

Final Report: Baseline Characterization Market Effects Study of Investor-Owned Utility Whole House Retrofit Programs in California

California Public Utilities Commission

Prepared by KEMA, Inc.

July 18, 2014

CALMAC Study ID: CPU0073.01

Copyright © 2014, KEMA, Inc.

This document, and the information contained herein, is the exclusive, confidential and proprietary property of KEMA, Inc. and is protected under the trade secret and copyright laws of the United States and other international laws, treaties and conventions. No part of this work may be disclosed to any third party or used, reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying and recording, or by any information storage or retrieval system, without first receiving the express written permission of KEMA, Inc. Except as otherwise noted, all trademarks appearing herein are proprietary to KEMA, Inc.

Table of Contents

Program Overview	1
Study Methods.....	3
Summary of Findings	5
Implications for EUC Program Operations.....	10
1. Introduction.....	11
1.1 Program Overview	12
1.1.1 Program Description	12
1.1.2 Summary of Program Activity	14
1.2 Overview of Analytic Approach and Methods	16
1.2.1 Program Theory Framework	16
1.2.2 Research and Analysis Methods.....	19
1.3 Structure of the Report	28
2. Development of Whole House Retrofit/Home Performance Programs in the United States	30
2.1 Origins and Early Development	30
2.2 Expansion and the Influx of Stimulus Funds	32
2.3 Current Issues and Challenges	34
3. The Consumer Market for Whole House Retrofit and Home Performance Services	38
3.1 The Consumer Market for Home Improvement Services: Trends in Volume and Spending	39
3.2 Motivations for Home Improvement Projects.....	40
3.3 Energy Efficiency Measures in Home Improvement Projects.....	42
3.4 Effect of Program Participation on Use of Energy Efficiency Measures in Home Improvement Projects	44
3.5 Project Costs and Use of Project Financing.....	46
3.6 Contractor Selection and Customer Experience of Energy Efficiency Service Sales and Delivery.....	51
3.6.1 Contractor Selection	51
3.6.2 Contractor Promotion of WH/HP Values	55
3.7 Program Recognition and Participation	56
3.7.1 Types of Services Received and Customer Assessment of their Value.....	56
3.7.2 Program Effect on Measure Implementation Decision.....	59
3.8 Non-participant Awareness and Interest in WH/HP Services.....	59
3.9 Conclusions.....	61
4. The Supply Chain for WH/HP Services.....	64
4.1 Characteristics and Practices of High Volume WH/HP Contractors	64
4.1.1 Business Strategies and Value Propositions.....	65

Table of Contents

4.1.2	Approaches to Key Business Challenges	66
4.1.3	Assessment of Current Programs	68
4.2	Population of Contractors and the Contractor Survey Sample	69
4.2.1	The Population of Home Improvement & Remodeling Contractors	69
4.2.2	The Contractor Survey Sample	70
4.3	Energy Efficiency Measures Installed in Home Improvement Projects	72
4.4	Home Performance Service Offerings	74
4.5	Contractor Awareness and Knowledge of WH/HP Concepts.....	75
4.6	Contractor Interest in Investing in WH/HP Delivery Capability	77
4.7	WH/HP Program Awareness, Participation, and Response	78
4.8	Conclusions.....	79
5.	Integrated Analysis: Market Indicators and Their Implications.....	81
5.1	Market Indicators and Summary of Market Development	81
5.2	Implications of Findings for IOU Home Upgrade / Advanced Home Upgrade Program Operations	86
5.3	Recommendations for Future Research.....	87
A.	References.....	A-1
B.	Selected Methodological Issues.....	B-1
	Construction of Comparison Areas	B-1
	Introduction	B-1
	Selection process – Out-of-State areas	B-1
	Selection process – Out-of-State areas	B-8
	Selection process – In-State areas.....	B-9
	Ratio Estimation Method Used in the Contractor Survey.....	B-14
	Comparability of Homeowner Samples from California and Out-of-State Comparison Areas.....	B-16
	Summary Tables: Homeowner Survey Results	B-19
1	Introduction.....	B-28
2	Screener	B-28
3	Project Details.....	B-31
	Program Participation/Energy Audit.....	B-32
	Shell Elements and Related Efficiency Measures	B-35
	Space Heating Equipment and Efficiency Measures	B-36
	Air Conditioning Equipment and Efficiency Measures.....	B-39
	Domestic Hot Water.....	B-41
	Solar PV	B-42

Table of Contents

	Project Finances	B-44
	Contractor Information.....	B-45
	Program Recognition and Participation.....	B-47
4	Respondent and Household Characteristics	B-50
5	Wrap-up.....	B-52

List of Exhibits

	Figure 1: EUC Program Logic Model	17
	Figure 2: Barriers to Market Acceptance of WH/HP Services and Typical Program Elements that Address Them	18
	Figure 3: Research Activities in Support of Baseline Characterization	20
	Figure 4: United States Climate Map	22
	Figure 5: Timeline of Key Events in the Development of WH/HP Programs and Related Organizations in the U.S.	32
	Figure 6: Number of Technicians with Active BPI Certifications in United States	34
	Figure 7: Quarterly Spending on Home Improvement Projects U. S. Q4 2010 through Q1 2014	39
	Figure 8: Distribution of Reported Project Costs - All Respondents	47
	Figure 9: Distribution of Reported Project Costs	48
	Figure 10: Sources of Information on WH/HP Services (Multiples Accepted)	76
	Figure 11: Dendogram from Cluster Analysis including both climatic (HDD, CDD) and demographic variables	B-7
	Table 1: Summary of Program Spending and Tracking System Savings: Program Inception through January 2014	15
	Table 2: Customer Expenditures on Thermal End Uses: California v. Massachusetts	21
	Table 3: Demographic Characteristics of California MSAs	23
	Table 4: Distribution of Homeowner Survey Sample by Area and Reported Program Participation	25
	Table 5: Estimation of the Fraction of Energy Efficiency Program Participants in the Population of Homeowners with Major Home Improvements	26
	Table 6: Summary of Participation and Gross Savings Results Nine Evaluations of WH/HP Programs	35
	Table 7: Motivations for Home Improvement Projects	41

Table of Contents

Table 8: Summary of Energy Efficiency Measures Included in Home Improvement Projects	43
Table 9: Summary of Energy Efficiency Measures Included in Home Improvement Projects by Program Participation Status	46
Table 10: Percentage of Home Improvement Projects Financed	49
Table 11: Reasons for Not Completing All Recommended Energy Efficiency Measures	50
Table 12: Characterization of Contractor with Primary Project Responsibility	52
Table 13: Characterization of Contractor by Program Participation	53
Table 14: Channel Used to Find Contractor by Respondent Participation Status	54
Table 15: Reasons for Contractor Choice (Multiples Accepted)	55
Table 16: Energy-Related Issues by Contractors in Planning the Respondent's Home Improvement Project	56
Table 17: Assistance Provided by Energy Efficiency Programs	57
Table 18: Importance of Program Services in Encouraging Project Planning and Completion	58
Table 19: Results of Free Ridership Questions	59
Table 20: Non-Participant Awareness of WH/HP Concepts and Programs	60
Table 21: Non-Participants Interest in WH/HP Services	61
Table 22: Selected Characteristics of WH/HP Contractors Profiled in Case Studies	65
Table 23: WO54 Whole House Contractor Survey - Population and Sample Counts	71
Table 24: Measure types installed - All contractors	73
Table 25: Home Performance-Related Services Offered	74
Table 26: Contractor Awareness, Knowledge, and Attitudes in Regard to Whole House/Home Performance Concepts	75
Table 27: Contractor Interest in and Current Capacity to Deliver WH/HP Services	77
Table 28: Contractor Awareness of and Participation in Local Programs that Support WH/HP Services	78
Table 29: Market Indicators for WH/HP Services	82
Table 30: Demographic and climatic data for potential non-program area comparison sites	B-4
Table 31: Demographic and climatic data for select cities within the program area in CA	B-5
Table 32: Demographic data for potential non-program area comparison sites	B-11
Table 33: Comparison of demographic variables in program and non-program areas within CA	B-13
Table 34: Distribution of Establishments in the California Program Area Sample Frame by Size and Type	B-15
Table 35: Demographic and Housing Characteristics of Homeowner Survey Respondents by Study Area	B-18

Table of Contents

Table of Acronyms

AHU	Advanced Home Upgrade
ARRA	American Recovery and Reinvestment Act of 2009
BPI	Building Performance Institute
CAEATFA	California Alternative Energy and Advanced Transportation Financing Authority
CATI	Computer Aided Telephone Interview
CDD	Cooling Degree Days
CPUC	California Public Utilities Commission
CSG	Conservation Services Group
DHW	Domestic Hot Water
DIY	Do it yourself
DNREC	Delaware's Department of National Resources and Environmental Control
DSIRE	Database of State Incentives for Renewable Energy (DSIRE)
E*	ENERGY STAR
EEGA	Energy Efficiency Groupware Application
EUC	Energy Upgrade California
FERC	Federal Energy Regulatory Commission
GHG	Green House Gases
HDD	Heating Degree Days
HERS	Home Energy Raters
HP	Home Performance
HVAC	Heating, Ventilation, Air Conditioning
IDSM	Integrated Demand Side Management
IOU	Investor Owned Utilities
LIPA	Long Island Power Authority
MMBTU	One million British Thermal Units
MSA	Metropolitan Statistical Area
NAICS	North American Industry Classification System
NATE	North American Technician Excellence
NYSERDA	New York State Energy Research and Development Authority
OOS	Out of State
PG&E	Pacific Gas and Electric

Table of Contents

RDD	Random Digit Dial
RECS	Residential Energy Consumption Survey
REN	Bay Area Regional Energy Network
RESNET	Residential Energy Services Network
SCE	Southern California Edison
SIC	Standard Industrial Classification
SoCalGas	Southern California Gas
TVA	Tennessee Valley Authority
WAP	Weatherization Assistance Program
WH	Whole House

Executive Summary

This is the Final Report of the Baseline Characterization of the market for Whole House Retrofit (WH) and Home Performance (HP) services in California. The Baseline Characterization is the first phase of a planned two-part study to assess the effect of programs sponsored by the California Investor-Owned Utilities (IOUs) on the market for WH and HP services. For the purposes of this report we define those services as follows.

- **Whole House Retrofit:** An approach to planning and executing energy efficiency improvements in a home so as to maximize energy savings. Generally, this involves following a “loading order” of measures whereby thermal loads are decreased through air sealing, duct sealing, insulation and other shell measures, followed by changes to energy supply systems such as space heating, water heating, and cooling to most efficiently meet the reduced load.
- **Home Performance Services:** A suite of pre- and post-installation services designed to identify cost-effective measures, inform customer decisions regarding the selection and sequencing of implementation, and assure the quality and effectiveness of the measures installed. These services include home energy assessments or audits, diagnostic testing of shell elements and heating and cooling equipment, and post-installation testing to ensure that measures are working properly.

The objectives of this phase of the study are to characterize the structure and current volume of activity in the WH/HP service market in California and in a comparison area that has not been served programs funded by public goods charges that promote those services, and to summarize the findings in a set of quantitative market indicators. The follow-up phase will re-estimate the value of the market indicators using essentially the same methods applied in the Baseline Characterization. The difference between California and the comparison areas in the pace of change of the market indicators will serve as the primary measure of the market effects of the IOU programs. Also, the comparison between California and the non-program on the current values of market indicators provides some insights into the early effects of EUC.

Program Overview

The California IOUs initiated delivery of programs to promote the delivery and purchase of WH/HP services as part of the 2010 – 2012 program cycle. At roughly the same time, state and local government agencies began to offer similar programs with the support of the U. S. Department of Energy, using economic stimulus funding made available under the American Recovery and Reinvestment Act of 2009. In early 2010, these efforts were consolidated at the statewide level under the rubric of Energy Upgrade California (EUC). In late 2012, by Commission Decision, the EUC brand, logo and name was expanded from being solely a whole house brand to being California’s new clean energy/integrated demand side management brand.

For this reason, the IOUs changed their whole house program names to Advanced Home Upgrade and Home Upgrade in 2013. Some IOU marketing of whole house programs using the EUC brand continued in 2013 during this transition period, but as of 2014, the EUC brand is expected to be devoted to marketing and awareness for California's larger Integrated Demand Side Management (IDSM) and clean energy statewide goals and campaigns. From here forward in this document, we refer to the Home Upgrade/Advanced Home Upgrade marketing programs when referring to IOU marketing of WH/HP concepts.

In addition to its energy savings objectives, the IOU's Home Upgrade/Advanced Home Upgrade is also designed to support "Transform[ation] of home improvement markets to apply whole house energy solutions to existing homes," a major goal identified in the *California Energy Efficiency Strategic Plan*. In its current form, the IOUs Home Upgrade/Advanced Home Upgrade programs offer the following incentives and services.

- **Customer Incentives.** The IOU's Home Upgrade/Advanced Home Upgrade (HU/AHU) program offers financial incentives up to \$4,500 for whole house retrofits using two different approaches.
- **Contractor Qualification and Listing.** In order to receive incentives, customers must use contractors who have been qualified by the HU/AHU statewide program. Qualifying contractors program remain listed on the EUC statewide website and can be searched geographically.
- **Quality Assurance.** The IOUs' program delivery contractor reviews all applications and home energy assessments for completeness and compliance with technical procedures. The program delivery contractor also inspects a high percentage of completed projects.
- **Contractor Training.** All contractors who participate in the program are required to take training to orient them to program rules and procedures. The utilities and other program sponsors also offer a variety of technical and sales training options through their Workforce Education and Training portfolios.
- **Marketing.** EUC undertook extensive marketing activities in support of the program during 2011-2012, some ARRA- funded, some IOU- funded. These efforts included mass media, social media campaigns, public relations events, visibility at events such as home shows, and maintenance of the statewide web site. In 2014, marketing for whole house services began using the HU/AHU program name exclusively, with program materials remaining easily available on the expanded Energy Upgrade California brand clean energy website.
- **Project Financing.** The California Alternative Energy and Advanced Transportation Financing Authority (CAEATFA) administers the Clean Energy Upgrade Financing

Program to facilitate the financing of energy retrofits on California properties. The IOU's HU/AHU programs provide referrals to customers as needed.

Participation and Savings. 6,315 projects were completed during the 2010 – 2012 program cycle: 4,330 through the advanced track and 1,985 through the prescriptive track. At the direction of the CPUC, the IOUs original *Program Implementation Plan* contained funding levels sufficient for 40,000 prescriptive projects during the first three-year cycle. During the first 13 months of the 2013 – 2014 cycle, 3,601 projects were completed, all but 190 of them through the Advanced track. While program participation has begun to accelerate somewhat, expenditures and *ex ante* savings have run consistently below plan since program inception. Virtually every other WH/HP program that we reviewed in the course of our literature review for this study has experienced similar difficulties in achieving planned levels of participation.

For the current cycle, the customer costs for projects completed under the Advanced Upgrade track averaged \$14,050. Average tracking system *ex-ante* savings estimated through the energy assessment were estimated at 29 percent of pre-program annual energy use.¹

Contractor Participation. Analysis of contractor lists on the EUC web site as of July/August 2013 found that 432 firms were qualified to provide services through the program out of roughly 13,000 firms that provide general home remodeling, HVAC, insulation, and specialty energy efficiency services in California.

Study Methods

To structure the research for this project, we identified three study areas. The California Program Area consisted of the full service territories of Southern California Edison, San Diego Gas & Electric, and SoCal Gas, as well as the counties in the PG&E service territory in which the initial roll-out of the program occurred. The California Comparison area consisted of counties in the PG&E service territory in which intensive program marketing had not been deployed during the study period. The Out-of-State (OOS) Comparison Area consisted of a set of Metropolitan Statistical Areas in North Carolina, South Carolina, Tennessee, and Texas which, taken together, corresponded to the climate, demographic, and housing market conditions found in the California Program Area to the extent feasible.

The primary research and analysis conducted for this study consisted of the following elements.

- **Homeowner Survey:** telephone survey of homeowners of single-family or two-family houses in the California Program and Comparison Areas. Respondents were screened for

¹ Ex ante savings are those projected or reported by IOU personnel, they have not been verified or approved by the CPUC. Personal correspondence with Nils Strindberg, California Public Utilities Commission

eligibility based on whether they had completed renovations in the past three years that cost more than \$3000 to complete. We completed 500 interviews in the CA Program and OOS Comparison Area; 200 in the CA Comparison Area. We did not establish quotas for customers who had received support from energy efficiency programs in completing their home improvement projects. However, a large enough number of respondents in all three study areas reported that they had received such assistance, which enabled us to report results for some items separately for participants and non-participants. The survey was in the field from June 24 2013 through January 8, 2014.

- **Contractor Survey:** telephone survey of contractors active in the trades and specialties addressed by WH/HP programs. These include firms active in general home remodeling, heating and cooling equipment (HVAC) installation and maintenance, insulation, and residential energy efficiency improvements. We completed 90 contractor interviews in the CA Program Area; 74 in the OOS Comparison Area. This survey was not conducted in the CA Comparison Area due to inadequate populations of firms to support the sample. This survey was in the field from early September 2013 until January 8, 2014.
- **In-depth Interviews and Case Studies of High-Volume Contractors:** in-depth interviews and case studies of 6 high-volume contractors: 3 active in California and three active in other states. The case studies developed narratives of the firm's entry into the energy efficiency contracting market, their basic business model, strategies to address common challenges, and their assessment of the prospects for development of an unsubsidized market. These case studies were conducted in early 2013.

Due to the timing of the study, the research effort necessarily focused on characterizing conditions in California and the Comparison Areas during the period of early program implementation. Thus, the period does not strictly represent a baseline as defined by most evaluation guidelines. Findings from the California Program Area reflect some effects of the operation of the HU/AHU programs. The difference between the California Program Area and the Comparison Areas in the observed values for market indicators provides a sense of the magnitude of those effects. However, as discussed in Sections 3 and 4 below, there are many other factors that contribute to those differentials, such differences between the study areas in code requirements. The cross-sectional comparisons provided by this study do not, by themselves, provide a strong basis for attributing observed differences in market indicators to the HU/AHU programs versus other potential factors. We believe analysis of the difference between the study areas in the pace of change in market indicators over time, as well as other potential approaches that become available with two sets of observations, will provide the basis for more comprehensive and convincing analyses of program effects.

Summary of Findings

Table E1 displays the estimates of the market indicators selected to represent the current condition of the market for WH/HP services in the CA Program Area and the Comparison Areas. The values in E1 represent the entire population of customers who made major home improvements, regardless of their participation status. The key overarching observations based on the findings presented in Sections 3 through 5 are as follows.

- **As of early 2014, we find the level of unsubsidized adoption of the WH/HP approach to energy efficiency to be very low, both in the California Program Area or in the Comparison Areas.** Among non-participants, only 8 percent in the California Program Area and 6 percent in the Comparison Areas reported installing combinations of shell and air sealing measures. Only 3 – 4 percent reported installing combinations of shell and HVAC measures. Fourteen percent of non-participants in the CA Program area reported having a blower door test done as part of their project, as did 10 percent of non-participants in the Comparison Areas. None of the high-volume contractors interviewed in depth for the case studies attempted to market their services without subsidies. When questioned why, none believed that the services could be marketed profitably without program support.
- **Individual components of the WH/HP approach are available on the market, and are being incorporated into a relatively small portion of home improvement projects, including some completed without program support.** In the California program area, 65 percent of homeowners who recently completed home improvements incorporated at least one energy efficiency measure into their projects; 35 percent included two or more measures. Relatively few homeowners used combinations of measures and diagnostic tests associated with the WH/HP approach, but there were some non-participants among those who did. For example:
 - Combination of insulation and air sealing measures. Eight percent of all projects in the CA Program area included this combination of measures, as shown in Table E1, which displays results for the full sample of respondents in each study area, regardless of participation status.
 - Blower door tests for infiltration. Seventeen percent of all projects in the CA Program Area included this test. The portion of projects with blower door tests was significantly higher (p-value < .10) in the two California study areas than in the OOS Comparison area.
 - Duct leakage tests. Thirty-four percent of all projects involving improvements to heating and cooling systems in the CA Program Area included this test, as did 24 percent of heating and cooling improvements carried out in the California Comparison Area. By contrast only 12 percent of consumers who carried out heating and cooling upgrades in the Out of State Comparison Area reported have duct

leakage tests performed. This result likely reflects changes in California building codes that require duct leakage tests for permitted installations of residential heating and cooling equipment

These findings are consistent with results from the contractor survey regarding the share of projects on which various types of measures and tests are deployed. They suggest the presence of a small unsubsidized market for some components of the WH/HP approach, but not for the entire, integrated package.

Table E1: Market Indicators for WH/HP Services

Market Indicator	Full Sample		
	CA Program	OOS Comparison	CA Comparison
Consumer Market			
Percent of home improvement projects with multiple Energy Efficiency measures	38%	32%	31%
Percent of projects with combined shell and air sealing measures	10%	6%	6%
Percent of projects with combined shell and HVAC measures	5%	4%	4%
Percent of projects that include blower door tests	17%	12%	21%
Percent of HVAC projects that include duct leakage tests	34%	12%	24%
Percent of projects with main motivation of energy saving, improved comfort, or improved air quality	29%	24%	35%
Percent of customers making home improvements who are aware of WH/HP services	29%	13%	17%
Percent of customers who find their contractor through a utility or government energy efficiency program.	3%	2%	3%
Supply Chain			
Number of BPI-certified contractors per 10,000 occupied housing units	4.36	2.59	
Share of market represented by contractors who deliver combined shell and air sealing measures in all or most projects	18%	11%	
Share of market represented by contractors who deliver combined shell and HVAC measures in all or most projects	20%	17%	
Share of market represented by contractors who deliver energy audits in all or most projects	20%	11%	
Share of market represented by contractors who use blower door tests in all or most projects	15%	5%	
Share of market represented by contractors who use duct leakage tests in all or most projects	17%	12%	
Share of market represented by contractors aware of whole house retrofit concepts	75%	67%	
Share of market represented by contractors who can accurately describe WH/HP practices	33%	30%	
Share of market represented by contractors who are aware of WH/HP programs in their local markets	59%	44%	
Share of market represented by contractors who report that they currently deliver WH/HP services	12	4%	

 Significantly different from the CA Program Area at the 90% confidence level

- **Low levels of awareness of the WH/HP value proposition and restricted contractor search practices are the major barriers to increased adoption of WH/HP practices among consumers.** Despite the marketing and publicity efforts that have supported the IOUs HU/AHU program, levels of customer awareness of WH/HP services and their value are relatively modest. In the California Program Area, 29 percent of sample customers who had carried out major home improvements in the last 3 years reported being aware of home performance programs after being read a detailed description of the services provided. In terms of adopting WH/HP practices, the effects of these modest levels of awareness are compounded by the restricted range of resources that customers access in finding a contractor. In 70 percent of cases customers used contractors whom they had employed on previous projects, found through word of mouth, or had previous personal relationships, regardless of study area or program participation status. High-volume WH/HP contractors interviewed for the case studies stressed the importance of personal selling in closing whole house projects, due to their complex value proposition. Given the restricted channels used to find contractors, it is difficult even for motivated contractors to insert themselves into the project specification process. Only 1 percent (OOS) to 2 percent (CA) of respondents reported using contractors found through energy efficiency programs.

Many studies of WH/HP programs identify first costs as a major barrier to undertaking whole house retrofits. In this study we found that cost was not a major barrier for inclusion of energy efficiency measures into home improvement projects generally. No more than 7 percent of customers in any of the study areas reported that they were unable to complete all energy efficiency measures recommended to them by an audit or contractor due to financial constraints. A recent process evaluation estimated the share of customers who did not complete all recommended measures due to financial constraints at 28 percent.² The difference between the results for the general population of homeowners with improvements versus homeowners in the California AHU program is likely due to the fact that virtually all participants in the AHU program received a comprehensive audit recommending a wide range of measures.

- **Effective delivery of WH/HP services and participation in WH/HP programs requires a scale of contractor operations that is beyond the capability of the large majority of firms in the home improvement industry.** The case studies of high-volume WH/HP contractors demonstrate that success in this field requires investment in hiring and training staff to market the services, maintain consistency and quality of delivery, and manage a significant flow of technical and administrative work associated with completing home assessments, obtaining rebates, and assuring compliance with program rules. All but one of the six high-volume contractors employed

² SBW Consulting, Inc. 2013.

20 or more workers. By contrast, only 5 percent of the more than 13,000 California firms listed by the InfoUSA business establishment database in relevant residential contracting specialties employed 20 or more workers.³ Eleven percent employ 10 or more workers. Thus, recruiting a significant portion of these larger firms into the program and encouraging their active marketing of its services is a critical step in growing WH/HP service delivery capacity and program participation.

- **Lack of understanding of WH/HP services and their potential business value is the major barrier to adoption of WH/HP practices and program participation among contractors.** Although contractors representing 75 percent of the home improvement market in the CA Program area reported being aware of WH/HP service concepts, only roughly half of those could accurately describe the WH/HP approach. When questioned whether it would be worthwhile to invest in developing WH/HP service delivery capability, 46 percent of all contractors in the California Program Area sample answered positively. Given the relatively small number of firms capable of delivering WH/HP services at scale, outreach and education to recruit and motivate contractors will be essential to achieving targeted levels of program participation and savings.
- **Progress in developing the California market.** Despite the challenges described above to the growth of WH/HP services and participation in programs that support them, the market indicators in Table E1 suggest that EUC, along with its predecessor retrofit programs, and related programs that support quality HVAC installation, are having a positive effect on the market. We note that a significantly higher (p-value < .10) percentage of who have recently undertaken major home improvements in the CA Program area have incorporated the following measures and procedures into their projects, versus their counterparts in the OOS Comparison Area:
 - Multiple energy efficiency measures in a single project;
 - Combination of air sealing and insulation measures; and,
 - Blower door tests.

We also note that a significantly higher (p-value < .10) percentage of homeowners with projects in the CA Program Area report that they are aware of WH/HP services than their counterparts in either the OOS or CA Comparison Areas. The difference between the CA Program and OOS Comparison area on this indicator is sufficiently large (29 percent v. 13 percent) to suggest that it reflects the effects of the significant marketing effort surrounding WH/HP concept during the 2010-12 period, when this was primarily

³ See infousa.com for a description of the establishment database and methods used to compile and maintain it.

ARRA-funded, and subsequently in 2013 when the IOUs spent heavily on EUC/ Home Upgrade/Advanced Home Upgrade marketing.

On the supply side of the market, the indicators of effects from programs to promote WH/HP services are less clear. Although contractors in the CA Program Area report offering and installing WH/HP components in a larger share of projects than their counterparts in the OOS Comparison Area, these differences are small and not statistically significant in most cases. We do observe two clear-cut differences between the study areas. First, the number of BPI-certified contractors, normalized for market size, is 70 percent higher in the CA Program Area than in the comparison area. Second, contractors representing 59 percent of the market in the California Program Area report being aware of WH/HP programs versus 44 percent in the Out-of-State Comparison Area, and the level of participation is nearly twice as high: 28 percent v. 14 percent.

Implications for EUC Program Operations

While the scope of this project did not include a thorough process evaluation of the IOU's HU/AHU programs, we believe the findings summarized above suggest general strategies for increasing program participation. These include the following:

1. **Continue and expand the consumer marketing and outreach campaign to inform customers and realtors of the value of WH/HP services.** The results of the household survey and the case studies suggest that messaging for program marketing should address the full range of program benefits, including:
 - Increased comfort and indoor air quality;
 - Upgrading and maintenance of key home systems;
 - Consumer protection elements, including contractor screening and inspections;
 - Reduction of search time and other transaction costs through contractor listing and administrative support in completing applications.
2. **Build contractor motivation and capacity to market and sell WH/HP services.** We understand that ARRA-funded EUC activities during the 2010-12 period put considerable effort into this objective. Some tactics to consider in this regard include the following.
 - Focus outreach to contractors in larger firms (those with 10 or more employees). Smaller firms will generally not have the capacity to build significant project volume or to hire sales and administrative personnel.
 - Develop intensive marketing sales training for contractor sales personnel.
 - Develop playbooks or other instructional material to provide guidance in building volume under the program.

Conduct competitions for contractors on volume and quality of work delivered.