



NYSERDA

Energy Efficiency Portfolio Standard (EEPS-2) Program Quarterly Report to the Public Service Commission

Quarter Ending December 31, 2016

Final Report

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Advance innovative energy solutions in ways that improve New York's economy and environment.

Vision Statement:

Serve as a catalyst – advancing energy innovation, technology, and investment; transforming New York's economy; and empowering people to choose clean and efficient energy as part of their everyday lives.

**Energy Efficiency Portfolio Standard
(EEPS-2) Program**
Quarterly Report to the Public Service Commission
Quarter Ending December 31, 2016

Final Report

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1 Introduction

This quarterly report reflects progress on Energy Efficiency Portfolio Standard (EEPS-2) Program evaluation activities administered by the New York State Energy Research and Development Authority (NYSERDA). This report contains the anticipated schedule and status of current and upcoming evaluation studies, summaries of recently completed evaluations, and the status of evaluation recommendations through December 31, 2016. Information contained within this report comports with the guidance received from the New York State Department of Public Service (DPS) and discussed with the Evaluation Advisory Group in July 2012 and the E2 Working Group in March 2014.

2 Evaluation Reports Completed

NYSERDA finalized the Home Performance with ENERGY STAR® impact evaluation report in the fourth quarter of 2016.

3 Evaluation Status Update

Tables 3-1 and 3-2 provide the anticipated schedule and status of current and upcoming impact, process, and market evaluation activities by program. As applicable, table notes provide further clarification and information about study timing. Planned evaluation projects and timing may change based on input from internal and external stakeholders, the EEPS evaluation review, and program progress. Likewise, evaluation project schedules are subject to change based on progress in administering the evaluation studies themselves. Future quarterly reports will highlight any timeline revisions. Timeline revisions made this quarter are designated by cell shading. PY denotes program year and Q denotes quarter.

Table 3-1. Impact Evaluation Schedule and Status

EEPS Program	Impact Evaluation Schedule					
	Detailed Evaluation Plan Submittal	Project Kickoff	Data Collection Complete	Draft Report	Final Report	Notes
Industrial & Process Efficiency (Phase 2)	Completed	TBD	TBD	TBD	TBD	Last report finalized in April 2015. EEPS-2 closeout Impact Evaluation plans in development.
Existing Facilities	Completed	TBD	TBD	TBD	TBD	Last report finalized in November 2015. EEPS-2 closeout Impact Evaluation plans in development.
Agriculture	TBD	TBD	TBD	TBD	TBD	EEPS-2 closeout Impact Evaluation plans in development.
New Construction	TBD	TBD	TBD	TBD	TBD	Last report finalized in May 2016. EEPS-2 closeout Impact Evaluation plan to be developed.
Agriculture Disaster	Completed	Completed	Completed	Completed	Completed	Final report completed July 2014. Program closed. No further evaluations planned.
FlexTech	Completed	TBD	TBD	TBD	TBD	Last report finalized in March 2012. EEPS-2 closeout Impact Evaluation plans in development.
Commercial Existing Buildings Non-Participant Spillover Study	Completed	Completed	Completed	Completed	Completed	Last report finalized in December 2013. No future evaluation plans in this area.
Multifamily Performance Program	Completed	TBD	TBD	TBD	TBD	Last report finalized in February 2015. EEPS-2 closeout Impact Evaluation plans in development.

Table 3-1 continued

EEPS Program	Impact Evaluation Schedule					
	Detailed Evaluation Plan Submittal	Project Kick-off	Data Collection Complete	Draft Report	Final Report	Notes
Point of Sale (POS) Lighting	Completed	Completed	Completed	Completed	Completed	Reports for 2012–2013 finalized in May 2014. Program closed. No further plans.
EmPower New York	Completed	TBD	TBD	TBD	TBD	Last report finalized in May 2015. EEPS-2 closeout Impact Evaluation plans in development.
Home Performance with ENERGY STAR®	Completed	Completed	Phase 2 Completed	Phase 2 Completed	Phase 2 Q4 - 2016	Report Finalized.
New York ENERGY STAR® Certified Homes	n/a	Completed	Q1 2017	Q1 2017	Q1 2017	In order to best inform possible future program investments, NYSERDA has narrowed the scope of this evaluation to focus on performance of Net Zero Energy projects.

* TBD indicates that final plans for EEPS-2 closeout evaluation are under development at this time.

Table 3-2. Process and Market Evaluation Schedule and Status

EEPS Program	Process and Market Evaluation Schedule					
	Detailed Evaluation Plan Submittal	Project Kick-off	Data Collection Complete	Draft Report	Final Report	Notes
Existing Facilities	Completed	Completed	Completed	Completed	Completed	Last process evaluation completed in February 2012. Last market evaluation completed in September 2012. Future Market Evaluation plans are defined within NYSERDA's Clean Energy Fund (CEF) Investment Plan, both in the Market Characterization and Design Chapter (MCDC) and other sector-specific chapters.
Agriculture	n/a	n/a	n/a	n/a	n/a	Cancelled for EEPS. Future Market Evaluation plans are defined within NYSERDA's CEF Investment Plan.
New Construction	Completed	Completed	Completed	Completed	Completed	Final report completed October 2014. Future Market Evaluation plans are defined within NYSERDA's CEF Investment Plan.
Agriculture Disaster	Completed	Completed	Completed	Completed	Completed	Final report completed September 2012. Program closed. No further evaluations planned.
FlexTech	Completed	Completed	Completed	Completed	Completed	Final report completed July 2014. Future Market Evaluation plans are defined within NYSERDA's CEF Investment Plan.
Multifamily Performance Program	Completed	Completed	Completed	Completed	Completed	Final report completed August 2014. Future Market Evaluation plans are defined within NYSERDA's CEFI Investment Plan.
Point of Sale Lighting	Completed	Completed	Completed	Completed	Completed	Reports for 2012–2013 finalized in May 2014. Program closed. No future evaluations planned.

Table 3-2 continued

EEPS Program	Process and Market Evaluation Schedule					
	Detailed Evaluation Plan Submittal	Project Kick-off	Data Collection Complete	Draft Report	Final Report	Notes
EmPower New York	Completed	Completed	Completed	Completed	Completed	Last process evaluation completed in July 2010. Future Market Evaluation plans for Low- to Moderate-Income are defined within NYSERDA's CEF Investment Plan: MCDC.
Home Performance with ENERGY STAR®	Completed	Completed	Completed	Completed	Completed	Report finalized
New York ENERGY STAR® Certified Homes	n/a	n/a	n/a	n/a	n/a	NYSERDA's CEF Investment Plan: MCDC includes plans for a Net Zero Energy Homes market assessment in 2016. This study takes the place of an EEPS Market Evaluation focused on ENERGY STAR® Homes.
C&I Natural Gas Market Characterization	Completed	Completed	Completed	Completed	Completed	Report finalized

3.1 Recommendation Tracking

Recommendations generated from NYSERDA evaluation studies are tallied in Table 3-3.

These recommendations are categorized as follows:

- Total Number of Recommendations Made to Date¹: Cumulative number of recommendations contained in final NYSERDA evaluation reports.
- Total Number of Recommendations Implemented to Date: Cumulative number of recommendations contained in final NYSERDA evaluation reports that have been implemented and incorporated into programs.
- Total Number of Recommendations Rejected to Date: Cumulative number of recommendations contained in final NYSERDA evaluation reports that have been rejected.
- Total Number of Recommendations Currently in Progress: Cumulative number of recommendations contained in final NYSERDA evaluation reports that NYSERDA are still under consideration for implementation or rejection.

Table 3-3. Recommendation Tracking

Total Number of Recommendations	Through December 31, 2016
Made to Date	229
Implemented to Date	161
Rejected to Date	22
Currently in Progress	46

¹ The Total Number of Recommendations Made to Date only includes recommendations made in Final (not Interim) evaluation reports.

4 Other Information

Per the DPS reporting guidance, this section provides an opportunity to report significant activities or events not already reflected in the report. This section is not for reporting routine activities.

There are no other significant activities requiring explanation for the fourth quarter of 2016.

Appendix A: Completed Evaluation Summaries

This appendix contains a high-level summary of each recently completed evaluation study. The full report on each evaluation study is available on the NYSERDA website. The Home Performance with ENERGY STAR impact evaluation report was finalized in the fourth quarter of 2016.

NYSERDA Home Performance with ENERGY STAR® (PY2010-2013) Impact Evaluation Summary

Evaluation Conducted by: Energy Resource Solutions (ERS) Impact Evaluation Team
West Hill Energy and Computing, Lead Investigators, November 2016

PROGRAM SUMMARY

From 2012 to early 2016, the ERS Impact Evaluation Team conducted a two-phase impact evaluation of NYSERDA’s HPwES Program. This study included a billing analysis of HPwES participant homes to estimate natural gas and electric savings, an assessment of the possible reasons for the low realization rates found in previous evaluations, and an estimate of additional savings not currently claimed by HPwES but which are generated by homeowners who received free or reduced-cost energy audits through the Green Jobs - Green New York (GJGNY) Program and installed energy efficiency measures outside of the HPwES Program.

The HPwES Program encourages owners and tenants of existing one- to four-family homes to implement comprehensive energy efficiency improvements by working with participating contractors accredited by the Building Performance Institute.

EVALUATION OBJECTIVE AND HIGH LEVEL FINDINGS

The overall objective of this evaluation was to develop a deeper understanding of how the Program is performing and how the performance could be improved, as well as extracting general learning applicable to future initiatives in this area. The evaluation involved a combination of primary and secondary research.

The HPwES PY 2010 to 2011 Impact Evaluation had three main components (Table 1):

- Phase 1 Billing Analysis (PY 2010–2011)
- Phase 2 Investigation into Program Savings
- Green Jobs - Green New York Audit-Only Impact Evaluation (PY 2010–2013)

Table 1. Evaluation Components and Objectives

Evaluation Component	Objective	Evaluation Activities
Phase 1 Billing Analysis	Estimate realization rate (RR) for electric and natural gas savings	1. Billing analysis
Phase 2 Investigation into Program Savings	Understand the reasons behind the RRs from recent billing analyses	1. Analysis of program QA files 2. Review contractor survey
GJGNY Audit-Only Impact Evaluation	Quantify potential savings from GJGNY audit-only participants	1. Screener survey to identify implementation rates 2. Billing analysis 3. Program influence cognitive interviews

DETAILED IMPACT EVALUATION FINDINGS

NYSERDA began the GJGNY audit program in November 2010 to provide free or reduced-cost audits and to encourage participation in the HPwES Program. HPwES eligible measures include building shell measures, such as air sealing and insulation; appliances, such as ENERGY STAR refrigerators; heating measures, such as boilers and furnaces; cooling measures, such as ENERGY STAR room or central air conditioners; and certain renewable energy technologies.

The previous evaluation is summarized in the 2007–2008 Home Performance with ENERGY STAR Program Impact Evaluation Report, prepared by Megdal and Associates (now Analytical Evaluation Consultants) with West Hill Energy and Computing as the primary investigator, dated September 2012.¹ A compilation of the results is presented in Table 2.

PHASE 1 BILLING ANALYSIS

The objective of this evaluation component was to estimate first-year energy savings for project years (PYs) 2010–2011 Home Performance with ENERGY STAR Program participants. The fixed effects natural gas billing model included 5,009 participating homes, and the electric model included 3,185 homes. The results for the Phase 1 analysis and the previous billing analysis are presented in Table 2.

Table 2. Comparison of Savings for HPwES Billing Analyses

	Phase 1 PY 2010-2011		PY 2007-2008 Evaluation	
	Annual Electric Savings	Annual Natural Gas Savings	Annual Electric Savings	Annual Savings for All Other Fuels
Realization Rate (RR)	19%	48%	35%	65%
90% Confidence Interval	+/-9%	+/-1%	+/-22%	+/-7%
Average evaluated savings per household	154 kWh	13.3 MMBtu	315 kWh	17.3 MMBtu
Percentage of pre-installation use saved*	2%	14%	3%	16%
Number of homes in the model	3,185	5,009	2,536	1,462
Number of utilities in the model	7	7	3	3

* The annual consumption during the pre-installation period was averaged for all homes in the billing models. The “percentage of pre-installation use saved” is the average annual evaluated savings divided by the annual average pre-installation consumptions.

¹ 2012 NYSERDA Evaluation Reports - NYSERDA

PHASE 2 INVESTIGATION INTO PROGRAM SAVINGS

Two separate evaluation activities were conducted to investigate the program savings and assess possible reasons for the low realization rates:

1. Analysis of program Quality Assessment (QA) activities
2. Review of the survey of participating contractors

For the analysis of the QA activities, 100 projects from each year from 2010 to 2012 and 150 projects from each year from 2013 to 2014 were randomly selected from the QA inspections completed in those years. An additional 30 projects from 2010 to 2011 that had undergone administrative review were selected in the hopes they would have TREAT modeling files available for review.²

Five hypotheses were developed to assess the reasons for the consistent overstatement of program-reported savings:

1. Model inputs inaccuracy
2. Software algorithm inaccuracy
3. Reconciliation to pre-installation consumption not done
4. Errors in data transfers
5. Quality of the installations

A summary of the results is provided in Table 3 below.

Table 3. Summary of Hypothesis Testing

Hypothesis	Evidence	Impacts	Potential Size of Impact on RR's
Contractors' model inputs are not accurate	Strong indication	Efficiency of pre-installation conditions may be understated, increasing both pre-installation consumption and savings.	Large
Software model algorithms are not accurate	Possible indication	Some interactive effects may slightly overstate savings; older homes may be more difficult to model accurately. The source of the electric space-heating savings is unclear, and the savings appear to be overstated.	Small for natural gas/ large for electric

² The Impact Evaluation Team later learned that TREAT modeling files were not available.

Table 3 Continued

Hypothesis	Evidence	Impacts	Potential Size of Impact on RR's
No reconciliation to bills	Strong indication	Program files rarely have bills entered; if they were entered, the modeled consumption was much higher than bills. Comparison to bills provides an important reality check on savings.	Large
Errors in data transfer	No indication	Model output was compared to program tracking, and the data matched.	None
Installation quality	Possible indication	Review of QA records indicated 24% of homes had some installation issue that could affect savings. From the information available, it seems that issues may be small.	Possible, needs additional research

REVIEW OF THE PARTICIPATING CONTRACTOR SURVEY

Evaluators fielded a contractor survey to serve multiple evaluation needs in September and October 2014. The impact evaluation used the survey results for two purposes:

1. To gather information that may be relevant to understanding why the program RRs are low.
2. To identify other areas of research to further investigate the reasons for low RRs.

Table 4 below summarizes the potential additional research to be conducted; it is organized by the Impact Evaluation Team's five topic areas.

Table 4. Summary of Areas for Future Research

Topic	Survey Findings	Future Impact Evaluation Research Areas
Staff hiring and training	Frequency of BPI certified auditors, installers, and supervisors; value of BPI training	Specifics on how training is done, what is expected, who covers the costs, etc.
Internal QA/QC	Frequency of QA/QC inspections and call backs	Content of inspections, use of diagnostic equipment, and how projects are selected for QA site visits
Modeling/ customer billing records	Contractors' perceptions on the value of modeling and issues with completing the modeling and obtaining customers' bills	Accuracy of inputs and frequency of reconciliation to participants' billing records
Use of diagnostic testing	Frequency of use of diagnostic tools, such as blower door tests and infrared scans, for audits	Use of diagnostic equipment during installations and to troubleshoot problems
Installation practices	Heating system sizing	Wide range of other issues about installation practices

As a result of these analyses, the Impact Evaluation Team recommends conducting in-person interviews along with direct data collection activities, including a combination of riding along with contractors and pre- and post-installation inspections.

GREEN JOBS - GREEN NEW YORK AUDIT-ONLY SAVINGS

This component of the evaluation was designed to investigate whether Green Jobs - Green New York (GJGNY) audit-only participants were generating energy savings outside of the HPwES Program and to estimate the savings from these installations.

This component of the evaluation had three parts:

1. **Initial screening survey** to identify GJGNY audit-only participants who had installed major measures and to create the sampling frame for the billing analysis.
2. **Billing analysis** to estimate the savings from the measures that were recommended in the audit report but installed outside of the Program.
3. **Cognitive interviews** to gain insights into decision making, assess program influence, and test an alternative approach to quantifying program influence through the use of pairwise comparisons³.

³ Pairwise comparisons are often used in cognitive interviews where the respondent is asked several questions about influence. A pairwise comparison is any process of comparing entities in pairs to judge which entity is preferred, or has a greater amount of some quantitative property, or whether or not the two entities are identical. This was used to test a method to assign program influence.

EVALUATION METHODS AND SAMPLING

Green Jobs - Green New York Audit-Only Screener Survey

The Impact Evaluation Team designed the Audit-only survey for the following purposes:

1. Determine the frequency of installations outside of the HPwES Program.
2. Collect detailed information necessary for a billing analysis of GJGNY audit-only recipients who have natural gas space heating.
3. Request data release forms to request utility billing records.

The survey was fielded via the web with follow-up phone calls to GJGNY audit recipients who did not respond electronically. NYSERDA's survey contractor, Abt/SBRI, conducted the survey. No incentives were offered for completing the survey or returning the utility consumption release form.

A total of 3,930 surveys were completed, which represented a 21% response rate, as shown in Table 5.

Table 5. Green Jobs - Green New York Screener Survey Responses

Measures Installed	Number of Participants	In Billing Analysis	Not in Billing Analysis
Installed Major EE Measures	1,348	358	990
Installed Minor EE Measures	675	0	675
Did not Install EE Measures	1,907		
Total	3,930	358	1,665

Billing Analysis

From the screener survey, the Impact Evaluation Team received utility billing records for 186 of the 209 respondents who provided the release forms. The billing analysis was restricted to natural gas savings, as there were only a few respondents with electric measures (92 of the 186 homes), and the primary electric measure was lighting, which tends to have small savings that are difficult to estimate through a billing analysis.

After cleaning the data, there were 133 homes in the final billing analysis model. These GJGNY audit recipients saved about 7.4 MMBtu per year on average per home, which is about half of the HPwES per-home savings estimated in the Phase 1 billing analysis. The 7.4 MMBtu per year corresponds to about 8% of the pre-installation consumption of these homes, and the relative precision of the estimated savings was 18%. Attempts to model measure savings at a more granular level were unsuccessful, most likely due to the low number of homes in the model.

Cognitive Interview Objectives and Process

The Impact Evaluation Team designed an alternative approach to estimating program influence, the Barriers Approach, and tested this new method through cognitive interviews. The Barriers Approach is based on identifying the barriers to measuring installation, the relative importance of these barriers, and the extent to which the Program helped the participants overcome the barriers.

The cognitive interviews were designed to provide insight into the following areas:

- Do the identified barriers (lack of information, time, money, and finding a contractor) cover the full range of barriers experienced by homeowners?
- Are we using terminology that homeowners understand?
- Do the pairwise comparisons make sense to the survey respondents?
- Does the approach to quantifying program influence provide numerical scores that seem reasonable in the context of the story told by the survey respondent?

The sample frame for the GJGNY cognitive interviews consisted of the respondents to the initial screener survey who had installed at least one major efficiency measure outside of the HPwES Program and had agreed to participate in a second survey. The sample frame was randomly ordered. All interviews were audio recorded, and recordings were provided to four expert reviewers.

VALUE OF MODELING

Conducting a diagnostic audit and modeling the household energy consumption and potential savings is a cornerstone of the HPwES Program. While modeling is a complex task and the results are imperfect, it is still the best alternative for estimating energy savings from both the contractors' and homeowners' perspectives, as is evident from the responses to the contractor survey fielded by NYSERDA's Process Evaluation Team, shown in Table 6.

Table 6. Responses from the Contractor Survey

Survey Responses
Participating contractors reported conducting highly comprehensive audits and demonstrated strong support for the diagnostic audit approach to home performance.
90% of surveyed contractors said modeling gives their firm an advantage . Two-thirds (67%) said that being able to demonstrate savings and/or payback was a unique advantage.
81% indicated they always recommend a diagnostic audit , and half reported that they will not provide simple walk-through audits. Contractors who provide walk-through audits indicated these cases apply only to homeowners who had an audit recently or had a single specific issue.

PROGRAM RECOMMENDATIONS

We recommend the following steps to improve the NYSERDA’s Home Performance with ENERGY STAR Program (“HPwES” or “Program”) and the Green Jobs - Green New York (GJGNY) audit-only impact evaluation.

Improving the Estimation of Program Savings for the HPwES Program

Program Recommendation #1: Continue the Diagnostic Audit and Modeling as Core Components of the HPwES program

The diagnostic audit and modeling should remain core components of the Program as they were clearly identified as valuable tools by both contractors and participants. Work with contractors to underscore the value of modeling and the importance of accurately modelling the pre-installation conditions.

Evaluation Recommendation #2: Expand Evaluation Methods

Consider alternative approaches to investigate the reliability of modeling inputs and installation quality, such as pre- and/or post-installation inspections, riding along with contractors and/or work-site inspections. As the Program seeks to adapt to changing conditions, evaluators can provide insight into strategies used in other jurisdictions and methods to ensure that the impacts of innovations can be compared to traditional NYSERDA HPwES programs.

GJGNY Audit-Only Impact Evaluation

Evaluation Recommendation #3: Expand Barrier Research

The cognitive interviews suggest that the barriers to installation of measures can be effectively researched through methods such as pairwise comparisons. This approach has the potential to provide useful information for the design and development of future interventions in this market. Understanding the homeowners’ perspectives is the key to developing effective market transformation interventions, outreach, and services.

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