to explain the various factors that impact the energy efficiency of windows (i.e. U-factor, visible transmittance, solar heat gain coefficient, and air leakage) and the potential energy savings associated with installing more efficient windows. After the audit is completed, the assessor recommends three near-term changes and three long-term changes the participant can implement to save energy. Additionally, they are given an informational packet which describes available rebates and loans that may help them complete their assessment recommendations. The near-term recommendations can be best described as low to no cost behaviors with a short useful life, whereas the long-term recommendations have a higher-cost with a useful life anywhere from 15-30 years. A week after the EASY assessment, the participant receives a clarifying report which reviews the specific recommendations they were given at their assessment, and information on whether there are specific incentives for those recommendations. Ultimately, the process of the EASY assessment aids assessors in discovering the current state of a participant’s home, and allows them to teach participant’s what they can do to save the most energy.

Marketing

The SGVCOG uses a variety of marketing strategies to encourage participation. Marketing strategies include in-person outreach at community events, newsletter articles, information on city websites, flyers and inserts in utility bills. Recently, the SGVCOG also launched a “refer-a-friend” program that is intended to leverage social capital. The
way this program works is that if a participant refers the program to another individual that then completes an EASY assessment, both participants receive a gift card for a nominal amount. One trend seen within all of the marketing strategies is that they generally focus on the potential economic impact of reduced utility bills. The EASY program brochure, which is used at outreach events, is shown in Figure 2 below.
This brochure is intended to appeal to an individual motivated by cost savings. This can be seen in the use of language such as “Want to save money on your utility bills?” or “By making improvements to these systems, you can reduce your energy bills…” located on the brochure. Figure 3 below is an example of a bill insert which can be sent out directly to residents with their utility bills. Similar to the program brochure, this bill insert is also directed towards people with financial motivations to save energy. For example, the words “save water, save energy, save money” is the first thing written on the top of the flyer to attract people with financial motivations to conserve energy. Conclusively, the
EASY program is marketed through a variety of platforms, and most of these marketing strategies include an appeal to people wanting to save money on their utility bills.

**Importance of This Research**

Given the purpose of the research and the background information of the program, the question “Why is this research important?” remains. On a local scale, this study is important and useful to the SGVCOG by providing advice on how they can improve the effectiveness (increasing energy-saving behaviors of SGV residents) of the EASY program. On a larger scale, this study will add to the following topics in the scientific literature: the effectiveness of educational intervention strategies, and how to contribute or catalyze pro-environmental behavioral changes. In addition, this study can prove to be useful to other energy program managers. The recommendations this study provides to the SGVCOG, are general enough to be useful to any other programs like EASY (an educational home audit program). Since this is the case, program managers of other programs can implement these recommendations in their existing, or newly created energy conservation programs. To sum it up, this study is important because it can be used to help the Energy Wise Partnership improve their EASY program, as well as help program managers in areas like the SGV improve their programs.
The main reason why successful and effective conservation promoting programs are necessary is because in this age, the health of the planet has begun to diminish at accelerating rates. As atmospheric science reveals the sensitivity of the Earth’s atmosphere in relation to the actions of humans, the side effects of our complacent behavior displays how energy consumption is a catalyst to climate change. From now till 2035, the mean air temperature on Earth is predicted to be between 1-1.5 degrees warmer than the levels in 1850-1900 (Intergovernmental Panel on Climate Change (IPCC), 2017). This will affect all life on the planet through the increase of floods in some areas, to the decrease of snow pack in other areas which will have detrimental implications on water supply, soil moisture, ocean temperatures, salinity, and more (IPCC, 2017). Due to these atmospheric predictions and the diminishing fossil fuel resources, energy conservation is a topic of upmost importance and concern. Since many people have homes that require energy, studying household energy consumption is an appropriate way to observe how patterns in human behavior relate to energy consumption—therein giving us the ability to create a culture oriented towards conservation. In 2015, 40% of energy consumption in the United States was from the residential and commercial sector (Energy Information Administration (EIA), 2016-a). Since 81% of United States energy consumption is from nonrenewable sources such as petroleum, natural gas, and coal, it can be assumed that a large portion of residential energy consumption is contributing significantly to the total greenhouse gas emissions of the country (EIA, 2016-a). This literature review seeks to explore the answers to two major questions: What influences
household energy consumption behaviors, and how can conservation programs be used to change an individual’s energy consumption?

**The Factors Affecting Energy Behaviors**

There are a variety of factors that influence an individual to behave in either energy conservative or consumptive ways. Two of the most common determinants of energy behavior are external socio-demographic factors, and internal motivational and attitudinal factors (Brounen, Kok, & Quigley, 2013; Meyer, 2015; Mullaly, 1998). The theories with which this study is based upon come down to two central ideas: that these factors affect human behavior, and that energy behaviors can be altered by intervening through education and helpful resources. In a work entitled “Value Structures Behind Pro-Environmental Behavior”, the external socio-demographic factors, and internal motivational factors and their implications on energy behavior are outlined (Nordlund & Garvil, 2002). External environmental factors (macro factors) affect a person’s internal beliefs, attitudes, and motivations (internal factors) which then influence personal norms (individual behavior) (Nordlund & Garvil, 2002; Stern 2000). A list of external environmental factors as seen through a 1998 empirical study by Gatersleben and Charles Vlek, are Technological developments, Economic growth, Demographics, Institutional, and Cultural developments (TEDIC factors). The internal environmental factors they affect are classified as behavioral antecedents which act as the stimuli needed to push a human into behaving in certain ways (Norlund & Garvil, 2002). Ultimately, the theory with which this study is based upon is that TEDIC factors (macro factors) influence the motivations, abilities, and opportunities (micro-factors) of individuals which then act as antecedents to energy consumption behavior (Thøgersen, 1995).
Types of Energy Consumption Behavior

This section seeks to describe the two types of energy-saving behaviors that decrease household energy consumption. The first type is energy purchasing behavior, which is the purchasing of items that will make a home more energy-efficient (Gardner & Stern, 1996). Some examples of these items are: energy-efficient refrigerators, LED light bulbs, double-paned windows, and insulation. Purchasing behaviors can directly reduce household energy consumption—such as replacing an older television with a newer energy-efficient model; or indirectly reduce consumption—such as installing wall insulation to decrease the need to turn on the air conditioning unit. The second type of energy-saving behavior is energy curtailment behavior, which is a more repetitive behavior that is characterized by an individual making a personal effort to restrict their energy consumption (Gardner & Stern, 1996). Examples of this behavior are: turning lights and fans off when not in a room, utilizing passive heating or cooling techniques, or adjusting the thermostat. These changes in behavior can directly decrease energy consumption in a household depending on the occurrence and regularity of these behaviors. Ultimately, both purchasing and curtailment behaviors are necessary to reduce household energy consumption. In fact, in a Danish study, it was found that household members who displayed more of these energy-saving behaviors consumed less electricity than those that displayed fewer of these energy-saving behaviors (Thøgersen & Grønhoj, 2010). This shows that household purchasing and curtailment behaviors are important to take note of in the pursuit to lower household energy consumption.
External Environmental Factors

In the literature, specific TEDIC factors (external factors) predispose individuals to a variety of energy behaviors. These factors are: household size, household income, individual age, individual gender, and an individual’s culture or ethnicity. These factors provide a good indication as to how much energy a household is consuming. This section will act as a guide through the literature to explain how these specific TEDIC factors affect human energy behaviors.

Household Size and Income

The first of these external factors is the amount of people that inhabit a household (household size), and the total income of the household. There is a positive relationship between household size and household energy consumption, meaning that households with more people use more energy (Cruz-Isla, 2013). A possible reason behind this is that the more people who live within a household, the more people there are behaving in energy consumptive ways such as using household appliances, and electronic devices. In the same breath, smaller households have higher per-capita energy consumption (Cruz-Isla, 2013). This means that household’s with fewer people living in the home consume more energy on a per person basis than larger households. In conclusion, bigger households (with many inhabitants) consume more energy than smaller households.

Regarding household income, high income households consume more energy than low income households (Brandon & Lewis, 1999; Cruz-Isla, 2013; Kennedy, Krahm, & Krogman, 2014). This is likely due to the tendency of high income households to own large (high square footage) homes, which gives them more space to fill with energy-consuming appliances and devices. In addition, these larger homes need more energy to
light, heat, and cool the home than smaller homes do. At the same time, people with higher incomes tend to use energy more efficiently because they can purchase the most recent technologies which are the most energy-efficient (Cruz-Islas, 2013; Schumacher, 2015). As for households with low incomes, they display more energy-saving curtailment behaviors rather than the energy-saving purchasing behaviors higher income households tend to display (Thøgersen & Grønhoj, 2010). In fact, a 2002 Canadian study showed that 42% of low income groups displayed energy curtailment behaviors, whereas only 13% of high income households displayed the same behaviors (Parker, Rowlands, & Scott, 2005). Ultimately, households with higher incomes living in larger homes use more energy than low income households. These high income households are also more inclined to exhibit energy-saving purchasing behaviors, whereas low income households exhibit more energy-saving curtailment behaviors.

**Age and Gender**

The second of these external factors, is the age and gender of the head of the household—also known as the person (or one of the people) who own a home. The literature shows that energy consumption behaviors of men and women differ in some ways, and relate in others. Overall, both male and female energy conserving behaviors come to fruition due to their belief that those behaviors will lower their total household energy usage (Thøgersen & Grønhoj, 2010). However, females differ from males in that they tend to have more of a concern for the environment, and they behave in more environmentally conscious ways than males (Diamantopoulos, Schlegelmilch, Sinkovics, & Bohlen, 2003). Conversely, males have a greater knowledge of environmental issues (Diamantopoulos, Schlegelmilch, Sinkovics, & Bohlen, 2003). Moreover, once
relationships are involved, between females and males, there are some interesting changes in behavior. In romantic relationships, males display a tendency to want to obey their spouse’s desires or lack thereof to save energy. Since females complete more energy-saving behaviors than males, it is theorized that women positively influence their spouses to conserve more energy than their spouse normally would outside of the relationship (Thøgersen & Grønhoj, 2010). Considering gender, the literature suggests that females complete more energy-saving behaviors than males, and they influence the number of energy-saving behaviors their spouses complete for the better.

Age is another factor the scientific literature mentions which has some implications on energy consumption. One finding in the literature is that younger people behave in more environmentally friendly ways, and use less energy in their homes than older people (Chan, 1996; Cruz-Isla, 2013). The findings from two other studies may explain the reasoning why. These studies discovered that younger generations have a greater concern for the environment, while older generations expressed a greater concern for their personal comfort (Brounen et al., 2013; Diamantopoulos et al., 2003). These different concerns may be what is leading younger people to save more energy, while it leads older people to use more energy to maintain comfort. In conclusion, younger people are more concerned about the environment, and use less energy than older people.

Ethnicity and Culture

The final external macro-factors that affect energy behaviors are ethnicity and culture. According to the Oxford Dictionary, ethnicity is the state of belonging to a social group with the same national traditions (2017). Sometimes one’s ethnicity can have implications on household energy consumption. One example of this could be
multigenerational living which is a commonplace practice in parts of Mexico. Multigenerational living is when grandparents live with their children and their children’s families, or vice versa. This tradition creates a tendency for bigger household sizes, and higher energy consumption. In fact, households with dependents older than 64 have been shown to consume more energy than households without (Cruz-Isla, 2013). The traditions that come with ethnicity is a notable factor that could potentially be affecting the diverse region of the SGV.

In addition to ethnicity, micro-cultures such as those found within schools have been able to shape the environmental behaviors of individuals. Micro-cultures are distinct cultures that have their own identities within a dominant culture. According to the literature, micro-cultures can have an external effect on the energy-saving behaviors of an individual. For example, one study compared the energy-saving efforts of two public high schools and found that the most effective school had a cohesive conservation culture which enabled them to use less energy than the nearby, LEED certified high school (Schelly, Cross, Franzen, Hall, & Reeve, 2011). The conservation culture found within this effective school was marked by several actions. These were that the effective school communicated their energy-saving goals more clearly, had a greater presence of energy conservation leaders, used encouragement and motivation to reach their goals, and made their efforts into a competition between the other school. These characteristics are tools that other organizations, businesses, and programs can use to increase their energy conservation culture. Another study showed that school students who verbally encouraged pro-environmental behaviors, and denounced environmentally harmful behaviors helped to increase helpful environmental behaviors within the school (Nolan,
Ultimately, this study as well as the one above shows that creating a culture oriented towards conservation can change the behaviors of individuals.

**Internal Factors Affecting Behavior**

Internal factors act as behavioral antecedents, meaning that they stimulate the cues that lead an individual to exhibit a specific behavior (Thøgersen & Gronhoj, 2010). This shows that these factors are vital in changing energy consumption behaviors because they most directly affect the resulting energy behaviors of an individual. According to the scientific literature, there are three most common internal micro-factors that result in energy conserving behaviors or upgrades. These are an individual’s economic, environmental, or comfort motivations to conserve energy (Vassilva & Campillo, 2014; Aravena, Riquelme, & Denny, 2016). Each of these internal motivations have their own implications for saving energy which will be described in greater depth below.

**Economic Motivations**

The literature suggests that more than half of homeowners partaking in energy curtailment or purchasing behaviors are doing it for economic reasons (Aravena et al., 2016; Palmer, Walls, Gordon, & Gerarden, 2013; Vassileva & Campillo, 2014). The reasons span from a desire to save money on home utility bills, to invest in energy upgrades which will bring future monetary gains, and to follow through with certain energy upgrades due to low cost. However, economic motivations to save energy do not necessarily lead a householder to behave in energy-saving ways; the reason being that some people with this motivation are less likely to make big purchases and more likely to make smaller purchases (Aravena et al., 2016; Palmer et al., 2013). This can be an issue because larger purchases like building insulation, window replacements, or appliance
upgrades can help a building run more efficiently with less temperature controls (which is one of the largest energy consumers) than smaller purchases or curtailment behaviors (Center for Climate and Energy Solutions, 2017). Since this is the case, people with mainly economic motivations to save energy may not be saving as much energy as people with environmental or moral motivations. However, knowing the type of motivation a person has is useful nonetheless.

Environmental Motivations

According to Howard Stern (2000), environmental motivations to adopt pro-environmental behaviors are the most powerful behavioral antecedents. This means that people with these motivations to conserve are the most likely to make energy-saving behavior changes. For one to have these motivations, they must have some knowledge and awareness of environmental issues. Otherwise, they would be unable to make the connection between his or her own behaviors, and their effects. This may explain why households with higher incomes (whom usually have higher education levels) are more motivated by environmental reasons to make energy changes than households with less income (Martinsson, Lundqvist, & Sundstrom, 2011).

In addition to having knowledge of environmental issues, people with environmental motivations to conserve display feelings of moral responsibility to protect the environment (Kaiser & Shimoda, 1999). In a study by Annika Nordlund and Jorgen Garvil (2002), 1,400 Swedish individuals filled out a survey which was used to understand pro-environmental behavior. It was discovered that people who had self-transcendent values (people who value self-improvement) and eco-centric beliefs (belief that all life on earth has value) had a lot of knowledge of environmental problems, a
moral obligation to protect the environment, and exhibited many pro-environmental behaviors. Alternately, the individuals who expressed self-enhancing values (people who value fulfilling their desires) and anthropocentric beliefs (beliefs that humans are the most important living beings) had a lower awareness of environmental problems, and exhibited less pro-environmental behaviors. This shows that the people who are more inclined to behave in environmentally beneficial ways possess inner beliefs and values that extend past themselves, and individuals who lack in environmentally beneficial behavior possess more personal values. One final note to consider is that although one may not classify themselves as an “environmentalist”, they may still have the environmental knowledge, and moral obligation to conserve due to the associations of that word (Barr, Gilg, Ford, 2005; Brandon & Lewis, 1999; McMakin, Malone, & Lundgren, 2002; Nordlund & Garvil, 2002). In conclusion, people with environmental motivations to conserve usually have knowledge of environmental issues, feel a moral obligation to protect the environment, and are the most likely to implement energy-saving behaviors.

**Comfort Motivations**

The final internal factor for saving energy is the comfort motivation to conserve energy. This motivation is almost solely linked with purchasing upgrades rather than curtailment behaviors. The individuals with comfort motivations wants to purchase various upgrades such as a newer air conditioning unit, newer LED lights, or insulation to increase the comfort of their homes. This motivation is especially popular among older adults who are more sensitive to extreme temperatures (Brounen et al., 2013; Diamantopoulos et al., 2003). Having a new upgrade such as installing new insulation
will save a homeowner money on their heating or cooling costs because it keeps the home at a more constant temperature (which makes the home more comfortable). Ultimately, comfort motivations lead an individual towards energy-saving purchasing behaviors, and are most popular among older adults.

**Intervention Strategies**

Intervention strategies are program elements that catalyze a change in a program participant’s behavior. These strategies are necessary because most people do not accurately perceive the amount of energy they consume, or how their behaviors affect their energy consumption, so they keep consuming excess energy (Attari, DeKay, Davidson, & Bruine de Bruin, 2010; Brounen, Kok, & Quigley, 2000). The EASY program uses an educational home audit intervention strategy to try to make residents aware of the amount of energy they consume, so that they can decrease this amount. One important finding in the literature is that intervention strategies which focus on educating alone are not always effective at changing an individual’s energy behaviors (Abrahamse, Steg, Vlek, & Rothengatter, 2005). Since this is the case, different intervention strategies will be analyzed for their effectiveness at changing human behavior.

**Educational Home Auditing**

Tailored, educational home auditing strategies have been shown to decrease the energy consumption of participating households (Hirst & Grady, 1982; Mcmakin et al., 2002; Winnett, Love, & Kidd, 1982). However, there are also studies of tailored audit programs that showed no result or even a rise in home energy consumption (McDougall, Claxton, & Ritchie, 1982). The different results of these programs could be due to the different approaches used in these programs. In the effective Winnett, Love, & Kidd
(1982) study as well as the Mcmakin (2002) study, specific populations were solicited to be involved in the energy-saving programs rather than having the residents respond to an advertisement. Another difference is that the effective Winnett (1982) and the Hirst and Grady (1982) studies both took an “in-home-doctor” type of an approach where energy specialists showed program participants exactly how to make energy curtailment behavior changes in their home such as lowering the temperature of the water heaters. The last clear difference is that all the effective studies were more specifically tailored to the individual households with their personal needs, motivations, and interests. For example, it was discovered in the Mcmakin (2002) study that some behaviors such as air-drying dishes were not suitable for some residents because their hard water would leave water marks on their dishes, so they did not recommend that behavior for that household.

In one of the ineffective programs, the principal investigator speculated that the program was not effective due to the marketing strategies they employed (McDougall, Claxton, & Ritchie, 1982). The program used a broad marketing approach which misled participants into thinking they were receiving a technical home audit, whereas it was a recommendation based, educational audit instead. The principal investigator speculated that participants did not complete many of their energy recommendations because they questioned the credibility of the assessor who gave the recommendations to them.

Ultimately, there are a variety of characteristics effective educational audit programs have that can be used to improve the EASY program.

**Feedback and Goal-Setting**

Goal-setting and behavioral feedback intervention strategies are effective only when conducted in specific ways. A feedback strategy is when a program participant is
reminded of the amount of energy they consume, or the dollar amount they spend on energy in a given amount of time. A goal-setting strategy is when participants are encouraged to make energy saving goals they will meet or follow in a set amount of time. Both strategies are most effective under specific conditions. For example, feedback intervention strategies are most successful when the feedback is given to the participant frequently, consistently, in an interactive manner, and in clear language (Abrahamse et al., 2005 & 2007; Fischer, 2008; Karlin, Zinger, & Ford, 2015). Goal-setting strategies are most effective at lowering household energy consumption when they are utilized in a program with feedback and a mixture of other intervention strategies (Abrahamse et al., 2005 & 2007; Brandon & Lewis, 1999; Houwelingen & Raaij, 1989). Ultimately, feedback and goal-setting strategies are most effectively used together.

Incentives and Disincentives

Incentives are rebates, or encouraging bits of information that inspire program participants to behave in energy conserving ways. Understandably, the most utilized incentives are the ones that provide the most savings on an energy upgrade (Alberini & Bigano, 2015; Stern et al., 1986). However, participants are not always drawn to the incentive that will give them the highest dollar amount off of a future purchase. Participants are also drawn to the incentivized energy upgrades they know will save them the most energy and money with long term use (Alberini & Bigano, 2015; Aravena, Riquelme, & Denny, 2016). This shows that participants keep the short term savings as well as the long term savings in mind when utilizing incentives. In addition to the encouraging aspects of incentives, they can also be persuasive. In a 2016 study, it was shown that incentive offerings increased the likelihood energy audit participants would
make energy-saving purchases than if no incentives were offered (Considine & Sapci, 2016). This shows that the inclusion of incentives makes home energy audits more persuasive in influencing a participant’s energy behaviors. Thus, incentives are useful strategies that can be leveraged to change participant behavior.

Although incentives are effective intervention strategies, they become even more powerful when used alongside disincentives. Disincentives are rules, information, policies, or penalties that can discourage an individual from acting in environmentally harmful ways. The combination of positive and negative reinforcement that using incentives with disincentives can provide, puts more pressure on an individual to behave in a desirable way. The positive result of this strategy is shown in the same study mentioned in the “Ethnicity and Culture” section. In this study, the students that encouraged and confronted environmentally positive and negative behaviors increased the amount of environmentally beneficial behaviors the took place in the school (Nolan, 2013). This shows that these strategies could be used by assessors to possibly increase the energy-saving behaviors of participants. As expressed, the combination of incentives and disincentives is a persuasive strategy that can benefit conservation program implementation.

**Rebound Effect**

Even with all the information and recommendations given to help program participants save energy, their implementation of these behaviors does not necessarily lead to a decrease in energy consumption. It is commonly understood that when an individual replaces an old electrical device for a more energy-efficient one, they will save energy with their use of the new device. The problem lies in assuming that an individual
will have the same trends of use for their new device as they did with their older one. The phenomena where a household’s energy consumption increases after switching to more energy-efficient technologies is known as the rebound effect (Missemer, 2012). This idea was coined by William Stanley Jevon as the Jevon’s paradox in his book entitled “The Coal Question” (Missemer, 2012). This puzzling occurrence has been observed in several studies that track the energy consumption of individuals seeking to lower their consumption (Bentzen, 2004; Lin & Liu, 2015; Roy, 2000). One hypothesis of this occurrence is that technologies that are more energy-efficient cheapen the cost of electricity, and so consumers opt to consume more (Missemer, 2012). The individual does not realize that their increased use of a device has led them to consume more energy than before. Another hypothesis is that as individuals get rid of their old televisions and electronic devices, they are replacing them with multiple or bigger energy-efficient versions, and they unknowingly end up offsetting what energy they would have saved with an equal swap. Although the rebound effect is an important option to consider, it is controversial and may not always occur.

**Concluding Statements**

Home energy programs are one of the means used to decrease greenhouse gas emissions emitted from the residential sector. The scientific literature on the subject reveals that there are a variety of external environmental factors which affect a person’s motivations, abilities, or beliefs (internal factors) which catalyzes an environmentally significant behavior. The most prevalent external factors are the household size and income, and the age, gender, ethnicity, and culture of the head of the household. These external macro-factors influence the most prevalent internal micro-factors of residents
within a household, which are an individual’s motivations (economic, environmental, or comfort motivations) to reduce their energy usage. Considering these factors when creating or changing an intervention strategy, like the EASY program, can ensure that it will be tactfully personalized for the variety of people who will participate in the conservation program. By utilizing effective feedback, goal-setting, incentive, disincentive, and marketing mechanisms within a behavioral intervention program, its likeliness of succeeding to lower household energy consumption, and avoid the rebound effect increases. Ultimately this study is based on, and will utilize the key findings in this scientific literature review to compare to and enhance the effectiveness of the EASY program.
CHAPTER 3: Methods

The following sections describe the research methods of this study.

Choosing the Research Method

A series of three hindrances were considered in deciding the best methods for this study. The first hindrance is the difficulty to track whether EASY participants change their behaviors after their participation in EASY. In the past, EASY assessors would ask for a participants’ gas and electricity bill to view during the home audit. The participants who provided their bills allowed assessors permission to view their energy consumption. This bill could be used to view the difference between their energy consumption before and after their audit, with the ability to obtain a later bill. However, since residents would forget to retrieve their bills before their audit, or felt uncomfortable providing their billing information, assessors stopped retrieving this information. Additionally, the fact that an individual’s household energy consumption information is not public reveals a second hindrance. Utility customers are protected by AB 1274 which keeps utility companies from disclosing customer energy usage to any third party without gaining consent from the customer (California Legislative Information, 2013). Having to get consent from each study participant to access their energy consumption data takes a lot of time, and the request may deter residents from participating in the study. Therefore, this study cannot focus on the energy usage metrics of a household, and instead focuses on the number of household energy behaviors that have been implemented. The third hindrance is the age of the EASY program. EASY is only a year and a half old, and there are only a small amount of people within the San Gabriel Valley who have participated. This makes
comparing household energy consumption data between the months before a participant had their assessment and the same months a year later is not feasible for all EASY participants. Ultimately, these three hindrances shift this study away from collecting and analyzing household energy consumption data, and towards collecting and analyzing household energy behavior data.

The other aspects that shaped the methods chosen for this study are: the need to discover the effectiveness of EASY, and the need to have as many participants in the study as possible. In the paragraph above, it was mentioned that comparing the amount of energy EASY participants consumed cannot be done due to time constraints. So instead, the data this study focuses on is the number of energy-saving behaviors EASY participants have implemented in a two-year span. This data alone cannot reveal the effectiveness of EASY. So, the energy-saving behaviors of a control group (EASY non-participants) will be compared to the energy-saving behaviors of participants to see if there is a statistically significant difference between each sample’s behaviors. In the case that there is a statistically significant difference, and EASY participants are implementing more energy-saving behaviors (on average) than non-participants, then this means that EASY is effective at increasing the energy-saving behaviors of participants. As expressed, the effectiveness of EASY will be discovered by comparing the number of energy-saving behaviors of EASY participants to the energy-saving behaviors of non-participants of the program.

Concerning the need to have as many people involved in this study as possible (to increase the accuracy of the results), a personalized, mailed survey was chosen as the best data collection method for this study. Getting a high response rate from a population as
big as the SGV is difficult. However, surveys can quickly reach many people with relatively minimal effort; this is beneficial considering the time constraints of this study. To ensure the highest response rate as possible, a more personalized approach to mailing the surveys was chosen. For example, to increase the likelihood that residents would open the letters sent to them, the resident’s address was handwritten on each envelope, and each document inside greeted the resident by their first and last name. To increase the likelihood that residents would fill out their survey, they were separately mailed a recruitment letter introducing the purpose of the study, and their survey questions. This was to ensure that their attention was seized twice so that it was unlikely that they would forget to participate. This technique also made it so that if they disregarded the first envelope, they were given another opportunity to change their mind and decide to participate with the arrival of the second envelope. Lastly, each survey was sent out with a stamped return envelope, to ensure that the process to send the surveys back were as convenient to survey participants as possible. In conclusion, the personalized, mailed survey method was chosen for this study to guarantee that it would receive the highest response rate possible.

**Survey Questions**

The survey questions (Appendix I-L) sent to the participant and non-participant samples (the resident sample) were designed to provide the necessary data to analyze the resident demographic characteristics and behaviors, and the effectiveness of EASY. A total of five demographic questions were asked to better understand the resident sample, and the external factors affecting their behaviors. These demographic factors of interest are the age, gender, and ethnicity of the head of the household, and the income, and
number of people living within the household. Most of these questions were placed in the beginning of the survey minus the question asking about the total household income. This question was placed at the end of the survey, where the chances of the resident sample disclosing this sensitive information is higher. Following the demographic questions, two questions ask the sample to check the boxes of the types of behaviors they have implemented in the past two years. The first question lists examples of purchasing behaviors, whereas the second questions lists examples of curtailment behaviors. The answers to these two questions expose the amount, and types of behaviors each household from resident sample have done. Lastly, the final two questions put on the survey address the motivational and encouraging influences (internal factors) that affect the resident sample’s energy conservation behaviors. These two questions seek to discover the motivations that presently determine their energy behaviors, and the offerings or information that could encourage future behavior changes. Ultimately, these questions address the three major areas that determine one’s energy consumption behaviors.

In addition to these questions, EASY participants were asked two additional questions to give the SGVCOG greater insight into the effectiveness of the program. The first question asks EASY participants if they have completed any of their recommendations. If the participant answers “yes”, the second question asks whether the recommendations they completed were “near-term” or “long-term” recommendations, or “both”. These questions were inserted into the survey to show the SGVCOG assessors the amount of people following through with their personalized recommendations, and which types of recommendations are the most popularly completed. This information could
show SGVCOG assessors how well they are doing at getting EASY participants to adopt energy-saving behaviors. Ultimately, these additional questions provide a more thorough understanding of the EASY program’s effect on its participants.

**Research Protocol**

Before the data collection phase of the study began, a mailing list was purchased in preparation. On January 18th, 2017, 2,153 non-participant addresses were purchased from 25 San Gabriel Valley Cities using Directmail.com. Directmail is a Coding Accuracy Support System (CASS) certified by USPS that provides all of the given addresses from a predetermined area. The addresses and the names of the head of the households are frequently checked real addresses to ensure that the information is correct. The Directmail address list was drawn from the cities where there have been EASY participants, that way the non-participant sample is from the same areas as the participants. However, since there have not been EASY assessments conducted in every SGVEWP city, some cities were left out (Bradbury, Montebello, South El Monte, Irwindale, Industry, and San Dimas) while some were added in (Azusa and Pasadena). The other criterion that was used to match the participant sample was: the homeowner must be over the age of 18, and they must have lived in their home for at least 2 years. After this random list was purchased, the first 200 non-participant addresses from the list were inserted into the Excel file that contained the 180 addresses of the EASY participants (who participated between March 2015 to December 2016). On February 19th, after the non-participant mailing list was assembled, the IRB approved the study protocol with human subjects under the protocol number, IRB-17-12. This approval
marked the beginning of the data collection phase which lasted from the end of February till May.

These months of data collection required organizing, filling, and addressing to collect data from the SGV residents. A total of two envelopes were sent out to each potential survey participant to begin the data collection phase. The first envelope included an Informed Consent Form, and a letter asking residents to participate in the study. Residents were also informed that their participation in the study would enter them into an opportunity drawing to win one of two Nest Thermostats. The second envelope included the surveys (English and Spanish versions), another copy of the Informed Consent Form (for the participant’s records), and a stamped return envelope to return the filled in informed consent form and survey back to the SGVCOG. On February 22, the first round of 180 EASY participants and 200 non-participants were sent out and were due by April 6th. However, in April there was an extremely low number of EASY non-participants represented in the sample, so a second round was mailed out. The second round included materials that were sent to 200 more EASY non-participants on April 7th and were due by May 1st. After this second round of surveys were sent out and received, it was determined that the resident sample was large enough to end the data collection phase and to begin the data analysis phase. In July, the two winners of the Nest Thermostat were randomly drawn from a cup, and they were mailed their Nest Thermostats. Meanwhile the data collected from the surveys entered the analysis phase.

Limitations

Although a lot of thought and effort were put into the organization and methods of this study, it is not without its limitations. The biggest limitation to the study is the
inability to increase the accuracy of the results by retrieving the exact energy usage data of the participants and non-participants of the EASY program. Due to the laws protecting the energy consumption information of residents of the SGV, and the time it would take to get permission from residents, it was not a feasible way to attain information. Because of this, the study was conducted by relying on self-reported energy behavior data. Self-reported behavior data is not as accurate as numerical energy consumption data, so this is one of the limitations to the study protocol. Another limitation to this study is that surveys were not sent to all of the SGVEWP cities. This ensured that the participant, and non-participant samples were pulled from similar areas of the SGV. However, it limits the ability to see why EASY participation rates are much lower some cities than others. Another limitation with the survey is the inability for residents to write-in specific answers. Although multiple choice options allow for simpler statistical analysis, it inhibits the amount of details in the results. It may have been more beneficial to let the survey respondent fill in their exact age, or the exact number of people that live in their household. Overall, these are the major limitations to this study, and in future studies these can be better accounted for.
CHAPTER 4: Results and Analysis

After four months of distributing and collecting surveys, the final response rate was 13.3% with 77 residents responding out of the 580 mailed surveys. The answers were inputted into a database for analysis. Analyzing these results reveal the overall characteristics of EASY participants and non-participants living in the San Gabriel Valley, and the effect the program has on resident energy behaviors. To cover all of the findings, this chapter will look at the normality of the sample compared to the San Gabriel Valley (SGV) population, the difference between participant and non-participant energy behaviors, and the relationships between the demographic factors and behaviors of the sample. These findings ultimately show how effective the EASY program is at increasing participant energy-saving behaviors, and whether the trends outlined in the literature review are supported by this study’s findings.

Survey Respondents

Before the findings of this study are revealed, an overview of the confidence intervals of the samples will provide a lens to view the upcoming results. The final count of surveys sent out to SGV residents are 180 to EASY participants, and 400 to non-participants out of a population of 169,254 households (as seen through the Directmail website). These rounds of mailing resulted in 48 filled out EASY participant surveys, and 29 non-participant surveys which adds to a total of 77 surveys. At a 95% confidence level, the final non-participant sample produced a +/-18 confidence interval, the EASY participant sample produced a +/-12 confidence interval, and the resident sample produced a confidence interval of +/-11. These confidence intervals have an ability to show how
similar the results of the study samples are to the entire population. Smaller confidence intervals are better because they show that the sample findings are the same or very similar to that of the entire population. For example, if 45% of the resident sample (which has a +/-11 confidence interval) said that they have environmental motivations to conserve energy, this means that the findings for the entire population could be as low as 34% (45% - 11%) or as high as 56% (45% + 11%). The higher confidence intervals in this study are a limitation because the sample results may be largely different (up to 18% more or less) than the SGV population. With a population this large, and with the research method used, this confidence interval is not uncommon. However, this information must be kept in mind throughout the results described in this chapter.

**Normality of the Data**

This section analyzes the geographic distribution, among survey respondents and the demographic characteristics of the samples compared to the population. A map is shown in Figure 4 to visualize and analyze the geographic distribution of the EASY participant and non-participant samples. This map includes the survey respondents (EASY participants and non-participants) and the 180 EASY participants (total from March 2015 to December 2016) organized by zip code. Although the overall survey respondent sample spans a wide area with almost every city being represented, the geographic distribution is not even. It is clear that eastern cities are better represented than the western cities. In fact, Pomona shows to have the greatest number of survey responses and largest EASY
Figure 4: Survey Respondents in the San Gabriel Valley

participation since the program began. This could either be because of the large area and population the city of Pomona has, or because the population has a large percentage of households considered low income, suggesting that residents have a greater need to learn about money-saving energy tips. Pomona is one of the Energy Wise Partnership cities with the highest percentage of its population living under the poverty level at 22% (United States Census Bureau, 2015). The city with the highest percentage of its population living under the poverty level is El Monte, a city with far less participation in the EASY program than Pomona. This could be due to the heavy marketing in Pomona in comparison to El Monte. Pomona marketing includes city website coverage and two rounds of 30,000 bill inserts which were sent out in the past two years of the program, both of these marketing strategies
have not occurred in the city of El Monte. Other cities such as Claremont have a high program and survey participation rate; however, these cities do not have a large percentage of people living below poverty level. A possible explanation for this is that the city of Claremont is known as a more environmentally-minded city compared to other cities, therefore many people living in Claremont may have environmental interests and that is why they signed up for an assessment. These interests could have been peaked through all of the environmental marketing pathways EASY has been displayed in such as through Sustainable Claremont events, or the city’s Earth day or environmental events. In conclusion, although there is a wide spread among the survey sample and EASY participants across the SGV, the distribution is not as uniform and this could be due to the marketing presence of EASY.

In addition to the distribution of survey respondents, the distribution of EASY participants vs non-participants is irregular. Ideally, there would be an equal survey response between participants and non-participants, but this is not the case in this study. In the “Survey Respondents” section above, it shows that many more participants (48) responded to the survey than non-participants (29). Figure 4 shows that north Pomona, Monrovia, south Glendora, and other cities have equal responses from participants and non-participants, however these are exceptions. Most of the cities and zip codes included in the SGV region are clearly unrepresented between participant and non-participant survey responses. Ultimately, the overall number of response between participants and non-participants is unequal. This will affect the comparative testing method used to assess the effectiveness of the program.
This section analyzes the demographic characteristics of the SGV population compared to the sample. The first demographic factor to analyze in this series is the ethnicity. The SGV charts were created based off of the information provided in the 2015 American Community Survey Census Data, and these charts are used to compare to the sample demographic charts. The illustrations in Figures 5 and 6 show that although the ethnicity of the SGV compared to the sample are very similar, there are slightly less people who consider themselves Hispanic, Asian or Pacific Islander, and White, and more people that consider themselves Native American, and Black in the sample population compared to the Census. Although these are very slight percentage differences overall, there is one exception which is the sample Hispanic population which is 15% less than the SGV population. This is important to note as the literature has expressed that there are some Hispanic cultural norms that have implications on energy consumption, such as multi-generational living.

Figure 6: San Gabriel Valley Ethnicity
Figure 5: Ethnicity of the Sample
Next, the age groups (18 years and older) of the SGV population and the sample are compared and illustrated in Figure 7 and 8. In comparing the two charts, it is evident that the sample and the census data of the San Gabriel Valley are represented very similarly. The only large percentage difference is in the older adult population age range of 65 years or older where there is 12% more in the sample than in the SGV. A deeper look into the separate sample charts of program participants and non-participants (which are not pictured), shows that the EASY participant sample is older than the non-participant sample. This could be because older people are more likely to sign up for energy assessments because they are more financially stable, and have the time and money to invest in their home than younger people.

When it comes to gender, both the SGV population and the sample are similarly represented. Both genders are about 50% in each chart, even though the charts are flipped with their being slightly more females in the SGV chart (Figure 9), but slightly more males in the sample chart (Figure 10) below.
The survey sample household size and income was more difficult to compare to that of the SGV. This is because the household size and income data that was collected from the survey was separated into categories that did not entirely match up with the categories displayed in the census. However, the categories were close enough to still be helpful in viewing the differences between the SGV population and the sample. The results for the average household size are listed in Figure 11. They show that the average household sizes of the survey samples are slightly smaller than the average household size of the San Gabriel Valley. In Figure 12 and 13 the sample chart shows that there are more people in the higher income bracket ($90,000/$110,000 or more a year) than the census data shows. The ample chart also shows less people in the lower income bracket range ($50,000 a year or less) than in the
census data. This shows that the sample population represents more wealthier families, and less low income families than the census data shows. When comparing the EASY participant sample and non-participant sample (not pictured) within the total resident sample, there seems to be more differences in income distribution. For example, the participant sample represents upper and lower income households more than middle-income households, and the non-participant sample represents more middle-income households.

Ultimately, the comparison of the SGV population to the sample population reveals their distinct differences and similarities. Overall, the sample is older, less Hispanic, and has a greater percentage of people in the highest income bracket than the SGV population. Some of these differences were expected like the differences in income. Owning a home is usually reserved for people with higher incomes, and one criteria of the sample population (that is not the case in the census data) is that that each household had to be owned for at least two years. In contrast, the sample is like the population in gender and household size. In conclusion, although there are some similarities between
the demographic characteristics of the sample to the SGV population, there are more differences to take note of for the following results.

**Effectiveness of EASY**

There are two measures of effectiveness of the EASY program. One of these is viewing whether participants have completed one or more of their assessment recommendations or not. The other is to see if there is a statistically significant difference between the number of behaviors EASY participants have done compared to non-participants. Figure 14 displays that 71% of the EASY participant sample have completed one or more of the energy-saving recommendations given to them at the end of their assessments while 29% have not. This reveals that most EASY participants are changing or including new energy-saving behaviors after participating in the program than not. In this way, it seems like the program is successfully increasing energy conservation. However, this increase may not necessarily be caused by the participant’s participation in the program. It is possible that EASY participants, along with other residents of the San Gabriel Valley, are independently changing their energy consumption due to other external factors such as increasing cultural pressures to save
energy among, or other factors. Ultimately, most EASY participants are completing their recommendations after the completion of their assessment, however this may not be due to the presence of the EASY program.

This brings us to the second measure of effectiveness which is whether there is a statistical difference between the number of energy behaviors of participants compared to non-participants. This can be tested and revealed through the acceptance or rejection of the Null Hypothesis. Accepting the Null Hypothesis means that there is no significant difference between the behaviors of EASY participants compared to EASY non-participants. Since the sample data is not normal (as seen through prior sections), and there are also differences between the participant and non-participant samples, a non-parametric Mann-Whitney U test was conducted (Appendix M). For both tests (one for purchasing behaviors, and another for curtailment behaviors), the critical value for 95% certainty is +/-1.960. In the case of purchasing behaviors, the z-score is 2.828, and since 2.828 > 1.960, the Null Hypothesis is rejected for the purchasing behaviors of participants compared to non-participants. This means that there is 95% certainty that participants of EASY did more energy purchasing behaviors than non-participants. In the case of curtailment behaviors, the z-score is 1.798, and since -1.960 < 1.798 < 1.960, the Null Hypothesis is accepted. This reveals that the study could not show with 95% certainty there is a difference between the number of energy curtailment behaviors implemented between participants and non-participants. Ultimately, although there is 95% certainty that the EASY participants are doing more energy purchasing behaviors than non-participants, this cannot be said about the curtailment behaviors of the participants.
The statistical results of the study raise the questions “Why do participants do more purchasing behaviors than non-participants” and “How come there is no difference between the curtailment behaviors of participants and non-participants”. One of the most likely inference as to why EASY participants complete more energy purchasing behaviors than non-participants is due to the EASY program. The information, encouragement, and incentives provided throughout the assessment may have caused the participant to implement more energy-saving purchasing behaviors afterward. Conversely, an individual’s behaviors may not be completely reliant on the EASY program itself, but rather they may already have an innate desire to complete more energy-saving purchasing behaviors which leads them to signing up for EASY.

Regarding the second question, there may be no significant difference between the curtailment behaviors between both samples because both are already well aware of the free or low cost behaviors they can implement to save money. The low cost of many curtailment behaviors makes them very attractive to implement, and with the ever-changing technologies, it is highly possible for someone to not be aware of what they could buy to save energy in their homes. Ultimately, the educational power of EASY may be the most likely reason why EASY participants do more purchasing behaviors than non-participants, and not with curtailment behaviors.

Types of Energy-Saving Behavior

With the statistically significant difference of purchasing behaviors established, a deeper look into the data will reveal the most or least popular purchasing behaviors. Figure 15 shows what types of purchasing behaviors people in the SGV are utilizing to save energy. The most utilized purchasing behavior for both participants and non-
participants is the purchasing of LED lights. This could be because the savings associated with buying new lighting is well known, and light bulbs are one of the cheaper energy upgrades. Heating and cooling (upgrading air conditioning units), laundry purchasing (upgrading washers and dryers), and building purchasing (upgrading insulation and windows) are the purchasing behaviors that are done the least in both participants and non-participants. These purchases may be the least implemented because they are all relatively high in cost. It could also be because many older, less efficient air conditioning units, and washers and dryers are still functioning well today so a homeowner sees no need in replacing them. Building purchasing behaviors are even lower than heating, cooling, and laundry purchasing behaviors. These behaviors include purchasing new wall and ceiling insulation, windows, and other materials that will help insulate the building the best (keeping it cool or warm without energy input). These are the single most expensive purchasing behaviors with the longest useful lives out of the whole list. Building purchases are also classified as indirect energy conservers. This means that they do not directly save energy when installed, but decrease the need to turn on the air conditioner or heater as often. Since the effects of these behaviors

![RESIDENT ENERGY SAVING BEHAVIORS: PURCHASING](image)

*Figure 15: Resident Energy-saving Behaviors: Purchasing*
purchases on energy-savings are more intangible than installing more efficient lighting or appliances, it is harder for people to view these purchases as worthwhile investments. One interesting observation shown in Figure 15 is that participants have done comparatively more purchasing behaviors in the “electronics” category than non-participants. There are two specific purchasing behaviors recommended within this section of the EASY checklist. One is to purchase and install smart power strips which have timers and programmed plugs to automatically decrease phantom loads in the entertainment centers and computer set-ups within the home. The second is to upgrade their plasma or LCD television to an LED television. Since EASY participants have completed more of these electronic purchasing behaviors, it implies that the EASY assessment makes a large difference in increasing the knowledge of what one can buy to save energy in the entertainment centers of their home. Lastly, the table contains an “other” section that 5 out of 48 participants checked. These individuals mentioned that they purchased solar panels for their home. This shows that more EASY participants have invested in solar panels than non-participants even though this is not a topic of conversation within the assessment. Ultimately, the purchasing behaviors of the sample are in line with the ideas in the literature that the cheaper an upgrade is, the more people will implement it. There is also evidence that EASY participants are completing more electronic recommendations due to knowledge EASY imparted on them.

Although there is not a statistically significant difference between the curtailment behaviors of EASY participants compared to non-participants, the data is useful in determining what energy conserving curtailment behaviors residents are aware of and implementing. Figure 16 shows that the most popular curtailment behaviors for
participants are heating and cooling behaviors. These include using fans or blankets instead of the air conditioning unit or the furnace, lowering the temperature of the water heater, or utilizing passive cooling methods (window opening and closing) within the home. Some of these recommendations are common sense such as the use of fans or blankets, however the other two pertaining to the water heater or the passive cooling methods are not. This suggests that participants implement more heating and cooling curtailment behaviors than non-participants because of the knowledge they gained through their energy assessment. The most utilized curtailment behaviors of non-participants is turning off the lights when not in a room. This finding is expected seeing as this behavior is commonly stressed within a household. The least utilized curtailment behaviors for both participants and non-participants are those in the kitchen and electronics categories. These behaviors include unplugging devices when they are not in use (decreasing phantom loads), raising the set temperature of the refrigerator and freezer, and turning down the brightness of televisions, computers, and phones. This is speculated to be due to not only a lack of knowledge on how much energy these behaviors could conserve each year, but also on how to actually implement the changes. This shows that more time could be spent on the
education of how much money specific curtailment behaviors could save a household each month, and how to implement some of these lesser known behaviors. As can be seen the most well-known curtailment behaviors are the behaviors that most people implement. Similarly, the least well-known curtailment behaviors are the least implemented; this implies that more time and education needs to be spent on these specific behaviors.

**Motivation and Encouragements to Conserve**

In this section, the resulting internal factors affecting the energy behaviors of participants and non-participants will be discussed. As predicted, most people of the SGV are motivated to conserve for financial reasons. Out of the survey sample, 51% of people marked that they conserve energy for financial reasons, 34% of people conserve for environmental reasons, and only 15% of people implement energy conserving behaviors to increase the comfort of their home (Figure 17). Although environmental motivation is the second-most popular reason SGV residents conserve, the literature concludes that it is the most powerful internal factor to leverage in order to change one’s energy

![Figure 17: Resident Conservation Motivation](image_url)
consumption behaviors. Therefore, EASY should tailor more to individuals with these motivations through the marketing and implementation of the program. The data also indicated (in charts not pictures) that participants are slightly more motivated by environmental reasons, whereas non-participants are more motivated by financial reasons. This shows that EASY attracts more people with environmental motivations to conserve, even though more SGV residents have financial motivations to conserve. Since this is the case, these environmentally motivated participants may not be receiving the type of information they are looking for since the program more heavily tailors to people with financial motivations to conserve. Ultimately, these motivations provide the insight that the EASY program could be improved by tailoring the program more to people with environmental motivations to conserve.

The results of the study also reveal the encouragements (internal factors) that would motivate the participants who did not complete any of their recommendations to conserve. In Figure 18, the EASY participants who did not complete any of their assessment recommendations expressed that they would be most encouraged to complete their recommendations if they had more grants and incentive programs. This

Figure 18: EASY Participants with No Completed Recommendations: Encouragement to Conserve
suggests that the expense of their recommendations was too much for them to invest. The data also shows that 32% of participants would be more encouraged to implement more energy behaviors if they received more knowledge of how to lower their utility bills. This finding suggests that the participant did not feel that they had enough information about how to lower their utility bills. This could also mean that the participant wished that they had more information on how much money their specific recommendations could save them on their utility bills. In brief, participants who did not complete their assessment recommendations would be encouraged to if they had more grants and incentive programs, and more information on how to save money on their utility bills.

The specific purchasing and curtailment recommendations these participants were given, provide more insight into why they did not complete any of them. The most frequently recommended purchasing behavior changes given to these participants were to install weather stripping or window film in their home, and/or to replace their insulation. Although there are no rebates provided for window film or weather stripping, these are relatively inexpensive energy upgrades and it is likely that the participant did not complete them due to the cost. They probably did not complete these behaviors because they lacked the knowledge of how to complete them, or they were skeptical of how much or whether these behaviors would save them on their utility bills. As for the insulation, there is currently a rebate from SCG to get $0.15/sqft off new wall insulation. Unfortunately, this does not drastically reduce the price of replacing the insulation on an entire house. According to HomeAdvisor, the estimated price to insulate a 1,500 sqft house is $1,573. By utilizing the $0.15/sqft rebate, the total price of this project is only reduced by about $200. This rebate may not be substantial enough for a participant to
want to purchase the insulation. The homeowner could also be unsure of how much money this would save them on their utility bills, and therefore they do not know if it is worth the expensive price. Subsequently, the curtailment behaviors these participants did not complete were to clean the condenser coils of their refrigerator, to lower the temperature of their water heater, and to raise the temperature of their refrigerator. These curtailment behaviors take a degree of skill and knowledge to complete. This suggests that EASY can benefit from spending more time informing participants of how much money they would save on particular behaviors, and on teaching them how to complete the simpler recommendations.

Figure 19 below, shows the same information as Figure 18, except with the results of the participants who completed at least one of their assessment recommendations. The results are like the participants who did not complete their recommendations. The only exception is that more of them want information on how to lower their utility bills instead of more grants and incentives. These results are interesting because even though these participants completed some or all of their recommendations, they want to save even more on their utility bills. Or they want to know how much money the recommendations

![Figure 19: EASY Participants with Completed Recommendations: Encouragement to Conserve](image)
they have not completed yet could save on their utility bills. Ultimately, these results show that participants want to be more educated on how certain behaviors affect utility bill cost.

In conclusion, there are two major motivations SGV residents have to conserve energy and two major ways the program would encourage them to change their energy behaviors. The study sample shows relatively more financial motivation to conserve energy than environmental motivation. Since this study has revealed the major motivations of the resident population, this information can be used to better market to these individuals. This would prove the most beneficial for the groups with environmental motivations since they are more inclined to complete energy-saving recommendations. Additionally, if the program offered more grants, incentives, and education on how and how much participants can lower their utility bills, the program would better encourage residents to implement energy-saving behaviors. Participants and non-participants also both show desire for more information on how much they could reduce their utility bill shows.

**Energy Behaviors and Demographics**

This section will show the relationship between the demographics of concern (age, gender, and income), and the average number of energy saving behaviors the resident sample completed. These factors represent the external, macro-factors that affect the amount of energy-saving behaviors people do, and will be compared to the literature.
Age

As shown in Figure 20, there is a positive relationship between the amount of energy behaviors a person implements and their age. This positive relationship was mentioned in the scientific literature on the subject. Theoretically, the older you are, the more resources and time you have to put toward energy-saving purchases and behaviors. Younger adults usually have lower incomes and are not as invested in their residence. Ultimately, these findings that age and energy behaviors are positively related are in line with the scientific literature.

Gender

Regarding gender, there are differences between the literature and results of this study. The literature concludes that women exhibit more energy-saving behaviors than men. However, the findings of this study are somewhat inconclusive. In the total resident sample (not pictured here), women are implementing slightly more energy-saving behaviors.
I 1 1

GENDER AND BEHAVIORS:
EASY PARTICIPANTS

<table>
<thead>
<tr>
<th>Average # of Behaviors/Person</th>
<th>Female</th>
<th>Male</th>
</tr>
</thead>
</table>

GENDER AND BEHAVIORS: EASY NON-PARTICIPANTS

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<thead>
<tr>
<th>Average # of Behaviors/Person</th>
<th>Female</th>
<th>Male</th>
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</thead>
</table>

Figure 21: Gender and Behaviors of EASY Participants

Figure 22: Gender and Behaviors of EASY Non-Participants

behaviors than men, however, when looking deeper into the resident sample, the trend is not as clear. In Figure 21, EASY participant women are shown to have completed more energy-saving behaviors than men which is the result that is expected based on the literature. However, Figure 22 shows that EASY non-participant men completed more energy-saving behaviors than women. All things considered, the scientific literature declares that women do more energy-saving behaviors than men, however these findings were not supported by this study.

Income

A reoccurring trend in the literature shows that households with higher incomes implement more energy purchasing behaviors, while households with lower incomes implement more energy curtailment behaviors. This is because households with higher incomes have the funds to update their homes as they age by purchasing the latest energy efficient technologies. However, households with lower incomes do not have these extra funds. So instead, they need to save energy and money by implementing curtailment behaviors. Although not as dramatically as was hypothesized, Figure 23 confirms the
positive relationship between income and purchasing behaviors. However, Figure 24 reveals a different result in the relationship between the number of curtailment behaviors and the household income. The results show that households within the middle-income bracket do more energy-saving curtailment behaviors than both low and high income households. This could be due to the effect that education has on a household. Higher education usually yields a higher income, so the low income households may lack the education necessary to know what curtailment behaviors they can implement to save money and energy in their household. The highest income bracket may be low in curtailment behaviors because they do not have the necessity to cut back their energy usage in this way since they have the money to pay their utility bills. Overall, the scientific literature suggests that lower income households complete more curtailment behaviors.
behaviors than higher income houses, however the data in this study suggests that middle income households complete the most curtailment behaviors.

Ultimately, the results of this study show that the EASY program is effective at changing the energy behaviors of its participants. They also show that some of the external and internal factors mentioned in the literature affect the behaviors of the SGV residents. Overall, the survey sample is representative of the SGV population in age, gender, ethnicity, household size, and household income, with small exceptions within ethnicity, age, and household income. In doing the statistical calculations, the Mann-Whitney U test revealed that the EASY program increases the energy-saving purchasing behaviors of participants without increasing their curtailment behaviors. In addition to these findings, there are multiple hypothesizes, most of which were mentioned in the literature review, that were proven in the data analysis. Firstly, cheaper purchasing behaviors are implemented more than more expensive upgrades. In regard to internal factors, most people show financial motivations to conserve energy and people with environmental motivations were the second most common. In regard to external factors, older people implement more energy-saving behaviors than younger people, and households with higher incomes do more energy-saving purchasing behaviors. In terms of improving the program, EASY participants expressed that they would be encouraged to save more if they had more information on how to implement some of their recommendations, and knew how much their actions would save them on their utility bills. They also expressed that more and better incentives and rebates would encourage them as well. In the following chapter, recommendations are given to the SGVCOG to increase effectiveness of the EASY program.
The following recommendations are drawn from the literary analysis on the topic, and the resident feedback. The literature review describes the characteristics of energy conservation programs that make them effective at changing energy consumption behaviors. These recommendations can further improve the program’s participation and effectiveness.

**Program Organization**

Although EASY has been shown to increase the purchasing energy behaviors of participants compared to non-participants, improvement in program organization could further increase these behaviors. To improve the program organization, two main questions are addressed. The first is to understand how SGVCOG can increase the amount of curtailment behaviors EASY participants do after their assessment. The second is to understand how to create an even greater difference between the energy-saving behaviors of EASY participants compared to non-participants. The literature review mentions multiple characteristics of an effective program. Some of which show that an effective program should not only use a mixture of intervention strategies (including disincentives), but their assessors should also take the “in-home-doctor” approach in their assessment.

EASY assessors currently use education, home energy auditing, and incentive intervention strategies to increase the energy-saving behaviors of residents. However, the EASY program was initially designed to also include the following intervention strategies: goal-setting, feedback, disincentive, and the “in-home-doctor” approach.
Therefore, it is evident that there is a discrepancy between how the EASY program was initially designed, and how it is currently organized and implemented by assessors. This section is going to discuss the effective intervention strategies mentioned within the literature review that were included within the design of EASY, and compare them to the current implementation of assessors. The first intervention strategy mentioned is the goal-setting intervention strategy. This strategy has been proven to be effective at increasing the number of energy-saving behaviors someone implements by helping participants make their own attainable energy-saving goals. However, assessors currently provide participants with the recommendations they should complete based on what will save the most energy rather than letting them set their own energy-saving goals based on the assessment checklist. This strategy has been proven to be especially effective when used in combination with feedback strategies (Abrahamse et al., 2007; Houwelingen & Raaij, 1989). Feedback strategies include either informing program participants on the energy they are using over a period of time, or following up to see if they are implementing the behaviors they had previously agreed upon. Since the EASY program cannot provide continuous energy data, the latter, simpler feedback strategy was the strategy included in the original EASY program design. Assessors used to determine if participants have completed any of their recommendations by retrieving feedback after their assessments. This is currently not being done. Conclusively, assessors have begun to exclude goal-setting, and feedback strategies from the organization of the EASY assessment although they were originally included in the program design.

In addition to these intervention strategies, the “in-home-doctor” approach is not currently being implemented by assessors as effectively as it could be. The “in-home-
doctor” approach requires assessors to provide detailed explanations or demonstrations on how to implement specific energy-saving changes within the home (Grady, 1982; Winnett, 1982). Some examples of this are to show participants how to change the temperature of the water heater to program standards, or showing them a video about how simple it is to install weather stripping on their windows and doors. EASY program assessors currently tailor audits to participants by ensuring the recommendations they provide are based on the participant’s answers to the energy checklist questions, along with their current energy consumption behaviors. However, they are not personalizing their assessments to the degree that is necessary to make the program more effective, and to fulfill the original expectations of the program design.

Lastly, the use of disincentives has been shown in the scientific literature to increase energy saving behaviors. According to the Merriam-Webster dictionary, a disincentive is “something that causes or that could cause a person to decide not to do [a specific behavior]” (Merriam-Webster, 2017). The literature reveals that informing people of the disincentives (negative consequences) of consuming energy is an effective way to alter human energy consumption (Mcmakin et al., 2002; Nolan, 2013). In order to properly reveal the pros and cons of using and saving energy, residents must be informed on the incentives and disincentives of energy consumption. This ensures residents will make more informed decisions on what actions they will or will not take to save energy in their homes. Although disincentives are included in the initial design of the EASY program, they can be implemented in more efficient ways. The best moment for an assessor to speak of the disincentives of consuming energy is after assessors complete the assessment checklist questions, and before assessors and participants decide on energy-
saving goals. This is the ideal time to discuss disincentives with participants because it will create urgency to set ambitious energy-saving goals, while not affecting the honesty of the participant’s checklist answers. The data shows that 51% of residents are motivated to save energy for economic reasons. So, a useful disincentive for these participants would be to show them how much money they are unnecessarily spending per month on utility bills. The literature suggests that participants are more likely to adopt energy saving behaviors if they know exactly how much it will save them on their utility bills (Alberini & Bigano, 2015; Aravena, Riquelme, & Denny, 2016). This can be achieved by providing calculations on the estimated monthly utility costs the participant is unnecessarily spending on incandescent light bulbs, phantom loads, and other inefficient practices. Tools such as Southern California Edison Green Button Data, the University of California Los Angeles’s (UCLA) Energy Atlas, and Southern California Gas Company’s quarterly gas data can be used by the SGVCOG to organize these metrics to include in assessment presentations.

In summary, the initial design of the EASY program included a wide variety of intervention strategies that the literature shows to increase program effectiveness. These include resident goal-setting, informative feedback, the “in-home-doctor” approach, and disincentives. These are currently not being effectively implemented by the assessors. By providing additional training to assessors and assuring proper implementation of each strategy, the initial design of the program can be reached.

**Assessor Training**

The initial program design can be reached through further assessor training and additional quality control. The following recommendations are given to address this in
greater detail. Firstly, assessors need to include residents in goal-setting during an assessment, and follow up with these goals after an assessment, as initially designed. Secondly, assessors can also be trained to demonstrate practical ways for a participant to achieve their energy-saving goals during the assessment. For example, an assessor could guide a participant in taking the temperature of their refrigerator and freezer and adjust it to the program standards during the assessment. Thirdly, protocol was previously suggested for disincentive information to be given out after the completion of the checklist, and before the energy goals are made. In addition, an assessor can ask a participant what their key energy interests are before they move on to the checklist questions. This will reveal if the participant is just interested in reducing their utility bills, or if they have other interests about the specific programs offered to them as an SGV resident. These intervention strategies can be implemented through the following. A test can be given to assessors on the information they need to know and how they need to administer that information. Afterwards, one or more mock assessments can be done before leading an assessment in a home to ensure proper knowledge and protocol is met. In order to provide quality control, supervisors can randomly attend assessments to observe whether assessors are properly implementing these intervention strategies. Ultimately, this additional training and testing will better equip the assessors to successfully implement the initial design of the EASY program.

**Marketing**

In addition to the previous sections, the marketing of the program can also be enhanced. According to the literature, programs that directly solicit a specific population have higher participation rates than programs that rely on responses through indirect
advertisement (Winnett, Love, & Kidd, 1982; Mcmakin, 2002). Word-of-mouth marketing has also shown effective results in similar programs (Stern et al., 1986). Although the SGVCOG uses word-of-mouth marketing strategies like the new “refer-a-friend” program, they do not yet utilize direct soliciting in program marketing. One example of direct solicitation marketing is to mail out personalized invitations to residents to see if they will participate in the EASY program. This example of direct solicitation is not only respectful of a resident’s time and privacy, but it can also be easily completed using the Directmail address list. One additional effective word-of-mouth marketing tactic not yet utilized is to include positive comments participants have said about the EASY program in city newsletters or bill inserts. These comments will be seen by others and possibly spark their interest to sign up for the program.

Study results show that the current marketing materials used by the SGVCOG for EASY are tailored towards people with financial motivations to conserve energy. However, people with environmental motivations have been shown to be more likely to implement energy-saving behaviors than those with financial motivations (Aravena et al., 2016; Nordlund & Garvil, 2002; Palmer et al., 2013). Therefore, it would be beneficial to create more marketing materials that are geared towards attracting people with these environmental motivations to conserve. This could potentially be done by providing environmental statistics on the relationship between energy consumption and pollution in the SGV, or the relationship between energy consumption and greenhouse gas emissions in the marketing materials. However, it is important to note that the environmental information chosen to be included in these newer marketing materials is appropriate for the SGV residents. For example, some cities in the SGV are more conservative than
others and they may not respond well to marketing materials that refer to greenhouse gas emissions and climate change. These cities are better marketed through information about energy consumption and air quality. Ultimately, marketing materials tailored to residents with environmental motivations to conserve could lead to an increase in participant energy-saving behaviors. However, it is important to ensure that the information is mindful of the specific characteristics of SGV residents.

Finally, the current marketing materials can include more detailed information on the program to more accurately represent the assessment. In one of the studies mentioned in the literature review, the marketing of a program led participants to believe that their assessment would be more technical than it was. This led them to believe that the energy-saving recommendations they were given were not credible (McDougall, Claxton, & Ritchie, 1982). Past comments of EASY participants (collected by the SGVCOG) have revealed that some participants expected the assessment to be more technical. This belief could ensue doubt in the recommendations given, and in turn affect the number of recommendations participants complete. This doubt can also keep participants from recommending the program to other SGV residents. To avoid these misunderstandings, the marketing materials can show interested residents more detail into what the assessment entails.

**Opportunity for Future Research**

In conclusion, this study determines whether the EASY program is effective at increasing the energy-saving behaviors of its participants through educational home audits, and how to further increase effectiveness. Through a survey sent to both
participants and non-participants of EASY, results revealed that although there is statistical significance that the EASY program is effective at increasing the energy-saving purchasing behaviors of program participants, there is not the same evidence for the energy-saving curtailment behaviors of participants. This suggests there are opportunities to enhance the organization and marketing of the program. Literary analysis and study results show that including both goal-setting intervention strategies at the end of the assessment and feedback intervention strategies months after the assessment will further improve the effectiveness of the program. Additionally, utilizing the “in-home-doctor approach”, and mentioning the disincentives to using energy throughout the assessment has also shown to improve program effectiveness. Additional training on these recommendations will guarantee optimal implementation of the program. Additionally, the current marketing strategies could be enhanced by utilizing more word-of-mouth strategies, and marketing more towards people who feel morally obligated to protecting the environment. Although EASY has helped in increasing SGV resident’s energy-saving behaviors, these improvements to the organization and marketing of the program can further increase program participation.

Future research can reinforce the findings of this study and help properly understand what makes a home energy assessment program effective. In order to create a more accurate and detailed version of this study, a similar, more qualitative study can be conducted. This study will interview EASY participants and non-participants to determine and compare their knowledge of energy-saving tactics (purchasing and/or curtailment), motivations and encouragements to save energy, and burdens they face that limit their ability to save energy. During these interviews, EASY participants can also be
asked how satisfied they are with the program, improvements they would like to see in the program, and what types of added incentives or rebates they would like to be given. This information could greatly add to the findings of this study by either reinforcing the findings with greater detail, or shedding light on unaddressed opinions or issues.

Additional studies can be similarly conducted in other parts of Southern California (or other regions with similar home energy audit programs) to strengthen the findings on the topic, and help better determine what makes an energy conservation program effective. Another beneficial study could be one that tries to discover how much the rebound effect is acting on participants of EASY (or other similar energy programs). Lastly, past EASY participants could be interviewed to discover how they heard about the program, and what interested them in the program. This could reveal possible areas for marketing improvements. In time, more studies dedicated to determining the best way to change negative environmental behaviors to pro-environmental behaviors can create better energy programs that effectively make the earth and its ecosystems healthier and more resilient to any arising future threat.
REFERENCES


APPENDIX A: The 29 Cities of the SGVCOG

1) Alhambra
2) Arcadia
3) Baldwin Park
4) Bradbury
5) Claremont
6) Covina
7) Diamond Bar
8) Duarte
9) El Monte
10) Glendora
11) Irwindale
12) City of Industry
13) La Canada Flintridge
14) La Verne
15) La Puente
16) Monrovia
17) Montebello
18) Monterey Park
19) Pomona
20) Rosemead
21) San Dimas
22) San Gabriel
23) San Marino
24) Sierra Madre
25) South El Monte
26) South Pasadena
27) Temple City
28) Walnut
29) West Covina
### Building Materials

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<tr>
<th>Done!</th>
<th>Recommended</th>
<th>Not Applicable</th>
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<tbody>
<tr>
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<tr>
<td></td>
<td><strong>Install weather stripping on windows and doors.</strong></td>
<td><img src="check" alt="" /></td>
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<tr>
<td></td>
<td><strong>Caulk and seal gaps/leaks around outlets, piping, and wall/floor seams.</strong></td>
<td><img src="check" alt="" /></td>
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<td></td>
<td><strong>Conduct a whole-house audit using a certified contractor.</strong></td>
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<td></td>
<td><strong>Install energy-efficient windows.</strong></td>
<td><img src="check" alt="" /> <img src="check" alt="" /> <img src="check" alt="" /></td>
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<tr>
<td></td>
<td><strong>Install additional roof or wall insulation.</strong></td>
<td><img src="check" alt="" /> <img src="check" alt="" /> <img src="check" alt="" /> <img src="check" alt="" /></td>
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### Heating and Cooling

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<th>Done!</th>
<th>Recommended</th>
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<tbody>
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<tr>
<td></td>
<td><strong>In unused rooms turn off window air conditioners, and close doors.</strong></td>
<td><img src="check" alt="" /></td>
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<tr>
<td></td>
<td><strong>Install a programmable thermostat.</strong></td>
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</table>
Install window film, solar shades (indoor or outdoor), patio covers, awnings or plant trees/shrubs to reduce glare and heat gain.

Upgrade HVAC to an Energy Star rated system.

Lighting

- Upgrade light bulbs with energy-efficient alternatives (i.e. CFLs or LED).
- Install occupancy sensors.

Kitchen Appliances

- Regularly clean the condenser coils on refrigerator.
- Adjust refrigerator temperature to 37-40 degrees and freezer temperature to 5 degrees.
- Replace gasket on refrigerator to ensure a tight seal.
- Upgrade appliances to Energy Star rated models.
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<tr>
<th>Done!</th>
<th>Recommended</th>
<th>Not Applicable</th>
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<tbody>
<tr>
<td>Laundry Appliances</td>
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<tr>
<td>“Launder Smart” (e.g. do not overfill washer or dryer, use cold water/energy-savings settings, air dry clothes).</td>
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<tr>
<td>Upgrade appliances to Energy Star rated models.</td>
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<tr>
<td>Home &amp; Office Electronics</td>
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<tr>
<td>Install smart power strips or unplug electronics that are not in use.</td>
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<td></td>
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<tr>
<td>Reduce computer monitor brightness.</td>
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<tr>
<td>Upgrade plasma television to Energy Star rated model (LED or LCD).</td>
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<tr>
<td>Indoor Water Usage</td>
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<tr>
<td>Task</td>
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<tr>
<td>Install faucet aerators.</td>
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<tr>
<td>Install thermostatic control valves and low-flow showerheads.</td>
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<tr>
<td>Lower water heater temperature to 120 degrees F.</td>
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<tr>
<td>Repair leaky sinks and toilets.</td>
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<tr>
<td>Install high-efficiency toilets.</td>
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<tr>
<td>Upgrade water heater to an Energy Star rated model (may include tankless water heater).</td>
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### Outdoor Water Usage

<table>
<thead>
<tr>
<th>Task</th>
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<tbody>
<tr>
<td>Adjust sprinklers to water plants, not driveway, and water early in the morning.</td>
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<tr>
<td>Install a “smart” controller system for irrigation</td>
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<tr>
<td>Install a drip-irrigation system</td>
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<tr>
<td>Install rain gutters to aid in capturing storm water.</td>
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<tr>
<td>Install a rain cistern to capture and reuse storm water.</td>
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<tr>
<td>Create a rain garden to soak up any water that hits the landscape.</td>
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<tr>
<td>Plant drought-resistant, native trees and plants.</td>
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<tr>
<td>Priority Recommendations</td>
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<td>---------------------------</td>
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<tr>
<td><strong>Near-term Actions:</strong></td>
</tr>
<tr>
<td>1. Add 3-6 inches of mulch to your garden.</td>
</tr>
<tr>
<td>2. Regularly clean pool drains and intake grates.</td>
</tr>
<tr>
<td>3. Install a pool cover to reduce evaporation.</td>
</tr>
<tr>
<td>Set timer to turn off pool pump from 2 PM to 6 PM.</td>
</tr>
<tr>
<td>Install an Energy Star rated pool pump with a variable speed drive.</td>
</tr>
<tr>
<td><strong>Mid-term and Long-term Actions:</strong></td>
</tr>
<tr>
<td>1.</td>
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<td>3.</td>
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</tbody>
</table>
APPENDIX C: EASY Participant Recruitment Letter

Dear EASY Participant,

My name is Kelsey Zurcher, and I am a Graduate Intern at the San Gabriel Valley Council of Governments (SGVCOG), and a student at California Polytechnic University of Pomona (CPP). I am conducting a research study through CPP with my advisor Dr. Kyle Brown entitled: “An Evaluation of the EASY Program: The Effectiveness of Tailored Home Audits on Changing Energy Consumption Behaviors”, and partnering with SGVCOG.

You were chosen to participate in this study because you had your home audited on insert date here through the SGVCOG Energy Assessment Screening for Your home (EASY) program. One purpose of this study is to discover if there is a difference in energy-saving behaviors between people who have undergone an educational home energy audit such as the EASY audit, and people who have not. This study is also seeking out to discover the relationship between a variety of demographic, economic, and motivational factors to each other and to energy-saving behaviors.

If this study is published, no personal information from you will be revealed. This information is confidential, and the answers to the questions will in no way be able to be traced back to you in this study. In a couple of days, a short questionnaire is going to arrive at your home. Your participation in filling out the questionnaire will be appreciated. If you choose to participate in this study, and fill out the questionnaire then there will be an addressed envelope provided for you to send the questionnaire along with the signed informed consent form to the SGVCOG.

One benefit of participating in this study is that you will be placed in a drawing to win a 3rd Generation Nest Learning Thermostat. Two other benefits are that you will be helping environmental program implementers create more effective energy conservation programs, and helping scholars to better understand how to change energy consumption behaviors.

If you have any questions or concerns regarding this study, then feel free to email me at Principal Investigator’s email or call me at (XXX) XXX-XXXX.

Best Regards,
Kelsey Zurcher
APPENDIX D: EASY Participant Recruitment Letter (Spanish)

Estimado __________,

Mi nombre es Kelsey Zurcher, y soy un estudiante de maestría en la universidad “California Polytechnic University of Pomona” (CPP) en “Science in Regenerative Studies” (Ciencia en Estudios Regenerativos), y estoy haciendo una pasantía en el “San Gabriel Valley Council of Governments” (SGVCOG). Estoy llevando a cabo un estudio de investigación titulado: "Una Evaluación del Programa EASY: La Efectividad de las Assessorías de Hogar Adaptadas sobre el Cambio de Comportamiento de Consumo de Energía" a través de CPP y con la ayuda de SGVCOG. La Junta de Revisión Institucional de Cal Poly Pomona ha revisado y aprobado para hacer esta investigación con humanos bajo el número de protocolo IRB-17-12.

Usted fue escogido para participar en este estudio porque su hogar tuvo una asessoria en ________ y fue llevado a cabo por el programa de SGVCOG EASY. Uno de los propósitos de este estudio es el de descubrir si hay una diferencia en los comportamientos de ahorro de energía entre las personas que han sido sometidas a una asessoría energética del hogar participante, y las personas que no lo han hecho. Este estudio también está tratando de descubrir la relación entre una variedad de factores demográficos, económicos y motivacionales y a los comportamientos de ahorro de energía.

En un par de días, un breve cuestionario llegara a su casa, por favor llénelo porque su participación será vital para los buenos resultados de este estudio y le quedaremos eternamente agradecidos. Si se llegara a publicar este estudio, toda la información presentada por usted se mantendría confidencial. Si decide participar en este estudio, por favor envié el cuestionario y el Certificado de Consentimiento firmado en un sobre dirigido proporcionado para usted.

Uno de los beneficios de participar en este estudio es que usted podrá participar en un sorteo para recibir una ‘3rd Generation Nest Learning Thermostat’. Otro beneficio es que usted contribuirá a crear programas de conservación de energía más eficaces y ayudara a que los estudios sean más útiles para convencer al usuario de cambiar las costumbres de uso de energía.

Si tiene alguna pregunta o inquietud con respecto a este estudio, no dude en enviarnos un correo electrónico a ________ o llamar al __________.

Atentamente,

Kelsey Zurcher
APPENDIX E: EASY Non-Participant Recruitment Letter

Dear EASY Non-Participant,

My name is Kelsey Zurcher, and I am a student at California Polytechnic University of Pomona (CPP) working towards a Master of Science in Regenerative Studies degree, and a Graduate Intern at the San Gabriel Council of Governments (SGVCOG). I am conducting a research study entitled: “An Evaluation of the EASY Program: The Effectiveness of Tailored Home Audits on Changing Energy Consumption Behaviors” through CPP with my advisor Dr. Kyle Brown, and with the help of SGVCOG. The Energy Assessment Screening for Your home (EASY) program is a home energy audit that focuses on trying to change the energy-saving behavior of its participants located in the San Gabriel Valley. The Cal Poly Pomona Institutional Review Board has reviewed and approved for conduct this research involving human subjects under protocol number IRB-17-12.

One purpose of this study is to discover if there is a difference in energy-saving behaviors between people who have undergone an educational home energy audit, and people who have not. This study is also seeking out to discover the relationship between a variety of demographic, economic, and motivational factors to each other and to energy-saving behaviors.

In a couple of days, a short questionnaire is going to arrive to your home. Your participation in filling out the questionnaire will be appreciated. If this study is published, no personal information from you will be revealed. This information is confidential, and the answers to the questions will in no way be able to be traced back to you in this study. If you choose to participate in this study, and fill out the questionnaire provided in the next letter we send you, then there will be an addressed envelope provided for you to send the questionnaire and the informed consent form back to the SGVCOG.

One benefit of participating in this study is that you will be placed in a drawing to win a 3rd Generation Nest Learning Thermostat. Two other benefits are that you will be helping environmental program implementers create more effective energy conservation programs, and helping scholars to better understand how to change energy consumption behaviors.

If you have any questions or concerns regarding this study, then feel free to email me at Principal Investigator’s Email or to call me at (XXX) XXX-XXXX.

Best Regards,

Kelsey Zurcher
APPENDIX F: EASY Non-Participant Recruitment Letter (Spanish)

Estimado __________,

Mi nombre es Kelsey Zurcher, y soy un estudiante de maestría en la universidad “California Polytechnic University of Pomona” (CPP) en “Science in Regenerative Studies” (Ciencia en Estudios Regenerativos), y estoy haciendo una pasantía en el “San Gabriel Valley Council of Governments” (SGVCOG). Estoy llevando a cabo un estudio de investigación titulado: "Una Evaluación del Programa EASY: La Efectividad de las Assessorias de Hogar Adaptadas sobre el Cambio de Comportamiento de Consumo de Energía" a través de CPP y con la ayuda de SGVCOG. El programa de Evaluación de Energía para Su Hogar (EASY) es una assessoria de energía en el hogar que se enfoca en tratar de cambiar el comportamiento de ahorro de energía de sus participantes ubicados en el Valle de San Gabriel. La Junta de Revisión Institucional de Cal Poly Pomona ha revisado y aprobado para hacer esta investigación con humanos bajo el número de protocolo IRB-17-12.

Uno de los propósitos de este estudio es el de descubrir si hay una diferencia en los comportamientos de ahorro de energía entre las personas que han sido sometidas a una assessoría energética del hogar participante y las personas que no lo han hecho. Este estudio también está tratando de descubrir la relación entre una variedad de factores demográficos, económicos y motivacionales y a los comportamientos de ahorro de energía.

En un par de días, un breve cuestionario llegara a su casa, por favor llénelo porque su participación será vital para los buenos resultados de este estudio y le quedaremos eternamente agradecidos. Si se llegara a publicar este estudio, toda la información presentada por usted se mantendría confidencial. Si decide participar en este estudio, por favor envié el cuestionario y el Certificado de Consentimiento firmado en un sobre dirigido proporcionado para usted.

Uno de los beneficios de participar en este estudio es que usted podrá participar en un sorteo para recibir una ‘3rd Generation Nest Learning Thermostat’. Otro beneficio es que usted contribuirá a crear programas de conservación de energía más eficaces y ayudara a que los estudios sean más útiles para convencer al usuario de cambiar las costumbres de uso de energía.

Si tiene alguna pregunta o inquietud con respecto a este estudio, no dude en enviarnos un correo electrónico a __________ o llamar al __________.

Atentamente,

Kelsey Zurcher
APPENDIX G: Informed Consent Form

“An Evaluation of the EASY Program: The Effectiveness of Tailored Home Audits on Changing Energy Consumption Behaviors”

Primary Investigator: Kelsey Zurcher
Faculty Advisor: Kyle Brown
IRB protocol # IRB-17-12

You are being asked to be a part of this research study, which the Cal Poly Pomona Institutional Review Board (IRB) has looked at and approved for Kelsey Zurcher to do with the help of Kyle Brown (her teacher). This form provides information about this study. You are allowed an Experimental Research Subject’s Bill of Rights and a copy of this form. If you have any questions about your rights as a participant, complaints about the informed consent process of this research study, or experience a bad event, call the Research Compliance Office within Cal Poly Pomona’s Office of Research at 909.869.4215. More information is on the IRB website, http://www.cpp.edu/~research/irb/getting-started-with-a-protocol/index.shtml

Voluntary Status
This form describes this study, and the risks and benefits of being in this study. If you want to be part of it, you will be asked to do the things below. You do not need to take part in it if you do not want to. You may pull out any time if you want.

Purpose
Kelsey Zurcher is doing this study through California Polytechnic University Pomona with the help of her teacher, Dr. Kyle Brown. She is also being helped by the San Gabriel Valley Council of Governments (SGVCOG). SGVCOG made the Energy Assessment Screening for Your home (EASY) program. This program is paid for by the utility companies. The EASY program is a free home energy audit program for the people in the San Gabriel Valley. The purpose of this study is to see if the EASY program is helping people to save energy.

Tasks and Promises
You are being asked to fill out the survey, to sign this form, and to mail these forms back with the envelope you are given. The survey will ask you questions about yourself, and about your energy behaviors.

Reward
After you mail back the survey and this signed form, you will be put into a random drawing to win a 3rd Generation Nest Thermostat. There will only be one winner. Kelsey will send the winner the prize in the mail.

Risks and Benefits
The main risk of this study is the time it will take to do the tasks written above. If you do not want to be part of the study, you can pull out of it whenever. This study may teach you more about saving energy in your home, and about the EASY program that is available to you. This study will also find out more about the connection between energy usage and how humans act. The outcome will be used so that the SGVCOG can better help the San Gabriel Valley.

Privacy
The people doing this study will not reveal the information that is taken from you. Your name and address is private, and will not be shared unless you allow
it or as required by law. Once the project is done, your survey will be destroyed. Note that the summarized findings will be shown twice through a presentation.

**Study Investigators**
If you have any questions about the research, please contact the:
*Principal Investigator, Kelsey Zurcher*
Phone: (XXX) XXX-XXXX Email:
*Faculty Advisor, Kyle Brown*
Phone: (XXX) XXX-XXXX Email:

Sign below to show that:
1) You understand the study and have no other questions.
2) You agree to take part in this study.
3) You understand that you can pull out of this study at any time you want.
4) You are 18 years or older and have been given a copy of this for

---

Printed name of participant

______________________________
Signature

______________________________
Date

______________________________
Signature of primary investigator

______________________________
Date
APPENDIX H: Informed Consent Form (Spanish)

Certificado de Consentimiento - Autorización para participar en estudio
"Evaluación del Programa EASY: La Efectividad de las Assessorías de Hogares para Cambiar los Comportamientos de Consumo de Energía"

Investigador principal: Kelsey Zurcher
Asesor del Investigador: Kyle Brown
IRB protocolo # IRB-17-12


Participación Voluntaria
Este formulario explica el estudio, los posibles riesgos y beneficios y como participar en él. Si decide participar, se le pedirá que haga las siguientes cosas. No tienes que participar si no quieres. Usted puede retirarse cuando quiera, sin problema.

Propósito del Estudio
Este estudio se está llevando a cabo por la estudiante de postgrado Kelsey Zurcher y con la ayuda de su profesor, Dr. Kyle Brown. Kelsey también tiene ayuda de Consejo de Gobiernos del Valle de San Gabriel (SGVCOG). Ellos hicieron el ‘Energy Assessment Screening for Your home’ (EASY) programa. Este programa está financiado por Southern California Gas Company y Southern California Edison. EASY es un programa gratuito de evaluación de la energía para los residentes en la región del Valle de San Gabriel. El propósito de este estudio es averiguar si el programa EASY ayuda los residentes a ahorrar energía.

Procedimientos y Compromiso
Se le pide que responda todas las preguntas del cuestionario, que firme este formulario y que lo envié por correo con el sobre previsto. El cuestionario te pregunta de si mismo y cómo usas energía en tu casa.

Compensación
Después de enviar el cuestionario y el formulario, tendrá la oportunidad de ganar un ‘3rd Generation Nest Learning Thermostat’. Sólo habrá un ganador. Kelsey va a mandar al ganador el premio por correo.

Posibles Riesgos y Beneficios
El único riesgo de hacer este estudio es la inconveniencia de gastar su tiempo para llenar el formulario. Puedes retirarse del estudio cuando quieras, sin problema. Este estudio puede ensenarle cómo ahorrar energía en su casa y sobre el programa EASY que está disponible para usted. Este estudio también dará importante información sobre como humanos usan energía en su casa. Los resultados ayudaran a mejorar los servicios de SGVCOG.
**Confidencialidad**
Las personas que están haciendo este estudio no revelarán su información personal. Tu nombre y dirección son privados y solo será revelada con su permiso o según lo requiera la ley. Cuando el estudio sea concluido, su encuesta será destruida. Tenga en cuenta que el resultado se muestra dos veces a través de una presentación.

**Datos de los Investigadores**
Si tiene alguna pregunta sobre la investigación, por favor comuníquese con:

*Investigadora principal, Kelsey Zurcher*
Teléfono: (XXX) XXX-XXXX
Email:

*Asesor y profesor, Kyle Brown*
Teléfono: (XXX) XXX-XXXX
Email:

**Certificado de Consentimiento**
Al firmar este documento usted:

1. Entiendes el estudio y que no tiene ninguna otra pregunta.
2. Quieres participar en el estudio
3. Entiendes que puedes retirarse del estudio cuando quieres, sin problema.
4. Tienes más de 18 años de edad y que se le ha entregado una copia de este documento.

________________________________
Nombre del participante

________________________________
Firma

________________________________
Fecha
APPENDIX I: EASY Participant Survey

Energy Efficiency Survey
Check the boxes of all that applies to you in this survey. When you are finished, there is an addressed and stamped envelope provided for you to send this survey in to the SGVCOG by May 1st. Once we receive your survey in the mail, you will be entered into a random drawing to receive a 3rd Generation Nest Learning Thermostat. Thank you for your participation.

<table>
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<tr>
<th>How old are you?</th>
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<tr>
<td>☐ 18 – 24 years</td>
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<td>☐ 25 – 34 years</td>
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<th>What is your gender?</th>
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<th>What is your ethnicity?</th>
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<td>☐ Hispanic or Latino</td>
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<td>☐ Black or African American</td>
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<td>☐ Native American or American Indian</td>
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<td>☐ Asian / Pacific Islander</td>
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<td>☐ Other</td>
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# Energy Usage Behaviors / Motivations

With these next two questions, refer to the “Home Energy Recommendations” paper attached to this survey.

Have you completed any of your written recommendations?
- [ ] Yes
- [x] No

If you answered yes, what types of recommended actions did you complete?
- [ ] Near-term recommendations
- [ ] Long-term recommendations
- [ ] Both

In the last **two years**, did you make any energy-saving changes to any of following areas of your home?

**(check all that apply and check none if you have not participated in any energy-saving changes)**

- [ ] **Building Materials** – Reinsulated your walls or attic, installed energy-efficient windows, sealed gaps in the walls or doors
- [ ] **Heating and Cooling** – Upgraded Air Conditioning, thermostats, or water heaters
- [ ] **Lighting** – Switched to CFL or LED Light bulbs, Installed light sensors
- [ ] **Electronics** – Purchased an energy-efficient TV or computer, and purchased smart power strips
- [ ] **Kitchen Appliances** – Upgraded refrigerator, freezer, stove, dishwasher, and small kitchen appliances
- [ ] **Laundry Appliances** – Upgraded washing machine or clothes dryer
- [ ] **Other** ___________

In the last **two years**, have you made any shifts in behavior in the following areas of your home?

**(check all that apply)**

- [ ] **Heating and Cooling** – Utilizing fans and blankets instead of the air conditioner or heater, lower the water heater temperature
- [ ] **Lighting** – Turn off lights in unoccupied rooms
- [ ] **Kitchen** – Raised the fridge or freezer temperature, clean the coils in the back of the fridge
- [ ] **Electronics** – Lower the TV, computer, or phone screen brightness. Unplug electronics after use
- [ ] **Laundry Appliances** – wash clothes with cold water more frequently
☐ My household’s behaviors have remained the same

What would encourage you to make any of the changes listed in previous two questions? (check all that apply)

☐ More information on the financial savings it will bring
☐ Grants or incentive programs to offset costs
☐ Low-interest loans
☐ Lower utility bills
☐ Other: ____________

What was the **first** & **second** most important motivation to make these energy-saving changes to your home?

(1 – first most important / 2 – second most important)

☐ Environmental – Ethical motivation to help the environment
☐ Financial – Economic motivation to save money
☐ Comfort – Motivation to increase the comfort of your home
☐ No Answer
☐ Other: ____________

---

Size: what is the size of your household?

☐ 1 person
☐ 2 people
☐ 3-4 people
☐ 5-6 people
☐ 7 or more people

Income: what is your total yearly household income?

☐ Less than $30,000
☐ $30,001 – $50,000
☐ $50,001 – $70,000
☐ $70,001 – $90,000
☐ $90,001 – $110,000
☐ $110,001 – 130,000
☐ $130,001 or more
Home Energy Recommendations

**Near-Term Recommendations**
- Clean refrigerator condenser coils
- Adjust fridge temperature
- Launder Smart with cold water
- Reduce Computer Brightness
- Install Faucet Aerators
- Lower Water Heater temperature
- Repair leaky sinks and toilets
- Set timer to turn off pool pump
- Clean pool drains and intake grates

**Long-Term Recommendations**
- Install weather stripping
- Caulk and seal
- Window Film
- Upgrade Lightbulbs
- Replace Fridge gasket
- Have a contractor conduct a whole house audit
- Install Energy-efficient Windows
- Install Insulation
- Install Programmable Thermostat
- Plant Trees
- Upgrade HVAC
- Upgrade fridge to Energy Star
- Upgrade Laundry Appliances to Energy Star
- Install low flow toilet
- Install/utilize smart power strips
- Upgrade TV to Energy Star
- Install low flow shower head
- Upgrade water heater to Energy Star
- Plant drought resistant plants
- Install a pool cover
- Install a drip irrigation system
- Install a smart controller for irrigation
- Install an energy star pool pump
APPENDIX J: EASY Participant Survey (Spanish)

Encuesta de Eficiencia Energética
Este estudio esta conducido a través de California State Polytechnic University Pomona. Por favor marque las casillas que le correspondan en esta encuesta. Las respuestas a esta encuesta se mantendrán confidencial. Cuando haya terminado, hay un sobre estampado para enviar esta encuesta y el Certificado de Consentimiento firmado al SGVCOG del 5 de Abril. Cuando recibimos los dos formularios por correo, se le ingresará en un sorteo para recibir una ‘3rd Generation Nest Learning Thermostat’. Le agradecemos su participación.

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<td>□ Asia / Islas del Pacífico</td>
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<td>□ Otros</td>
</tr>
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Con estas dos preguntas siguientes, refiérase al documento "Recomendaciones de Energía para el Hogar" adjunto a esta encuesta.

¿Ha completado alguna de sus recomendaciones por escrito?
☐ Si
☐ No
Si respondió que sí, ¿qué tipos de acciones recomendadas completó?
☐ Recomendaciones a corto plazo
☐ Recomendaciones a largo plazo
☐ Ambos

En los últimos dos años, ¿hizo algún cambio en el ahorro de energía en cualquiera de las siguientes áreas de su hogar?

(Marque todas las opciones que correspondan y no marque ninguna si no ha participado en ningún cambio de ahorro de energía)

☐ Materiales de Construcción - Reasumió sus paredes o áticos, instaló ventanas eficientes en energía, selló huecos en las paredes o puertas
☐ Calefacción y refrigeración - aire acondicionado, termostatos o calentadores de agua mejorados
☐ Iluminación - Cambiado a CFL o LED Bombillas, Sensores de luz instalados
☐ Electrónica - Compró un televisor o una computadora eficiente en energía y adquirió tiras de alimentación inteligentes
☐ Electrodomésticos de cocina - Refrigerador, congelador, estufa, lavavajillas y pequeños electrodomésticos de cocina
☐ Electrodomésticos de lavandería - Lavadora o secadora acondicionada
☐ Otros ___________

En los últimos dos años, ¿ha cambiado su comportamiento en las siguientes áreas de su hogar?

(Marque todo lo que corresponda)
☐ Calefacción y enfriamiento - Utilizando ventiladores y mantas en lugar del aire acondicionado o del calentador, baje la temperatura del calentador de agua
☐ Iluminación - Apagar luces en habitaciones desocupadas
☐ Cocina - Actualizo el refrigerador o el congelador, limpia las bobinas en la parte posterior del refrigerador
Electrónica - Baje el brillo de la pantalla del televisor, del ordenador o del teléfono. Desenchufe los aparatos electrónicos después del uso.

Electrodomésticos de lavandería - lave la ropa con agua fría con más frecuencia.

Los comportamientos de mi hogar han permanecido iguales.

¿Qué le estimularía para realizar cualquiera de los cambios que se enumeran en la pregunta anterior? (Marque todo lo que corresponda)

☐ Más información sobre los ahorros financieros que traerá
☐ Programas de incentivos para compensar los costos
☐ Préstamos a bajo interés
☐ Reducción en los costos de servicios públicos
☐ Otros: __________

¿Cuál fue la primeira y segunda motivación más importante para hacer estos cambios de ahorro de energía en su hogar?

(1 - el primero más importante / 2 - segundo más importante)

☐ Medioambiental - Motivación ética para ayudar al medio ambiente
☐ Financiero - Motivación económica para ahorrar dinero
☐ Confort - Motivación para aumentar la comodidad de su hogar
☐ Sin respuesta
☐ Otro: __________

Tamaño: ¿cuál es el tamaño de su hogar?

☐ 1 persona
☐ 2 personas
☐ 3-4 personas
☐ 5-6 personas
☐ 7 o más personas

Ingresos: ¿cuál es el ingreso anual total de su hogar?

☐ Menos de $30,000
☐ $30,001 – $50,000
☐ $50,001 – $70,000
☐ $70,001 – $90,000
☐ $90,001 – $110,000
☐ $110,001 – 130,000
☐ $130,001 o más
☐ $130,0001 o más

90
Recomendaciones de Energía en el Hogar

**Recomendaciones a Plazo Medio**
- Instalar el desmontaje
- Calafatear y sellar
- Película de la ventana
- Mejora las bombillas
- Limpie las bobinas del condensador del refrigerador
- Ajuste la temperatura del refrigerador
- Reemplace la junta del refrigerador
- Launder Smart con agua fría
- Instalar / utilizar tiras de alimentación inteligentes
- Reduce el brillo de la computadora
- Instale los aireadores del grifo
- Instale el cabezal de ducha de flujo bajo
- Baje la temperatura del calentador de agua
- Reparar los fregaderos y los inodoros
- Ajuste el temporizador para apagar la bomba de la piscina
- Limpie los desagües de la piscina y las rejillas de admisión

**Recomendaciones a Largo Plazo**
- Pida a un contratista que realice una asesoría de toda la casa
- Instalar Windows eficiente en energía
- Instale el aislamiento
- Instale el termostato programable
- Plantar árboles
- Actualizar HVAC
- Actualice el refrigerador a Energy Star
- Mejore los electrodomésticos de lavandería a Energy Star
- Instale un baño de flujo bajo
- Actualizar TV a Energy Star
- Actualice el calentador de agua a Energy Star
- Plantas resistentes a la sequía
- Instalar una cubierta de piscina
- Instalar un sistema de riego por goteo
- Instalar un controlador inteligente para riego
- Instale una bomba de piscina de estrella de energía
APPENDIX K: Non-participant Survey

Energy Efficiency Survey

This study is conducted through California State Polytechnic University Pomona. Please check the boxes of all that applies to you in this survey. Your answers to these questions will remain confidential. When you are finished, give this survey and the signed informed consent form to the SGVCOG. Once we receive both forms, you will be entered into a random drawing to receive a 3rd generation Nest Learning Thermostat. Thank you for your participation.

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How old are you?
- 18 – 24 years
- 25 – 34 years
- 35 – 44 years
- 45 – 54 years
- 55 – 64 years
- Age 65 or older

What is your gender?
- Female
- Male
- Other

What is your ethnicity?
- Hispanic or Latino
- Black or African American
- White
- Native American or American Indian
- Asian / Pacific Islander
- Other
### Energy Usage Behaviors / Motivations

In the last two years, did you make any energy-saving changes to any of the following areas of your home?

(check all that apply and check none if you have not participated in any energy-saving changes)

- **Building Materials** – Reinsulated your walls or attic, installed energy-efficient windows, sealed gaps in the walls or doors
- **Heating and Cooling** – Upgraded Air Conditioning, thermostats, or water heaters
- **Lighting** – Switched to CFL or LED Light bulbs, Installed light sensors
- **Electronics** – Purchased an energy-efficient TV or computer, and purchased smart power strips
- **Kitchen Appliances** – Upgraded refrigerator, freezer, stove, dishwasher, and small kitchen appliances
- **Laundry Appliances** – Upgraded washing machine or clothes dryer
- **Other** ____________

In the last two years, have you made any shifts in behavior in the following areas of your home?

(check all that apply)

- **Heating and Cooling** – Utilizing fans and blankets instead of the air conditioner or heater, lower the water heater temperature
- **Lighting** – Turn off lights in unoccupied rooms
- **Kitchen** – Raised the fridge or freezer temperature, clean the coils in the back of the fridge
- **Electronics** – Lower the TV, computer, or phone screen brightness. Unplug electronics after use
- **Laundry Appliances** – Wash clothes with cold water more frequently
- **My household’s behaviors have remained the same**

What would encourage you to make any of the changes listed in the two previous questions?

(check all that apply)

- More information on the financial savings it will bring
- Grants or incentive programs to offset costs
- Low-interest loans
- Lower utility bills
- Other: ____________
What was the first & second most important motivation to make these energy-saving changes to your home?

(1 – first most important / 2 – second most important)

___ Environmental – Ethical motivation to help the environment
___ Financial – Economic motivation to save money
___ Comfort – Motivation to increase the comfort of your home
___ No Answer
___ Other: __________

Size: what is the size of your household?

☐ 1 person
☐ 2 people
☐ 3-4 people
☐ 5-6 people
☐ 7 or more people

Income: what is your total yearly household income?

☐ Less than $30,000
☐ $30,001 – $50,000
☐ $50,001 – $70,000
☐ $70,001 – $90,000
☐ $90,001 – $110,000
☐ $110,001 – 130,000
☐ $130,001 or more
Encuesta de Eficiencia Energética

Este estudio está conducido a través de California State Polytechnic University Pomona. Por favor marque las casillas que le correspondan en esta encuesta. Las respuestas a esta encuesta se mantendrán confidenciales. Cuando haya terminado, hay un sobre estampado para enviar esta encuesta y el Certificado de Consentimiento firmado al SGVCOG del 5 de Abril. Cuando recibimos los dos formularios por correo, se le ingresará en un sorteo para recibir una ‘3rd Generation Nest Learning Thermostat’. Le agradecemos su participación.

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**Edad**
- □ 18 – 24 años
- □ 25 – 34 años
- □ 35 – 44 años
- □ 45 – 54 años
- □ 55 – 64 años
- □ 65 años o más

**Sexo**
- □ Femenino
- □ Masculino
- □ Otro

**Raza**
- □ Hispano o Latino
- □ Negro o Afro Americano
- □ Blanco
- □ Indígena Nativo Americano
- □ Asia / Islas del Pacífico
- □ Otros
Comportamientos de uso de energía / Motivaciones

En los últimos dos años, ¿hizo algún cambio en el ahorro de energía en cualquiera de las siguientes áreas de su hogar?

(Marque todas las opciones que correspondan y no marque ninguna si no ha participado en ningún cambio de ahorro de energía)

☐ Materiales de Construcción - Reasumió sus paredes o áticos, instaló ventanas eficientes en energía, selló huecos en las paredes o puertas
☐ Calefacción y refrigeración - aire acondicionado, termostatos o calentadores de agua mejorados
☐ Iluminación - Cambiado a CFL o LED Bombillas, Sensores de luz instalados
☐ Electrónica - Compró un televisor o una computadora eficiente en energía y adquirió tiras de alimentación inteligentes
☐ Electrodomésticos de cocina - Refrigerador, congelador, estufa, lavavajillas y pequeños electrodomésticos de cocina
☐ Electrodomésticos de lavandería - Lavadora o secadora acondicionada
☐ Otros ___________

En los últimos dos años, ¿ha cambiado su comportamiento en las siguientes áreas de su hogar? (Marque todo lo que corresponda)

☐ Calefacción y enfriamiento - Utilizando ventiladores y mantas en lugar del aire acondicionado o del calentador, baje la temperatura del calentador de agua
☐ Iluminación - Apagar luces en habitaciones desocupadas
☐ Cocina - Actualizo el refrigerador o el congelador, limpia las bobinas en la parte posterior del refrigerador
☐ Electrónica - Baje el brillo de la pantalla del televisor, del ordenador o del teléfono. Desenchufe los aparatos electrónicos después del uso
☐ Electrodomésticos de lavandería - lavar la ropa con agua fría con más frecuencia
☐ Los comportamientos de mi hogar han permanecido iguales

¿Qué le estimularía para realizar cualquiera de los cambios que se enumeran en la pregunta anterior? (Marque todo lo que corresponda)

☐ Más información sobre los ahorros financieros que traerá
☐ Programas de incentivos para compensar los costos
☐ Préstamos a bajo interés

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Reducción en los costos de servicios públicos
☐ Otros: ________

¿Cuál fue la primera y segunda motivación más importante para hacer estos cambios de ahorro de energía en su hogar?
(1 - el primero más importante / 2 - segundo más importante)
☐ Medioambiental - Motivación ética para ayudar al medio ambiente
☐ Financiero - Motivación económica para ahorrar dinero
☐ Confort - Motivación para aumentar la comodidad de su hogar
☐ Sin respuesta
☐ Otro: __________

Tamaño: ¿cuál es el tamaño de su hogar?
☐ 1 persona
☐ 2 personas
☐ 3-4 personas
☐ 5-6 personas
☐ 7 o más personas

Ingresos: ¿cuál es el ingreso anual total de su hogar?
☐ Menos de $30,000
☐ $30,001 – $50,000
☐ $50,001 – $70,000
☐ $70,001 – $90,000
☐ $90,001 – $110,000
☐ $110,001 – 130,000
☐ $130,001 o más
APPENDIX M: Mann-Whitney U Calculations

Mann-Whitney U Directions:
1) The number of behavior boxes each person checked were ordered from least to greatest.
2) This list was then ranked from 1 to 77 (the total number of the sample)
3) Then the list was separated between EASY participants, and EASY non-participants since these are the two samples to be compared.
4) Once separated, the sum of the rank columns were calculated. R1 being from the non-participant column, and R2 being from the participant column.
5) Then the number of people in each sample were calculated. N1 for non-participants, and N2 for participants.
6) Then the U statistic was calculated for each using this formula:
   \[ U = N_1 N_2 + \frac{(N_1 (N_1 + 1))}{2} - R_1 \]
7) Next, the Mean=(N1+N2/2) and Standard Deviation=\(\sqrt{\frac{N_1 N_2 (N_1+N_2+1)}{12}}\) were calculated.
8) The above numbers were then plugged into the equation below to calculate the Z score:
   \[ Z = \frac{(U - \text{Mean})}{\text{Standard Deviation}} \]
9) Lastly, the Z score is compared to the Z critical which is +/-1.960 (for a two-tailed t-test with a 95% degree of Certainty), to determine whether there is a significant difference between the two samples.

Purchasing Behavior Calculations:
- R1= 862   N1= 29
- R2= 2141  N2= 48

\[ U = 29 \times 48 + \left[ \frac{(29 \times (29+1))}{2} \right] - 862 = 965 \]
\[ \text{Mean} = 29 \times 48 / 2 = 696 \]
\[ \text{Standard Deviation} = \sqrt{\frac{29 \times 48 \times (29+48+1)}{12}} = 95.12097 \]

\[ Z \text{ score} = \frac{(965-696)}{95.12097} = 2.827977723 \]
Since 2.828 > 1.960 there is a significant difference between the number of purchasing behaviors implemented between participants and non-participants of EASY

Curtailment Behavior Calculations:
- R1= 960   N1= 29
- R2= 2043  N2= 48

\[ U = 29 \times 48 + \left[ \frac{(29 \times (29+1))}{2} \right] - 960 = 867 \]
\[ \text{Mean} = 29 \times 48 / 2 = 696 \]
\[ \text{Standard Deviation} = \sqrt{\frac{29 \times 48 \times (29+48+1)}{12}} = 95.12097 \]

\[ Z \text{ score} = \frac{(965-696)}{95.12097} = 1.797711 \]
Since -1.960 < 1.798 < 1.960 there is not a significant difference between the number of curtailment behaviors implemented between participants and non-participants of EASY.