THESIS TITLE: Normative Social Influence and the Moderating Role of Group Identification: A Field Experiment on Household Electricity Consumption

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Normative Social Influence and the Moderating Role of Group Identification:

A Field Experiment on Household Electricity Consumption

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Abstract

This experiment examined the role of social norms in encouraging conservation behaviors. Participants were 624 households from neighborhoods located in North San Diego County, California. This was a field experiment with participants randomly assigned to one of five conditions: generic normative information, specific normative information, efficient normative information, information-only control, or no-contact control. Prior to the experiment, participants indicated their level of identification with the three different referent groups. The dependent variable was average daily household electricity consumption. Results indicated that participants who received the efficient normative information significantly reduced their household electricity consumption. Participants who received the specific normative information trended towards an increase in consumption. Further analyses showed that the trend was driven by low users who highly identified with their specific referent; these households used significantly more electricity from baseline to intervention. In addition, households identified with the specific referent group significantly more than they did with either a generic or an efficient referent group.

*Keywords:* electricity conservation, social norms, moderation, referent group, identify, smart meter
Normative Social Influence and the Moderating Role of Group Identification: A Field Experiment on Household Electricity Consumption

Each year humans use roughly 135% of the resources that the earth produces (Global Footprint Network, 2011). If humans are to balance their ecological budget, they need to reduce current resource consumption to a level where fewer natural resources are used than are being produced. Many different strategies have been used in an effort to reduce consumption, some successfully, some unsuccessfully. One method that has demonstrated positive results is making environmentally friendly social norms salient in the minds of consumers. While these messages have been effective at getting people to reduce their consumption (Nolan, Schultz, Cialdini, Griskevicius, & Goldstein, 2008; Ferraro & Price, 2011), there is still an environmental imperative to improve current strategies to achieve more conservation. This thesis examined the role of social norms in encouraging conservation behaviors and the moderating role of group identification.

The following section provides background information on current environmental issues, with a particular focus on energy issues and climate change. The second section examines how social norms have been employed to encourage behavior change, and hypotheses are formulated about the moderating effects of referent groups in normative social influence.

Environmental Issues

Each year, humans use more of the earth’s resources than can be replenished in the span of a year. This over consumption has been coined “Earth Overshoot,” and scientists can approximate the exact day each year that the earth’s replenishable resources for that year have been used up. In 2012, Earth Overshoot Day was on August 22\textsuperscript{nd}, which means any consumption after that date was beyond the earth’s capacity. Over time, consumption has
increased. In 2011, Overshoot Day was September 27th, and back in 1992 it was October 21st. Current human consumption of the earth’s resources such as water, land, biomass, energy or materials cannot be sustained (United Nations Environmental Programme, 2012).

Among the many activities that consume resources, electricity consumption stands as a crucial area for change. Electricity consumption is something that most people from industrialized nations engage in every day, and a reduction in energy usage would translate into a substantial reduction in the overconsumption of resources. In terms of global electricity consumption, the United States is second only to China (CIA World Factbook, 2013). U.S. electricity use in 2011 was 13 times greater than it was in 1950 (U.S. Energy Information Administration, 2012). The residential energy sector consumes the most electricity (37%), followed by commercial (34%), and industrial (26%), and a minimal amount (3%) goes to transportation. Specifically in the residential sector, 55% of the electricity used in homes is for appliances and lighting.

![Figure 1: How Electricity is Used in Homes, 2011](chart.png)

There are a number of actions that can reduce a household’s energy footprint. For example, LED light bulbs use 75% less energy than traditional light bulbs. If people in the United States switched to LED light bulbs, by 2027 they could prevent the construction of 40 new power plants (Energy Star, 2012). Because over half of the energy use in households can be directly attributed to objects purchased by the homeowners, buying products that use less energy can reduce the environmental impact of the house. In the United States, nearly half of residential energy use goes to products that are plugged into power outlets (EPA, 2010). Consumers can buy ENERGY STAR appliances and reduce the electricity they are drawing from the grid. These solutions do not only apply to the United States; in the Organization for Economic Cooperation and Development (OECD) countries, 20% of energy produced is for household usage (Steg, 2008). Switching to LED light bulbs and buying energy efficient household appliances are simple changes that can lead to substantial reductions in energy usage. For example, in 2010, energy efficiency was responsible for 63% of reductions in peakload demand, compared to only 37% attributed to load management (U.S. Energy Information Administration, 2012).

Fossil fuels largely dominate electricity production in the United States. In 2011, coal produced 42% of the electricity in the United States, followed by 25% produced by natural gas, 19% by nuclear, 8% by hydroelectric, and 6% from other sources (U.S. Energy Information Administration, 2012). Overconsumption of nonrenewable fossil fuels has consequences for the planet and the climate. Fossil fuels release CO2 and other contaminants into the atmosphere and lessen the quality of the air humans breathe to survive. Across the United States, tens of thousands of people die each year due to poor air quality (NOAA, 2011). Encouraging people to
use less electricity, and therefore less coal, would have a positive impact on air quality and the environment as a whole.

Reducing electricity consumption would help to mitigate the effects of climate change. According to the United States Environmental Protection Agency, (2014a) the average temperature on earth has risen in the past century, and it is projected to rise further over the next century. This rise in global temperature is responsible for alterations in average rainfall, leading to droughts in some areas and floods in others, along with rises in sea level and an increase in the overall acidity of the ocean. The primary driver of the rise in temperatures is human activity, with the majority of effects stemming from the burning of fossil fuels to generate electricity (EPA, 2014b). In order to achieve a reduction in the amount of resources consumed, individuals need to change their behavior (Schultz, 2011).

Generally, information alone is not an effective motivator of behavior change (Schultz, 2002). There are a variety of tools that can be used to prompt behavior change (Tabanico, Schmitt, & Schultz, 2014). According to Ajzen (1991) and the theory of reasoned action, behavior can be changed by understanding how underlying behavioral intentions are formed. To change behavior, social learning theory considers the independent and interacting effects of personal factors and environmental factors (Bandura, 1978). An effective method of changing behavior is to use social norms messages.

Social Norms

Social norms refer to a person’s beliefs about the common and accepted behavior in a specific situation (Kallgren, Reno, & Cialdini, 2000). These beliefs are generally formed through social interaction, although people use a variety of contextual cues to infer social norms. In terms of social norms, there is a further distinction that can be made. As Kallgren, Reno, and
Cialdini, (2000) point out, social norms include descriptive norms and injunctive norms. Descriptive norms refer to what most people in a social group do, or are perceived to do. People acquire knowledge about descriptive norms by gathering information, or by directly observing a situation and seeing how people in it behave. For example, when in a classroom, an outside observer would deduce the descriptive norm that in order to speak one raises their hand to be called upon. The observer would conclude this because the individual sees that whenever people have a comment they raise their hand and wait for the teacher to call on them. Once it is their turn, they are given the time to speak.

If the observer in the classroom wants to determine what behaviors are appropriate, they need to figure out the injunctive norms of the situation. According to Cialdini (2003), injunctive norms refer to approval or disapproval of behaviors by most people in a social group. The observer can infer these norms by watching the behavior of the teacher and other students in the classroom. If people raise their hands, they are called on and politely allowed time to speak. However, if a person talks out of turn, the teacher stops the individual, and that person is given disapproving looks by other students. From this, an observer would conclude people in classrooms approve of people in the situation who raise their hand and wait their turn to speak.

Cialdini et al. (2006) demonstrated that simple normative signs at Arizona’s Petrified Forest National Park influenced the amount of wood that was stolen from trails in the park. Researchers placed signs with different normative messages along trails within the park. They marked pieces of petrified wood and scattered them along the trails. They then went back and counted the remaining marked pieces of wood. They determined that signs utilizing injunctive normative messages that theft of petrified wood was disapproved of were more effective at preventing theft than signs indicating that theft is frequent (descriptive norm).
Cialdini (2003) proposed that normative messages that are aligned will exert the strongest influence on behavior. This alignment consists of ensuring that the descriptive norms, what people typically do, match up with the injunctive norms, what is valued. Cialdini (2003) conducted an analysis of the effectiveness of public service announcements that were intended to increase recycling. The successful ads were the ones that showed viewers that recycling was prevalent (the descriptive norm), and that recycling was widely approved (the injunctive norm). This study demonstrated that effective social norms interventions need to be carefully crafted so that the messages are in alignment.

While the research is clear in showing that normative social influence can be quite powerful, people are often not aware that norms are influencing them. Nolan, Schultz, Cialdini, Griskevicius, and Goldstein (2008) showed that people underdetected the influence of social norms. They conducted two studies to determine the relationship between the importance people place on norms and behavior change. The first study was a large survey of intentions to conserve electricity, reasons to conserve, beliefs about conservation, and descriptive norms. Results indicated that “conserving because other people do it” was the least frequently endorsed reason for conserving, the top three reasons being environmental protection, benefit to society, and saving money. The second study tested this directly. Participants were given door-hangers with information about their electricity consumption. The different conditions in the second study were the reasons for conserving in the first study. While people rated others’ behaviors as least influential, when they received feedback based on others’ electricity consumption, they reduced their own consumption by a significant amount. Yet, additional results showed that participants did not believe that other people’s behavior had an influence on their own behavior. However,
normative information about how often their neighbors tried to conserve led to significantly more conservation compared to the other types of feedback that was rated as more influential.

Because these messages are effective and underdetected, there are many examples of ways in which social norms have been used to increase a desired behavior or reduce an unwanted behavior. Research has been conducted in the areas of sun protection (Mahler, Kulik, Butler, Gerrard, & Gibbons, 2008), teen alcohol consumption (Perkins & Berkowitz, 1986), smoking intention (Eiser, Morgan, Gammage, & Gray, 1989), problem gambling (Larimer & Neighbors 2003), and bullying (Perkins, Craig, & Perkins, 2011). The use of social norms in these domains has seen success in reducing these unwanted behaviors. For example, Perkins et al. (2011) showed that interventions in schools aimed at altering perceptions of the prevalence of bullying were successful at reducing the amount of bullying in middle schools.

The power of social influence has also been applied to the domain of promoting environmental conservation. Some of these domains include littering (Schultz, Bator, Tabanico, Bruni, & Large, 2011), recycling (Schultz, 1999), water consumption (Ferraro & Price, 2011), and energy conservation (Göckeritz, Schultz, Rendón, Cialdini, Goldstein, & Griskevicius, 2010; Schultz, Khazian, & Zaleski, 2008). Schultz, Nolan, Cialdini, Goldstein, and Griskevicius (2007) conducted a study of particular interest to this thesis. In this study, the authors examined the boomerang effect of normative messages. That is, instances when participants react in the opposite of the desired direction. In this study, energy meters were read to obtain a household’s energy usage each week. The following week, door-hangers were placed at each house detailing how much the household used, compared to similar houses in the neighborhood. The meter was read again and analyzed for changes in consumption. Results showed that when only the descriptive norm was used, both high and low users trended toward the mean. When an
Injunctive norm conveying low energy use was included, only the high users moved towards the mean; the low users continued to use less than the mean.

In a related study, Smith and Louis (2008) conducted two experiments to test the impact of descriptive and injunctive norms. Participants were exposed to supportive or opposing descriptive or injunctive norms messages. The authors found that participants exposed to the supportive injunctive norm indicated higher post-test attitudes towards the target behavior, and were more likely to sign a petition favoring a university fee increase. When the descriptive and injunctive norms were aligned, there was a trend towards increased behavioral polarization. When the descriptive norms were contrary to pre-measured attitudes, the injunctive norm did not have a significant influence on the target behavior. For this thesis, descriptive and injunctive norms were aligned to strengthen the effect.

More specifically, the social norms approach as a means of reducing electricity consumption has been implemented on a large scale, reaching over 10 million households (OPower, 2014). Electricity customers in diverse areas across the country receive electricity reports that compare their electricity use to the use of their neighbors. Electricity savings from this approach has been around 2.5% (Schultz, 2010), Allcott (2011) found similar savings, 2%. These savings are particularly pronounced for high consumption households, who end up with an electricity reduction of 8% (Schultz 2010) to 6.8% (Allcott, 2011). The Opower model is a direct extension of the research that Schultz et al. (2007) conducted.

The evidence is clear: utilizing social norms is an effective way of encouraging behavior change, particularly when injunctive and descriptive norms are aligned. However, a potentially important factor in normative social influence is the referent group—what group the person is
being compared to. To date, only a few studies have directly examined the role of referent groups in normative social influence.

**Referent Groups**

Whereas social norms have been successful at achieving behavior change in a variety of domains (Cox & Bates, 2011), there are instances where such interventions do not produce the desired results. Rimal and Real (2003) demonstrated that descriptive norms alone are not sufficient to change behavior when they studied group identity, communication patterns, and alcohol consumption. They speculated that descriptive norms might affect other intermediate variables, which then lead to behavior change.

There have also been issues with implementing a social norms approach aimed at a large and diverse population (Carter & Kahnweiler, 2000). For example, college Greek populations, especially fraternities, tend not to respond to social norms interventions aimed at reducing alcohol consumption, and Carter and Kahnweiler (2000) set out to determine why. The study was correlational in nature, and the authors surveyed fraternity members about their drinking behavior, along with the perceptions of drinking behavior for Greeks and non-Greeks on campus. They investigated three possible explanations as to why an application of the social norms model typically did not alter the drinking behavior of fraternity members. They found that perceptions of drinking norms for fraternity men were much higher than the perceptions of non-Greek men. Further, fraternity members did not identify themselves as a part of the general student population when it came to drinking behaviors. This suggests that an important factor in normative social influence is the referent group.

Other studies have suggested that a person’s identification with the referent group can have an influence on the effectiveness of normative messages (Christensen, Rothegerber, Wood,
neighbors et al. (2010) conducted a correlational study testing the moderating effects of identification with referent groups as a predictor of alcohol consumption. They surveyed students about their alcohol consumption, perceived drinking norms, and identification with four referent groups, typical student, same sex, same race, or same Greek membership. They found that feelings of closeness to a referent group moderated reported drinking behavior. The results also indicated that the strength of identification did not matter when the referent group was less specific, in this case the typical student.

Similarly, Reed, Lange, Ketchie, and Clapp (2007) conducted a correlational study to examine the moderating role of referent group identification on college drinking behavior. They surveyed a large sample of undergraduate students about their drinking behavior, their identification with their friends, their peers, and members of Greek organizations, along with the injunctive norms of heavy drinking on campus. They found that stronger identification with various referent groups was associated with higher reported drinking behavior. They also found that group membership was not critical; non-Greek members who identified strongly with members of Greek organizations reported heavier drinking than members who did not strongly identify with the Greek community. Results suggest normative messages may be less effective when individuals do not identify with the referent group.

There is evidence that identification with the referent group is not the only factor that influences the success of a social norms intervention. Borsari and Carey (2003) conducted a meta analysis to determine the factors that influence a student’s misperception of the norms about alcohol consumption. They found several important factors: type of norm assessed, gender, relevance of the social group, types of questions asked, and campus size. Of particular importance to this thesis is that the perceived relevance (identification) of the referent group
influenced norm perceptions. The authors note that the referent groups in the meta analysis ranged from “your best friend” to “a typical member of your athletic team.” They found that the magnitude of norms misperceptions increased as the referent groups became more distant from one’s valued referent group.

These studies on referent group identification are consistent with social identity theory. Social identity theory proposes that part of an individual’s self-concept originates from their knowledge of their membership in social groups, along with the emotional significance of those group memberships (Tajfel, 1981). If a person identifies more strongly with a group they will not want to deviate from it. By staying consistent with the group, the individual can reap the benefits of positive self-esteem from the group membership.

There have also been attempts to ensure that normative messages are more personal and specific, but with mixed results. For example, Schultz et al. (2008) conducted a study of towel reuse by hotel guests. These guests stayed in rooms that had varying messages promoting the reuse of towels. The messages were varied by norm type, and strength of the norm, along with a control. For one study, the authors tried to make the norm more specific by slightly modifying the referent group comparison from “75% of hotel guests” to “XX% of guests in this room”. The results showed that while the specific and generic prompts were significantly different from the control group they were not significantly different from each other. The authors were surprised by this effect since Goldstein, Cialdini, and Griskevicius (2008) found that providing same room towel reuse information led to the highest levels of towel reuse.

Taken together, these studies suggest that the norms of a referent group influence the behavior of participants when the participants strongly identify with that referent group. In addition, people will be more influenced by the norms of the referent group when the referent
group is specifically defined. These findings hold true even if the person is not a member of the group with which they highly identify. However, to date no experimental study has measured this effect.

**In-groups and Out-groups**

Some attention also needs to be paid to what type of group the normative information is coming from. White, Hogg, and Terry (2002) conducted a study manipulating both the salience and agreeability of an in-group. Researchers referred to participants either by their name (low salience) or by their university (high salience). Participants were faced with an issue of comprehensive examinations, and how students at their university (in-group) and students at another university (out-group) felt about the issue. The authors found that participants were more likely to behave in accordance with their attitudes when they received information about an in-group that was consistent with their attitudes than with information about an in-group that was inconsistent with their attitudes. Participants who received out-group information indicated less support for engaging in the target behaviors, signing a petition. Smith and Louis (2008) also found that supportive in-group injunctive norms have an effect on attitudes but not behavioral willingness. Interestingly, Smith and Louis (2008) found that when the norms were from an out-group, normative support had no effect on attitudes, behavior, or actions.

Research has demonstrated that normative information provided about an outgroup can have an effect that is opposite of the intended effect. Costa and Kahn (2010) explored this alternative boomerang effect. Researchers used data from a local utility that was providing its customers Home Energy Reports (HERs). These reports were used as “nudges” to encourage a reduction in electricity conservation. The researchers analyzed the electricity consumption of the participating households along with the political affiliation of the participants. They found that
behavioral “nudges” were effective at reducing electricity consumption for liberal participants. However, for conservative participants they found an increase in electricity consumption.

Rabinovich, Morton, Postmes, and Verplanken (2012) conducted two studies to examine the effects of upward or downward comparisons. They gave British participants an upward comparison of Swedish people, and a downward comparison of Americans to tease apart the issue. Participants rated British people on various characteristics, including environmental ones. The results showed that when participants were exposed to a downward comparison, their in-group environmental stereotype shifted upwards. The second study demonstrated that participants reported a stronger willingness to engage in sustainable behaviors when they compared themselves to a downward group than when they compared themselves to an upward group.

**Gaps in the Literature**

Prior research has clearly shown that social norms messages are effective at changing behavior, but there are still a number of unanswered questions. The first is the relevance of the referent group. In the social norms approach, participants are given normative information about some group, and it is assumed that he or she will identify with this group, for example “people in your community” from Nolan et al. (2008). However if the participant does not understand who is in this comparison group, they might be hesitant to adopt the norms of that group. To test the impact of referent group identification on compliance with social norms, an experiment needs to be conducted that provides varying degrees of specific information about the referent group to see if more specific information leads to a stronger compliance with the norms of the group. Also, to date the research on the moderating role of identification has been correlational. A controlled experiment would determine if stronger identification with a referent group causes
greater compliance with normative information. In addition, exploring if the boomerang effect occurs as a result of an out-group comparison could also be explored further in an experimental study.

For this thesis, an experiment was conducted to address these gaps in the literature. In the experiment, households were placed in one of five experimental conditions: generic comparison, specific comparison, efficient comparison, information-only, or control. The first hypothesis was that as the information provided about the referent group moved from generic to specific, households would conserve more electricity. The second hypothesis was that people who identified more strongly with their given referent group would conserve more electricity than participants who did not identify with their referent group.

Method

This thesis was conducted as a part of a National Science Foundation climate change education grant. Through this grant, we have developed a partnership with the local electric utility to utilize the smart grid technology in Southern California. To save time and conserve resources, we recruited participants for two separate studies using the same recruitment survey and methodology. Unless otherwise stated, all reported results are only for those participants selected for this thesis.

Power Analysis

Prior studies looking at the influence of social norms on conservation behaviors have resulted in an average effect size range of small to medium (\(d=.30\) to \(.50\)). A power calculation for a moderated regression with pairwise comparisons, using a small to medium effect size, alpha of \(.05\), and power of \(.8\), resulted in an estimated sample size of 150 participants per condition for a total of 750 participants (Jaccard, Turrisi & Wan, 1990).
Sample

Participants for this study were 624 single-family homes in North County San Diego. See Appendix A for a map of targeted neighborhoods. On average, each household had 3.37 residents with a length of time in the home of 12 years. In terms of income, 76% reported earning more that $55,000 per year. Politically, there was a fairly even split between those who reported an identification, with 35% of the sample classifying as Republican, 33% Democrat, and 32% other. While all households in the study were single-family detached homes, households ranged from 712 to 4327 square feet, with an average size of 1982 square feet. Households had an average of 3.59 bedrooms, 2.42 bathrooms, and 86% did not have a pool. Households with electricity producing solar panels were excluded from this study due to variability in the energy use data. During the two weeks prior to the intervention, all households used an average of 19.07 kWh per day.

Materials

**Pre survey.** To recruit for both studies, a mail survey was sent to 6,500 households in North County San Diego. In addition to questions for the other study, the survey contained a measure of referent group identification. Level of identification was assessed using four items adapted from Ellemers, Spears and Doosje, (1997), “I am similar to this group,” “I see myself as a part of this group,” “I am glad to belong to this group.” and “I feel I have strong ties to this group.” All items were rated from 1= not at all true to 7= very true. Identification was measured for the following three groups:

- Your neighbors
- Similar households that are 2000sqft, with a pool, 3 bedrooms, 2 baths, and no solar panels. (Underlined items were specifically tailored to the household).
• Very energy efficient households

All items demonstrated good reliability, “your neighbors” $\alpha=.90$, “Similar households that are…” $\alpha=.90$, and “efficient households” $\alpha=.93$. See Appendix B for a copy of the survey.

*Pre survey consent.* To be included in the study, participants had to sign a consent paragraph provided at the end of the survey. The consent allowed researchers at CSUSM to download the customers hourly kWh consumption directly from the local utility and allowed researchers access to data the year prior to and up to a year following the study start date.

*Door-hanger pre-notification.* The local utility was concerned that even though participants had signed the consent form they would be upset about receiving a door-hanger with their household electricity consumption on it. To alleviate concerns, a postcard informing the participants that they may be receiving a door-hanger was developed. The postcard contained contact information for the researchers so the participant could opt out of the study. See Appendix C for a copy of the door-hanger pre-notification postcard.

*Door-hangers.* Comparison feedback information was provided to participating households using door-hangers. Four door-hangers were developed for this study. They were each printed on white paper, and any items written in by the researchers were written in blue felt pen. To increase the perception of personalization and to be consistent with previous research methods, electricity use and the injunctive norm were handwritten on the door-hanger. Participants received two door-hangers over the course of the study, each time the door-hanger format was the same.

*Generic.* The top portion of the generic door-hanger contained a spot to write in the average electricity consumption of the participant, and the average electricity consumption of “your neighbors.” Below the written-in portion was a sentence that verbally described, “your
household used MORE/LESS than your neighbors.” Researchers would circle the correct word. To convey an injunctive norm of conservation, a happy or a sad face was drawn next to the sentence. If participants were using less than the referent group, a happy face was drawn. Alternatively, a sad face was drawn if the household was using more. The bottom portion of the door-hanger contained three tips on conserving electricity, and the address of the household. See Appendix D for an example of the generic door-hanger.

**Specific.** Other than an alteration of the referent group, the specific door-hanger was identical to the generic door-hanger. Instead of the generic comparison group, the door-hanger was populated with a more specific comparison group. In all there were 13 different comparison groups ranging in size, number of bedrooms, bathrooms, and presence or absence of a pool. See Appendix E for an example of the specific door-hanger.

**Efficient.** Similarly, the efficient door-hanger was identical to the generic and specific door-hangers, but with a different referent group. For this door-hanger the referent group was “your most efficient neighbors”. Even though there were no direct hypotheses related to this condition it was included to test an aspect of the Opower model. Opower provides a household with its consumption, along with the consumption of similar households and most efficient households. See Appendix F for an example of the efficient door-hanger.

**Information-only.** The information-only door-hanger did not contain any household electricity information or comparison group. This door-hanger consisted entirely of the same three tips as the other door-hangers. See Appendix G for an example of the information-only door-hanger.

**Smart meter data.** The dependent measure of electricity consumption was measured using the smart meter grid and obtained from San Diego Gas & Electric. Most houses in North
San Diego County are equipped with a smart meter that monitors their energy use for the power company in real-time. Data was in hourly kWh units in a password-protected file identified by meter number.

**Procedure**

Using Google maps and Zillow.com, researchers selected 6,500 houses in North County San Diego for possible participation in the study. Researchers recorded physical attributes about each house such as presence of a pool, square footage, number of bedrooms and bathrooms, and any solar panels, along with addresses. Following the Tailored Design Method (Dillman, 2007), a pre-notification postcard was sent to each household followed by the survey a week later. Also, to increase response rates, all addresses were hand written, and a window cling with the university logo was included with each survey. The mailing contained a postage paid return envelope addressed to the university.

The initial mailing did not produce a sufficient response to power the study, so researchers went door to door to recruit additional participants. Participants were encouraged to fill the survey out at the door; however, they were also given the option to mail it back in a pre-posted return envelope. If the participant was not home at the time of the visit, the survey and return envelope were left at the door. As a result of the recruitment efforts, there was an 18% positive response rate. This response rate was well below the expected 25%. To be eligible for this study participants had to have filled out at least three of the four items in each of the identification scales. After selecting participants for the main NSF study, 632 remaining households met the selection criteria for the study and were randomly assigned to conditions.

Once the final sample was determined, the door-hanger pre-notification postcard was mailed out. Four participants called to opt out of the study because they did not want a door-
hanger. However, only three were actually removed from the sample, the fourth did not leave a name, an address, or a coherent contact number on the message asking to be removed. Remaining households were randomly assigned to one of five conditions: generic, specific, efficient, information-only, or control.

Household kWh data was downloaded from the local utility the Friday before the first Saturday intervention. Averages for the conditions were figured separately; for example, the generic mean was the mean of only households in the generic condition, not the mean of the sample as a whole. These means, along with the household’s average daily consumption for the week, and the injunctive happy or sad face were drawn on the door-hangers Friday afternoon. For consistency, all door-hangers were filled out by a single research assistant who was blind to the hypotheses.

Saturday morning, starting at 7:00am researchers went to all the households and deployed the door-hangers. During the course of dropping off the door-hangers the researchers noticed that two of the households had since installed photovoltaic solar panels. These households were then removed from the study and not given their door-hangers.

The second intervention occurred the following week and the same procedure was followed. The same research assistant who wrote the door-hangers the first time filled out the second round. Following the second intervention three households contacted the research team to inform them that they had medical equipment and were unable to reduce electricity consumption. These households were removed from the sample, bringing the final total to 624.

Energy use data was provided to the research team directly from the collaborating utility company. The password protected data files contained hourly kWh consumption and meter numbers for every household in the study for the year prior to the start date through the duration
of the study. In addition, hourly temperature and humidity data were taken from the NOAA mesowest database.

**Results**

The first set of analyses focused on the overall electricity consumption data. Histograms of the daily kWh consumption indicated nonnormality, with a positive skew, but there were no extreme outliers. Analyses reported below were preformed on the untransformed data. The dependent variable for each analysis was average daily kWh aggregated by week. This daily average was computed for: the week prior to the intervention (baseline), two weeks prior to the intervention (baseline week 2), and the week following the intervention (week 1). See Appendix H for a histogram of the daily kWh dependent variable during baseline, and Appendix I during week 1.

A regression analysis was conducted to determine the relationship between temperature, humidity and electricity consumption. Average hourly temperature and average hourly humidity were used to predict average hourly kWh consumed across the seven weeks of available data (2 weeks of baseline, 5 weeks following intervention). The regression equation was significant, $F(2,30676)=36.7, p<.001, R^2=.002$. Both temperature ($M=62.45, SD=3.73, N=30679$) and humidity ($M=67.26, SD=15.8, N=30679$) were significant predictors of kWh consumption; ($beta=.04, t=6.57, p<.001$) and ($beta=-.01, t=-2.17, p=.03$) respectively. Since the betas were both very low, indicating minimal impact, no corrections for temperature or humidity were made to data for the subsequent analyses.

Next, a repeated measures ANOVA was used to determine if there were significant differences between the information-only and the no-contact control groups from baseline to week 1. The repeated measures ANOVA indicated that there were no significant differences
between the information-only at baseline ($M=18.73$, $SD=9.66$, $N=126$), information-only at week 1 ($M=18.43$, $SD=9.2$, $N=126$), no-contact control at baseline ($M=19.02$, $SD=10.02$, $N=126$), and the no-contact control at week 1 ($M=18.87$, $SD=9.76$, $N=126$) conditions $F(1,249)=.25$, $p=.61$. Because there was no significant difference, the information-only and the no-contact control conditions were combined into a combined control condition for the remaining analyses.

The final preliminary analysis was an ANCOVA to determine if there were any significant differences in baseline usage. The ANCOVA indicated that there were no significant differences between the generic ($M=18.59$, $SD=9.80$, $N=123$), specific ($M=18.25$, $SD=9.87$, $N=125$), efficient ($M=18.89$, $SD=10.85$, $N=124$), and combined control ($M=18.88$, $SD=9.82$, $N=252$) groups, $F(3,619)=.81$, $p=.49$. No significant difference indicates that random assignment to condition worked.

**Hypothesis 1**

The first hypothesis was that after receiving the door-hangers the specific referent condition would use less electricity than the other conditions. A 2 (baseline and intervention) X 4 (condition) mixed model ANCOVA was conducted using baseline 2 weeks prior to the intervention (baseline week 2) as a covariate. The results demonstrated a significant effect for the baseline week 2 covariate, $F(1,619)=32.31$, $p<.001$, $\eta^2=.05$. There was a significant main effect for week, $F(1,619)=15.17$, $p<.001$, $\eta^2=.02$. Overall there was not a significant main effect for the four conditions, $F(3,619)=.5$, $p=.69$; nor was there a significant interaction between week and condition, $F(3,619)=1.8$, $p=.15$. See figure 2 for kWh consumption by condition for baseline and intervention.

Planned comparisons were computed to determine changes in consumption for each condition. There was not a significant change in consumption for the combined control
condition from baseline week 1 ($M=18.76, SE=.17, N=252$) to week 1 ($M=18.54, SE=.2, N=252$), $t(619)=-1.22, p>.05$. There was not a significant decrease in consumption for the generic condition from baseline week 1 ($M=18.52, SE=.24, N=123$) to week 1 ($M=18.13, SE=.28, N=123$), although it was trending in the expected direction, $t(619)=-1.54, p>.05$. Contrary to hypothesis 1, there was a trend toward an increase in consumption for the specific condition from baseline week 1 ($M=18.51, SE=.24, N=125$) to week 1 ($M=18.68, SE=.28, N=125$), $t(619)=.677, p>.05$. Lastly, there was a significant decrease in consumption for the efficient condition from baseline week 1 ($M=18.95, SE=.24, N=124$) to week 1 ($M=18.31, SE=.28, N=124$), $t(619)=-2.5, p<.05, d=-.32$.

To determine why the specific condition trended towards an increase in consumption, exploratory follow-up comparisons were conducted. This time, the same analyses were conducted, but each condition was dichotomized into high and low users. High and low users were determined by whether the participant received a happy or a sad face on the door-hanger (i.e., above or below the mean). Although not significant, high users in the specific condition trended in the expected direction and used less electricity from baseline ($M=18.99, SE=.34, N=51$) to week 1 ($M=18.69, SE=.41, N=51$), $t(373)=-.80, p>.05$. The reverse trend was identified for the low users in the specific condition, while not significant, more electricity was used from baseline week 1 ($M=18.16, SE=.28, N=74$) to week 1 ($M=18.67, SE=.34, N=74$), $t(373)=1.65, p>.05$. 
Hypothesis 2

The second hypothesis was that households that identified more strongly with the referent group would conserve more electricity than participants who did not identify with their referent group. Prior to doing an analysis by condition, an ANOVA was run to determine in general, which referent group participants identified with more strongly. There was a significant difference in the reported level of identification with the three referent groups, $F(1.87,1165.71)=23.98$, $p<.001$, $\eta^2=.04$ (Greenhouse-Geiser epsilon corrected). Pairwise follow up comparisons indicated that participants identified significantly more with the specific comparison group ($M=4.74$, $SD=1.54$, $N=624$) than with the generic ($M=4.31$, $SD=1.49$, $N=624$) or efficient ($M=4.44$, $SD=1.55$, $N=624$) comparisons, $p<.001$. There was not a significant difference in the level of identification between the generic and efficient comparisons, $p=.07$.  

[Figure 2: Average Daily kWh Consumption by Week]
The remainder of the identification analyses were conducted on the dichotomized identification scales. A median split was conducted to generate a high identified group and a low identified group. Initially, the intent was to do a moderated regression, however, the lower than anticipated sample size is below the power threshold to use that test. Although participants responded to all three groups on the survey, only the identification scale corresponding to the referent group on the door-hanger was the one that was used for analyses. Mixed model ANOVAs were conducted for each treatment group, comparing consumption from baseline to week 1 for high identifiers and low identifiers. Once again baseline week 2 was used as a covariate. For the generic condition, there was no significant interaction effect for time by identification, $F(1,120)=.10, p=.76$. Similarly, in the specific condition, there was no significant interaction effect for time by identification, $F(1,122)=2.57, p=.11$. Finally, there was no significant interaction effect for time by identification, $F(1,121)=.41, p=.52$ in the efficient condition.
An exploratory analysis was conducted to further examine identification, and to probe the trended increase in consumption for low users in the specific condition seen earlier. A mixed model ANOVA was conducted for the specific condition, comparing consumption from baseline to week 1 for high identifiers and low identifiers split by high and low users. Overall there was not a significant three-way interaction between time, identification, and consumption level, $F(1,120)=.12, p=.75$. However, follow up comparisons indicated that there was a significant increase in consumption for low users with high identification from baseline ($M=17.84, SE=.31, N=48$) to week 1 ($M=19.06, SE=.43, N=48$), $t(120)=3.14, p<.05, d=.64$. While with the control group, there was not a significant change in consumption for low users with high identification from baseline ($M=18.73, SE=.29, N=88$) to week 1 ($M=18.33, SE=.34, N=88$), $t(247)=-.16, p>.05$. 

![Figure 4: Average Daily kWh for Low Using Participants in the Specific Condition](image-url)
Discussion

Even though the primary hypotheses were not fully supported by the data, this thesis still had a few noteworthy findings. First, an efficient comparison was the most effective at significantly reducing electricity consumption. Secondly, contrary to what was expected, a specific comparison led to a trend of increased electricity consumption. Further, this effect was driven by low users who strongly identified with the provided referent group. Also of note, participants identified significantly more with a specific comparison group than they did with a generic or an efficient comparison group.

Of all four conditions, the efficient norms comparison was the one that produced a significant decrease in household electricity consumption from baseline to week 1. A possible explanation for this could be that one of the main drivers of a reduction effect was the high users in the group. High users had more room to reduce, therefore bringing down the average significantly. For this thesis, the majority of households in the efficient condition were considered to be high users. Efficient users were defined as the lowest consuming 30% of the sample. The mean was calculated for that small group and then provided as the comparison for the experiment. As a result, only 17 households received a happy face in the efficient condition, and all the rest received a sad face. Overall there were significantly more classified high users in the efficient condition than there were in the other conditions. To examine this possible explanation further, future research should test comparison groups, with a somewhat artificial mean. By doing this, the proportion of participants receiving happy and sad faces can remain constant. Research results can determine if it is the amount of households receiving the sad faces, or if it is something inherently motivating about the efficient group.
The hypothesis that households in the specific comparison group would conserve the most electricity was not only not supported, there was actually a trend towards an *increase* in consumption. There are a few possible explanations as to why the hypothesis may have been incorrect. First, the study was run as an opt-in design. Participants had to consent to participate in the study, and due to the perceived invasive nature of the study, the consent was somewhat daunting. It is possible that truly high users were not included in the study, and those are the participants that drive the effects. Messina (2012) considered the possibility of this type of self-selection influencing the results. This self-selection bias could be why even the generic comparison did not lead to a significant reduction in electricity consumption as it has in previous studies (Nolan et al., 2008; Schultz et al., 2007). Further, results showed that low users who highly identified with the specific comparison significantly increased their electricity consumption. It may be that because the comparison was so specific, a simple happy face was not enough to combat the boomerang effect Schultz et al. (2007) identified. Future research should empirically establish whether or not there is a significant difference between opt-in and opt-out groups. Also, future research can test different methods of conveying social approval to combat the boomerang effect. When doing this, special attention should be paid to how strongly the participant identifies with the referent group.

An exploratory analysis found that participants identified significantly more with the specific comparison group than with the generic or the efficient groups. Also, participants did not significantly differ in their identification with the generic and efficient groups. This indicates that participants see a difference between the generic neighbors comparison and a more specific comparison. Although it was not identified in this thesis, given the differing levels of identification, and the increase in consumption for low users with high identification, there may
still be identification effects yet to be uncovered. The onerous consent may have inhibited identification of these effects, and future studies should investigate the relationship without a burdensome consent.

**Limitations**

As previously discussed, one of the primary limitations of this thesis is the opt-in design. Explicitly granting consent to access utility data was likely perceived as scary by many participants, and therefore skewed the sample. Although participants were still randomly assigned to conditions, that may not have been enough to compensate for the self-selection bias. It would be difficult to run this type of experiment as a fully opt-out study because of the identification ratings needed from the participants. Exploratory analyses comparing all contacted participants indicate some differences in participants returning the survey (surveys completed at the door are considered returned for these analyses) to those who did not. See table 1 for the means, standard deviations, and number of participants in each group. Participants returning the survey had slightly more bedrooms than participants who did not return the survey, \( t(5608.71)=6.71, p<.001, d=.18 \). Similarly, participants returning the survey had slightly more bathrooms than participants who did not return the survey, \( t(4814.76)=2.73, p=.006, d=.08 \). Also, participants returning the survey had slightly larger households than participants who did not return the survey, \( t(5008.37)=2.89, p=.004, d=.07 \). Importantly, the \( d \) values for these analyses were rather small, and there was not a significant difference between the returned and not returned surveys. Further work needs to be done to determine possible differences between opt in groups and opt out groups.
Table 1:

Mean, Standard Deviation, and Sample Size for Returned Surveys and Non-returned Surveys.

<table>
<thead>
<tr>
<th>Category</th>
<th>Returned Surveys</th>
<th>Non-Returned Surveys</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Bedrooms</td>
<td>3.65</td>
<td>.75</td>
</tr>
<tr>
<td>Bathrooms</td>
<td>2.48</td>
<td>.69</td>
</tr>
<tr>
<td>Household Square Feet</td>
<td>2040.46</td>
<td>743.438</td>
</tr>
<tr>
<td>Home Value</td>
<td>$385,046</td>
<td>$166,269</td>
</tr>
</tbody>
</table>

Category values were gathered from Zillow.com for each household in the sample, not all households had home value data.

Secondly, the sample size was below the minimum requirement indicated by a power analysis. To compensate for this limitation a dichotomization technique was used instead of a moderated regression. As Fitzsimons (2008) states, dichotomizing can lead to false significant results. Future studies can compensate for this by increasing the sample size, but after personally visiting over 4000 households, the resources for this study were tapped out.

A limitation related to the low sample size is that of timing. There was a significant lag between initial participant recruitment (March) and the intervention (October). This lag lead to attrition in the sample, 28 households who had initially consented to participate had moved prior to the intervention and had to be dropped. Also, participants’ level of identification with the referent groups may have changed over the course of the interim months. This was partially due to the order of this thesis and the other study. Both were recruited for at the same time, but the other study was run first, over the summer.

For this experiment we were using an individual measure to try to predict household consumption. Past identification research has explored individual identification and individual behavior (Neighbors et al., 2010). The experiment may be limited by only getting a measure of
identification for one member of the household. It is quite possible that the reported identification does not represent the identification of all members of the household. There was some indication of household variability in the political affiliation portion of the survey. A few households reported split affiliation, (“me democrat, wife republican”). There was no way to determine who viewed the door hanger message to make sure that it matched who filled out the survey initially.

Conclusion

This thesis examined the influence of the referent group in normative social comparisons, along with the role of identification with the referent group. In terms of reducing electricity consumption, the efficient comparison led to the greatest reduction, with a generic comparison not leading to a significant reduction, and a specific comparison trending to an increase in consumption. In addition, it is clear that identification with the referent group had an impact on intended behavior, especially for highly identified users that received the specific comparison. However, due to the limitations of this study the moderating role of identification was not fully realized.

Acknowledgments

This research was funded through NSF award number ANT–1043435 & DUE-1239797. I would like to thank my committee, Dr. P. Wesley Schultz, Dr. Mica Estrada, and Dr. Heike Mahler, for their support and guidance in crafting this thesis. A very special thank you to the research assistants who contributed a significant amount of time to this thesis, Nicholas Roome, Perla Sandoval, Anela Amba-Pascua, Jenna Szuch, Danielle Teece, Andrea Briseno, Kayla Sinfield, Mariah Parvizi, Rebecca Sokoloski, Stefano De Dominicis, Sierra Schultz, Giuseppina Melucci, Lilibeth Flores, and Justin Leonard. Thank you to Valissa Middleton for helping
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References


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http://www.research.noaa.gov/weather/t_understanding.html


Appendix A

Map of Targeted Neighborhoods
Appendix B

Survey Front Page

This short questionnaire only takes about 5 minutes to complete. Your participation is completely voluntary, and you may choose not to respond to any or all of the items. The last item in the survey asks for permission to access your electricity usage from SDG&E®. This is an important part of our study, and we are grateful for your participation. We thank you in advance for completing and returning the survey in the prepaid envelope.

<table>
<thead>
<tr>
<th>1. When thinking about your neighbors, how true are the following statements? (circle response from 1= not true to 7= very true)</th>
<th>Not true</th>
<th>Very true</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. I am similar to this group.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>B. I see myself as part of this group.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>C. I am glad to belong to this group.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>D. I feel that I have strong ties to this group.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. When thinking about households in your neighborhood that are similar to yours (2000sqft, with a pool, 3 bedrooms, 2 baths, and no solar panels), how true are the following statements?</th>
<th>Not true</th>
<th>Very true</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. I am similar to this group.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>B. I see myself as part of this group.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>C. I am glad to belong to this group.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>D. I feel that I have strong ties to this group.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3. Some people are very energy efficient in their homes. Thinking about those types of people in your neighborhood, how true are the following statements?</th>
<th>Not true</th>
<th>Very true</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. I am similar to this group.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>B. I see myself as part of this group.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>C. I am glad to belong to this group.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>D. I feel that I have strong ties to this group.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4. How much do you know about the following:</th>
<th>Nothing</th>
<th>A great deal</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Electricity consumption in your home?</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>B. The cost of electricity consumption in your home?</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>C. How electricity consumption in your home compares to electricity consumption in similar households?</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>D. The link between electricity usage and climate change?</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>5. Please rate the following statements:</th>
<th>Strongly Disagree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. I feel personally obligated to use less electricity.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>B. It is important to me to conserve energy.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>C. I feel guilty when I waste electricity.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>D. People like me should do all they can to reduce their electricity use.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
</tbody>
</table>

Over →
Survey Back Page

6. Here are some statements about climate change. Based on your personal knowledge, how true do you think each of the following statements is?

<table>
<thead>
<tr>
<th>Statement</th>
<th>Not True</th>
<th>Very True</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity generation emits carbon dioxide into the atmosphere.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>The rise in carbon dioxide in the atmosphere is a major cause of temperatures rising globally.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>The rise in carbon dioxide is caused by human activities.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
</tbody>
</table>

7. Demographics

A. Do you have internet access through a modem in your home? Yes No
B. Do you own or rent your home? Own Rent
C. How long have you lived in your home? _______ years
D. In total, how many people live in the home? _______ How many are kids under 18? _______
E. In 2012, was your household income greater than or less than $55,000? Greater Less
F. What is your political affiliation? Democrat Republican Other

Authorization to Disclose Customer Usage Data

BY SIGNING BELOW, I (CUSTOMER OF RECORD) AUTHORIZE SDG&E TO RELEASE UP TO 24 MONTHS OF MY HISTORICAL AND/OR FUTURE DAILY ELECTRICAL USAGE DATA TO THE THIRD PARTY DESIGNATED BELOW. I understand and acknowledge that such data may reveal information about the way I use energy on my premises and may be used to gain personal information about me. I acknowledge and agree that San Diego Gas & Electric® is not responsible for such third party’s use of my data.

I understand that by participating in this study, I may be asked to install an energy monitoring device in my home.

Third Party Receiving Information: California State University, San Marcos (CSUSM)

Purpose: Participation in CSUSM’s study on household electrical use

Phone Number: ________________________ Email: ________________________
Address: ____________________________
City: __________________ Zip Code: __________________
Authorized Customer Signature: __________________________
Print Name: __________________________

California State University San Marcos

In collaboration with: SDG&E

#
Appendix C

Door-Hanger Pre-Notification

Residential Electricity Use in San Marcos

Dear Fellow Resident of San Marcos: September 2013

Thank you for agreeing to participate in our study. We greatly appreciate your willingness to help us with our research.

In the next few weeks, we will be distributing door hangers to randomly selected households that are participating in our study. These personalized door hangers will provide residents with their average electricity consumption for the previous week, along with a few tips for ways to save energy. If you receive a door hanger, please take the time to read and consider the information.

As with the survey you filled out, please rest assured that our interests are purely academic—we are not selling or promoting anything. Your participation is very important for the success of our project. If however, for privacy or other reasons, you would not like to receive a door hanger please contact us at (760) 750-3022. Please also feel free to contact us if you have any questions or comments.

Sincerely,

Wesley Schultz, Ph.D.
Professor, CSUSM

Joey Schmitt
Graduate Student, CSUSM
Appendix D

Generic Door-Hanger

Energy Conservation: How Do You Measure Up?

Here is what researchers from Cal State San Marcos found out about households in your neighborhood:

<table>
<thead>
<tr>
<th>Week of:</th>
<th>On average, your household used kWh/day</th>
<th>On average, your neighbors used kWh/day</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Our measures: The results reported above are specific to your home and similar homes in your neighborhood, and were provided by SDG&E.

Last week, your household consumed:

MORE / LESS than your neighbors.

Here are some good ways to reduce your energy consumption:
- Turn off unnecessary lights
- Unplug small appliances when not in use
- Use a fan instead of running the A/C

Address:
This information has been provided to you because someone in your household returned a survey to us. Please direct questions or comments about this study to the research team at CSUSM: 760-750-3022 or send an email to study@csusm.edu

Energy Conservation: How Do You Measure Up?

Here is what researchers from Cal State San Marcos found out about households in your neighborhood:

<table>
<thead>
<tr>
<th>Week of: 9/28 - 10/4</th>
<th>On average, your household used kWh/day</th>
<th>On average, your neighbors used kWh/day</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20.1</td>
<td>19.3</td>
</tr>
</tbody>
</table>

Our measures: The results reported above are specific to your home and similar homes in your neighborhood, and were provided by SDG&E.

Last week, your household consumed:

MORE / LESS than your neighbors.

Here are some good ways to reduce your energy consumption:
- Turn off unnecessary lights
- Unplug small appliances when not in use
- Use a fan instead of running the A/C

Address: 716 GREGOR LN
This information has been provided to you because someone in your household returned a survey to us. Please direct questions or comments about this study to the research team at CSUSM: 760-750-3022 or send an email to study@csusm.edu
## Appendix E

### Specific Door-Hanger

**Energy Conservation: How Do You Measure Up?**

Here is what researchers from Cal State San Marcos found out about households in your neighborhood:

<table>
<thead>
<tr>
<th>Week of:</th>
<th>kWh/day</th>
<th>kWh/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>On average, <strong>your household</strong> used</td>
<td><strong>16.2</strong></td>
<td><strong>22.8</strong></td>
</tr>
<tr>
<td>On average, similar households that are XXXX sqft, X pool, X bedrooms, X baths, and no solar panels used</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Last week, your household consumed:**

MORE / LESS than similar households that are XXXX sqft, with X pool, X bedrooms, X baths, and no solar panels.

Here are some good ways to reduce your energy consumption:
- Turn off unnecessary lights
- Unplug small appliances when not in use
- Use a fan instead of running the A/C

**Address:**
This information has been provided to you because someone in your household returned a survey to us. Please direct questions or comments about this study to the research team at CSUSM: 760-750-3022 or send an email to study@csusm.edu
Appendix F

Efficient Door-Hanger

<table>
<thead>
<tr>
<th>Week of:</th>
<th>kWh/day</th>
<th>kWh/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>On average, your household used</td>
<td>10.2</td>
<td>8.6</td>
</tr>
<tr>
<td>On average, your most efficient neighbors used</td>
<td>10.2</td>
<td>8.6</td>
</tr>
</tbody>
</table>

Last week, your household consumed:

MORE / LESS than your most efficient neighbors.

Here are some good ways to reduce your energy consumption:

- Turn off unnecessary lights
- Unplug small appliances when not in use
- Use a fan instead of running the A/C

Address:

This information has been provided to you because someone in your household returned a survey to us. Please direct questions or comments about this study to the research team at CSUSM: 760-750-3022 or send an email to study@csusm.edu.
Appendix G

Information-Only Door-Hanger

Energy Conservation:

Researchers from Cal State San Marcos would like to share a few tips with you:

Here are some good ways to reduce your energy consumption:

- Turn off unnecessary lights
- Unplug small appliances when not in use
- Use a fan instead of running the A/C

Address:

This information has been provided to you because someone in your household returned a survey to us. Please direct questions or comments about this study to the research team at CSUSM: 760-750-3022 or send an email to study@csusm.edu

Address: 716 GREGOR LN

This information has been provided to you because someone in your household returned a survey to us. Please direct questions or comments about this study to the research team at CSUSM: 760-750-3022 or send an email to study@csusm.edu
Appendix H

Histogram of Daily kWh Consumption During Baseline

Histogram

Mean = 18.70
Std. Dev. = 9.83
N = 624
Appendix I

Histogram of Daily kWh Consumption During Week 1

Histogram

Mean = 18.44
Std. Dev. = 9.354
N = 024