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U.S. DEPARTMENT OF ENERGY

Energy Upgrade California (EUC), a statewide initiative, educates residents to use energy more efficiently in support of California's goal to double the energy efficiency of existing buildings by 2030. Ratepayer-funded energy efficiency programs play a significant role in California's plans. As part of EUC, non-profit Build It Green has partnered with Pacific Gas & Electric (PG&E) to implement the Home Upgrade Program across PG&E's territory. Started in 2011, the program offers a whole-house approach to home energy upgrades, with rebates for homeowners who complete energy-saving improvements. Customers can qualify for the highest rebate amounts if they complete a comprehensive home assessment that includes energy modeling to estimate energy savings from recommended improvements.

Less than a year after starting, demand for program rebates grew to exceed administrative processing capacity. An internal review of the rebate approval process revealed opportunities to reduce the administrative burden on participating contractors and the program, and in turn to improve data. To improve the process, Build It Green and PG&E worked to:

1. Streamline the rebate application review process to reduce errors at two key points: data collection and transfer, and

2. Improve the reliability of predicted energy savings.

Streamlining Data Collection

Build It Green's initial program plans included use of an online portal and database service designed for energy efficiency rebate programs. Contractors used the portal to submit rebate applications, access program resources, and track rebate approval progress. While the portal and databases could process some information from contractors, they had difficulty processing and managing all of it efficiently and effectively. Manual processes were put in place, but with program growth, those solutions wore thin. Program quality assurance staff and contractors spent four business days on average (sometimes up to three weeks) going back and forth to correct mistakes and data errors in rebate applications, resulting in significant rebate approval delays and inefficient use of human resources.

Introducing Contractors to New Online Portal and Process Improvements

KEY LESSONS LEARNED

1. Map data processes to clarify the purpose of data collection and identify root causes of data errors.

2. Data standardization is the foundation to improving quality of data from multiple sources.

3. Measuring energy savings at the meter while using standardized methods can improve the accuracy of modeling software predictions.

"Instead of being a simple way to submit projects for program rebates, our earlier reporting process added unnecessary tests of contractor staff's home performance knowledge. We could better identify contractors needing additional training and support through the quality assurance process."

—Torsten Glidden
Senior Manager for Policy & Technical Innovation at Build It Green

Build It Green undertook a series of process analysis exercises and worked with Efficiency First California, the home performance contractor trade association, to narrow the source of these errors. The analysis determined the online portal for rebate applications was overly complex and needed the ability to process all required data automatically. For example, contractors were asked to identify 15 - 30 relevant data fields, out of nearly 50 – for every upgrade project. Putting this burden on multiple contractors' staff invited data error, inconsistency, and frustration for both contractors and the program as well as requiring a steep learning curve when new staff were hired to handle rebate application submissions.

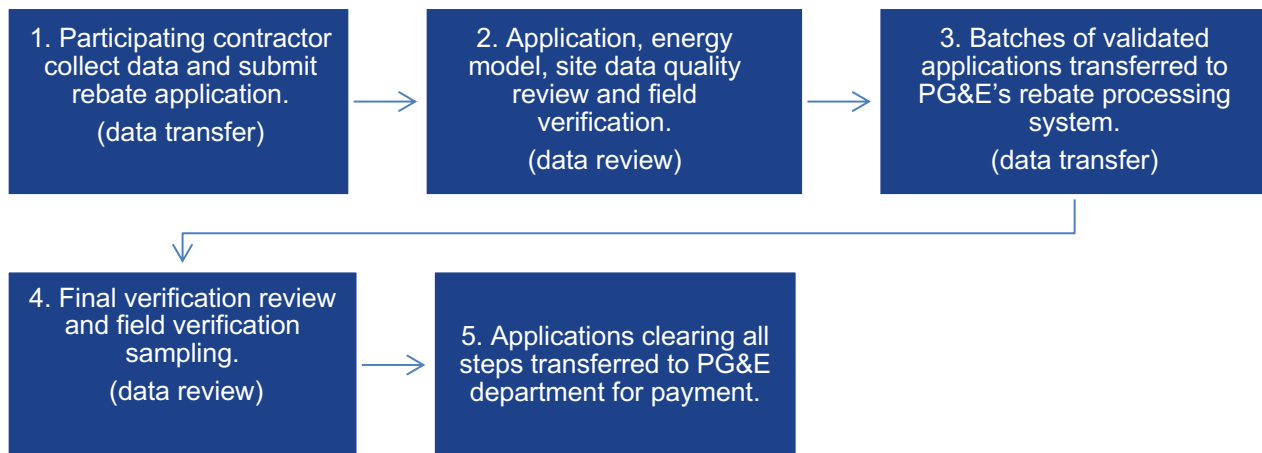To stem the flow of data collection errors, Build It Green:
▶ **Upgraded to a logic-enabled web portal** that included filtering capabilities to identify relevant fields for each upgrade, based on earlier entries.
▶ **Consolidated redundant fields.** In total, the program reduced the number of rebate application fields by over 30 percent.

These improvements enabled the program to reduce not only the complexity of data reported but also the hours needed for data quality reviews and corrections. Building on the success of these process improvements, the program created a logic-enabled web form to similarly simplify data collection for combustion appliance safety inspections and testing to reduce input fields by 25 percent. When released, these additional web portal improvements will give contractors the option to enter data using mobile devices while onsite, reducing duplicative data entry.

Streamlining Review Processes & Systems

Mapping the program's data process revealed the other main source of data error: the multiple data transfers that took place before a rebate application was approved and paid. The rebate approval process included three reviews and multiple data transfers and processing steps, which introduced data errors and created bottlenecks. The program worked to minimize data transfer errors by streamlining its processes and upgrading to data systems more appropriate for its volume and processes.

Table 1. Rebate application review process streamlined from 8 steps/5 databases to 5 steps/2 databases.

1. Participating contractor collect data and submit rebate application. (data transfer)	2. Application, energy model, site data quality review and field verification. (data review)	3. Batches of validated applications transferred to PG&E's rebate processing system. (data transfer)

4. Final verification review and field verification sampling. (data review)	5. Applications clearing all steps transferred to PG&E department for payment.	

Build It Green, PG&E, and their partners invested in fixing data errors and minimizing the source of errors. Regular, time-intensive, and error-prone data-mapping was needed for routine system-to-system data transfer to occur. Occasional, ad hoc error correction was needed to account for seemingly minor definition and formatting differences (e.g., should 80 percent be entered as 80 or 0.8). Each data transfer system update also introduced new errors, as each new customization or "fix" often broke previously functioning versions. The statewide EUC adoption of industry standards for data definitions and transfer, BPI-2100 (commonly known as HPXML) and BPI-2200, ameliorated some of these issues.

Around the same time, Build It Green expanded use of its customized cloud-based customer relationship management (CRM) system to better manage Home Upgrade Program implementation. They saw the system as a single, more agile solution for not only the program's project-customer communications but also rebate application processing needs and contractor communications. With the new CRM system, Build It Green was able to streamline the rebate approval process by absorbing the data processing portion and eliminating a data transfer step. Build It Green added an in-house programmer to its team to customize the CRM, giving them more control over the system.

PG&E undertook a similar internal process redesign and system upgrade to streamline data intake from Build It Green (as well as other program implementers) and the rebate payment process. These upgrades also eliminated a bottleneck in the approval process. Initial system constraints required review of applications in batches. When one application in a batch was selected for field verification, the other applications in that batch were put on hold. With the new systems, the program was able to streamline this step and minimize delays to the approval process.

The program was able to customize the new system to process most of the necessary data in the energy assessment files during data collection, addressing contractors' frustration with manual duplicative data entry. Additionally, because the new system could process HPXML-formatted energy assessment files, it supported another program effort to improve the reliability of predicted energy savings. The new systems provided an integrated data intake and quality review platform for the program and its contractors and enabled program staff to provide better service to customers and contractors.

"With the results of our data mapping in front of us, we realized that our original database and reporting structure had been under-designed for efficient data capture and transfer, while simultaneously being over-designed for collection of useful data points."

—Torsten Glidden
Senior Manager for Policy & Technical Innovation at Build It Green

Improving the Quality of Predicted Energy Savings

While the program improved its internal processes and data infrastructure, work was underway to make energy efficiency savings estimates more reliable for all programs under the EUC initiative. EUC's program design made higher customer rebates contingent on the estimated energy savings of installed improvements. These savings were determined by energy modeling software.

A 2013 analysis found that a significant portion of estimated energy savings were not being realized and that the one state-approved energy modeling software – used by contractors to qualify customers for higher rebates – overestimated energy savings. This over-prediction compromised PG&E's ability to meet its energy efficiency goals. In addition, contractors complained that the modeling software was difficult to use and advocated for greater choice of modeling software to meet their specific business needs. Customers were also not getting the energy savings they expected. To temporarily account for these overestimates, the California Public Utilities Commission (CPUC) mandated that California investor-owned utilities apply correction factors to their programs' predicted energy savings, reducing natural gas estimates by 20 percent and electric estimates by as much as 60 percent.

In response to this issue and with the support of the California Energy Commission (CEC) and CPUC, PG&E formed a technical working group in 2013 to develop a long-term solution to improve the accuracy of energy savings estimates. Working group members partnered to develop:

▶ California Test for Energy Software Tools (CalTEST), a screening tool to ensure minimum accuracy of software and calibrate software based on actual energy use.
▶ CalTRACK, a standardized methodology to calculate weather-normalized, metered energy savings.

These two resources were built through close collaboration with a diverse group of stakeholders. PG&E worked closely with software experts at OptiMiser, SnuggPro, and Cake Systems to develop CalTEST. CalTRACK was established with data analysis experts at OpenEE, EnergySavvy, and DNVGL. Staff from the CEC and CPUC participated in both processes.

Four modeling softwares passed CalTEST in 2015. In 2016, PG&E approved three – OptiMiser, Snugg Pro, and Cake Systems – for the program, giving contractors more choices. In 2018, PG&E will be able to check the 2016 software predictions against 2017 meter data to calculate realization rates for each software tool and to identify course corrections and adjustments.

Some contractors are using the tools more accurately than others, meaning more training may be needed for some of them. The software tools and modeled energy savings predictions may also need refinements and/or calibration to better reflect climate, homes, and human behavior. The near-term goal is to use the meter data to improve the accuracy of the predicted savings. The long-term goal is to build off the new CalTRACK methods and pivot to a new program design called Pay for Performance (P4P) where incentives are no longer calculated based on predicted savings but rather on metered savings.

"PG&E's success has come from continuously improving our program offerings in close coordination with participating contractors, industry experts, our regulators, and non-profit organizations. To reduce 'program friction,' we get advice from select contractor-advisors and then test new systems before rolling out the changes program-wide."

—Leif Magnuson
Expert Program Manager at PG&E

Results

Improvements to the rebate approval process enabled faster rebate payments as well as optional direct payment to contractors. Build It Green and PG&E's improvements condensed the overall application processing timeline from 4-8 weeks on average down to 2-3 weeks. The shorter process resulted in faster repayment to contractors, which relaxed cash-flow constraints for these small businesses. The program was able to address data errors stemming from the initial data entry point by about 70 percent and from multiple data transfers by about 90 percent, which directly freed time and resources that the program and participating contractors could allocate elsewhere. Build It Green's contractor survey showed a 29 percent increase in satisfaction with the program's user interface and rebate application process. Additionally, with this data in a more accessible platform, Build It Green is in a better position to use data for program management and monitor the status of upgrades and contractors.

The ongoing effort to align initial savings estimates with actual savings will help both homeowners and the utility achieve expected energy savings. Build It Green and PG&E implemented improvements to advance the success of their program and the industry. CalTEST, CalTRACK, and the standardization of energy modeling software requirements enabled the program to not only give contractors their desired flexibility but also work toward improving the accuracy of predicted energy savings. Predicted site energy savings of upgrades using the initial state-mandated tool averaged 31 percent and decreased to 23 percent with the CPUC-mandated correction factors. CalTEST-approved software saw the energy savings estimates average around 26 percent, more closely aligning with the CPUC-mandated correction factor-adjusted energy savings estimates. Build It Green and PG&E anticipate further refinement in 2018, based on CalTRACK analysis, will create even more accurate estimated savings predictions that can inspire greater confidence in the ability of residential energy efficiency to deliver reliable energy savings.

Next Steps

Having upgrade data readily accessible created new opportunities to use it. Build It Green and PG&E proved that better data systems and quality can make a difference – not only in terms of using people's time more effectively but in terms of incentivizing real savings. With better quality data available internally and externally and easy-to-use dashboards, they can drive better program decision-making and allow contractors to see their individual projects' energy savings realization rates, as well as other performance-based feedback.

As of early 2016, HPXML-compliant modeling software became mandatory for participating contractors. With more reliable energy savings predictions, the program can better align incentives with electric and natural gas savings. These improvements move California one step closer to an innovative "pay-for-performance" approach where utilities will pay for energy savings as they occur.

ABOUT THE HOME UPGRADE PROGRAM ACCELERATOR

The Home Upgrade Program Accelerator is designed to help home energy upgrade programs bring energy efficiency to more homes across the country by leveraging data management strategies that minimize costs while improving overall program effectiveness.