

Cx Associates Testimony Regarding Energy Efficiency Program Evaluation

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Firm Background

Cx Associates is an energy engineering consulting firm, founded in 1994 and based in Burlington, Vermont. The firm currently employs seven full time staff. We have assisted energy efficiency programs in 5 states and have been involved with the evaluation of more than 1.9TWh¹ of annual energy savings.

While “Cx” is the industry abbreviation for building commissioning, Cx Associates does much more than commissioning.

Cx Associates focuses on building energy performance. We provide services including:

- Building commissioning² for new and existing buildings owned by larger institutional and commercial customers in the region
- Energy efficiency program evaluation
- Consulting services on energy efficiency policy, program design, implementation and evaluation
- Building energy studies and oversight of efficiency upgrades for individual customers
- Administration of the LEED certification process³

Cx Associates is a key member of energy efficiency program evaluation teams in the region. In VT our work includes evaluation for commercial and industrial (C&I) programs⁴ administered by Efficiency Vermont and Burlington Electric Department including both verification of annual savings claims and measurement and verification of demand savings bid into the ISO New England’s Forward Capacity Market⁵. We are

¹ TWh – terrawatt hour = 1,000,000,000 kWh

² Building commissioning is a quality assurance process used to ensure that complex building systems are designed, installed and operated to meet the building owner’s needs.

³ LEED, or Leadership in Energy & Environmental Design, is a green building certification program administered by the U.S. Green Building Council that recognizes best-in-class building strategies and practices.

⁴ This work is completed under contract to West Hill Energy and Computing who is the prime contractor to the VT PSD.

⁵ The Forward Capacity Market is an auction administered by ISONE to purchase sufficient capacity for reliable system operation for a future year at competitive prices where all resources, both new and existing, can participate. Demand resources obtained through energy efficiency can be bid into the FCM as if they are

performing technical evaluation for several programs administered by New York State Energy and Resource Development Authority (NYSERDA) and are leading the evaluation of their award winning C&I New Construction Program. Jennifer Chiodo currently serves as the lead consultant on the Massachusetts' nation-leading commercial and industrial programs as well as a consultant on the evaluation of those programs on behalf of the MA Energy Efficiency Advisory Council.

Presenter Background

Jennifer Chiodo is an electrical engineer who spent the first ten years of her career overseeing the engineering systems design of major new buildings⁶ from the San Francisco offices of two leading consulting engineering firms. Chiodo has been working in energy efficiency in Vermont since her tenure at the VT Public Service Department in the mid-1990s. She joined Vermont Energy Investment Corporation (VEIC) in 1996 where she became the Director of the VEIC's burgeoning Business Energy Services Division. Chiodo oversaw the development and implementation of an award winning energy efficiency program called REEP which brought together 5 utilities and State and Regional Weatherization Programs to deliver comprehensive efficiency services to low income multi-family buildings. She was a founding Director of Efficiency Vermont and oversaw the Business Programs for the first contract period. In 2004, Ms. Chiodo left VEIC to join Cx Associates as a partner and has fostered the growth of the organization as a recognized leader in building energy performance.

Chiodo is actively engaged in community service through her work on multiple Boards and the Charlotte Town Energy Committee.

Purpose

The purpose of today's presentation is to provide information and observations about energy efficiency program evaluation.

Energy Efficiency Program Evaluation Background

The National Action Plan for Energy Efficiency⁷ has published the *Model Energy Efficiency Program Impact Evaluation Guide*⁸ which identifies the following key objectives for energy efficiency program evaluation:

1. Document and measure the effects of a program

generation; efficiency providers throughout the region bid the demand resources achieved through energy efficiency into this market resulting in added revenue streams for the states administering those programs.

⁶ Chiodo's projects included Space Ship Earth and the Main Entrance Complex at EPCOT Center, the Monterey Bay Aquarium, the GSA Federal Building (1 million sq ft), university laboratories for Stanford and the UC System, several downtown San Francisco high rises, including 5 Fremont Center and more.

⁷ <http://www.epa.gov/cleanenergy/energy-programs/suca/resources.html>

⁸ http://www.epa.gov/cleanenergy/documents/suca/evaluation_guide.pdf

2. Determine whether the program met its goals as a reliable energy resource
3. Understand why the program effects occurred
4. Identify ways to improve existing and to select new programs

The American Council for an Energy-Efficient Economy (ACEEE) states that “providing evidence of real and reliable savings is essential to assure funding and public support for energy efficiency programs”⁹ in support of rigorous program evaluation.

Types of Energy Efficiency Program Evaluation:

Impact evaluation – verification of the impacts (energy savings, demand savings, avoided emissions, etc.) that are a direct result of the energy efficiency program. Impact evaluations are used to ensure the reliability of program results and to support cost-effectiveness analysis.

Process evaluation – assessment of program delivery to identify bottle necks and effective practices. These evaluations are used to support improvement in program processes to improve cost-effectiveness, address market barriers and increase customer satisfaction.

Market Characterization – studies look at the market (baseline, penetration, etc.) as well as roles of various market actors. These studies help to inform program planning to ensure responsiveness to market conditions in program design and implementation.

Regional Perspective

Because of our work in three of the states that lead the country in energy efficiency program implementation, we are intimately familiar with the best practices in program evaluation across the region. The ACEEE Ranks Massachusetts as first in the nation for energy efficiency, New York as third and Vermont as seventh¹⁰.

We should all be proud of the excellent work that our efficiency utilities¹¹ and the Public Service Department (PSD) are doing to garner cost effective energy efficiency resources for Vermont. The purpose of this testimony is to share my observations on the importance of energy efficiency program evaluation, the need to provide the resources necessary to meet published standards for energy efficiency program evaluation and to provide some context about the potential limitations and benefits of different evaluation approaches with a focus on Impact Evaluation.

Case Study: Impact Evaluation of NYSERDA’s C&I New Construction Program

NYSERDA’s New Construction Program (NCP) provides technical assistance and incentives to support the design and construction of efficient new buildings throughout

⁹ <http://www.aceee.org/topics/emv>

¹⁰ <http://www.aceee.org/sector/state-policy>

¹¹ Efficiency Vermont and the Burlington Electric Department are both designated as Energy Efficiency Utilities in Vermont.

New York State. NYSERDA undertook a comprehensive impact evaluation of the NCP for program years 2007 and 2008. While the scale of both the program and evaluation dwarf Vermont's current spending¹² in this sector, the approaches are scalable.

The impact evaluation included detailed measurement and verification of a statistically valid sample of 39 participant facilities.

1. Engineers went on site and installed meters to determine how the energy efficient equipment supported by the NCP was actually operating.
2. Using the meter data that our team collected and the utility bills for the projects, the evaluation team was able to build accurate models of the energy efficient buildings and the baseline buildings that would have been constructed absent the program.

Based on the engineering analyses, the NCP Impact Evaluation¹³ findings included:

- NYSERDA Claimed Savings: 82.9 GWh/yr¹⁴
- Evaluated Gross Savings: 58.9 GWh/yr

This means that the NCP was delivering 71% of the savings that it was reporting¹⁵. These results provide important feedback to the program administrators and the regulators. Even with the lower savings, the NCP was delivering cost effective energy savings for the State and participants. The Impact Evaluation identified opportunities for the NCP to improve their accuracy in estimating energy savings for their customers and to increase the levels of efficiency delivered by the NCP.

In response to those findings, NYSERDA's NCP made significant changes to program offerings and improved procedures to increase the accuracy of energy analyses and savings estimates. In 2013 the ACEEE recognized NYSERDA's NCP as an Exemplary Energy Efficiency Program. Even though the NCP is a nationally recognized exemplary program, NYSERDA is currently undertaking another impact evaluation for program to understand how the improvements are working and to find areas where they can make further gains in the accuracy of NCP savings estimates.

It is important to understand that while the rate-payer funded energy efficiency programs are making significant investments to help customers attain energy savings, participating customers are making even larger investments to obtain the promised savings. If the savings are routinely falling short of what is predicted, then customers are not receiving a return on their investment and rate-payers are not receiving the

¹² The NCP Program budget for 2009-2013 (the period currently under evaluation) is \$132 million (average annual C&I new construction budget of over \$26 million); the current impact evaluation budget for the NYSERDA NCP from 2009-2013 is \$4 million (3% of program spending). Efficiency VT's C&I new construction program spending was 3.4 million for program year 2012. Vermont does not have a separate evaluation for the C&I NCP.

¹³ <http://www.nysERDA.ny.gov/Publications/Program-Planning-Status-and-Evaluation-Reports/NYSERDA-Evaluation-Contractor-Reports/2012-Reports/Impact-Evaluation.aspx> - New Construction Program [PDF] – Final Report

¹⁴ GWh – gigawatt hour = 1,000,000kWh

¹⁵ This is also known as a gross savings realization rate which is a key output of Impact Evaluations.

promised benefits from the program¹⁶. Unchecked, such trends will ultimately undermine public confidence in energy efficiency programs. The only way to identify this type of issue is through measurement-based Impact Evaluation.

Vermont's Method: Desk Reviews

Vermont uses a verification technique known in the industry as a desk review. This practice has been in place since the early days of Efficiency Vermont. The VT Public Service Department (PSD) has responsibility for verifying Efficiency Vermont's savings claims. Paper verification using a desk review of the efficiency program's files identifies issues such as incorrect application of agreed upon savings formulas or baselines. Unlike true impact evaluation, it does not provide on-site measurement and verification of the project. This methodology is not recognized by the International Performance Measurement and Verification Protocol (IPMVP)¹⁷, which provides guidance on the acceptable methods for verifying energy efficiency savings.

Case Study: Desk Review/Impact Evaluation Comparison

Using a New York NCP project as an example, we can look at the potential for differing results of Desk Reviews and Impact Evaluation.

The project was a newly constructed college laboratory building with comprehensive energy efficiency upgrades and claimed savings of 5 GWh annually. A desk review of the project files showed that a comprehensive energy model was completed by a well-respected engineering firm. The parameters such as baseline and operating conditions were accurately modeled. The project included third party commissioning to verify equipment and operations during construction. The project had a satisfied owner. The savings attributed to this project based purely on a desk review would be 5 GWh annually.

However, using impact evaluation to evaluate the same project provided a significantly different result. The evaluation team performed on site metering and calibrated energy modeling¹⁸ which revealed that the project was in fact saving 2 GWh per year because a key control strategy was never implemented on the building air conditioning system. The impact evaluation included feedback to the customer and NYSERDA about the

¹⁶ Impact evaluation identifies both over and under-estimation of energy savings. A recent impact evaluation in MA resulted in 12% of additional savings from prescriptive lighting resulting in 2GWh of added savings for one program.

¹⁷ The IPMVP is published by the Efficiency Valuation Organization, an international non-profit concerned with the appropriate valuation of energy efficiency savings. <http://www.evo-world.org/>

¹⁸ Calibrated modeling is a process by which a detailed energy model of a building is adjusted to accurately reflect actual energy consumption on a monthly basis. The adjustments are made based on equipment and whole building meter data. Calibrated models used for impact evaluation are developed in compliance with industry standards to be accurate within 15% of the actual building energy consumption for each fuel source used in a building on a monthly basis and typically to be within 5% annually of actual building energy consumption.

absence of this measure¹⁹. Cx Associates provided an estimate of the scope and cost for rectifying the issue to NYSERDA who then worked with the customer and another engineering firm to complete the project and capture the lost savings²⁰.

The ISO New England Forward Capacity Market

Vermont bids electric demand savings resulting from energy efficiency measures supported by the energy efficiency utilities, into the ISO New England Forward Capacity Market. In order for ISO New England to accept demand savings as equivalent to power generation, they require rigorous measurement and verification (M&V) of those savings. The PSD and their evaluation contractors, including Cx Associates, perform rigorous evaluation studies of the demand savings for the Forward Capacity Market every year. This level of rigor is on par with that used for Impact Evaluation, but the scope does not include the evaluation of the annual energy savings estimated by the program.

In addition, the current FCM evaluation contains a significant inefficiency in its methodology that is unique to Vermont. Efficiency Vermont is responsible for metering their large FCM projects²¹. While this approach may have seemed like it would save time and reduce customer impacts, years of troubled project evaluations²² indicate that change is needed.

Recommendations

The recommendations²³ below will bring Vermont into alignment with the approaches used by other national energy efficiency leaders and will increase the veracity of and confidence in Vermont's reported energy efficiency savings.

¹⁹ In this case the measure was missed because the contractor had gone bankrupt during construction and the customer was very satisfied just to have their project completed. The commissioning provider was not hired to verify the measures supported by NYSERDA, but rather to verify the control contractor's submitted approach to the project, which did not include the missing measure.

²⁰ Industry standard practice precludes evaluation contractors from being involved in remedying issues they identify in the field to avoid any potential conflict of interest.

²¹ At the inception of the measurement and verification (M&V) of the FCM savings it was understood that Efficiency Vermont intended to meter most large projects, therefore it seemed to make sense for that meter data to be used for the FCM evaluation. In actuality, EVT meters many projects to determine energy savings, however, such metering often does not meet the requirements of the ISO NE and significant additional effort is required to bring project metering into compliance.

²² Of the 7 EVT projects assigned to Cx Associates to evaluate in the 2012 FCM evaluation, one project had to be dropped from the sample due to lack of meter data and one was only partially evaluated, again due to lack of meter data. Five of the seven projects had to be re-metered due to failure of initial metering to satisfy the ISO NE requirements. Dropping large projects from the sample due to lack of data can introduce bias in the results. This issue has occurred consistently over the course of the FCM evaluation in spite of numerous efforts to rectify it within the current framework.

²³ Disclosure: Cx Associates acknowledges that we provide evaluation services to the State of Vermont. Increases in the rigor of evaluation may benefit our business through increased evaluation budgets to support the added work.

1. Vermont has the opportunity to combine the forward capacity market evaluation with a full Impact Evaluation. This will enable the elimination of Desk Reviews and provide accurate, measurement based, feedback to Vermont's Energy Efficiency Utilities about the accuracy of their savings estimates. While there would be a cost increase associated with such a change, the incremental cost is believed to be relatively small.
2. The responsibility for metering all projects must be with the independent evaluators. This is industry standard practice. In cases where a project file selected for evaluation contains useable meter data obtained in the process of delivering the project, evaluation experts typically validate that data in the field, providing independent verification without adding duplicative metering. Once a project is selected for evaluation, any metering required to complete that evaluation can be most efficiently and effectively provided by the evaluation contractor.

Vermont currently dedicates between 2-3% of energy efficiency spending on evaluation. New York State caps evaluation spending at 5% of program spending and MA, after many years of evaluation spending closer to the 5% mark has lowered evaluation spending to 4% of program spending. Replacing desk reviews with Impact Evaluation and including large project metering in the evaluation scope could increase Vermont's evaluation spending to approximately 3.5% of annual program spending.

Evaluation is a tool that helps to increase the benefits that programs provide to participants and ensures that rate-payer benefits are accurately assessed. It provides independent verification that the large investments paid for with rate-payer dollars are delivering the claimed benefits.