Draft

Ameren IU Residential Programs: Evaluation Plan

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1. Introduction

AIU's Residential Energy Efficiency Solutions portfolio (REES) includes the following programs:

- Home Energy Performance
- Residential HVAC Tune-Up
- Residential Appliance Recycling
- Residential Lighting & Appliance
- Residential Multifamily
- Residential New HVAC
- Residential Demand Response-Direct Load Control

As of February 2009, four of these programs were up and running with sufficient activity to warrant some level of evaluation of their performance during PY09:

- Home Energy Performance
- Residential Appliance Recycling
- Residential Lighting & Appliance
- Residential Multifamily

The remaining programs will all begin before May 31, 2009, but because of their late start, Cadmus plans to focus the PY09 evaluation on the four programs above. The following sections include detailed descriptions of our proposed work plans for evaluating each of the four launched programs over the next three years.

2. Residential Lighting and Appliance

Program Description

The Residential Lighting and Appliance Program is designed to encourage the purchase of high efficient lighting products, such as Compact Fluorescent Lamps (CFLs) and ENERGY STAR rated lighting fixtures and other appliances. During PY09, the program has focused on lighting; promoting appliances will begin in early PY10. The Program is implemented primarily through instant or mail-in rebate coupons, upstream markdowns, and buy-down promotions, although the specific strategy employed varies by product and retailer. According to the Implementation Plan, 2008 incentives ranged from $1.12 for a 13 watt CFL, to $20 for an ENERGY STAR rated ceiling fan. In PY 09 the program concentrated on the big box stores and larger retail chains for rebate delivery. Other program activities included branded point of purchase (POP) materials, customer and retailer education materials, in-store events, training retail sales staff, and providing cooperative advertising funds for smaller independent retail partners.

Conservation Services Group (CSG) is the implementation contractor for all of AIU's residential programs. CSG has two subcontractors for the Residential Lighting and Appliance program: APT for all field work, particularly with local retailers; and the Energy Federation Inc. (EFI) for all internet and catalogue orders.

Impact evaluations for upstream rebate programs are inherently difficult due to a lack of participant contact information. Over the course of the evaluation, Cadmus will be estimating program impacts based on a variety of data sources that include participating retailer sales data, CFL user telephone surveys, nested in home site visits, and shelf stocking studies. Multiple data sources will allow a triangulation of results and a higher degree of accuracy. Due to budgetary and time constraints, however, the first year of evaluation will consist of limited activities. Subsequent evaluation years will expand on the data collection activities and analysis.

Evaluation Plan

Overview

Table 4-6 provides an overview of the tasks proposed for evaluating the PY09 Residential Lighting Program.

Table 2-1. Summary of Evaluation Tasks

Action	Sample Size	Details
CFL User Survey		Used for estimating CFL awareness, sales, saturation, calculating the NTG, and assessing program implementation
Participant Retail Store Sales Analysis	Census	Provides an unbiased assessment of program and non-program lighting sales.

Impact Evaluation Data Sources

Consumer Surveys. Telephone surveys of residential customers have proven to be a useful technique to estimate a number of important progress indicators, including:

- Awareness of CFLs;
- Total sales of CFLs (number of CFLs sold during Year One);
- Sales by distribution channel;
- Installation and storage rates;
- Installation location (used to estimate hours of use); and
- CFL saturation (percent of homes with CFLs).

Approximately 300 to 400 surveys will be conducted with AIU residential customers, with the quota of reaching at least 100 purchasers of CFLs during PY09.[1] Cadmus will survey a random sample of AIU residential customers. We will split the sample between zip codes where the program has been active and those where it has not yet started.

When analyzing the results from the CFL User Survey, each respondent is considered a complete, regardless of whether or not the contact actually purchased a bulb or is even aware of CFLs. This strategy provides a snapshot of the lighting sales throughout the service territory, including the number, timing, and types of lighting purchased, the percentage of respondents currently using CFLs, and general awareness of CFLs.

Retail Sales Analysis. According to the Implementation Plan, detailed tracking reports are available for all rebated transactions. These files tie payment requests to identified transactions and track:

- program activity by product or product family;
- program activity on an aggregated basis, of products rebated and dollars spent;
- program activity by various identified components – i.e., by product, by store chain, by manufacturer;
- current period and year-to-date program activity;

As part of the lighting evaluation, Cadmus staff will review the tracking and transaction databases to review the accuracy reasonableness of sales claims.

[1] The total number of surveys is estimated based on the incidence of CFL purchasers in other studies that Cadmus has conducted.

Impact Evaluation Savings Estimates

As shown in Figure 2-1, a variety of data collection activities can be used to collect the necessary information to estimate savings from CFL programs. However, limited resources in the first year will require that research activities be confined to customer surveys and a review of the program tracking data. Specifically, Cadmus will estimate savings through the following inputs:

- ***Number of Program Bulbs.*** The program tracking database will be reviewed and utilized to calculate the number of CFLs that were incented through the program.

- ***Leakage.*** Although program bulbs may leave the AIU service territory (leakage), we assume this effect is minimal for a few reasons. First, the program has attempted to limit leakage by selecting stores that are not bordering on adjacent service territories. Secondly, the adjacent service territories are also offering CFL discounts, so leakage can be assumed to work in both directions (positive and negative). For the purposes of the first year evaluation, therefore, leakage will be assumed to be zero.

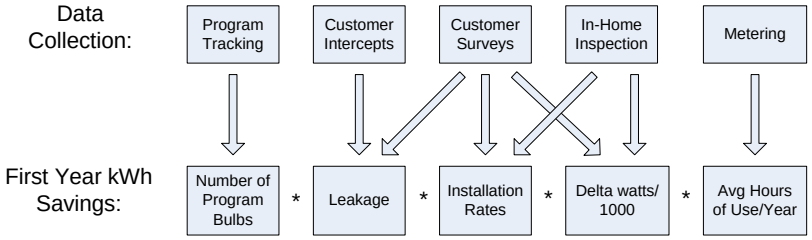
- ***Installation Rate.*** The CFL User survey will provide the basis for the percent of CFLs installed versus those that were put in storage.

- ***Delta watts.*** The baseline wattage will be estimated by reviewing the program bulb wattages and comparing to secondary data sources of equivalent incandescent wattage. The room of installation (from the telephone survey) will also be used to help inform the delta watts (i.e., by examining typical differences in wattage by room type).

- ***Hours of Use.*** Hours of use for each bulb, by room type, will be estimated from secondary data sources. For example, Cadmus is currently conducted a large metering study to estimate hours of use as part of the California Residential Retrofit evaluation, and that study will produce a model that estimates CFL hours of use as function room type, CFL saturation, housing type, bulb type, and other variables. .

- ***Net to Gross (NTG).*** Spillover, free-ridership, and other NTG indicators will be estimated by combining the results of the telephone survey (to estimate total CFL sales), the program tracking (to estimate sales through the program), and secondary data sources (to estimate baseline CFL sales in absence of the program). For example, sales of CFL in non-program states, as collected as part of the CPUC CFL Market Effects study, can be used to assess the baseline estimate of CFL sales per household in absence of any program activity.

Figure 2-1. Example of Data Collection Activities Used to CFL Estimate Savings



Program Data Review

Prior to beginning the evaluation, Cadmus is taking steps (e.g., reviewing an extract of the CSG database) to ensure the appropriate data are being collected by the program implementer and that important program definitions are being applied consistently.

3. Appliance Recycling Program

Program Description

As described in its implementation plan, the Appliance Recycling Program (ARP) is designed to promote the retirement and recycling of secondary, inefficient refrigerators and freezers from AIU electric households by offering a turn-in incentive of $35 and free pickup, as well as information and education on the cost of keeping an inefficient unit in operation. ARP is available to all residential electric customers with working secondary refrigerators and freezers manufactured before 1993 and between 10 and 27 cubic feet in size. During PY09, ARP has been concentrated in the area around Springfield. The program began in October 2008, and has built steadily since that time, with a jump in participation just after Christmas.

From an evaluation perspective, appliance recycling programs are different from most programs in that savings are generated by rebating the *removal* of an operable but inefficient measure, rather than rebating the installation of an efficient measure. This poses unique evaluation challenges that require less traditional methodological approaches. However, methods to evaluate the energy savings and freeridership associated with recycling programs have been refined in recent years through several recent robust evaluations and rigorous discussion at energy and evaluation conferences. The methods proposed in this work plan incorporate the lessons learned through these experiences and provide an accurate and reliable approach for assessing the impact of the program within AIU's service territory.

Evaluation Plan

Overview

The evaluation of ARP consists of both impact and process elements. Table 4-6 provides an overview of the tasks proposed for evaluating this program.

Table 3-2. Summary of Evaluation Tasks

Action	Impact	Process	Details
Participant Survey	✓	✓	Used for verification, calculating the NTG, and assessing program implementation
Nonparticipant Survey	✓	✓	Provides an unbiased assessment of "what would have happened" to the recycled appliances in the absence of the program.
Market Actor Interviews	✓	✓	Help understand the natural movement of used appliances by talking to local new and used appliance dealers – important for the impact evaluation and planning purposes.
Stakeholder Interviews		✓	Interviews with program staff and implementers provide insight into program design and delivery.
Program Database Review	✓		To ensure the appropriate data are being collected to inform the evaluation, in particular the engineering model. Recommendations will be made as needed. (PY09). The database review will take place in April/May 2009.
Secondary Research	✓		Review results of recent appliance recycling evaluations (Ongoing). Specific appliance models' savings will be obtained from other studies and secondary sources

Impact Evaluation

The impact evaluation is primarily aimed at verifying reported program participation, determining the program's net-to-gross ratio (or NTG - a metric especially critical and complex for appliance recycling programs) and calculating the gross and net savings. A brief explanation of each impact evaluation task, including proposed methodologies and sample sizes, is provided below.

Participant Surveys. Since it is impossible to verify the removal of an appliance that may or may not have been there in the first place utilizing site visits, the evaluation will rely on participant self-reported data to verify program participation records. In addition, surveys with ARP participants will help determine the program's NTG as well as assess satisfaction levels. As shown in **Error! Reference source not found.**, the evaluation team plans to survey a total of 200 randomly selected ARP participants, stratified by measure, in PY10 and PY11; we will begin with a smaller sample in PY09 because of the program's late start.

Table 3-3. Participant Impact Evaluation Survey Sizes

Measure	PY 2009	PY 2010	PY 2011	Total
Refrigerators	50	150	150	350
Freezers	20	50	50	120

Nonparticipant Surveys. Surveys with nonparticipants—defined as AIU customers discarding a secondary refrigerator and/or freezer independent of the program—will provide valuable insight into what happens to older, operable appliances in the absence of the program. Since participants of utility programs often exaggerate the frequency with which they would have done "the right thing"—in this case recycling their old appliance independent of ARP— it is important to collect supplementary information for the NTG analysis. Information collected from nonparticipants

provides a "reality check" on the self-reported participant NTG. Currently, we plan to interview 100 nonparticipants each in PY10 and PY11. Nonparticipants will be identified in part through other evaluation survey efforts, including the CFL baseline study.

Utilizing both participant and nonparticipant responses to determine the program's NTG increases the reliability of the final NTG and aligns this evaluation with the approach most recently employed in California.

Table 3-4. Nonparticipant Impact Evaluation Survey Sizes

Measure	PY 2009	PY 2010	PY 2011	Total
Refrigerators/Freezers	0	100	100	200

Market Actor Interviews. Similar to the nonparticipant surveys, interviews with local appliance market actors will provide insight into the natural movement of older, operable appliances within AIU's service territory. Specifically, these interviews will determine the fraction of units of various ages and other characteristics discarded through traditional channels, indicating those that are destroyed and those that are resold to new users (which therefore remain active within AIU's service territory). This research further informs the overall NTG calculation (details provided below) and aligns this evaluation's approach with the recent California methodology.

Specifically, interviews will be conducted with approximately 10 market actors (Table 3-5). These market actors will be determined through Internet research and input from AIU.

Table 3-5. Market Actor Sample Sizes

Market Actor	PY 2010	PY 2011	Total
Local Appliance Retailers (New and Used)	6	6	12
Appliance Haulers	4	4	8

Determine Gross Program Savings. Since this evaluation is not collecting primary data to determine the gross savings of participating refrigerators or freezers (e.g., *in situ* metering or laboratory testing), the evaluation team recommends continuing to utilize the wealth of such information recently collected in California.[2] However, the evaluation team recommends these values be validated through additional research. To conduct this validation, the evaluation team will develop a database detailing the per-unit savings associated with the retirement of every combination of the following appliance characteristics:

- Appliance Type (Refrigerator, Freezer)
- Appliance Configuration (Top Freezer, Side-by-Side, etc.)
- Appliance Age
- Appliance Size (Internal Cubic Feet)

The information needed to populate this database will be industry databases detailing the Department of Energy tested energy consumption of units at the time of their manufacturer. Since energy consumption increases over time as the appliance degrades, an annual degradation factor will be applied to approximate energy consumption at the time of retirement. Additional adjustment to account for weather will also be applied.

Once compiled, the per-unit savings database described above will be merged with AIU's ARP database. The number of participating units within each set of unique appliance characteristics will be multiplied by the per-unit savings determined for that set of appliance characteristics. An overall weighted per-unit average can then be determined which indicates the typical energy and demand savings of a participating refrigerator and freezer. The observed weighted averages will then be used to validate to the values determined by the 2004-2005 California study referenced above. If the values vary significantly, the evaluation team will investigate the reason for the disparity and potentially recommend utilizing either the weighted averages or the values determined by another study to be utilized by AIU.

Lastly, given the timeline of this evaluation, it is possible the results of the 2006-2008 Appliance Recycling Evaluation in California will become available. Since the units metered as part of that California study (also conducted by Cadmus) are more comparable to those being retired by AIU (in terms of age), these values will also be investigated and used where appropriate.

Determine Net Program Savings As noted previously, calculating the NTG for appliance recycling programs is more complex than for most energy efficiency programs. To ensure an accurate NTG is calculated, the evaluation team will follow the methodological approach utilized in the 2004-2005 California Residential Appliance Recycling Program evaluation. This methodology – which was discussed and refined by industry experts at the International Energy Program Evaluation Conference – has gained acceptance as the industry standard for assessing

[2] http://www.calmac.org/publications/EM&V_Study_for_2004-2005_Statewide_RARP_-_Final_Report.pdf

appliance recycling program NTG. Specifically, NTG will be calculated by determining the program's "part-use" and "attribution" factors.

In that evaluation, "part-use" and "attribution" factors were estimated. These factors are:

- ***Part-Use Factor***: Adjusts for the fraction of time participants were using the recycled appliance and/or the fraction of time it would have been used if they had kept it.
- ***Attribution Factor***: Adjusts for the percentage of participants that would have disposed of the unit independent of the program, and gives partial credit to the program for destroying a unit that would otherwise have been transferred to another user.

For the 2002 study, both factors were used to determine the program's NTG. However, for the evaluation of the 2004-05 statewide California study, the evaluator used the part-use factor in its calculation of the program's gross savings, not its NTG. While this application does not change the net impact of the program, it provides a more accurate assessment of gross savings

There are four categories for what could have happened to a refrigerator or freezer had it not been recycled:

- Unit would have been kept by the household but not used;
- Unit would have been kept by the household and still used;
- Unit would have been discarded by the household through a method in which the unit would be destroyed; and
- Unit would have been discarded by the household through a method in which the unit would be transferred and kept in use.

Of the four categories, two are indicative of free ridership:

- Unit would have been kept by the household but not used; or
- Unit would have been discarded by the household through a method in which the unit would be destroyed.

These categories are indicative of free ridership because the units would have been removed or not used/destroyed even if they had not been recycled through the program. As a result, the program can not claim the energy savings generated by the appliance's retirement. To determine free ridership, participants will be asked how they would have discarded the appliance independent of the Program. The response provided will be assessed to determine which of the four categories is relevant and whether the disposal method would have led to the eventual destruction of the appliance.

In addition to utilizing participant survey results to inform this assessment, nonparticipant surveys will also be used. Since the "stated intentions" offered by participants may differ from what actually may have happened, nonparticipants will be used to provide "revealed preferences" of what actually happens to discarded units not participating in the program. The

results will be presented using attribution factors utilizing both datasets, with a weighted average being used in the final calculation. Any significant differences between the two groups will be explored.

Process Evaluation

Participant and Nonparticipant Surveys. As noted above, we will conduct surveys to inform the impact evaluation. These surveys will also include process evaluation questions aimed at assessing the level of participant satisfaction, experience with the program, and reasons for nonparticipation.

Stakeholder Interviews. Evaluators will also conduct interviews with stakeholders (including CSG, ARCA, and implementation team members). These interviews will focus on assessing the program process flow, program design versus program implementation, changes in implementation, and program marketing. Following each set of interviews, the evaluation team will assess the appropriateness of the current methodology and determine if midstream changes are needed to continue effectively evaluating the program. These interviews will happen in both PY 2009 and PY2011.

Assessing Evaluability

Prior to beginning the evaluation, Cadmus would like to ensure the appropriate data are being collected by the program implementer and that important program definitions are being applied consistently. Specifically, Cadmus will review the following:

> ***Review of Program Database***. While the program's implementer, ARCA, has provided data to support numerous program evaluations, Cadmus will review an extract of the AIU database at the outset of the evaluation and ensure the appropriate data are being collected.

4. Multifamily Program

Program Description

AIU's Multifamily Program (Program) offers multifamily building owners/managers and private contractors incentives to promote the installation of energy-efficient lighting in common areas and also provides energy audits for the installation of central AC unit diagnostics and tune-up measures in tenant spaces. The program offers building owners and managers Compact Fluorescent Lamps (CFLs) and water conservation measures for installation in resident units, and leaves information on the measures installed and other energy savings tips for those residents. The program also offers custom measures (windows, replacement of roof-top AC units) that will be subject to an energy audit to validate cost-effectiveness and establish incentive levels. None of these more complex measures have yet been implemented in PY09.

Evaluation Plan

Overview

The PY09 Multifamily Program evaluation will consist of a data review and a process evaluation. Since the program just began in November 2008, there is not yet enough activity and data to allow for an impact evaluation. Table 4-6 provides an overview of the tasks proposed for evaluating this program. While only brief details are provided in the table, each task is described in significant detail later in the section.

Table 4-6. Summary of Evaluation Tasks

Action	Impact	Process	Details
Data Review	✓	✓	Review of program documentation including records of marketing outreach, applications and all verification documentation on a sample of buildings enrolled in the Program.
Participant Survey	✓	✓	To verify installation of materials and assess the program marketing and outreach, application process, delivery, and incentives. (PY10 and PY11 only)
Stakeholder Interviews		✓	Interviews with program management and implementation staff to provide insight into program design, marketing, and delivery
Program Database Review	✓		To ensure the appropriate data are being collected to inform the evaluation, particularly the impact work. Recommendations will be made as needed.

Evaluation Tasks

Impact Evaluation

The impact evaluation is primarily aimed at verifying reported program participation, determining the program's net-to-gross ratio, and calculating the gross and net savings. A brief explanation of each impact evaluation task, including proposed methodologies and sample sizes, is provided below.

Participant Surveys. Cadmus' participant surveys will focus on building owners and managers over the course of this evaluation, since they are the key decision makers on whom program participation depends. These surveys will also be used to assess free-ridership, spillover, and program-specific installation rates. Cadmus will not conduct any surveys for PY09, but will design the survey to begin conducting in PY10.

Site Visits. Cadmus will visit a sample of treated buildings and apartments In PY10 and PY11. We will visit 15 buildings each year. If measures were installed in both individual apartments and common areas, the actual number of units visited will exceed 15.

Table 4-2 shows the proposed sample sizes for the multifamily evaluation surveys and site visits.
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Table 4-7. Participant Survey and Site Visit Sizes

Measure	PY 2009	PY 2010	PY 2011	Total
Surveys	0	70	70	140
Site Visits	0	15	15	30

Billing Analysis. Cadmus will conduct a billing analysis for the Multifamily Program in PY10 and PY11 to determine measure level and overall electric savings estimates. The billing analysis will be performed on the census of participants and include a nonparticipant group.

To allow for versatility of obtaining savings estimates for many different participant subgroups, a separate PRISM-like weather normalization model will first be run for both the pre and post periods for each participant and nonparticipant. These models will separate the normalized annual consumption (NAC) into three components for electric models: heating, cooling and base load.

Some program measures affect only the base-load, such as lighting, while others that may be installed as custom measures affect both the heating and cooling weather sensitive components. Cadmus proposed modeling approach will yield accurate estimates of savings by examining only the appropriate component of usage associated with each measure type.

Measure Level Savings Estimates. Cadmus will use to modeling approaches to obtain measure level savings estimates, to test for the robustness of the savings estimates, and to triangulate the final measure level savings estimates. These two approaches are statistically adjusted engineering (SAE) and a conditional savings analysis (CSA) . The two model types are somewhat similar, the main difference between them is that in the SAE approach, the measure level engineering deemed savings are used as explanatory variables, whereas in the CSA approach binary variables for each of the measures installed are used to separate out the effects of the various measures. We will run all models using data on both participants and non-participants.

Process Evaluation

Data Review. Cadmus will review all program documents, including records of marketing and outreach efforts. Program applications, records of installation, audit documents, and incentive paperwork will be reviewed for ten buildings enrolled in the Program between November 2008 and February 2009. If enrollment is less than ten buildings, Cadmus will review all program documentation for all buildings enrolled during April and May 2009. The evaluation will provide feedback on the program launch and will highlight any issues or concerns to help ensure a successful program.

Participant Surveys. Cadmus will conduct surveys of property managers and owners participating in the program to assess program design, delivery and participant satisfaction. These surveys will include questions aimed at assessing the benefits participants have experienced as a result of the program, their level of satisfaction and any areas of improvement for the program.

Stakeholder Interviews. Program delivery will also be assessed through interviews with program managers, implementation team members, and trade allies. Cadmus will conduct interviews in year one with 10 program stakeholders. These interviews will focus on assessing the program process flow, program design versus program implementation, changes in implementation, and program marketing. Following each set of interviews, the evaluation team will assess the appropriateness of the current methodology and determine if midstream changes are needed to effectively evaluate the program. Interviews will be conducted in April and May 2009.

Table 4-3. Stakeholder Interviews

Stakeholders	PY 2009	PY 2011	Total
Local Appliance Retailers (New and Used)	10	10	20

Assessing Evaluability

Prior to beginning the evaluation, Cadmus will ensure the appropriate data are being collected by the program implementer and that important program definitions are being applied consistently. Specifically, Cadmus will address the following:

> ***Review of Program Database***. The program's implementer, CSG, has provided some data to date on the program progress. Cadmus is reviewing an extract of the AIU database to ensure that the appropriate data are being collected.

5. Home Energy Performance Program

Program Description

Home Energy Performance (HEP) is a home diagnostic and improvement program that, as it establishes itself, can evolve into a more comprehensive Home Performance with ENERGY STAR program focused on developing a local home performance industry. Program participants will receive an energy audit that yields a list of identified cost-effective shell measures for implementation through a network of participating contractors. In addition, several energy efficiency measures are typically installed by the auditor at the time of the audit. Customers who use qualified insulation contractors will be eligible for the program insulation and air sealing incentives, provided that the jobs meet program standards, are properly reported and subject to Program quality assurance inspections.

HEP offers customers with electric heat (heat pump, electric resistance and electric furnace) and central air conditioning an energy audit for $25. During the audit, the auditor installs CFLs and water conservation savings measures. Homeowners are encouraged to contract with insulation contractors for improvements in the building shell, and/or with HVAC contractors in the HVAC program to replace older heating and cooling equipment with highly efficient HVAC systems.

Insulation Contractor Training

HEP recruits, trains and qualifies insulation contractors to perform comprehensive, effective building shell improvements including blower door assisted air sealing, use of high density (dense-pack) cellulose and other effective procedures. The program will also provide ongoing quality assurance and technical training to contractors who join the program via training and a participation agreement. Qualified insulation contractors are eligible for program incentives for jobs they sell to eligible homeowners directly without the program energy audit. Contractors who take advantage of this approach contact the program to prequalify customers, and provide customers with the documentation necessary to claim the customer rebate. These jobs are subject to standard program quality assurance inspections.

Contractors who agree to participate sign a participation agreement that assures the program that the contractors will provide high quality services with good customer service, maintain proper insurance and inform the program in a timely fashion of their work. Contractors also receive a one-day training which will include a field review of the technical standards of the program. Contractors who wish may elect to receive addition training in proper insulation, air sealing and duct sealing techniques. This training is offered at a rate of $1,000 per day for up to four technicians, and contractors who wish are encouraged to certify their technicians with the Building Performance Institute.

Data Tracking

HEP audits initially use a paper data collection sheet, producing a written proposed scope of work on site. Data is then entered into the HEP database in the office and a more formal report prepared and mailed to the customer within a week of the audit. CSG, who implements the program, is working to transition to home data entry with final reports printed on site.

Evaluation Plan

Overview

The HEP evaluation includes both impact and process elements. Table 4-6 provides an overview of the tasks proposed to evaluate this program.

Table 5-1. Summary of Evaluation Tasks

Action	Impact	Process	Details
Participant Survey	✓	✓	Used for verification, calculating free ridership and spillover, and assessing program implementation (n=70, PY10 and PY11)
Stakeholder Interviews		✓	Provides insight into program design and delivery (n=10, in PY09 and n=5, PY10 and PY11) This group includes program management and implementation contract staff, as well as insulation installers.
Program Records Review	✓		To verify the savings attributable to home energy performance (25% should be census in PY09 and 10% in PY10 and PY11)
Site Visits	✓		A small sample of homes will be visited in the second and third year. The intent is to provide qualitative data on the quality of installations (n=15, PY10 and PY11)
Billing Analysis	✓		Determine each participating home's energy savings separately and identify homes that have performed as expected, better than expected, or worse than expected (Census in PY10 and PY11)

Evaluation Approach

The impact evaluation is primarily aimed at verifying reported program participation, calculating free ridership and spillover, and determining the gross and net savings. A brief explanation of each impact evaluation task, including proposed methodologies and sample sizes, is provided below.

Specifically, the HEP program evaluation will examine the following:

- Motivations for or barriers to customer participation in the program (to be evaluated through customer surveys)
- Motivations for or barriers to trade ally participation in the program, which will be evaluated through phone calls with trade allies
- Deemed savings values, through an analytic review.
- Audit data housed in central database
- Quantitative field analysis of small sample of homes to evaluate:

- Precision of contractor reported values for leakage rates
- Presence of installed measures

Impact Evaluation

Cadmus will undertake the following tasks:

Review of Deemed Values. At the outset of the Program, Cadmus will review the Program's deemed values for reasonableness. While the values will be refined through the evaluation process, Cadmus believes a review at the beginning of the Program can identify issues early and avoid surprises at the end of the evaluation.

Cadmus will review not only the values themselves but also the assumptions that informed them. Specifically, Cadmus will examine the following sensitive factors that impact measure savings:

Insulation and Windows

- Length of heating and cooling seasons
- Assumed equipment efficiencies
- Internal temperature setpoints

Infiltration

- Assumed infiltration reduction
- Length of heating and cooling seasons
- Assumed equipment efficiencies
- Internal temperature set-points

Duct Leakage

- Assumed duct leakage reduction
- Portion of leakage to outside of building envelope
- Length of heating and cooling seasons
- Assumed equipment efficiencies
- Internal temperature set-points

Hot Water Measures

- Hot water usage
- Temperature set-point

Duct Sizing

- Airflow over evaporator coil and furnace heat exchange air handling fan

Lighting

- Hours of operation
- Baseline wattage and final wattage

Audit Data Review. To verify the savings attributable to home energy performance, Cadmus will select random samples of participating homes on a recurring basis and review program records associated with the selected homes, including rebate forms. During the first year Cadmus will examine 25% of all participant records. Subsequently, Cadmus will examine random samples of approximately 10 percent of participating homes.

Reviews will include all information collected, energy efficiency improvements recommended and, in PY 10 and PY 11, any follow up action that the customer has either committed to or expressed interest in. Information on rebates provided through the HVAC programs, the Appliance Recycling Program and the Demand Response program (after PY 09) will be cross-checked to connect those customers who got audits and then proceeded to take advantage of the other programs.

Participant Site Visits. To further validate HEP records, Cadmus will conduct small number of site visits to participating homes, approximately 15 in both PY10 and PY11. While the effort will not yield statistically significant results, it provides some qualitative verification and insight into the quality of HEP installation. If serious issues are raised during the site visits, Cadmus will revisit the allocation of evaluation resources in order to complete additional site visits and pinpoint the cause and extent of the identified issue. To leverage the reviews of audit data, potential site visits candidates will be selected from the sample of reviewed households.

Participant Surveys. To assess the effectiveness of HEP, surveys will be conducted with 70 randomly selected participants in both PY10 and PY11. In addition to assessing how well the HEP and its audits informed and empowered homeowners to undertake efficiency improvements, the surveys will be used to determine free ridership and spill over.

The surveys also provide an important opportunity for Cadmus to verify measure installation and ensure the records detailed in the HEP database match participant's recollection. To ensure an accurate comparison, Cadmus will conduct participant survey regularly and limit the survey sample to only participants receiving an audit within the past two months. Quickly reaching participants improves the quality of the information collected and minimizes the possibility that the participant will confuse Program work with other improvement made independently or through other programs.

Billing Analysis. Cadmus will begin a billing analysis of all participating homes 12 months after program inception (to ensure adequate post-treatment data exist). Cadmus will re-run the billing analysis quarterly to ensure the Program is tracking well with regard to projected energy savings and cost-effectiveness. Specifically, the billing analysis will include both participating homes and a random sample of similar non-participant homes (with a representative distribution of home type, location, etc). The nonparticipating home will control for general changes in energy consumption not related to the program. Employing standard weather normalization tools to control for the effects of weather on energy consumption, Cadmus will weather-normalize each home individually, following an approach similar to that used by the Princeton Scorekeeping Method (PRISM), the industry standard for weather normalization. Using this approach, it will be possible to determine each participating home's energy savings separately and to identify homes that have performed as expected, better than expected, or worse than expected. The characteristics of homes in these three groups will be investigated through reviews of program

records, customer surveys, and site visits. Please see billing analysis for Multifamily program for details regarding the statistical models to be constructed.

Determine Gross and Net Savings. Utilizing input from all the evaluation tasks described above, Cadmus will determine the gross and net Program savings.

Process Evaluation

Participant Surveys. As noted above, we will conduct surveys to inform the impact evaluation. These surveys will also include process evaluation questions aimed at assessing the level of participant satisfaction, experience with the program, and reasons for nonparticipation.

Stakeholder Interviews. Cadmus will conduct interviews with stakeholders (including insulation, sealing and HVAC contractors). These interviews will focus on assessing the program process flow, program design versus program implementation, changes in implementation, and program marketing. Following each set of interviews, the evaluation team will assess the appropriateness of the current methodology and determine if midstream changes are needed to continue effectively evaluating the program. These interviews will happen in both PY09 and PY11.

Table 5-4: Summary of HEP Evaluation Proposed Approach

		PY 2009	PY 2010	PY 2011	Total
Data Collection	Stakeholders Interviews	10	5	5	20
	Participant Surveys	0	70	70	140
	Site Visits	0	15	15	30
	Review Audit Data	25%	10%	10%	
Data Analysis	Billing Analysis		Census	Census	

Assessing Evaluability

Prior to beginning the evaluation, Cadmus will ensure the appropriate data are being collected by the program implementer and that important program definitions are being applied consistently. Specifically, Cadmus will address the following:

> ***Review of Program Database***. The program's implementer, CSG, has provided some data to date on the program progress. Cadmus is reviewing an extract of the AIU database to ensure that the appropriate data are being collected.