



Small Business Energy Efficiency Program Impact Evaluation Report

Energy Efficiency Plan: Plan Year 6 (PY6)
(6/1/2016-12/31/2017)

Presented to
Nicor Gas Company

FINAL

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1. INTRODUCTION

This report presents the results of the impact evaluation of the Nicor Gas PY6 Small Business Energy Efficiency Program (SBEEP or Small Business Program). It presents a summary of the energy impacts for the total program and broken out by relevant measure and program structure details. The appendix presents the impact analysis methodology. PY6 covers June 1, 2016 through December 31, 2017.

2. PROGRAM DESCRIPTION

The SBEEP is designed to assist qualified Nicor Gas non-residential customers¹ to achieve natural gas energy savings by educating them about energy efficiency opportunities through on-site assessments conducted by trade allies (TAs) and installation of no-cost direct-install (DI) natural gas energy efficiency measures. Further energy savings are available to participating customers through prescriptive and custom incentives offered for select contractor-installed (CI) natural gas efficient measures. The SBEEP is implemented by CLEAResult.

The PY6 program was essentially the same as the PY5 program, which experienced lowered rebates for space heating and steam traps, reduced marketing and outreach efforts.²

The program had 73 participants in PY6 and completed 85 projects as shown in the following table.

Table 2-1. PY6 Volumetric Summary

Participation	Custom	Direct Install	Prescriptive Rebate	Total
Participants*	3	19	51	73
Installed Projects†	3	21	61	85

Source: Nicor Gas tracking data and Navigant team analysis.

* Participants are defined as unique BuildingPremiseIDs provided in the tracking data.

† Installed Projects are defined as unique VendorProjectIDs provided in the tracking data.

Table 2-2 summarizes the installed measure quantities that are the basis for verified energy savings.

¹ To qualify for SBEEP, customers must be active Commercial and Industrial (C&I) customers of Nicor Gas who use no more than 60,000 therms per year.

² Nicor_Gas_GPY5_Q4_Quarterly_Report.pdf

Table 2-2. PY6 Installed Measure Quantities

Measure	Quantity Unit	Installed Quantity
Custom Measures	Projects	3
ENERGY STAR Fryer	Each	2
High Efficiency Boiler	Each	2
High Efficiency Furnace	Each	18
High Efficiency Pre-Rinse Spray Valve	Each	11
Infrared Heaters (all sizes), Low Intensity	Each	1
Low Flow Faucet Aerators (Bath)	Each	46
Low Flow Faucet Aerators (Kitchen)	Each	5
Low Flow Showerheads	Each	38
Pipe Insulation - Dry Cleaner	Linear Feet	817
Pipe Insulation, Indoor Hot Water DHW	Linear Feet	3,224
Pipe Insulation, Indoor LPS Space Heat	Linear Feet	12,548
Small Commercial Programmable Thermostats	Each	14
Small Pipe Insulation	Linear Feet	180
Space Heating Boiler Tune-up	Each	9
Steam Trap Replacement or Repair	Each	172
Water Heater Wrap	Linear Feet	36

Source: Nicor Gas tracking data and Navigant team analysis.

3. PROGRAM SAVINGS SUMMARY

Table 3-1 summarizes the energy savings the Small Business Program achieved by path in PY6.

Table 3-1. PY6 Annual Energy Savings Summary

Program Path	Ex Ante Gross Savings (Therms)	Verified Gross RR*	Verified Gross Savings (Therms)	NTGR†	Verified Net Savings (Therms)
Custom	7,897	121%	9,539	0.93	8,871
Direct Install	2,260	100%	2,263	0.93	2,104
Prescriptive Rebate	171,371	100%	171,452	0.93	159,453
Total	181,528	101%	183,254	0.93	170,428

Source: Nicor Gas tracking data and Navigant team analysis.

* Realization Rate (RR) is the ratio of verified gross savings to ex ante gross savings, based on evaluation research findings.

† Net-to-Gross Ratio (NTGR) is the ratio of verified net savings to verified gross savings. The NTGR is a deemed value. Source: Nicor_Gas_GPY6_NTG_Values_2016-02-29_Final.xlsx, which is to be found on the Illinois SAG web site: <http://ilsag.info/net-to-gross-framework.html>.

4. PROGRAM SAVINGS BY MEASURE

The program includes 16³ measures as shown in the following table. The Pipe Insulation, Indoor LPS Space Heat and Steam Trap measures contributed the most savings.

Table 4-1. PY6 Annual Energy Savings by Measure

Measure	Ex Ante Gross Savings (Therms)	Verified Gross RR*	Verified Gross Savings (Therms)	NTGR†	Verified Net Savings (Therms)
Custom Measures	7,897	121%	9,539	0.93	8,871
ENERGY STAR Fryer	3,535	100%	3,537	0.93	3,289
High Efficiency Boiler	692	100%	692	0.93	643
High Efficiency Furnace	4,478	100%	4,478	0.93	4,165
High Efficiency Pre-Rinse Spray Valve	1,085	100%	1,084	0.93	1,009
Infrared Heaters (all sizes), Low Intensity	451	100%	451	0.93	419
Low Flow Faucet Aerators (Bath)	281	100%	281	0.93	261
Low Flow Faucet Aerators (Kitchen)	37	100%	37	0.93	35
Low Flow Showerheads	821	100%	822	0.93	765
Pipe Insulation - Dry Cleaner	3,555	100%	3,555	0.93	3,306
Pipe Insulation, Indoor Hot Water DHW	11,329	101%	11,442	0.93	10,641
Pipe Insulation, Indoor LPS Space Heat	103,716	100%	103,716	0.93	96,456
Small Commercial Programmable Thermostats	382	100%	381	0.93	355
Small Pipe Insulation	15	94%	15	0.93	14
Space Heating Boiler Tune-up	11,649	100%	11,649	0.93	10,834
Steam Trap Replacement or Repair	31,569	100%	31,537	0.93	29,330
Water Heater Wrap	37	103%	38	0.93	35
Total	181,528	101%	183,254	0.93	170,428

Source: Nicor Gas tracking data and Navigant team analysis.

* Realization Rate (RR) is the ratio of verified gross savings to ex ante gross savings, based on evaluation research findings.

† Net-to-Gross Ratio (NTGR) is the ratio of verified net savings to verified gross savings. The NTGR is a deemed value. Source: Nicor_Gas_GPY6_NTG_Values_2016-02-29_Final.xlsx, which is to be found on the Illinois SAG web site: <http://ilsag.info/net-to-gross-framework.html>.

³ Excluding Custom project measures

5. IMPACT ANALYSIS FINDINGS AND RECOMMENDATIONS

Table 5-1 shows the unit therm savings and realization rate findings by measure from our review. The realization rate is the ratio of the verified savings to the ex ante savings. Following the table, we provide findings and recommendations, including discussion of all measures with realization rates above or below 100 percent. Appendix 1 provides a description of the impact analysis methodology.

Table 5-1. Verified Gross Savings Parameters

Measure	Unit Basis	Ex Ante Gross (therms/unit)	Verified Gross (therms/unit)	Realization Rate	Data Source(s)
Boiler Tune Up, Space Heating	Each	1,294.34	1,294.34	100%	IL TRM v5.0 Section 4.4.2
Condensing Boilers, >90%	Each	345.87	345.87	100%	IL TRM v5.0 Section 4.4.10
Custom Measures	Project	Varies	Varies	121%	PTD*
DHW WH Pipe Wrap - 6' - DI	Linear Feet	1.03	1.06	103%	IL TRM v5.0 Section 5.4.1
Faucet Aerators - Bath - DI	Each	6.10	6.10	100%	IL TRM v5.0 Section 4.3.2
Faucet Aerators - Kitchen - DI	Each	7.44	7.44	100%	IL TRM v5.0 Section 4.3.2
Fryer - E >50%	Each	505.00	505.23	100%	IL TRM v5.0 Section 4.2.7
Furnace, >95% AFUE	Each	248.80	248.80	100%	IL TRM v5.0 Section 4.4.11
Infrared Heaters	Each	451.00	451.00	100%	IL TRM v5.0 Section 4.4.12
Low Flow Shower Heads - DI	Each	21.60	21.63	100%	IL TRM v5.0 Section 4.3.3
Pipe Insulation - Dry Cleaner	Linear Feet	4.35	4.35	100%	IL TRM v5.0 Section 4.4.14
Pipe Insulation, Indoor Hot Water DHW	Linear Feet	3.51	3.55	101%	IL TRM v5.0 Section 4.4.14
Pipe Insulation, Indoor LPS Space Heat	Linear Feet	8.27	8.27	100%	IL TRM v5.0 Section 4.4.14
Programmable Thermostat Commercial	Each	27.25	27.25	100%	IL TRM v5.0 Section 4.4.18
Salon Sprayer	Each	102.33	102.28	100%	IL TRM v5.0 Section 4.2.11
Small Pipe Insulation, 1/2, Indoor Space Heat	Linear Feet	0.086	0.081	94%	IL TRM v5.0 Section 4.4.24
Spray Valve (Med Sized Restaurants)-DI	Each	171.92	171.92	100%	IL TRM v5.0 Section 4.2.11
Spray Valve (Small Restaurants)-DI	Each	57.31	57.31	100%	IL TRM v5.0 Section 4.2.11
Steam Trap, Commercial	Each	89.46	89.23	100%	IL TRM v5.0 Section 4.4.16
Steam Trap, Dry Cleaner	Each	515.28	515.28	100%	IL TRM v5.0 Section 4.4.16

* Program Tracking Data (PTD) provided by Nicor Gas, extract dated February 27, 2018.

† State of Illinois Technical Reference Manual version 5.0 from <http://www.ilsaq.info/technical-reference-manual.html>.

The “Pipe Insulation, Indoor LPS Space Heat” measure had savings that were based on Equivalent Full Load Hours (EFLH) value of 4,963 hours, which is the deemed value for heating seasonal recirculation systems. Navigant found the tracking system did not explicitly indicate whether specific projects have year-round recirculation, seasonal recirculation or non-recirculation systems. Navigant asked the implementer to provide their basis for choosing the EFLH assumption and was told the program requires the customer to provide information on their heating recirculation type on the application. In instances where the customer omitted this detail, Nicor Gas would reach out to the customer to collect this information. Navigant selected two projects and asked that Nicor Gas provide the application information

to demonstrate their data collection. The project application materials confirmed the recirculation system as heating season only. Navigant determined that the measure gross realization rate is 100 percent. Nicor Gas has indicated that changes will be made to the tracking database for the 2018 program year.

Recommendation 1. We recommend that Nicor Gas update the tracking system to include a field that provides the data collected on the application form indicating when a heating system has a year-round recirculation, seasonal recirculation or non-recirculation, and track the associated EFLH value provided in the TRM (there is already a field for EFLH).

The IL TRM v5.0 deems an energy savings value of 0.081 therms per linear foot for “Small Pipe Insulation, 1/2, Indoor Space Heat” measures installed in Retail – Strip malls. The ex ante calculations used a value of 0.086 therms per linear feet which is not consistent with the building type and climate zone, leading to the realization rate of 94 percent.

Recommendation 2. Use the TRM deemed savings per linear feet for small pipe insulation, and ensure they are consistent with the building type and climate zone. Otherwise, provide inputs in the tracking database to justify a custom savings calculation.

For DHW WH Pipe Wrap and Pipe Insulation, and Indoor Hot Water DHW, Navigant used the input assumptions provided in the tracking data to calculate the verified savings. The small discrepancy in the realization rates were due to rounding error of the input assumptions provided in the tracking database for savings calculation. For dry cleaner pipe insulation, the ex ante savings used a custom calculation with a 0.4 thermal regain factor (TRF), based on weighted average of 70% indoor (TRF=0.15) and 30% indoor unconditioned space (TRF = 1), based on hours of use during heating season. This value is acceptable but should be documented in the tracking system.

Recommendation 3. Use the verified per unit savings for DHW WH Pipe Wrap and Pipe Insulation, and Indoor Hot Water DHW, while minimizing rounding errors, and ensuring that results are consistent with the building type and climate zone. For Dry Cleaner Pipe Insulation, correct the thermal regain factor in the tracking system to the custom average value (0.4), to be consistent with the calculation of 4.35 therms/ln.

Other Findings and Recommendations

Navigant conducted file reviews on the three custom projects that the Small Business Program received in PY6. The following findings are related to the custom projects

Project NG06-004 involved the replacement of two roofs at a greenhouse facility. The solar heat gain coefficient (SHGC) factor, which indicates how much solar radiation can travel through a material, directly affects the facility’s savings from the roof replacement. The greater the roof material’s SHGC factor, the more solar radiation can travel through the roof. The initial calculation reduced both the existing and proposed SHGC values per a note from the implementation contractor stating, “accounts for dirt, some areas appear to have a film.” Navigant updated the SHGC values for both the existing and proposed materials to their specification values.

Recommendation 4. Navigant recommends that the implementation contractor not update savings factors with degradation based on visible observations. The accumulation of a film on a material will likely be similar on the existing and proposed surfaces over time, and thus the difference in SHGC values between existing and proposed materials will stay consistent.

Project NG06-033 involved the installation of HVAC controls. The savings calculation employed a billing analysis approach using monthly billing data. The heating degree-day (HDD) values used in the ex ante savings estimate were calculated using a base temperature of 65°F. The verified savings instead

calculated HDDs using a base temperature of 57°F. Navigant identified this base temperature by running a series of regressions that calculated HDDs with differing base temperatures and selecting the base temperature that yielded the largest R² value (i.e., best fit) for the regression. The range of base temperatures considered in this project was 54°F to 66°F. This approach accounts for building characteristics that are difficult to quantify such as internal heat gains.

Recommendation 5. For custom calculations that use HDDs, Navigant recommends calculating the HDD base temperature using a building-specific base temperature, identified using a grid-search approach such as that described above. Typical base temperatures will range from 50°F to 70°F, though extreme circumstances such as high internal heat gains (e.g., industrial ovens) or overheating (e.g., poorly controlled steam systems in multifamily buildings) may result in base temperatures outside of that range.

Project NG06-056 involved demand control ventilation (DCV) and outdoor air (OA) minimums reset on HVAC controls at a surgical center. Verification of this project occurred over two program years, represented by project NG05-074 in PY5 and project NG06-056 in PY6. Project NG06-056 was an updated analysis of project NG05-074 from PY5, which utilized facility HVAC data to calculate savings. Project NG06-056 was analyzed several months after the HVAC controls reset was complete and could utilize updated facility natural gas usage. The facility gas usage history allowed an updated savings estimate using a billing analysis that calculated the facility baseline and post-installation gas usage to determine savings. For both the ex ante and verified savings calculations, the difference between the gross savings calculated using the billing analysis and the savings calculated using facility HVAC data (NG05-074) were the savings attributed to Project NG06-056 in PY6.

The implementer's billing analysis savings approach was documented in project NG06-056. Savings were initially calculated averaging baseline and post-installation gas usage using average therms/day values for month or two-month periods. This method of taking an average of average therm usage values is not optimal and was updated to calculate average baseline and post-install usage values by dividing the cumulative sum of therms used divided by the cumulative sum of days for both baseline and post-install therms/day calculations.

Recommendation 6. Navigant recommends when calculating average therms/day values to calculate baseline and post-install gas usage in a billing analysis, to calculate the average values by dividing the cumulative sum of therms by the cumulative number of days those therms were used. This avoids calculating average baseline and average post-install therm usage using already calculated average therms/day values.

Recommendation 7. Navigant recommends that for projects with a savings estimate split over two program years that the implementer indicate a multi-year assessment in the first-year tracking data. The supporting documents for the first year of the project should include a thorough explanation of why the project savings are being analyzed in two steps, the method of initial savings calculation, and what the initial savings were. The supporting documents for the second year should describe the updated method and savings of the final calculation (this was done for NG06-056).

6. APPENDIX 1. IMPACT ANALYSIS METHODOLOGY

Navigant's evaluation in PY6 involved verifying the compliance of the Small Business Program gross savings with the Illinois Technical Reference Manual (TRM v5.0)⁴ or applying, where necessary, research adjustments to non-deemed savings in the tracking database and calculating verified net impact savings using the net-to-gross ratio (NTGR) deemed through Illinois Stakeholder Advisory Group (SAG) consensus.⁵

Navigant determined verified gross savings for each program measure by:

1. Reviewing the savings algorithm inputs in the measure tracking data for agreement with the TRM or evaluation research for non-deemed measures.
2. Validating that the savings algorithm was applied correctly.
3. Cross-checking ex ante per-unit savings values in the tracking data for each installed measure with Navigant's verified savings calculations.
4. Multiplying the verified per-unit savings value by the quantity reported in the tracking data.

Engineering Review of Project Files

Additionally, the evaluation team conducted engineering desk file reviews of all three custom projects installed in PY6 (a census), to verify project savings that were not based on measures specified in the TRM.

For each project, an in-depth application review was performed to assess the engineering methods, parameters and assumptions used to generate all ex ante impact estimates. For each measure in the sampled project, engineers estimated ex post gross savings based on their review of documentation and engineering analysis.

To support this review, the implementation contractor provided project documentation in electronic form for each sampled project. Documentation included some or all scanned files of hardcopy application forms and supporting documentation from the applicant (invoices, measure specification sheets, and vendor proposals), pre-inspection reports and photos (when required), post-inspection reports and photos (when conducted), and calculation spreadsheets.

⁴ Illinois Statewide Technical Reference Manual for Energy Efficiency Version 4.0, available at: <http://www.ilsag.info/technical-reference-manual.html>

⁵ http://ilsagfiles.org/SAG_files/NTG/2016_NTG_Meetings/Final_Documents/Nicor_Gas_NTG_Summary_GPY1-6_2016-02-29_Final.pdf

7. APPENDIX 2. PROGRAM-SPECIFIC INPUTS FOR THE ILLINOIS TRC

Table 7-1 the Total Resource Cost (TRC) variable table, only includes cost-effectiveness analysis inputs available at the time of finalizing the PY6 Small Business Program impact evaluation report. Additional required cost data (e.g., measure costs, program level incentive and non-incentive costs) are not included in the tables and will be provided to the evaluation team later. Detail in the TRC tables (e.g., EULs), other than final PY6 savings and program data, are subject to change and are not final.

Table 7-1. TRC Test Inputs for Nicor Gas Small Business Program

Measure/Project	Units	Quantity	Effective Useful Life	Ex Ante Gross Savings (Therms)	Verified Gross Savings (Therms)	Verified Net Savings (Therms)
Custom Measures	Project	3	16	7,897	9,539	8,871
ENERGY STAR Fryer	Each	7	15	3,535	3,537	3,289
High Efficiency Boiler	Each	2	20	692	692	643
High Efficiency Furnace	Each	18	17	4,478	4,478	4,165
High Efficiency Pre-Rinse Spray Valve	Each	11	5	1,085	1,084	1,009
Infrared Heaters (all sizes), Low Intensity	Each	1	12	451	451	419
Low Flow Faucet Aerators (Bath)	Each	46	9	281	281	261
Low Flow Faucet Aerators (Kitchen)	Each	5	9	37	37	35
Low Flow Showerheads	Each	38	10	821	822	765
Pipe Insulation - Dry Cleaner	Linear Feet	817	15	3,555	3,555	3,306
Pipe Insulation, Indoor Hot Water DHW	Linear Feet	3,224	15	11,329	11,442	10,641
Pipe Insulation, Indoor LPS Space Heat	Linear Feet	12,548	15	103,716	103,716	96,456
Small Commercial Programmable Thermostats	Each	14	4	382	381	355
Small Pipe Insulation	Linear Feet	180	15	15	15	14
Space Heating Boiler Tune-up	Each	9	3	11,649	11,649	10,834
Steam Trap Replacement or Repair	Each	172	6	31,569	31,537	29,330
Water Heater Wrap	Each	36	15	37	38	35
Total/Weighted Average		17,131	13	181,528	183,254	170,428

Source: Nicor Gas tracking data and Navigant team analysis.