2014–2017 Industrial and Process Efficiency Program Impact Evaluation

Executive Summary

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Executive Summary

The IPE program is a mature industrial resource acquisition program that has been in place since 2009, helping fund a large quantity of custom projects covering many unique and varied measure types. The evaluated savings are based on project-specific measurement and verification (M&V) performed on a statistically representative sample of 55 electric energy savings and 30 natural gas savings projects. Ten projects had a combination of both electric and natural gas savings.

The projects included the evaluation were initiated through NYSERDA's Energy Efficiency Portfolio Standard (EEPS-2)[1] and Clean Energy Fund (CEF)[2] Resource Acquisition Transition chapter funding. Table 1-1 outlines the Program's population of projects for the period of study.

Table 1-1. IPE Program-Reported Savings (1/1/14–12/29/17) for EEPS-2 and CEF Transition Projects

Measure Type/Facility Type	No. of Projects with Completed Measures[a]	Annual Savings	Percentage of Installed Savings
Electric – MWh/yr			
Non-process/all facility types	135	128,810.8	67%
Process/industrial	39	16,434.7	14%
Process/data center	29	22,537.4	20%
Total Electric Savings (MWh/yr)	**188**	**167,782.9**	**100%**
Natural Gas – MMBtu/yr			
Non-process/all facility types	28	232,689	33%
Process/industrial	27	468,752	67%
Process/data center	0	0	0%
Total Natural Gas Savings (MMBtu/yr)	**55**	**701,441**	**100%**

[a] There were 188 distinct electric projects, but 15 of those projects had measures in more than one Facility Type category.

The evaluation objectives and methods are summarized in Table 1-2.

Table 1-2. IPE Program Gross Impact Evaluation Objectives and Methods

Objective	Purpose	Method
Estimate gross energy impacts	To establish annualized first-year evaluated gross energy savings based on electric (kWh) and fuel savings (MMBtu) at the customer site	On-site M&V using on-site logging, custom engineering assessments, and/or billing analysis of a representative sample of Program participants.

[1] Department of Public Service, Filing #4779 Case No. 07-M-0458, 2016

[2] CEF Quarterly Report, Case 14M0094, 2016

The evaluated savings are based on the rigorous project-specific M&V and calculations of representative realization rates (RRs) from a sample of projects from the population. The sample is designed to provide Program gross energy savings with 10% relative precision at 90% confidence for each of three project types (process, data center, and non-process).

The realization rate (RR) for the electric energy savings component of the Program is 0.86. Table 1-3 provides the results of the evaluation effort for electric savings.

Table 1-3. Electric Savings Overall (MWh) and By Facility Type for EEPS-2 and CEF Transition Funded Projects

Metric	All Electric Projects	Industrial Processes	Data Center Processes	Industrial and Data Center Non-Processes
Sample size	55	17	16	22
Population size	188	39	29	135
Weighted tracking savings, MWh	171,336.5	23,712.6	26,673.4	120,950.4
Weighted evaluated savings, MWh	147,984.8	20,353.7	29,069.7	98,561.4
Total reported savings, MWh	167,782.9	16,434.7	22,537.4	128,810.8
Evaluated gross savings, MWh	144,915.6	14,106.7	24,562.1	104,966.8
Weighted RR	86%	86%	109%	81%
Standard error	3.9%	3.5%	3.4%	5.4%
Relative precision at 90% confidence	7.4%	6.7%	5.2%	11.0%
Standard deviation of the RR	0.38	0.38	0.36	0.35
Error ratio	0.34	0.31	0.28	0.35
% of evaluated gross savings	100%	14%	20%	67%

While the sample was designed to achieve 90/10 confidence and relative precision, the non-process group achieved a relative precision of 11%. This is driven by the greater-than-anticipated variability in RR and the lower weighted RR for this group. Further detail on sample design and weighting is included in Appendix A.

The RR for the natural gas savings component of the Program is 0.91. Table 1-4 provides the results of the evaluation effort for natural gas savings.

Table 1-4. Natural Gas Savings (MMBtu) Overall and By Facility Type for EEPS-2 and CEF Transition Funded Projects

Metric	All Natural Gas Projects	Industrial Processes	Industrial and Data Center Non-Processes
Sample size	30	16	14
Population size	55	27	28
Weighted tracking savings, MMBtu	701,646	475,182	226,464
Weighted evaluated savings, MMBtu	635,861	439,768	196,093
Total reported savings, MMBtu	701,441	468,752	232,689
Evaluated gross savings	635,675	433,817	201,483
Weighted RR	91%	93%	87%
Standard error	0.8%	1.1%	1.1%
Relative precision	1.5%	2.0%	2.1%
Standard deviation of the RR	0.35	0.33	0.39
Error ratio	0.42	0.47	0.38
% of evaluated gross savings	100%	69%	31%

The Impact Evaluation Team analyzed the evaluation findings in terms of whether or not Program M&V had been performed. The IPE program requires that M&V be performed by the applicant for projects whose savings exceed a certain threshold.[3] Table 1-5 presents the RRs for electric and natural gas projects with and without Program M&V.

Table 1-5. Electric and Natural Gas Unweighted Realization Rates Dependent on Program M&V

Fuel Type	With Program M&V	Without Program M&V
Electric, kWh	96%	81%
Natural gas, MMBtu	93%	83%

The strong RRs of projects receiving Program M&V is indicative of successful and critically important Program M&V; without Program M&V, reported savings would be less precise. A review of the difference between PIR and M&V phase savings yields an average absolute change between the two phases of 17%. Recent gross impact evaluations of large custom industrial programs in Massachusetts and California yielded lower RRs then those found in the current or previous IPE evaluations. Table 1-6 provides the RRs from those recently published studies.

[3] See Appendix C for Program M&V thresholds.

Table 1-6. Recent National Industrial Program Impact Evaluation Results

Realization Rates	Previous IPE Evaluation	Current IPE Evaluation	Massachusetts C&I Impact Evaluation of 2013 Custom Process[a]	California 2013–2015 Custom Impact Evaluation[b]	California 2010–2012 Annual Progress Evaluation Report Industrial Findings[c]
kWh RR	91%	86%	63%	44%–66%	60%–70%
MMBtu RR	96%	91%	N/A	50%–63%	60%–70%

[a] Massachusetts Commercial and Industrial Impact Evaluation of 2013 Custom Process Installations, published 2017: http://ma-eeac.org/wordpress/wp-content/uploads/MA-2013-CI-Custom-Process-Impact-Evaluation.pdf

[b] California 2013–2015 Custom Impact Evaluation Results, published 2017: http://www.calmac.org

[c] California 2010–2012 Energy Efficiency Annual Progress Evaluation Report, published 2015, industrial findings: http://www.cpuc.ca.gov/General.aspx?id=6391

A review of the differences between the program-reported and evaluated savings demonstrates some findings that are valuable for improvement of the program.

The majority of savings differences occurred at Measure Performance, after installation of the project. For projects that received Program M&V, many of these differences are driven by changes that took place after Program M&V (e.g., a different load profile that represents a new typical operation) and could not have been predicted by the Program. The Application Review category also shows significant differences, and these should be the target for improvement in the future, as they are attributable to issues in the savings calculations that were likely preventable.

The differences are dispersed among numerous categories, and while certain categories represent a larger portion of the differences, it is important to note that no systemic differences were found. Differences, even within a given category, were diverse in nature and reflect the unique nature of the projects and the TRs approach to estimating energy savings.

A small number of high-impact differences occurred in the electric sample, and 7 of these 10 are related to supercomputer measures. Supercomputer sites trend toward very large savings, representing 40% of the sampled energy savings in this study. A key finding related to these projects is related to investigation of the baseline efficiency for a given supercomputer. All cases were partially or entirely capacity expansion projects, so the baseline case includes a theoretical "standard efficiency" supercomputer operating at the same loads. The program established a protocol for calculating the baseline efficiency of supercomputers in 2013 (and later revised slightly in 2018), which was thoroughly reviewed as a part of this evaluation. This baseline determination document is available by request from NYSERDA.

Recommendations

- **Calculate and track demand impact in accordance with the New York State Technical Resource Manual.** Going forward, it is recommended that all IPE projects with a component of electrical energy savings have the peak demand impacts calculated in accordance with the New York Technical Resource Manual (NYTM). This will allow the Program to track demand impact values that have been calculated in a uniform manner and within the guidelines of the Department of Public Service and to claim these values in regulatory reporting. Even if not a key metric right now, demand and energy historically have cycled back and forth in terms of relative importance. Grid resiliency and related concerns are gaining visibility. It may be prudent and worth the relatively small marginal effort to estimate demand savings at the same time and with similar rigor as energy savings.
- **Leverage all available site-specific data during the EA phase.** Impactful differences were associated with the EA phase of project review. These differences ranged from the use of non-site-specific data, a misuse or non-use of trend data, and errors in calculations. It is recommended that Technical Reviewers leverage all available site-specific data and review their assumptions with the site to ensure their understanding of the project is in-line with the participant's intent. Many of the differences were preventable, and this recommendation should not incur additional cost to the Technical Reviewers or the Program.
- **Continue with Program M&V and baseline characterization procedures.** As presented in Table 2-7, above, the IPE program has achieved strong realization rates for both electric and natural gas savings for the past two evaluations. These results are largely attributable to the rigorous M&V requirements of the Program, and to the standardized and detailed methodology[4] that is used to characterize the baseline alternative considered in the individual project savings calculations. The Program staff is experienced and successfully leverage these tools, as evidenced by the strong RRs. The Impact Evaluation Team recommends that the IPE program continue with Program M&V and the use of a standardized baseline characterization protocol, as they represent best practices in the implementation of an industrial program, particularly one that considers a wide variety of large and complex custom measures.

[4] Available by request from NYSERDA.