2010–2012 PG&E Whole House Retrofit Program Phase II Process Evaluation Study – PGE0302.04

Prepared For

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ENERGY + WATER + EFFICIENCY

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Additionally, we want to thank the many homeowners and independent contractors who took the time to participate in our lengthy interviews and provided invaluable insights about the program.

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1. EXECUTIVE SUMMARY

Pacific Gas and Electric (PG&E) operates part of the statewide Energy Upgrade California™ (EUC) initiative. The program delivers multiple energy efficiency upgrades to the homes, including but not limited to infiltration control, efficient heating and cooling equipment and upgrades to the thermal integrity of building envelope.

A broad-based evaluation of the program was completed in 2012 (Phase I) and covered program operations from July 2011 through February 2012. This report describes a second phase of evaluation for PG&E's portion of the program, referred to as Phase II. In Phase II, various elements of data collection were repeated to allow for analysis of trends and to examine the impact of changes made in program design and operation.

This study's research objectives were:

- Assess customer attitudes, motivation, and experience with the program
- Assess participation barriers
- Assess contractor attitudes, motivation, and experience with the program
- Assess energy rater attitudes, motivation, and experience with the program
- Assess the effectiveness of contractor training

We have identified high-priority recommendations that we believe will improve the program's marketing, implementation, and design. We have also identified one high priority research topic that should be explored in future evaluations.

Marketing Recommendations

- Sustain and enhance IOU marketing strategies, including:
  - Continue to support contractors in face-to-face marketing opportunities
  - Continue to use the EUC website as an educational medium
  - List contractors in a fair order on the EUC website
  - Continue promoting main program benefits
  - Target customers to get the largest amount of gross and net savings

Implementation Recommendations

- Encourage the Contractor-Customer Relationship
- Develop follow-up protocols for prospective participants, including:
  - Follow-up with customers who request contact on the EUC website
  - Follow-up with customers who receive an assessment
- Improve Contractor Training Classes, by:
  - Rename the Basic Class

  - Implement Adult Learning Principles in the Advanced Class
- Close Contractor Performance Gaps, including:
  - Safety
  - Measure assessment
  - Measure implementation
  - Modeling
- Redesign Training into Modules, including:
  - Potential Required Trainings
  - Potential Optional Trainings
  - Online Modules
- Leverage and Integrate Existing Training Resources, including:
  - Relevant Energy Training Center Courses
  - Training Roadmap
  - Cross Advertising
  - Home Performance Training Calendar
  - Self-Assessment and Personal Training Plan
  - Personal Training Alerts

Program Design Recommendations

- Consider Financing and Incentive Structure, including:
  - Continue seeking attractive financing options
  - Evaluate project incentive levels and home assessment incentives

Additional Research Recommendation

One particular study should be conducted, if it is not already covered by the impact evaluation, to help quantify program spillover. That study should investigate the spillover that might be happening amongst customers that receive a home assessment but never complete a program project.

2. INTRODUCTION

Pacific Gas and Electric (PG&E) operates part of the statewide Energy Upgrade California™ (EUC) initiative. The program delivers two levels of energy efficiency services (basic and advanced) to homeowners. These services result in multiple energy efficiency upgrades to the homes, including but not limited to infiltration control, efficient heating and cooling equipment and upgrades to the thermal integrity of building envelope. The basic service level delivers a fixed package of improvements and pays a fixed incentive. The advanced service level delivers a customized package of improvements and pays an incentive based on estimated savings.

A broad-based evaluation of the program was completed in 2012 and covered program operations from July 2011 through February 2012. For PG&E, this period immediately followed a pilot phase of the program. That evaluation will be referred to as Phase I. The Phase I final report provided recommendations for improving the program marketing, implementation, and design.

This report describes a second phase of evaluation for PG&E's portion of the program, referred to as Phase II. In Phase II, various elements of data collection were repeated to allow for analysis of trends and to examine the impact of changes made in program design and operation. New types of data were also collected to complete work that was not feasible during Phase I, such as survey of homeowners that interacted with the program but did not complete an upgrade job.

We evaluated the PG&E Whole-House Program in its second year in the marketplace. During this time, the previous ARRA funding was winding down and PG&E was offering most of the incentives. During the previous evaluation (referred to as 2011 throughout this report), customers had access to PG&E and ARRA incentives where customers could have received up to $10,000 in incentives. Post-ARRA funding, most PG&E customers only had access to a maximum of $4,500 in PG&E incentives.

This evaluation covers March 2012 through June 2013. For PG&E, this is the second year following its pilot phase. During its second year, PG&E continued to market the program, the program website was updated and transitioned to another administrator, PG&E continued contractor training and mentoring, and PG&E introduced a new Energy Rater pathway.

The key features of the PG&E Whole-House program during the evaluation period are:

- The program offered incentives and other support for two types of upgrade packages (Basic and Advanced) to homeowners. The Basic Package was being vetted across the state for potential changes to make it more attractive to both customers and contractors.
- Upgrades included house and duct sealing, insulation (attic, duct, wall, and floor), windows, HVAC, hot-water heater, and lighting.
- The program recruited, trained, and supported a workforce of independent contractors who marketed the program (primarily in person), identified packages of efficiency measures, performed pre- and post-upgrade testing and EnergyPro modeling (Advanced Upgrade only), and provided PG&E with required documentation.

- PG&E conducted QA/QC reviews, approved jobs, and paid incentives. In a few cases, local entities paid additional incentives to the contractors or homeowners using ARRA funding for projects completed early (Q1) in 2012 and ARRA funding then exited the market.
- PG&E launched the Energy Rater pathway in September 2012 in which customers can hire a Rater separately from the contractor. An Energy Rater can perform any or all of the following for a customer: Market the program; Conduct the test-in (pre-installation testing), test-out (post-installation testing), and energy modeling to identify upgrades in customers' homes and estimate savings; Coordinate contractors to complete the home upgrade; and Complete and submit program paperwork. At the time of this evaluation, there were nine Energy Raters but most of them were just starting with the program. Due to the time lag in when Energy Raters started conducting assessments and the pool of participants for our survey, we did not explore the new Energy Rater pathway in our participant surveys but recommend that this be explored as a key research objective in future evaluations.

2.1. Evaluation Objectives

This study's research objectives and the evaluation work that supports each are described below.

- **Assess customer attitudes, motivation, and experience with the program**. We met this objective by surveying participating homeowners by phone. The survey results were compared to those obtained in the Phase I survey of participants to identify important trends.
- **Assess participation barriers**. The data gathered from telephone surveys with participating homeowners also provided the data needed to assess participation barriers. In addition, we conducted surveys with two groups of homeowners that interacted with the program, but according to the program tracking records did not complete an upgrade job. One group was homeowners that used the EUC website. The other group was homeowners that initiated a job but did not complete it, according to the program tracking records.
- **Assess contractor attitudes, motivation, and experience with the program**. We met this objective by surveying contractors by phone. We surveyed contractors who are participating in the program (completed one job, complete 2-9 jobs or completed more than 10 jobs). The survey results were compared to those obtained in the Phase I survey of contractors to identify important trends.
- **Assess energy rater attitudes, motivation, and experience with the program**. We met this objective by surveying energy raters. Energy rater is a new role within the program design, so no comparison to Phase I was possible.
- **Assess the effectiveness of contractor training**. We assessed the appropriateness and effectiveness of contractor training by examining the design, training methods, and materials used by PG&E. This included in-depth surveys with Build It Green staff and instructors. To the extent possible, comparison was made to the findings of the SCE training assessment conducted in Phase I.

2.2. Summary of Data Collected

Table 1 lists each type of data collected for this evaluation, and shows the sample sizes, source, and timing of the data collection.

Table 1: Summary of Process Evaluation Data Collected

Data-Collection Task	Sample Size / Source	Timing
Participant Survey	n = 100	June 2013
EUC Website Drop-Out Survey	n = 100	June 2013
Build It Green Drop-Out Survey	n = 50	June 2013
Energy Rater Interviews	n = 6	April 2013
Contractor Interviews	n = 20 (6 one job), (8 low-volume), (6 high-volume)	May - June 2013
Program Tracking Data	All records	Various times through June 2013
Training Assessment	Various Build It Green staff, instructors and training materials	May - July 2013

2.3. Organization of Report

This report is organized in two volumes. The balance of this volume is organized into these three sections:

3. High Priority Recommendations
4. Recommendations and Supporting Findings
5. Trends in Program Accomplishments

The second volume describes our evaluation methods and detailed findings from this research. The volume also contains supporting documentation that includes the survey guides, the instruments used to collect data, and frequency tabulations for each of the questions asked in these guides and instruments.

3. HIGH PRIORITY RECOMMENDATIONS

We have identified high-priority recommendations that we believe will improve the program's marketing, implementation, and design. We have also identified one high priority research topic that should be explored in future evaluations.

3.1.1. Marketing

Our marketing recommendations are to:

- **Sustain and enhance IOU marketing strategies, including**:
  - **Continue to support contractors in face-to-face marketing opportunities**: Contractors are still a large marketing channel that is effective in driving full program participation. One-third (32%) of participants heard about the program through contractors, the most common method. Many contractors indicated that the most effective styles of marketing they do involve meeting customers and prospective leads face-to-face. Events such as home-energy expos, neighborhood fairs, and other speaking opportunities help provide face-to-face opportunities. We recommend that the program continue to use contractors as a primary marketing channel for the program and continue to provide marketing materials that support contractors' efforts to converse with customers face-to-face such as brochures and customer testimonials.
  - **Continue to use the EUC website as an educational medium**: Among customers that signed up for a contractor through the EUC website, the most common methods for hearing about the program were through the PG&E website, an internet advertisement, or a direct mailing to their home (by mail or door-hanger). Half of participants visited the website and most of them gave the website high ratings. Further, many customers find their contractors through the website. We recommend that the program continue to use marketing to channel customers to the EUC website where customers can learn more about the program and sign-up for a contractor to follow-up with them.
  - **List contractors in a fair order on the EUC website**: The EUC website can greatly affect the number of leads contractors receive. But the ordinal position of a contractor in the list influences how many leads that contractor gets. Therefore, the EUC website has only been an effective lead generator for contractors who appear near the top of the list. Some contractors rely heavily on the website to generate leads, while some indicate that they have not received any leads from the website. We recommend that the program pay attention to the order of how contractors are listed on the website as this largely impacts how many leads each contractor receives. It is believed that the ordering is random; however some contractors insist that they are always on the bottom of the list. We recommend that this be investigated and ensured that random generation is happening.
  - **Continue promoting main program benefits**: Contractors cited the perceived comfort and health benefits as being much larger drivers for prospective customers than

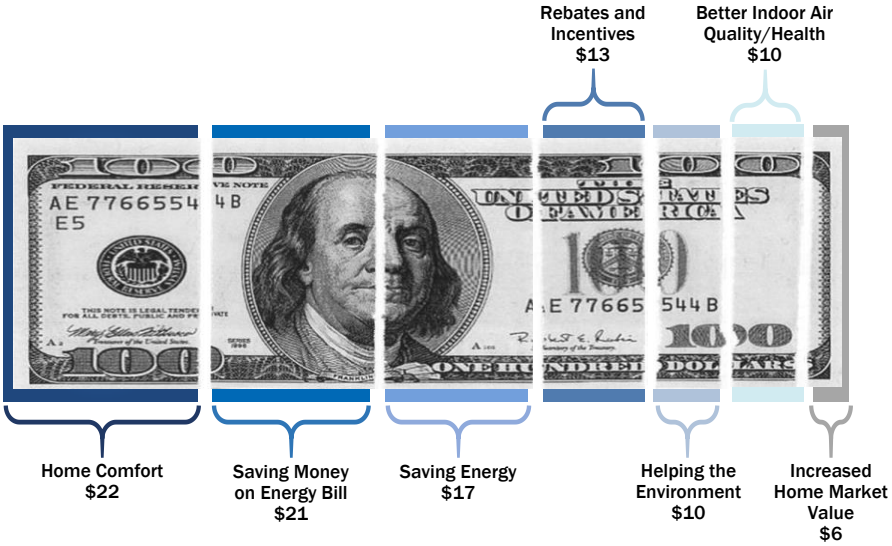
energy/cost savings. However, participant survey results show that comfort and energy/cost saving are both large motivators but health issues ranked lower. As shown in Table 2, the participant survey found that the top motivations for participants are comfort, saving money by reducing energy use, the incentives available and reducing their environmental impact, which are consistent with current program messaging.

Table 2: Participant Motivation to Complete Home Energy Upgrades

	2012 (n=100)	2011 (n=62)
Improving the comfort of your home	4.6	4.7
Saving money on your energy bills	4.5	4.5
Reducing your energy usage	4.5	4.6
Incentives available from the utility	**4.1**	**4.6***
Reducing the environmental impact of your home	4.0	4.0
The home energy assessment you received	4.0	4.3*
Improving the air quality in your home	3.7	4.0
Increasing the value of your home	3.7	3.7
Addressing health and safety issues in your home	3.6	3.9
Addressing energy efficiency prior to the installation of solar panels	3.5	N/A
Replacing failing or broken equipment	3.5	4.0*
Incentives available from your city or county	**3.0**	**4.1***

* Statistically significant at 90%. Means are on a 5-point scale where 1 means “not at all important” and 5 means “very important.” All means are derived using valid responses, i.e., a few data points were removed when respondents stated "don't know" or refused to answer.

As shown in Figure 1, when asked about the main program benefits, participants were consistent with what motivated them with top benefits being saving money/energy and home comfort.



"Considering the cost of your recent retrofit and these main benefits that you experienced, if you were to express the value of each of these benefits by distributing 100 dollars across your list – how much out of 100 dollars would you pay for…?"

n=87

Figure 1: Quantifying Energy and Non-Energy Benefits

We recommend that the program continue promoting multiple program benefits in its messaging including home comfort, energy/cost savings, incentives and protecting the environment.

- **Target customers to get the largest amount of gross and net savings**: More research is currently underway to determine the right targets for obtaining the highest possible savings (See the PG&E Marketing Study). However, we recommend that the program consider some of the findings in this report on this topic.
  - As shown in Figure 2, the majority of participation thus far has been in the San Francisco Bay area however, the climate there is more temperate than the central valley and therefore central valley customers have a greater probability of more energy savings.

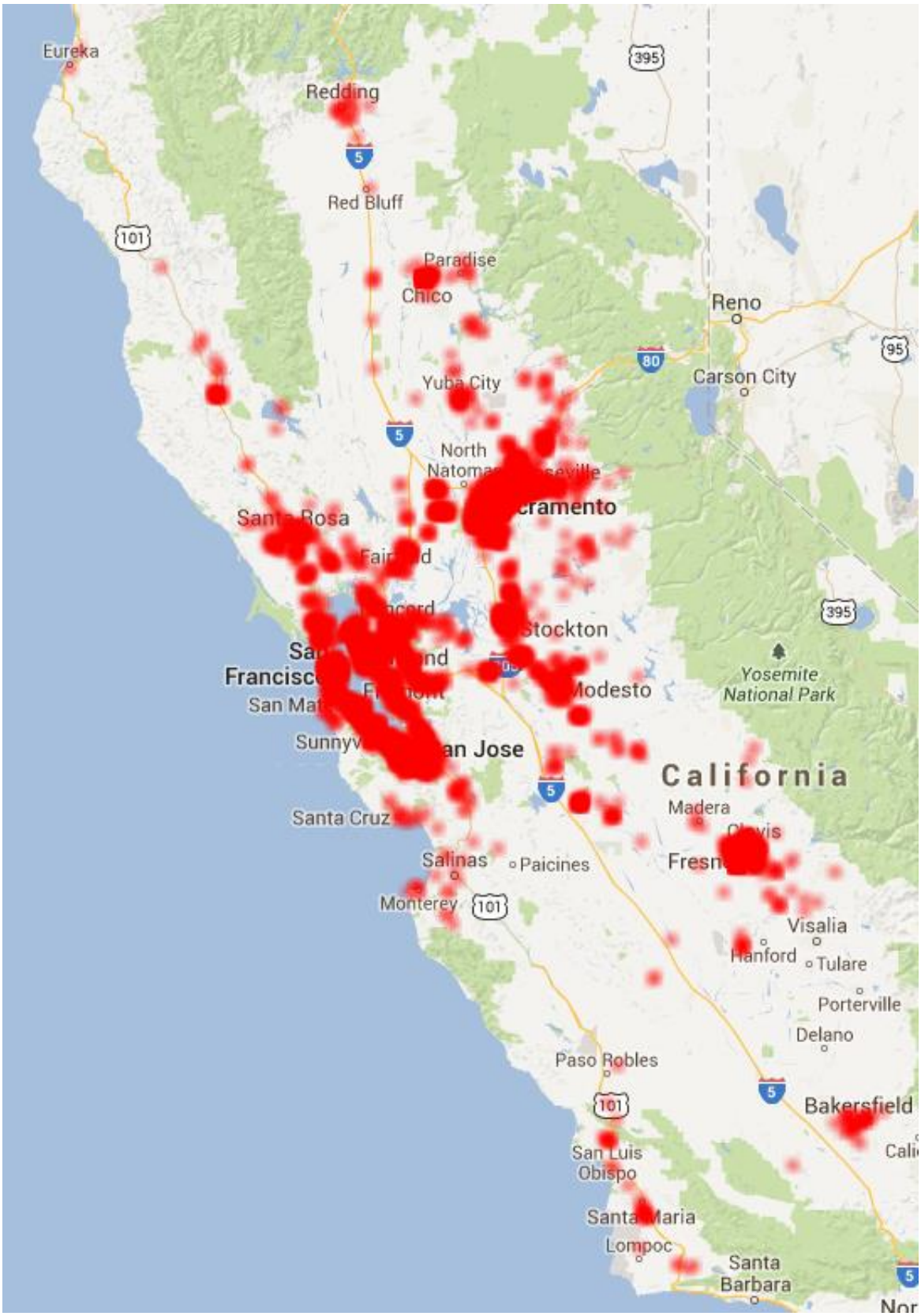
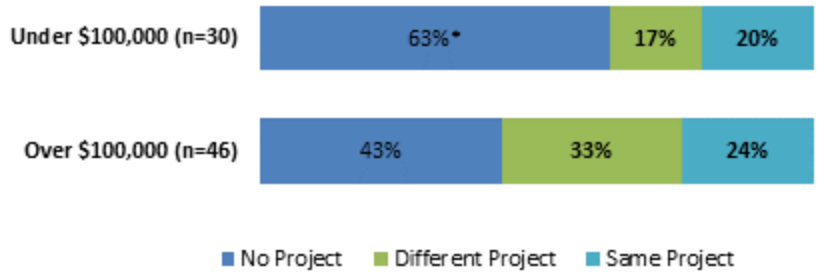


Figure 2: Job Locations

- The program appears to be set up well to target people who are in need of an A/C or heating system replacement, which present a large energy saving opportunity, 32% of participants conducted whole house projects at the time when they were in need of an A/C or heating system replacement.
- In 2012, 18% of participants conducted whole house jobs at a time when they just purchased a new home; which is down from 30% in 2011 (Phase 1 Process Evaluation). This does seem like a pivotal time for the program to intervene in the market as this is often a time when customers are making improvements. In fact, San Diego had a program in the '06-'08 cycle that targeted home inspectors as a channel for encouraging energy upgrades around the point of sale. However, we note that this may be a good strategy for gross savings but may not be a good one for net savings. Since people commonly do home upgrades at this time, the program may be less influential with this target. The 2012 participant survey shows that the program incentives were less influential amongst new home buyers; 61% of new home buyers rated the PG&E incentives as an important motivational factor (4 or 5 on a 1-5 importance scale) while 73% of existing homeowners said the incentives were important in their decision making. These are not statistically significant differences between the two groups due to the small sample size (n=18) of new homebuyers in the participant survey but the trend should be considered and net savings should be explored in future impact evaluations to identify the best targets for the program from this perspective.
- In 2012, 15% of participants did this at a time when someone in their household was retiring. This is also a pivotal time when retirees may be more compelled by the home comfort aspect because they are spending more time in the home but also by the monthly energy savings since they are often moving to fixed incomes after retirement.
- Finally, a potential target for getting good net savings are moderate income customers (defined as household earning less than $100K per year in this report). In 2012, 39% of participants earned moderate incomes. As shown in Figure 3, the PG&E rebate is more influential with moderate income customers. If the program is able to market attractive financing options and potentially increased incentives to moderate income customers, it will help reduce the cost barrier for this target.



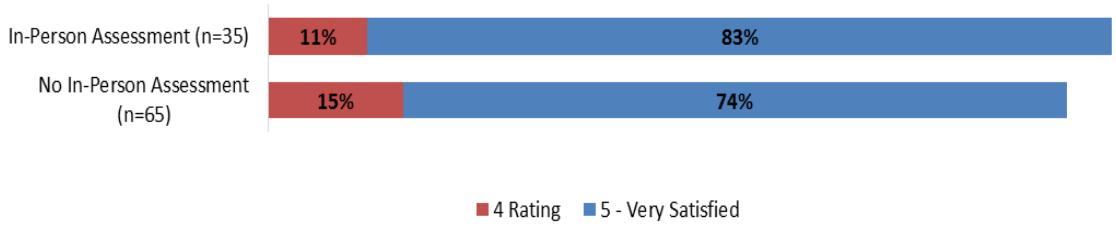
Based on valid responses. * Difference statistically significant at 90%. Question: Which of the following best describes the type of home remodel you would have done without the program's incentives?

Figure 3: Relationship between Income and Likelihood to Conduct the Same Project

3.1.2. Implementation

The full list of implementation recommendations (including those with low priority) can be found in 4.2 Implementation. High-priority recommendations related to implementation are:

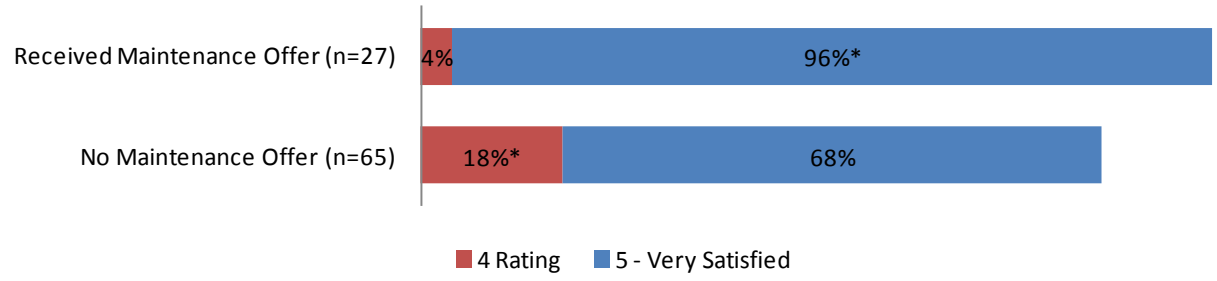
- **Encourage the Contractor-Customer Relationship**: Overall program satisfaction and contractor satisfaction is very strong for this program amongst most participants. As shown in Figure 4, participants who receive a face-to-face review of their home assessment are more satisfied with the program overall. They are also more likely to do all of the recommended upgrades.



Difference not statistically significant at the 90% level.

Figure 4: Relationship between Overall Program Satisfaction and Report Format

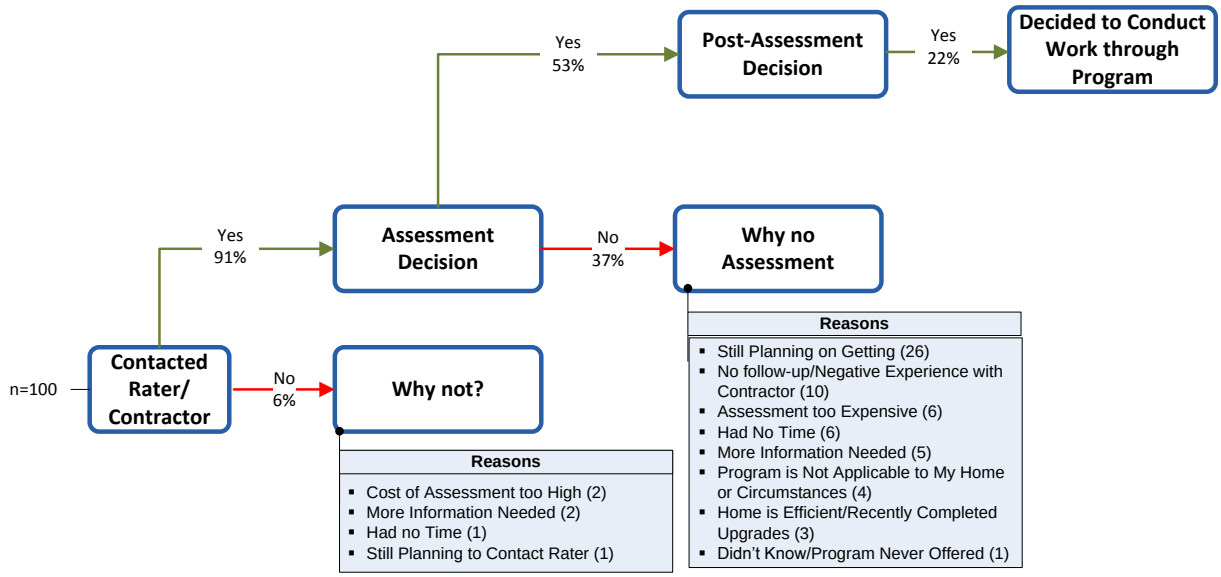
Further, as shown in Figure 5, participants who were offered an ongoing maintenance service are more satisfied with the program overall. They are also more likely to do all of the recommended upgrades.



* Statistically significant difference at 90%.

Figure 5: Relationship between Overall Program Satisfaction and Maintenance Offerings

As shown in Figure 6, one of the top barriers to getting a home assessment was negative experiences with contractors (such as lack of professionalism or follow-up). Note that the respondents who said they did get an assessment (53%) were combined with the BIG respondents who conducted an assessment to explore the barriers in the post-assessment stage (see Figure 7).

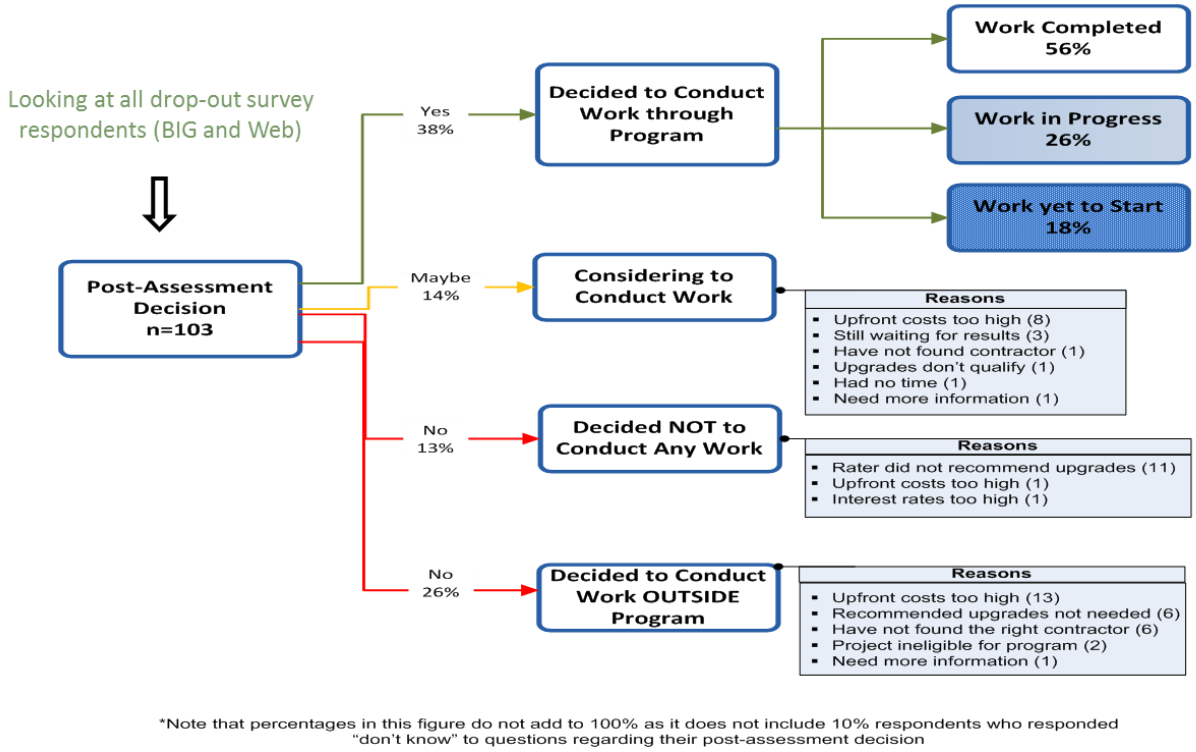


*All percentages based on 100 respondents. Note that percentages in this figure do not add to 100% as it does not include 3% respondents who responded "don't know".

Figure 6. Barriers to Getting a Home Assessment

We recommend that the program encourage contractors to build good relationships with customers by conducting in-person customer meetings to discuss home assessment results, offering ongoing maintenance services, following-up with customers and being courteous. The program should especially encourage contractors to follow-up with customers who request that a contractor contact them through the website. We also suggest that the program train contractors on the value and benefits of in-person assessment meetings and offering ongoing maintenance services.

- Develop follow-up protocols for prospective participants, including:
  - Follow-up with customers who request contact on the EUC website: One of the top barriers to customers getting a home assessment was that contractors had not responded to their request (see Figure 6). Further, some customers have not received a home assessment yet because it was unclear how customers would be reimbursed or when they would know if they would be reimbursed. The program should keep track of customers that ask for a contractor through the website and call customers within 1-2 months of the request to ensure follow-up if they have not conducted an assessment yet or help answer their program questions. Note that the implementer is about to install new software (Salesforce.com) that will allow them to easily act upon this recommendation.
  - Follow-up with customers who receive an assessment: As shown in Figure 7, beyond cost, some of the top barriers to getting a project initiated after an assessment were that customers needed more information or had not found a contractor yet.



*Note that percentages in this figure do not add to 100% as it does not include 10% respondents who responded "don't know" to questions regarding their post-assessment decision

Figure 7. Post-Assessment Participation Barriers

The program should consider strategies to follow-up with customers who receive an assessment but do not initiate a job within 1-2 months to see if the program can help them overcome any barriers at that point.

- **Improve Contractor Training Classes**: To participate in the Whole-House Program for PG&E, contractors must attend certain training associated with their role in the program. Those performing Basic Upgrades must attend the Participation Workshop and the Basic Package

Training. The Participation Workshop is also required for Energy Raters and contractors performing Advanced Upgrades, along with the Advanced Package Training. The Basic Package Training is recommended but not required for Energy Raters and Advanced Upgrade contractors. These classes can be improved in a number of ways. Two high priority improvements are:

- **Rename the Basic Class**. The Basic Package Training presents essential concepts for the both the Basic Package and the Advanced Package energy efficiency measures; however, because it is not a required class for BPI certified individuals, the training is not pursued by all of the contractors. There seems to be a mismatch regarding the title of the Basic Package Training and the perception regarding its value to contractors. For contractors and especially Energy Raters who may have little experience in the field, we recommend they attend this class. It may be easier to make the case for attending the class with all contractors if the class is given a new name like "Residential Building Science Level 1."
- **Implement Adult Learning Principles in the Advanced Class**. The Advanced Upgrade Package Technical Training is an advanced course for experienced contractors and primarily focuses on supplementary combustion appliance safety protocols that augment those specified by BPI. The specific requirements in the PG&E territory are unlike that anywhere else in the state, and for some measures are more stringent than BPI standards. One of the key goals of this class is to identify these differences in protocols and requirements. However, the class is not as effective as it should be because it does not does not adhere to adult learning principles. In particular, it needs to include interactive classroom activities, develop and use formal training objectives, inquire about and adjust to student's goals and expectations, and allow opportunities for review at the end of each major section of the class.

- **Close Contractor Performance Gaps**: Training design typically looks at the gaps in the performance of the persons being trained. The evaluation team analyzed Field Quality Assurance Score Sheets which revealed gaps in contractor performance. We cannot conclude that these performance gaps are directly caused by inadequacies in the training materials we reviewed. However, many of these performance gaps can likely be addressed by remedial training or observational study.
  - **Safety**. To improve all-around performance with safety testing: encourage more contractors to participate in the Combustion Safety and Depressurization Hands-On Training. Also, provide additional training, including hands-on practice in detecting gas leaks and training on electronic "sniffing" gas leak detectors. Further, provide additional training content on maintaining clearance from combustibles, installing venting for inadequate combustion ventilation air, remedying complex drafting problems, and reducing worst-case depressurization when it exceeds limits.
  - **Measure assessment**. To improve measure assessments encourage more contractors to attend the Duct Leakage to Outside training. In addition, modify the Basic Package training content: for attic insulation, condense the section on spray foam insulation and expand content on other insulation options and relevant program standards; for duct

insulation, specify R-8 and provide examples of how to achieve it; and, for duct sealing, provide information on acceptable materials and difficult-to-seal areas. Also, encourage Advanced Package contractors to attend the Basic level training, which covers essential concepts of residential building science.

- **Measure implementation**. To improve measure implementation, encourage all contractors to attend the Basic Package course, or extract blower door testing content into a separate module. In addition, remove or condense content about the plenum pressure matching and flow capture hood methods from both the Basic and Advanced Package Trainings, and expand content on the Duct Leakage to Outside method. Further, the classes should present more detail on program standards for installation of attic insulation and ensure contractors know what is required versus what is simply recommended. Also, add content on duct sealing that reviews acceptable and unacceptable materials, and identify locations that are often overlooked or are difficult to seal.
- **Modeling**. To improve EnergyPro modeling, encourage contractors to use standard data collection forms to document the characteristics of the home and the measures installed.

- **Redesign Training into Modules**: Over the course of the training assessment, it has become clear that a "one size fits all" approach is not optimal. Contractors in PG&E's Whole-House Program come from different professional backgrounds and have different training needs. Some are veteran home performance contractors who just need to know the program rules, and already have the techniques and best practices mastered. Many contractors are competent in certain aspects of the program such as HVAC or insulation, but may need additional combustion safety training. Others may have recently completed a BPI certification, but have no real-world experience and still need training in many areas. Contractors from different backgrounds and levels of experience need different "onramps," where they can come up to speed with program expectations by addressing their individual training needs. This would save contractors time by not needing to review areas where they already are very experienced. The training program could be modularized as follows:
  - **Potential Required Trainings.** EUC Combustion Safety for non-BPI, EUC Combustion Safety for BPI Building Analysts, and Understanding EUC Program Standards and QA.
  - **Potential Optional Trainings.** Basic Building Science, Attic Air Sealing and Insulation, Duct Sealing and Insulation, Shell Sealing and Insulating, Additional Measures – Windows, Pipe Insulation, Radiant Barrier, Cool Roof, etc., Blower Door Testing and Zonal Diagnostics, Combustion Safety – How to Resolve Failed Tests.
  - **Online Modules.** In some instances, it might make sense to offer webinar trainings that can be recorded and posted to the website. This would be most appropriate for optional classes that do not require a hands-on component, or for classes that would otherwise have low attendance or are only occasionally offered.
- **Leverage and Integrate Existing Training Resources**: Throughout our interviews with PG&E and Build It Green program managers, the concept of "leveraging existing resources" was

mentioned repeatedly. In the context of the training program, existing resources to leverage include additional facilities that could be utilized, or trainings that are already being offered within the PG&E service territory. The following strategies should be deployed to leverage existing resources.

- **Relevant Energy Training Center Courses**. Courses that could be leveraged include: Air Sealing and Insulating Existing Homes, Auditing Electricity Use in Homes, Balanced Ventilation for High Performing Homes, Windows Selection for New and Existing Homes, and Optimizing Residential HVAC System Performance.
- **Training Roadmap**. The program currently has several optional trainings, but it seems that most contractors are not aware of them or are just not taking advantage. To best take advantage of existing resources and to provide guidance for contractors in selecting appropriate trainings to attend, we recommend creating a "training roadmap" document that displays all of the home-performance-related courses offered to the public within PG&E territory. This would allow contractors to understand the big picture of the training program, and the context in which the classes fit together.
- **Cross Advertising**. In addition to creating a document such as the "training roadmap" and posting it on the website, we recommend taking measures to ensure that it reaches the contractors. One way to do this is to distribute the "training roadmap" handout to participants of all home performance trainings, including those offered at the Stockton Energy Training Center that are relevant to the Whole-House program. The document also could be displayed in a PowerPoint slide by training center personnel during classes.
- **Home Performance Training Calendar**. To help contractors and Energy Raters schedule and attend trainings, we recommend adding all courses listed on the "training roadmap" document to the online events calendar, or a web page devoted to showing all upcoming training dates in one location, including course descriptions and registration information. This would require Build It Green to look up classes as they are scheduled, and to update the listing on a regular basis.
- **Self-Assessment and Personal Training Plan**. To help contractors identify the trainings that would be most helpful to them, we recommend offering an online self-assessment tool, especially if training is to be modularized. It could be as simple as a questionnaire where contractors rate their own knowledge and experience for the various skills and abilities required.
- **Personal Training Alerts**. If recommendations such as the home performance training calendar or personal training plans are implemented, it would also be of benefit to alert contractors about upcoming trainings that would personally benefit them. A form could be provided on the training area of the program website for contractors to indicate courses they are interested in. As training dates are added to the "home performance training calendar," notifications would be emailed to interested contractors along with a registration link.

3.1.3. Program Design

The full list of program design recommendations (including those with low priority) can be found in 4.3 Program Design. High-priority recommendations related to program design are:

- **Consider Financing and Incentive Structure, including***:*
  - **Continue seeking attractive financing options**: As shown in Figure 6 and Figure 7, cost continues to be a program barrier and the dominant reason for dropping out of the program at any stage.

    Among drop-out customers, see Table 3, we found that financing options do increase customers' likelihood to install whole house upgrades and will assist in reducing the cost barrier. Amongst customers who said cost was a barrier to moving forward with projects after receiving the assessment, 55% said that a financing option would have increased their likelihood to install the recommended measures. These customers were more interested in low interest loan options from banks or other financial institutions than other options tested in the surveys (i.e. on-bill financing, mortgage-related loans or contractor payment plan options). The program should continue to seek financing options that can complement this program.

Table 3: Web and BIG Respondents with Interest in Financing Support

	% of respondents 4-5 Rating	Mean
	(n=20)	(n=20)
Lower interest rate for loans for energy efficiency upgrades	35%	3.7
Non-mortgage loans through local bank or financial institution	20%	2.1
On-bill financing	15%	2.4
A payment plan or financing through your contractor	10%	1.9
Mortgage through a bank or financial institution for energy efficiency upgrades	10%	2.1
Any of the above (rating 4-5)	55%	

Question: Using a scale from 1 to 5 where "1" means "does not increase at all" and "5" means "increases a great deal", please indicate whether these would increase your likelihood to install the recommended equipment from you Home Performance Audit.

Fewer participants used financing to fund whole house projects in 2012 (21%) than in 2011 (50%). Further, fewer participants are aware of financing options than in previous years. Roughly, half of participants (52%) only took some of the recommendations from the assessment. When asked why they did not do all of the recommendations, half of them (54%) said they could not afford all of the recommendations. Financing might also attract more moderate income customers given that moderate income participants were more likely to use financing to fund the whole house projects.

- **Evaluate project incentive levels and home assessment incentives**: Interviews with Energy Raters revealed that they think the main customer participation barrier is the program incentive levels. Two of the six Raters said that the low incentives make the program not worthwhile for customers. Interviews with participating contractors revealed that many of them experienced a sharp decline in the amount of work they had through the program recently and they attributed this to the expiration of ARRA funding. While PG&E program incentives have not declined, the additional incentives have, and contractors think the PG&E incentives are not high enough to attract many customers. From the drop-out surveys, we found that the dominant reason for dropping out of the program at any stage is high upfront costs, where customers often said "I can't afford any upgrades at this time" or they "did not want to pay $500 for an assessment". Contractors indicate that partial subsidies on energy assessments would be an excellent offering, and would increase business and the number of jobs completed through the program. Some contractors also suggested a full rebate for energy assessments if a customer went on to complete a job. We recommend that that the program evaluate the incentive levels for projects and consider whether it can subsidize the home assessment cost, or promise to reimburse the assessment cost if a customer initiates a program project, especially for moderate income customers. However, the program must balance this recommendation with program budget constraints.

3.1.4. Additional Research

Several additional research efforts would be useful to help understand how to increase participation in the program and make program services better and more efficient. The full list of additional research recommendations (including those with low priority) can be found in 4.4 Additional Research. The one high-priority recommendation is:

One particular study should be conducted, if it is not already covered by the impact evaluation, to help evaluation, to help quantify program spillover. That study should investigate the spillover that might be that might be happening amongst customers that receive a home assessment but never complete a complete a program project. As shown in

- Table 4, we identified 27 customers in this evaluation who conducted energy upgrades outside of the program after receiving a home assessment. The table provides an overview of the type and quantity of measures they installed. The assessment and other program intervention could have still influenced these savings that are currently not captured in program estimates.

Table 4: Energy Upgrades Outside of Program

Measures Installed Outside of Program (mult. resp.)	n=27
ENERGY STAR appliances	70%
Windows/Doors	48%
Air sealing	41%
ENERGY STAR Heating/Cooling	37%
Attic/Wall/Floor insulation	37%
Duct Sealing	33%
Solar Panels	11%

Number of Measures Installed Outside of Program	
7	4%
5	19%
4	19%
3	26%
2	22%
1	11%

4. RECOMMENDATIONS AND SUPPORTING FINDINGS

In this section, we present all our recommendations for how to sustain and improve the Whole-House Program along with the supporting finds from our evaluation research. The recommendations fall into four categories:

- Marketing
- Implementation
- Program Design
- Additional Research

Each recommendation is associated with the relevant supporting findings drawn from the second volume of this report. All the recommendations and their relative priority are shown in Table 5. Note that in some cases the recommendation is given a low priority because the program is already working on the recommended action or has done it.

Table 5: Recommendations

Category	Recommendation	Priority
Marketing	Sustain and Enhance IOU Marketing Strategies	High
Implementation	Encourage the Contractor-Customer Relationship	High
	Develop Follow-Up Protocols with Prospective Participants	High
	Streamline Processes and Customer Service	Low
	Continue to Examine Value of EnergyPro	Low
	Improve Contractor Training Classes	High
	Improve Online Webinar Training	Low
	Close Contractor Performance Gaps	High
	Improve Training for Energy Raters	Low
	Offer Additional EnergyPro Training	Low
	Encourage More Field Mentoring	Low
	Redesign Training into Modules	High
	Leverage and Integrate Existing Training Resources	High
Program Design	Consider Financing and Incentive Structure	High
	Consider Allowing Propane Users to Participate	Low
Additional Research	Explore Value of the Energy Rater	Low
	Continue Efforts to Revise Basic Package	Low
	Explore Potential Spillover in Impact Evaluations	High

4.1. Marketing

4.1.1. Sustain and Enhance IOU Marketing Strategies

Recommendation

Based on the evaluation results thus far, we suggest the following in the area of marketing. However, we note that further information on targeting and marketing will be added after the evaluation team completes the marketing billing analysis and the behavior change stage model analysis. Based on results thus far we recommend that the program:

- Continue to support contractors in face-to-face marketing opportunities.
- Continue to use marketing to channel customers to the EUC website where customers can learn about the program and sign-up for a contractor to follow-up with them.
- Attempt to be as consistent as possible with customer-facing marketing to help even out program participation throughout the calendar year. This may not be the most effective strategy given that the marketing team may want to target customers at certain times of the year. If so, it may be helpful to share PG&E's marketing strategy and timing with contractors so they can be prepared and staffed for busier times.
- Pay attention to the order of how contractors are listed on the website as this largely impacts how many leads each contractor receives.
- Continue with messaging that stresses multiple program benefits including home comfort, energy/cost savings and increasing home value.
- Be as targeted as possible with marketing to the customers who will likely produce the most gross and net savings. (We note that we will further build upon the suggestions for market targeting based on the forthcoming research noted above.)

Supporting Findings

- Participants' most common suggestion for program improvement was to publicize the program more (18% of participants suggested this); indicating that this is a good program from the participants' perspective and that it should continue to benefit more customers. When strategizing on how to increase program awareness, the program should consider targeted strategies so that it reaches the people who will produce the most energy savings for the program, gross and net, as well as catering the program messaging to specific targets.
- Program marketing efforts have a noticeable effect on contractors' job leads. Contractors are generally somewhat displeased with program marketing. Many contractors mentioned inconsistency of marketing—heavy marketing at times and very light marketing at others. Contractors said that, during periods of heavy marketing, they would get large numbers of leads, and when marketing was light, they would get very few.
- Many contractors, both low- and high-volume, indicated that the most effective styles of marketing that they could personally do involved meeting customers and prospective leads

face-to-face. Events such as home-energy expos, neighborhood fairs, and speaking opportunities were mentioned in addition to referrals (also cited as a highly effective way to get leads) and typical mass-media advertising channels.

- The EUC website can greatly affect the number of leads. But the position of a contractor in the list influences how many leads that contractor gets. Therefore, the EUC website has only been an effective lead generator for contractors who appear near the top of the list. Some contractors rely heavily on the website to generate leads, while some indicate that they have not received any leads from the website.
  - At least one contractor, who indicated a substantial percentage of his leads came from the website, expressed concern with how the website presents contractors to the customer. This contractor indicated that he had been the "top hit" on the website when searching in his city for a long time. This produced an enormous number of leads—but recently, the website had apparently reordered him on the list, and his business has dramatically dropped.
- The majority of participation thus far has been in the San Francisco Bay area however the climate here is more temperate than the central valley. The program should consider focusing more on customers in the central valley since they have a greater probability of more energy savings. If the program focuses on this area, we recommend that the program look to see how much contractor coverage they have of the central valley to see if they can adequately serve this region.
- The program appears to be set up well to capture people who are in need of an A/C or heating system replacement since most participating contractors provide this service as part of their standard business offering or have built relationships with specific HVAC contractors to support this need and this pivotal moment provides a good upselling opportunity for contractors. One-third (32%) of participants conducted whole house projects at the time when they were in need of an A/C or heating system replacement.
- In 2012, 18% of participants conducted whole house jobs at a time when they just purchased a new home, down from 32% in 2011. The decrease may be due to the disappearance of a California New Home Buyers financing program between the two years. However, this does seem like a pivotal time for the program to intervene in the market, as this is often a time when customers are making improvements. Home upgrades are also often part of home sale negotiations and have multiple people involved who can help market this program, including contractors, property assessors, home insurance agents, mortgage brokers and real estate agents. However, we note that this may be a good strategy for gross savings but may not be a good one for net savings. Since people commonly do home upgrades at this time, the program may be less influential with this target. Findings from the process evaluation survey show that the program incentives were less influential amongst new home buyers; 61% of new home buyers rated the PG&E incentives as an important motivational factor (4 or 5 on a 1-5 importance scale) while 73% of existing homeowners said the incentives were important in their decision making. These are not statistically significant differences between the two groups due to the small sample size (n=18) of new homebuyers in the participant survey but the trend should be considered

and net savings should be explored in future impact evaluations to understand the best targets for the program from this perspective. Participants who moved into new homes at the time of program participation are typically removed from billing analyses, therefore the savings (gross and net) from these participants may need to be explored via modeling instead of billing analyses in the impact evaluation and a special battery of net-to-gross questions should be considered for new home buyers versus others if net-to-gross is calculated through a self-report approach.

- In 2012, 15% of participants completed their upgrade at a time when someone in their household was retiring. This is also a pivotal time when retirees may be more compelled by the home comfort aspect because they are spending more time in the home but also by the monthly energy savings since they are often moving to fixed incomes after retirement.
- Good potential targets for getting good net savings are moderate income customers. In 2012, 39% of participants earned moderate incomes. Survey results show that the PG&E rebate is more influential with moderate income customers; 63% of moderate income participants said they would NOT have done any home energy upgrades without the program incentives, compared to 43% of customers with incomes over $100k. If the program is able to market attractive financing options and potentially increased incentives to moderate income customers, it will help reduce the cost barrier for this target.
- Contractors typically indicated that the initial effective messaging is the idea of saving money and/or receiving a rebate. However, after an assessment and discussion with the customer, contractors reported that customers still wanted to complete jobs through the program, even though it was evident that the upfront cost would not be paid back by bill savings in a short period of time. Contractors cited the perceived comfort and health benefits as being much larger drivers for prospective customers, once they received information on these benefits. Some contractors reported that customers were motivated by a desire to be “green,” but contractors typically said that this motivation was more prevalent among affluent customers.
- Top motivations for participants are comfort, saving money by reducing energy use, the incentives available and reducing their environmental impact. The home assessment itself also continues to be a critical component of the program that further motivates people to install energy upgrades. Participants gave all of these motivational factors a mean score of 4.0 or higher (on a 1-5 scale) when asked to rate the importance of them in their decision to participate. When asked about the main program benefits, participants were consistent with what motivated them with top benefits being saving money/energy and home comfort.

4.2. Implementation

4.2.1. Encourage the Contractor-Customer Relationship

Recommendation

- **Encourage relationship building amongst contractors and customers**. Encourage contractors to build good relationships with customers by conducting in-person customer meetings to discuss home assessment results, offering ongoing maintenance services, following-up with customers and being courteous to customers. The program should encourage contractors to follow-up with customers who request that a contractor contact them through the website. We suggest that the program train contractors on the value and benefits of in-person assessment meetings and offering ongoing maintenance services.

Supporting Findings

- One-third (35%) of participants discussed their assessment results with their contractor in-person. Those who received this face-to-face assessment are more satisfied with the program; 83% gave the highest program satisfaction score (5 on a 1 to 5 scale) compared to 74% who did not get the results in-person. Further, these participants are more likely to take all of the recommended upgrades (51% compared to 43%). While these differences are not statistically significant at the 90% confidence interval (mainly due to the small sample of size, n=35, of participants who received an in-person assessment discussion), the trend is compelling and should be considered.
- One-quarter (27%) of participants recall that their contractor offered them an ongoing maintenance service for their HVAC systems during the project. Ongoing maintenance service helps build long-term relationships with customers and has multiple program benefits, such as higher program satisfaction and greater uptake of recommended upgrades. All respondents who were offered an ongoing maintenance service were highly satisfied (gave the highest rating of 5 on a 1-5 scale) with their contractor, 96% were “very satisfied” (giving a 5 on a 1-5 scale) with the program overall compared to 68% of customers who did not receive this offer, and 63% did all of the recommended measures compared to 40% of customers who did not receive this offer.
- Overall program satisfaction and contractor satisfaction is very strong for this program amongst most participants. They gave satisfaction mean scores of 4.5 or higher (on a 1-5 scale) to the program overall and to several contractor attributes such as professionalism, work knowledge, equipment quality and program knowledge. Almost all participants (90%) would recommend their contractor. Among the 10% of participants that expressed some dissatisfaction, reasons predominately focus on poor contractor relations such as rude or rushed staff and poor communication.
- Top barriers to getting an assessment are: (1) negative experiences with contractors (such as lack of professionalism or follow-up) (2) the assessment is too expensive and (3) more information is needed to make the decision. Several customers mentioned that contractors did not respond to inquiries or missed scheduled appointments.

- While there may be several explanations for the lack of responsiveness, one interviewed energy rater said that he screens participants for real interest in conducting home improvements over the phone before agreeing to an assessment because he cannot charge enough for the assessment alone. *"I get … calls that I'm turning away. … They have a general interest in getting an assessment; they don't often sound like they're ready to undertake an improvement. They just want to see what the assessment is. And that's fine, but I can't charge enough just to do an assessment. … When there were rebates for HERS II assessments, I took those clients all the time."*

4.2.2. Develop Follow-Up Protocols with Prospective Participants

Recommendation

- **Follow-up with customers who request contact on the EUC website**. The program should keep track of customers that ask for a contractor through the website and call customers within 1-2 months of the request to ensure follow-up if they have not conducted an assessment yet or help answer their program questions.
- **Follow-up with customers who receive an assessment**. The program should consider strategies to follow-up with customers who receive an assessment but do not initiate a job within 1-2 months to see if the program can help them overcome any barriers at that point.

Supporting Findings

- Top barriers to getting an assessment are: (1) negative experiences with contractors (such as lack of professionalism or follow-up) (2) the assessment is too expensive and (3) more information is needed to make the decision. Several customers mentioned that contractors did not respond to inquiries or missed scheduled appointments.
  - While there may be several explanations for the lack of responsiveness, one interviewed energy rater said that he screens participants for real interest in conducting home improvements over the phone before agreeing to an assessment because he cannot charge enough for the assessment alone. *"I get … calls that I'm turning away. … They have a general interest in getting an assessment; they don't often sound like they're ready to undertake an improvement. They just want to see what the assessment is. And that's fine, but I can't charge enough just to do an assessment. … When there were rebates for HERS II assessments, I took those clients all the time."*
- Top barriers to deciding to conduct a job post-assessment include: (1) Up-front costs are too high, (2) Have not found the right contractor yet, and (3) Need more information.

4.2.3. Streamline Processes and Customer Service

Recommendation

The program should continue focusing on streamlining the application process and providing good customer service to both contractors and customers. This recommendation was provided

in the Phase 1 Process Evaluation and while improvements have been made in this area, the program should continue efforts to improve.

- **Streamline application processing**. The program should continue efforts to streamline the application review process.
- **Provide good customer service**. Provide customers and contractors with staff that is knowledgeable about the program, and ensure that consistent program information is provided to customers.

Supporting Findings

- Contractors rated the program overall slightly lower compared to last year. Contractors did say some things have improved. Contractors rated the paperwork slightly higher than last year, although the mean rating is still quite low indicating that there is still room for improvement. In contrast to our evaluation last year, very few contractors reported any major issues with the time it takes to receive rebates after the job is processed. Most contractors who participated in the program in previous years reported that the rebate-processing time had improved and, while room for improvement remains, they were now mostly satisfied with the rebate payment timeframe.
- Contractors discussed several issues affecting their satisfaction levels.
  - A significant majority of contractors said that the paperwork required and the back-and-forth with the program while completing an application delays their work and the rebate disbursement. It also raises the overhead for contractors. This investment also causes mid-sized and smaller contractors who do not have a robust administrative staff to spend less time in the field completing retrofits. Specific complaints about processing job applications through the Green Energy Compass online portal were common. Several contractors mentioned that the staff responsible for processing appeared to be outsourced and were not as familiar with the program as they would like.
  - Contractors also mentioned that processing was inconsistent. Applications were often rejected for “very minor” issues (for example, names being spelled wrong) that contractors felt should not have held up the process, but that these errors were sometimes allowed to slide.
  - Large firms with multiple dedicated administrative employees were the exception. Complaints about paperwork and processing were not as common from them.
  - Contractors who had participated in the program in previous years indicated that the paperwork and processing is moving in the right direction. One contractor mentioned that paperwork was “better, but still torturous.”
  - Some contractors indicated that some utility staff lacked knowledge about the program making it difficult for contractors to convince customers to participate.
- Further, some Energy Raters mentioned that program staff should be more knowledgeable about the program requirements.

- Among participants, while one-quarter of them did not think the program needed any improvement, some suggested publicizing the program more (18%), providing higher incentives (14%) and 10% said they would suggest better communication, customer service and program information. Further, some participants' (ranging from 1-9%) suggestions were around shortening rebate processing time, decreasing the number of parties involved/streamlining process and making it all easier to understand.
- In the drop-out surveys, while exploring the barriers to getting a home assessment, some customers mentioned that is was not clear how customers would be reimbursed or when they would know if they would be reimbursed, which caused frustration.

4.2.4. Continue to Examine Value of EnergyPro

Recommendation

- **Continue to examine value of EnergyPro**: We recommend that the program continue to examine the issues with EnergyPro. The program should consider whether another modeling software is better or explore whether a deemed savings approach based on DEER estimates would provide savings estimates closer to billing analysis results. Even if deemed savings approaches were no better than EnergyPro at predicting billing analysis results, it would be easier to use than EnergyPro, requiring less time and frustration.

Supporting Findings

- Most contractors indicated that they prefer EnergyPro over other software options and that now that they know how to use it, they would rather continue than learn another program. Most contractors indicated that learning to use EnergyPro was very difficult but they are now relatively comfortable using it. Larger, high-volume contractors typically report fewer problems with EnergyPro's complexity and quirks. These contractors appear to typically have dedicated staff who primarily perform EnergyPro modeling, and are more familiar with the ins and outs of the software.
- Generally, contractors think EnergyPro does an acceptable job of covering the major energy-saving opportunities in homes. While not perfect, the software is considered "good enough" for the program. Most contractors indicated that EnergyPro was useful in successfully completing a retrofit. High-volume contractors cited EnergyPro as a timesaver in the long run.
- A significant number of contractors cited problems with EnergyPro, including:
  - Poor modeling of insulation and air sealing savings; customer behavioral data (occupancy patterns, setpoints, etc.); incomplete libraries of equipment types, making contractors identify the most similar equipment as a "best guess" (though one contractor recognized that the program is constantly updating the equipment library and this is helping); absence of solar measures; no credit or guidance given for proper or improper sizing of HVAC units, and unrealistic dollar savings amounts.
- Many contractors were displeased with the EnergyPro output reports. Contractors indicated that the reports were too technical and unusable, without modification, by customers.

Several contractors indicated that they built their own software tools that simplify the EnergyPro report for customers.

- When presented with the hypothetical option of not using any software at all for the Whole-House Program, contractors were evenly split. Contractors who did want to use modeling software generally cited the increase in customer confidence it provides. Those who wanted to eliminate software altogether generally indicated that the increased overhead and time required to use the software was not worth the benefits.
- All six Energy Raters said that the software was adequate for the program's current needs. However, all six also said that there was room for improvement. Five of the six Raters said that EnergyPro captured all of the possible energy savings opportunities. Two Raters, however, qualified their answer by saying that it captured all of the possible energy savings for the Whole-House Program, but they felt the program is missing energy savings opportunities, and these opportunities are not captured by the model. Three Raters said that they wanted EnergyPro to model renewable energy measures. Four Raters said that EnergyPro is not completely accurate, but all say that it is accurate enough to identify upgrades. Two said that EnergyPro lacks accuracy due to calibration and technical issues, while two others said it is not sensitive enough and excludes potential savings opportunities, such as water, crawlspace sealing, pipe insulation, air sealing, and lighting.
- However, the Raters believed strongly in using energy modeling software in general, and said that the EnergyPro software had several key advantages. Four noted that the model helped increase compliance with standards; two Raters described the benefit of having a standard for comparing all tested homes. One said the software increases their credibility with clients.

4.2.5. Improve Contractor Training Classes

4.2.5.1. Basic Upgrade Package Technical Training Course

Recommendations

Our recommendations for the Basic Upgrade Package Technical Training are based on the review of the materials, our discussions with the instructor, and on several conversations with program managers at Build It Green.

- **Slides and workbooks**
  - Add a table of contents. This should include major sections and sub-sections, as well as supporting documents organized as appendices.
  - Include "check your understanding" or similar interactive quiz content. This will provide participants an opportunity to answer informal questions about the material they were just exposed to. The answers and ideas generated can be discussed as a group.
  - For the workbooks, consider using a PowerPoint "notes" format when appropriate. This displays one slide per page and provides space for accompanying text on the page

below the slide. With text accompanying each slide, it should be possible to reduce the number of text-heavy slides while providing more detailed information.

- Some of the information, best practices, and tips typically delivered in class by the instructor could be documented and included in the notes page text.
- Also using the notes pages could include relevant installation specifications, combustion safety procedures, or BPI standards.
- Even if there is no text to insert for some of the slides, there will be room on each page for the contractors to take notes. Note-taking should be encouraged; it is particularly helpful to kinesthetic (hands-on type) learners.

- Label and put into a clear context for later reference the photographs and pictures of fieldwork used in the training slides, especially those for Typical Weatherization Measures, Maintaining Quality Control, Combustion Safety, Zone Pressure Diagnostics, and Attic Insulation. Text labels or accompanying text below could explain what the contractor is looking at, why it is important, and any key features to remember. For example, describe in the text the name of the portrayed area or piece of equipment, what to measure, whether it presents an example of poor workmanship or of good-quality workmanship, if it is a common issue, how to avoid or remedy the problem, etc.

- **Revise the Training Design into Modules**

  First of all, any future class revisions will need to accommodate the changes being made to the Whole-House Program—the Basic Package in its new configuration under the Home Upgrade program. The revised program involves different energy efficiency measures, different program requirements, and other changes which mean there will be different training requirements.

  Also, the understanding of the evaluation team is that it is often difficult for some contractors to let their people off work to attend several consecutive days of training, although they do realize the importance and value of the training. This indicates the need for a flexible training curriculum and course design that will accommodate both contractors new to the program and existing contractors who want some of their staff to attend the training.

  One possible approach involves breaking up the existing three-day class into a single introductory day that presents the program essentials and science found in the training, then the remaining content could be presented in multiple half-day or full-day modules that contractors could attend at their convenience. These possibly shorter segments would cover classroom or instruction in the demonstration house to provide hands-on practice with the testing equipment. These may include evening or weekend offerings.

  (This suggestion for designing the training in modules is discussed in further detail below under “Special Recommendations.”)

- **Consider an optional fourth day for the Basic Upgrade Package Technical Training**

  With his understanding of the skills and experience of the students, and knowing that the content is both valid and interesting, the instructor thinks this class is too short, and it would serve the contractors to consider an optional fourth day for hands-on practice.

  The evaluation team agrees; there is a lot of content to cover in the three-day period, and contractors could benefit from more time to practice the procedures to be better prepared to perform the work in the field. However, even as a three-day class the instructor feels that most of the students leave the class with a fairly good introduction and initial indoctrination to the whole-house concepts.

  The instructor understands that not all students would require more time, but he recommends an optional fourth day for the Basic Package training that would precede the Hands-on Duct Leakage Training. This extra day would give more time for students who want to better their understanding to review certain BPI protocols and concepts, plus enable more hands-on practice with such protocols as the worst case training, air sealing, and testing with the blower door and duct blaster.

- **Rename the Basic Class**

  An observation that was mentioned a few times in our interviews concerned the Basic Package Training, which, as indicated above, presents essential concepts for the both the Basic Package and the Advanced Package energy efficiency measures. This training is only required by the program for non-BPI-certified contractors who intend to perform Basic Package measures. And because it is not a required class for BPI certified individuals, the training is not pursued by all of the contractors.

  To this issue, there seems to be a mismatch regarding the title of the Basic Package Training and the perception regarding its value to contractors.

  One reason that the training is not attended is because many the contractors that were interviewed did not intend to do any Basic Package jobs and for that reason the training was not needed. However, for contractors and especially Raters who may have little experience in the field or if they need a review, we recommend they attend this class because it covers the building science essentials that pertain to Basic Package measures, which are recommended as part of the Advanced Package measures as well.

  If the title of the course were changed to something less misleading, something that did not specifically target the EUC Basic Package measures, such as “Residential Building Science Level 1,” we feel more contractors would attend and benefit from the class, which in our opinion would reduce QA failures and make the Whole-House Program more effective and successful.

- **Re-sequence selected topics**

  The instructor re-sequences the topics for day two by beginning with the Whole-House Program specific content. The evaluation team recommends making this a permanent change, to address this content prior to the technical content that follows to provide context with the Whole-House Program.

- **Spend more time on CAS**

  The instructor realizes the importance of the combustion portion of the training, that the topic is rather technical, and that the contractors will be subjected to strict testing protocols. Because of this, he spends as much time as possible on these protocols and tests, particularly because some students are simply not familiar with these tests. The evaluation team recommends for any future implementation to follow this practice of spending more time on this topic.

- **Incorporate student worksheets**

  We recommend incorporating worksheets that the students can use in the field and documentation and review of hands-on practice in all of the training sessions. Although we understand there are time constraints especially with larger classes, we recommend including methods for demonstrating understanding e.g., a final multiple-choice exam, and proficiency, e.g., blower door setup, sealing for attic insulation, and measuring insulation, etc.

Supporting Findings

- Contractors and Raters come from diverse backgrounds and fields of expertise, and have differing skill levels and experience.
- Regarding the PowerPoint slide presentation, some slides with photographs do not have accompanying text to help describe or explain the image. There also were some slides of documents where the text was unreadable (possibly reproduced in the supplementary appendices).
- There were no documented interactive classroom activities, quizzes, or application. The training that was done in the demonstration house did entail interactive hands-on activities.
- At the end of the class there are no final exams or any kind of tests to demonstrate proficiency. The contractors are only required to attend the entire session, which is monitored closely.
- It is often difficult for some contractors to let their people off work to attend several consecutive days of training, although they do realize the importance and value of the training.
- The instructor thinks this class is too short, and it would serve the contractors to consider an optional fourth day for hands-on practice.
- The Basic Package Training presents essential concepts for the both the Basic Package and the Advanced Package energy efficiency measures; however, because it is not a required class for BPI certified individuals, the training is not pursued by all of the contractors. There seems to be a mismatch regarding the title of the Basic Package Training and the perception regarding its value to contractors.
- There is a lot of content to cover in the three-day period, and contractors could benefit from more time to practice the procedures to be better prepared to perform the work in the field.

- The instructor re-sequences the topics for day two by beginning with the Whole-House Program specific content.
- The instructor realizes the importance of the combustion portion of the training, that the topic is rather technical, and that the contractors will be subjected to strict testing protocols. Because of this, he spends as much time as possible on these protocols and tests, particularly because some students are simply not familiar with these tests.

4.2.5.2. Basic Package Training – Content Mapping Analysis

Recommended Additional Content

As part of the training evaluation, we looked at the written materials for the Basic course and compared them to program requirements and best practices found in official program documents. The program documents used for reference include the "Program Participant Handbook," "EUC Installation Specifications," and the "Whole House Combustion Appliance Safety Testing Procedure Guide."

The following section presents critical content we believe should be included in the Basic training, but was missing. The "missing" content as best we can tell is not specifically covered or found in the training, although perhaps some may be found in the supplementary documents.

- **Combustion Appliance Safety (CAS)**
  - General Procedures, Requirements
    - Combustion appliance safety testing must be conducted or supervised by a BPI BA.
    - Gas Service Representative call procedures, triggering conditions (gas leaks, etc.).
    - CAS testing must be performed whenever insulation, air sealing, duct sealing, or ventilation is installed.
  - CAS Appliance Testing
    - Special Consideration—Water heater combustion testing procedures (as this has a high failure rate in the field).
  - Carbon Monoxide (CO) Monitor Installation
    - Requirement—CO monitors must be installed in every area with atmospherically vented appliances; in kitchens, hallways near bedrooms, door to garage.
    - Best Practice—It is recommended that additional CO detectors are installed, as needed, to provide a separate detector for each floor of the building.
- **Measure Installation**
  - General Procedures
    - Requirement—Blower door testing shall be performed whenever insulation, air sealing, duct sealing, or ventilation is installed.

- Air Sealing
  - Eligibility Requirement—No air sealing to .35 ACHn in past 6 years.
  - Requirement—Test air-tightness between garage and living areas with smoke stick or blower door and pressure test.
- Duct Sealing
  - Requirement—Sheet metal and flexible ductwork shall be sealed at all duct connections using mastic or similar material. Aluminum FSK tape ok for board systems and air handler.
- Hot Water Pipe Insulation
  - Requirement—Minimum thickness should be no less than interior pipe dimension, per ASHRAE 90.1.
  - Recommendation—Pipe insulation may be omitted where pipe is buried within attic, crawlspace, or wall insulation.
  - Best Practice—Insulate all accessible piping.
  - Safety Requirement—Identify and avoid instances where pipe insulation may present a fire hazard.
- Insulation
  - Eligibility Requirement—R-19 or lower installed for attic insulation.
  - Best Practices—Identifying and selecting the best insulation for various applications.
- Low-Flow Showerheads
  - Requirement—Contractor shall recommend installation of a low-flow showerhead with a thermostatic shut-off valve in the primary shower.
  - Best Practice—Install showerheads at or below 1.6 gal /minute, and bear the WaterSense label.
- Thermostatic Control Shower Valves (TCSV), Requirements
  - A TCSV shall be installed on the primary shower if not already in place, through installation of either a new showerhead or retrofit design.
  - The TCSV shall feature a 95 degree stop mode, self-reset feature after inactivity, and have at least a 3-year warrantee.
  - Contractor shall instruct occupant on use of the device, provide a manual, and warn homeowner that no safety upgrade or scald protection was installed.

Supporting Findings

- Of all program standards, requirements, recommendations, and best practices from official Installation Specification and Combustion Safety Testing documents, 71 items were deemed

critical for the Basic Package training by the evaluation team. The team found 50 of these items covered in the existing training, leaving 21 items remaining unaddressed.

- Many of the unaddressed items relate to minor measures that are not often included in a project's scope of work, such as the low-flow showerhead and thermostatic shut-off valve. These measures may be infrequently implemented due to perceived low energy savings or lack of customer willingness, but may also have been overlooked because they are not included in the training.

4.2.5.3. Advanced Package Contractor Training

Recommendations

The evaluation team and the instructor had the following observations and recommendations for the Advanced Training:

- **Slides and workbooks**
  - Add a table of contents. This should include major sections and sub-sections, as well as supporting documents organized as appendices.
  - Include "check your understanding" or similar interactive quiz content. This will provide participants an opportunity to answer informal questions about the material they were just exposed to. The answers and ideas generated can be discussed as a group.
  - Label and put into a clear context for later reference the photographs and pictures of fieldwork used in the training slides. Text labels or accompanying text below could explain what the contractor is looking at, why it is important, and any key features to remember.
- **Adult Learning Principles**
  - Include interactive classroom activities, quizzes, checks of understanding, and application of skills. Provide for other teaching techniques other than lecture.
  - Develop and use formal training objectives to ensure the content covered addresses the training needs of the students.
  - Inquire about students' goals and expectations for the class, and adjust as possible the content to address those.
  - Include summary slides for major sections for review and an opportunity for discussion.
- **Extract content from text heavy slides and use "notes" pages.** Some slides are very text heavy with small fonts and could benefit from extracting and bulleting the key point in concise sentences or phrases, with the bulk of the text put in the "notes" section the slide. Also, for slides of images (photographs), add descriptive text.
- **Add a second day to the class.** With his understanding of the skills and experience of the students, and knowing that the content is both valid and interesting, the instructor thinks this class is too short, and would serve contractors better to have at least a two-day class. There is not enough time to cover the important content in this class. He also thinks the class

could benefit from an optional third day for hands-on practice. Also, perhaps divide the class up into multiple, shorter segments to accommodate the schedules of busy contractors. These may include evening or weekend offerings.

- **Add hands-on practice.** As it is structured, this class does not provide any opportunities for hands-on practice. Alternatively, for additional hands-on practice, contractors may attend the Duct Leakage to Outside Hands-on Training (DLTO) or the Combustion Safety and Depressurization Testing Hands-on Training offered at the Energy Training Center (ETC) in Stockton.
  - **Require that students demonstrate competence and skills.** As the class is structured now, there is no final exam or final demonstration of understanding, skills, or proficiency. The instructor states that the BPI BAs should be able to prove competency before being allowed to do jobs for the Whole-House Program. He realizes this may be expensive and would require more time, but in some cases, home performance is getting a bad reputation due to too much sub-optimal work.
  - **Improve communication between the instructor and EUC QA verification process.** The instructor is not familiar with and does not receive feedback regarding the specific areas contractors are not performing well, the on-the-job tasks where there are high levels of QA failure. Therefore, he does not emphasize these areas in the class.

    The EUC or Build It Green program management should occasionally close the loop with the instructor and provide data on where the QA failures occur so the instructor can emphasize and spend more time on these topics in the class, include these in in-class quizzes or earmark for additional discussion.

Supporting Findings

- The instructor thinks this class is too short, and would serve contractors better to have at least a two-day class. There is not enough time to cover the important content in this class. He also thinks the class could benefit from an optional third day for hands-on practice.
- As the class is structured now, there is no final exam or final demonstration of understanding, skills, or proficiency. The instructor states that the BPI Building Analyst (BA) should be able to prove competency before being allowed to do jobs for the Whole-House Program.
- The instructor is not familiar with and does not receive feedback regarding the specific areas contractors are not performing well, the on-the-job tasks where there are high levels of Quality Assurance (QA) failure. Therefore, he does not emphasize these areas in the class.
- The class time is listed as six and one-half hours, but it usually runs longer, typically by an hour. (This is due to the fact there is more content to teach than comfortably fits in the listed amount of time.)
- Some slides are very text heavy and use a small font that is difficult to read.
- Several of the slides contain images (photographs) without any descriptive text. These slides may leave participants wondering what the key message was if they go back to review them.

- The class is mostly configured for lecture presentation. The instructor does take time to sketch on a whiteboard to illustrate concepts, and a small amount of time is dedicated to answering questions from the students. As a rule, the only scheduled individual or group activities involve performing some mathematical calculations.
- There were no documented interactive classroom activities, quizzes, or application. There were examples that connected new learning to the participants' prior learning and experience. Also, the classroom materials only provided for lecture as the instructional method.
- There are no formal training objectives for the Advanced Package Training.
- The training did not introduce the class with statements regarding the relevance of the content and class to the students ("what's in it for you" for the students). The training does touch on relevance in a later discussion of incentives and reasons why contractors should participate in the Whole-House Program.
- The instructor does not inquire about students' goals and expectations; however, for smaller groups he has them do a round of self-introductions and asks about their experience.
- The training does not include any "Check Your Understanding" activities (short, informal quizzes) during the class or summary slides to review key points.
- The instructor noted that the degree of competence and success with completing the tasks required by the program varied with the level of prior experience of the contractors; some less-experienced contractors were not sufficiently prepared and indicated a need for additional practice.
- At the end of this class there is no test or demonstration of skill required before they are allowed to do the work.

4.2.5.4. Advanced Package Training – Content Mapping Analysis

Recommended Additional Content

As part of the training evaluation, we looked at the written materials for the Advanced Package course and compared them to program requirements and best practices found in official program documents. The program documents used for reference include the "Program Participant Handbook," "EUC Installation Specifications," and the "Whole House Combustion Appliance Safety Testing Procedure Guide."

The following section presents critical content we believe should be included in the Advanced training, but was missing. The "missing" content as best we can tell is not specifically covered or found in the training, although perhaps some may be found in the supplementary documents.

- **Combustion Appliance Safety (CAS)**
  - CAS Appliance Testing
    - Best Practice—There is no need to test direct-vent combustion appliances if they are properly installed. Focus instead on older appliances that need to pull air out of the house to operate safely (natural draft combustion).
  - CO Monitor Installation and Requirements
    - CO monitors must be installed in every area with atmospherically vented appliances—in kitchens, hallways near bedrooms, door to garage.
    - CO monitors must be replaced every 5 years, existing monitors older than 5 years must be replaced.
- **Measure Installation**
  - Air Sealing
    - Eligibility Requirement—No air sealing to .35 ACH in past 6 years.
    - Requirement—Test tightness between garage and living areas using a smoke stick or blower door and pressure test.
    - Best Practice—Rather than seal to .35 ACH, a better practice is to seal as tightly as possible against pollutants and then install mechanical ventilation.
    - Verification Standard—Blower door pre and post-test should reflect 20% or greater improvement.
    - Verification Standard—QA Verifier blower door test-out should be within 5% of contractor.
  - Cool Roofs
    - Eligibility Requirement—Home must have a central air conditioning system or be installing a central air conditioning system concurrently.
    - Requirement—Roofing materials must by rated by the Cool Roof Rating Council, and carry a minimum 20 year warranty.
  - Duct Sealing
    - Eligibility Requirement—Has not participated in duct test and seal program or has not done duct sealing (10% or less leakage) in past six years
    - Eligibility Requirement—Home had existing AC, heat pump, or furnace prior to work being performed, cooling unit size must be between 1.5 and 7 tons.
    - Requirement—Sheet metal and flexible ductwork shall be sealed at all duct connections using mastic or similar material. Aluminum FSK tape ok for board systems and air handler.
    - Requirement—Outdoor heating ducts or in-attic cooling ducts must be sealed under the duct wrap and must be insulated to R-5.

        - Verification Standard—QA Verifier duct pressurization test-out should be within 10% of contractor.
    - Insulation
        - Eligibility Requirement—R-19 or lower installed for attic insulation.
        - Requirement—Access hatches or stairs must be tightly gasketed and insulated to R-14 or better.
        - Requirement—Insulate knee walls or any exposed vertical walls in attic.
    - Radiant Barriers
        - Requirement—All radiant barriers must have a low emissivity (0.1 or less) and high reflectivity (0.9 or more).
        - Best Practice—In cool climates, it's usually more cost effective to install more than the minimum recommended level of insulation rather than a radiant barrier.

Supporting Findings

- Of all program standards, requirements, recommendations, and best practices from official Installation Specification and Combustion Safety Testing documents, 89 items were deemed critical for the Advanced Package training by the evaluation team. The team found 69 of these items covered in the existing training, leaving 20 items remaining unaddressed.
- Many of the unaddressed items relate to minor measures that are not often included in a project's scope of work, such as cool roofs and radiant barriers. These measures may be infrequently implemented due to perceived low energy savings or lack of customer willingness, but may also have been overlooked because they are not included in the training.

4.2.5.5. Duct Leakage to Outside Hands-on Training (DLTO)

Recommendations

- **Slides and workbooks**
    - Add a table of content. This should include major sections and sub-sections, as well as supporting documents organized as appendices.
    - Include "check your understanding" or similar interactive quiz content. This will provide participants an opportunity to answer informal questions about the material they were just exposed to. The answers and ideas generated can be discussed as a group.
    - Label and put into a clear context for later reference the photographs and pictures of fieldwork used in the training slides. Text labels or accompanying text below could explain what the contractor is looking at, why it is important, and any key features to remember.
- **Inquire about participants' goals and expectations**. There typically are two main groups with different goals for the training. Experienced contractors are mostly interested in

learning about the rules; contractors with less experience want as much hands-on practice as they can get.

- If the instructor asks at the beginning of the class about participant goals and expectations for the session, he could adjust the emphasis of the session to address these interests and objectives.

Supporting Findings

- The instructor does not inquire about attendees' goals and expectations for the class; however, he does involve the students interactively by encouraging participation, asking questions, and facilitating discussion.
- There typically are two main groups with different goals for the training. Experienced contractors are mostly interested in learning about the rules; contractors with less experience want as much hands-on practice as they can get.
- The estimated time the instructor spends in the class for lecture and presentation is about 60% of the class time. The remaining time is on demonstration by the instructor (15%), demonstration by students (5%), individual students performing hands-on tasks (20%). The instructor monitors and evaluates the students' work the entire time they are setting up test equipment.

4.2.5.6. Combustion Safety and Depressurization Testing Hands-on Training

Recommendations

- **Slides and workbooks**
  - Add a table of content. This should include major sections and sub-sections, as well as supporting documents organized as appendices.
  - Include "check your understanding" or similar interactive quiz content. This will provide participants an opportunity to answer informal questions about the material they were just exposed to. The answers and ideas generated can be discussed as a group.
  - Label and put into a clear context for later reference the photographs and pictures of fieldwork used in the training slides. Text labels or accompanying text below could explain what the contractor is looking at, why it is important, and any key features to remember.
- **Inquire about participants' goals and expectations.** There typically are two main groups with different goals for the training. Experienced contractors are mostly interested in learning about the rules; contractors with less experience want as much hands-on practice as they can get.
- If the instructor asks at the beginning of the class about participant goals and expectations for the session, he could adjust the emphasis of the session to address these interests and objectives.

- **Add a second day to the class**. The instructor feels more time for hands-on practice is needed and would like for contractors to be able to repeat the tests multiple times with different scenarios. Also, often there is usually not sufficient time for all students to practice and to take their own measurements for the Worst Case Depressurization (WCD) lab for water heaters.
- **Add more content to the written materials**; Include many more appliances and how to test them, even if they are not specifically part of the BPI field exam.
- **Provide an EUC-specific version of this training**, where program QA standards can be incorporated and interactions with installed measures can be discussed

Supporting Findings

- The instructor does not inquire about students' goals and expectations for the class, but for smaller groups he has them do a round of self-introductions, asks how many residential tests they have done, and asks about their experience.
- There typically are two main groups with different goals for the training. Experienced contractors are mostly interested in learning about the rules; contractors with less experience want as much hands-on practice as they can get.
- The instructor feels more time for hands-on practice is needed and would like for contractors to be able to repeat the tests multiple times with different scenarios. Also, often there is usually not sufficient time for all students to practice and to take their own measurements for the Worst Case Depressurization (WCD) lab for water heaters.
- The estimated time the instructors spend in the class for lecture and presentation is only about 15% of the class time. The remaining time is on demonstration by the instructors (35%), demonstration by students (25%) , individual students performing hands-on tasks (25%). The instructors monitor and evaluate the students' work for the whole class, all of the time.

4.2.6. Improve Online Webinar Training

4.2.6.1. Business Opportunity through Energy Upgrade California

Recommendations

- Provide better-quality audio.
- Edit text-heavy slides to present concise, readable phrases.
- **Adult Learning Principles**
  - Insert summary slides between the major sections.
  - Add additional opportunities for participant interaction.

Supporting Findings

- One of the presenters called in from a remote location and at the beginning of his section had rather poor audio quality caused by a distracting echo. However, the audio quality eventually got better.
- Some slides are very dense and text heavy, containing lots of words.
- Although the presentation went well without them, there were no summary slides between the major sections. These help review and drive home the key points as well as provide an opportunity for asking questions.

4.2.6.2. Marketing: Whole House Marketing Tactics Worth Stealing

Recommendations

- Edit text-heavy slides to present concise, readable phrases.
- Make the provided slide deck more consistent with presentation.
- **Adult Learning Principles**
  - Insert summary slides between the major sections.
  - Add additional opportunities for participant interaction.

Supporting Findings

- It is difficult to read the fine print or see the details in a photo or graphic in the very small presentation screen shown on the Build It Green webinar page.
- Some of the slides were very text heavy and used a small font, making it difficult to read. There was inconsistent use of font size and style and bullet and numbering format, some typographical errors, and some content was repeated.
- The downloaded copy of the presentation slide deck was somewhat different from the one seen in the webinar; some slides were edited with different text, and others were deleted.

4.2.6.3. Sales: Whole House Sales Strategies that Work

Recommendations

- Edit text-heavy slides to present concise, readable phrases.
- Add more text to slides containing only one or two words.
- Refine and polish slides that are visually unappealing or not optimized for online viewing.
- **Adult Learning Principles**
  - Insert summary slides between the major sections.
  - Add additional opportunities for participant interaction.

Supporting Findings

- Regarding the slide presentation, there is uneven quality and a mix of the types of content on the slides. Some of the slides were quite nice and interesting to look at; others were not particularly visually appealing nor were they optimized for online viewing.
- The overall quality of the slide deck was good, but some aspects were somewhat unpolished. There was inconsistent use of font size and style and bullet and numbering format, some typographical errors, and some grammatical errors.
- Some slides are very text heavy with small fonts (too small to read) that could benefit from extracting and bulleting out the key points in concise phrases. Conversely, there were some slides with perhaps too little text.
- Although the presentation went well without them, there were no summary slides between the major sections. These help review and drive home the key points as well as provide an opportunity for asking questions.

4.2.6.4. Modeling Existing Homes with EnergyPro

Recommendations

- Re-post the video with a higher resolution, or break it into multiple parts as necessary.
- Have speakers introduce themselves, including their background and connection with the program.
- Field participant questions at multiple pre-determined points rather than only at the end of the presentation.
- **Adult Learning Principles**
  - Insert summary slides between the major sections.
  - Add additional opportunities for participant interaction.

Supporting Findings

- The video posted is very blurry, making it very difficult for viewers to read labels and descriptions in the software interface. This makes it much more difficult to utilize the training, and greatly reduces its training value.
- The three presenters hosting the webinar did not introduce themselves as part of the introduction, or provide information about their background or relationship with Build It Green or PG&E's Whole-House Program.
- There was no initial agenda or overview slide in the presentation, although there were slides containing summaries of the major steps toward the end of the webinar. The presenter encouraged participants to submit typed questions at any time.
- The presenters did not field any questions during the delivery of the training content, but devoted the last 30 minutes of the webinar to answering the many participant questions that had accumulated.

4.2.6.5. An Introduction to Green Energy Compass

Recommendations

- Record an updated webinar tailored for new contractors entering the program as well as for existing contractors.
- Have speakers introduce themselves, including their background and connection with the program.
- Use a different format for fielding questions, with participants submitting questions in writing which are read aloud by a co-presenter.
- **Adult Learning Principles**
  - Use select slides for an initial agenda, recaps between major sections, and to display contact information and resources upon conclusion.
  - Add additional opportunities for participant interaction.

Supporting Findings

- This webinar was recorded in the first weeks of implementing Green Energy Compass while many changes were still being made to the application. In addition, this webinar was not geared toward the larger population of program contractors.
- The presenters began the webinar by introducing themselves, but did not provide information about their backgrounds or relationship with Build It Green and PG&E's Whole-House Program.
- Participants had an opportunity to ask questions at regular intervals, at which time the microphones of all participants on the line were un-muted. Each time this happened, background noises from participants caused a major distraction.
- Although a full slide deck may not be necessary for this type of training, no slides at all were used to provide an agenda, section recaps, or contact information and resources upon conclusion.

4.2.7. Close Contractor Performance Gaps

4.2.7.1. Safety Gaps

Recommendations

In summary, we recommend the following improvements to address safety gaps:

- To improve all-around performance with safety testing, encourage more contractors to participate in the Combustion Safety and Depressurization course taught at the Energy Training Center in Stockton. If possible, provide this type of training in additional locations.
- To help mitigate the frequency of unidentified natural gas leaks found during field verification, ensure that all contractors receive training on electronic "sniffing" gas leak

detectors. Expand content to emphasize the importance of a methodical "sniffing" procedure, and provide instruction on locations to sniff, the proper speed to pass the probe, how to perform a soap test, and any other tips that may help in the field.

- To increase success with combustion testing, ensure that adequate instructional time is spent on domestic water heaters, as they see the most issues across all safety tests, including spillage, CO, draft, and combustion appliance zone (CAZ).
- To enable contractors to better remedy unsafe situations, we recommend providing additional training content on maintaining clearance from combustibles, installing venting for inadequate combustion ventilation air (CVA), remedying complex drafting problems, and reducing worst case depressurization (WCD) when it exceeds limits.
- To provide contractors with a clearer understanding of testing procedures, we recommend including training details for some procedures such as achieving steady-state for CO testing and following flue drilling guidelines.

Specific strategies for implementing these recommendations are as follows:

Detecting Small to Moderate Natural Gas Leaks

Provide additional training, including hands-on practice, in detecting of gas leaks. Stress the importance of a methodical "sniffing" procedure on the gas meter as well as all gas lines and combustion appliances. The training should address in detail proper technique and the speed at which the sniffer is passed over various areas.

This additional training content should be inserted within the required courses for both Basic and Advanced Packages. If training is divided into multiple modules, this content should be included in a safety module required by all contractors.

Taking Spillage Measurements for Combustion Appliances

Encourage more contractors to participate in the Combustion Safety & Depressurization Hands-On Training. Additionally, since most problems with spillage relate to domestic hot water (DHW) systems, we recommend allocating more lab time to testing and setting up the worst case depressurization (WCD) for DHW systems within this course or other similar offering.

Identifying Proper Ventilation for Combustion Appliances

Enhance the Advanced Package Training by adding annotated photographs that show examples of spaces where there is less than the required 50 cubic feet per kBTU ventilation air and examples where additional venting has been installed. Also, we recommend presenting an overview of typical obstructions that may compromise CVA venting.

Taking Carbon Monoxide (CO) Flue Measurements

Add content to the Advanced Package Training on how to achieve a steady state for the appliance, and when to perform the test after the alternative ten minute period. To address the issue of contractors not drilling test holes in flues, we recommend making adjustments or adding additional content to clarify which type appliances must be drilled for CO measurement.

In addition, encourage more contractors to participate in the Combustion Safety & Depressurization Hands-On Training.

Program management might also consider finding places in the training to inform contractors of what they will be held accountable for during field QA verification. For instance, contractors should know that flues will be inspected for signs of drilling and that homeowners will be asked if they received service recommendations when a CO measurement is above program thresholds.

Providing Sufficient Fire Clearance for Combustion Appliance Venting

Add content regarding types of insulation and other common materials considered combustible and specify the proper clearance for single wall and double-wall vents. This content could be included in the Basic Package course in detail, and in a more compact format within the Advanced class. If the training is redesigned into modules, this content should be presented within a module that is required for all contractors.

Conducting Draft Testing for Combustion Appliances

Encourage more contractors to participate in the Combustion Safety & Depressurization Hands-On Training.

We also recommend adding content to the Advanced Package Training that provides information about drilling guidelines as required in the BPI standards, instead of simply suggesting contractors review the standards.

If training is divided into multiple modules, we recommend a module that focuses on how to solve complex drafting problems, particularly with commonly vented appliances and complex WCD scenarios, because these issues are associated with most failed draft tests in the field.

Creating Worst Case Depressurization (WCD) in the Combustion Appliance Zone

Encourage more contractors to participate in the Combustion Safety & Depressurization Hands-On Training.

We also recommend adding content about what to do when WCD limits are exceeded within an expanded Advanced Package Training, or within a training module devoted to remedying situations where safety testing has failed. If possible, provide additional practice with complex WCD scenarios because improper WCD set up is associated with many failed safety tests in the field.

Supporting Findings

- Contractors often fail to recognize or act on natural gas leaks that may pose a safety risk to residents. These unaddressed leaks are most often found at the meter, as well as certain combustion appliances.
- Sometimes when contractors perform a spillage test, they give it a passing score; but when a QA verifier repeats the same test, it fails. Discrepancies between the results found by contractors and QA verifiers could be due to problems with the worst case depressurization setup, in which the negative pressure is not maximized, resulting in less spillage.

- Some contractors fail to identify a lack of adequate combustion ventilation air (CVA) in a combustion appliance zone (CAZ). This issue is typically associated with water heaters and occasionally with furnaces.
- Occasionally, a contractor records an acceptable level of carbon monoxide (CO) from the flue of an appliance, but the measurement fails when replicated during field QA. This issue occurs with many appliances; most commonly with furnaces, clothes dryers, and gas log fireplaces.
- Contractors sometimes leave combustible material in contact with or in close proximity to the flue of an appliance. When a QA verifier conducts a visual inspection, it is scored as a fail if the material is too close. This performance gap is typically associated with water heater and furnace flues, and poses a safety risk to occupants as a fire hazard.
- Occasionally, contractors record a draft test as passing, but the same test is considered a fail when repeated by a QA verifier. A failed draft test presents a safety risk to occupants since combustion byproducts could back draft into the nearby zone, or into the living area. This performance gap is most often associated with domestic water heaters.
- On some jobs, the contractor will set up a worst case depressurization (WCD) scenario and take a pressure measurement which passes, followed by the QA verifier taking a measurement that fails.

4.2.7.2. Measure Assessment Gaps

Recommendations

In summary, we recommend the following improvements to address measure-related gaps:

- To help contractors perform more accurate duct leakage and blower door tests, we recommend encouraging more contractors to attend the Duct Leakage to Outside (DLTO) training. Within this hands-on training, contractors get significant experience practicing duct leakage and blower door tests while learning the DLTO procedures that are now required.
- To increase awareness of program standards among all contractors, we recommend including more detail on standards within the Basic Package training content. Ensure that the training clearly distinguishes program requirements from general recommendations.
- To help prevent some of the most common issues with measure installation, we recommend modifying the Basic Package training content. For attic insulation, condense the section on spray foam insulation and expand content on other insulation options and relevant program standards. For duct insulation, specify R-8 and provide examples of how to achieve it. For duct sealing, provide information on acceptable materials and difficult-to-seal areas.
- In order to improve endorsement of the Basic Package training content, program management should consider segmenting larger sections of content to create multiple course modules. These courses should be no longer than one full day of training, and include a hands-on component, if applicable. Examples of topics that could be addressed in modules

include attic sealing and insulation, duct sealing and insulation, building shell sealing and insulation (all other), and a safety class for non-BPI crew members.

- To improve quality of work amongst Advanced Package contractors, we recommend encouraging them to attend the Basic level training, after being modified and/or modularized as suggested above. The new training should be re-framed as basic-level training for all contractors, instead of just for Basic Package contractors.

Specific strategies for implementing these recommendations are as follows:

Characterizing Attic Insulation

Condense the multiple slides devoted to spray foam insulation within the Basic Package training, and providing additional content that clearly identifies program standards relating to attic insulation of all types, such as those found in the "EUC Installation Specifications" document. We also recommend informing contractors that their work will be held to these standards, and is likely to be inspected by a field QA verifier.

Program management should also consider breaking out large topics such as "attic sealing and insulation" into separate modules, which may encourage attendance by more contractors and produce better verification results.

Identifying Air Leaks

Encourage all contractors to attend the Basic Package course, or perhaps to develop a training module specifically designed to present content on air sealing that may be more convenient for many contractors to attend rather than the current three-day training.

Characterizing Duct Insulation

Specify the recommended value as R-8 in the Basic Package training slides. There also should be targeted content to help contractors gauge duct insulation R-value more accurately, including options for insulation materials, and instruction on providing the proper air space required to fully realize insulation potential.

Supporting Findings

- Contractors often do not accurately judge the quality of coverage or accurately measure the R-value of attic insulation. The locations at which contractors measure insulation depth vary and can affect the estimated R-value. This issue affects estimates of energy savings and can delay jobs if insulation is does not meet program requirements.
- Contractors commonly fail to meet air-sealing requirements in the houses they are upgrading. If a house is not properly sealed and ventilation levels are high, the conditioned inside air is exchanged with outside air too often.
- Occasionally, contractors will mischaracterize duct insulation, claiming a value higher than what is observed by the QA verifier.

4.2.7.3. Measure Implementation Gaps

Recommendations

- **Performing Blower Door Testing**. Encourage all contractors to attend the Basic Package course, or extract blower door testing content into a separate module. We also recommend encouraging more contractors to attend the Duct Leakage to Outside (DLTO) training, which provides ample opportunities to practice blower door testing while learning the DLTO procedure.
- **Performing Duct Testing**. Remove or condense content about the plenum pressure matching and flow capture hood methods from both the Basic and Advanced Package Trainings, and expand content on the DLTO method. We also recommend encouraging more contractors to attend the Duct Leakage to Outside (DLTO) training, in order to take advantage of the hands-on practice performing duct leakage tests.
- **Installing Attic Insulation**. Present more detail on program standards and ensure contractors know what is required versus what is simply recommended. Program management should also consider breaking out large topics such as "attic sealing and insulation" into separate modules, to encourage greater participation and understanding of contractors.
- **Assembly or Sealing of Ductwork**. Add content on duct sealing that reviews acceptable and unacceptable materials, and identify locations that are often overlooked or are difficult to seal. This content could be included in the Basic Package training or within a separate module specifically designed to focus on duct assembly, sealing, and testing.

Supporting Findings

- For some blower door tests performed at test-out, contractor and QA verifier results differ significantly. Most discrepancies beyond program limits are usually in the 10-15% range, most likely indicating minor problems with setting up the test. However, some tests show a difference of 30-40%, indicating major flaws in the test setup by the contractor.
- For many duct leakage tests performed at test-out, contractor and QA verifier results differ significantly. In the most common scenario, a contractor will perform a duct leakage test, and the verifier will find a much higher percentage of duct leakage when attempting to replicate the test. These discrepancies indicate differences in duct leakage testing procedure.
- On occasion, a contractor will air seal and insulate an attic, but may omit important aspects of the installation such as insulating attic hatches or providing sufficient insulation coverage of buried ducts. Often the contractor does not install knee wall insulation, or has installed it but neglected to insulate or seal where it joins with the floor. In other instances, the contractor has simply forgotten to staple rulers in the attic that show insulation depth.
- QA verifiers occasionally come across ductwork that has not been sealed or has been improperly assembled, causing the job to fail inspection.

4.2.7.4. Modeling Gaps

Recommendation

Encourage contractors to use standard data collection forms to document the characteristics of the home and the measures installed.

Supporting Findings

- Occasionally, a mistake is found in a contractor's energy model that is more than just a discrepancy in measurement. The most common issue relates to the modeled location of the ductwork. Ducts may be modeled as if they were in the attic when they are actually located below the home in a crawlspace. Other times ducts might be modeled as if they were in the crawlspace but are actually located in the garage.

4.2.8. Other Training Recommendations

4.2.8.1. Improve Training for Energy Raters

Recommendations

- **Address the Raters' general lack of marketing and selling experience**. Offer specific training targeted specifically to Raters for developing a usable business model that incorporates marketing and sales concepts for the program. Also, there is a consensus that Raters could benefit from some type of targeted business-related mentoring. All of the mentoring elements apply for Raters, and would be beneficial to Raters: field data collection, job processing, EnergyPro, QC inspection.
- **Document the expected role of the Raters** in either the "Participant Handbook," Participation Workshop, or in the Advanced training. Include a clear definition of the role of the Raters in the Whole-House Program to help avoid misunderstandings, and include best practices for the Rater/contractor partnerships.
- **Make sure Raters are aware business marketing and sales training is available** (the recorded webinars available through the Build It Green web portal) to help them design and market a business model that will work for them and take advantage or their experience and skills.
- Suggest the Rater's **contractor and the crew that did the work be present at the test-out with QA verifier**, or communicate with them after the inspection any issues that were noted.

Supporting Findings

- Raters reported some disconnect between the training they received and the program rules, documentation requirements, and paperwork found in the field; they were not clear on the program requirements until they ran into them in the field.
- Raters were asked what other types of program-related training would benefit them or their staff. The specific responses were mixed: one wanted training in marketing; four requested

more technical training in combustion and safety, follow-up training with modeling and EnergyPro and why models pass or fail, and the QA assessment processes.

- Some Raters partner with contractors who make the contact, but usually the process is initiated by the customer.
- Only one out of six of the interviewed Raters had extensive experience with marketing strategies and how to sell jobs. Of the six Raters that were interviewed by ODC, only three reported they were promoting the program to their customers.
- Raters are typically not experienced with the role of rounding up new work, and were unsure about how much of their job required generating jobs through the use of marketing and promotion.
- Some Raters say there is a need for more of an attitude of teamwork for them and the contractors, a need to work together in cooperation and not in an adversarial relationship.

4.2.8.2. Offer Additional EnergyPro Training

Recommendation

Based on our findings and interviews with instructors, we recommend offering an optional half day of training to introduce EnergyPro, and that would address just the essential parts of the application contractors need know for modeling for the Whole-House Program. (Build It Green does have optional recordings of online webinars on EnergyPro and related documents on their online library.)

Supporting Findings

- Some of the contractors simply want to "get in the game," with the Whole-House Program and add some volume to their work, and are not ready to spend a lot of time learning and understanding EnergyPro. These contractors simply hire professionals to do this work for them.
- Some modelers are part of a larger company and on the project management side, who do the scheduling and other tasks, and who work with computers every day.

4.2.8.3. Encourage More Field Mentoring

Recommendations

To alleviate the apprehension felt by many contractors about receiving mentoring at the job site, we recommend offering additional options for contractors to use their five free mentoring sessions.

One format that may be more appealing is an off-site post-QA review between the verifier and contractor's crew. With this option, the QA verifier would complete the inspection process according to the usual procedure. If the contractor received an unsatisfactory score and wanted to review the test-out findings, they could request an in-depth review with the verifier. During this review, the verifier could share photos of each problem found, and perhaps compare these

with photos from other jobs where the same work was completed satisfactorily. QA verifiers could also walk through various options for correcting issues found. This review could be conducted either in person or using simple screen sharing software to review photos and discuss them remotely.

Another possible option is to offer mentoring sessions in a test house. With this option, a contractor would notify field QA that they would like to schedule a test house mentoring session for their crew. The field QA team would then schedule a time to reserve the test house, and encourage the contractor to have the whole crew attend. The QA verifier leading the session should review the contractor's past job scores, look for the areas of greatest deficiency, and tailor their approach to address those areas.

Supporting Findings

- Build It Green offers hands-on field mentoring as an option for all PG&E EUC contractors. Contractors are encouraged to request a mentoring session to be conducted at a customer's home at the time of test-out.
- From interviews with program management and instructors and from contractor survey results, it seems that many contractors are hesitant to receive mentoring at the job site in the presence of a customer.
- Some contractors feel that being instructed in front of the customer could negatively affect their impression of the contractor's competence.

4.2.8.4. Redesign Training into Modules

Recommendations

Over the course of the training assessment, it has become clear that a "one size fits all" approach is not optimal. For this reason, we recommend re-designing the training into a variety of modular training courses.

If this is the path taken with the EUC training, we recommend a mix of required and optional modules. We suggest that topics such as safety and program installation specifications be required, and topics such as building science and installation best practices be offered as optional.

The following presents ideas on structuring the training into modules.

- **Potential Required Trainings**
  - EUC Combustion Safety for non-BPI
  - EUC Combustion Safety for BPI BAs
  - Understanding EUC Program Standards and QA
- **Potential Optional Trainings**
  - Basic Building Science
  - Attic Air Sealing and Insulation

- Duct Sealing and Insulation
- Shell Sealing and Insulating
- Additional Measures – Windows, Pipe Insulation, Radiant Barrier, Cool Roof, etc.
- Blower Door Testing and Zonal Diagnostics
- Combustion Safety – How to Resolve Failed Tests

- **Online Modules**

In some instances, it might make sense to offer webinar trainings that can be recorded and posted to the website. This would be most appropriate for optional classes that do not require a hands-on component, or for classes that would otherwise have low attendance or are only occasionally offered.

Supporting Findings

- Contractors in PG&E's Whole-House Program come from different professional backgrounds and have different training needs.
- Contractors from different backgrounds and levels of experience need different "onramps," where they can come up to speed with program expectations by addressing their individual training needs.
- Many contractors find it difficult to accommodate multiple-day trainings such as the three-day Basic Package training.

4.2.8.5. Leverage and Integrate Existing Training Resources

Recommendations

- **Relevant Energy Training Center (ETC) Courses**. Throughout our interviews with PG&E and Build It Green program managers, the concept of "leveraging existing resources" was mentioned repeatedly. In the context of the training program, existing resources to leverage include additional facilities that could be utilized, or trainings that are already being offered within the PG&E service territory.

  For instance, in addition to the required courses and the two hands-on courses, there are several classes offered by the ETC in Stockton that are highly recommended for EUC contractors to support their home improvement education and skill set.

  These classes include:

  - Air Sealing and Insulating Existing Homes
  - Auditing Electricity Use in Homes
  - Balanced Ventilation for High Performing Homes
  - Windows Selection for New and Existing Homes
  - Optimizing Residential HVAC System Performance

- **Training Roadmap**. The program currently has several optional trainings, but it seems that most contractors are not aware of them or are just not taking advantage. To best take advantage of existing resources and to provide guidance for contractors in selecting appropriate trainings to attend, we recommend creating a "training roadmap" document that displays all of the home-performance-related courses offered to the public within PG&E territory. This would allow contractors to understand the big picture of the training program, and the context in which the classes fit together.

  The roadmap document could take the form of a flowchart, or a well-organized list with details for each course and where it is offered. The extra guidance would be especially useful if training was to be modularized, allowing contractors to easily locate the best "onramp" for their level of experience and areas of expertise.

- **Cross Advertising**. In addition to creating a document such as the "training roadmap" and posting it on the website, we recommend taking measures to ensure that it reaches the contractors. One way to do this is to distribute the "training roadmap" handout to participants of all home performance trainings, including those offered at the Stockton ETC that are not EUC-specific. The document also could be displayed in a PowerPoint slide by training center personnel during classes.

- **Home Performance Training Calendar**. To help contractors and Raters schedule and attend trainings, we recommend adding all courses listed on the "training roadmap" document to the online events calendar, or a web page devoted to showing all upcoming training dates in one location, including course descriptions and registration information. This would require Build It Green to look up classes as they are scheduled, and to update the listing on a regular basis.

- **Self-Assessment and Personal Training Plan**. To help contractors identify the trainings that would be most helpful to them, we recommend offering an online self-assessment tool, especially if training is to be modularized. It could be as simple as a questionnaire where contractors rate their own knowledge and experience for the various skills and abilities required. In this case, a contractor's self-reported level of capability could be indicated as a value on a scale of one to five.

  A more sophisticated assessment might ask more specific questions to reveal gaps in basic understanding. In this case, there might be five questions associated with each particular training module. If one or more questions is answered incorrectly, or an answer such as "I'm not sure" is marked, the associated course will be recommended for the contractor to attend. The resulting document would constitute a recommended "personal training plan," which the contractor could print out and save.

- **Personal Training Alerts**. If recommendations such as the home performance training calendar or personal training plans are implemented, it would also be of benefit to alert contractors about upcoming trainings that would personally benefit them. A form could be provided on the training area of the program website for contractors to indicate courses they are interested in. As training dates are added to the "home performance training

calendar," notifications would be emailed to interested contractors along with a registration link.

For program managers there would be an additional benefit: data could be kept on which courses are currently needed by the largest number of contractors, allowing them to gauge demand for various training offerings. This would allow for trainings to be offered strategically, resulting in more seats filled in each class and more contractors trained.

Supporting Findings

The optional classes now offered such as DLTO and CST Hands-on are underutilized by contractors, despite providing training that most need greatly.

- Many contractors state the need for further training in a variety of areas relating to home performance, yet many of the existing courses at PG&E Energy Education Centers provide this training.
- There is no single source for EUC contractors to see all required and optional training offerings in one location.
- Many courses are offered only once or twice a year, and are easily missed.
- There is no document or roadmap showing a recommended order in which to take training offerings for the inexperienced contractor.

4.3. Program Design

4.3.1. Consider Financing and Incentive Structure

Recommnendation

- **Continue seeking attractive financing options**: The program should continue to seek financing options that can complement this program.
- **Evaluate project incentive levels and home assessment incentives**: Evaluate the incentive levels for projects and consider whether it can subsidize the home assessment cost, or promise to reimburse the assessment cost if a customer initiates a program project, especially for moderate income customers. However, the program must balance this recommendation with program budget constraints.

Supporting Findings:

- Fewer participants used financing to fund whole house projects in 2012 (21%) than in 2011 (50%). This may be due to the disappearance of low-interest financing for new home buyers that was available in 2011.
- Fewer participants are aware of financing options than in previous years. Amongst 2012 participants 54% were unaware of financing options, up from 27% in 2011. Further, while participants gave contractors a high satisfaction mean rating (4.0 on 1-5 scale) for the contractors' knowledge of available financing options, the contractors' financing knowledge

received the lowest satisfaction score relative to all other contractor attributes (means of 4.5 and higher).

- Roughly, half of participants (52%) only took some of the recommendations from the assessment. When asked why they did not do all of the recommendations, half of them (54%) said they could not afford all of the recommendations.
- Financing might attract more moderate income customers given that moderate income participants were more likely to use financing to fund the whole house projects. One-third of 2012 participants (30%) earned a moderate income; among them, 23% used financing to pay for the whole house upgrades while fewer (16%) high income customers financed. While these differences are not statistically different at 90% confidence mainly due to small sample sizes (n=30 for moderate income customers), the trend is compelling and should be considered.
- From the drop-out surveys, we found that the dominant reason for dropping out of the program at any stage is high upfront costs, where customers often said "I can't afford any upgrades at this time" or "they did not want to pay $500 for an assessment".
- Among drop-out customers, we found that financing options do increase customers' likelihood to install whole house upgrades and will assist in reducing the cost barrier. Amongst customers who said cost was a barrier to moving forward with projects after receiving the assessment, 55% said that a financing option would have increased their likelihood to install the recommended measures. These customers were more interested in low interest loan options from banks or other financial institutions than other options tested in the surveys (i.e. on-bill financing, mortgage-related loans or contractor payment plan options).
- Interviews with Energy Raters revealed that they think the main customer participation barrier is the program incentive levels. Two of the six Raters said that the low incentives make the program not worthwhile for customers.
- Interviews with participating contractors revealed that many of them experienced a sharp decline in the amount of work they had through the program recently and they attributed this to the expiration of ARRA funding. While PG&E program incentives have not declined, the additional incentives have, and contractors think the PG&E incentives are not high enough to attract many customers.
  - Since the ARRA funding expired, a few contractors mentioned that they have shifted away from promoting whole house retrofit work and went back to marketing their business as they did prior to the program (focusing on a specific specialty such as HVAC/insulation/general remodeling).
- In general, contractors strongly support subsidized energy audits. Contractors believe that the high up-front cost of energy audits is a significant barrier to consumers. In areas where subsidies are or were available, contractors have received an increased number of leads. However, some contractors were skeptical of free audits because they believed it might lower the conversion to project rate; when free audits are available, contractors believe

that many customers will pursue them with no intention of completing the retrofit. Therefore, contractors indicate that partial subsidies on energy audits would be an excellent offering, and would increase business and the number of jobs completed through the program. Some contractors also suggested a full rebate for energy audits if a customer went on to complete a job. One contractor mentioned that they currently refund the cost of the assessment if a job is completed.

4.3.2. Consider Allowing Propane Users to Participate

Recommendation

- **Consider allowing propane users to participate**. Based on the evaluation results, the program should consider whether it can offer the program to propane fuel users.

Supporting Findings

- A major participation barrier mentioned by some contractors was that the program does not match the needs of their customers. The primary example was the program's inability to cover rural customers using propane for fuel. One contractor who completed only one job through the program mentioned that all other jobs he had completed in 2012 were for propane customers and therefore ineligible for the program.

4.4. Additional Research

4.4.1. Explore Value of the Energy Rater

Recommendation

The program should consider the role of the Energy Rater and how big of a role they want them to have. If the program wants them to play a large, proactive marketing role, then the program will need to work on its relationship with the Energy Raters. Currently, many of the Raters are new to the program and describe similar frustrations with the program to what contractors experienced when they started. At the time of this evaluation, many of the Energy Raters were just getting started with the program. Therefore, it is uncertain at this time how the Energy Raters are performing from the participant perspective. Future research with 2013 participants should explore the program experience and feedback amongst participants who use Energy Raters as a project coordinator versus others.

Supporting Findings

- The overall attitude of the Energy Raters toward the program—with a satisfaction score of 5.6 out of 10—was neutral and could stand to be improved. Four of the six Raters noted a lack of support from the utility, notably in the area of marketing with respect to referrals. For example, one respondent suggested creating marketing-support tools, such as a database for referrals, and emphasize marketing rather than training efforts in the future. Three of the respondents suggested improving program targeting and rebates by easing

program requirements, incentivizing the assessment, and increasing program rebates "to make it worth their while."

- Only half of the Raters said they are actively trying to promote the program to customers. Two said that they did some marketing but did not emphasize the program much, and two said they did not do any marketing for the program. Of these four Raters, one said that they were still ramping up their role in the program as a new Rater, while the other three said that they chose not to market the program. One said that they do not conduct marketing generally and that their company is focusing on promoting other programs that are more lucrative to them than the Whole-House Program. Another said that their company has not made money with the Whole-House Program so they do not promote it. The third said that they rely on Build It Green and the website to generate clients for them.
- Overall, the Raters do not appear to be generating customers for the program, but instead are waiting for leads from the program website, contractors in their network or from Build It Green. The program would have to make some changes if they want the Raters proactively to market the program. Options may include conducting marketing training with turn-key resources for Raters to use on their own, and potentially provide some Rater incentives tied to marketing (such as offering them incentives to buy down the assessment cost if they successfully meet a certain marketing goal).
- The current program design allows Raters to provide anything from a light touch to full customer service. Our interviews found that Raters prefer this flexible design. However, the rater's ability to play the customer service or project coordinator role often depends on the contractors' and customers' preferences. While program design may intend for Raters to take on an administrative and guidance role in project management, this may be at odds with the preferences of contractors and customers.
- Two Raters reported that Raters and contractors do not sufficiently trust each other, but said that this happened for different reasons. One said that contractors do not trust "outside forces" while another said that many Raters were not sufficiently trained to evaluate the contractors' work properly, and instead made the work for contractors more difficult.

4.4.2. Continue Efforts to Revise Basic Package

Recommendation

We recommend that the program continue to explore alternatives to the Basic Package offering. At the time of this evaluation revisions to the Basic Package are underway. Future evaluations should explore the effectiveness and uptake of the new Basic Package offering after it is available in the market.

Supporting Findings

- Rater and contractors still prefer the advanced package. Almost all completed projects (99%) were advanced package jobs.

- About half of the contractors were familiar with the proposed changes to the Basic Path of the program, known as the "flex" package. Roughly half of them viewed the proposed changes positively, citing that it was easier to understand, required less overhead time, and included additional options. Most of the remaining contractors did not believe that the proposed changes would have an effect. Contractors cited test-in and test-out requirements and high levels of administrative/overhead costs as issues with the Basic Path that are not addressed by the proposed changes.

4.4.3. Explore Potential Spillover in Impact Evaluations

Recommendation

We recommend that future impact evaluations for this program attempt to account for potential spillover that is happening outside of this program.

Supporting Findings

- There are several customers who get a home assessment through a qualified Energy Rater and then decide to move forward with home upgrades outside of the program. The assessment and other program intervention could have still influenced these savings that are currently not captured in program estimates. From our survey of drop-outs, we found that 26% of customers that received an assessment decided to conduct work on their homes outside of the program.
- Amongst those that conducted work outside of the program, the majority did multiple upgrades (68% of these drop-outs installed 3 or more measures) and the most common upgrade was upgrading to ENERGYSTAR appliances followed by new windows and/or doors. Given that program eligibility is determined by estimating the potential energy savings from upgrades, it is difficult to determine just based on the measures whether any of these projects would have qualified for the program. It is possible that some of these measures would have instead qualified for other programs, and may already be counted through other programs, such as upstream appliance programs and the Residential HVAC program. These issues were not explored through the process evaluation but should be considered in future impact evaluations so the program can claim spillover savings where appropriate.

5. TRENDS IN PROGRAM ACCOMPLISHMENTS

We obtained program tracking data from the utilities (or their contractors) covering all Whole-House jobs initiated before or during the evaluation period (February 16, 2012 through June 30, 2013). We added these data to what was gathered from these same sources during Phase I of this evaluation. Collectively, these data provide information on the entire history of program accomplishments for PG&E.

There were several milestones throughout the program. There was a pilot program which ran from August 2010 through June 2011, Phase I which ran from July 2011 through Feb 15, 2012, and finally the current evaluation period. Following the pilot program, PG&E changed the third party implementers. The transfer to the current implementer (Build it Green) was completed in June of 2011. The job data and the check data (rebate checks paid to homeowners) are handled by different third party implementers, so there are some system differences which affect the reliability of the data. Further, early in 2012 the program switched from single family home only to allow the inclusion of multifamily buildings with up to four units which caused some data processing issues. For instance, some buildings have a single gas meter, but individual electric meters which causes units to initially be denied rebates after one has gotten a rebate.

Each job goes through a series of statuses as it makes its way from the beginning to the end of the process, starting with pre application ready and ending with full application approved. The statuses are not always reliable, but they present a fairly good indicator of where a job is in the process. Every job has an initiated date which is the date when it entered the system. An approved job has reached the status of full application approved. In order to be a completed job the homeowner must have received a rebate check from the utility; its status should be full application approved but that was not always the case. An approved job and a completed job are almost synonymous, meaning that they completed the process successfully, but its completed status has a little more certainty because it is reinforced by the receipt of the check. A job was considered a drop out if it did not reach a status of full application approved (or received a check) and there were no changes to its status after September 15, 2012. Its drop out date was considered to be the date of its last status change. A job is considered in progress if it has not reached a status of full application approved but it has had status changes after September 15, 2012.

Figure 8 shows how many jobs were initiated, approved, and dropped in each quarter. Table 6 lists total jobs by category over the entire history of the program. There were 6,357 total jobs initiated with 4,791 of them approved so far. The American Recovery and Reinvestment Act (ARRA) provided a pool of money that the local utilities could spend in a variety of ways including funding assessments, rebates, or education. The ARRA funds had to be spent by the end of June of 2012. As can be seen in Figure 8, there is a marked increase in initiated jobs in the second half of 2011 and the first quarter of 2012 which is likely due to the injection of the ARRA funds. There is a corresponding jump in approvals in the first half of 2012. Without the ARRA bump, the initiated jobs increased in an almost linear fashion. The approved jobs do not show the same linear progression, with a drop after the ARRA bump. The approved jobs have a big spike in the second quarter of 2013 which may be catching up for a lack of approved jobs

the previous two quarters. There are no drop outs after Q3 in 2012 because all jobs that have not reached the full application approved status after that date were still considered in progress.

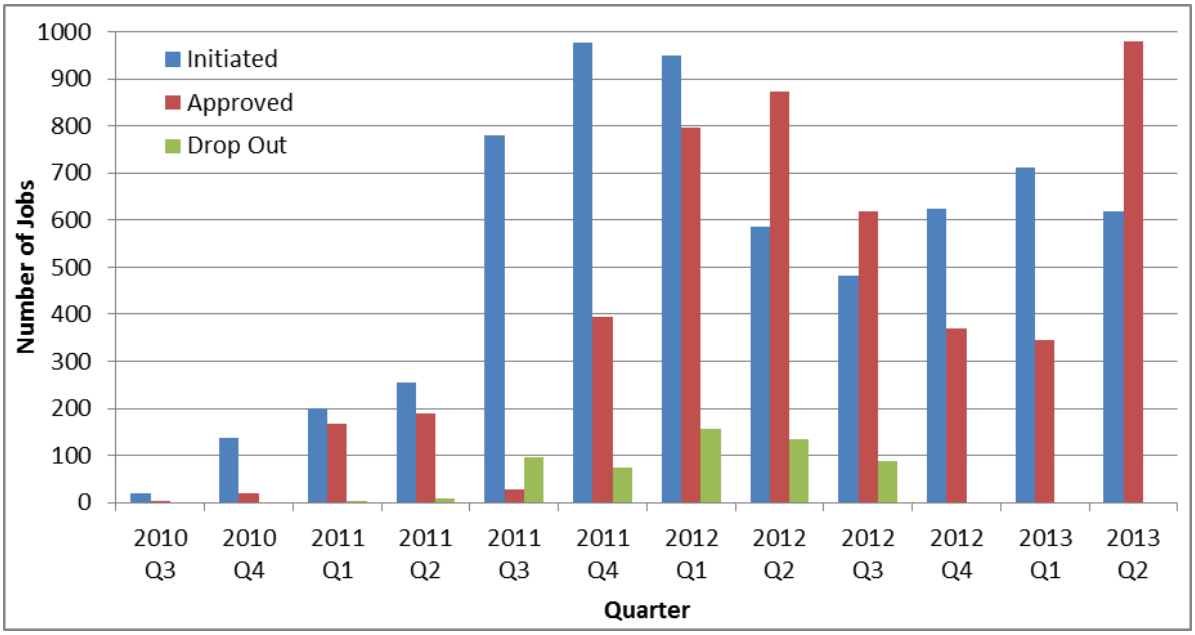


Figure 8: Quarterly Job Activity

Table 6: Total Jobs by Category, Entire Program History

Category	Jobs
Approved	4,791
Drop Out	561
In Progress	1,005
Total	**6,357**

We looked at the check processing data, in trying to understand why approved jobs shifted down in the last three quarters shown in Figure 8. It is unclear if this delay is due to an actual delay in the approvals or delays in processing checks. As seen Figure 9, starting in 2012, the first month each quarter has more checks than the subsequent two months. This is especially pronounced in the last quarter of 2012 and the first quarter of 2013. For most months, all the checks are written on only a few days. While the data does not tell the whole story, it is clear that there is bunching of the processing which could be due to batching by the contractors or the check processor. The check data before September 1, 2011 cannot be matched to the completed jobs so the time period before that is not shown in the figure.

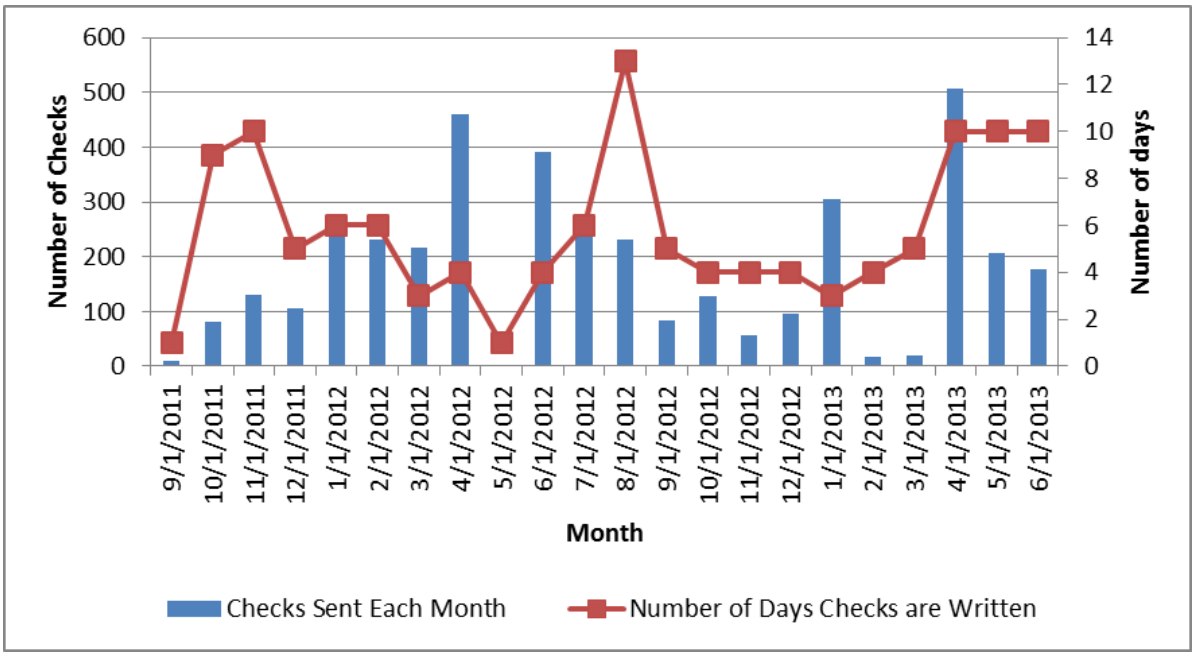


Figure 9: Check Processing

Figure 10 shows the amount of time that passed between the approval date and the date a rebate check was issued and the number of checks written. The second quarter of 2013 was not included in the figure because only jobs with the quickest payments would be included by the end of June. Throughout the program, the time it took to issue checks has remained fairly constant (between 4-6 weeks), even throughout the period of ARRA funding when many more checks were issued.

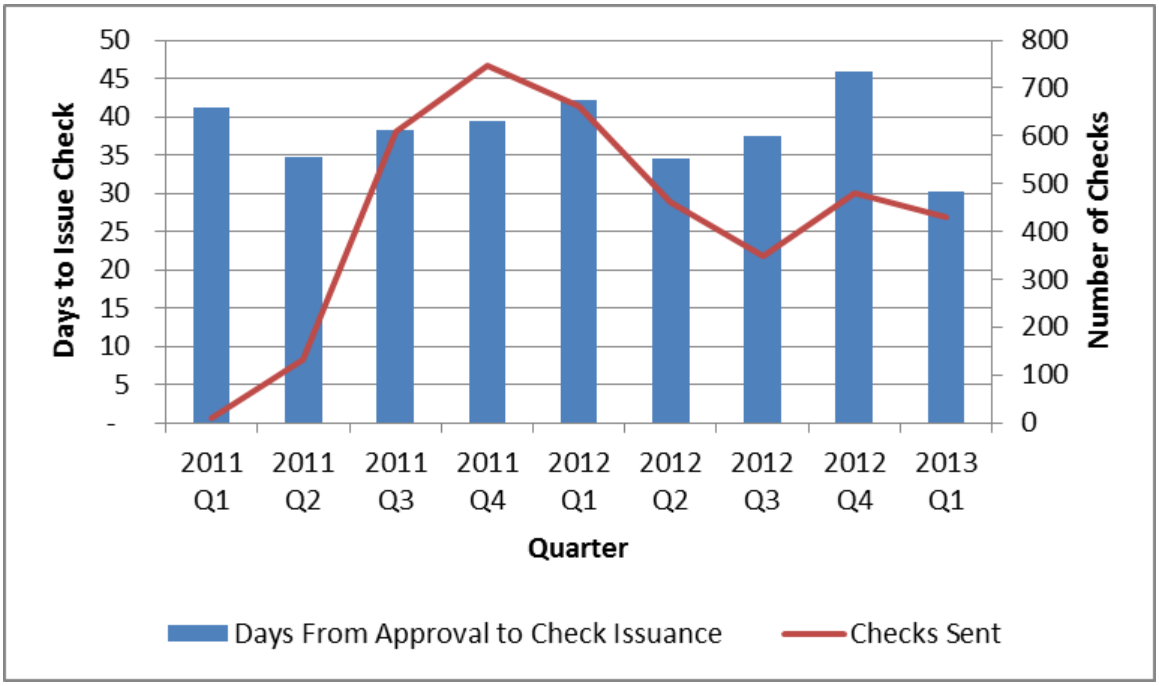


Figure 10: Check Processing Time

The jobs in the pipeline are jobs that are initiated or completed in the period as well as jobs that span the period. Figure 11 shows the number of jobs in the pipeline was slowly increasing until midway into 2011 the number of jobs jumps markedly. At that time the ARRA funds became available. After the ARRA funding ended in the second quarter of 2012, the jobs in the pipeline dropped and then remained constant for a few quarters. In the last three quarters the jobs in the pipeline has been steadily decreasing.

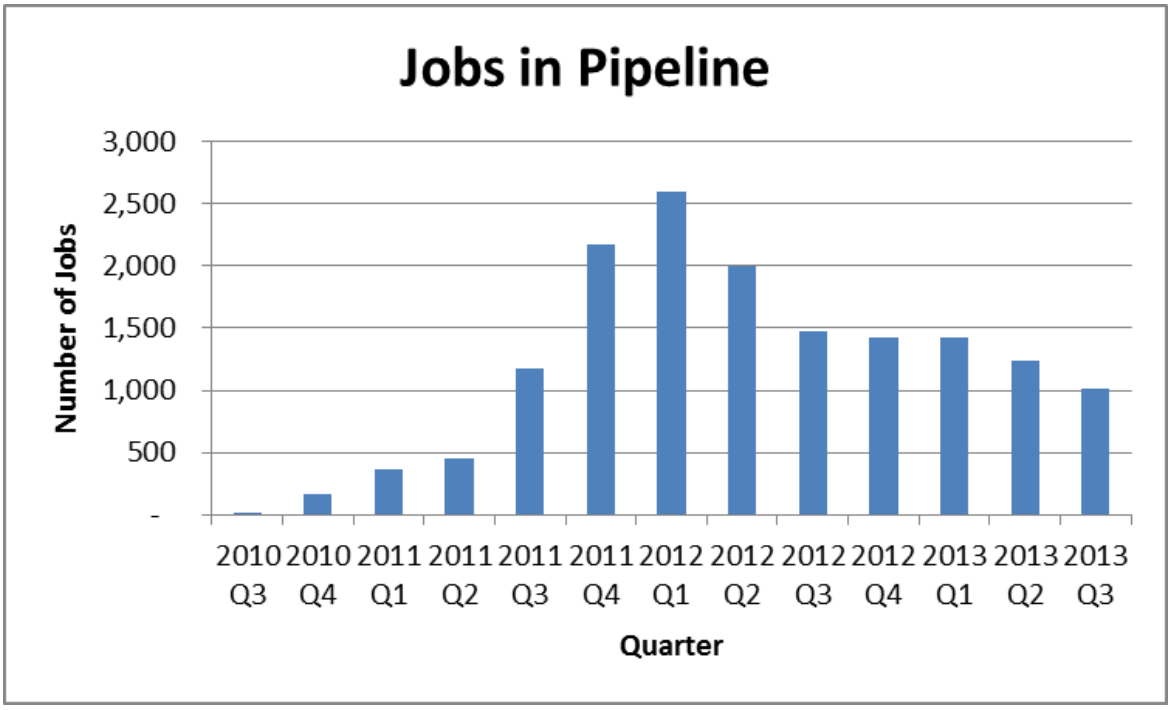


Figure 11: Jobs in Pipeline

Figure 12 shows the jobs initiated each period and the number of those same jobs that eventually got approved. The approval rate started out very high (over 90%) in the pilot phase then dropped noticeably during the time the ARRA funds were in play. After the ARRA funds ended the approval rate has been rising, but still has not returned to the very high rate during the pilot period.

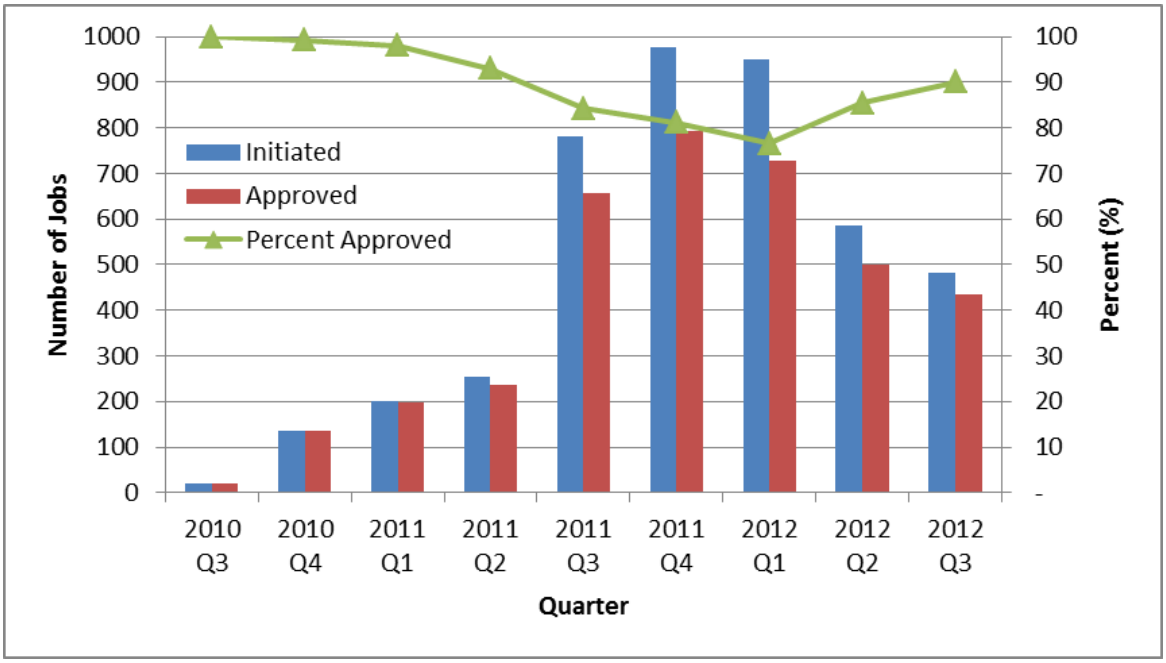


Figure 12: Job Approval Rate

Figure 13 shows the average time to move a job from start to finish. There is large variation throughout the program, ranging from a low of 83 days to a high of 168 days. The two longest periods correspond to the jobs that were started during the ARRA funding period, the second and third quarter of 2011. During those quarters the length of time to complete is nearly double the prior period. The number of jobs in the pipeline is also included to show how the longer completions (four months) occur when there are the most jobs in the pipeline (2 quarters later). The final quarter of 2012 also has a very long time to complete, but it is unclear what may have caused jobs in that period to take so much longer. No data from 2013 was included because the data was skewed by jobs still in progress.

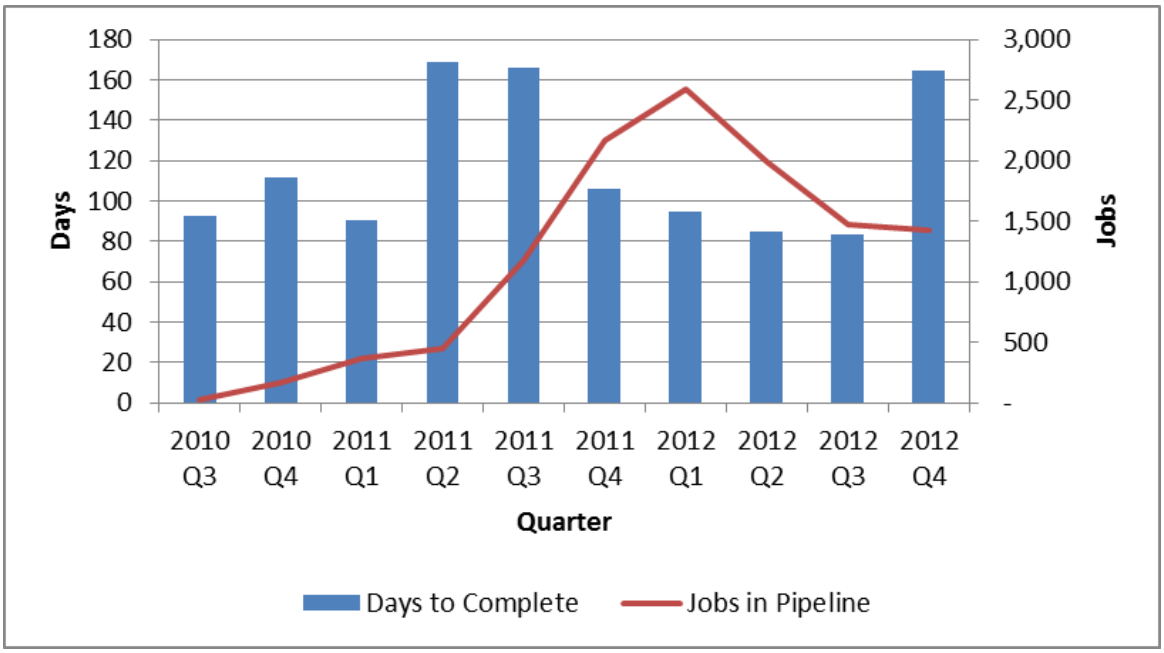


Figure 13: Time to Complete a Job

Figure 14 shows the rebate to cost ratio throughout the program. The average rebate to cost ratio through the entire program varied from 0.21 to 0.32. The whiskers inside the bars show the standard deviation of the average. There was a large range in the values with the minimum at .006 and the maximum at 1. There were only 5 cases where the ratio was 1. There is no discernible trend in the ratio as the program progressed.

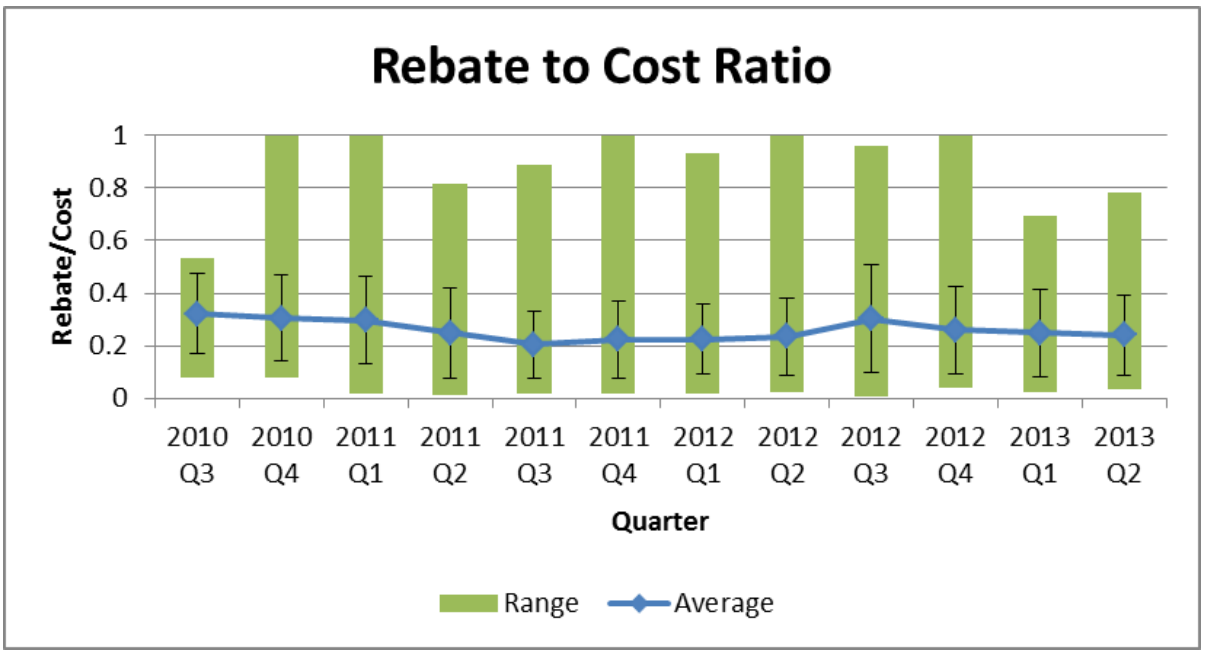


Figure 14: Rebate to Cost Ratio

The location of all the jobs was mapped in Figure 15. The areas with heavier red had more jobs. The three areas with the most jobs were the Bay area, Sacramento, and Fresno.

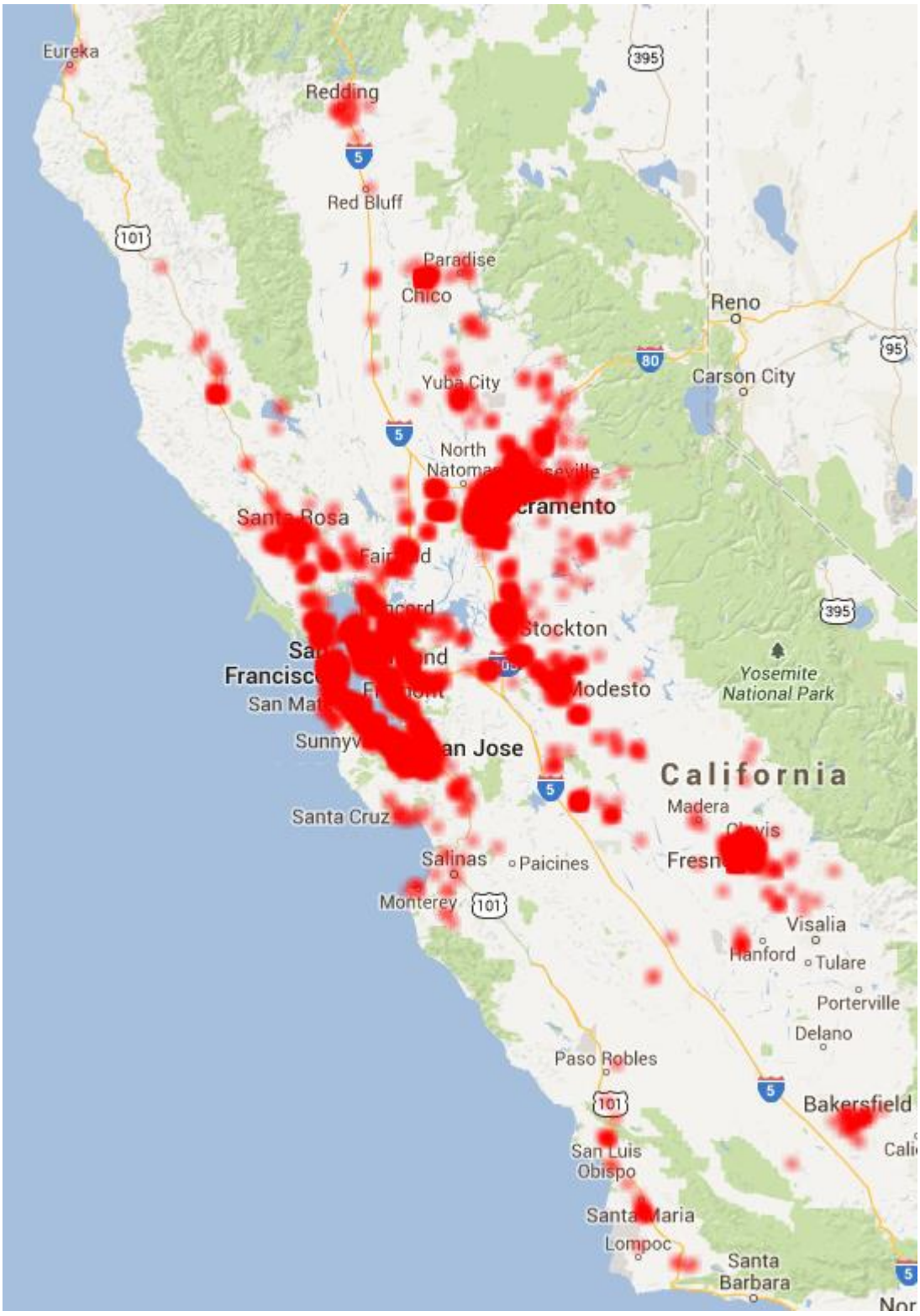


Figure 15: Job Locations

Table 7 lists all the approved jobs by county. Sacramento has by far the most jobs of any county representing 26% of all the jobs, and they are almost all gas only (PG&E territory overlaps in this region with SMUD who delivers electric service). Sacramento had 89% of all the gas only jobs. Most other counties are predominately duel fuel. Alameda and Santa Clara counties also each have 10% or more of the jobs. These three counties make up 47% of all the jobs.

Table 7: Approved Jobs by County

City	Duel Fuel	Electric	Gas	Total	Percent of Total
Sacramento	7		1238	1245	26%
Alameda	529	1	22	552	12%
Santa Clara	468	1	9	478	10%
Contra Costa	388	7		395	8%
San Francisco	350			350	7%
San Mateo	299	1		300	6%
San Joaquin	214	5	14	233	5%
Fresno	189	8		197	4%
Placer	126	16	8	150	3%
Sonoma	134	9	1	144	3%
Yolo	89	3	2	94	2%
Solano	92			92	2%
Stanislaus	14	3	73	90	2%
Marin	84			84	2%
Butte	28	55		83	2%
El Dorado	36	43		79	2%
Merced	50	1		51	1%
Mendocino	8	2	14	24	1%
Sutter	19			19	0%
Napa	17			17	0%
Kern	11	5		16	0%
Amador	6	7		13	0%
Shasta	1	2	10	13	0%
Santa Barbara		11		11	0%
Nevada	3	6		9	0%
Yuba	8			8	0%
Madera	5	2		7	0%
Kings	1	6		7	0%
San Luis Obispo	2	4		6	0%
Glenn	3	2		5	0%
Calaveras		3		3	0%
Monterey	3			3	0%
Santa Cruz	3			3	0%
Lake		3		3	0%
Humboldt	2			2	0%
Tulare	1	1		2	0%
Tehama	1			1	0%
San Benito	1			1	0%
Colusa	1			1	0%
Total	**3193**	**207**	**1391**	**4791**	
Fuel Percentage	67%	4%	29%		

Figure 16 shows the approved jobs by fuel and upgrade path (Basic and Advanced). The Basic jobs only accounts for 1-2% of all jobs, leaving the Advanced jobs to dominate. The number of Basic jobs is very small throughout the program, though in the case of the gas jobs, there are no Basic jobs in the last three quarters. Duel fuel jobs always outnumber the other fuels. Electric jobs, except for one quarter, are significantly less than the other fuels. The data from the second quarter of 2013 was not included because the data was skewed by jobs still in progress.

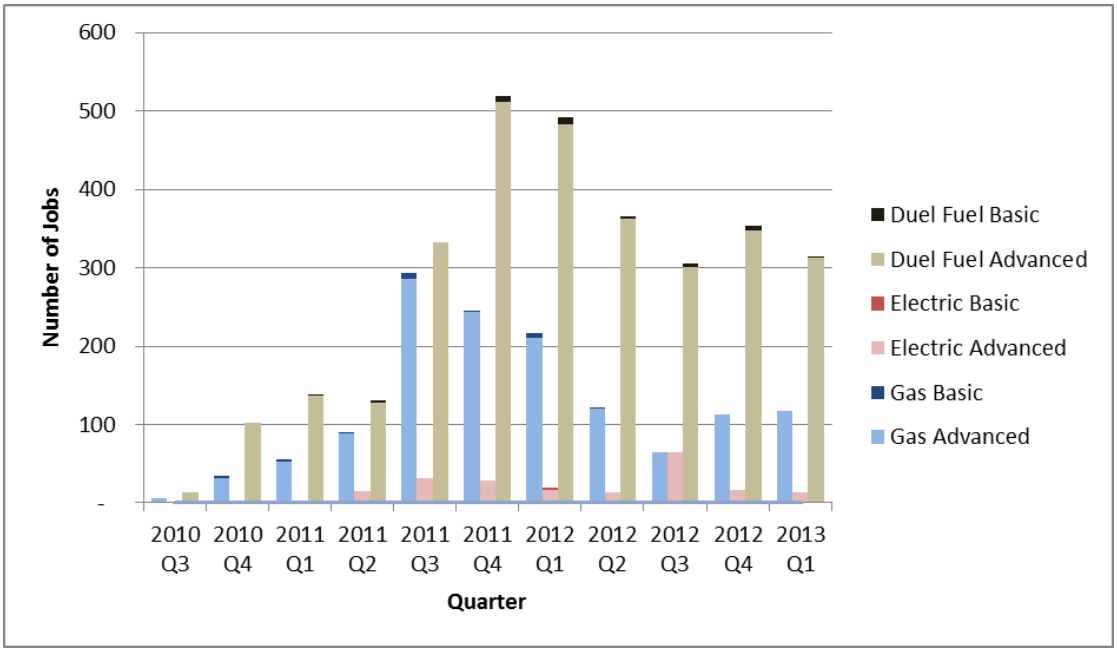


Figure 16: Approved Jobs by Fuel and Path