Business New Construction Program Evaluation

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City of Palo Alto Utilities
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Palo Alto, CA 94301

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1. Executive Summary

The City of Palo Alto Utilities (CPAU) is the only city-owned utility in California that operates its own utilities including electric, fiber optic, natural gas, water, and wastewater services. CPAU has been providing quality services to the citizens and businesses of Palo Alto since 1896. CPAU serves almost 29,000 meters with the largest portion of its electrical sales to its commercial and industrial customers (80%), while about 20% of sales are to residential customers. Although residential electric sales are only 20% of sales, these customer accounts represent 90% of CPAU's customer base.

CPAU has a number of energy efficiency and renewable energy programs in both the residential and non-residential sectors. About 74% of the savings achieved through its energy efficiency programs comes from the non-residential sector. Under law, CPAU is required to evaluate its energy efficiency programs every year. Given that nearly three-fourths of the savings come from non-residential programs, the impact evaluation efforts for CPAU's FY 2013-2014 programs are centered on CPAU's non-residential program projects.

CPAU retained Cadmus to conduct an impact and process evaluation of its FY 2013-2014 Business New Construction (BNC) Program, which included six commercial new construction projects. Table 1 lists the evaluations' primary objectives.

Table 1. Evaluation Objectives

Evaluation Focus	Evaluation Objective
Process	1. Assess the effectiveness of program design and delivery. 2. Identify possible program changes that might increase customer uptake and program efficiency.
Impact	1. Verify measure installation and utilization. 2. Calculate gross energy (kWh and therms) and demand (kW) savings.

CPAU's BNC program encourages energy-efficient building design and construction practices and promotes the efficient use of energy by offering up-front assistance to commercial customers (property owners and operators), supported by final measurement and verification (M&V) of actual project energy savings. During FY 2013-2014, the program required new construction to exceed the efficiency requirement of CPAU's Green Building Program by at least 5% and at least 20% above the Title-24 building code requirement. San Francisco-based engineering firm BASE Energy, Inc., supports CPAU program implementation activities and calculated *ex ante* savings estimates for each completed project.

Cadmus evaluated the BNC program through site visits and reviews of engineering calculations and building simulation models and results. During site visits, we validated the proper installation and functioning of equipment for which incentives were provided and recorded operational characteristics data to support our engineering analysis. Cadmus engineers analyzed the differences between baseline and as-built annual energy consumption. Through this impact evaluation, we identified a variety of

factors that affected the measure and overall program realization rates (the ratio of *ex post* evaluated to *ex ante* reported savings), as shown in Table 2 and 3.

Table 2. End Use Level Energy Savings and Realization Rates

Measure Category	Reported *Ex Ante* Savings		Evaluated *Ex Post* Savings		Realization Rate	
	Electricity (kWh)	Gas (therms)	Electricity (kWh)	Gas (therms)	Electricity Savings	Gas Savings
HVAC	383,002	36,198	356,993	29,316	93%	81%
Lighting	97,788	0	95,592	0	98%	N/A
Motors	64,465	0	74,528	0	116%	N/A
Water Heating	22,563	842	9,054	842	40%	100%
Total	**567,818**	**37,040**	**536,168**	**30,158**	**94%**	**81%**

Table 3. Project Level Realization Rates

Measure Category	Reported *Ex Ante* Savings		Evaluated *Ex Post* Savings		Realization Rate	
	Electricity (kWh)	Gas (therms)	Electricity (kWh)	Gas (therms)	Electricity Savings	Gas Savings
Site 1	65,295	2,309	73,791	1,825	113%	79%
Site 2	26,564	3	16,933	4	64%	133%
Site 3	22,474	10	26,036	4	116%	40%
Site 4	35,485	0	24,157	9	68%	N/A
Site 5	41,700	0	46,540	0	112%	N/A
Site 6	376,300	34,718	348,711	28,315	93%	82%
Total	**567,818**	**37,040**	**536,168**	**30,157**	**94%**	**81%**

Most measure types achieved high realization rates. The primary factors that caused the realization rates to be more or less than 100% were:

- Evaluated equipment operation differed from the expected patterns used to develop deemed savings estimates.
- Building simulation models did not accurately reflect operating parameters (e.g., hours of use schedule).
- Energy savings calculation errors occurred.

Overall, based on our review of the reported energy savings analysis, the program implementer performed a reasonable level of review and quality control to achieve high average project savings realization rates. The operating patterns of measure types with lower evaluated savings such as large, complex measures can be difficult to predict, particularly in a new construction application. Among other factors, energy savings estimates can vary due to differences in operating patterns. Stakeholder interviews indicated the implementer has continually worked to streamline and improve the program's delivery mechanisms, and we believe their work has been effective.

2. Introduction

The City of Palo Alto Utilities (CPAU) is the only city-owned utility in California that operates its own utilities including electric, fiber optic, natural gas, water, and wastewater services. CPAU has been providing quality services to the citizens and businesses of Palo Alto since 1896. CPAU serves almost 29,000 meters with the largest portion of its electrical sales to its commercial and industrial customers (80%), while about 20% of sales are to residential customers. Although residential electric sales are only 20% of sales, these customer accounts represent 90% of CPAU's customer base.

CPAU has a number of energy efficiency and renewable energy programs in both the residential and non-residential sectors. About 74% of the savings achieved through its energy efficiency programs comes from the non-residential sector. Under state law, CPAU is required to evaluate its energy efficiency programs every year. Given that nearly three-fourths of the savings come from non-residential programs, the impact evaluation efforts for CPAU's FY 2013-2014 are centered on CPAU's non-residential projects.

2.1 Background

Two legislative bills (SB1037 and AB2021) were signed into law a year apart. SB1037 requires that the Publicly Owned Utilities (POUs), similar to the Investor Owned Utilities (IOUs), place cost effective, reliable, and feasible energy efficiency and demand reduction resources at the top of the loading order. They must procure "negawatts" first. Additionally, SB1037 (signed September 29, 2005) requires an annual report that describes the programs, expenditures, expected energy savings, and actual energy savings.

Assembly Bill 2021, signed by the Governor a year later (September 29, 2006), reiterated the loading order and annual report stated in SB1037 as well as expanding on the annual report requirements. The expanded report must include investment funding, cost-effectiveness methodologies, and an independent evaluation that measures and verifies the energy efficiency savings and reductions in energy demand achieved by the energy efficiency and demand reduction programs. AB2021 additionally requires that publically-owned utilities submit a report to the California Energy Commission every three years that highlights potentially cost-effective electricity savings from energy efficiency and establishes annual targets for energy efficiency and demand reduction over ten years.

The legislative reports require both an on-going assessment of what is occurring within the programs along with a comparison of how much possible savings are left within the CPAU service territory.

2.2 Program Description

CPAU retained Cadmus to conduct an impact and process evaluation of its FY 2013-2014 Business New Construction (BNC) Program, which included six commercial new construction projects. CPAU's BNC Program encourages energy-efficient building design and construction practices and promotes the efficient use of energy by offering up-front assistance to commercial customers (property owners and operators) supported by final measurement and verification (M&V) of actual project energy savings.

During FY 2013-2014, the program required new construction to exceed the efficiency requirement of CPAU's Green Building Program by at least 5% and at least 20% above the Title-24 building code requirement. San Francisco-based engineering firm BASE Energy, Inc., is under contract with CPAU to administer this program.

3. Impact and Process Evaluation Approach

To verify reported program participation and estimate gross energy savings as part of the impact evaluation, Cadmus estimated changes in gross energy consumption using data collected on site, program tracking data, and engineering models.

We used the following approaches to determine the gross energy savings attributable to the program:

- Data collection
- Engineering analysis

Cadmus verified measure installations and utilization. Cadmus also calculated gross energy (kWh and therms) and demand (kW) savings based on changes between baseline and installed efficiency measures, using program tracking data and assessing the assumptions and accuracy in the calculations.

The objective of the process evaluation is to assess the operational efficiency of program delivery and to identify any opportunities for program improvements. To fulfil the objective, Cadmus assessed the effectiveness of program design and delivery and identified possible program changes that might increase customer uptake and program efficiency.

3.1 BNC Program Overview

The BNC program encourages energy-efficient building design and construction practices and promotes the efficient use of energy and water by offering up-front assistance supported by final measurement and verification of actual project performance. In FY 2013-2014, the program applied to new construction that exceeded Palo Alto's Green Building Program requirements by at least 5% and the Title-24 energy code by at least 20%. Rebates are available for the following types of measures:

- Lighting
- Boilers and water heating equipment
- HVAC and motor equipment
- Chillers and heat rejection equipment

We implemented the program impact evaluation starting with verification activities relying on site visits to collect key information on each project including:

1. The presence of proposed energy efficient measures based on comparing the number of installations observed with the number of installations recorded in the rebate application.
2. Reasons why observed equipment did not match program reported installations in those cases where they did not.
3. The quality of measure installations, including whether or not they were operating correctly.
4. Key facility operating and performance data, such as daily schedules, seasonal variations in schedules, and control strategies.

3.2 Data Collection

Cadmus reviewed the available documentation (e.g., audit reports, savings calculation work papers) for six project sites, paying particular attention to the calculation procedures and documentation for savings estimates. We reviewed analyses originally used to calculate *ex ante* expected savings and verified operating and structural parameters.

During site visits, we verified installations and determined changes to operating parameters following measure installation. We obtained trend data from energy management systems (EMS), including energy demand, lighting, or temperature details. Site visit and trend data informed savings impact calculations. Individual measure savings, aggregated into measure categories, allowed calculations of measure-level realization rates (the ratio of evaluated to reported savings). Site visit data and analysis also provided information enabling Cadmus to develop recommendations for future programs.

3.2.1 Document Review

The evaluation began with a review of relevant documentation and other program materials from the implementer. We reviewed information for projects, including program forms, audit reports, and savings calculation work papers for each rebated measure (if applicable). Our review examined each project file for the following information:

- Documentation on equipment installed, including:
  - Descriptions
  - Schematics
  - Performance data
  - Other supporting information
- Information about savings calculation methodologies, including:
  - Methodologies used
  - Assumption specifications and the sources for these specifications
  - Calculation accuracy

3.2.2 Site Verification Visits

Cadmus utilized a comprehensive data collection form for all evaluated projects, focusing on specific end uses when verifying individual measures at a site.

During the site visits, our field engineers conducted these three primary tasks:

- **Verifying installation of all measures for which participants received incentives:** To the extent possible, field engineers verified that energy-efficiency measures had been correctly installed, remained in place, and functioned properly. They conducted spot measurements, collected energy management system trend data, or made visual inspections, as appropriate. Field engineers also verified operating parameters for installed equipment.

- **Collecting the physical data required to analyze energy savings realized from installed measures:** Field engineers determined pertinent data for collection from each site using in-depth reviews of project files.
- **Conducting interviews with the facility operations staff** to confirm project documentation accuracy and to obtain additional data on operating characteristics for installed systems.

Procedures used to verify savings through engineering analysis depended on the type of measure analyzed. The program included these major measure groups:

- Lighting Measures
- HVAC Measures
- Motor and Variable Speed Drive Measures
- Water Heating Measures

The following sections describe the focus of site visits and the procedures Cadmus used to verify incentivized measures installed through the program.

3.2.2.1 Lighting Measures

The analyses covered three types of lighting projects:

- **Installation of high-efficiency lamps, ballasts, and/or fixtures**, expected to reduce lighting power densities below code-required values. These measure types reduced demand and energy consumption without affecting operation hours between baseline and as-built conditions. Incentives were provided for these measures on a measure-by-measure basis, rather than at a whole-building level.
- **Lighting control strategies, including occupancy sensors, daylight dimming controls, and automated lighting control systems.** These measure types typically involved operation-hour reductions to more closely match building occupancy.
- **Lighting power density reductions** for the entire facility below the values prescribed by the 2008 Title-24

We analyzed lighting measure savings using required documentation regarding fixture wattages, quantities, and operation hours. We also verified space types and areas for lighting power density calculations.

We verified energy-efficient replacement input wattages using several sources, including the manufacturer industry lamp and ballast product catalogs. The investigation also evaluated operation hours for each site, based on activities of the buildings' occupants within the relevant spaces.

We evaluated lighting control systems by specifically focusing on functionality and operation hours. Occupancy sensors were checked twice per site visit: initially to trigger the sensor activating the lights and again to determine if the lights turned off. We visually inspected lighting automation systems for scheduled operation hour setpoints, which we then verified against claims used in submitted calculations.

In addition to verifying parameters listed above, we conducted onsite interviews with building operators and facility staff, verifying operation hours and areas where fixtures had been installed. The field engineer documented lamp and ballast information for each fixture, counting the number of fixtures installed and organizing fixtures affected by lighting controls systems.

3.2.2.2 HVAC Measures

For most sites with HVAC measures, Cadmus focused on equipment counts, verifying that the units met the program's efficiency requirements. Our site inspections included interviews with facility personnel, which enabled us to verify operation hours, temperature setpoints, and proper installation of energy-efficient equipment.

3.2.2.3 Motors and Variable Speed Drives Measures

For high-efficiency motor and variable speed drive (VSD) installation measures, Cadmus focused on equipment counts, verifying that the units met the program's efficiency requirements. For verification purposes, we confirmed motors met or exceeded program requirements by motor type, speed, and horsepower rating. Field engineers also reviewed VSD operation to confirm that the drives were active and that they had not been manually overridden to operate at 100% speed.

3.2.2.4 Water Heating Measures

For most sites with water heating measures, Cadmus focused on equipment counts, verifying that the units met the program's efficiency requirements, and comparing manufacturers' specified efficiencies with code requirements. Our site inspections included interviews with facility personnel, which enabled us to verify operation hours, temperature setpoints, and proper installation of energy-efficient equipment.

3.3 Engineering Analysis

The impact evaluation goal was to independently assess and report energy savings (kWh and therms) that result from projects for which incentives were provided through the BNC program. Cadmus evaluated all projects according to the protocol and methods described in the California Energy Commission *EM&V Guidelines POU Energy Efficiency Programs* document dated January 2011.

3.3.1 Proposed Energy Savings Calculation Approach

Cadmus proposed using the IPMVP Option D: Calibrated Computer Simulation to verify energy savings and demand reductions for the five projects estimating *ex ante* savings using simulation models. This approach includes the use of building energy simulations combined with utility billing or metered data to calibrate the simulation models.

In the course of our research, however, we discovered this was not possible for these projects. The utility bill data was not available individually by facility, but only for the site address. The addresses for projects analyzed using simulation models included multiple facilities, and we found there was no way to extract and isolate the data for the individual facilities participating in the program. In addition, the scope and timing of the evaluation (during the holiday period when occupancy was atypical) did not permit us to meter energy use of the building. Consequently, we could not use billing or metered data to calibrate the simulation analysis as required by Option D.

The sixth project used a different approach to estimate *ex ante* energy savings. The implementer performed engineering calculations to estimate savings for the installed measures. Cadmus proposed to use IPMVP Option A: Retrofit Isolation with Key Parameter Measurement to estimate evaluated savings for this project.

3.3.2 Actual Energy Savings Calculation Approach

Given the utility bill and metering limitations that prevented us from using Option D for the five sites for which whole building simulations were performed, Cadmus' applied a variation of the IPMVP M&V Option A energy savings approach instead. Option A refers to adjusting engineering calculations of baseline and post-installation energy use based on verified parameters. In our evaluation of these projects, we used the original building simulation models as the engineering calculations that we adjusted based on verified parameters.

We acquired original energy simulation models from BASE Energy and performed a thorough review of the model inputs. We reviewed the models for both the baseline and as-built measures. The *ex ante* reported energy savings was estimated by calculating the difference between the estimated as-built annual energy consumption and the baseline annual energy consumption. For the *ex post* evaluated energy savings, Cadmus updated the original energy simulation models with data collected from our site visit and interviews. These updates resulted in changes to the annual energy consumption estimates. We then calculated the difference between the updated as-built annual energy consumption and the updated baseline annual energy consumption.

For the sixth project, we used Option A by adjusting the original engineering calculations for each measure based on the parameters we evaluated.

3.3.3 Baseline Simulation Model

Cadmus' document review determined that the original energy simulation models used code compliance with the 2008 Title-24 as the baseline. For the four school projects, the baseline energy consumption estimate was generated using the compliance analysis module in the eQUEST simulation software. This feature generates a minimally code compliant model based on the project's geographical and architectural data.

Although we found that the reported baseline measures were correctly modeled as code compliant by the eQUEST compliance analysis module, we discovered that the baseline models used default operating schedules, which cannot be modified or overwritten in the compliance module to account for actual building operations. To evaluate savings properly, it is necessary to use the actual operating schedule in the baseline, as well as the as-built models. Based on this, we concluded that this module is inappropriate for estimating energy savings because it does not permit the operating schedule to be adjusted in the baseline.

To properly estimate savings that accounted for actual operating schedules, the original energy simulation models was copied, all measures were updated to reflect minimum code compliance, and the standard eQUEST analysis (not the code compliance analysis) was simulated to generate a baseline model that was capable of incorporating schedule adjustments. After this was completed, we verified the estimated annual energy consumption for the new baseline models (with the default schedules) were consistent with the reported baseline. For the savings analysis, we used the observed operating schedule in both the baseline and as-built models.

Due to budgetary constraints, BASE Energy was unable to provide Cadmus one baseline model for an elementary school (Site 4) using a standard eQUEST analysis module. Without this critical component, Cadmus and CPAU agreed the best way to proceed would be to calculate an energy savings estimate. This was calculated by averaging the evaluated *ex post* energy savings intensity (kBtu per square foot) of the three other schools and applying it to Site 4.

3.3.3 Energy Use Intensity

Without the availability of utility billing data, we took another step to assess the reasonableness of the energy use estimates by comparing estimated energy use of each facility to other similar buildings. This benchmarking provides a general validation of the annual energy consumption estimates from the simulation models. Cadmus calculated the projects' energy use intensity (EUI) by examining building floor area in square feet and the original simulated gas and electricity usage.

4. Process Evaluation

This section presents the findings from process evaluation research on the CPAU BNC program. The objective of this research was to assess the operational efficiency of program delivery and to identify any opportunities for program improvements. Because of budgetary constraints, the scope of this process evaluation was limited. We relied almost entirely on in-depth interviews with customer project decision makers, and CPAU and BASE Energy third-party program staff. Secondary information sources were also reviewed to gain background information on the program for appropriate context prior to the interviews and for clarification.

The BNC program's primary issues addressed in the process analysis included: effects of customer outreach, marketing, customer response, functioning of the delivery infrastructure, and program operational efficiency. Cadmus assessed these issues through interviews addressing the program's effectiveness in disseminating information, generating awareness, and driving participation to achieve desired savings.

The process evaluation examined whether the program (including the delivery channel) operates efficiently and effectively. Cadmus designed questions to assess whether the program effectively encourages customers to purchase efficient equipment. In addition, we assessed the effectiveness of this program in promoting other CPAU energy-efficiency programs.

A complete list of stakeholders interviewed for this research is found in Table 4.

Table 4. Completed Interview Samples

Organization	Interviewee Type
CPAU Staff	• BNC Program Staff • CPAU Green Building Planner
BASE Energy	• BASE Program Manager • BASE Engineer
Program Participant	• Facility Manager • Energy Specialist • Facilities Director

In addition to in-depth interviews, the evaluation research team also reviewed the following secondary sources of information to better understand the program processes:

- CPAU Green Building Program Brochure
- CPAU Business New Construction Program Brochure
- CPAU Business New Construction Program Application
- CPAU Commercial Advantage General Application

4.1 Program Characteristics

The BNC program is an energy efficiency program that provides early design support and custom incentives for the purchase of energy efficient products and energy efficient building designs by commercial customers. To be eligible for the program, participants must be:

- Early enough in the construction process where changes can be implemented to the project's design
- Within CPAU's service area and be provided with electricity or gas from CPAU
- A new construction or major renovation in the commercial segment

To participate in this program, customers must fill out an owner's application form with their project and design team information to show interest in participating. The form is available on the CPAU website as well as from CPAU directly. BASE Energy will then work with the project's design team to discuss energy efficiency opportunities and provide the customer with a report listing recommendations for program-qualifying upgrades. To qualify for BNC incentives, the project's design must exceed Title 24 code requirements by at least 20%. Incentives increase with further savings up to 30% beyond Title 24. The customer must provide documentation as needed to support these proposed savings.

Prior to ordering, purchasing, or installing the selected equipment, the customer must provide a BNC Incentive Application and agree that they have not and will not apply for any other incentives offered by other utilities for the measures being installed under the BNC program. Once the project is complete, customers must agree to give access to the facility for an on-site verification inspection, and to participate in measurement and evaluation studies if chosen by the program. CPAU will then provide the incentive to the customer based on any adjustments made post-verification.

4.1.1 Program Processes

CPAU is responsible for marketing and outreach to potential customers, with assistance by the City of Palo Alto Building division. The City's green building staff network with prospective customers during their planning phase and inform them of the program. CPAU and BASE Energy staff give periodic presentations to key account customers to market the program, as well as send out email updates regularly. There are also program brochures and the BNC website available as a resource to customers.

BASE Energy staff handles the enrollment process once the customer contacts CPAU with their interest to participate. BASE Energy then oversees the implementation of the program, first by assigning an engineer to the project to assist with the customer's design team to suggest energy efficiency strategies and measures. From that point forward, they maintain their relationship with the customer through installation, collecting project information and documents, reviewing and calculating project data for energy savings, and performing the post-installation verification inspection. BASE Energy sends the initial design and final verification reports to CPAU staff, who then issues the incentive to the customer after reviewing the project documentation. According to the majority of program participants that were interviewed, they received frequent communication with CPAU and/or BASE Energy staff. Program

participants indicated communicating "very frequently" or "at least once a month" over the project's timeline.

4.1.2 Key Staff

The CPAU program manager handles program marketing duties, oversees any program design changes, ensures the program is executed smoothly, and provides the incentive at the end of each customer project. City of Palo Alto Development services staff coordinates with interested customers to connect them with the program staff in order to begin their enrollment in the program.

The BASE Energy program manager makes the initial enrollment contact with the customer and coordinates a meeting with a BASE Energy engineer and the project design staff. Additionally, the program manager acts as the primary point of contact between CPAU and the project team, prepares invoices, and fulfills other requests from CPAU staff. The BASE Energy engineer on the project helps the design team with the project, collects the necessary project data and documentation, reviews and calculates project information, creates project reports that go to the customer and CPAU, and performs the post-installation verification inspection.

4.2 Program Observations

4.2.1 Application Processing

BASE Energy is directly involved with the customer during design and installation, which enables them to collect required documentation throughout the course of the project. When asked an open-ended question about the application process, two interviewed customers indicated that BASE Energy helped significantly in assembling the required documentation and providing support for their incentive application. One customer reported being very satisfied with the ease of the application process. All interviewees had described the process of participating in the program as "smooth and easy."

CPAU is responsible for processing the paperwork once BASE Energy has collected and submitted the completed application. Neither CPAU nor BASE Energy staff reported having any issues with getting forms or information from customers that impeded program participation at any stage.

4.2.2 Audits

The sites of all customers we interviewed went through the program's post-installation verification inspection. Two customers interviewed were aware that a post-installation verification inspection was a requirement of the program. One customer that was unaware of this requirement had no issues with verification. One customer could not comment on the inspection because he had not been at the site when it occurred, but he was aware it had taken place. One customer who was aware of the requirement had been through another utility's similar program and had no issues with the inspection. The customers who had participated in the inspection were very satisfied with the process, and said that the inspectors were very helpful throughout the entire process, although gathering the documentation required for the inspection was time consuming.

4.2.3 Staffing

BASE Energy has a small staff of 11 engineers who can be assigned to program projects depending on their availability, but there is not one solely dedicated to BNC since the program does not have enough participation to require it. Based on favorable comments during customer interviews, this small staff is performing adequately for the amount of participants in the program.

4.2.4 Marketing

CPAU staff reported that the most successful method of recruiting customers has been their relationship with Key Account managers and through direct face to face meetings, either from giving presentations or through customers coming into the planning department. Both CPAU and BASE Energy staff mentioned that commercial customers in Palo Alto are eager to implement energy efficient strategies and pursue innovative equipment and design, so merely raising awareness of the program is often enough to get them interested. CPAU does have marketing materials—a program brochure, the CPAU website, and an information card in development—but there currently exists no system tracking any marketing efforts. Customers reported receiving a regular email update that keeps them informed about program updates and available opportunities, and reported that this was the best way to keep them informed, being most interviewees had noted email as the most effective form of contact.

BASE Energy staff said they support the CPAU marketing efforts, but would like to transition to taking a more active role in assisting with this activity. BASE Energy staff said if they were able to help expand the marketing activities and help attract more customers, then they could possibly expand the savings targets for the program over time.

While the customers that have participated have been eager, CPAU staff said they often see new construction projects being executed in their service area without involvement in their program, and wonder if they are capturing as many projects as possible. One recruitment strategy, they said, was to work with their planning department staff to come up with the names of commercial builders in the area and deliver presentations to them, similar to the approach for key account customers. Currently, there are no participation targets or goals.

4.2.5 Rebate and Customer Tracking

CPAU staff outlined the electric incentive structure as a “sliding scale” where the incentive scales up from 20% beyond Title 24 to 30% above, at which point (and beyond) the incentive is at its maximum of $0.30/kWh saved. Therm savings are given a flat $1.00/therm saved. The BNC program budget comes from the state mandated public benefit charge to implement energy efficiency and renewables programs.

Overall, customers said they were satisfied with the incentive amounts, with only one customer thinking the money provided was not enough. They commented that a new construction project of a scope like theirs would earn more than it did, but they also said that they understand that there are certain rules to the rebates and did not hold their incentive amount against CPAU since CPAU provided what they could within the rules. However, the same customer and one other both said the incentive allowed them to utilize more efficient equipment than they would have without the incentive funds, thus indicating that the incentive was effective in its purpose.

Both CPAU and BASE Energy said that there is currently no official customer tracking system, either for leads or active projects, outside of their system where they input the applications. BASE Energy staff stated they have an unofficial, basic tracker for projects in process to keep track of when their completion dates are coming up to keep in contact with the customer around that time. The projects are infrequent enough that all parties are able to keep up to date on project progress without a formal system.

4.2.6 Project Files and Savings Calculations

We encountered problems trying to find the final calculations or simulation models used for projects. CPAU assisted us to locate the correct models on several projects, but on others we had to contact the building simulation model contractors for the appropriate models.

We also found the project documentation for simulation projects was inconsistent from one project to the next, which made it difficult to determine the appropriate savings and relevant material to support energy savings. The basis of final incentive, supporting documentation, final incentive amount, and simulation models was not always categorized consistently, and clearly labeled.

5. Impact Evaluation

This section presents the results of engineering analyses, adjustments to reported values, and calculation of realization rates, as applied to six projects completed under the CPAU BNC program. It also includes general observations regarding discrepancies and other factors influencing measure-level realization rates. Finally, it examines energy-use intensity data derived from the projects.

5.1 Analysis and Findings

We evaluated the BNC program based on an analysis of the six participant sites.

5.1.1 End-Use Level

We compared the *ex ante* reported and the *ex post* evaluated energy savings to derive realization rates for each measure category, and overall, as shown in Table 5. Overall, the electricity realization rate was 94% and the natural gas realization rate was 81%. Some realization rates were more and some were less than 100% across the measure categories. The following sub-sections discuss the adjustments we made to the reported savings estimates for each category to derive the evaluated savings.

Table 5. Reported and Evaluated Savings and Realization Rates

Measure Category	Electricity Savings		Gas Savings		Realization Rate		
	Reported (kWh)	Evaluated (kWh)	Reported (therms)	Evaluated (therms)	Electricity	Gas	Total* (Btu)
HVAC	383,002	356,993	36,198	29,316	93%	81%	84%
Lighting	97,788	95,592	0	0	98%	N/A	98%
Motors	64,465	74,528	0	0	116%	N/A	116%
Water Heating	22,563	9,054	842	842	40%	100%	71%
Total	**567,818**	**536,168**	**37,040**	**30,158**	**94%**	**81%**	**86%**

*The total realization rate is based on Btus. Note: Due to rounding, totals do not necessarily equal the sum of individual values in the table.

5.1.1.1 HVAC Measures

The HVAC category covered a range of electric and gas measures, including high-efficiency air conditioners, heat pumps, chillers, boilers, furnaces, and economizers. These measures had an overall realization rate of 84%.

We made energy savings adjustments for measures in the projects based on Cadmus' calculations for maximum zone supply temperatures, discrepancies in observed occupancy and operational schedules, and users' fume hood improper operations. Adjustments are explained in the next sections.

Maximum Zone Supply Temperature

For one medical center, Cadmus completed a detailed building management system (BMS) review and compared collected data and setpoints to the model. We identified a space heating model input error; the maximum zone supply temperature was entered in the model as 95° F. We updated the maximum

zone supply temperature using data collected from our BMS review (110° F). This modification led to a site an end-use level realization rate of 86%.

Operating Hour Schedule

Cadmus discovered the operating hours used in three of the four education facility energy models were based on the simulations' default schedule for elementary school buildings, not the actual school schedule. The original modeled schedule assumed a total of only 1,800 hours per year of operation; however, per Cadmus' review of the operating hours listed in the school's BMS, the sites were actually open for 3 hours more every day, resulting in an increase of 600 hours annually. Cumulatively, the site schedule adjustments led to a 119% realization rate for school HVAC savings.

One educational facility incorrectly modeled the schedule without holidays or summer vacations. Cadmus' modified the analysis to exclude these closed days, resulting in a significant decrease to the annual operating hours. As a result, the overall realization rate for this site decreased to 64%.

Fume Hood Variable Speed Exhaust Fan User Error

During our visit to the laboratory project site, Cadmus noted most fume hoods were not operating at the recommended level for unoccupied work stations. Red marks are labeled on the side of the hoods that indicate the required level for when the station is in use and when it is unoccupied. Nearly half of all unoccupied stations had fume hoods set at full capacity, causing the exhaust fan to run at maximum speed. The incentivized BNC measure included programming the site's BMS to modulate the exhaust fan from 100% speed to 60% speed when the fume hood is nearly/fully closed, and providing training to the laboratory occupants to ensure participation and compliance. Cadmus' interview with the site facility manager verified the training had occurred; however, it does not appear that it has had a lasting effect on occupant behavior.

Predicted energy savings estimates from reduced exhaust fan speeds can be achieved only if occupants comply with the new fume hood alignment requirements. At the time of the site visit, trend data was not available for exhaust fans. Without it, we have to estimate how often the fan speed is reduced. Based on Cadmus' site visit, it is possible the savings from this measure could be reduced by as much as 50% based on the proportion of fume hoods we observed set at full capacity even though the station was unoccupied. The facility manager not only noted that they had implemented the appropriate training, but also said they frequently reminded the occupants to operate the fume hoods properly. Given the effort the facility staff are making to improve awareness, we make the assumption that on the average the settings are not being followed properly 25% of the time when unoccupied. This increases the amount of time fans run at full speed by 1,537 hours and decreases the realization rate to 85% overall.

5.1.1.2 Lighting Measures

The Lighting category includes lighting power density reductions, efficient lighting fixtures, and controls such as occupancy sensors and daylight dimming. Lighting measures achieved a 98% realization rate overall.

To evaluate savings, Cadmus analyzed measures based on actual wattages, ballast factors, and operation hours, which were determined through site visits and reviews of invoices and manufacturer specification sheets. Field engineers conducted detailed lighting sampling (50% of fixtures were sampled in each space) and noted no discrepancies between reported and observed fixture counts and lamp types.

The primary factor influencing the realization rate was adjustments to *ex ante* operating schedules.

Lighting Fixture Average Operating Hours

Evaluated sample project lighting fixture measures (e.g., CFLs, T8, and T5 lamps) sometimes operated for different periods than values used in deemed energy savings estimates. This is expected, since the deemed savings estimates rely on assumptions of operating hours across a range of building and usage types. The average evaluated operating hours were shorter than the assumed hours, resulting in decreased energy savings.

5.1.1.3 Motors

The Motors category included variable speed drives (VSD). Cadmus verified equipment efficiencies and counts on site and through BMS review. The only adjustment made was to correct duct static pressure, which led to a realization rate of 116% for this end-use category.

Variable Speed Drives

Cadmus confirmed VSD quantities and operational characteristics. In the case of one site, the site's model utilized the "auto calculate" input feature for duct static pressure. Cadmus corrected this to 0.7" per our review of the site's BMS. This modification resulted in most of the improved realization rate.

5.1.1.4 Water Heating

The Water Heating category represented the remaining measures with deemed savings, including water heaters and measures significantly influencing water heating loads. Cadmus adjusted energy savings to account for energy consumption calculation errors and operating hour schedules. The realization rate for all measures in this category was 40%. Note, this realization was significantly impacted by one site. More details are provided below.

Calculation Error

To ensure total project level energy savings were reported accurately, Cadmus itemized energy savings at the end-use level. During this process, we discovered one site incorrectly added an above-code domestic hot water heater (DHW) to the reported energy savings total. The DHW was not listed as an incentivized measure from BNC program in the site report, nor were any new DHWs found onsite during Cadmus' field visit. A follow up phone call to the site's facility manager confirmed DHW was not addressed during this project. Cadmus removed this measure from the energy savings analysis, resulting in a project level realization rate decrease to 68%.

Operating Hours

Site 2, an educational facility was modeled with the incorrect operating hours. The schedule did not include holiday breaks or summer vacations. As a result, the schedule incorrectly overestimated the DHW energy consumption. We determined the proper site schedule via BMS review and facility manager interviews. The model schedule was updated and calculated the resulting project level realization rate at 64%.

Similarly, another school (Site 3) was modeled with an incorrect operating hours schedule, however the schedule underestimated the DHW energy consumption, resulting in a project level 134% realization rate.

5.1.2 Site Level

We compared reported energy savings to evaluated energy savings at the site level to determine site realization rates, as shown in Table 6. During site visits, we determined how equipment actually operated, compared to the initial simulation model. We reviewed program documentation, determining calculation sources for each measure and contacting the sources, where necessary, to obtain original calculation spreadsheets or models. We compared inputs and methodologies with available data to confirm methodologies and results, or adjusted values, as necessary. In most cases, we determined the methodology and reported savings values were reasonable, although slight adjustments were required occasionally. Collectively the evaluated projects have a 94% electric realization rate, and an 81% natural gas realization rate.

Cadmus adjusted electricity and gas savings resulting for the project-specific reasons described in the sections below. Many of the adjustments were detailed above in the discussion by measure.

Table 6. Project Level Realization Rates

Project	Building Type	*Ex Ante* Reported Electricity Savings (kWh)	*Ex Post Calculated* Electricity Savings (kWh)	*Ex Ante* Reported Gas Savings (therms)	*Ex Post* Calculated Gas Savings (therms)	Electricity Savings Realization Rate	Gas Savings Realization Rate	Total Savings Realization Rate
Site 1	Medical Center	65,295	73,791	2,309	1,825	113%	79%	96%
Site 2	Educational Facility	26,564	16,933	3	4	64%	133%	64%
Site 3	Educational Facility	22,474	26,036	10	4	116%	40%	115%
Site 4	Educational Facility	35,485	24,157	0	9	68%	N/A	69%
Site 5	Educational Facility	41,700	46,540	0	0	112%	N/A	112%
Site 6	Laboratory	376,300	348,711	34,718	28,315	93%	82%	85%
Total		567,818	536,168	37,040	30,157	94%	81%	86%

Note: Total realization rate is based on Btus. Due to rounding, totals do not necessarily equal the sum of individual values in the table.

5.1.2.1 Site 1

This project consists of a new 2-story, medical office building, covering 28,000 square feet, and includes conference rooms, a lecture hall, cafeteria, exercise areas/gym, locker rooms, bathrooms, and electrical/mechanical rooms. The BNC program measures include:

- Energy-efficient windows
- Variable frequency drives on hot water pumps
- Variable frequency drives on packaged unit supply fans
- High-efficiency lighting and controls
- High-efficiency hot water boilers

During the field verification survey, Cadmus determined all reported ECMs were installed. Although trend logs were not available, we evaluated operational patterns through detailed onsite BMS review.

Our comparison of collected data and setpoints with the model identified a space heating error: the maximum zone supply temperature was entered incorrectly in the model as 95° F. We updated the maximum zone supply temperature using data collected to 110° F per the BMS review.

Analysis of VFDs led to an increase in electric savings due to differences between the reported and as-built duct static pressure. The initial model utilized the “auto calculate” input feature for duct static pressure. The on-site verification, however, required us to correct the model to 0.7”.

These adjustments resulted in a realization rate of 113% for electricity and 79% for natural gas savings.

5.1.2.2 Sites 2-5

These projects consist of new elementary and middle school classroom buildings. Table 7 provides site-specific data.

Table 7. School Site Data

Project	Stories	Spaces Types	Square Footage	BNC Program Measures
Site 2	2	Classrooms, Restrooms, and Electrical Room	10,500	• High-efficiency lighting • High-efficiency electric instantaneous water heaters • Variable frequency drives on hot water pumps • High-efficiency heating water boiler
Site 3	2	Classrooms, Restrooms, and Conference Room	11,300	• High-efficiency lighting and controls • High-efficiency gas-fired hot water heater • High-efficiency gas-fired furnace • High-performance windows and glazing
Site 4	1	Classrooms and Restrooms	7,800	• High-efficiency lighting and controls • High-efficiency gas furnaces • High-efficiency HVAC units • High-efficiency windows and glazing
Site 5	1	Classrooms, Library, Reading Areas, Offices, and Conference Rooms	17,900	• High-efficiency lighting and controls • High-efficiency HVAC units • High-efficiency windows and glazing

Cadmus identified discrepancies in operating hours and occupant system practices in several sites. We discovered the operating hours used in three of the four educational facility energy models were based on the simulations' default schedule for elementary school buildings, not the actual school schedule. The original modeled schedule predicted only a total of 1,800 hours per year of operation; however, from Cadmus' review of the operating hours listed in their BMS these three sites were actually open for 3 hours more every day, resulting in an increase of 600 operating hours annually. On the other hand, one educational facility incorrectly modeled the schedule without holidays or summer vacations; our modification resulted in a significant decrease to the annual operating hours. These calibrations affected the HVAC, lighting, and DHW end-uses.

The total realization rate for all four education facilities is 90%. This realization rate was significantly impacted by one site's calculation error. As noted before, one school incorrectly added an above-code

DHW to the reported energy savings total. Cadmus removed this measure from the energy savings analysis, resulting in a site level electricity realization rate decrease to 68%.

During our interview with the facility manager, he stated that he had received complaints regarding extreme temperature swings at all of the schools since installing the new HVAC systems. The standard practice for teachers is for them to leave the entryway door open in the morning to welcome and receive students, resulting in significant decreases to zonal temperatures. The supply temperature to the classrooms is consistent with the setpoint required to reach the zonal temperature requirements; however, the occupants are uncomfortable during this adjustment time. As a result, many teachers resort to opening the doors again, thereby creating this cycle. If trend data were available for these sites, Cadmus would have been able to verify the systems are indeed cycling and incorporate this performance into the energy models.

5.1.2.3 Site 6

This project consists of a new science laboratory and includes two stories covering about 85,000 square feet. The equipment is operational 24 hours per day, 365 days per year, for a total of 8,760 hours per year. The BNC program measures include:

- Program building automation systems (BAS) to reduce exhaust flow when fume hoods are lowered
- Program BAS to reduce air flow of laboratory air supply fans during unoccupied hours
- High-efficiency heating water boilers
- High-efficiency chillers
- High-efficiency air supply fans
- Primary-only variable speed chilled water pumping
- Variable frequency drives on cooling tower water pumps
- Variable frequency drives on hot water pumps
- High-efficiency water heaters
- High-efficiency AC units

The “System Approach” was used to calculate energy savings for each of the energy efficiency measures. Interactive effects between each of the energy efficiency measures were accounted for. During the field verification survey, Cadmus determined all reported ECMs were installed. Detailed operational patterns were difficult to evaluate, however, as trend logs were not available. Basic system setpoints were verified.

As described earlier, Cadmus noted during the site visit that most fume hoods were not aligned with the recommended level for unoccupied work stations. Predicted energy savings estimates from reduced exhaust fan speeds can only be achieved if occupant comply with the new fume hood alignment requirements. Based on our observations and professional judgment, we have assumed that the fume hood settings were being set properly 25% of the time.

Taking into account the effects of all the measures, including the fume hoods, we estimate this site achieves a realization rate of 85% overall.

5.1.3 Total Project Level

Table 8 provides the verified gross savings for the six projects analyzed in the BNC program. Overall, the program realization rate is estimated to be 86%. It should be noted that this realization rate is largely a result of adjustments to *ex ante* estimates based on occupant behavior and operational parameter adjustments, and one DHW calculation error.

Table 8. Total Project Level Realization Rates

Fuel Type	Realization Rate
Electricity (kWh)	94%
Gas (therms)	81%
Total Energy (kBtu)	86%

5.2 Energy Use Intensity

Without the use of utility bill data, it is important to determine how the facility compares relative to other similar buildings types. This will provide a general validation/”sanity check” for the annual energy consumption estimates from the simulation models.

Cadmus calculated the projects’ energy use intensity (EUI) by examining building floor area in square feet and the simulated estimates of gas and electricity usage. Note, the simulation models only accounted for the energy savings attributable to BNC program incentivized measures, and did not capture effects of any other systems installed that might exceed Title-24 code requirements.

Table 9 shows our EUI estimates for the six projects.

Table 9. Energy Use Intensities for Six Evaluated Buildings

Project	Building Type	Area (sf)	Electricity EUI (kWh/sf)	Gas EUI (therms/sf)	Total Energy EUI (kBtu/sf)
Site 1	Medical Center	27,931	10	0.14	48
Site 2	Elementary School	10,472	7	0.02	27
Site 3	Elementary School	11,300	11	0.14	53
Site 4	Elementary School	7,035	10	0.01	38
Site 5	Elementary School	17,900	9	0.04	38
Site 6	Laboratory	85,000	N/A	N/A	N/A
Total		159,638	9	0	41

Note, we were unable to estimate the EUI for the laboratory site due to the initial energy savings evaluation methodology. Unlike the other sites, which utilized the whole building analysis approach, the laboratory was analyzed using only the systems approach. This method does not include estimated energy consumption for any measures that are not incentivized. Without an estimated total annual energy consumption for the whole building, an EUI cannot be estimated.

Site 3 consumes more natural gas than the other three schools, as shown in Table 9. This is likely a result of the school's DHW fuel source. Site 3 is the only school with a natural gas water heater; the other schools use electric systems.

Table 10 shows average energy use intensity by building type in California. A comparison of project EUIs to average EUIs in California shows for the two building types we could compare that the estimated EUIs are comparable to or less than average stock values. This provides evidence that the simulation model estimates are reasonable, even though we were unable to analyze them based on empirical energy use data.

Table 10. Average California EUI Data*

Building Type	Buildings in Sample	Average Project EUI (kBtu/sf)	CA EUI Data (kBtu/sf)
Elementary School	4	41	41
Medical Clinic/Office	1	48	80

*California Commercial End-Use Survey Report, Itron, 2008

6. Conclusions

The City of Palo Alto (CPAU) retained Cadmus to evaluate six commercial new construction projects completed through the Business New Construction (BNC) Program and complete a program process evaluation.

Cadmus completed the impact evaluation by analyzing energy savings for measures implemented in six projects. We performed verification site visits for each project and evaluated energy savings based on verified equipment counts, operating parameters, and assumptions derived from engineering experience and secondary sources. For each measure, these data informed prescriptive algorithms, calculation spreadsheets, and building simulation models.

CPAU and its implementer, BASE Energy, applied appropriate methodologies and assumptions for most measures, but Cadmus' *ex post* evaluated savings differed from the *ex ante* reported energy savings for various reasons. For several measures we identified differences assumptions used to estimate reported savings and the verified values used in the evaluation. Cadmus also noted revisions to calculation methodologies, equipment counts, and variations between expected and achieved simulation model performance. These combined factors led to an 86% total program realization rate.

Based on our review, the BNC program implementer performed a reasonable level of review and quality control to achieve high average project savings realization rates. The measure types with lower evaluated savings represented large, complex measures whose final operating patterns can be difficult to predict, particularly in a new construction application. The implementer has continually worked to streamline and improve the program's delivery mechanisms, and we believe their work has been effective.

7. Recommendations

Through this evaluation, Cadmus identified several areas for potential program improvements. This section presents our recommendations in two areas: (1) program changes that will increase the accuracy of reported savings and the ability of CPAU and evaluators to verify the savings and (2) process changes that will improve program effectiveness and participation.

7.1 Improving Savings Estimates and Ability to Evaluate

7.1.1 Require Separate Baseline Models

To estimate reported and evaluated energy savings accurately, it is critical baseline measures and operational parameters can be easily identified and adjusted as needed. Cadmus' document review showed that original baseline energy consumption estimates were generated using the compliance analysis module in eQUEST simulation software for four projects. This analysis module is inappropriate for estimating energy savings as it can only use default operational parameters in the baseline and cannot be modified or overwritten to account for actual building operations. To correct this issue, Cadmus needed to create a separate baseline model. To prevent this time consuming process in future evaluation studies, we recommend requiring all energy savings analysis use a separate baseline energy simulation model.

7.1.2 Require Energy Metering in Projects without a Separate Utility Meter

For projects that do not have dedicated energy meters, such as individual buildings on a campus, CPAU should consider requiring that the participant sub-meter the energy sources in order to receive incentives for the energy conservation measures. For example, if a building is served by electricity, gas, and steam, CPAU requires that electrical power, gas therm, and steam Btu meters be installed if incentives are paid for all utility types. This will provide more accurate savings verification.

7.1.3 Encourage Participants to Enable Energy Management System Trends

Cadmus has found that, in general, new construction facilities have energy management systems and typically enable trending on major equipment and controls systems. This data is critical to impact evaluation efforts and proper performance monitoring, as it provides important information to the participant, utility, and evaluator about how the facility is operating. None of the six project sites regularly generated trend data. Although the participants were willing to enable trends at our request, the resulting data was insufficient and not reflective of the normal operation parameters due to the holiday season when this analysis took place. We believe it would be helpful for participants and future evaluation efforts for the program to encourage participants to enable EMS trends during the commissioning process.

7.1.4 Require Energy Savings Reported at Measure- and Site- Level

Cadmus recommends requiring that reported energy savings be provided at the measure-level and site-level in both the initial project reports as well as the post-verification reports. Our report reviews indicate measure-level energy savings are not submitted in the post-verified reports.

At one educational facility, a DHW measure was incorrectly added to the project's energy savings total in the post-verification report. This additional savings was likely not identified due to the lack of detail at the measure level. Cadmus discovered the error during our analysis of the site's energy savings by end-use. We recommend requiring consistent reporting outlines in both the initial project report and the post-verification report. Requiring energy savings shown as electrical (kWh) and gas (therms) savings as well as combined energy savings (kBtu) would also further help to clarify this issue.

7.1.5 Ensure Occupant Trainings are Conducted Regularly

The energy savings performance of nearly any measure is significantly influenced by occupant behaviors. Providing new-building occupant training can help to steer behaviors towards energy conservation. Trainings will need to be conducted regularly to ensure all occupants are aware of the building's specific requirements. For example, during Cadmus' laboratory site visit, we observed the occupants were not complying with the fume hood alignment requirements as presented to them in their new building training. We recommend that occupant trainings be conducted at least every 12 months and that facility operating requirements be posted publicly.

7.1.6 Encourage Whole Building Energy Modeling

To verify incentivized measures and their energy savings effects through utility bill calibration analysis, whole building energy modeling should be obtained. Modeling using the "Systems Approach" limits verification methods and prevents identifying all interactive effects.

7.1.7 Obtain Energy Simulation Models during Program Year

Cadmus recommends CPAU conduct energy simulation models reviews during the program year or require building simulation model developers sign a consent form that releases models for evaluation purposes. This step should be a requirement for any incentives using model-estimated savings, thus improving the likelihood a project can be evaluated.

7.1.8 Maintain Consistent Documentation on Simulation Model Files

Cadmus recommends that documentation on simulation models be categorized consistently and clearly labeled, across all projects. Cadmus also recommends the implementer list any changes made to the simulation models and document why those changes were made.

7.1.9 Obtain Calculation Sheets for Exceptional Calculations

If the savings claimed include any exceptional calculations other than simulation modeling, the implementer should document the spreadsheets or source of these calculations. For example, if the participant claims gas savings from installing a boiler and these savings are included in the incentive amount, the implementer should document the methodology and source of the stated savings or exclude them from the incented savings.

7.1.10 Develop "Sanity Checks" to Review Projects

CPAU may want to consider developing "sanity checks" to approve incentives for lighting, water heating, and HVAC equipment. These checks can serve to screen out unrealistic savings estimates. One option is calculating the energy use intensity (EUI) for projects, which will show how the facility compares relative to other similar buildings types. This will provide a general validation for the annual energy consumption estimates from the simulation models.

7.2 Enhancing Effectiveness and Participation

7.2.1 Develop Measurable Program Goals

Set measurable goals for participation, and possibly for savings levels in an effort to drive an internal push for more outreach to potential customers.

7.2.2 Develop a Tracking System

Develop a tracking system to compile information on customers who have been contacted regarding the program. This could include information such as where the lead originated from, contact information for key parties (builders, architects, designers, etc.), and efforts taken to enroll each customer in the program. By tracking customers in this way, more can be learned about the efficacy of marketing and outreach efforts, and insight can be gained into how to increase participation.

7.2.3 Assess Market Potential

Determine how many customers and projects in the current market are eligible for program participation. Use the information to evaluate outreach effectiveness. Network with the design and construction community to get information on potential participants and regularly monitor recently submitted building permits.

7.2.4 Broaden Program Outreach

Investigate a customer referral program to help generate word-of-mouth referrals within the local new construction community. This will broaden the program’s outreach by increasing the number of potential participants that will become aware of the project. Also, we recommend working with the implementer to develop and expand program marketing and outreach activities.

Appendix A. Stakeholder Survey

Appendix B. Customer Survey