Embedded Evaluation and Data Mining to Increase Audit Conversions

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ABSTRACT

It can be a challenge for utilities and contacted implementers to motivate commercial and industrial customers to implement energy savings measures identified during a facility energy audit. Even the best energy audit reports that clearly articulate project benefits, costs, and return on investment can be shelved. The barriers for moving forward are many and varied, and have been assessed and communicated for more than a decade. Yet still, there is a struggle to convert audit reports into installed energy savings measures.

To address this long-standing challenge, we developed our 'Audit, Engage, Convert' initiative, a four-pronged embedded evaluation approach. First, we are developing a tracking tool that captures interactions with energy audit participants, audit recommendations, and projects completed as a result of an audit. Second, we simplified and refocused a 30-day follow-up call to re-engage customers after the audit report is delivered, but possibly filed away. Third, we are embedding evaluation and program metrics into the program engagement processes. And fourth, we are monitoring program metrics and assessing program and evaluation data to help us better understand barriers for individual participants, and inform overall program design and operations.

This paper presents our embedded evaluation effort of our audit process, including evaluation recommendations and process changes we have made thus far. At the ACEEE 2018 Summer Study, we expect to have sufficient data to present a comparison of our Energy Savings Conversion Rate (the energy savings from recommended measures implemented divided by the energy savings from recommended measures) before and after we implemented our 'Audit, Engage, Convert' initiative.

Introduction

An ASHRAE Level II Audit cost for an entire facility is about $0.04 to $0.05 per square foot, with utilities offering incentives that cover a part or all of this cost. An objective of this investment is to direct customers to utility energy efficiency and demand reduction programs. However, this investment does not always result in energy savings or demand reduction projects. Our project is designed to investigate methods to deliver more savings.

An ASHRAE Level II Audit involves interviews with site personnel, a review of site energy consumption, an energy walk-through survey with an energy engineer, and energy savings and financial analysis designed to provide enough information for the customer to act upon study recommendations. The audit includes an on-site building survey, a breakdown of energy end uses, energy consumption and peak demand analysis, and savings and cost analysis of practical energy efficiency measures identified during the building survey. An energy audit report is presented and reviewed in person with the customer. Approximately 30-days after the final report presentation, the auditor conducts a '30-day follow-up' call to check on the customer's progress implementing measures, offers assistance through utility programs, and answer questions the customer may have.

We have modified the ASHRAE Level II Audit definition to include cost and savings estimates for nearly all measures identified, including more capital intensive measures that wouldn't typically be included in a Level II Audit report. Cost and savings are developed using rules of thumb, technical reference manuals, data from similar implemented projects, and engineering judgment. Incentives available from utility programs are also included, where applicable.

Our ASHRAE Level II Audit process allows for customer engagement at multiple stages (as illustrated in Figure 1):

(1) Energy audit scheduling call
(2) Energy audit
(3) Post-audit report delivery
(4) Post-report delivery follow-up

At each stage, we capture data and information that we use to better understand the customer decision making process for participating in an audit and for moving recommended projects forward. This data and information includes:

(1) Customer motivation for the energy audit
(2) Customer pain points – What are they struggling with and how might we be able to help them? Pain points are associated with energy use as well as other concerns, such as operations and maintenance, employee comfort, and lighting aesthetics
(3) Project approval process – Who approves? What is their budgeting cycle?
(4) Projects completed (measures installed) and projects planned based on energy audit

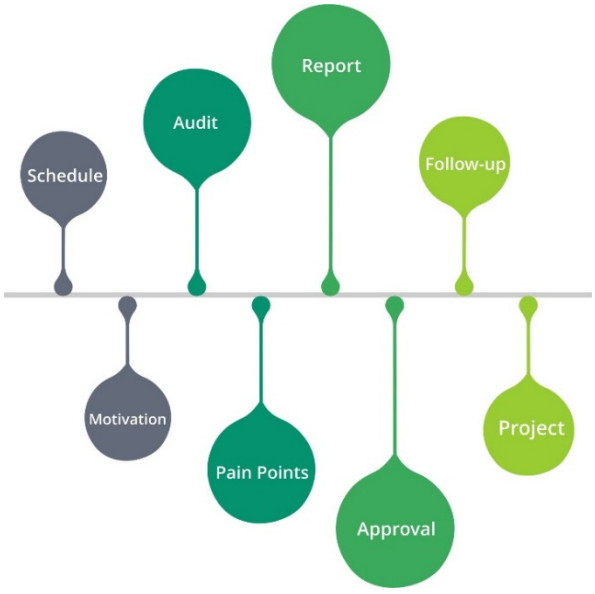

Figure 1. Michaels Energy ASHRAE Level II Audit Customer Engagement Process With Data Capture and Monitoring

Embedded Evaluation: Can We Drive More Savings From Energy Audits?

To assess our energy audit effectiveness and to identify ways to deliver more energy savings, we launched an embedded evaluation effort in the Fall of 2017. The objectives of this evaluation were to:

- Determine how to use existing data to better understand program performance and to drive higher conversion rates
- Identify data and information gaps
- Assess our audit process
- Improve conversion rates

For our internal continuous improvement efforts, we assign an internal evaluation expert who is not deeply familiar with the program to work closely with program staff. This independent objective evaluation is an essential factor for the success of embedded evaluation as it enables more questions and less assumptions. We take a truly critical view during each embedded evaluation activity, searching for new and unbiased insight.

Initial embedded evaluation activities were identified at the start of the effort. These evaluation activities can and do change as the evaluation progresses based upon what we are learning. We may also adjust evaluation activities when we make changes to our program processes. As of May 2018, we completed the activities described next.

Activity 1. Tracking Data Assessment: What do the data tell us?

To better understand the effectiveness of the energy audit process and how we might be able to drive more energy savings, we are diving deep into the energy audit program data. The objective of the program data analysis is to identify how many measures recommended in energy audits (and the associated energy savings) lead to completed energy projects through utility efficiency programs.

Our initial dataset was sourced from two databases we merged for analysis. The time period is January 2011 through April 2018. The first is an internal audit tracking database. At the start of our embedded evaluation project in November 2017, the data tracked included customer contact information, each recommended audit measure, and measure savings and cost information. It did not include information to assess customer motivation for participating in an audit, reasons for moving projects forward to adopt audit report recommendations, or barriers to implementing measures.

The second database is the tracking system used for utility rebate processing. This data set includes a customer identifier, measures installed through utility programs eligible for incentives, incentive amount paid, and associated energy savings.

Merging datasets from independent systems, let alone from different firms, is seldom easy. The biggest challenge was matching the customer information between the two databases, as customer information varied between the two. In the future, both databases will use an identical, unique customer identifier attached to both audits and rebate projects to make it simpler to match up the data.

Energy Savings Conversion Rate

To assess the impact of our embedded research project, we established the Energy Savings Conversion Rate. The Energy Savings Conversion Rate is calculated as:

$$\textit{Energy Savings Conversion Rate, kWh} = \frac{\textit{Estimated kWh Savings Implemented}}{\textit{Estimated Recommended kWh Savings}}$$

The baseline Energy Savings Conversion Rate, kWh at the start of our embedded evaluation and data assessment effort, is 18 percent.

Cumulative Projects Completed and Cumulative Savings Over Time

Figure 2 shows the cumulative number of projects completed after the audit report is delivered. Figure 3 illustrates the cumulative kWh energy savings after the audit report is delivered. Both figures show a steady ramp-up through year 3, a decline in years 4 and 5, and substantially dropping off into year 6. This information is useful in helping us understand the timeframes for customer decision making and budgeting to implement recommended measures.

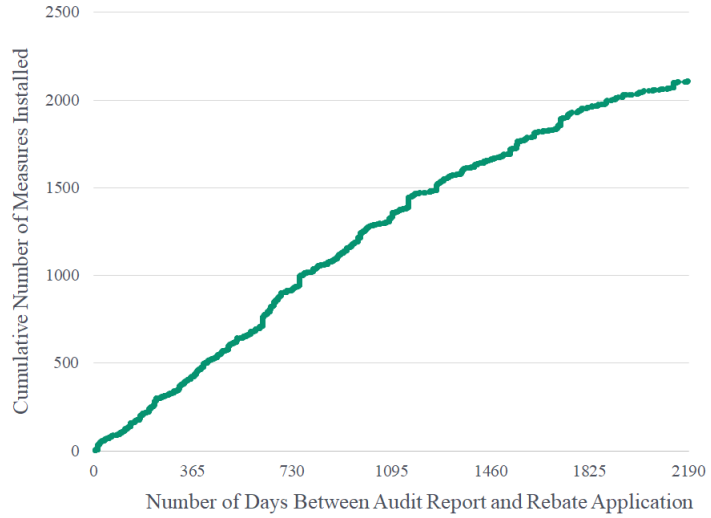

Figure 2. Cumulative Projects Completed (January 2011 – October 2017)

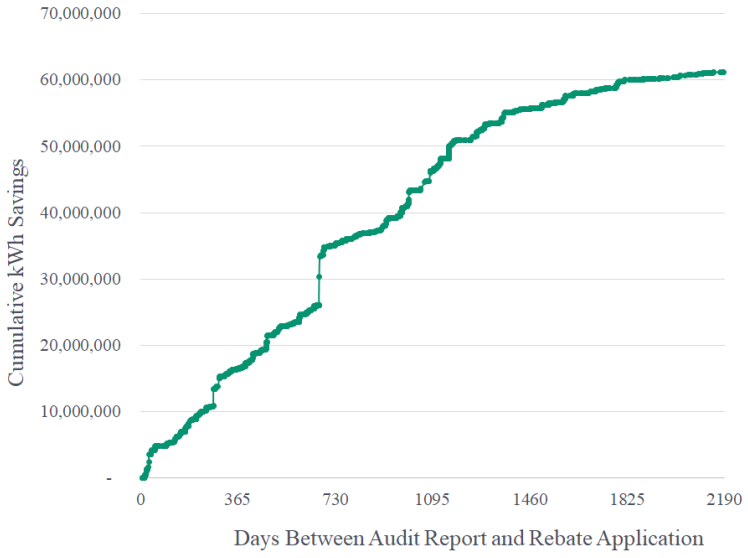

Figure 3. Cumulative kWh Energy Savings (January 2011 – October 2017)

Measure Types Installed Within First 90 Days

Next, we wanted to explore the types of measures installed within the first 90 days of the audit report delivery. Lighting measures are the most common. This is followed by HVAC-related measures like control adjustments and the installation of adjustable speed drives. These types of measures are typically easier to implement and have a relatively low cost.

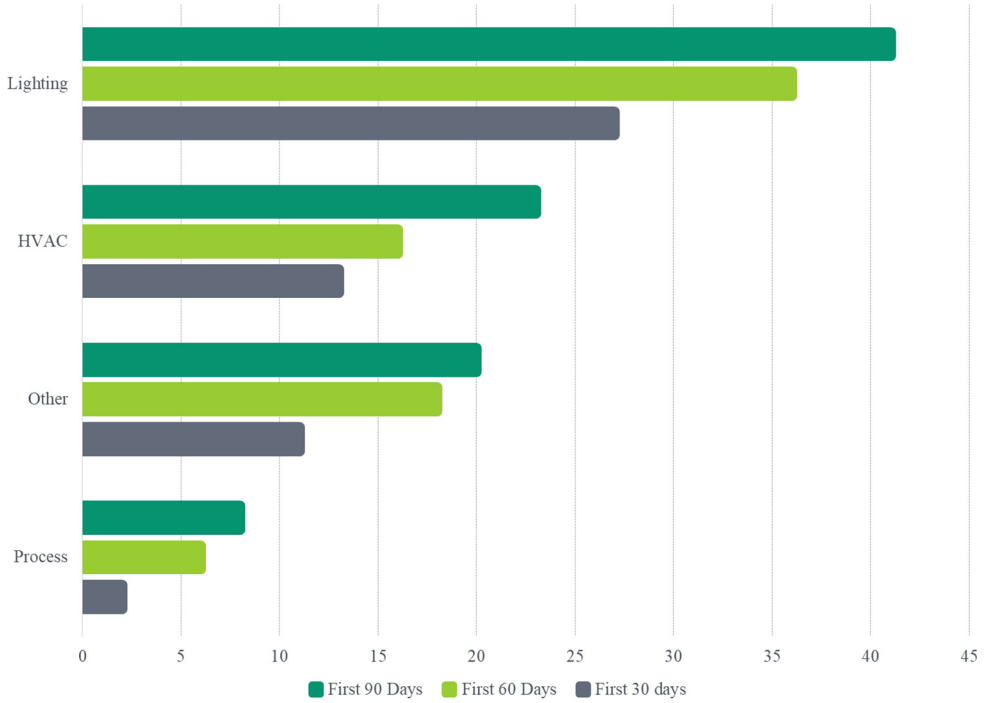

Figure 4. Number of Measures Installed by Category Within the First 90 Days Following Audit Report, 2011-2017

The 30-Day Follow-up Call

The program manager tracks project management metrics outside of the audit tracking system. The 30-Day Follow-up Call Report (Follow-up Report) tracks the time between when the audit report is delivered to the customer and when the energy auditor completed the follow-up call with the customer. Although termed 'the 30-Day Follow-up Call', this is a guideline and not a hard and fast rule. It is dependent on customer availability and other factors.

The intent of the follow-up call is to remind customers of the recommended measures and to gather information about installed measures and those planned for installation. On average, these calls occur about 100 days after the audit report is delivered to the customer.

Activity 2. In-depth Interviews with Energy Auditors: What can their experiences tell us?

The second activity with the embedded evaluation effort included in-depth interviews with auditors. We conducted in-depth interviews with energy auditors to understand the program from their perspective. We asked what they believe is working well and what isn't. We explored ways their activities differ from the documented process – and whether or not those deviations worked better. We discussed interactions with customers and probed on examples where the

interactions went particularly well (the audit resulted in projects) to identify what we might have done differently to drive project completion and energy savings.

Activity 3. Desk Reviews: Is there useful information in the project folders that is not contained in the tracking dataset?

In addition to the data in the tracking system, engineers take notes during the 30-Day Follow-up Call. This form captures information about measures installed or planned for installation, barriers to project development or completion, and additional study opportunities (such as a feasibility study). Until May 2018, call notes were captured in a Microsoft Word form, not in a database.

We randomly selected 13 of these forms to determine if there was useful information to inform our embedded evaluation effort, to look for any missed opportunities for customer project development support, and to identify additional information that would be helpful to capture electronically for more robust analysis in the future.

Activity 4. In-person Observation: As an independent observer, what can we learn about the interactions with the customer during an energy audit and during an audit report delivery?

Through May 2018, we have conducted one in-person observation during an energy audit and one in-person observation during the audit report delivery to the customer. The independent evaluator was a silent observer critiquing the interactions with the customer.

Embedded Evaluation Results Through May 2018: Fast Feedback is Vital

During and after each evaluation activity, the independent evaluator conducts a check-in meeting with program staff to share findings. Together, the program staff and evaluator brainstorm recommendations and action plans based on findings. This fast feedback communication loop ensures findings that warrant quick action are acted upon in near real-time.

Findings and Recommendations

Through May 2018, the embedded evaluation effort has identified 25 findings and produced 24 program staff accepted recommendations. A sample of findings and recommendations for each evaluation activity are provided in Table 1. Our embedded evaluation has been primarily qualitative, not quantitative. As our database expands to capture more data and information useful for this embedded evaluation effort, more quantitative analysis will become possible.

Table 1. Findings and Recommendations Sample

Evaluation Activity	Finding	Recommendation	Status
Data assessment	Additional data can be collected during the project set-up and throughout the process for more robust data mining.	Program manager will identify fields, vet with energy auditors for ease of collection, and work with IT to include agreed upon data points in the new platform.	IP
In-depth energy auditor interviews	Earlier identification of customer pain points can better prepare the energy auditor for the on-site energy audit.	The scheduling call questionnaire was adjusted to include a question to gather information about customer pain points. This also ensures that the 'right people' are available for the energy audit and report delivery meetings.	I
In-depth energy auditor interviews	Energy engineers have different tactics for engaging with customers when scheduling the energy audit, and during and after the audit.	Meet quarterly with energy auditors to discuss engagement tactics and effectiveness of changes to program delivery and engagement strategies.	NS
In-depth energy auditor interviews	The timing of the 30-day call does not work for many customers.	Set-up the follow-up call during the audit report delivery meeting, or determine the customer's preferred timeframe for follow-up and note in the Follow-up Report tracking tool.	I
Desk reviews of follow-up forms combined with Fast Feedback discussion with program staff	More meaningful information can be collected during the Follow-up Call.	Revise the follow-up questions to focus on those that help drive projects and/or provide more useful information on the audit process.	IP
In-person Observations	In 2018, the program administrator is offering an extra incentive for custom projects.	Highlight this additional incentive in the audit report and during the audit report delivery.	I
In-person Observations	Providing concrete next steps and a timeline for customers during the report delivery meeting can help drive projects.	Provide the customer with a customized checklist of next steps and suggested timeline for moving projects forward at the conclusion of the report delivery meeting.	I

Evaluation Activity	Finding	Recommendation	Status
Overall evaluation effort	The three customer engagement points provide opportunities to connect meaningfully with customers and to collect data and information more logically and efficiently.	(1) Revise the information and data request requirements for each engagement point to align in a logical sequence from the customer perspective. (2) Use these customer engagement opportunities for gathering information to assess the effects of process changes.	IP
Status Legend: I = Implemented, IP = In progress, NS = Not Started			

A Case Study

The recommendations outlined above have been implemented and several audits have already been completed with these program adjustments in place. We have not yet completed a statistical analysis of the effectiveness of these improvements since there are not yet a sufficient number of completed audits, nor has there been a sufficient passage of time after report completion. However, anecdotal reports from auditors suggest that there has been an improvement in customer engagement and enthusiasm. One particularly successful set of energy audits was completed for a college, including a science center, athletic complex, and student center.

First, a new questionnaire was used during the initial phone interview with facilities staff prior to the energy audit site work. This questionnaire focused on customer pain points and revealed that the college experienced extensive complaints from students and faculty after implementing efficiency measures in the past. Many buildings are partially occupied 24/7, but schedules set up by controls contractors did not take this into account. As a result, many of the controls schedules have been overridden, and HVAC systems now run in occupied mode continuously. This gave energy auditors two critical insights: first, there is likely a potential for significant energy savings through HVAC controls optimization or retro-commissioning; and second, the customer must be convinced not only of the potential savings, but also that any proposed changes will not negatively impact occupant comfort and lead to complaints.

A second audit process improvement is to ensure that each customer engagement point is being used not just to gather information, but also to address customer concerns and drive projects forward. Because HVAC controls had been overridden in the past, energy auditors made an extra effort to engage the controls technician during the energy audit on-site walkthroughs. Conversations with the controls technician were valuable in helping auditors to understand the specific issues that had caused problems in the past and in establishing trust. By discussing potential changes early in the process and listening carefully to the technician’s concerns, the engineers established a collaborative working relationship.

A third audit process improvement is to ensure that the customer is presented with concrete next steps for each measure during the audit report delivery (the report-out). With this in mind, energy auditors contacted the utility account manager and arranged to have proposals for a retro-commissioning study prepared and presented at the report-out meeting. A retro-commissioning engineer, with experience in similar facilities, attended the report-out to provide assurance that savings can be achieved while maintaining occupant comfort.

The college is planning to move forward with the recommended retro-commissioning projects, and requested a proposal for another building that was not included in the original energy audits. We believe that the audit process improvements played an important role in converting these audit measures into projects that are being implemented, and will assess this through customer interviews and discussions.

Next Steps

Embedded Evaluation

The current embedded evaluation plan is expected to conclude in late Summer 2018. However, the embedded evaluation effort will continue over the life of the program with the types of evaluation activities and/or the frequency of the activities changing. As the program changes are implemented and the outcomes assessed, the embedded evaluation effort will move away from active evaluation activities to focus on monitoring the program metrics (passive evaluation activity). When program metrics indicate possible issues with the process, active embedded evaluation activities will be re-engaged. The remaining embedded evaluation plan activities currently defined are:

- Additional in-person observations for energy audits and audit report delivery
- Collecting more meaningful data and information
- Monthly check-in meetings

Additional in-person observations for energy audits and audit report delivery will continue over the remainder of the current embedded evaluation plan as opportunities arise. The primary objective of these continued observations is to assess changes made to customer engagement practices while looking for improvement and consistency for key protocols.[1]

We will assess the new information and data gathered through the customer engagement points of contact (scheduling, audit, and follow-up) to ensure it is meaningful. We will discontinue collecting data and information found to be problematic for the customer to provide or that does not provide value. As the embedded evaluation project progresses, we may also identify other data or information we would like to test.

We use the monthly check-in meetings to review action plans, discuss any new findings, and develop new recommendations and action plans when warranted. For example, as we begin to collect new data and information through the customer engagement points, we anticipate that we will identify new findings and recommendations.

Embedded Research

We plan to add an embedded research component to this effort. The research will attempt to identify ‘customer readiness’ attributes for moving projects forward. Then, customers who have had an energy audit will be slotted into readiness categories. The research will assess the appropriateness of the attributes and the accuracy of the categorizations.

[1] Although we encourage energy auditors to be personable and authentic by ‘being themselves’ and, therefore, not follow a prescribed customer engagement script, we do expect that certain information and data will be collected at different contact points.

New Program Tracking Platform and Data Mining

The new tracking platform is expected to be operational in May 2018. Once operational and tested, we will begin tracking existing and new metrics. Where data exists, we will compare current performance to baselines. We will also set targets for performance-based metrics such as the *Energy Savings in kWh Conversion Rate.* The new tracking platform will make data mining easier and more transparent. Program staff will have access to the system to monitor their performance metrics and to analyze data.

Conclusion

Embedded evaluation for continuous improvement provides a framework and process in which to assess program components as they currently function, and then as changes are made. With the program manager leading the effort, the embedded evaluation focuses on those areas most important to program staff. Assigning an independent evaluation perspective[2] ensures an objective viewpoint not biased through program experience. This objective viewpoint, coupled with program staff expertise, facilitates thoughtful, unbiased questions (evaluator) and informed responses (program staff). This conversation can lead to unexpected findings and insight.

The data assessment enables program staff to first assess how the program is currently performing, and second to evaluate the effects of program changes. It also provides information on which to base program metric targets.

Embedded evaluation and data mining activities are completed more frequently than standard retrospective evaluation. This provides fast feedback to program staff allowing for quick action to address issues or to explore program adjustments.

Over the next several months, we will assess the effectiveness of this embedded evaluation and data mining effort as we adjust program delivery and assess the effects. We anticipate to have actual data and information to share in August for the ACEEE Summer Study, although it is expected to be limited in number given the long timeframe for customer project completions.

[2] For this effort, an 'independent evaluator perspective' does not refer to working with an evaluator from outside, although this is possible. For our internal embedded evaluation efforts, we assign an evaluation expert from outside the program group, but internal to the firm.