

# **EEPS Commercial & Multifamily Close-Out Impact Evaluation, including National Fuel Gas Distribution Corporation's Non-Residential Rebate Program**

*Final Report*

## *EXECUTIVE SUMMARY*

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## Notice

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# 1 Executive Summary

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This impact evaluation is a final reporting of Energy Efficiency Portfolio Standard (EEPS) funded commercial programs; it studies the gross impact of three NYSERDA EEPS–funded legacy programs and one National Fuel Gas Distribution Corporation (NFGDC) program:<sup>1</sup>

- NYSERDA Existing Facilities Program (EFP)
- NYSERDA Multifamily Performance Program (MPP)
- NYSERDA Commercial New Construction Program (CNCP)
- NFGDC Non-Residential Rebate Program, administered by NYSERDA and delivered with EFP during the early part of the evaluation period, run by NFGDC in the latter part of the period

**Objectives.** The primary objective was to determine verified gross savings (VGS)<sup>2</sup> for electric energy, electric demand, and natural gas energy and calculate corresponding realization rates for each of the four programs, with no worse than 10% relative precision at 90% confidence. The evaluated period of performance covered projects completed in 2014 through 2018 Q2 for EFP natural gas, NFGDC, and MPP, and 2016 through 2018Q2 for EFP electricity and NCP.

With one of the programs no longer being offered and two substantially different from the version offered during the evaluation period, recommending program improvements was a limited secondary objective.

**Evaluation History.** The NYSERDA programs have been evaluated frequently in the last decade with the most recent impact studies in 2015–2016 for all NYSERDA and NFGDC programs. There were also impact evaluations in 2012 for EFP and CNCP, process evaluations in 2012 and 2013, and market characterization studies in 2012 and 2013. The evaluations have shown a collective upward trend in realization rates (RR), which has continued with this evaluation; many programs have achieved RRs near 1.0.

**Methodology.** For each program, the evaluators selected a statistically representative sample of projects and evaluated their impact through a combination of engineering desk reviews of application materials, interviews with participants, and site-specific billing analysis. Site visits with long-term metering were not in the scope for this set of evaluations, as the programs were either ending or undergoing substantial redesign and had intensive on-site measurement & verification (M&V) in their prior evaluations. The analysts aggregated the site-specific

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<sup>1</sup> NYSERDA’s EFP has ended. CNCP and MPP are continuing but in substantially altered form. NFGDC Non-Residential Rebate program is stable and continuing.

<sup>2</sup> Called “evaluated gross savings” in prior NYSERDA evaluation reports. New York Department of Public Service CE-08: Gross Savings Verification Guidance, August 23, 2019. <http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7BB53F3D02-2292-4F10-AC79-EDBE5C0860C7%7D>

results and prepared a discrepancy analysis to describe and quantify why evaluator savings differed from program estimates.

## 1.1 Results Summary

The overall electric and natural gas realization rates (RR) for each evaluated program are provided in Tables 1-1 and 1-2, respectively.

**Table 1-1. EEPS Evaluation Electric Results by Program**

| Program | Reported First-Year Electric Savings (MWh) | Evaluated First-Year Electric Savings (MWh) | Electric RR | Relative Precision at 90% Confidence Interval |
|---------|--|---|-------------|---|
| EFP     | 130,259                                    | 127,897                                     | 0.98        | ±2.0%   |
| CNCP    | 85,004                                     | 84,548                                      | 0.99        | ±5.5%   |

**Table 1-2. EEPS Evaluation Natural Gas Results by Program**

| Program                            | Reported First-Year Gas Savings (MMBtu) | Evaluated First-Year Gas Savings (MMBtu) | Gas RR | Relative Precision at 90% Confidence Interval |
|------------------------------------|---|--|--------|---|
| EFP                                | 264,182                                 | 259,366                                  | 0.98   | 0.7%  |
| NFGDC -2014 - 2015 <sup>1</sup>    | 77,057                                  | 58,837                                   | 0.76   | 9.5%  |
| NFGDC -2016 – Q2 2018 <sup>2</sup> | 50,897                                  | 50,530                                   | 0.99   | 4.9%  |
| MPP <sup>3</sup>                   | 1,069,545                               | 867,301                                  | 0.81   | ±4.0%   |
| CNCP                               | 141,869                                 | 101,191                                  | 0.71   | ±6.8%   |

<sup>1</sup> EEPS funded and administered by NYSERDA through EFP.

<sup>2</sup> 2016 – Q2 2018 results for NFGDC are reported separately because this portion of the program was ETIP/SEEP funded and continues to be administered by NFGDC.

<sup>3</sup> The MPP reported and evaluated savings values reflect all fossil fuels, including fuel oils and district steam. The MPP’s funding sources over the studied program years emphasized gas impacts only. As a result, the MPP typically tracked measure impacts as natural gas, including for incremental savings from fuel conversion measures. Evaluators therefore developed a fossil fuel-neutral RR that does not unnecessarily penalize the program in light of the tracking limitations established by gas-specific funding sources.

## 1.2 Existing Facilities Summary

This section provides an overview of the EFP/NFGDC evaluation methodology, results, and recommendations.

### 1.2.1 EFP and NFGDC Evaluation Methods Summary

This evaluation developed estimates of project RRs for program-reported natural gas savings for EFP and NFGDC for 2014 – Q2 2018, and EFP electric custom savings for 2016 – Q2 2018. Methods included verifying the installation of efficiency measures and the generation of an independent savings analysis. All sites in a representative sample of participating custom electric and natural gas projects underwent desk review of project documentation and phone or email communication with site personnel to verify equipment installation and

operational parameters. The evaluators did not conduct site visits or metering for EFP or NFGDC sites. Billing analysis was conducted for those gas sites where billing data was available.

### 1.2.2 EFP and NFGDC Evaluation Results Summary

Evaluation results for EFP and NFGDC are presented below for gas and electric projects.

#### 1.2.2.1 NYSERDA

The evaluation of the EFP electric projects included some projects that also received incentives under NYSERDA’s Demand Management Program (DMP). Those demand savings were also evaluated, but the results are not statistically representative of the DMP population. The following tables provide these summaries.

**Table 1-3. Existing Facilities Overall Electric Results**

| Subset       | Achieved Sample | Total Reported Savings (MWh) | Total Evaluated Savings (MWh) | Evaluated Gross RR | Relative Precision |
|--------------|-----------------|------------------------------|-------------------------------|--------------------|--------------------|
| Upstate      | 8               | 20,878                       | 21,173                        | 1.01               | 3.0%               |
| Downstate    | 17              | 109,380                      | 106,724                       | 0.98               | 2.4%               |
| <b>Total</b> | <b>25</b>       | <b>130,259</b>               | <b>127,897</b>                | <b>0.98</b>        | <b>2.0%</b>        |

**Table 1-4. Existing Facilities Demand Management Program Results**

| Subset   | Achieved Sample | Total Reported Savings (MW) | Total Evaluated Savings (MW) | Evaluated Gross RR | Relative Precision |
|--|-----------------|-----------------------------|------------------------------|--------------------|--------------------|
| DMP  | 12              | 3.20                        | 3.26                         | 1.02               | N/A                |
| DMP projects were not sampled for specifically and, consequently, although an RR was calculated, it is not representative of the DMP population. |                 |                             |                              |                    |                    |

**Table 1-5. Existing Facilities NYSERDA Natural Gas Results**

| Subset       | Achieved Sample | Total Reported Savings (MMBtu) | Total Evaluated Savings (MMBtu) | Evaluated Gross RR | Relative Precision |
|--------------|-----------------|--------------------------------|---------------------------------|--------------------|--------------------|
| Upstate      | 21              | 215,158                        | 211,850                         | 0.98               | 0.8%               |
| Downstate    | 5               | 48,023                         | 47,516                          | 0.98               | 1.3%               |
| <b>Total</b> | <b>26</b>       | <b>264,182</b>                 | <b>259,366</b>                  | <b>0.98</b>        | <b>0.7%</b>        |

**1.2.2.2 NFGDC**

**Table 1-6. Overall NFGDC Gas Results**

| Subset                       | Achieved Sample | Total Reported Savings (MMBtu) | Total Evaluated Savings (MMBtu) | Evaluated Gross RR | Relative Precision |
|------------------------------|-----------------|--------------------------------|---------------------------------|--------------------|--------------------|
| 2014 to 2015 <sup>1</sup>    | 15              | 77,057                         | 58,837                          | 0.76 <sup>2</sup>  | 9.5%               |
| 2016 to Q2 2018 <sup>3</sup> | 15              | 50,897                         | 50,530                          | 0.99               | 4.9%               |
| <b>Total</b>                 | <b>30</b>       | <b>127,955</b>                 | <b>109,367</b>                  | <b>0.86</b>        | <b>5.6%</b>        |

<sup>1</sup> EEPS funded and administered by NYSERDA through EFP.  
<sup>2</sup> RR discrepancies from tracking/clerical issues with high impact from one large savings value reported incorrectly, and eight projects with adjustments to parameters utilized in analysis algorithms or TRM methods.  
<sup>3</sup> 2016 – Q2 2018 results for NFGDC are reported separately because this portion of the program was ETIP/SEEP funded and continues to be administered by NFGDC.

**1.2.3 Existing Facilities Conclusions and Recommendations Summary**

**NYSERDA:** Overall, the RRs in the EFP evaluation were very close to 1. The impact evaluation team found that the program estimated savings well for both electric and natural gas saving measures. The evaluators did, however, encounter challenges with the tracking data and project documentation in several instances. Some projects had missing files or the files contained information that did not match the tracking database. Additionally, the tracking data itself did not contain all the information needed to evaluate the programs effectively. As this program is not continuing, these issues do not justify a recommendation, but the need for accurate tracking data correlated with project documentation is relevant to other ongoing NYSERDA programs.

**NFGDC:** The findings and recommendations for the NFGDC Non-Residential Rebate Program are summarized below.

**1. The program is estimating natural gas savings well.**

The RRs for projects in the latter time period of this evaluation were very close to 1. The 2014–2015 NFGDC gas program achieved a much lower RR attributable to record keeping and algorithm/TRM adherence. Since 2015, the program has instituted practices that are effective in estimating natural gas savings and the program RR has improved significantly. These include post-installation inspections as well as some project M&V performed by their implementation contractor.

- **Recommendation:** Continue performing M&V for custom projects. This process seems to be accurately estimating natural gas savings. Additionally, where fiscally possible, we recommend doing site-level M&V during the next evaluation cycle to continue reviewing the savings estimates being calculated by the program.

## 2. Project documentation is critical for evaluation and verification of savings estimates.

There were some missing project documents from a time period in the evaluation that was administered by a different implementation contractor than the Program is currently using. This lack of documentation caused some minor logistical challenges with this evaluation. This is one of the reasons why the former implementation contractor was relieved from their duties associated with NRCIP. These issues have been resolved with the newer implementation contractor.

- **Recommendation:** Ensure that the program continues its current practice of collecting and retaining project documents at a regular interval from the implementation contractor to ensure consistent and complete tracking of projects and the associated documentation.

## 1.3 Multifamily Performance Program Summary

### 1.3.1 MPP Evaluation Methods Summary

MPP evaluation techniques generally reflected those in Executive Summary Section 1.2.1 with three notable exceptions:

1. The MPP evaluation sample was stratified to develop results by market (affordable housing<sup>3</sup> vs. market rate) and payment stage (receiving performance payment<sup>4</sup> or not).
2. The evaluators most frequently assessed the sampled MPP projects using site-specific analysis of pre- and post-project utility consumption data, normalized to reflect any fluctuations in occupancy.
3. The evaluation team quantified savings persistence among 49 sampled projects for which at least two years of post-project consumption data was available.

### 1.3.2 MPP Evaluation Results Summary

Table 1-7 summarizes the MPP evaluation results.

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<sup>3</sup> NYSERDA defines affordable housing as buildings in which at least 25% of the residential units are, or are expected to be, occupied by households earning 80% or less of the regional or statewide median income, whichever is higher.

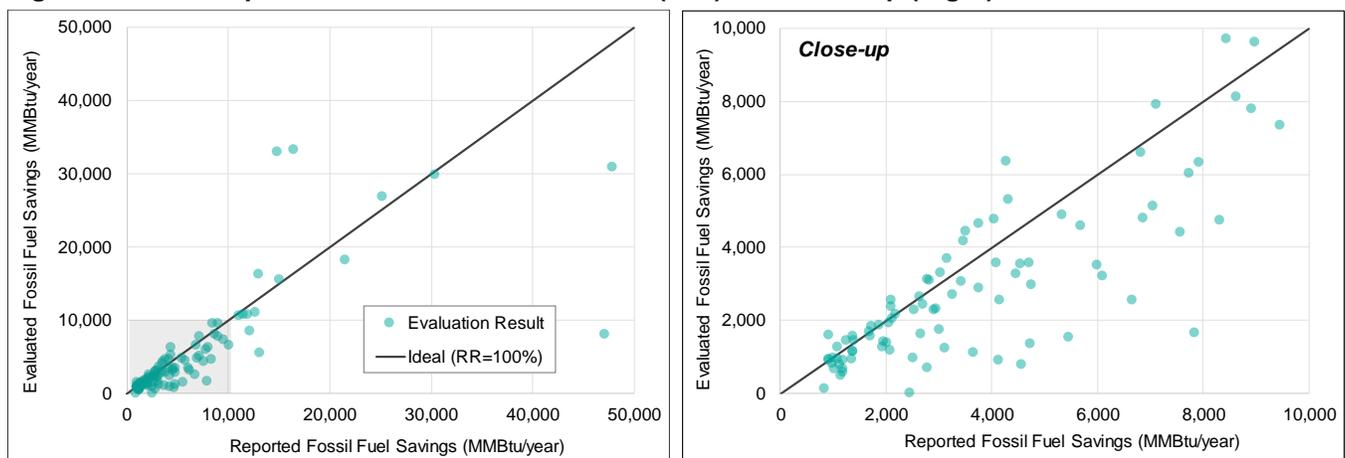
<sup>4</sup> Participating facilities are eligible for a bonus incentive payment (the “performance payment” or payment #4) if the target energy reduction is demonstrably achieved when comparing at least 12 months of pre- and post-project utility consumption data.

**Table 1-7. Multifamily Performance Program Results Summary**

| Upper-Level Stratum |                     | Count Projects 2014 – Q2 2018 | Reported Savings (All Fossil Fuels, MMBtu/year) | Evaluated Savings (All Fossil Fuels, MMBtu/year) | RR          | Relative Precision at 90% Confidence |
|---------------------|---------------------|-------------------------------|---|--|-------------|--------------------------------------|
| Affordable          | 100% Complete       | 220                           | 536,823   | 392,528  | 0.73        | ±5.6%                                |
| Affordable          | Performance Payment | 50                            | 127,709   | 150,106  | 1.18        | ±5.2%                                |
| Market Rate         | 100% Complete       | 77                            | 345,142   | 263,951  | 0.77        | ±10.3%                               |
| Market Rate         | Performance Payment | 12                            | 59,872  | 57,404   | 0.96        | ±4.4%                                |
| <b>Total</b>        |                     | <b>359</b>                    | <b>1,069,545</b>                                | <b>867,301</b>                                   | <b>0.81</b> | <b>±4.0%</b>                         |

The MPP realized 81% of reported fossil fuel MMBtu savings over the studied program years. As observed in prior evaluation cycles and hypothesized for this study, the projects that received the performance payment performed better than those that did not. The evaluation results are more precise than predicted, due to lower variability in results (actual error ratio [ER] = 0.6) compared with assumed variability in the sample design (ER = 1.0). Figure 1-1 illustrates performance and variability of evaluated projects, with the rightmost figure a close-up of the gray box in the left.

**Figure 1-1. MPP Impact Evaluation Results: Overall (Left) and Close-Up (Right)**



Overall, the key contributors to the 81% realization rate include differences in equipment efficiency (-4% impact to the overall RR), weather normalization (-4%), and occupancy (4% increase).

### 1.3.3 MPP Conclusions and Recommendations Summary

The MPP evaluation findings and recommendations are summarized below and expanded on in Section 3.5 of the main report.

1. The MPP achieves aggressive reductions in fossil fuel consumption at multifamily buildings. While this evaluation addressed fossil fuels only, the evaluators found that MPP projects result in a 23% reduction in pre-project fossil fuel consumption on average.

2. The program’s MMBtu savings claims have become more accurate. The prior impact evaluation<sup>5</sup> of the MPP (2013-14) determined a fossil fuel performance factor<sup>6</sup> of 0.60, whereas this evaluation found a fossil fuel realization rate of 0.81.
3. Projects receiving the performance payment performed significantly better (RR = 111%) than those that did not (RR = 74%). The evaluators found no significant differences in performance between affordable and market rate projects.
4. The evaluators commend the MPP for its comprehensive data tracking and archiving practices.
5. The MPP does not, however, adequately track impacts by specific fuel type. The program frequently claimed all fossil fuel impacts as natural gas, even when fuel conversions occurred (e.g., #2 fuel oil to natural gas). Such inaccuracies underestimate the program’s carbon emissions reduction impacts.
  - **Recommendation:** The program should enhance its savings tracking protocols to allow more accurate reporting of fuel-specific impacts. After discussions with program staff, the evaluators are encouraged to hear that such improvements are underway.
6. Projects with an “anchor” measure – a high-impact upgrade of a building’s central heating or hot water system – performed better than those without. For example, projects with a boiler measure (n = 71) achieved 87% of reported MMBtu savings, while projects without a boiler measure (n = 35) achieved 70%.
7. The program’s savings models generally differed from real-world performance in three cases:
  - a. Condensing boilers typically did not achieve the modeled performance efficiencies due to higher-than-expected return water temperatures (RWTs).
    - **Recommendation:** Modeled condensing boiler measures should reflect a realistic efficiency value based on the installed boiler’s performance curve and the RWTs identified in the post-installation inspection report.
  - b. Controls and weatherization measures are difficult to characterize using modeling software.
    - **Recommendation:** The program should require supplemental supporting evidence, such as measurement-based justification for model inputs, for any proposed controls, weatherization, or

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<sup>5</sup> The evaluators note that projects over the program years previously evaluated, 2009-11, were primarily SBC-funded. Therefore, fossil fuel savings were not the focus of such projects, but the program nonetheless reported those impacts and evaluators assessed them in the prior study.

<sup>6</sup> In the prior study, the term was used in place of realization rate to denote that the Impact Evaluation Team did not recommend the application of this factor during future program reporting. The term “performance factor” was associated with ancillary fossil fuel impacts as well as any supplemental analysis findings for which statistical significance was not planned to be achieved.

re-commissioning measures that claim savings of more than 10% of pre-project whole-building consumption.

- c. The program’s simulation software uses TMY3 weather files to represent typical weather conditions, whereas evaluators used 11-year (2008–2018) NOAA weather averages to define typical conditions. This difference resulted in slightly lower HDDs and evaluated savings.

- **Recommendation:** The MPP (and NYSERDA) should establish a uniform definition of typical weather.

- 8. The evaluators found that MPP savings persist from the first year after project completion to the second year. In fact, savings are constant from the first to second year, while third-year savings increase slightly.

## 1.4 Commercial New Construction Summary

This section provides an overview of the CNCP evaluation methodology, results, findings, and recommendations.

### 1.4.1 CNCP Evaluation Methods Summary

CNCP evaluation techniques generally reflected those used in the EFP evaluation. The evaluation team used multiple sources – measure operation profiles and as-built conditions (verified through phone interviews), as-built drawings and billing data, commissioning reports, and post-installation inspection reports – to update technical analysis energy savings calculations for whole building, custom, and prequalified projects.

### 1.4.2 CNCP Evaluation Results Summary

Tables 1-8 and 1-9 summarizes the CNCP evaluation results.

**Table 1-8. CNCP Overall Electric Results**

| Measure Type | Count Projects: 2016–Q2 2018 (EEPS 2) | Sampled Projects | Reported Savings (MWh/year) | Evaluated Savings (MWh/year) | Realization Rate | Relative Precision at 90% Confidence | Error Ratio |
|--------------|---------------------------------------|------------------|-----------------------------|------------------------------|------------------|--------------------------------------|-------------|
| Electric     | 251                                   | 50               | 85,004                      | 84,548                       | 0.99             | 5.52%                                | 0.32        |

**Table 1-9. CNCP Overall Natural Gas Results**

| Measure Type | Count Projects: 2016–Q2 2018 (EEPS 2) | Sampled Projects | Reported Savings (MMBtu/year) | Evaluated Savings (MMBtu/year) | Realization Rate | Relative Precision at 90% Confidence | Error Ratio |
|--------------|---------------------------------------|------------------|-------------------------------|--------------------------------|------------------|--------------------------------------|-------------|
| Gas          | 27                                    | 17               | 141,869                       | 101,191                        | 0.71             | 6.81%                                | 0.43        |

Key contributors to the 99% electric RR include incorrect baselines (-4% impact to the overall RR), differences in operations (+1%), changes in the as-built equipment quantity (+1%), and incorrect algorithm or TRM references (+1%). Key contributors to the 71% gas RR include differences in operation (-11%), errors in the reported tracking savings (-10%), measures not installed (-7%) and incorrect baselines (-3%).

### 1.4.3 CNCP Conclusions

The CNCP evaluation findings are summarized below and expanded on in Section 4.5 of the main report. NYSERDA staff should review the current CEF program to see if the program is at risk for the process and methodological errors found in this evaluation.

1. Baseline-related discrepancies had the largest impact (-4%) on program electric RR and a notable impact (-3%) on gas RR. Most baseline discrepancies were due to the baseline energy models not being developed correctly or the wrong value being used in the model to define a baseline parameter.
2. There were two occurrences where energy savings from other fuels were reported as natural gas savings. For these two projects, the evaluators assigned a realization rate of 0 as no natural gas savings were obtained even though the project may have saved on the non-incented fuel. As more emphasis is placed on carbon reduction, accurate fuel characterization is important.
3. The evaluators recorded 18 instances where reported measures were not installed, resulting in a -2% impact on the electric RR and a -7% impact on the gas RR. The evaluators confirmed that the measures were not installed either through a phone interview with the site contact or via the post-inspection and commissioning reports present in the project files. Because post-inspection and commissioning reports indicated that measures were not installed yet tracking savings did not reflect this, the evaluators believe the tracking savings are not consistently updated to reflect post-installation and commissioning report findings.
4. There were at least 14 occurrences where the evaluators observed discrepancies in the Technical Assistant (TA) calculations of TRM values (hours, energy savings factor, etc.) for the application.
5. For several project files, neither the as-built mechanical drawings nor the complete modeling files were available, preventing the evaluators from replicating the TA evaluator modeling approach. Referencing these documents would have improved the efficiency and accuracy of the evaluation.