

Energy Research and Development Division

**FINAL PROJECT REPORT**

# **California Latino Households and Energy Efficiency Upgrades**

Research Findings and Program Recommendations

**California Energy Commission**

Edmund G. Brown Jr., Governor

**August 2018 | CEC-500-2018-018**



**PREPARED BY:**

**Primary Author(s):**

Laura Parsons, Center for Sustainable Energy  
Georgina Arreola, Center for Sustainable Energy  
Linda Dethman, Research Into Action  
Mithra Moezzi, Ghoulem Research  
Edward Vine

Center for Sustainable Energy  
9325 Sky Park Court, Suite 100  
San Diego, CA 92123  
Phone: 858-244-1177  
<http://www.energycenter.org>

**Contract Number:** EPC-14-037

**PREPARED FOR:**

California Energy Commission

James Lee  
**Project Manager**

Erik Stokes  
**Office Manager**  
**ENERGY DEPLOYMENT AND MARKET FACILITATION**

Laurie ten Hope  
**Deputy Director**  
**ENERGY RESEARCH AND DEVELOPMENT DIVISION**

Drew Bohan  
**Executive Director**

**DISCLAIMER**

This report was prepared as the result of work sponsored by the California Energy Commission. It does not necessarily represent the views of the Energy Commission, its employees or the State of California. The Energy Commission, the State of California, its employees, contractors and subcontractors make no warranty, express or implied, and assume no legal liability for the information in this report; nor does any party represent that the uses of this information will not infringe upon privately owned rights. This report has not been approved or disapproved by the California Energy Commission nor has the California Energy Commission passed upon the accuracy or adequacy of the information in this report.

## ACKNOWLEDGEMENTS

The authors thank the following contributors; this project would not have been possible without their time, resources, and expertise.

- **Other Members of the Research Team:** John Anderson, Alexandra Dunn, Vallerie Gonzalez, Dena Gromet, Nora Hennessy, Michelle Jones, Timothy Kleinheider, Ria Langheim, Jen Loomis, Damian Ludwig, Christina Machak, Nicholas Pallonetti, Kipp Searles, Andres Spagarino, Timothy Treadwell, and Joe Van Clock.
- **Field Research Partners:** Jose Gonzalez of the City of Fresno, Alex Vantaggiato and David Meyers of Consol, and the canvassers and raters of the Central Valley Energy Tune-Up Program (CVETU).
- **Research Participants:** Contractors who contributed insights during the semi-structured interviews; homeowners who participated in the focus groups, survey and online experiments; and CVETU audit recipients who shared their stories for our field research.
- **Knowledge-Sharing Partners:** Catalina Lamadrid of Inova Energy Group and Brandi Turner of San Diego Gas & Electric.
- **Technical Advisory Committee:** Tom Dietz of Michigan State University, David Hungerford of the California Energy Commission, Loren Lutzenhiser of Portland State University, Varun Rai of the University of Texas at Austin, Annalisa Schilla of the California Air Resources Board, and Larry Tabizon of Southern California Edison.

## PREFACE

The California Energy Commission's Energy Research and Development Division supports energy research and development programs to spur innovation in energy efficiency, renewable energy and advanced clean generation, energy-related environmental protection, energy transmission, and distribution and transportation.

In 2012, the Electric Program Investment Charge (EPIC) was established by the California Public Utilities Commission to fund public investments in research to create and advance new energy solution, foster regional innovation and bring ideas from the lab to the marketplace. The California Energy Commission and the state's three largest investor-owned utilities—Pacific Gas and Electric Company, San Diego Gas & Electric Company, and Southern California Edison Company—were selected to administer the EPIC funds and advance novel technologies, tools, and strategies that provide benefits to their electric ratepayers.

The Energy Commission is committed to ensuring public participation in its research and development programs. These programs promote greater reliability, lower costs and increase safety for the California electric ratepayer and include:

- Providing societal benefits.
- Reducing greenhouse gas emission in the electricity sector at the lowest possible cost.
- Supporting California's loading order to meet energy needs first with energy efficiency and demand response, next with renewable energy (distributed generation and utility scale), and finally with clean conventional electricity supply.
- Supporting low-emission vehicles and transportation.
- Providing economic development.
- Using ratepayer funds efficiently.

*California Latino Households and Energy Efficiency Upgrades: Research Findings and Program Recommendations* is the final report for Home Energy Efficiency Retrofits in California: An Analysis of Sociocultural Factors Influencing Customer Adoption (Contract Number EPC-14-037), conducted by Center for Sustainable Energy, Research Into Action, Ghoulem Research, and Edward Vine. The information from this project contributes to the Energy Research and Development Division's EPIC Program.

For more information about the Energy Research and Development Division, please visit the Energy Commission's website at [www.energy.ca.gov/research/](http://www.energy.ca.gov/research/) or contact the Energy Commission at 916-327-1551.

## ABSTRACT

Latinos represent 39 percent of California's population, but for several reasons, evidence suggests that Latino households often participate less in mainstream energy efficiency programs. This three-year study investigates how social, cultural, and behavioral factors affect the adoption of energy efficiency measures, services and practices among Latino households. In particular, it explores the views and behaviors of Latino single-family homeowners in Fresno and San Diego Counties to understand:

- What they think, feel and act regarding energy efficiency upgrades, including their financing preferences and use of contractors.
- What marketing and educational strategies will engage them.
- What program design strategies will address their priorities and needs.

The study uses a mixed methods approach—including a literature review, focus groups, semistructured interviews, a survey of Latino and non-Latino households, online experiments, and field experiments—to inform the results. It translates this robust set of research findings into recommendations for program outreach, design and research to better serve this important and growing population.

Keywords: Latinos, Hispanics, underserved, residential, energy efficiency, energy savings, comfort, home improvements, housing, HVAC, insulation, contractors, raters, audits, utilities, financing, social, cultural, motivations, behavior, research, programs, outreach, San Diego, Fresno, Central Valley, behavior

Please use the following citation for this report:

Parsons, Laura, G. Arreola, L. Dethman, M. Moezzi, and E. Vine. 2018. *California Latino Households and Energy Efficiency Upgrades: Research Findings and Program Recommendations*. California Energy Commission. Publication Number: CEC-500-2018-018.

# TABLE OF CONTENTS

	Page
<b>ACKNOWLEDGEMENTS</b> .....	<b>i</b>
<b>PREFACE</b> .....	<b>ii</b>
<b>ABSTRACT</b> .....	<b>iii</b>
<b>TABLE OF CONTENTS</b> .....	<b>iv</b>
<b>LIST OF FIGURES</b> .....	<b>vii</b>
<b>LIST OF TABLES</b> .....	<b>viii</b>
<b>EXECUTIVE SUMMARY</b> .....	<b>1</b>
Introduction.....	1
Project Purpose.....	1
Project Process.....	2
Project Results .....	3
Benefits to California.....	6
<b>CHAPTER 1: Why This Research Is Important</b> .....	<b>8</b>
<b>CHAPTER 2: Literature Review</b> .....	<b>10</b>
Select Findings .....	10
Demographic and Family Characteristics .....	10
Immigration, Language Characteristics, and Acculturation .....	11
Education and Income .....	11
Home Ownership and Housing Characteristics.....	12
Home Energy Use and Costs .....	13
Decision-Making: The Role of Women and Family .....	14
Reaching the Targeted Groups.....	15
Messaging Frames .....	15
Message Delivery Strategies .....	16
<b>CHAPTER 3: Market Characterization</b> .....	<b>18</b>
<b>CHAPTER 4: Focus Groups</b> .....	<b>20</b>
Research Objectives.....	20
Methods.....	20
Participant Demographics.....	20

Select Findings .....	21
<b>CHAPTER 5: Semistructured Interviews .....</b>	<b>23</b>
Research Objectives.....	23
Methods.....	23
Select Findings .....	24
Themes and Stereotypes.....	24
<b>CHAPTER 6: Survey .....</b>	<b>28</b>
Research Objectives.....	28
Methods.....	28
Response Rate.....	30
Select Findings .....	30
Home Improvements and Motivations .....	30
Hiring Contractors .....	33
Financing.....	36
Family Decision-Making Dynamics.....	39
<b>CHAPTER 7: Online Experiments .....</b>	<b>41</b>
Research Objectives.....	41
Methods.....	41
Experiments 1-3.....	42
Messages Tested.....	42
Select Findings .....	44
Experiment 4 .....	47
Messages Tested.....	47
Select Findings .....	49
<b>CHAPTER 8: Field Experiments.....</b>	<b>53</b>
Study 1.....	53
Methods .....	53
Select Findings .....	56
Study 2.....	56
Study 3.....	57
Research Objectives.....	57
Methods.....	57

Select Findings .....	57
<b>CHAPTER 9: Program and Research Recommendations .....</b>	<b>59</b>
Program Outreach Recommendations.....	59
1. Partner With Community-Based Organizations (CBOs) as Trusted Messengers .....	59
2. Take a Bilingual Approach, Especially for Populations With Low Acculturation.....	60
3. Use Imagery That Resonates With the Target Audience.....	61
4. Use Personal Stories to Demonstrate What’s Achievable to Lower Energy Bills .....	61
Program Design Recommendations .....	62
5. Address Individual Concerns, Motivations, and Learning Styles in a Personalized Way .....	62
6. Design Programs to Promote Upgrades by a Broader Network of Contractors and DIY Homeowners.....	63
7. Offer Options for Low-Income Households Through Varied Financing Options, Phased Whole-House Retrofit Programs, Low-Cost Recommendations and Expanded Direct-Install Programs .....	65
8. Create Regional One-Stop Shops to Integrate Energy Efficiency Retrofits With Other Sustainability, Health, and Safety Improvements .....	66
Research Recommendations.....	67
9. Evaluate Program Design and Outreach Recommendations .....	67
10. Conduct Research to Understand the Opportunities and Limitations of Housing Stock and Behavior Patterns in Different Communities .....	68
<b>CHAPTER 10: Benefits to California.....</b>	<b>69</b>
Method.....	69
Projected Benefits .....	70
<b>LIST OF ACRONYMS .....</b>	<b>72</b>
<b>REFERENCES .....</b>	<b>73</b>
<b>Appendix A: Variables and Calculations .....</b>	<b>A-1</b>

# LIST OF FIGURES

	Page
Figure 1: Research Phases.....	9
Figure 2: Average Family Size for Targeted Groups in California.....	10
Figure 3: Highest Level of Education Attained by Targeted Group Population Aged 3 and Older.....	11
Figure 4: Home Improvement Projects Completed or Considered.....	31
Figure 5: Primary Motivations to Complete or Consider Central A/C Upgrades .....	33
Figure 6: Funding Mechanism for Most Recent Planned Home Repair.....	36
Figure 7: Funding Mechanism for Most Recent Emergency Home Repair.....	37
Figure 8: Agreement With Statement "I Am More Likely to Consider a Large Purchase If I Know That There Is Financing Available to Help Me Pay for It" .....	38
Figure 9: Agreement With Statement "I Have Experienced Difficulty Accessing Credit or Financing" .....	38
Figure 10: Choice to Learn About Attic Insulation by Experiment and Ethnic Group .....	44
Figure 11: Choice to Learn About Attic Insulation by Gender.....	45
Figure 12: Answers to "Who in Your Household Is Primarily Responsible for [Various Major Household Decisions]?" by Experiment and Gender .....	45
Figure 13: Family Emphasis Main Effect Tested in Experiments 1, 2, and 3 by Ethnicity .....	46
Figure 14: Bilingual Main Effect Tested in Experiments 2 and 3 by Ethnic Group.....	47
Figure 15: Percentage Choosing to View List of Contractors for Each Message Frame.....	49
Figure 16: Sources Used to Find the Last Contractor Hired by Ethnicity .....	50
Figure 17: Contractor Attributes in Order of Most to Least Important.....	51
Figure 18: Percentage of Respondents Getting Energy Efficiency Information From Various Sources .....	52
Figure 19: Old Brochure (Two Sides) .....	54
Figure 20: New Brochure (Two Sides).....	55
Figure 21: Canvasser Assisted Audit Sign-Ups.....	56

## LIST OF TABLES

	Page
Table 1: Average Household Income and Income to Poverty Ratio of Targeted Groups in California.....	12
Table 2: Home Ownership by Target Group Members in California .....	12
Table 3: Dwelling Type by Target Group in California.....	13
Table 4: Proportion of Target Groups Using Primary Home Heating Fuels in California.....	14
Table 5: Average Fuel Costs by Target Group in California .....	14
Table 6: Characteristics of 10 Counties With the Most CF1R-ALT Records in CalCERTS Registry .....	18
Table 7: Average Household Size and Range of Focus Group Participants.....	21
Table 8: Average Number of Years in Home of Focus Group Participants .....	21
Table 9: Characteristics of the Contractors Interviewed.....	24
Table 10: Distribution of Surveys.....	29
Table 11: Survey Respondents by Ethnicity Category and Geography.....	30
Table 12: Primary Motivations Among Respondents Who Had Completed or Considered Projects .....	32
Table 13: Percentage of Respondents Ever Hiring a Contractor for Home Improvements/Repairs.....	33
Table 14: Percentage of Latino Respondents, by Acculturation Level, Ever Hiring a Contractor for Home Improvements/Repairs .....	34
Table 15: Methods Used to Look for a Contractor .....	34
Table 16: Percentage Choosing "Extremely Important" for Contractor Selection Criteria.....	35
Table 17: Percentage of Respondents Who Make Decisions on Their Own, Defer to Another, or Make Them Jointly by Group.....	39
Table 18: Percentage of Respondents Who Make Decisions on Their Own, Defer to Another, Or Make Them Jointly by Gender.....	40
Table 19: Content of the Four Messages Tested in Experiment 1 .....	42
Table 20: Content of the Four Messages and Main Effects Tested in Experiments 2 and 3 .....	43
Table 21: Content of the Four Messages and Main Effects Tested in Experiment 4 .....	48
Table 22: Parameter Values .....	70
Table 23. Benefits to California From Increased Latino Participation.....	71



# EXECUTIVE SUMMARY

## Introduction

California has set ambitious goals to reduce greenhouse gas emissions to 40 percent below 1990 levels by 2030 and double energy efficiency savings in existing buildings, including homes. Meeting this goal means that a large proportion of California's 11 million households need to take steps to improve the efficiency of their homes.

The good news is that there are many ways for households to be more efficient and many reasons to invest in efficiency. In addition to reducing bills and climate change effects, efficiency upgrades can improve comfort and indoor air quality, reduce noise, and add value to a home.

Yet residents often face challenges in making efficiency improvements. Making efficiency upgrades can be expensive, disrupt busy lives, and involve a daunting set of decisions.

For decades, California's utilities, local governments, and other stakeholders have sought to engage residents in energy efficiency activities by implementing programs that help them understand the benefits and overcome their barriers to action through financial incentives and other services.

## Project Purpose

Historically, energy efficiency program participation and overall market potential estimates have been driven by cost-effectiveness. Yet cost-effectiveness calculations do not capture the social and cultural factors influencing individual decisions.

Furthermore, recent research shows that many programs geared toward the general population have disproportionately served high-income, college-educated, and white audiences. This suggests new approaches are needed to effectively serve California's many ethnic, racial, and cultural groups. In addition, the state is committed to environmental equity and to delivering the benefits of clean energy to all its people.

In 2014, to address these gaps, the California Energy Commission funded several research studies to better understand how social, cultural, and behavioral factors affect the adoption of energy efficiency measures, services, and practices.

This study takes an in-depth look at California's Latino households, specifically those that own single-family homes, to explore:

- What they think, feel, and act regarding energy efficiency upgrades, including their financing preferences and use of contractors.
- What marketing and educational strategies will engage them.
- What program design strategies would address their priorities and needs.

## **Project Process**

The study, conducted over three years (2015-2018), included multiple methods.

The research team reviewed more than 60 academic, market, and program evaluation research studies on three ethnic groups in California that are “underserved” by energy efficiency programs: Latinos, Asian Americans and African Americans. The review explored sociocultural characteristics of these groups, as well as effective messaging and communication strategies for reaching each group about energy efficiency topics and programs. Based on this review and practical research considerations, the team selected Latinos as the focus of this research.

Next, the team conducted a market characterization to identify regions with large, dynamic residential energy efficiency markets and large Latino populations. Based on this analysis, the team chose San Diego and Fresno Counties as the coastal and inland areas of focus for the study.

After selecting the target audience and geographic regions, the research team conducted focus groups to identify sociocultural characteristics of Fresno and San Diego Latino households that shape how they think about executing and financing home improvement projects, with a focus on energy and energy efficiency improvements. In addition, the team interviewed, by phone, seven contractors or home energy raters working with single-family owner-occupied homes in San Diego County, Fresno County, and Kern County. The goal of these phone interviews was to understand contractors’ views on how Latino households think about energy and energy efficiency in planning, executing, and financing home improvements.

Building on the insights from the focus groups and interviews, the research team conducted a survey to understand Latino and non-Latino homeowner perspectives about home improvement projects, energy efficiency, expectations for thermal comfort, hiring contractors, using financing, and making major household decisions. Six hundred ninety-seven (697) single-family homeowners completed surveys and of those respondents who provided their ethnic status, 79 percent were Latino, and 21 percent were non-Latino.

Next, the research team conducted a series of online experiments to understand how various messages affected the likelihood that Latino and non-Latino homeowners would take action on home energy efficiency upgrades. The first three experiments tested the effects of the following message themes on participants’ likelihood to choose to learn more about installing attic insulation:

- comfort benefits vs. cost savings.
- family emphasis vs. untargeted.
- English only vs. bilingual (English and Spanish) presentation.

The fourth experiment tested the effects of the following themes on participants’ likelihood to choose to see a list of contractors that can help with home energy efficiency upgrades: utility representative messenger vs. local homeowner messenger, and contractor license status vs. untargeted.

The team also put together a Technical Advisory Committee comprised of Tom Dietz of Michigan State University, David Hungerford of the California Energy Commission, Loren Lutzenhiser of Portland State University, Varun Rai of the University of Texas at Austin, Annalisa Schilla of the California Air Resources Board, and Larry Tabizon of Southern California Edison. This advisory group helped guide and review the information.

In the final research phase, the team conducted three field studies in partnership with the Central Valley Energy Tune-Up program, which provides no-cost home energy audits to Pacific Gas and Electric customers in California's Central Valley. The first two studies were experimental designs: one testing the effect of imagery in the Central Valley Energy Tune-Up audit recruitment brochure on audit sign-ups, and one effect the impact of providing do-it-yourself tips and property assessed clean energy financing information on the likelihood to conduct upgrades post audit. The second experiment did not yield a useable sample size, so the team conducted an ethnographic study in which English and Spanish phone interviews were conducted with audit recipients about upgrade activity, motivations, and barriers.

## **Project Results**

### **Perceptions of Utilities**

The research revealed mixed perceptions of energy utility companies among Latino homeowners. The literature review found an example of a focus group study that showed low-income Latinos had low levels of trust in their energy utilities, and the online experiment study noted that Latino participants were less likely than non-Latino participants to respond to a utility messenger promoting the benefits of attic insulation. On the other hand, Latino members of the focus groups, who had hired contractors to do major home renovations, revealed high awareness of and participation in energy and water utility programs.

In the interviews with contractors, a range of perspectives was expressed on the importance of Spanish-speaking staff for serving Latino customers. Some noted that bilingual staff can help establish trust and comfort – especially with older family members – even when the customer has a reasonable knowledge of English. Latino focus group participants also noted that messaging should be in both English and Spanish to reach the largest Latino audience, since some older people do not read English, while their children may not want to learn Spanish. The survey revealed that more than one-third of Latino respondents considered the ability to conduct business in their preferred language to be extremely important when selecting a contractor. In the interviews conducted with Central Valley Energy Tune-Up audit recipients, several participants mentioned that language barriers limited their ability to find contractors or find additional information on pursuing energy upgrades.

The effects of language on energy efficiency decision-making were further explored through the online experiments. The experiments presented two versions of the same message about the benefits of attic insulation: one in English and one in English and Spanish side-by-side. This research suggested that Latino participants with low levels of acculturation were more likely to choose to talk to an energy specialist when presented with bilingual messaging than participants who were more highly acculturated. Importantly, the bilingual messaging did not

influence non-Latino participants' likelihood to choose to talk to an energy specialist, indicating little downside of using both languages in marketing materials.

### **Imagery in Marketing Materials**

In the focus group of Latino homeowners in Fresno, some participants reacted negatively to an energy efficiency financing advertisement that featured a relatively large, expensive-looking home. One participant said, "It looks like they are in their big house—they could save, but I couldn't."

The impact of imagery was tested further through a field experiment in which Central Valley Energy Tune-Up canvassers distributed two versions of the same brochure when recruiting participants for their no-cost energy audits. The researchers found that the brochure with images of people who appeared Latino in front of modest homes (as compared to the brochure with Caucasians in front of large, expensive homes) had a positive impact on audit sign-up rates in census tracts with high concentrations of Latinos.

### **Learning Styles**

Interviews with Central Valley Energy Tune-Up participants revealed common barriers to executing upgrades based on the results of an energy audit. While Central Valley Energy Tune-Up provided many tips and resources in its audit reports (presented in either English or Spanish, depending on the household's preferred language), some interviewees indicated that they still did not know what to do with the suggestions. This challenge may be related to different learning styles; for example, some people may process information more effectively if presented with a conversational, personal approach. Many auditors do, in fact, take this approach while they are in the home: they engage the resident in conversation about their home and family. Contractors also indicated that they enjoy explaining energy efficiency concepts and recommendations during energy audits.

### **Do It Yourself vs. Hiring a Contractor**

Throughout several phases of this research project, the team found that Latino households are likely to conduct projects themselves or use their personal network to find someone to do the work, even if that person is not officially licensed or formally trained in a relevant specialty.

In the focus groups, which were limited to homeowners who had previously hired someone to help with a home improvement project, several respondents from the Latino and non-Latino groups reflected their desire to attempt certain projects if they had the skills and time. Participants indicated they were less likely to take on projects involving electricity, plumbing, steep roofs, permits, or simply a larger, more complex scope.

The survey revealed that foreign-born Latino respondents were much more likely to do the work themselves or get help from unpaid family or friends compared to United States-born non-Latino respondents. Furthermore, Latino respondents were significantly less likely to have ever hired a contractor for home improvement or repair compared to non-Latino respondents.

Finally, interviewees from the field research overwhelmingly mentioned relying on family members or others in their network who could do the work or could refer them to somebody who could. One said, “Honestly, because we have our family in construction, it’s very easy for me to say hey, do you know somebody who can do this?”

### **Financing**

Income-related issues, including access to capital, is a primary barrier to whole-house energy efficiency retrofits for many households. Financing may be helpful for some Latino households, but this study found mixed perspectives on the Latino appetite for financing, and it should not be viewed as a silver bullet for improving program participation.

On the one hand, the literature review indicated that Latino Americans may be less likely to trust banks and have a cultural tendency to use cash rather than credit, compared to non-Latinos. The Latino (as well as non-Latino) focus group participants reflected some reluctance to use financing for high cost items. In interviews with Central Valley Energy Tune-Up audit recipients, only 20 percent seemed willing to consider taking out a loan for energy efficiency upgrades. Some expressed reluctance to take on debt: “I can’t afford [attic insulation] right now. I almost lost my house already. I [had] to get a loan for it. So, I’m paying on my loan right now... it’s hard for me to do anything with my house.”

Alternatively, when survey respondents were asked about how they would proceed with a desired (nonemergency) home improvement project if cash were not available but financing were, 50 percent of foreign-born Latinos and 40 percent of U.S.-born Latinos reported that they would use financing to complete the project rather than wait to save up the cash. (This was higher than the 37 percent of United States-born non-Latinos who reported they would use financing.) Similarly, Latino respondents agreed more with the statement “I am more likely to consider a large purchase if I know that there is financing available to help me pay for it” than non-Latino respondents.

However, the research also found the respondents who expressed more desire to use financing may be the ones less likely to be approved for financing. In the survey, foreign-born Latinos reported more trouble accessing credit than the other groups. Moreover, while the survey and focus groups discussed financing in terms of home improvement projects more generally, the field research interviews were specific to energy efficiency upgrades recommended for the interviewees’ homes. It is possible that any appetite for taking on debt for home improvement projects is reduced when considering energy efficiency upgrades specifically.

### **Housing Conditions**

Homeowners often have multiple concerns about their homes, and energy efficiency may not be at the top of the list. In the focus groups, Latino participants more frequently described their homes as old, and talked about higher priority needs such as leaking roofs, leaking pipes and broken furnaces. Census data supports that Latino Californians are more likely to live in older homes than the general California population.

## **Energy Use Practices**

This research project indicated that there may be less opportunity for savings related to heating, ventilating, and air-conditioning (HVAC) systems in Latino households. For example, in interviews with contractors, several contractors mentioned that Latinos have lower energy use relative to other households as they often use evaporative cooling, fans, or other alternatives to central air conditioning. The survey reinforced the finding that of respondents with central air conditioning, foreign-born Latinos were less likely than United States-born non-Latinos to use air conditioning (82 percent vs. 91 percent).

The relative lack of air-conditioning use could be related to cost sensitivity. One contractor, speaking of Latinos and non-Latinos, noted, “If you were to look at the summer electricity bills of people in this area, it would be misleading. Many people cut way back for affordability. One taste of a \$400 summer electricity bill, and a household may be very hesitant to use air conditioning, turning it on only when it is very hot.”

## **Program and Research Recommendations**

The research findings led to the following program and research recommendations that are described in more detail in the main report.

### **Program Outreach Recommendations**

1. Partner with community-based organizations (CBOs) as trusted messengers.
2. Take a bilingual approach, especially for populations with low acculturation.
3. Use imagery that resonates with the target audience.
4. Use personal stories to demonstrate what’s achievable to lower energy bills.

### **Program Design Recommendations**

5. Address individual concerns, motivations, and learning styles in a personalized way.
6. Design programs to promote upgrades by a broader network of contractors and do-it-yourself homeowners.
7. Offer options for low-income households through varied financing options, phased whole-house retrofit programs, low-cost recommendations, and expanded direct-install programs.
8. Create regional one-stop shops to integrate energy efficiency retrofits with other sustainability, health, and safety improvements.

### **Research Recommendations**

9. Evaluate program design and outreach recommendations.
10. Conduct research to understand the opportunities and limitations of housing stock and behavior patterns in different communities.

## **Benefits to California**

The research findings and recommendations have been shared with hundreds of stakeholders (including local governments, federal and state agencies, utilities, consultants, community-based organizations and researchers) through a variety of channels. Presentations were given at

two Behavior, Energy and Climate Change conferences, the American Council for an Energy-Efficient Economy's Summer Study on Energy Efficiency in Buildings, the Empowering Texas Communities conference, the Energy Commission's Electric Program Investment Charge Symposium, webinars hosted by the Electric Power Research Institute and the Center for Sustainable Energy, and a Department of Energy Better Buildings Residential Network peer exchange call. Reports and handouts summarizing the research and recommendations, as well as a recording of the Center for Sustainable Energy-hosted webinar, have been posted online at [www.energycenter.org/sociocultural](http://www.energycenter.org/sociocultural).

If the recommendations are implemented, more Latino households will likely participate in California's IOU energy efficiency programs, resulting in energy savings, utility bill savings and greenhouse gas emission reductions. The research team's analysis finds that increased Latino participation in California whole-house retrofit and HVAC energy efficiency programs would increase annual electricity savings by 0.55 to 5.30 gigawatt-hours (GWh), annual greenhouse gas reductions by 182 to 1,753 metric tons, and annual utility bill savings by \$103,303 to \$994,291.

Other benefits of home energy efficiency upgrades that are not quantified in this analysis include natural gas and propane savings and improved home comfort, indoor air quality, and associated health impacts. Furthermore, the report recommendations may help improve participation in energy efficiency programs beyond whole-house retrofit and HVAC programs, the focus of this analysis, resulting in additional energy savings. Finally, some recommendations may help stimulate increased participation among non-Latino households, resulting in additional energy savings.

# CHAPTER 1:

## Why This Research Is Important

---

California, recognizing the significant impacts of climate change on its people, resources, and economy, has become a world leader in addressing these effects. Through ambitious energy and climate goals, policies, and programs, such as those embodied in Senate Bill 350 (De León, Chapter 547, Statutes of 2015) and Assembly Bill 758 (Skinner, Chapter 470, Statutes of 2009), the state's goal is to reduce greenhouse gas emissions to 40 percent below 1990 levels by 2030. This goal is to be achieved, in part, by doubling energy efficiency savings in existing buildings, including homes.

Meeting this energy efficiency target means a large proportion of California's 11 million households need to take steps to improve the efficiency of their homes. The good news is that there are many ways for households to be more efficient – from replacing light bulbs to whole-house efficiency upgrades – and many reasons to invest in it. In addition to reducing bills and climate change effects, adding insulation or high-efficiency windows can significantly improve comfort and reduce noise. Improved air sealing and ventilation can improve indoor air quality. Furthermore, new windows and modern appliances can improve aesthetics and add value to the home.

Yet residents often face challenges in making efficiency improvements. Making efficiency upgrades can be expensive, disrupt busy lives, and involve a daunting set of decisions.

For decades, California's utilities, local governments, and other stakeholders have sought to engage residents in energy efficiency activities by implementing programs that help them understand the benefits and overcome their barriers to action. These programs typically involve a marketing, education, and outreach component, as well as a rebate, subsidized installation and/or financing product to help homeowners overcome the barrier of the upfront investment. The energy savings associated with these programs play a significant role in measuring progress toward state goals.

Historically, energy efficiency program participation and overall market potential estimates have been driven by cost-effectiveness. Yet cost-effectiveness calculations do not capture the multitude of social and cultural factors influencing individual decisions.

Furthermore, recent research shows that many programs geared toward the general population (i.e., not income-qualified), particularly whole-house retrofit programs, have disproportionately served high-income, college-educated, and white audiences (Frank and Nowak, 2016). This conclusion suggests that new approaches are needed to effectively serve California's many ethnic, racial, and cultural groups. In addition, the state is committed to environmental equity and to delivering the benefits of clean energy to all its people.

In 2014, to address these gaps, the California Energy Commission funded research to better understand how social, cultural, and behavioral factors affect adoption of energy efficiency. This report describes the results of one of the studies funded.

The research team initially considered three underserved groups: Hispanics and Latinos,<sup>1</sup> Asian Americans and African Americans. After the initial literature review, the team identified the Latino population, a large (39 percent) and growing part of California’s sociocultural landscape, as the target audience. Through market characterization, the team chose Fresno and San Diego Counties as the primary regions of focus.

This study takes an in-depth look at California’s Latino households, specifically those that own single-family homes, to explore:

- What they think, feel, and act regarding energy efficiency upgrades, including their financing preferences and use of contractors.
- What marketing and educational strategies will engage them.
- What program design strategies would address their priorities and needs.

The study, conducted over three years, included multiple methods, as outlined in Figure 1.

**Figure 1: Research Phases**



Source: Center for Sustainable Energy

This report summarizes the methods and findings of each research phase, provides 10 recommendations to help energy efficiency programs better serve Latino homeowners, and concludes with an estimate of the potential energy savings, cost savings, and greenhouse gas reductions that could result from better serving this audience. The team has posted online longer discussions of each research phase; one-page best-practices reference sheets for program implementers, contractors, auditors, and raters; and a recorded webinar of the team presenting the research at [www.energycenter.org/sociocultural](http://www.energycenter.org/sociocultural).

<sup>1</sup> The federal government defines “Hispanic or Latino” as a person of Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture or origin regardless of race (Humes, Jones, & Ramirez, 2011). For the sake of simplicity, the research team refers to this population as “Latino” throughout the remainder of this report.

# CHAPTER 2:

## Literature Review

---

The first phase of the research (January 2016) was a review of more than 60 academic, market, and program evaluation studies on three underserved ethnic groups in California: Latinos, Asian Americans, and African Americans. The review explored sociocultural characteristics of these groups, as well as effective messaging and communication strategies for reaching each group about energy efficiency topics and programs. This chapter presents a subset of the literature review findings most relevant to Latinos, the ultimate focus of the research. The full literature review can be accessed at [www.energycenter.org/sociocultural](http://www.energycenter.org/sociocultural).

### Select Findings

Unless otherwise cited, figures come from the American Community Survey (ACS) five-year estimates for 2010-2014 (U.S. Census Bureau).

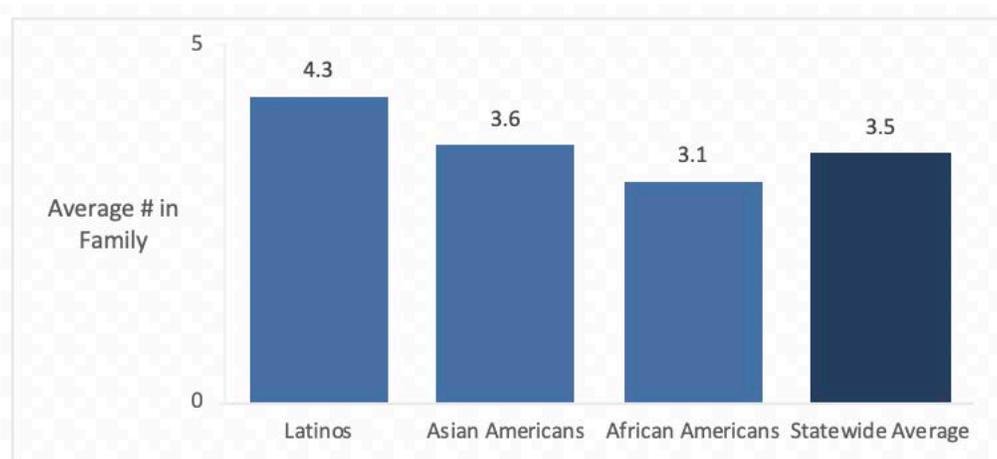
#### Demographic and Family Characteristics

Among the three groups, Latinos, at 39 percent, make up the largest portion of California's population followed by Asian Americans (15 percent) and African Americans (7 percent).

Young people are more prevalent in the Latino and African American populations in California than in the state's population as a whole. Children are particularly prevalent in the Latino population. People under the age of 18 live in nearly three-quarters (73 percent) of the Latino households in California. African American (57 percent) and Asian American (55 percent) households are much closer to the statewide average (56 percent) in this regard.

Consistent with the prevalence of children in Latino households, Latino families are, on average, larger than the other two groups and the statewide average (Figure 2).

**Figure 2: Average Family Size for Targeted Groups in California**



Source: Research Into Action, Inc. et al., 2016

## Immigration, Language Characteristics, and Acculturation

First-generation immigrants are more prevalent in Asian American communities in California than in Latino communities, with a majority (58 percent) of Asian Americans in the state born outside the United States relative to just over one-third (37 percent) of Latinos.

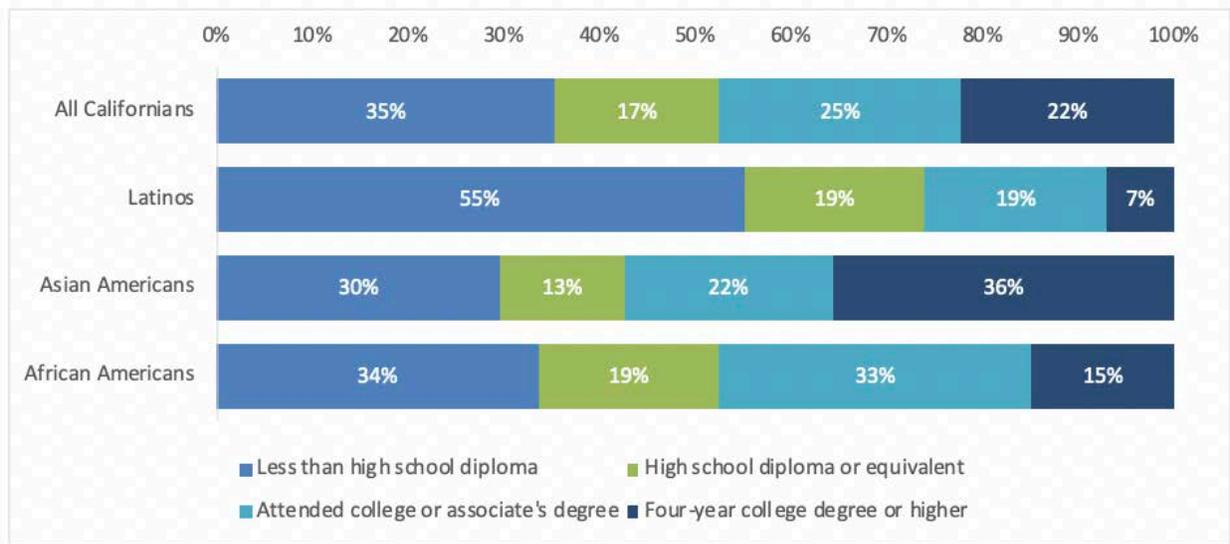
Large majorities of both Asian Americans (66 percent) and Latinos (68 percent) speak a language other than English in their homes. Notably, about half of both Asian and Latinos report that they speak English “well” or “very well” (52 percent and 50 percent, respectively).

Language preferences can be an indicator of a minority group member’s level of acculturation (Davis & Engel, 2011), an important metric explored in later research phases of this study. Acculturation is the degree to which members adapt to a majority culture, while maintaining sufficient cultural markers to retain a distinct cultural identity. At the same time, aspects of a minority culture are introduced into the majority culture. Acculturation will vary depending on the social and economic context of the locale in which immigrant groups make their new home, affecting their self-identity.

## Education and Income

Among the three groups, Asian Americans are the most likely to have postsecondary degrees (Figure 3). Latinos in California are considerably more likely than the population in general to have less than a high school diploma, but this may, in part, reflect the relative youth of the Latino population.

**Figure 3: Highest Level of Education Attained by Targeted Group Population Aged 3 and Older**



Source: Research Into Action, Inc. et al., 2016

Asian Americans, on average, earn the highest incomes among the three groups (Table 1) and are the only one of the three groups whose incomes is above the California average. Latinos have slightly higher incomes, on average, than African Americans but are, on average, closer to the poverty level, likely due to the prevalence of larger families in the Latino community.

**Table 1: Average Household Income and Income to Poverty Ratio of Targeted Groups in California**

Group	Average Household Income	Average Income to Poverty Ratio*
Asian Americans	\$106,451	329%
Latinos	\$63,067	219%
African Americans	\$62,044	246%
All Californians	\$86,211	288%

\* ACS calculates the income to poverty ratio by taking the household family income and dividing it by the poverty threshold. The poverty threshold is a deemed dollar amount the U.S. Census uses to determine whether a household is in poverty. The poverty threshold depends upon the number of people in a household. Typically, a household is determined to be in poverty if its ratio is below 100%.

Source: Research Into Action, Inc. et al., 2016

**Home Ownership and Housing Characteristics**

Asian Americans are the most likely of the three groups to own their homes and the only one of the three groups that is more likely than the California population as a whole to own their homes (Table 2).

**Table 2: Home Ownership by Target Group Members in California**

	African Americans	Asian Americans	Latinos	All Californians
Own	38%	61%	45%	55%
Rent	60%	37%	54%	44%
Other	1%	1%	1%	1%

Source: Research Into Action, Inc. et al., 2016

Besides having lower incomes on average, the literature suggests that mortgage lending requirements of large down payments and high credit scores have limited the ability of African Americans and Latinos to buy homes (Carr, Anacker, and Hernandez 2013; Becerra 2013). For example, the cultural tendency for Latino Americans to use cash rather than credit and a higher prevalence of self-employment for Latino Americans can make it difficult for Latino Americans to meet lending requirements based on credit scores and employment histories (Becerra 2013).

Given these challenges, African Americans and Latinos have had access to less attractive home financing options than members of other groups, resulting in higher interest rates and higher housing costs relative to house value (Bocian et al. 2011; Zillow 2014; Boehm, Thistle, and Schlottmann 2006; Cheng, Lin, and Liu 2015). Because of their higher housing costs and less attractive financing options, as well as higher rates of unemployment, Latino and African American households disproportionately lost their homes in the 2008-2009 mortgage crisis (Bocian et al. 2011; Rugh and Massey 2010).

Despite the challenges they face in obtaining financing to purchase homes, Latinos accounted for 56 percent of the net growth of homeownership between 2010 and 2013 (Becerra 2013). Latinos have expressed positive views of homeownership as a financial benefit, as a means to enable future decisions, and as a stable place to raise a family (ibid).

Demographers consider gross rents (including both the contract rent and utility costs) of 30 percent of a household’s income or higher to pose a moderate burden for renters, and gross rents of 50 percent or higher to pose a severe housing cost burden (Schwartz and Wilson 2007). Most Californians (57 percent) face at least a moderate housing cost burden, and Latinos (61 percent) and African Americans (63 percent) are somewhat more likely than average to face a burden. African Americans are more likely than average to face a severe housing cost burden.

African Americans are notably more likely to live in multifamily buildings (2-4 units or larger) than members of the other groups, or Californians in general (Table 3). Latinos are more likely than members of the other groups to live in mobile homes or trailers.

**Table 3: Dwelling Type by Target Group in California**

Type of Dwelling	African Americans	Asian Americans	Latinos	All Californians
Single-Family	62%	74%	70%	74%
<i>Detached</i>	54%	63%	60%	65%
<i>Attached</i>	7%	9%	6%	7%
<i>Mobile Home, Trailer, or Vehicle</i>	1%	1%	4%	3%
2-4 Units	11%	6%	9%	7%
5 or More Units	28%	20%	20%	18%

Source: Research Into Action, Inc. et al., 2016

There is relatively little variation between the groups in the age of their homes. Asian Americans tend to live in somewhat newer homes than members of the other groups, with 45 percent living in homes built since 1980, relative to 39 percent of all Californians. While there is little difference in home vintage between groups, there are differences in housing quality between minority groups and non-Latino whites. Both African and Latino Americans are more likely to live in homes that have subpar structural features (such as lack of toilets, plumbing, or electrical fittings, water leaks, or lack of heating), as non-Latino whites (Mundra and Sharma 2015; Lopez-Aqueres, Skaga and Kugler 2003).

### **Home Energy Use and Costs**

The three targeted groups are relatively consistent with statewide averages in their primary home heating fuels, although Latinos are considerably more likely than the other groups, and Californians in general, to live without a primary heating system (Table 4).

**Table 4: Proportion of Target Groups Using Primary Home Heating Fuels in California**

Primary Heating Fuel	African Americans	Asian Americans	Latinos	All Californians
Utility gas	67%	69%	62%	66%
Electricity	29%	26%	27%	25%
Bottled, tank, or LP gas	1%	2%	2%	3%
Other	1%	1%	1%	2%
No Fuel Used	2%	2%	8%	4%

Source: Research Into Action, Inc. et al., 2016

Across fuel types, Latino households, on average, spend the least amount on energy of the three targeted groups. Latino households and Asian American households both spend less on energy, on average, than a typical California household. African American households are consistent with statewide averages in terms of expenditures on energy use, with the exception that African American households spend less money on delivered fuels than the average household (Table 5).

**Table 5: Average Fuel Costs by Target Group in California**

Average Fuel Costs*	African Americans	Asian Americans	Latinos	All Californians
Electric (Monthly)	\$116	\$107	\$104	\$117
Gas (Monthly)	\$41	\$35	\$34	\$39
All Other Fuels (Annual)	\$15	\$18	\$13	\$25

\*Fuel costs are self-reported by ACS survey respondent.

Source: Research Into Action, Inc. et al., 2016

## Decision-Making: The Role of Women and Family

For all three target groups, women are highly involved in, or are the primary decision-makers for, matters concerning the home (Abbas, Rao and Wang 2014, Fitzgerald 2003, Stevenson and Plath 2002, 2006). Considerations of family and community also figure prominently in decision-making for these populations (Landale and Oropesa 2007, Gevorgyan 2010).

For both Latinos and Asian Americans, the role women play in household decision-making has grown (O’Guinn et al. 1987, Abbas, Rao, and Wang 2014). Latina mothers and wives tend to have primary responsibility for household management, including financial and familial matters (Becerra 2013; Alcance Media Group 2013; Stevenson and Plath 2006). According to a national real estate industry report, 86 percent of Latina women make many of the decisions in household spending, and many seek information and complete purchases online. According to one analysis, Latina women “are family oriented, bilingual, super connected, and are adopting and using all types of technology at a higher pace than non-Latino U.S. females” (Becerra 2013).

Family is an important consideration in decision-making for all three groups. Martinez (2010) found that Latinos' "motivation for activism often hinges on the real and perceived impacts on their children and families." In Asian American cultures, the family and social networks also influence motivations and decision-making, reflecting the collectivist nature of many of these cultures (Schneider et al. 2001, Gevorgyan 2010, Weber and Hsee 2000, Weber, Hsee, and Sokolowska 1998). For both Latino and Asian American families, these strong family ties can provide a safeguard that can, in turn, reduce the risks inherent in household decisions. Strong social and familial networks can provide help or resources in case a risk turns out poorly (Martinez 2010, Weber, Hsee, and Sokolowska 1998).

## **Reaching the Targeted Groups**

Through the concept of message framing, the literature provides insight into effective themes around which energy efficiency messages could be created for the target populations. Sources also provide information about the most promising message delivery strategies for reaching underrepresented populations.

## **Messaging Frames**

Multiple social science disciplines have studied the concept of framing: presenting an issue within a particular context, often with the intent of maximizing the relevance of that message to a given audience (Nisbet 2009). Like a picture frame, frames downplay certain aspects of a situation and highlight others. In this way, they shape the interpretation and understanding of events and issues, and this comprehension bears on motivation to engage in certain behaviors (Snow et al. 1986). Social movement scholars have paid substantial attention to message frames and how such frames incline an individual to act, as have psychologists and behavioral economists.

Relatively few publicly available studies have sought to identify the most effective metaphor or linguistic frames for presenting energy efficiency specifically to Latino, Asian American, and African American populations. Furthermore, while mentioned by contractors as an effective outreach tool, few publicly available studies have sought to measure the effectiveness of speaking the target's language, such as Spanish or Chinese, to sell energy efficiency projects. Existing literature does not allow for a comparison of the most effective frames for each group, but the available studies indicate three characteristics on which ethnic groups may differ that are relevant for framing energy efficiency messages:

- **Relationship with, and attitudes toward, nature and the environment:** Studies have found that Latinos often view a connection between people and the land and environment in which they live. As a result, Latinos may be receptive to messages that emphasize the protection of land, nature, and farmland, among other benefits (Gade 2013, Speiser and Krygsman 2014). While these messages may be effective for Latinos, one study found messages focused on being close to nature were least likely to resonate with African Americans (Speiser and Krygsman 2014).
- **Level of collectivism in culture and role of family:** Researchers have found that Asian Americans are most responsive to messaging frames that address the collectivist nature

of their culture, for example, emphasizing membership within a group, community relations, interdependence, information sharing, and many-to-many forms of communication like forums (Gevorgyan 2010). Consistent with these themes, Speiser and Krygsman (2014) suggest that messages on climate change targeting Asian Americans highlight that climate change solutions can benefit family well-being and that many viable climate change solutions exist. Latino audiences also may be receptive to messages focused on “working hard to achieve important goals for their children and families” (Muñiz and Rodriguez 2004).

- **Trust in various societal actors as messengers:** One study found that Latinos, Asian Americans, and African Americans were all most likely to trust scientists as messengers on climate change, but the proportion of each group that found scientists trustworthy ranged from 62 percent for Latino respondents to 79 percent for Asian American respondents (Speiser and Krygsman 2014). The groups also varied in their ratings of other types of messengers’ trustworthiness regarding climate change, with a majority (58 percent) of Latino respondents citing first responders as trustworthy, and a majority of African American respondents (57 percent) citing the president of the United States as trustworthy on climate change (ibid). In a focus group-based study on how low-income Latinos and African Americans view energy conservation and utility energy programs, Hall (1989) stressed the low levels of trust that both groups expressed with respect to their energy utilities. Furthermore, Hall notes, these groups did not trust people outside their peer group for information on energy conservation.

## **Message Delivery Strategies**

### **Mass Media Outreach**

Evaluations of Southern California Edison’s (SCE’s) Community Language Education and Outreach (CLEO) program have investigated the mass media outlets favored by the various target populations of the program. Chinese-American participants reported they would normally expect to find information pertaining to energy-efficient products and programs in newspapers (55 percent), radio (24 percent), and television (14 percent) (ASW Engineering Management Consultants, Inc. 2006). African Americans reported that they would prefer to learn about energy efficiency program offerings through television, mail, and the internet (McLain ID Consulting and KVDR Inc. 2010). When program administrators pursued media outlets targeting the Latino community as an outreach method, they found that advertisement costs in Latino media outlets were two to three times those of Asian media outlets (Kan et al. 2013).

### **Community-Based Organizations and Events**

Research suggests, and some efficiency programs have found, that outreach efforts leveraging community-based organizations (CBOs) and community events can be an effective way to reach minority populations who might have lower levels of trust in energy utilities, large institutions, or the government. For example, Fitzgerald (2003) notes that Latinos may be more likely to distrust and have limited experience with banks. An evaluation of SCE’s CLEO program found

that Latinos tend to be wary of unknown organizations and are wary of free items and offerings because they expect there to be hidden back-end costs (Kan et al. 2013).

To overcome these challenges, programs and other entities seeking to reach minority communities may benefit from establishing a presence in the community by partnering with grassroots and community-based organizations. Based on focus groups with Latinos and African Americans, Hall (1989) notes both groups trust local neighborhood or community groups once they have established relationships with these groups. Furthermore, based on research on financial education programs, Muñiz and Rodriguez (2004) suggest implementing financial education for Latinos through community-based organizations. These organizations can present the financial products in a way that will be relevant to the community.

In addition to forming partnerships with CBOs, participating in community events can be an effective way to present efficiency program information to minority communities. For example, local youth sports leagues draw large numbers of community members and are a good avenue for event-based marketing. Through sponsorship or providing tangible resources like uniforms, an organization can gain visibility and credibility with the target group (Stevenson and Plath 2006). By marketing at existing community events, efficiency programs can reach large numbers of community members without the added difficulty of organizing and drawing people to a program-specific event (Research Into Action 2015).

Participation in certain types of events may be particularly effective in reaching specific minority groups. For example, Paustian (2001) suggests financial institutions invest in education and the organizations and events that support it because Latinos in particular care about education and may view favorably financial groups investing in education.

# CHAPTER 3:

## Market Characterization

---

After the literature review, the project team chose to focus on Latino homeowners for the remainder of the research. This population was selected for the following reasons.

- Latinos represent 39 percent of California’s population; this percentage is expected to increase substantially.
- Latinos accounted for 56 percent of the net growth of homeownership between 2010 and 2013.
- The Latino population’s geographic dispersion and language preferences (primarily English or Spanish) facilitated the survey and field research.

The next step (January - February 2016) was to select two geographic markets to serve as the focus of the research. The goal was to identify regions with large, dynamic residential energy efficiency markets and large Latino populations. The research team used records of diagnostic tests required at time of HVAC replacements (known as CF1R-ALTs and recorded by CalCERTS, a Home Energy Rating System provider) as a proxy for energy efficiency activity. Preference was given to areas that together have a demographic and climatic composition that would be most useful for extrapolating results to the state at large, including a large coastal metropolitan area and a large inland metropolitan area. Given the EPIC funding requirement to benefit electric investor-owned utility (IOU) customers, these territories were prioritized over counties primarily served by publicly owned utilities (POUs). Additional preference was given to areas where the project team has stakeholder relationships, which would facilitate the field research conducted near the end of the study. Table 6 provides a summary of the analysis of major metropolitan regions in the state.

**Table 6: Characteristics of 10 Counties with the Most CF1R-ALT Records in CalCERTS Registry**

County	CF1R-ALT Count	Percentage of Total Data	% Occupied Homes with Latino Householder	% Households Who Speak Spanish at Home	Primary Climate	Metro Utility Service
Sacramento	44,133	17%	16%	13%	Inland	POU
Los Angeles	36,482	14%	36%	34%	Coastal	POU
Riverside	25,418	10%	34%	30%	Inland	POU
Orange	13,665	5%	23%	22%	Coastal	IOU
San Bernardino	13,500	5%	39%	33%	Inland	IOU
Placer	11,145	4%	9%	7%	Inland	IOU
Contra Costa	10,788	4%	17%	15%	Inland	IOU

Fresno	9,778	4%	41%	32%	Inland	IOU
San Diego	8,519	3%	23%	22%	Coastal	IOU
San Joaquin	8,162	3%	31%	25%	Inland	IOU

Source: Center for Sustainable Energy, 2016b

Based on the criteria described above, San Diego and Fresno Counties were chosen as the coastal and inland areas of focus for the study.

# CHAPTER 4:

## Focus Groups

---

After selecting Fresno and San Diego Counties as the primary regions for the research, the research team conducted focus groups in March 2016 to explore qualitatively the sociocultural characteristics of Latino households that shape how they think about executing and financing home improvement projects, with a particular focus on energy and energy efficiency. Following is a subset of the full focus group report, which can be accessed at [www.energycenter.org/sociocultural](http://www.energycenter.org/sociocultural).

### Research Objectives

The following research questions were explored.

- What motivates focus group participants to make home improvements?
- How do focus group participants select and work with contractors?
- What role does energy efficiency play in focus group participants' thinking about home improvements?
- What messages resonate with customers about energy efficiency improvements?
- How receptive are focus group participants to home energy audits and programs, including their experience with such programs?
- What are focus group participants' attitudes toward financing for energy efficiency upgrades?

### Methods

Four focus groups were conducted in March 2016: two each in Fresno and San Diego. In each location, one focus group included participants who self-identified as Latino and were fluent Spanish speakers or felt comfortable speaking only in Spanish, if necessary; the other group included participants who self-identified as non-Latino and were comfortable speaking in English. All focus group participants had experience hiring someone from outside the household to complete a large home improvement project. Focus group participants were not chosen on any statistical basis, and, therefore, no statistical inferences should be drawn from the results of the discussion.

### Participant Demographics

Because household characteristics can relate to home improvement decisions, the research team collected information on the number of people living in the household and length of time spent in the current home from focus group participants. Average family size varied little among the groups, although the Fresno Latino group had some larger families, which increased their average family size to 4.1 people (Table 7).

**Table 7: Average Household Size and Range of Focus Group Participants**

	<b>Fresno</b>	<b>San Diego</b>
Non-Latino	3.1 (2 to 6)	3.4 (2 to 5)
Latino	4.1 (2 to 7)	3.3 (2 to 5)

N=10 per focus group.

Source: Research Into Action, Inc. and Center for Sustainable Energy, 2016

The length of time that focus group participants had lived in their homes varied dramatically by region, but not by ethnic group. Those in San Diego had been in their homes more than twice as long, on average, as participants in Fresno (Table 8).

**Table 8: Average Number of Years in Home of Focus Group Participants**

	<b>Fresno</b>	<b>San Diego</b>
Non-Latino	5.9*	19.7
Latino	7.5	16.8

N=10 per focus group, except the Fresno non-Latino group where n=11

Source: Research Into Action, Inc. and Center for Sustainable Energy, 2016

## Select Findings

The following are key findings from the four focus groups.

- Both groups reported that improving the appearance of their home and making needed repairs were their top motivations to do home renovations. However, family needs and circumstances were a more important motive for Latinos than for non-Latinos. Home comfort motivated Fresno participants more than San Diego participants.
- Participants across groups and regions linked energy-efficient windows and insulation to improved comfort in the home and to saving money on electric bills.
- Participants used similar criteria of project safety, size, and cost to decide if they would take on a project themselves or hire a professional. Latinos had considerable experience hiring professional contractors and had a sophisticated understanding of credentials. Latinos reported using referrals from friends and family to locate contractors, while non-Latinos relied more on online sources such as Angie's List and Facebook.
- All participants recommended messages highlighting how energy efficiency leads to demonstrated cost savings as an effective way to promote energy efficiency.
- Latinos preferred to receive energy efficiency information via television and appreciated a message that provides helpful information from a trusted source (like a .org or .gov website).
- Latinos identified with images of Latino models in advertisements presented during the focus groups; on the other hand, they reacted negatively toward one ad that showed an image of a couple in front of a large, expensive-looking home.
- Compared to non-Latinos, Latinos demonstrated greater awareness and experience with utility energy and water programs. Despite their engagement, they recommended more utility program outreach.

- Latinos reported challenges in obtaining loans, whereas non-Latinos did not mention difficulty accessing credit. All groups were averse to high interest rates, preferring loan packages with terms combining short timelines with low interest rates.

# CHAPTER 5:

## Semistructured Interviews

---

Semistructured interviews with contractors were conducted concurrently with the focus groups (March and April 2016). The goal of the interviews was to understand contractors' views on how Latino households think about energy and energy efficiency in planning, executing, and financing home improvements. Following is a subset of the full interview report, which can be accessed at [www.energycenter.org/sociocultural](http://www.energycenter.org/sociocultural).

### Research Objectives

The following research questions were explored.

- How do customers think about home upgrades overall?
- Are the projects done for Latino households different than those for non-Latino households?
- Is the upgrade process different for non-Latino versus Latino households?
- How does energy fit into the entire process of home improvement from the perspective of the contractor? From the perspective of the household, according to the contractor? How does this differ for Latino versus non-Latino households?
- For Latino households, how is energy efficiency understood, and how, if at all, does this contrast with “conservation” as a more behavioral mode of saving energy? With conventional notions of energy efficiency investments?
- How does contractor home improvement and project marketing differ for Latino versus non-Latino households? What about for energy aspects of these improvements?
- What are the most effective methods that contractors use to sell projects?
- How important is it for the contractor to be perceived as having Latino/Latino identity and/or to have other viable links to the Latino community, in fostering trust and influence with Latino/Latino households?

### Methods

Seven contractors/contracting allies working with single-family owner-occupied homes in San Diego County, Fresno County, and Kern County were interviewed for this task. Contractors were recruited primarily from the network of contractors who work with or are otherwise known by the Center for Sustainable Energy, though several were obtained by other methods (in particular, cold calls and referrals from other interviewees). The selection of interviewees was designed to cover a range of different-sized firms and business models, to focus on contractors who do projects for which energy implications are generally high, and to include experts who have a broad understanding of the market, particularly for Latino households. Table 9 summarizes basic characteristics of the seven experts interviewed.

**Table 9: Characteristics of the Contractors Interviewed**

<b>Specialty</b>	<b>Geography</b>	<b>Firm Type</b>
Green design/build; whole house retrofits	San Diego County	Single-person firm
Air conditioning, heating, solar	San Diego County	Larger business
Home performance	San Diego County	Small business
Air conditioning	Fresno County	Family-owned firm
Air conditioning, heating	Fresno County	Larger business
Air conditioning	Kern County	Mid-sized business
HERS rater	Fresno County	Single-person firm

Source: Moezzi, 2016

Interviews were conducted by phone in March and April 2016. Each lasted from about 30 minutes to more than one hour. To reduce possible tension, no audio recordings were made. Experts were offered a \$100 incentive in gratitude for their time and insights. Though few were interested in claiming this incentive, most seemed grateful that it was offered. The general mode of the interviews was social scientific and conversational, in keeping with the objectives of the research project and the exploratory nature.

By nature, the interviews were directed to each contractor's experience with his or her own clientele. Thus, they obviously reflect particular customer bases, rather than Latino or non-Latino homeowners in general. Furthermore, contractors can speak primarily about households that pursue home improvements, and then only to households that use contractors rather than do-it-yourself (DIY) for these improvements. So, the DIY homeowners are relatively missing from the mix represented by interview results.

## **Select Findings**

### **Themes and Stereotypes**

There are various themes and stereotypes about California Latinos and Latino households that are perpetuated widely, if not believed. Many are reported in the academic and grey literature, and others are popularized stereotypes, often in performances, e.g., television programs, movies, or comedy sketches, that may portray historical biases. During conversations with contractors, these themes often served as launching points or resonant subtext, accompanied by comments such as: "That used to be true, but probably not so much anymore," or "There is no difference between Latinos and non-Latinos, they are all people, the only difference is the houses," or "Yes, absolutely, that's the way it works in my experience."

This section lists some of the common themes and stereotypes that arose in the interviews, whether the interviewee appeared to concur or appeared to disagree. Each theme or stereotype is listed in bold, along with a summary of viewpoints expressed in the interviews. The stereotypes listed are not intended as statements about what is true but rather statements about popular ideas of what may be true.

### Community and Culture

- **There is a “Latino bubble.”** Latinos prefer to buy from other Latinos, socialize with other Latinos, and may rely more on informal networks within their community. This theme was strongly suggested by some experts, but rejected by others.
- **Latinos tend to be more community-oriented and family-oriented than non-Latino whites.** Several interviewees endorsed the theme that Latinos put special emphasis on family; references to community-orientation came up primarily when speaking about locales that were densely populated by Latinos, whether a specific street or an entire town.
- **Latino households rely much more heavily on word of mouth.** In general, contracting businesses may rely heavily on referrals, but the (positive) importance of word of mouth among Latinos was noted and valued by several contractors.
- **Latinos are loyal customers.** While it may take a while to build trust, once a good relationship is established, Latinos are usually loyal customers. Some interviewees mentioned loyalty; for others, there was an implication that cost-sensitivity or previously established networks (such as friends and acquaintances) made this difficult.
- **Americanization, acculturation matters.** The further the generation away from the initial immigrant, the more American the person will be. Most interviewees seemed to see this as a nuanced issue, where the level of acculturation would vary by topic, e.g., nth generation Latinos might be more likely to have “American” levels and standards of comfort (as variable as those may be), but still be relatively uninterested in credit. As at least one contractor pointed out, it’s not quite a matter of becoming less Latino, but rather an evolving Latino identity made in the context of the United States with its own uniqueness.
- **Preference to speak in Spanish.** Contractors who spoke Spanish or who had developed a large Spanish-speaking staff thought that their ability to serve in Spanish was very important, as was advertising on Spanish radio or television programs. There was often an implication that speaking Spanish was not just about literal communication but about signaling cultural understanding, caring about Latinos, and making customers comfortable.
- **Female vs. male in household decision making.** Nobody discussed this directly, but there was an interesting pattern in which contractors seemed to give examples where Latina-headed households were particularly “ahead of the game,” in particular, dogged in pursuing whole-house efficiency upgrades, and strong in convincing neighbors to pursue upgrades with the contractor.

## Housing Conditions and Practices

- **Latinos, particularly low-income Latinos, live in old houses and often in bad houses with poor air quality and low levels of comfort.** One of the clearest messages of the interviews was that air-conditioning costs and low summer comfort were major problems, especially for lower-income (Latino and non-Latino) households in the Central Valley. Households might tolerate either high bills or high levels of discomfort for a while, or cool primarily by other means, but then eventually call the contractor in distress. One contractor described a variety of ways in which households cooled without central air conditioning, similar to those noted in Hungerford (2003). Many use evaporative cooling, which is inexpensive, but works poorly when temperatures are about 95°F or when humidity is high. Others use a combination of box fans and spray bottles, constituting sort of personal makeshift evaporative cooling system. As an alternative, households may use a series of window units or portable air conditioners, a scalable solution where breakdowns are not unmanageably expensive to repair or replace. Exceptions to this theme were mentioned as well (e.g., a very wealthy second- or third-generation Latino household that was primarily Spanish-speaking).
- **Latino households have lower energy use relative to other households and are skilled at and attentive to conservation.** Several contractors mentioned this, one pointing especially to cases where members of the households grew up in poorer areas of Mexico, e.g., without reliable electricity or no electricity at all. Sometimes the explanation offered for this relatively low energy use was the cost of the utility bill, sometimes largely biographical, and other times a matter of the characteristics of the house (e.g., designed to stay relatively cool).
- **Latinos prefer do-it-yourself.** In general, the opinion seemed to be that this stereotype was “sort of” true, though counterexamples were offered, e.g., “I know Latino households that don’t own a screwdriver.”
- **Latino households tend to repair when possible and avoid investing in higher levels of home improvement.** Overall, the impression among interviewees was that the tendency to repair rather than replace was largely a matter of income.

## Financing

- **Latinos pay in cash and don't like or can't qualify for credit:** Interviewees knew this stereotype well. Overall, the impression was that low income and lack of community experience in accessing credit were of substantial consequence to what Latino households did, or did not, do with respect to home improvement.

# CHAPTER 6:

## Survey

---

The next phase of the research was a mixed-mode survey of Latino and non-Latino homeowners in Fresno and San Diego Counties, conducted in summer 2016. The survey enabled a quantitative analysis of the themes that emerged during the focus groups and surveys. The following is a subset of the full survey report, which can be accessed at [www.energycenter.org/sociocultural](http://www.energycenter.org/sociocultural).

### Research Objectives

The survey was designed to answer the following research questions.

- What types of home improvements have been completed? How many of these were done with a contractor vs. do-it-yourself (DIY)?
- What motivates homeowners to make home improvement projects? How do these motivations differ for energy efficiency-related projects, or for discretionary/planned vs. emergency repair or “break-fix” projects?
- What are the barriers preventing homeowners from completing home improvement projects?
- How do homeowners find contractors? What qualities are most important in contractor selection?
- What are homeowners’ expectations for thermal comfort? How does this affect home improvement choices?
- How do homeowners finance projects? What are their attitudes toward financing? Do they have different strategies for financing discretionary vs. break-fix projects?
- What are the family/gender dynamics associated with making home upgrade decisions? Who makes the decision?
- How do these answers vary by Latino vs. non-Latino identification, generational status, level of acculturation, politics, geography, and other demographic/home characteristic variables?

### Methods

The San Diego County and Fresno County assessors’ databases were used to derive the sampling frame. First, single-family parcels were selected, and properties held in trusts or owned by management companies were excluded. Next, surnames were filtered to include only those names for which at least 75 percent of American Community Survey respondents self-identified as Hispanic/Latino (U.S. Census Bureau, 2000). The resulting sampling frame included 77,721 San Diego County homeowners and 60,358 Fresno County homeowners. The Social and Economic Sciences Research Center at Washington State University (WSU-SESRC), hired to administer the survey, then randomly selected 5.05 percent of each census tract to achieve the final sample of 6,661 homeowners, including 2,954 in Fresno County and 3,707 in San Diego

County. This sample size was selected with the intention of achieving 770 responses at a 95% confidence level.

Using the Tailored Design Method (TDM)<sup>2</sup> to achieve maximum response rates, WSU-SESRC mailed a series of five invitations (presented in both English and Spanish) to recipients (Table 10). Each round of invitations included a Uniform Resource Locator (URL) and unique access code to take the survey online in either English or Spanish. Two invitation rounds included a hard copy of the survey in English and Spanish. Two rounds included a \$1 bill inside each envelope as a gesture of good will for taking the survey. Adults who lived at the address full time and were involved with making decisions about major home improvements at the residence were invited to take the survey. WSU-SESRC administered the survey between June 17, 2016, and August 16, 2016.

**Table 10: Distribution of Surveys**

<b>Mailing</b>	<b>Approximate Arrival Date</b>	<b>Hard Copy Provided?</b>	<b>\$1 Incentive Included?</b>
1	June 20, 2016	No	Yes
2	June 30, 2016	No	No
3	July 12, 2016	Yes	Yes
4	July 19, 2016	No	No
5	August 1, 2016	Yes	No

Source: Center for Sustainable Energy et al., 2017

WSU-SESRC conducted data entry of responses from the paper surveys. Open-ended answers were entered verbatim; for surveys completed in Spanish, both the Spanish answer and an English translation were entered.

---

<sup>2</sup> “The TDM was formulated as an extension of social exchange theory, a sociological theory used to explain why individuals are motivated to engage in certain social behaviors and not others. Applied to surveys it emphasized writing questionnaires that included interesting questions that respondents would see as useful and easy to answer. It also emphasized providing explanations of how answering the survey would be useful to others, personalized correspondence (a significant challenge to the printing technologies of that time), and several coordinated contacts. Emphasis was also placed on establishing the legitimacy of the survey by providing contact information and creating trust that the survey results would be useful when the survey was completed.” (Dillman, 1978)

## Response Rate

The survey achieved 697 completes and partial completes, representing an 11.7 percent response rate from all deliverable addresses. Of the 697 total respondents, Latino or Non-Latino status could be determined for 620. Of these, 70 percent identified as Latino (Table 11).

**Table 11: Survey Respondents by Ethnicity Category and Geography**

	<b>Fresno</b>	<b>San Diego</b>	<b>Total</b>
Latino	34.8%	35.2%	70.0%
Non-Latino	4.3%	14.6%	18.9%
Unknown	3.9%	7.2%	11.0%
Total	43.0%	57.0%	100%

N=697

Source: Center for Sustainable Energy et al., 2017

## Select Findings

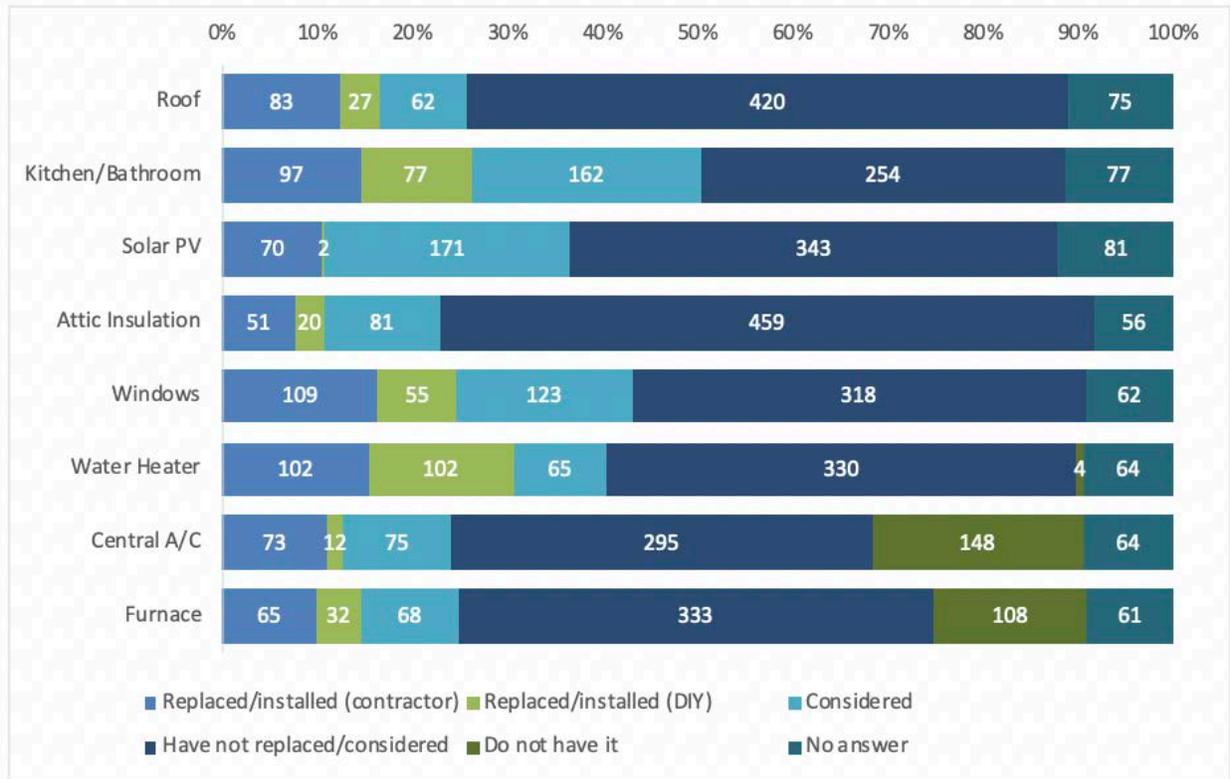
### Home Improvements and Motivations

In a series of eight questions, respondents were asked about home improvement projects. They were asked: *In the last 5 years, have you...*

- Replaced or seriously considered replacing a FURNACE in your home?
- Replaced or seriously considered replacing a CENTRAL AIR CONDITIONER in your home?
- Replaced or seriously considered replacing a WATER HEATER in your home?
- Replaced/upgraded or seriously considered replacing/upgrading WINDOWS in your home?
- Installed or seriously considered installing ATTIC INSULATION in your home?
- Installed or seriously considered installing a SOLAR ELECTRIC SYSTEM for your home?
- Remodeled or seriously considered remodeling your KITCHEN or BATHROOM?
- Replaced or seriously considered replacing the ROOF of your home?

Of the eight home improvement project types, water heater replacements and kitchen/bathroom remodels were most commonly reported to have been completed within the past five years (Figure 4). Installations of attic insulation, a furnace, and a solar electric system were the least common projects.

**Figure 4: Home Improvement Projects Completed or Considered**



N=667

Source: Center for Sustainable Energy et al., 2017

The results revealed a variety of primary motivations by project type. The strongest motivator for installing solar PV was saving money on utility bills (Table 12). Close to half (42 percent) of those who had replaced or considered replacing a water heater were primarily motivated by an emergency situation of a nonfunctioning unit, whereas fewer than 20 percent of those who had replaced or considered replacing a furnace or central air conditioner were motivated primarily by an emergency break-fix situation.

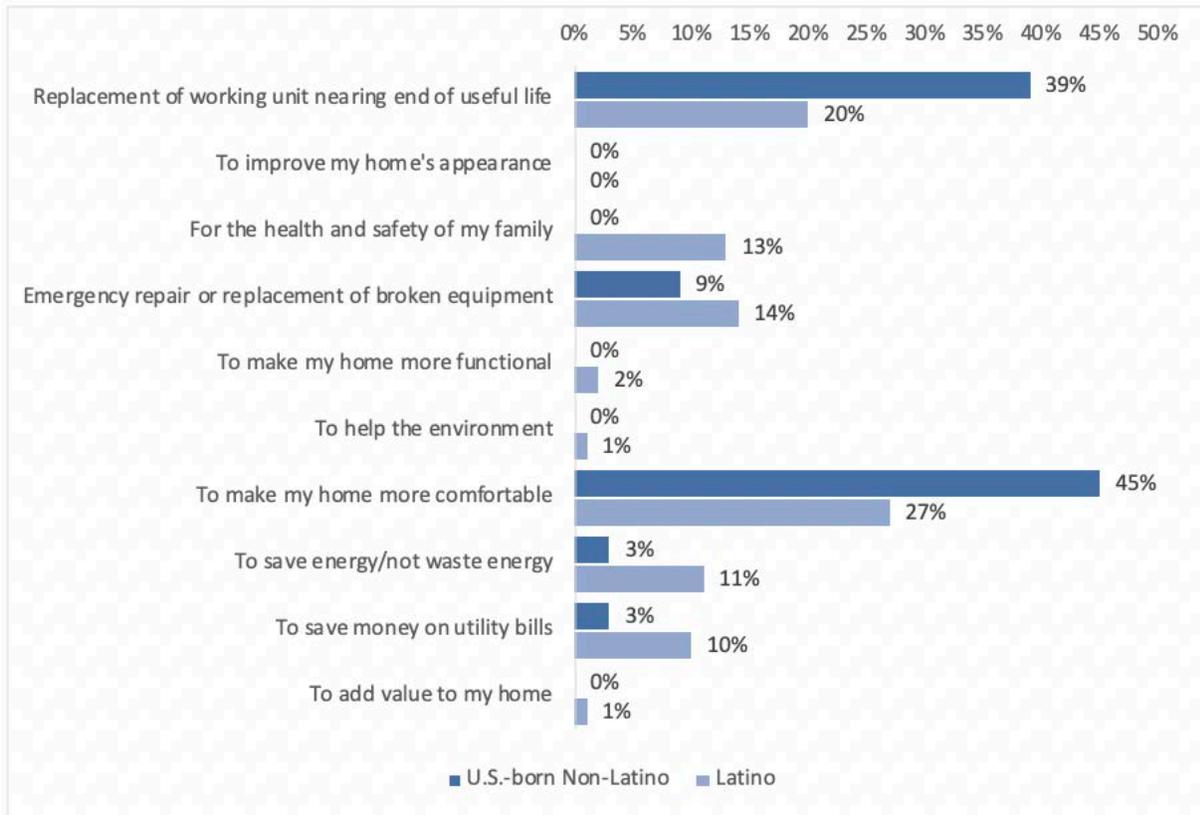
**Table 12: Primary Motivations Among Respondents Who Had Completed or Considered Projects**

	Furnace (N=177)	Central A/C (N=167)	Water Heater (N=272)	Windows (N=288)	Attic Insulation (N=148)	Solar (N=245)	Kitchen/ Bathroom (N=342)	Roof (N=186)
To add value to my home	1%	1%	0%	5%	1%	2%	12%	4%
To save money on utility bills	14%	8%	7%	24%	28%	68%	2%	3%
To save energy/not waste energy	14%	10%	9%	25%	32%	21%	1%	2%
To make my home more comfortable	18%	33%	3%	15%	27%	1%	17%	4%
To help the environment	1%	1%	1%	0%	1%	7%	0%	1%
To make my home more functional	3%	2%	4%	6%	3%	0%	26%	2%
Emergency repair or replacement of broken equipment	16%	13%	42%	7%	0%	0%	6%	14%
For the health and safety of my family	14%	10%	5%	8%	8%	2%	5%	6%
To improve my home's appearance	1%	0%	0%	10%	0%	0%	32%	8%
Replacement of working unit nearing end of useful life	20%	23%	29%	0%	0%	0%	0%	58%

Source: Center for Sustainable Energy et al., 2017

Primary motivations among project types did not differ with statistical significance between ethnic groups in most cases. One exception was for air conditioner replacements. While improving comfort was the number one motivation overall and the largest primary motivation for Latinos, replacing a working unit near the end of the lifespan was the most cited primary motivation for non-Latinos. Latinos were also more likely to be motivated primarily by health and safety concerns or the desire to save energy more than non-Latinos (Figure 5).

**Figure 5: Primary Motivations to Complete or Consider Central A/C Upgrades**



N=152

Source: Center for Sustainable Energy et al., 2017

### Hiring Contractors

The survey asked respondents a series of questions about how they used contractors for home improvements. Foreign-born Latinos were less likely than U.S.-born Latinos to have ever hired a contractor; U.S.-born Latinos were in turn less likely than U.S.-born non-Latinos (Table 13). When examined by acculturation levels (measured by language preferences for conducting various tasks), the research team finds that highly-acculturated Latinos were more likely to have hired a contractor than those with low acculturation scores (Table 14).

**Table 13: Percentage of Respondents Ever Hiring a Contractor for Home Improvements/Repairs**

Ethnicity Category	Percentage
Foreign-born Latino	51%
U.S.-born Latino	63%
U.S.-born Non-Latino	82%

N=564

Source: Center for Sustainable Energy et al., 2017

**Table 14: Percentage of Latino Respondents, by Acculturation Level, Ever Hiring a Contractor for Home Improvements/Repairs**

Level of Acculturation	Percentage Among Latino Respondents
Low acculturation	48%
High acculturation	63%

N=432

Source: Center for Sustainable Energy et al., 2017

Those who said that they had hired a contractor to do home improvement or repairs were queried about how they looked for contractors in the past. The most popular method used to look for a contractor for all ethnicity groups was asking for a recommendation or referral from family, friend, or coworker (Table 15). U.S.-born non-Latino respondents were more likely than Latino respondents to look at online reviews/ratings when searching for a contractor.

**Table 15: Methods Used to Look for a Contractor**

	Foreign-Born Latino	U.S.-Born Latino	U.S.-Born Non-Latino	p-value	Summary Comment
<b>Asked for a recommendation or referral from a friend, family member, coworker, etc.?</b>	83%	87%	90%	0.45	Very popular across all ethnicity categories
<b>Look at online reviews/ratings (such as Yelp, Angie's List, BBB)?</b>	42%	45%	60%	0.04*	Common, especially among U.S.-born non-Latinos
<b>Respond to direct contractor marketing (such as door-to-door sales, mailers, phone solicitations)?</b>	30%	22%	17%	0.19	Fairly common among foreign-born Latinos
<b>Look at the yellow pages?</b>	16%	27%	20%	0.15	Surprisingly high levels; least common among foreign-born Latinos
<b>Post a referral request to a social media group or network (such as Facebook, Nextdoor, listserv)?</b>	9%	10%	16%	0.35	Not a common approach for any group
<b>Look at contractor lists provided on the utility website?</b>	3%	15%	14%	0.04*	Rarely reported among foreign-born Latinos

Note: N=365; differences that are statistically significant according to a  $\chi^2$  test at  $p < 0.10$  are indicated by an \* in p-value column

Source: Center for Sustainable Energy et al., 2017

All respondents, whether or not they had hired a contractor, were asked about how much importance they placed on each of 11 factors. When evaluating which contractor to hire, professionalism of the contractor/staff was the most likely attribute to be called “extremely important” for each ethnic group (Table 16). Licensed/bonded/workman’s compensation insurance was the second or third most important attribute for each ethnic group, although U.S.-born non-Latinos were significantly more likely (60 percent) to rate it as extremely important than either U.S.-born Latinos (48 percent) or foreign-born Latinos (39 percent).

**Table 16: Percentage Choosing "Extremely Important" for Contractor Selection Criteria**

Criteria	Foreign-Born Latino	U.S.-Born Latino	U.S.-Born Non-Latino	p-value
Low price	<b>33%</b>	22%	18%	0.01*
Licensed/bonded/workman’s compensation insurance	39%	48%	<b>60%</b>	0.01*
Recommended by personal contact	26%	32%	29%	0.58
High rating/positive review online	22%	27%	31%	0.26
Offers warranties	35%	36%	33%	0.85
Able to conduct business in my preferred language	37%	39%	45%	0.38
Fast estimated time to complete project	28%	32%	<b>46%</b>	0.01
Professional, clear and detailed proposal	25%	26%	23%	0.84
Depth of knowledge and experience	45%	48%	50%	0.77
Professionalism of the contractor/staff (e.g., appearance, responsiveness to requests)	58%	61%	70%	0.15

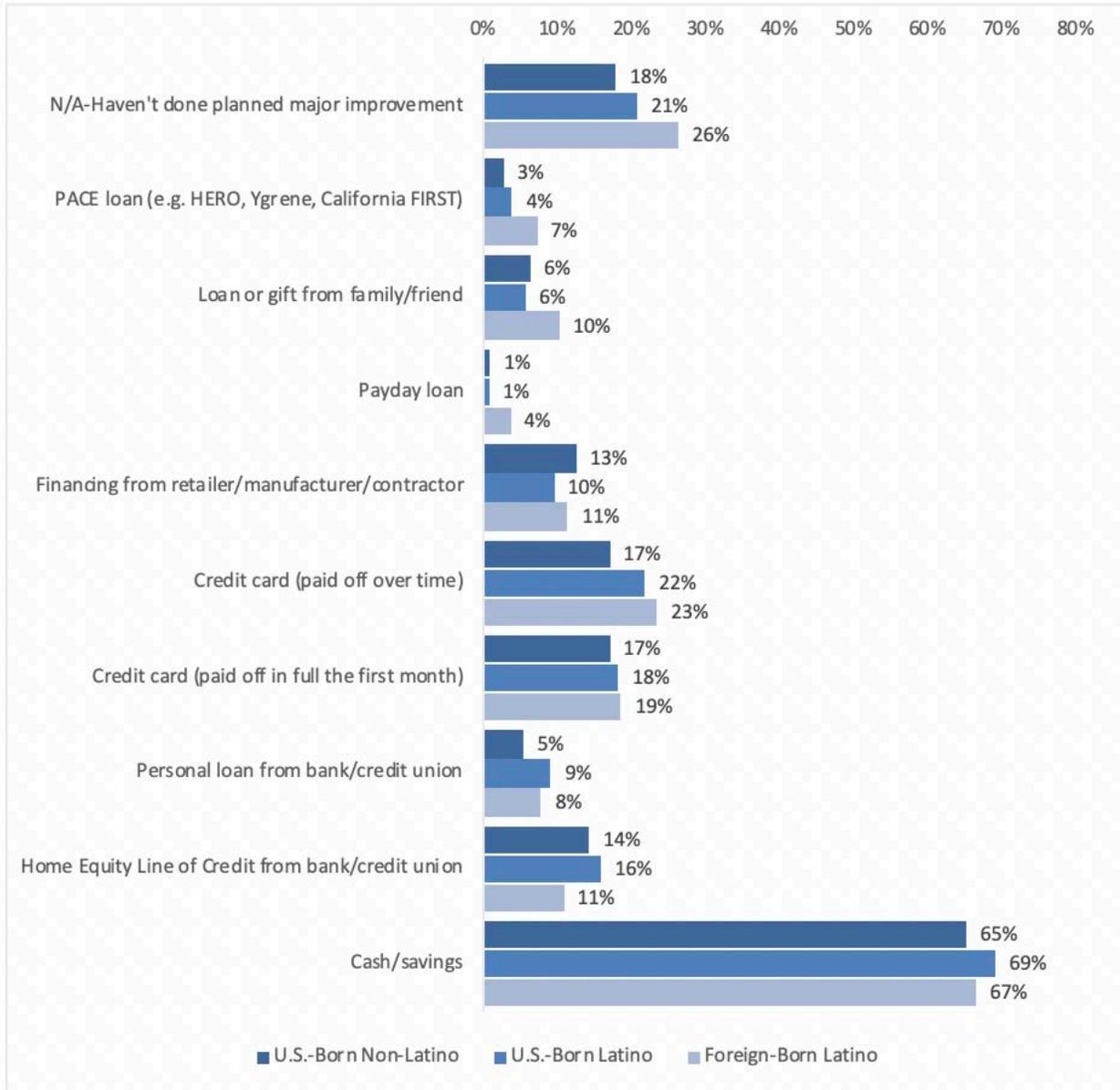
Note: For cases where differences are statistically significant at  $p < 0.10$ , entries in bold indicate the highest percentage for the given criteria (row).

Source: Center for Sustainable Energy et al., 2017

## Financing

When respondents were asked how they had paid for their most recent planned home improvement, as well as how they had paid for their most recent emergency home repair, funding mechanisms differed as shown in Figures 6 and 7. Few differences in funding sources surfaced across the groups. After cash/savings, credit cards (paid off over time) were the most commonly cited way to fund home repair projects across all ethnic groups.

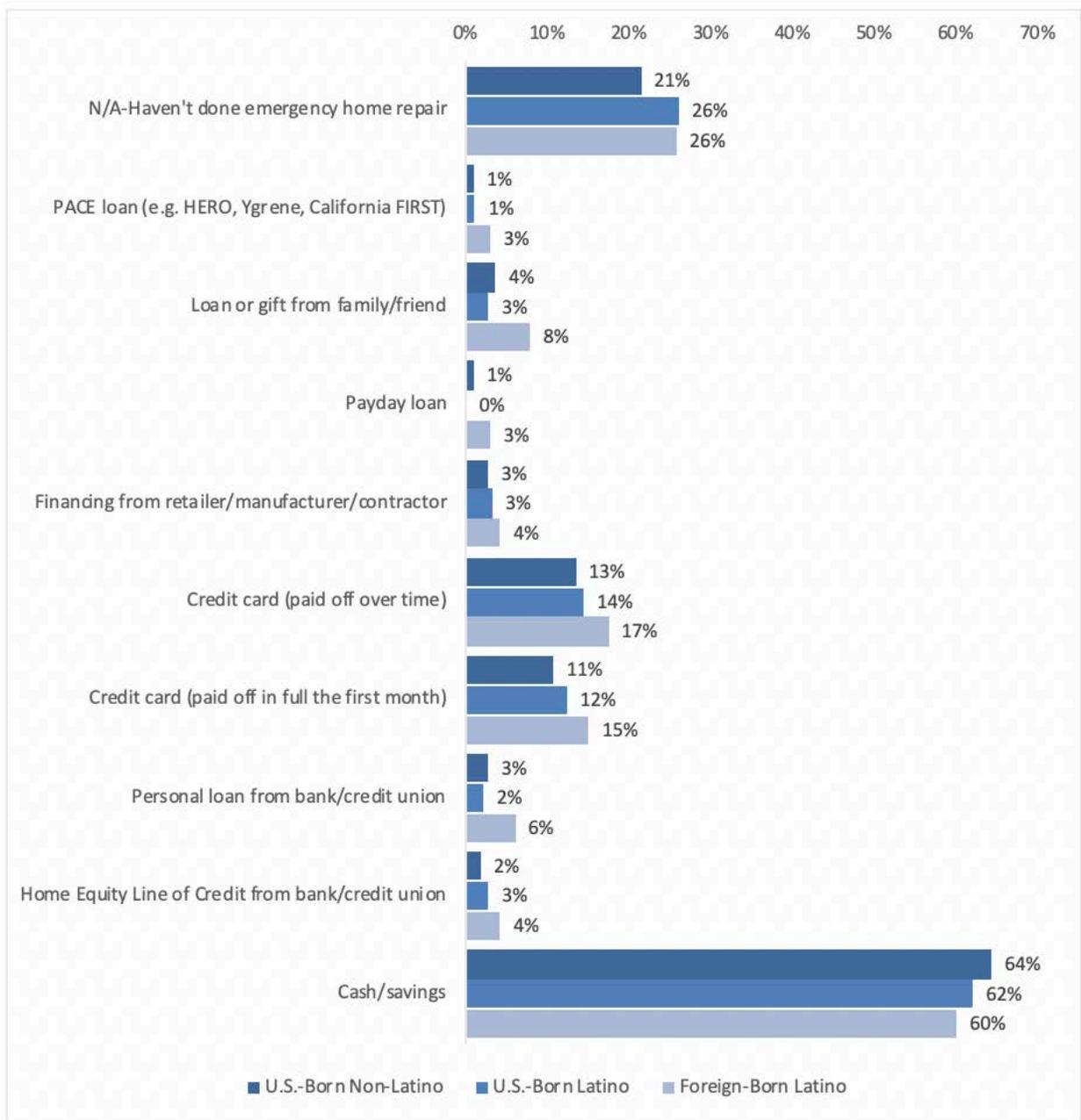
**Figure 6: Funding Mechanism for Most Recent Planned Home Repair**



N=441

Source: Center for Sustainable Energy et al., 2017

**Figure 7: Funding Mechanism for Most Recent Emergency Home Repair**



N=423

Source: Center for Sustainable Energy et al., 2017

Latino respondents indicated greater desire to use financing for major projects/purchases than non-Latinos (Figure 8); however, they also reported more difficulty accessing credit (Figure 9).

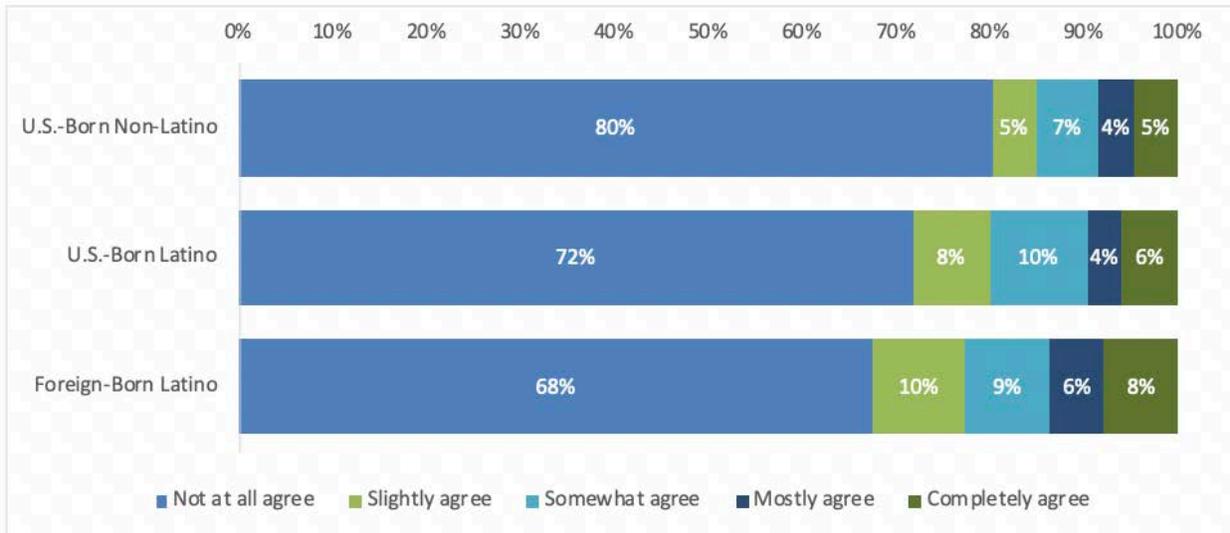
**Figure 8: Agreement with Statement "I Am More Likely to Consider a Large Purchase If I Know That There Is Financing Available to Help Me Pay for It"**



N=564

Source: Center for Sustainable Energy et al., 2017

**Figure 9: Agreement with Statement "I Have Experienced Difficulty Accessing Credit or Financing"**



N=564

Source: Center for Sustainable Energy et al., 2017

While actual propensity to finance a purchase depends on what the purchase is (e.g., a much-needed car vs. attic insulation), these results provisionally suggest that easier financing – and specifically, options for consumers that do not qualify for traditional loans and credit options – could help Latino households pursue home energy efficiency upgrades, if they considered them valuable. Property assessed clean energy (PACE) programs, which qualify customers based on

home equity rather than personal credit, may be filling part of this niche market. Survey results indicated that, while PACE loans were infrequently cited as a funding mechanism for recent home repair projects (this makes sense, given that only solar, energy efficiency or water efficiency projects are typically eligible for PACE), foreign-born Latino respondents were slightly more likely to report having used them.

### Family Decision-Making Dynamics

Respondents were asked whether they make household decisions on their own, defer to others, or make them as a family when buying expensive items, managing their household finances, and making renovations to their home. Most respondents noted making these household decisions jointly with other members of their household (Table 17). A larger percentage of Latinos, both U.S. and foreign born, tended to make home renovation decisions on their own when compared to U.S.-born non-Latinos (26 percent and 21 percent versus 13 percent for U.S.-born non-Latinos).

**Table 17: Percentage of Respondents Who Make Decisions on Their Own, Defer to Another, or Make Them Jointly by Group**

Decision	The respondent...	U.S.-born non-Latino	U.S.-born Latino	Foreign-born Latino
Buying expensive items for the home	Makes the decision	29%	41%	27%
	Defers to another in household	5%	3%	9%
	Makes a joint decision	65%	56%	64%
Managing household finances	Makes the decision	17%	27%	18%
	Defers to another in household	1%	3%	6%
	Makes a joint decision	83%	69%	73%
Making home renovations or improvements	Makes the decision	13%	26%	21%
	Defers to another in household	2%	3%	7%
	Makes a joint decision	85%	69%	68%

Source: Center for Sustainable Energy et al., 2017

There were no statistically significant differences between genders in terms of household decision-making (Table 18).

**Table 18: Percentage of Respondents Who Make Decisions on Their Own, Defer to Another, or Make Them Jointly by Gender**

<b>Decision</b>	<b>The respondent...</b>	<b>Men</b>	<b>Women</b>
Buying expensive items for the home	Makes the decision	33%	35%
	Defers to another in household	6%	7%
	Makes a joint decision	60%	58%
Managing household finances	Makes the decision	20%	26%
	Defers to another in household	5%	3%
	Makes a joint decision	74%	71%
Making home renovations or improvements	Makes the decision	21%	25%
	Defers to another in household	5%	4%
	Makes a joint decision	74%	71%

N=606

Source: Center for Sustainable Energy et al., 2017

# CHAPTER 7:

## Online Experiments

---

Based on findings from the previous phases of this research project, the online experiments were an opportunity to test the effectiveness of different messages on the likelihood of Latino and non-Latino homeowners to take action on home energy efficiency upgrades. Following is a subset of the full online experiment report, which can be accessed at [www.energycenter.org/sociocultural](http://www.energycenter.org/sociocultural).

### Research Objectives

The following research questions were explored.

- How do different *motivations* for energy efficiency upgrades resonate with Latino homeowners?
- How do different *languages* affect Latino homeowners' interest in home energy efficiency projects?
- How do different *messengers* affect Latino homeowners' interest in home energy efficiency projects?
- What attributes do homeowners prioritize when choosing a contractor?
- What sources do homeowners use to get information on energy efficiency?

### Methods

Four rounds of online experiments were conducted between September and November 2016 via Survey Sampling International's platform and participants; 800 California homeowners participated in each round, with an even split between self-identified Latinos and non-Latinos.

At the beginning of the study, participants completed a set of demographic questions to validate whether they resided in California, owned a single-family home, were above the age of 18, and their ethnicity to achieve a balanced sample of Latino and non-Latino participants. Then, participants completed two attention check questions adapted from Phillips (2013). Participants that failed to answer both questions correctly could be respondents that provide poor data overall and should be excluded from the study. However, in all three experiments, nobody failed multiple attention checks, and, therefore, no participants were excluded.

Each experiment followed a factorial design containing four treatments, including two main effects in a crossover design. The treatments (messages) were randomly assigned to the participants. Each message was viewed by 100 Latino and 100 non-Latino participants.

## Experiments 1-3

### Messages Tested

All three experiments began with the same introductory text: “Good attic insulation keeps heat inside during the colder months, and prevents heat from penetrating your home during the warmer months.” Subsequently, the following message themes were presented to the different treatment groups to test the effect on participants’ likelihood to choose to learn more about installing attic insulation.

- Comfort benefits vs. cost savings
- Family emphasis vs. untargeted
- English only vs. bilingual (English and Spanish) presentation

The messaging presented in Experiment 1 is in Table 19.

**Table 19: Content of the Four Messages Tested in Experiment 1**

Treatment	Message for Corresponding Treatment Group
Save money, untargeted	Enjoy having more money in your bank account. Get attic insulation! Adding attic insulation can save you money on your energy bill.
Comfort, untargeted	Enjoy more comfortable indoor temperatures year-round. Get attic insulation! Adding attic insulation can help keep your home more comfortable all year round.
Save money, family emphasis	Benefit the whole family! Enjoy having more money in your bank account. Get attic insulation! Adding attic insulation can save your family money on your energy bill.
Comfort, family emphasis	Benefit the whole family! Enjoy more comfortable indoor temperatures year-round. Get attic insulation! Adding attic insulation can help keep your family more comfortable all year round.

Source: Center for Sustainable Energy, 2017

In Experiments 2 and 3, a main effect of family emphasis underwent additional testing. The emphasis on family was strengthened by including more instances of the word to tease out its impact. In Experiments 2 and 3, motivation was no longer tested as a main effect. Instead, all treatments in Experiment 2 focused on comfort benefits and all treatments in Experiment 3 focused on saving money (Table 20). As a second main effect, Experiments 2 and 3 tested whether bilingual presentations of the message influenced choice. Thus, two of the four treatments included English-only messages while the other two included Spanish translations side-by-side with the English messages.

**Table 20: Content of the Four Messages and Main Effects Tested in Experiments 2 and 3**

Treatment	Experiment 2 (“Improve Comfort”) Message for Corresponding Treatment Group	Experiment 3 (“Save Money”) Message for Corresponding Treatment Group
Untargeted, English only	Be prepared to get comfortable. Add attic insulation to your home! Soon you’ll be cozier in winter, cooler in summer. Adding attic insulation can help you stay comfy all year round.	Be prepared for more cash in your pocket. Add attic insulation to your home! Watch your energy bills go down and your piggy bank fill up. Adding attic insulation can give you more money to spend.
Family emphasis, English only	Make your family more comfortable. Add attic insulation to your home! Soon your family will be cozier in winter, cooler in summer. Adding attic insulation can help your family stay comfy all year round.	Be prepared for more cash in your family’s pocket. Add attic insulation to your home! Watch your family’s energy bills go down and your piggy bank fill up. Adding attic insulation can give your family more money to spend.
Untargeted, English and Spanish	[English version same as above]  Prepárate para estar más cómodo. ¡Añade aislamiento en el ático de tu hogar! Pronto estarás más acogedor en el invierno y más fresco en el verano. Aislamiento en el ático puede ayudar a mantenerte más cómodo todo el año.	[English version same as above]  Pon más dinero en tus bolsillos. ¡Añade aislamiento en el ático de tu hogar! Mira mientras tus costos de energía bajan y tu alcancía se llena. Añadir aislamiento en el ático puede darte más dinero para gastar.
Family emphasis, English and Spanish	[English version same as above]  Haz más cómoda a tu familia. ¡Añade aislamiento en el ático de tu hogar! Pronto tu familia estará más acogedora en el invierno y más fresca en el verano. Añadir aislamiento en el ático puede ayudar a tu familia a mantenerse cómoda durante todo el año.	[English version same as above]  Pon más dinero en los bolsillos de tu familia. ¡Añade aislamiento en el ático de tu hogar! Mira como los costos de energía de tu familia bajan mientras su alcancía se llena. Añadir aislamiento en el ático le puede dar a tu familia más dinero para gastar.

Source: Center for Sustainable Energy, 2017

After reading the message in Experiment 1, participants indicated yes or no to the following prompt.

*Right now, you can find out about options to install attic insulation in your home. All you have to do is click “Yes” below. Do you want to learn more about installing attic insulation in your home?*

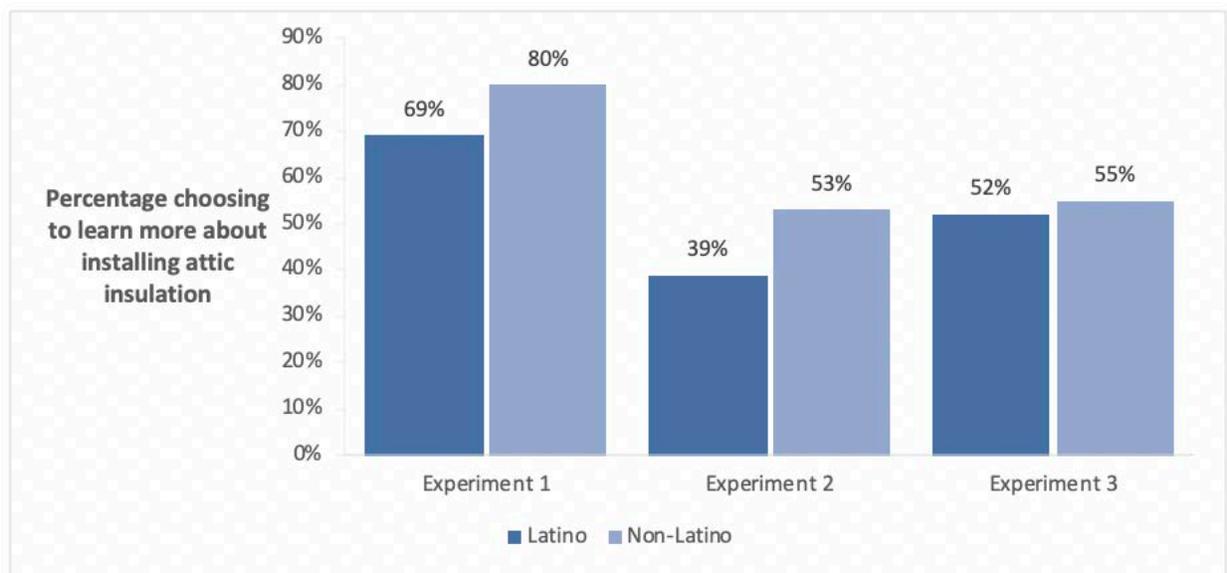
In Experiments 2 and 3, the question was changed to the following.

*Right now, you can find an energy specialist to talk about installing attic insulation in your home. All you have to do is click “Yes” below. Do you want to learn more about installing attic insulation from an energy specialist?*

## Select Findings

In Experiments 1 and 2, Latino participants were overall less likely to opt to learn more about attic insulation than non-Latino participants. Latinos were more responsive to the messages emphasizing cost savings in Experiment 3 than the comfort messages used in Experiment 2; however, there was no significant difference in Latino responsiveness to these themes within Experiment 1 (Figure 10).

**Figure 10: Choice to Learn About Attic Insulation by Experiment and Ethnic Group**

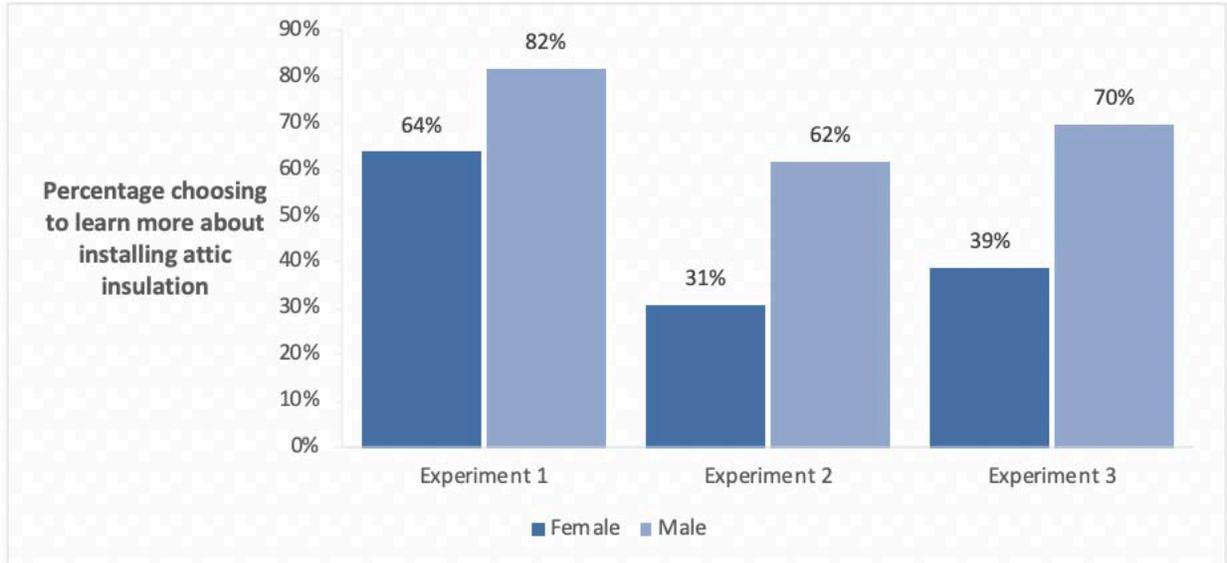


Note: Experiment 1: ( $\chi^2(1, N=687) = 11.6554, p=0.001$ ), Experiment 2: ( $\chi^2(1, N=633) = 11.7695, p=0.001$ ), Experiment 3: ( $\chi^2(1, N=627) = 0.7323, p=0.392$ )

Source: Center for Sustainable Energy, 2017

Across all experiments, male participants were significantly more likely to make the choice than females (Figure 11); this may be related to the fact that females were consistently less likely to report that they make major household decisions by themselves (Figure 12).

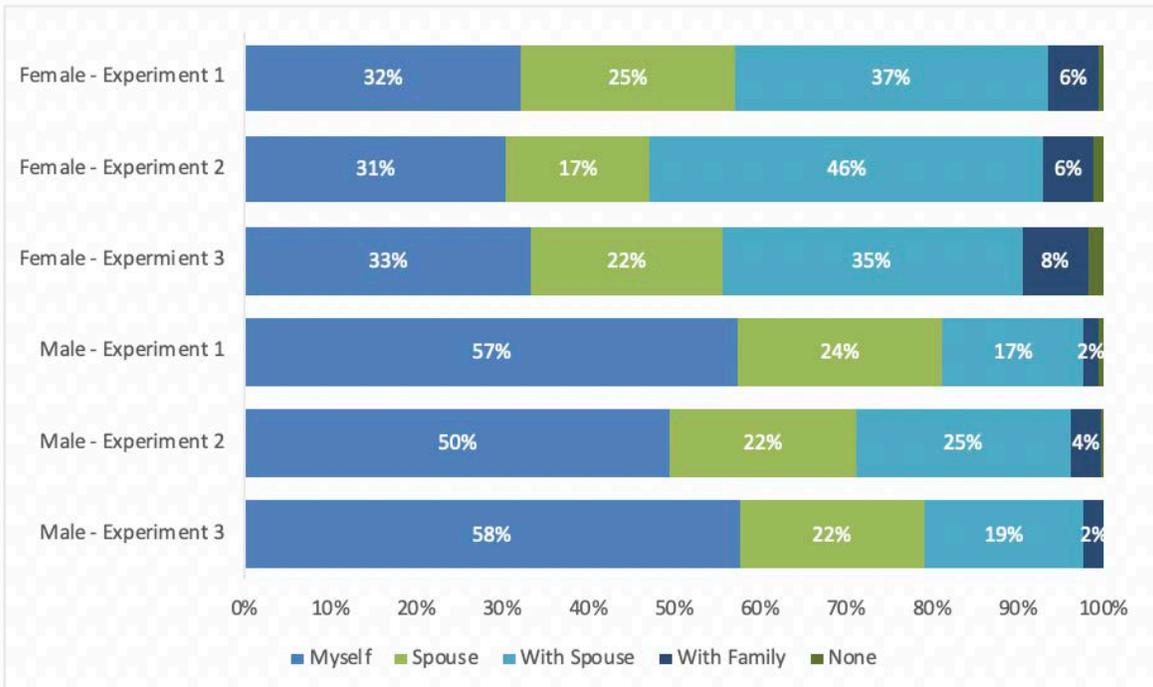
**Figure 11: Choice to Learn About Attic Insulation by Gender**



Note: Experiment 1: ( $\chi^2$  (1, N=687) = 28.8083,  $p=0.000$ ), Experiment 2: ( $\chi^2$  (1, N=633) = 60.7854,  $p=0.000$ ), Experiment 3: ( $\chi^2$  (1, N=627) = 57.9812,  $p=0.000$ )

Source: Center for Sustainable Energy, 2017

**Figure 12: Answers to “Who in Your Household Is Primarily Responsible for [Various Major Household Decisions]?” by Experiment and Gender**

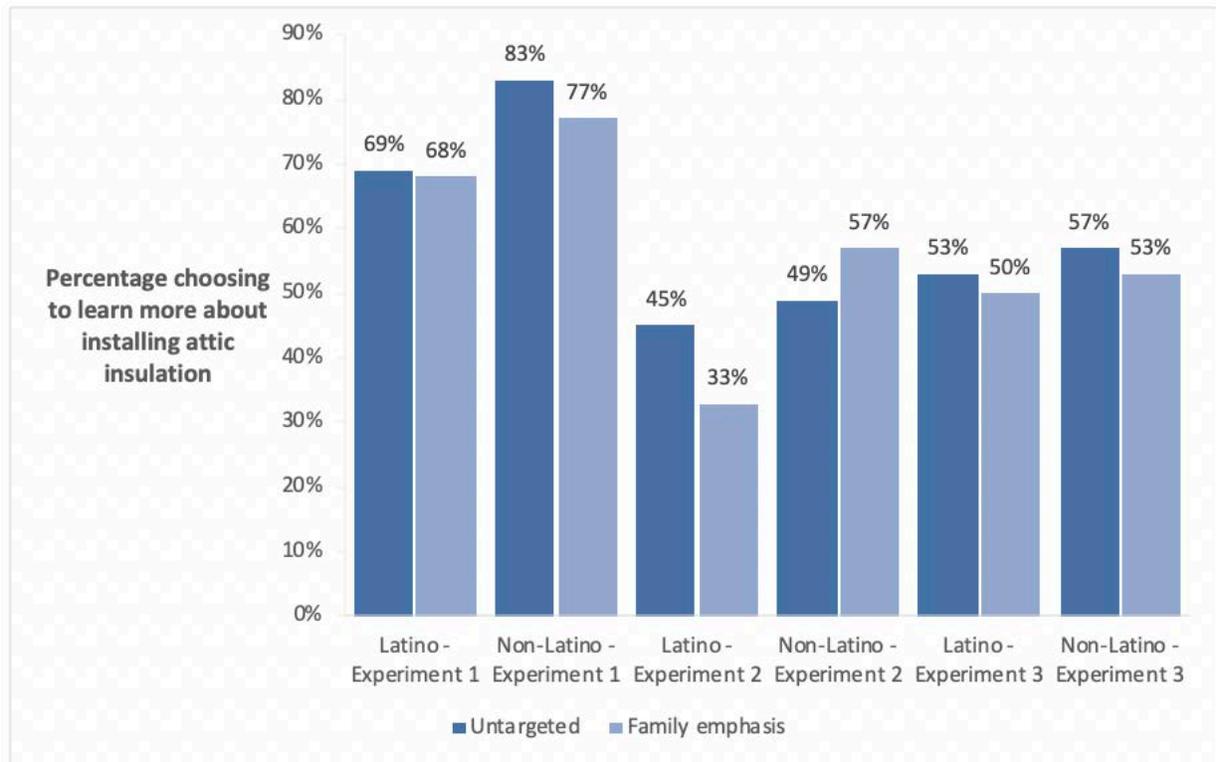


Note: Responses were averaged across three questions. Difference male/female. Experiment 1: ( $\chi^2$  (4, N=687) = 58.8483,  $p=0.000$ ), Experiment 2: ( $\chi^2$  (4, N=633) = 39.1926,  $p=0.000$ ), Experiment 3: ( $\chi^2$  (4, N=627) = 49.5171,  $p=0.000$ )

Source: Center for Sustainable Energy, 2017

The family emphasis had an interesting effect on Latino participants in Experiment 2: when paired with messaging around comfort benefits, it resulted in fewer participants making the choice as compared with comfort messaging and no family emphasis (Figure 13).

**Figure 13: Family Emphasis Main Effect Tested in Experiments 1, 2, and 3 by Ethnicity**

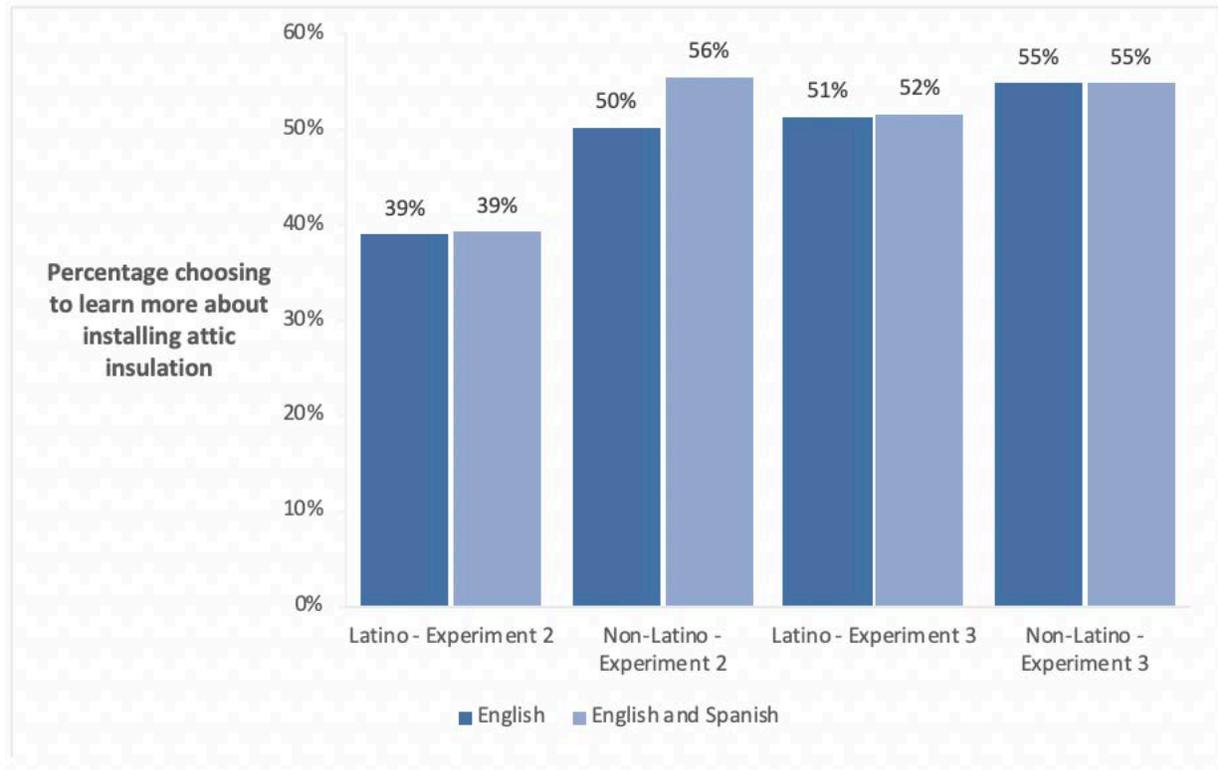


Note: Experiment 1: Latinos: ( $\chi^2(1, N=326) = 0.0503, p= 0.823$ ), Non-Latinos: ( $\chi^2(1, N=361) = 2.2540, p= 0.133$ ), Experiment 2: Latinos: ( $\chi^2(1, N=296) = 4.0350, p= 0.045$ ), Non-Latinos: ( $\chi^2(1, N=337) = 2.1255, p= 0.145$ ), Experiment 3: Latinos: ( $\chi^2(1, N= 301) = 0.1588, p= 0.690$ ), Non-Latinos: ( $\chi^2(1, N=326) = 0.7359, p= 0.391$ )

Source: Center for Sustainable Energy, 2017

The language of the messages presented had no significant effect on participant choices among the Latino or non-Latino groups (Figure 14). However, when focused on participants with lower levels of acculturation, the research found that bilingual messaging increased the odds of choosing to learn more about attic insulation.

**Figure 14: Bilingual Main Effect Tested in Experiments 2 and 3 by Ethnic Group**



Note: Experiment 2: Latinos: ( $\chi^2(1, N=296) = 0.0027, p= 0.959$ ), Non-Latinos: ( $\chi^2(1, N=337) = 0.9131, p= 0.339$ ), Experiment 3: Latinos: ( $\chi^2(1, N=301) = 0.0018, p= 0.966$ ), Non-Latinos: ( $\chi^2(1, N=326) = 0.0001, p= 0.991$ )

Source: Center for Sustainable Energy, 2017

## Experiment 4

### Messages Tested

Experiment 4 tested the effects of the following themes on participants' likelihood to choose to see a list of contractors that can help with home energy efficiency upgrades.

- Utility representative messenger vs. local homeowner messenger
- Contractor license status vs. untargeted

The messages tested are presented in Table 21.

**Table 21: Content of the Four Messages and Main Effects Tested in Experiment 4**

Treatment	Message for Corresponding Treatment Group
Utility recommendation, untargeted	<p>Save energy and make your home more comfortable.</p> <p>Contractors participating in your electric utility’s program can help you save energy by installing attic insulation, a high-efficiency heating/cooling system, or other upgrades.</p> <p><i>"Our participating contractors are ready to help you."</i> – Sarah Covarrubias, local utility representative</p>
Utility recommendation, contractor licensing emphasized	<p>Save energy and make your home more comfortable.</p> <p>Licensed contractors participating in your electric utility's program can help you save energy by installing attic insulation, a high-efficiency heating/cooling system, or other upgrades.</p> <p><i>"Our participating contractors are licensed by the state of California through the Contractors State License Board (CSLB) and ready to help you. The CSLB protects you by ensuring that licensed contractors have the proper skills and education before performing work on your home."</i> – Sarah Covarrubias, local utility representative</p>
Local resident recommendation, untargeted	<p>Save energy and make your home more comfortable.</p> <p>Contractors who have worked with your neighbors can help you save energy by installing attic insulation, a high-efficiency heating/cooling system, or other upgrades.</p> <p><i>"I had a great experience working with my contractor."</i> – Sarah Covarrubias, local homeowner</p>
Local resident recommendation, contractor licensing emphasized	<p>Save energy and make your home more comfortable.</p> <p>Licensed contractors who have worked with your neighbors can help you save energy by installing attic insulation, a high-efficiency heating/cooling system, or other upgrades.</p> <p><i>"I had a great experience working with my contractor. He was certified and licensed by the state of California through the Contractors State License Board (CSLB). Because he was licensed I felt secure because I know CSLB ensures that licensed contractors have the proper skills and education before performing work on your home."</i> – Sarah Covarrubias, local homeowner</p>

Source: Center for Sustainable Energy, 2017

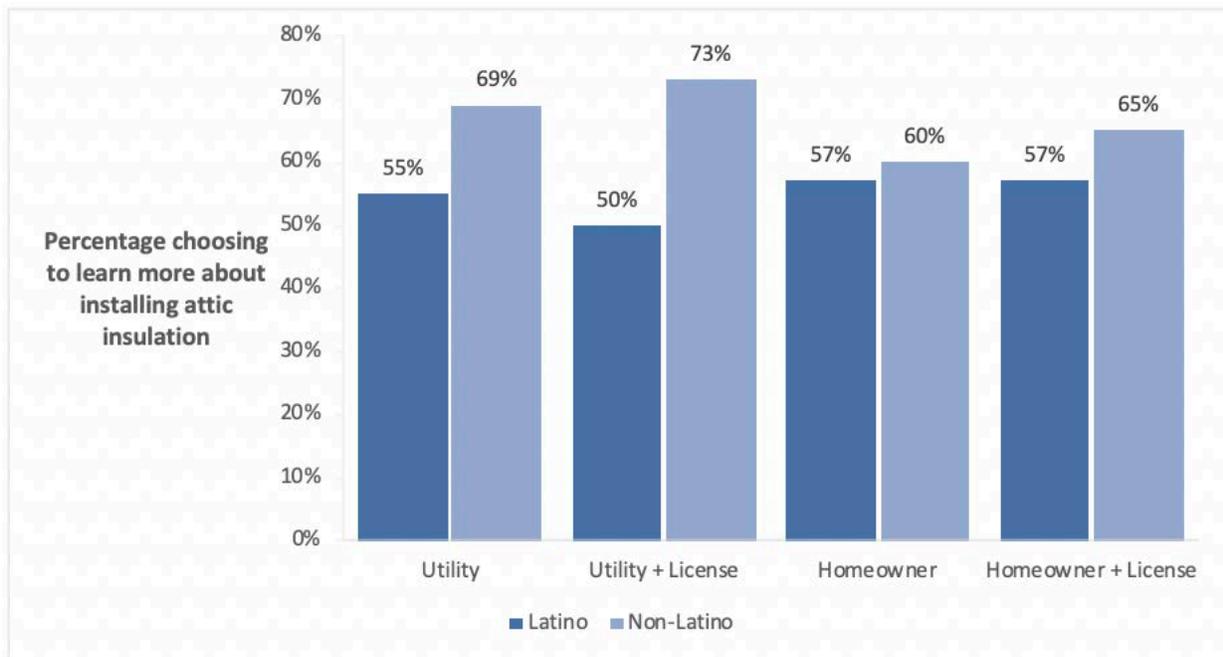
After reading the message in Experiment 4, participants were asked the following question, with the option to select “yes” or “no.”

*Right now, you can view a list of [licensed]<sup>3</sup> contractors that can help you with installing attic insulation, a high efficiency heating/cooling system, or other energy-saving upgrades. Would you like to see this list?*

## Select Findings

The results showed that Latino participants were less likely than non-Latino participants to respond to the utility messenger, and this difference grew when emphasis on license status was added to the message (Figure 15). However, multivariate analysis of additional demographic variables revealed that the partial effect of Latino ethnicity was no longer statistically significant, and in fact, the variables most salient in predicting a positive response were education, gender and presence of children in the home.

**Figure 15: Percentage Choosing to View List of Contractors for Each Message Frame**



Note: Message Frames: Utility: ( $\chi^2(1, N=800) = 4.1596, p= 0.041$ ), Utility + License: ( $\chi^2(1, N=800) = 11.1709, p= 0.001$ ), Homeowner: ( $\chi^2(1, N=800) = 0.1854, p= 0.667$ ), Homeowner + License: ( $\chi^2(1, N=800) = 1.3451, p= 0.246$ ).

Source: Center for Sustainable Energy, 2017

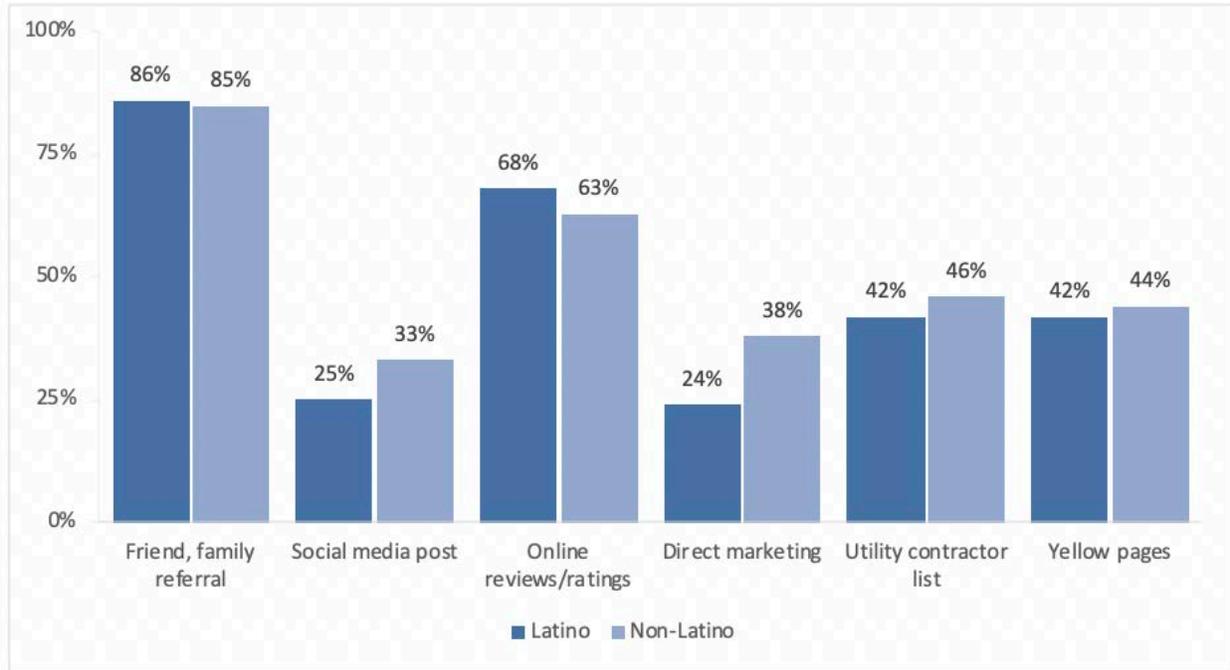
Experiment 4 also asked about the sources used to find contractors, attributes used to evaluate contractors, and energy information sources and brands. The most common methods of finding a contractor were referrals from family or friends or online reviews/ratings. Non-Latino

---

<sup>3</sup> The word “licensed” was inserted only for the two treatments that emphasized license status.

participants were more likely to post on social media or respond to direct marketing than Latino participants (Figure 16).

**Figure 16: Sources Used to Find the Last Contractor Hired by Ethnicity**

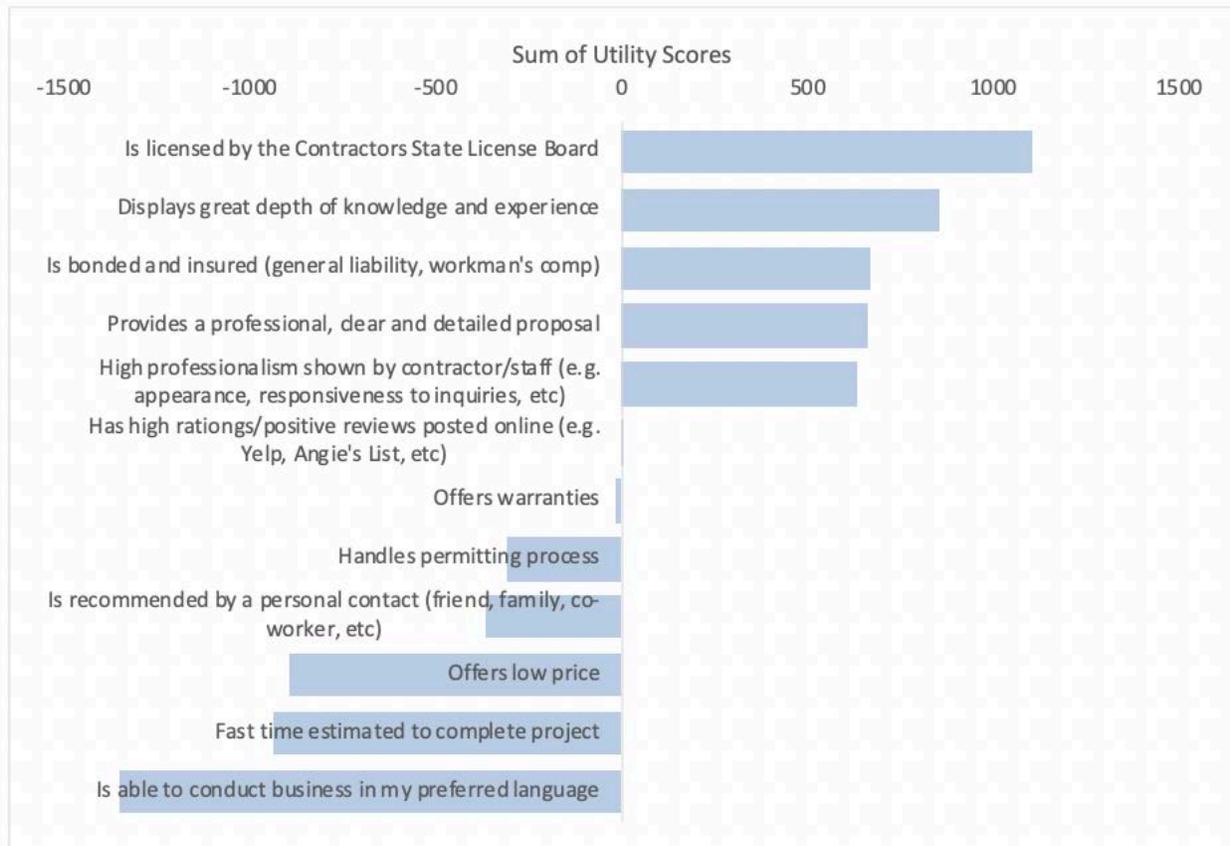


N=598

Source: Center for Sustainable Energy, 2017

The most important attributes used to evaluate contractors were license status and depth of knowledge and experience; attributes ranked highly relative to others received higher utility scores as shown in Figure 17. The least important attributes were the ability to conduct business in preferred language and a fast time estimated to complete the project.

**Figure 17: Contractor Attributes in Order of Most to Least Important**

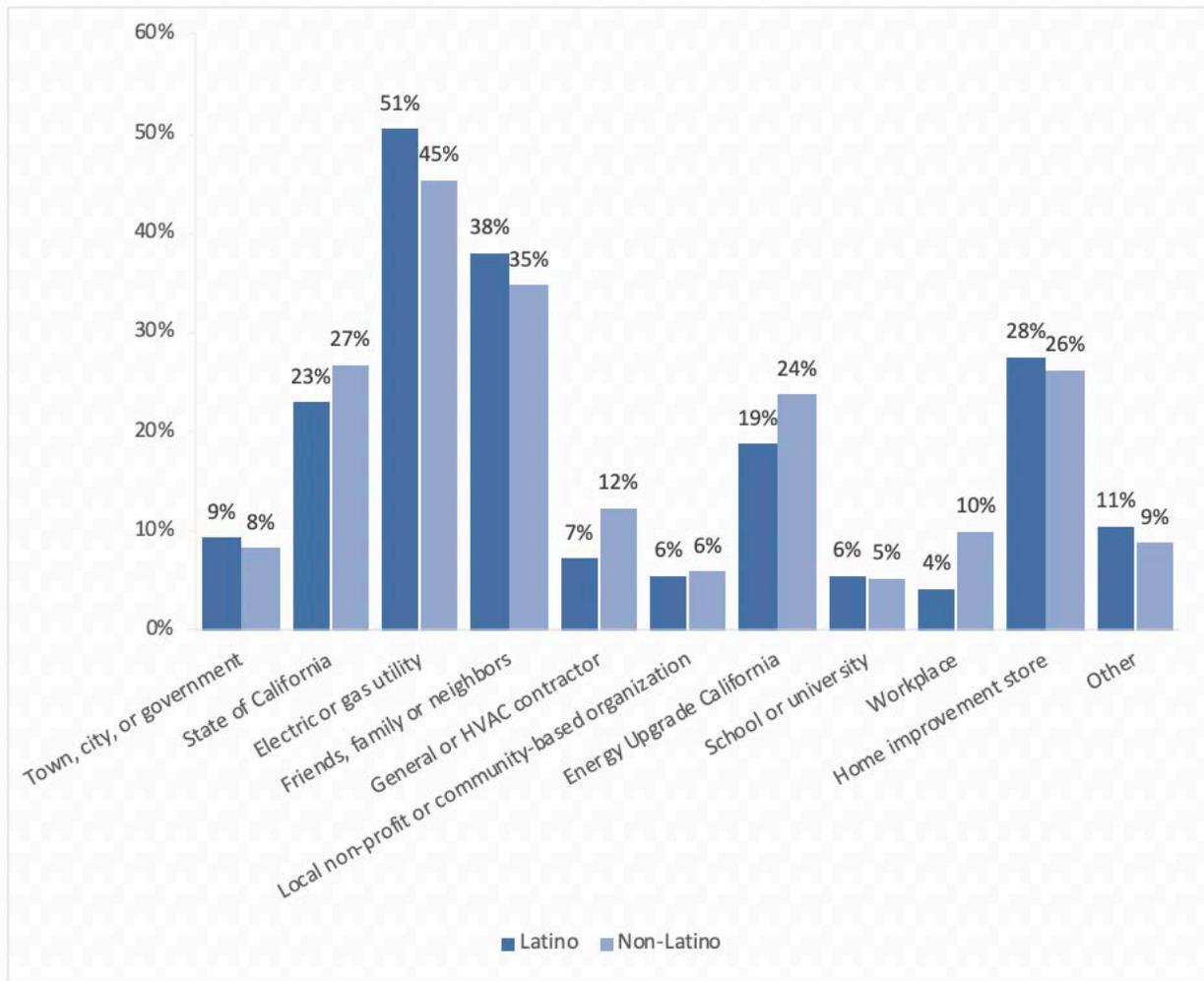


N=800

Source: Center for Sustainable Energy, 2017

The most common sources where participants of both groups get information on energy efficiency were their electric or gas utility and friends, family, or neighbor (Figure 18). The least frequently reported sources were school or university, local nonprofit or community-based organization, and workplace. Those who reported getting energy efficiency information from the state, electric or gas utility, Energy Upgrade California® or the workplace were more likely to make the choice to view a list of contractors.

**Figure 18: Percentage of Respondents Getting Energy Efficiency Information from Various Sources**



N=800

Source: Center for Sustainable Energy, 2017

# CHAPTER 8:

## Field Experiments

---

The final research phase was the field experiments, providing an opportunity to test prior findings within the context of a fully operational energy efficiency program working with Latino households. The field research was conducted in partnership with the Central Valley Energy Tune-Up (CVETU) program, which provides hundreds of no-cost home energy audits each month to Pacific Gas and Electric customers in California's Central Valley.

The importance of relevant imagery emerged during the focus groups, when Latino participants reacted negatively to a picture of a large, expensive-looking home in energy efficiency program marketing. The CVETU recruitment process offered a forum to test the effect of different imagery on its trifold brochures on audit sign-up rates (Study 1).

The survey findings revealed that Latino homeowners were less likely than non-Latinos to hire a contractor to complete a home improvement project and more likely to conduct DIY projects or use unpaid help from family or friends. Furthermore, Latino survey respondents – and foreign-born Latinos in particular – were more likely to consider a large purchase if they knew there was financing available. Yet the research team found that foreign-born Latinos reported more trouble accessing credit (CSE 2017). This finding motivated the research team to design an experiment to test the effect of providing Latino audit recipients with additional resources on DIY tips and PACE financing on the likelihood to conduct upgrades.

The final field study (Study 3) was not experimental but employed phone interviews to capture more insights on home energy efficiency upgrade activity, motivations, and barriers among CVETU audit recipients.

Following is a subset of the full field research report, which can be accessed at [www.energycenter.org/sociocultural](http://www.energycenter.org/sociocultural).

### Study 1

#### Methods

This experiment tested the effect of imagery on Latino homeowners' likelihood to sign up for an energy audit. The experiment was a randomized control trial embedded into CVETU's normal door-to-door recruitment. Canvassers distributed two versions of the recruitment brochure: CVETU's existing brochure (Figure 19) that featured images of a large home and a family that appeared to be non-Latino Caucasian and a second version (Figure 20) that had images of more modest homes and families that appeared Latino. The research focused on areas where at least 75 percent of residents self-identified as Latino/Hispanic.

Figure 19: Old Brochure (Two Sides)

**Central Valley ENERGY TUNE-UP**

**Tune-Up Your Home and Start Saving Energy Today!**

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

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

**Central Valley ENERGY TUNE-UP**  
855-621-3733

**PG&E** Pacific Gas and Electric Company

**PG&E** Pacific Gas and Electric Company

[www.cvetu.com](http://www.cvetu.com)

[www.cvetu.com](http://www.cvetu.com)

---

**Central Valley ENERGY TUNE-UP**

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

Remember when your grandpa would yell at you to stop leaving the door open? He didn't want all that cool air to escape his house. It makes sense when you think about it. You're paying to heat your home in the winter and cool your home in the summer. Why would you want to lose a good portion of it to the great outdoors? Unfortunately, a good deal of Central Valley homes have leaks, poor duct work, and insufficient insulation. So how much energy is your home wasting? Read on, and you'll learn how to find out for yourself... with absolutely no cost and no obligation!

*Sponsored by your friends at PG&E*

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

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

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

**Step 1:** Sign up by today by visiting [www.cvetu.com](http://www.cvetu.com) or by calling 855-621-3733

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

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

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

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

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

**Additional Ways You Can Save:**

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

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

Source: Central Valley Energy Tune-Up Program

Figure 20: New Brochure (Two Sides)

**Central Valley ENERGY TUNE-UP**

**Tune-Up Your Home and Start Saving Energy Today!**

**Common Cents**

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

**What Have You Got to Lose?**

**How About a Third of Your Energy Bill!**

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

**Central Valley ENERGY TUNE-UP**

855-621-3733

**Pacific Gas and Electric Company**

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

[www.cvetu.com](http://www.cvetu.com)

---

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

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

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

*Sponsored by your friends at PG&E*

**What's So Good About This Program?**

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

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

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

**Central Valley ENERGY TUNE-UP**

**Step 1:** Sign up by today by visiting [www.cvetu.com](http://www.cvetu.com) or by calling 855-621-3733

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

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

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

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

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

**Additional Ways You Can Save:**

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

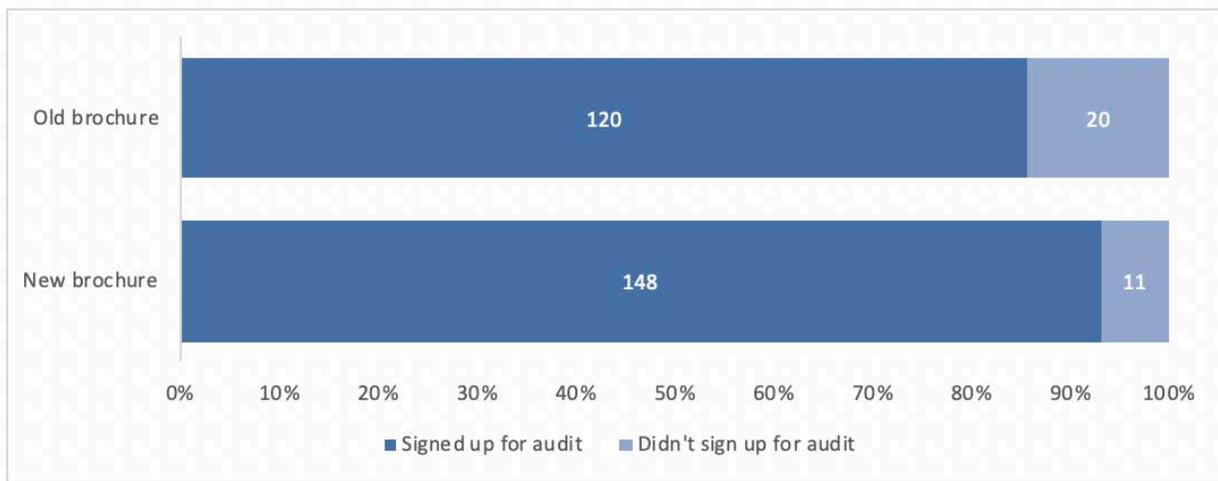
PG&E Customers Living in Fresno, Kings, Kern, Tulare, and Madera Counties are Eligible!

Source: Center for Sustainable Energy

## Select Findings

An analysis of 303 canvasser-assisted interactions in this sample revealed that using brochures with imagery of modest houses and families that appeared Latino (as opposed to imagery of large homes and non-Latino, Caucasian families) had a positive effect on audit sign-up rates among those in census tracts with at least a 75 percent concentration of Latinos. A test of independence shows that the rate of sign-up refusal fell from 14 percent (with the old brochure) to under 7 percent (with the new brochure), statistically a marginally significant difference (Figure 21). Although the research did not explore the effect of such imagery on actual enrollments for home energy upgrade programs, it would be a logical strategy to test given the relatively low effort and cost to update marketing materials.

**Figure 21: Canvasser Assisted Audit Sign-Ups**



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

Source: Arreola et al., 2017

## Study 2

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

## Study 3

Study 3 was designed as an alternative method for exploring DIY, PACE, and other topics related to home energy efficiency upgrades among CVETU audit recipients.

### Research Objectives

The following topics were explored.

- **Motivations for audit:** What led the household to complete an audit?
- **What did they remember about the audit and its follow-up?** What recommendations did they receive, what happened during the in-home portion of the audit, any follow-up with CVETU, their perception of report?
- **Response to audit recommendations:** What recommendations did they do, consider, not do, and why?
- **How they completed recommended upgrades, if they did any:** If they completed one of the audit recommendations, how did they do the work—including whether they did the work themselves, whether they hired somebody to do it, and, if so, how did they find that person, and what research they did?
- **Probes about recommendations they were considering, and upgrades of any sort they had done:** Are they considering doing any (or any additional) recommendations? If so, what are their thoughts on how they will do it? What other home upgrades have they done, or are they considering doing? How do they usually do home upgrade work, such as themselves, hiring a contractor, etc.?
- **Loans and financing:** Did they consider or elect financing for this work, particularly a PACE loan? Are they familiar with the various types of PACE loans? Or how else do they finance? What are their attitudes toward loans for home energy upgrades?
- **Feedback on audit process:** Was there additional information that they would have liked to receive? Do they have recommendations to improve the audit experience?
- **Demographics:** Monthly energy bills, number of occupants, whether any occupant was born outside United States, etc.

### Methods

The research team conducted 30 phone interviews with self-identified Latino audit participants. The interviews took place between 4 and 10 months after their CVETU audits.

### Select Findings

Key findings from the interviews include the following.

- A few had completed, or planned, major upgrades based on the audit recommendations. Others had made minor upgrades such as weatherstripping or lightbulb replacements.
- Few of the owner-occupied households seemed to think that they had an “efficiency problem” before they did the audit. Many did not believe they had an actionable energy problem even after the audit, either because they perceived no lack of efficiency or did not have the means, time, attention, or desire to do more.

- Some indicated the audit recommendations were not clear enough, or they needed more information on how to take action. While the audit report provides much of this guidance, the report may not have suited some homeowners' learning styles.
- Many mentioned the infrared thermographic images as being useful; these images seemed to be one of the most memorable aspects of the audit.
- Many interviewees had trusted networks of people who knew how to do home repairs and improvements in general, even if they were not efficiency specialists.
- Most households were not interested in financing energy efficiency upgrades.

# CHAPTER 9:

## Program and Research Recommendations

---

These recommendations are based upon the research findings discussed earlier and intended to help policy makers, local governments, utilities, contractors, auditors, and other program stakeholders better serve Latino households as they pursue energy efficiency in their homes. Like all households, Latino households are far from homogenous across California, much less the United States; they can be characterized by a variety of factors—level of acculturation, family country of origin, income, occupation, local climate, and more, any of which may influence attitudes and practices concerning energy use and energy efficiency. The recommendations are derived from patterns and tendencies that the analyses found were common in the Latino households studied. Some of these recommendations are specific to the Latino audience; some apply broadly to low- and moderate-income households, or even to improving energy efficiency programs and research for any audience.

### Program Outreach Recommendations

#### 1. Partner with Community-Based Organizations (CBOs) as Trusted Messengers

The research revealed mixed perceptions of energy utility companies among Latino homeowners. The literature review found an example of a focus group study that showed low-income Latinos had low levels of trust in their energy utilities, and the online experiment study noted that Latino participants were less likely than non-Latino participants to respond to a utility messenger promoting the benefits of attic insulation<sup>4</sup> On the other hand, Latino members of the focus groups, who had hired contractors to do major home renovations, revealed high awareness of and participation in energy and water utility programs.

These mixed findings suggest that some pockets of Latino households are responsive to utility efficiency programs, but that other segments of Latinos know very little about these programs and have generally not participated in these programs. Also, research shows that even for households with positive impressions of their local utility, programs often need to reach out to potential participants multiple times before they are ready to act, and partnering with local, trusted organizations may extend and amplify the reach of a message (U.S. Department of Energy, 2017).

**Recommendation:** Energy efficiency program funders and implementers should partner with community-based organizations (CBOs)—such as cultural and faith-based organizations, neighborhood associations, low-income assistance organizations, or environmental justice

---

<sup>4</sup> A subsequent analysis of additional demographic variables revealed that the partial effect of Hispanic/Latino ethnicity was no longer statistically significant in explaining why households install attic insulation, and in fact, the variable most salient in predicting a positive response to installing attic insulation were education, gender, and presence of children in the home.

groups - that have established relationships with Latino households. These partnerships can leverage the technical expertise of the energy program and the CBO's cultural expertise, reputation as a trusted messenger, and access to large social networks. CBOs should be widely known in the target community and not strongly aligned with any single subgroup that would limit their effectiveness with the broader community (Reed et al. 2001). In particular, CBOs can provide outreach or nonmonetary assistance to help promote energy efficiency. If a CBO is experienced in delivering services, the organization could be enabled—through training and resources—to help deliver energy efficiency services along with its traditional offerings. If a CBO already offers other services, this type of partnership could also provide cross-sector benefits such as helping with air quality or financial issues. (Recommendation 8.)

## **2. Take a Bilingual Approach, Especially for Populations with Low Acculturation**

In the interviews with contractors, a range of perspectives was expressed on the importance of Spanish-speaking staff for serving Latino customers. Some noted that bilingual staff can help establish trust and comfort—especially with older family members - even when the customer has a reasonable knowledge of English. Latino focus group participants also expressed that messaging should be in both English and Spanish to reach the largest Latino audience, since some older people do not read English, while their children may not want to learn Spanish. The survey revealed that more than one-third of Latino respondents considered the ability to conduct business in their preferred language to be extremely important when selecting a contractor. In the interviews conducted with CVETU audit recipients, several participants mentioned that language barriers limited their ability to find contractors or find additional information on pursuing energy upgrades (Arreola et al., 2017).

The effects of language on energy efficiency decision-making were further explored through the online experiments. The experiments presented two versions of the same message about the benefits of attic insulation: one in English and one in English and Spanish side-by-side. This research suggested that Latino participants with low levels of acculturation were more likely to choose to talk to an energy specialist when presented with bilingual messaging than participants who were more highly acculturated. Importantly, the bilingual messaging did not influence non-Latino participants' likelihood to choose to talk to an energy specialist, indicating little downside of using both languages in marketing materials.<sup>5</sup>

**Recommendations:** Present all marketing materials and websites in English and Spanish, and employ bilingual staff - preferably native speakers. Language (such as printed materials and phone scripts) should be reviewed by native speakers to ensure the translation is accurate and effective and contains the appropriate vernacular. In an ethnographic study of California Latinos and energy use, energy efficiency program experts mentioned that outreach must use the “right” Spanish—specifically reflecting cultural awareness and an accurate use of technical terms (Inova Energy Group, 2017). Programs that partner with community-based organizations

---

<sup>5</sup> The online experiments also asked participants to rank 12 contractor attributes in order of importance. The ability to conduct business in their preferred language was ranked last, somewhat contradicting the results of the research team's survey (Center for Sustainable Energy, 2017).

(Recommendation 1) may also be able to leverage experience communicating effectively in Spanish. To gauge the importance of providing bilingual materials, programs can use census data to identify the primary languages spoken at home in each census tract.

### **3. Use Imagery That Resonates with the Target Audience**

Programs with limited marketing resources may rely on a few images across the associated marketing materials. However, the research conducted in this study shows it is a wise investment to use a more diverse selection of images that reflect the appearances of the varied target audiences and their homes, so that the target audience can “put themselves in the picture.” In the focus group of Latino homeowners in Fresno, some participants reacted negatively to an energy efficiency financing advertisement that featured a relatively large, expensive-looking home. One participant said, “It looks like they are in their big house – they could save, but I couldn’t.” (Research Into Action, Inc. and Center for Sustainable Energy, 2016)

The effect of imagery was tested further through a field experiment in which CVETU canvassers distributed two versions of the same brochure when recruiting participants for their no-cost energy audits. The researchers found that the brochure with images of people who appeared Latino in front of modest homes (compared to the brochure with Caucasians in front of large, expensive homes) had a positive effect on audit sign-up rates in census tracts with high concentrations of Latinos (Arreola et al., 2017). This finding aligns with other research that has found that customers identified more with advertisements when people of their ethnicity were featured (Lee et al., 2002).

**Recommendations:** Given the relatively low cost to update marketing materials, adopt imagery to match target populations, wherever possible. Programs can identify neighborhoods with high concentrations of Latino residents through census data. Appropriate pictures can be purchased through stock photography sites or acquired from actual program participants who had a good experience and agree to release their images for marketing purposes. Using real program participants from neighborhoods close to the target audience also can tap into social norming effects, where a person’s behavior is influenced by the accepted standards of behavior of one or more social groups.

### **4. Use Personal Stories to Demonstrate What’s Achievable to Lower Energy Bills**

Interviews conducted in this research project with audit recipients revealed that some households may not view discomfort or high energy bills as “fixable” problems but rather as conditions to be endured. These households are unlikely to seek energy audits or energy efficiency program assistance. These issues will have even greater effect as average temperatures continue to rise in coming years, potentially exacerbating health issues or high electric bills or both that accompany the cooling season.

**Recommendations:** Offer free or heavily subsidized energy audits to “get in the door” and market those audits through convenient, personal interactions that do not depend on the target audience seeking energy-specific services. The CVETU program achieves strong audit enrollment rates through door-to-door recruitment. Working with a local CBO (see

Recommendation 1) also will help ensure access to hard-to-reach households and the opportunity to discuss how efficiency can improve comfort and lower bills.

Audits, of course, are just the first step. To help bridge the gap between audit and upgrades, programs need to use a variety of strategies to illustrate that efficiency improvements are achievable and bring tangible benefits. Demonstrations—as a walk-through tours of homes that have completed energy efficiency upgrades—can help homeowners visualize improvements in their own homes (Office of Efficiency and Renewable Energy). Short and inspiring testimonials, online videos, and blogs can create interest and buzz. Case studies (for example 1-2 page handouts or short videos, presented bilingually) can provide more images and details about actual project experiences (including completed project measures and costs, contractors used, estimated savings, rebates or financing used, and quotes from the residents about the comfort, health, or other benefits resulting from the upgrades)<sup>6</sup> These examples should come from the local community to show that projects are possible for the target audience and to leverage social norming effects.

## Program Design Recommendations

### 5. Address Individual Concerns, Motivations, and Learning Styles in a Personalized Way

Interviews with CVETU participants revealed common barriers to executing upgrades based on the results of an energy audit. While CVETU provided many tips and resources in its audit reports (presented in either English or Spanish, depending on the household's preferred language), some interviewees indicated that they still did not know what to do with the suggestions. This challenge may be related to different learning styles; for example, some people may process information more effectively if presented with a conversational, personal approach. Many auditors do, in fact, take this approach while they are in the home: they engage the resident in conversation about their home and family. Contractors also indicated that they enjoy explaining energy efficiency concepts and recommendations during energy audits.

**Recommendations:** The following strategies can help auditors and other program staff address the individual concerns, motivations, and learning styles of a given homeowner or resident,<sup>7</sup> with the goal of overcoming barriers to action more quickly.

- Provide audit results, upgrade recommendations, and information on resources in a written report in the homeowner's preferred language. Include images of their home and systems, where possible.
- Make follow-up calls in the homeowner's preferred language. Ideally, the call would be conducted by the auditor who examined the home firsthand and has already established rapport with the homeowner. This may require additional training for auditors on phone

---

<sup>6</sup> An example of a case study for a neighborhood demonstration home can be found on CSE's website at <https://energycenter.org/energy-efficiency-florey-home-case-study>.

<sup>7</sup> If the home is owner-occupied, the owner and resident are the same.

etiquette, evaluating and hiring contractors, financing options, and rebate program requirements.

- During an audit, engage homeowners in a discussion about the concerns they have about their home or equipment.
- Ask homeowners to be available during audit visits, so that the auditor can show them any visual signs of poor home performance – e.g., thin or bunched attic insulation, gaps in air barrier or ducts, dirty HVAC filter, etc. If the homeowner cannot access all spaces (attic, crawl spaces, etc.), the auditor should photograph the conditions and share the photos with the homeowner to illustrate the poor condition. These photographs should be included in any post-audit report.
- Gauge the homeowners' readiness to act and determine whether they would be more interested in hiring a contractor vs. doing the project themselves, and (if comfortable discussing finances) whether they would need financial help via rebates, loans, or direct install programs.<sup>8</sup>
- Use infrared (IR) images – both to show the energy savings opportunities to homeowners while onsite and to include in a report. IR images were mentioned as particularly memorable by audit recipient interviewees (Arreola et al., 2017).
- Provide auditors with one-page case studies of energy efficiency upgrades from the community to demonstrate the savings potential in their homes. (See Recommendation 4.)
- Add fields in the auditor's data collection platform to record the homeowner's areas of interest or concern, so program staff can provide specific, actionable recommendations in follow-up calls.
- Plan a second round of follow-up calls several months after the first round, as homeowners often do not have the time, money, or motivation to immediately act on their audit results.

While providing personalized guidance to program participants can be resource-intensive, programs can leverage the time that auditors, contractors and outreach staff are already spending in personal interactions by providing the training and data-collection platforms described previously. This approach may be best suited for programs that seek to achieve significant energy savings in a smaller number of households (as opposed to programs designed to effect small energy-saving actions in many households) and to be involved in that community for the long term.

## **6. Design Programs to Promote Upgrades by a Broader Network of Contractors and DIY Homeowners**

Many whole-house energy efficiency upgrade programs require homeowners to use contractors who have been officially vetted by the utility. The eligibility criteria for contractors are intended to ensure high-quality work, proper insurance coverage and appropriate license stature.

---

<sup>8</sup> Direct install programs can be performed as part of an energy audit or as a stand-alone service. They typically employ program-approved contractors to install prescriptive energy efficiency measures at low or no cost to the customer.

Building envelope, HVAC, and water heater retrofits can have serious combustion safety and air quality implications if not executed correctly.

Unfortunately, the requirement to use a participating contractor may not align with the way many Latino households approach home improvement projects. Throughout several phases of this research, the team found that Latino households are likely to conduct projects themselves (i.e., DIY projects) or use their personal network to find someone to do the work, even if that person is not officially licensed or formally trained in a relevant specialty.

In the focus groups, which were limited to homeowners who had previously hired someone to help with a home improvement project, several respondents from both the Latino and non-Latino groups reflected their desire to attempt certain projects if they had the skills and time. Participants indicated they were less likely to take on projects involving electricity, plumbing, steep roofs, permits, or simply a larger, more complex scope.

The survey revealed that foreign-born Latino respondents were much more likely to use DIY or get help from unpaid family or friends compared to U.S.-born non-Latino respondents. Furthermore, Latino respondents were significantly less likely to have ever hired a contractor for home improvement or repair compared to non-Latino respondents.

Finally, interviewees from the field research overwhelmingly mentioned relying on family members or others in their network who could do the work or could refer them to somebody who could. One said, “Honestly, because we have our family in construction, it’s very easy for me to say, ‘Hey, do you know somebody who can do this?’”

Programs may better reach the Latino population by acknowledging that many are not inclined to use unfamiliar contractors on the approved list, and the programs should provide alternate pathways to participation.

**Recommendations:** Simplify DIY work and help ensure the quality of the work by offering low-cost trainings, mentoring, streaming video tutorials, equipment lending libraries, quality assurance checks, and/or audits to inform work scope.<sup>9</sup> In addition to promoting DIY work, programs can better engage Latino households by ensuring approved contractor lists include contractors from the local Latino community. Contractor outreach efforts can be improved in some of the same ways mentioned for homeowner outreach: by partnering with community-based organizations and using culturally relevant, bilingual messaging.

---

<sup>9</sup> A small pilot program implemented by the Central Vermont Community Action Council and Efficiency Vermont in 2011 demonstrated the potential for this approach. The program focused mostly on attic air sealing and provided DIYers with a daylong skills training as well as a professional audit report, midterm inspection, and final inspection by an auditor to ensure quality. The messaging to potential participants was “You can do it. We can help.” ([U.S. Department of Energy, 2012](#)). Another pilot program, RePower Bainbridge from Washington state, offered DIY options and used checklists as a resource to help participants. And the California Solar Initiative – Thermal program allows self-installers to claim rebates for their solar water heating systems as long as they complete the same workshop required for contractors to be eligible for the program. Although fewer than 2 percent of CSI-Thermal projects in SDG&E territory have been self-installs, program staff reports anecdotally that they are often the highest quality because the DIY crowd takes great pride in their workmanship and their own home.

## 7. Offer Options for Low-Income Households Through Varied Financing Options, Phased Whole-House Retrofit Programs, Low-Cost Recommendations and Expanded Direct-Install Programs

Access to capital is a primary barrier to whole-house energy efficiency retrofits for many households (Fuller et. al, 2010). Financing may be helpful for some Latino households, but this study found mixed perspectives on the Latino appetite for financing, and it should not be viewed as a silver bullet for improving program participation.

On the one hand, the literature review indicated that Latino Americans may be less likely to trust banks and have a cultural tendency to use cash rather than credit. The Latino (as well as non-Latino) focus group participants reflected some reluctance to use financing for high-cost items. In interviews with CVETU audit recipients, only 20 percent seemed willing to consider taking out a loan for energy efficiency upgrades. Some expressed reluctance to take on debt: “I can’t afford [attic insulation] right now. I almost lost my house already. I [had] to get a loan for it. So, I’m paying on my loan right now... it’s hard for me to do anything with my house.”

Alternatively, when survey respondents were asked about how they would proceed with a desired (nonemergency) home improvement project if cash were not available but financing were, 50 percent of foreign-born Latinos and 40 percent of U.S.-born Latinos reported that they would use financing to complete the project rather than wait to save up the cash. (This was higher than the 37 percent of U.S.-born non-Latinos who reported they would use financing.) Similarly, Latino respondents agreed more with the statement “I am more likely to consider a large purchase if I know that there is financing available to help me pay for it” than non-Latino respondents.

However, the research also found the respondents who expressed more desire to use financing may be the ones less likely to be approved for financing. In the survey, foreign-born Latinos reported more trouble accessing credit than the other groups. Furthermore, while the survey and focus groups discussed financing in terms of home improvement projects more generally, the field research interviews were specific to energy efficiency upgrades recommended for the interviewees’ homes. It is possible that any appetite for taking on debt for home improvement projects is reduced when considering energy efficiency upgrades specifically.

**Recommendations:** Although access to capital is a barrier to engaging in major energy efficiency upgrades, programs can still engage with Latino households through the following mechanisms:

- Offer varied financing options such as property assessed clean energy (PACE, where financing is tied to home equity rather than personal credit), on-bill financing, local credit union loans, or the California Hub for Energy Efficiency Financing (CHEEF) pilot programs.<sup>10</sup> The options will vary based on whether the barrier to traditional financing is based on personal credit, ease of enrollment/repayment, or trust in lending

---

<sup>10</sup> The California Hub for Energy Efficiency Financing (CHEEF) is a public-private partnership among state agencies, utilities, lenders, contractors, and borrowers. Its goal is to increase the availability of lower-cost financing for energy efficiency investments throughout the state (California Hub for Energy Efficiency Financing, 2017)

institutions. The previously listed program outreach recommendations also should be applied to any financing offerings to ensure they are personalized and relevant to the target audience.

- Offer phased approaches to whole-house energy efficiency upgrade programs. These approaches can help homeowners break major projects into more manageable pieces over several years without sacrificing access to full incentive amounts. These approaches differ from Energy Upgrade California® Home Upgrade,<sup>11</sup> as a prominent example, which requires fundamental building envelope upgrades to be included in projects. If a homeowner can afford to layer in additional upgrades (such as a high-efficiency HVAC or water heater) at the same time as the envelope upgrades, the rebate amount grows. However, the homeowner would not be able to claim the extra rebate amount if he or she replaced the HVAC or water heater later.
- Offer recommendations for low-cost measures (e.g., changing lightbulbs, HVAC filters, or showerheads) or behavioral changes (e.g., changing thermostat settings, using a shower timer, or turning off lights or fans when leaving a room) that have short or immediate payback periods. Many low-income households already may be working hard to save energy, and additional savings may be scarce.
- Offer direct-install programs for low-income households. The California Energy Commission acknowledges that direct-install programs may be the most straightforward, if costly, method to enable energy efficiency retrofits for this sector (Scavo, et al., 2016).

## **8. Create Regional One-Stop Shops to Integrate Energy Efficiency Retrofits with Other Sustainability, Health, and Safety Improvements**

Homeowners often have multiple concerns about their homes, and energy efficiency is likely not at the top of the list. In the focus groups, Latino participants more frequently described their homes as old and talked about higher-priority needs such as leaking roofs, leaking pipes, and broken furnaces. Census data support the fact that Latino Californians are more likely to live in older homes than the general California population. Often, conditions found in older or lower-quality homes have such serious health and safety implications (e.g., asbestos, lead, and mold) that energy efficiency improvements cannot be made until these issues are addressed. Adding to the need to improve housing conditions is the state's urgent effort to move toward zero-net-energy<sup>12</sup> and climate-resilient buildings. Considering that home improvement projects require major efforts from households to complete, even when they are heavily subsidized, it would be most efficient and appealing to homeowners to address several of these needs at once along with energy efficiency, under the guidance of one program provider.

---

<sup>11</sup> Energy Upgrade California® Home Upgrade provides assistance and incentives for whole-house energy efficiency upgrades. The program is managed locally by IOUs and regional energy networks, with support from the CPUC in collaboration with the California Energy Commission. (SDG&E, n.d.).

<sup>12</sup> Achieving zero net energy means the total amount of energy used by the building annually is roughly equal to the amount of renewable energy created on the site.

**Recommendations:** Offer regional one-stop shops to provide a streamlined access point for Latino owners or residents of low-quality housing to access a collection of home improvement services.<sup>13</sup> The one-stop shops should coordinate and possibly partner with local providers of energy- and non-energy services, such as energy efficiency direct install programs; solar, storage, and demand response programs; water efficiency resources; zero-emission transportation options; asbestos, lead, and mold removal; basic structural maintenance; and climate-resilient retrofits.

## Research Recommendations

### 9. Evaluate Program Design and Outreach Recommendations

This is an exploratory study, and the recommendations have not been prioritized. To help policy makers, local governments, utilities, contractors, auditors, and other program stakeholders better serve households as they pursue energy efficiency in their homes, more research is needed to systematically evaluate these recommendations. Furthermore, more data are needed to establish a baseline for measuring program participation among Latinos or other underrepresented groups. According to a 2016 study of 29 utility energy efficiency programs, only 55 percent of these programs collected data on race or ethnicity, and only 21 percent collected data on primary language spoken (Frank and Nowak, 2016).

**Recommendations:** Policy makers and program implementers should devote resources to evaluate the recommendations made in these studies. This could be coordinated either statewide (e.g., through the California Energy Commission or the California Public Utilities Commission or both) or regionally. Lessons learned from these evaluations should be disseminated widely, so that others can build on these efforts to better serve Latino households.

Programs also should begin collecting race, ethnicity and language data through voluntary fields on program enrollment forms or through a voluntary program survey<sup>14</sup> – both of which should be available in English and Spanish. While asking for this information can be sensitive, partnerships with trusted CBOs can help ensure it is done effectively. Programs can leverage question-and-answer wording from the American Community Survey to ensure high-quality data and promote comparisons to data about the broader population. Language preferences should be determined during enrollment (or as early as possible) to enable effective program engagement; these data also can be used as a rough proxy for acculturation levels, which can provide further insights into Latino populations.

---

<sup>13</sup> This is also recommended by the California Energy Commission and others (Scavo, et al., 2016).

<sup>14</sup> An example of a program that collects demographic data through a voluntary survey is California's Clean Vehicle Rebate Project. The CVRP survey is administered via email to all program participants and achieves an approximate 20 percent response rate; the data are weighted to make it representative of program participants with respect to county, vehicle model, and purchase vs. lease (Center for Sustainable Energy, 2016a).

## 10. Conduct Research to Understand the Opportunities and Limitations of Housing Stock and Behavior Patterns in Different Communities

A prerequisite for achieving energy savings is understanding how energy is being *used* in a home, particularly at a level where conservation (through behavior changes) or efficiency gains (through improved equipment or building envelope) would make significant energy and non-energy impacts. This research indicated that there may be less opportunity for savings related to HVAC systems in Latino households. For example, in interviews with contractors, several contractors mentioned that Latinos have lower energy use relative to other households as they often use evaporative cooling, fans, or other alternatives to central air conditioning. The survey reinforced the finding that of respondents with central air conditioning, foreign-born Latinos were less likely than U.S.-born non-Latinos to use air conditioning (82 percent vs. 91 percent).

The relative lack of air-conditioning use could be related to cost sensitivity. One contractor, speaking of both Latinos and non-Latinos, noted, “If you were to look at the summer electricity bills of people in this area, it would be misleading. Many people cut way back for affordability. One taste of a \$400 summer electricity bill, and a household may be very hesitant to use air conditioning, turning it on only when it is very hot.”

Furthermore, a prerequisite for investing in energy efficiency upgrades is the perception that high energy bills are problems to be solved. Accordingly, more research is needed to understand household perspectives among different segments within the broader Latino population on what they believe needs to be fixed, as well as understanding how households think on how they should be fixed (e.g., using personal/social networks to complete home improvement projects).

**Recommendations:** Conduct attitudinal and behavioral research across different geographies and household metrics such as language spoken at home, family country of origin, income, age, and generations in home. Some of this research should be done in surveys and interviews, as well as other anthropological research methods in real homes. Hopefully, this research would then be used to help policy makers and program implementers better quantify potential energy savings and design more targeted and relevant programs based upon understanding the needs of distinct segments within the Latino population.

# CHAPTER 10:

## Benefits to California

---

The research findings and recommendations have been communicated to hundreds of stakeholders (including local governments, federal and state agencies, utilities, consultants, community-based organizations and researchers) through a variety of channels. Presentations were given at two Behavior, Energy and Climate Change conferences, the American Council for an Energy-Efficient Economy's Summer Study on Energy Efficiency in Buildings, the Empowering Texas Communities conference, the Energy Commission's EPIC Symposium, webinars hosted by the Electric Power Research Institute and the Center for Sustainable Energy, and a Department of Energy Better Buildings Residential Network peer exchange call. Reports and handouts summarizing the research and recommendations, as well as a recording of the Center for Sustainable Energy-hosted webinar, have been posted online at [www.energycenter.org/sociocultural](http://www.energycenter.org/sociocultural).

If the recommendations are implemented, more Latino households will likely participate in California's IOU energy efficiency programs, resulting in energy savings, utility bill savings, and greenhouse gas emission reductions. Potential benefits from implementing project recommendations are quantified based on past participation in energy efficiency programs (specifically whole-house retrofit and HVAC programs), electricity savings associated with these historical projects, and projected increases in Latino participation rates in these programs.

### Method

The research team used a simple model, described by the equations (Appendix A), to calculate savings. The approach to calculating benefits is outlined in the following steps.

1. **Determine number of IOU HVAC and whole-house energy efficiency projects per ZIP code and associated electricity savings:** The California Public Utilities Commission's (CPUC) Energy Efficiency Data sets (CPUC 2015; CPUC 2017) were used to determine the number of projects completed through energy efficiency programs in each ZIP code from 2010 through 2015 and the average electricity savings per project and per ZIP code. As the research focused primarily on whole-building and HVAC retrofits, projects in other categories (such as lighting and water heating) were excluded from the list of projects when finding the historical annual average project count and average project electricity savings. Likewise, projects by nonelectric investor-owned utilities (IOUs) were excluded.
2. **Determine the percentage Latino population in each ZIP code:** The percentage of Latinos in each census tract was obtained from the American Community Survey Data of single-unit homes in California census tracts (U.S. Census Bureau, 2016) and converted to ZIP code-level data using HUD-USPS Crosswalk Files (U.S. Department of Housing and Urban Development, n.d.).

3. **Make project increases in Latino program participation rates:** The research team made low, medium and high projections of the percentage increase in participation among Latinos in energy efficiency programs (Table 22). The low scenario was based on the 8 percent increase in audit sign-ups achieved in the field research by employing more relevant imagery on recruitment brochures (Arreola, Moezzi, and Parsons 2017). The high scenario assumes the percentage of Latino single-family homeowners participating in energy efficiency programs matches the percentage of non-Latino whites participating in programs. According to Frank and Nowak, while 16 percent of single-family homeowners in California IOU territories are Latino/Hispanic, only 9 percent California whole-home retrofit participants are Latino/Hispanic (Frank and Nowak, 2016). Assuming representative participation would result in a 77 percent increase in participation by Latinos. The medium scenario was selected as the midpoint between the high and low scenarios. No ramp-up time was assumed for participation rates to increase, and energy savings in Latino households were assumed to be equivalent to savings projected for average participating households. In summary, the low, medium, and high projections of the percentage increase in participation among Latinos in energy efficiency programs were 8 percent, 42.5 percent, and 77 percent, respectively.
4. **Project increase in electricity savings in Latino households:** Using the information from steps 1-3, total projected increase in annual household electricity savings among Latinos in each ZIP code was calculated for each scenario. These household savings were summed to obtain the total projected increase in annual household electricity savings among Latinos.
5. **Convert electricity savings into GHG emissions reductions:** Using the results of step 4, along with a greenhouse gas (GHG) emissions factor provided by the California Energy Commission (0.331 kg CO<sub>2</sub>e/kWh), the annual reduction in GHG emissions was calculated.
6. **Convert electricity savings into utility bill cost savings:** Using the results of step 4, along with the average retail residential electricity price (U.S. Energy Information Administration, 2018) in California, the annual reduction in utility bills was calculated.

**Table 22: Parameter Values**

<b>Low % increase in participation</b>	<b>Med % increase in participation</b>	<b>High % increase in participation</b>	<b>GHG emissions factor (kgCO<sub>2</sub>e/kWh)</b>	<b>Average price of electricity in California (cents/kWh)</b>
8%	42.5%	77%	0.331	18.77

Source: Center for Sustainable Energy

## Projected Benefits

The analysis found that increased Latino participation in California whole-house retrofit and HVAC energy efficiency programs would increase annual electricity savings by 0.55-5.30

gigawatt-hours (GWh), annual greenhouse gas reductions by 182-1,753 metric tons and annual utility bill savings by \$103,303-\$994,291 (Table 23).

**Table 23: Benefits to California From Increased Latino Participation**

<b>Scenario</b>	<b>Annual Additional Electricity Savings (GWh/year)</b>	<b>Annual Additional GHG Reductions (Metric tons/year)</b>	<b>Annual Additional Electricity Cost Savings to Latino Households (\$/year)</b>
Low (8% increase)	0.55	182.2	\$103,303
Medium (42.5% increase)	2.92	967.8	\$548,797
High (77% increase)	5.30	1,753.5	\$994,291

Source: Center for Sustainable Energy

Other benefits of home energy efficiency upgrades that are not quantified in this analysis include natural gas and propane savings and improved home comfort, indoor air quality, and associated health impacts (Wilson et al. 2016, International Energy Agency 2014). Furthermore, the recommendations made in this report may help improve participation in energy efficiency programs beyond whole-house retrofit and HVAC programs, the focus of this analysis, resulting in additional energy savings. Finally, some recommendations may help stimulate increased participation among non-Latino households, resulting in additional energy savings.

## LIST OF ACRONYMS

<b>Term</b>	<b>Definition</b>
CBO	Community-based organization
CPUC	California Public Utilities Commission
CVETU	Central Valley Energy Tune-Up
DIY	Do-it-yourself
EPIC	Electric Program Investment Charge
GHG	Greenhouse gas
HVAC	Heating, ventilation, and air conditioning
IOU	Investor-owned utility
PACE	Property assessed clean energy
PG&E	Pacific Gas and Electric
SCE	Southern California Edison
SDG&E	San Diego Gas & Electric

## REFERENCES

- Abbas, K., Y. Rao, and J. Wang. 2014. "The Impact of Cultural Values Emergence on the Financial Decision Making Behavior: Case Study of Chinese Women." *International Journal of Business and Social Sciences* 5 (1).
- Alcance Media Group. 2013. "U.S. Hispanic Trends and Behaviors." Presentation. <http://www.alcancemg.com/download/media-kits/hispanic-101-eng.pdf>.
- Arreola, G., Moezzi, M., and Parsons, L. 2017. *Field Research Findings: Home Energy Audits and Upgrades Among Latino in California's Central Valley*. Center for Sustainable Energy.
- ASW Engineering Management Consultants. 2006. *Program Evaluation for the Chinese Language Efficiency Outreach Program (CLEO - 2004, 2005)*. Global Energy Services. Study ID: SCE1366-04.
- Becerra, Alejandro. 2013. *State of Hispanic Homeownership Report*. National Association of Hispanic Real Estate Professionals. <http://nahrep.org/downloads/state-of-hispanic-homeownership-2013.pdf>.
- Bocian, D. G., W. Li, C. Reid, and R. G. Quercia. 2011. *Lost Ground, 2011: Disparities in Mortgage Lending and Foreclosures*. Center for Responsible Lending. <http://www.responsiblelending.org/mortgage-lending/research-analysis/Lost-Ground-2011.pdf>.
- Boehm, Thomas P., Paul D. Thistle, and Alan Schlottmann. 2006. "Rates and Race: An Analysis of Racial Disparities in Mortgage Rates." *Housing Policy Debate* 17 (1): 109. doi:10.1080/10511482.2006.9521563.
- California Hub for Energy Efficiency Financing. 2017. "About the CHEEF." Retrieved from <https://www.thecheef.com/>
- California Public Utilities Commission. 2017. "Energy Efficiency Full Program Cycle 2013-2015 ZIP Code V5." California Energy Efficiency Statistics. Retrieved from <http://eestats.cpuc.ca.gov/Views/EEDataShelf.aspx>.
- California Public Utilities Commission. 2015. "Energy Efficiency Full Program Cycle 2010-2012 Geographic V1." California Energy Efficiency Statistics. Retrieved from <http://eestats.cpuc.ca.gov/Views/EEDataShelf.aspx>.
- Carr, James H., Katrin B. Anacker, and Ines Hernandez. 2013. *The State of Housing in Black America*. The National Association of Real Estate Brokers. [https://www.chapa.org/sites/default/files/State%20of%20Black%20Housing%20in%20American%20NAREB\\_final\\_080413.pdf](https://www.chapa.org/sites/default/files/State%20of%20Black%20Housing%20in%20American%20NAREB_final_080413.pdf).
- Center for Sustainable Energy. 2016. California Air Resources Board Clean Vehicle Rebate Project, EV Consumer Survey Dashboard. Retrieved from <http://cleanvehiclerebate.org/survey-dashboard/ev>.
- Center for Sustainable Energy. 2016. *Study Area Summary Report*.
- Center for Sustainable Energy. 2017. *Online Experiment Findings: Message Effects on Energy Efficiency Choices Among Latino and Non-Latino Homeowners in California*.

- Center for Sustainable Energy, Research Into Action, Inc., and Ghoulam Research. 2017. *Survey Findings: Attitudes and Experiences with Home Improvement Projects among Hispanics and Non-Hispanics in Fresno and San Diego Counties*. Center for Sustainable Energy.
- Cheng, Ping, Zhenguo Lin, and Yingchun Liu. 2014. "Racial Discrepancy in Mortgage Interest Rates." *The Journal of Real Estate Finance and Economics* 51 (1): 101. doi:10.1007/s11146-014-9473-0.
- Davis, L. E., and Engel, R. J. 2011. *Measuring Race and Ethnicity*. New York: Springer.
- Dillman, D. A. 2000. *Mail and Internet Surveys: The Tailored Design Method. 2nd Edition*. John Wiley Co., New York.
- Fitzgerald, M. 2003. "Rompiendo Barreras (Breaking Barriers) The Number and Size of Businesses Launched by Latina Entrepreneurs Has Exploded." American Demographics.
- Frank, M., and Nowak, S. 2016. *Who's Participating and Who's Not? The Unintended Consequences of Untargeted Programs*. Washington, DC: ACEEE. Retrieved from [http://aceee.org/files/proceedings/2016/data/papers/2\\_542.pdf](http://aceee.org/files/proceedings/2016/data/papers/2_542.pdf).
- Fuller, M. C., Kunkel, C., Zimring, M., Hoffman, I. M., Soroye, K. L., and Goldman, C. A. 2010. *Driving Demand for Home Energy Improvements*. Berkeley: Lawrence Berkeley National Laboratory, Environmental Energy Technologies Division.
- Gade, M. K. 2013. "The Environmentalism of Everyday Life1: A Quantitative Study on the Effectiveness of Message Frames for Latino Engagement." Unpublished Thesis. <https://www.american.edu/soc/communication/upload/Melanie-Gade.pdf>.
- Gevorgyan, G. 2010. "Does Culture Matter? Using Accommodation, Framing, and Hofstede Theories to Predict Chinese Voters' Perceptions and Attitudes Toward Culturally Oriented Online Political Advertising." *China Media Research* 6 (1).
- Hall, Nicholas P. 1989. "Views and Opinions on Energy Programs and Services: Results of Focus Group Interviews with Low-Income Hispanics, Blacks, and Senior Citizens," in the *Proceedings of the International Energy Program Evaluation Conference (IEPEC)*.
- Humes, K. R., Jones, N. A., and Ramirez, R. R. (2011). "Overview of Race and Latino Origin: 2010." U.S. Census Bureau. Retrieved from <https://www.census.gov/prod/cen2010/briefs/c2010br-02.pdf>.
- Hungerford, David. 2003. "Living Without Air Conditioning in a Hot Climate: Thermal Comfort in Social Context." In the *Proceedings of the 2003 ACEEE Summer Study on Energy Efficiency in Buildings*. American Council for an Energy Efficient Economy. Washington, DC.
- Inova Energy Group. 2017. *Capturing Cultural Diversity: An Energy Ethnography of Latino Households*.
- International Energy Agency. (2014). *Capturing the Multiple Benefits of Energy Efficiency*. Retrieved from [http://www.iea.org/publications/freepublications/publication/Multiple\\_Benefits\\_of\\_Energy\\_Efficiency.pdf](http://www.iea.org/publications/freepublications/publication/Multiple_Benefits_of_Energy_Efficiency.pdf).

- Kan, Cynthia, Allen Lee, Linda Dethman, Benjamin Mabee, and Kathryn Thomsen. n.d. *PY2010-2012 Community Language Education and Outreach Process Evaluation Report*. Southern California Edison. CALMAC Study ID: SCE0339.01.
- Landale, Nancy S., and R. S. Oropesa. 2007. "Hispanic Families: Stability and Change." *Annual Review of Sociology* 33 (1): 381. doi:10.1146/annurev.soc.33.040406.131655.
- Lee, C., Fernandez, N., and Martin, B. 2002. "Using Self-Referencing to Explain the Effectiveness of Ethnic Minority Models in Advertising." *International Journal of Advertising*, 21, pp. 367-379.
- Lopez-Aqueres, W., Skaga, J., and Kugler, T. (2003). *Housing California's Latino Population in the 21st Century: The Challenge Ahead* (Research Report 1050). Claremont, CA: Tomás Rivera Policy Institute.
- Martinez, Lisa M. 2010. "Politicizing the Family: How Grassroots Organizations Mobilize Latinos for Political Action in Colorado." *Latino Studies* 8 (4): 463. doi:10.1057/lst.2010.54.
- McLain ID Consulting and KVDR Inc. 2010. *PY 2006-08 ETO Process Evaluation*. Southern California Edison. Study ID: SCE0285.
- Moezzi, M. (2016). *Contractor Interview Findings: Perceptions of Latino Households' Views on Home Energy Upgrades*. Center for Sustainable Energy.
- Mundra, Kusum and A. Sharma 2015. "Housing Adequacy Gap for Minorities and Immigrants in the U.S.: Evidence from the 2009 American Housing Survey." *Journal of Housing Research: 2015*, Vol. 24, No. 1, pp. 55-72.
- Muñiz, B., and E. Rodriguez. 2004. *Financial Education in Latino Communities: An Analysis of Programs, Products, and Results/Effects*. National Council of La Raza. National Council of La Raza.
- Nisbet, Matthew C. 2009. "Communicating Climate Change: Why Frames Matter for Public Engagement." *Environment: Science and Policy for Sustainable Development* 51 (2): 12. doi:10.3200/envt.51.2.12-23.
- Office of Efficiency and Renewable Energy. (n.d.). "Innovative Home Tours Homeowners Understand Energy Savings." U.S. Department of Energy. Retrieved from <https://energy.gov/eere/better-buildings-neighborhood-program/innovative-home-tours-help-homeowners-understand-energy>.
- O'Guinn, T. C., G. Imperia, and E. A. MacAdams. 1987. "Acculturation and Perceived Family Decision-Making Input Among Mexican American Wives." *Journal of Cross-Cultural Psychology* 18 (1): 78. doi:10.1177/0022002187018001009.
- Paustian, Chuck. 2001. "Anybody Can Do It: Smaller Companies Embrace Ethnic Marketing." *Marketing News*.
- Phillips, Keith. 2013. "An Evaluation of Quality-Control Questions." *2013 Quirk's Marketing Research Review*: 1-5.
- Reed, J. H., Oh, A., Talerico, T., Riggert, J., and Johnson, K. 2001. *Statewide Residential Customer Needs Assessment Report*. TecMRKT Works.

- Research Into Action. 2015. *Evaluation of the Better Buildings Neighborhood Program*. U.S. DOE. [http://energy.gov/sites/prod/files/2015/08/f25/bbnp\\_volume\\_1\\_final\\_evaluation\\_072215\\_0.pdf](http://energy.gov/sites/prod/files/2015/08/f25/bbnp_volume_1_final_evaluation_072215_0.pdf).
- Research Into Action, Inc. and Center for Sustainable Energy. 2016. *Focus Group Findings: Exploring Home Improvement Projects and Energy Efficiency Among Latinos and Non-Latinos in Fresno and San Diego*. Center for Sustainable Energy.
- Research Into Action, Inc., Ghoulam Research, Dena Gromet. 2016. *Literature Review: Housing, Energy Use, Decision-Making and Messaging among Key Ethnic Groups in California*. Center for Sustainable Energy.
- Rugh, J. S., and D. S. Massey. 2010. "Racial Segregation and the American Foreclosure Crisis." *American Sociological Review* 75 (5): 629. doi:10.1177/0003122410380868.
- Scavo, Jordan, Korosec, S., Guerrero, E., Pennington, B., and Doughman, P. 2016. *Low-Income Barriers Study, Part A: Overcoming Barriers to Energy Efficiency and Renewables for Low-Income Customers and Small Business Contracting Opportunities in Disadvantaged Communities*. California Energy Commission. Publication Number: CEC-300-2016-009-CMF.
- Schneider, Tamera R., Peter Salovey, Anne Marie Apanovitch, Judith Pizarro, Danielle McCarthy, Janet Zullo, and Alexander J. Rothman. 2001. "The Effects of Message Framing and Ethnic Targeting on Mammography Use Among Low-Income Women." *Health Psychology* 20 (4): 256. doi:10.1037//0278-6133.20.4.256.
- Schwartz, M., and E. Wilson. 2008. "Who Can Afford to Live in a Home?: A Look at Data from the 2006 American Community Survey." U.S. Census Bureau. <http://www.basicknowledge101.com/pdf/housing/who-can-afford.pdf>.
- SDG&E. (n.d.) Energy Upgrade California Home Upgrade. Retrieved from <https://www.sdge.com/save-money/energy-upgrade-california-home-upgrade>.
- Snow, David A., E. Burke Rochford, Steven K. Worden, and Robert D. Benford. 1986. "Frame Alignment Processes, Micromobilization, and Movement Participation." *American Sociological Review* 51 (4): 464. doi:10.2307/2095581.
- Speiser, Meighen, and Kirra Krygsman. 2014. "American Climate Values." *Strategic Business Insights and ecoAmerica*. [http://ecoamerica.org/wp-content/uploads/2014/09/eA\\_American\\_Climate\\_Values\\_2014\\_Insights\\_by\\_Racial\\_Ethnic\\_Groups.pdf](http://ecoamerica.org/wp-content/uploads/2014/09/eA_American_Climate_Values_2014_Insights_by_Racial_Ethnic_Groups.pdf).
- Stevenson, T. H., and D. A. Plath. 2006. "Marketing Financial Services to Hispanic American Consumers: A Portfolio-Centric Analysis." *Journal of Services Marketing*. <http://www.emeraldinsight.com/doi/abs/10.1108/08876040610646563>.
- U.S. Census Bureau. 2000. "Frequently Occurring Surnames From the Census 2000." [http://www.census.gov/topics/population/genealogy/data/2000\\_surnames.html](http://www.census.gov/topics/population/genealogy/data/2000_surnames.html).

- U.S. Census Bureau. "2010-2014 Census of Population and Housing, Public Use Microdata Sample, United States." Data accessed via DataFerret.
- U.S. Department of Energy. 2012. "Better Buildings Neighborhood Program Peer Exchange Call: Incorporating Do-It-Yourself Projects Into Programs."
- U.S. Department of Energy. (2017, June 29). "Community-Based Social Marketing: Using Social Science & Data to Change Behavior." Retrieved from [https://energy.gov/sites/prod/files/2017/07/f35/bbrn\\_Summary\\_Comm\\_Based\\_Social\\_Marketing\\_062917.pdf](https://energy.gov/sites/prod/files/2017/07/f35/bbrn_Summary_Comm_Based_Social_Marketing_062917.pdf).
- U.S. Department of Housing and Urban Development. (n.d.). *HUD USPS ZIP Code Crosswalk Files*. Retrieved from [https://www.huduser.gov/portal/datasets/usps\\_crosswalk.html#codebook](https://www.huduser.gov/portal/datasets/usps_crosswalk.html#codebook).
- U.S. Energy Information Administration. (2018). "Table 5.6.A Average Price of Electricity to Ultimate Customers by End-Use Sector, by State, November 2017 and 2016 (cents per kilowatthour)." *Electric Power Monthly*. Retrieved from [https://www.eia.gov/electricity/monthly/epm\\_table\\_grapher.php?t=epmt\\_5\\_6\\_a](https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_5_6_a)
- Weber, Elke, and Christopher Hsee. 2000. "Culture and Individual Judgment and Decision Making." *Applied Psychology* 49 (1): 32. doi:10.1111/1464-0597.00005.
- Weber, Elke U, Christopher K Hsee, and Joanna Sokolowska. 1998. "What Folklore Tells Us About Risk and Risk Taking: Cross-Cultural Comparisons of American, German, and Chinese Proverbs." *Organizational Behavior and Human Decision Processes* 75 (2): 170. doi:10.1006/obhd.1998.2788.
- Wilson, J., D. Jacobs, A. Reddy, E. Tohn, J. Cohen, and E. Jacobson. 2016. *Home Rx: The Health Benefits of Home Performance: A Review of the Current Evidence*. U.S. Department of Energy. Retrieved from <https://betterbuildingssolutioncenter.energy.gov/sites/default/files/attachments/Home%20Rx%20The%20Health%20Benefits%20of%20Home%20Performance%20-%20A%20Review%20of%20the%20Current%20Evidence.pdf>.
- Zillow. 2014. "A House Divided: How Race Colors the Path to Homeownership." [http://zillow.mediaroom.com/file.php/1760/A\\_House\\_Divided\\_DOWNLOAD.pdf](http://zillow.mediaroom.com/file.php/1760/A_House_Divided_DOWNLOAD.pdf).

# Appendix A: Variables and Calculations

---

The research team used a simple model, described by these equations to calculate savings.

## Variables

The variables used in the model were as follows.

$z = (z_1, z_2, \dots, z_n)$  set of all ZIP codes in electric IOU territories

$n_z$  = Historical number of projects in each ZIP code (# proj)

$h_z$  = Percentage of single-family homes with at least one Latino householder in each ZIP code (%)

$i$  = Projected increased participation rate among Latinos (low, medium, high) (%)

$e_z$  = Average annual household electricity savings per project in each ZIP code (kWh/proj)

$s_z$  = Annual additional electricity savings per ZIP code (kWh/year)

$S$  = Total annual additional electricity savings (kWh/year)

$g$  = GHG emissions factor (kgCO<sub>2</sub>e/kWh)

GHG = Total annual GHG emissions reduction (kgCO<sub>2</sub>e/year)

$p$  = Price of electricity in California (\$/kWh)

$C$  = Total annual cost savings (\$/year)

## Model Calculations

$$s_z = n_z * h_z * i * e_z$$

$$S = \sum_{z=z_1}^{z=z_n} s_z$$

$$GHG = S * g$$

$$C = S * p$$