



Home Energy Rebate Impact Evaluation Report

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

Presented to
Peoples Gas and North Shore Gas

FINAL

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TABLE OF CONTENTS

1. Introduction	1
2. Program Description	1
3. Program Savings Summary	4
4. Program Savings by Measure	5
5. Impact Analysis Findings and Recommendations	7
Impact Parameter Estimates	7
6. Appendix 1. Impact Analysis Methodology	9
7. Appendix 2. Impact Analysis Supplemental Information	11
8. Appendix 3. Program-Specific Inputs for the Illinois TRC	13

LIST OF TABLES AND FIGURES

Table 2-1. PY6 Volumetric Summary for PGL	1
Table 2-2. PY6 Installed Measure Quantities for PGL	2
Table 2-3. PY6 Volumetric Summary for NSG	2
Table 2-4. PY6 Installed Measure Quantities for NSG	3
Table 3-1. PY6 Annual Energy Savings Summary for PGL	4
Table 3-2. PY6 Annual Energy Savings Summary for NSG	4
Table 4-1. PY6 Annual Energy Savings by Measure for PGL	5
Table 4-2. PY6 Annual Energy Savings by Measure for NSG	6
Table 5-1. Verified Gross Savings Parameters	7
Table 6-1. Profile of Gross Impact Sample for Insulation Projects	9
Table 6-2. Gross Therm Realization Rates and Relative Precision at 90% Confidence Level	10
Table 7-1. Attic Insulation Project Detail	11
Table 7-2. Foundation Wall Insulation Project Detail	11
Table 7-3. Wall Insulation Project Detail	12
Table 8-1. TRC Inputs for PGL	13
Table 8-2. TRC Inputs for NSG	14

1. INTRODUCTION

This report presents the results of the impact evaluation of the Peoples Gas (PGL) and North Shore Gas (NSG) PY6 Home Energy Rebate program. It presents a summary of the energy impacts for both the total program and broken out by relevant measure and program structure details, for each utility. The appendix presents the impact analysis methodology. PY6 covers June 1, 2016 through December 31, 2017.

2. PROGRAM DESCRIPTION

The Home Energy Rebate program provides rebates to PGL and NSG residential customers who make energy-saving improvements to their homes. The program is composed of two distinct offerings: 1) HVAC and other equipment, and 2) weatherization improvements. The HVAC and equipment offering incentivizes contractor-installed energy efficient furnaces, boilers, and water heaters, as well as customer-installed programmable and advanced (smart) thermostats. The weatherization offering incentivizes trade ally installed home insulation measures, air sealing and duct sealing. Franklin Energy Services (Franklin Energy) implements both offerings for both utilities.

The PGL program had 6,038 participants in PY6 and completed 6,875 projects as shown in the following table.

Table 2-1. PY6 Volumetric Summary for PGL

Participation	HVAC and Equipment	Weatherization	Total
Participants †	5,369	693	6,038
Installed Projects ‡	6,180	695	6,875
Measure Types Installed	8	5	13

Source: Peoples Gas tracking data and Navigant team analysis.

† Participants are defined as number of unique gas account numbers

‡ Installed Projects are defined as number of unique project IDs

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

Table 2-2. PY6 Installed Measure Quantities for PGL

Measure	Quantity Unit	Installed Quantity
Air Sealing	CFM Reduced	1,442,451
Attic Insulation	Projects	646
Duct Sealing	CFM Reduced	13,570
Foundation Wall Insulation	Projects	3
Wall Insulation	Projects	240
Gas Water Heater - Indirect	Each	4
Gas Water Heater - Tankless Whole House	Each	63
High Efficiency Boiler	Each	50
High Efficiency Furnace	Each	1,304
Programmable Thermostat - Furnace	Each	91
Smart Thermostat – Manual Baseline	Each	1,191
Smart Thermostat – Programmable Baseline	Each	1,677
Smart Thermostat – Unknown Baseline	Each	1,800

Source: Peoples Gas tracking data and Navigant team analysis.

The NSG program had 3,772 participants in PY6 and completed 4,229 projects as shown in the following table.

Table 2-3. PY6 Volumetric Summary for NSG

Participation	HVAC and Equipment	Weatherization	Total
Participants †	2,778	967	3,722
Installed Projects ‡	3,309	990	4,229
Total Measure Types	8	5	13

Source: North Shore Gas tracking data and Navigant team analysis.

† Participants are defined as number of unique gas account numbers

‡ Installed Projects are defined as number of unique project IDs

Table 2-4 summarizes the installed measure quantities that are the basis for NSG verified energy savings.

Table 2-4. PY6 Installed Measure Quantities for NSG

Measure	Quantity Unit	Installed Quantity
Air Sealing	CFM Reduced	702,126
Attic Insulation	Projects	452
Duct Sealing	CFM Reduced	283,198
Foundation Wall Insulation	Projects	6
Wall Insulation	Projects	13
Gas Water Heater - Indirect	Each	3
Gas Water Heater - Tankless Whole House	Each	28
High Efficiency Boiler	Each	15
High Efficiency Furnace	Each	1,569
Programmable Thermostat - Furnace	Each	57
Smart Thermostat – Manual Baseline	Each	370
Smart Thermostat – Programmable Baseline	Each	685
Smart Thermostat – Unknown Baseline	Each	582

Source: North Shore Gas tracking data and Navigant team analysis.

3. PROGRAM SAVINGS SUMMARY

Table 3-1 summarizes the energy savings the PGL Home Energy Rebate program achieved in PY6.

Table 3-1. PY6 Annual Energy Savings Summary for PGL

Program	Ex Ante Gross Savings (Therms)	Verified Gross RR†	Verified Gross Savings (Therms)	NTGR‡	Verified Net Savings (Therms)
HVAC & Equipment	608,558	101%	612,178	0.81	495,864
Weatherization	201,191	98%	196,702	0.81	159,328
Total	809,749	100%	808,880	0.81	655,193

Source: Peoples 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: PG-NSG_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>.

Table 3-2 summarizes the energy savings the NSG Home Energy Rebate program achieved in PY6.

Table 3-2. PY6 Annual Energy Savings Summary for NSG

Program	Ex Ante Gross Savings (Therms)	Verified Gross RR†	Verified Gross Savings (Therms)	NTGR‡	Verified Net Savings (Therms)
HVAC & Equipment	439,287	100%	440,456	0.81	356,769
Weatherization	297,238	99%	294,883	0.81	238,855
Total	736,525	100%	735,339	0.81	595,625

Source: North Shore 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: PG-NSG_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 PGL program includes 13 measures as shown in the following table. The smart thermostat and high efficiency furnace measures contributed the most savings.

Table 4-1. PY6 Annual Energy Savings by Measure for PGL

Research Category	Ex Ante Gross Savings (Therms)	Verified Gross RR†	Verified Gross Savings (Therms)	NTGR‡	Verified Net Savings (Therms)
Air Sealing	126,437	100%	125,834	0.81	101,926
Attic Insulation	50,324	94%	47,352	0.81	38,355
Duct Sealing	9,633	100%	9,628	0.81	7,799
Foundation Wall Insulation	898	100%	897	0.81	727
Wall Insulation	13,899	93%	12,990	0.81	10,522
Gas Water Heater – Indirect	195	100%	195	0.81	158
Gas Water Heater - Tankless Whole House	1,753	100%	1,753	0.81	1,420
High Efficiency Boiler	6,733	100%	6,734	0.81	5,455
High Efficiency Furnace	266,740	100%	266,741	0.81	216,060
Programmable Thermostat - Furnace	3,175	100%	3,175	0.81	2,572
Smart Thermostat – Manual	105,331	100%	105,332	0.81	85,319
Smart Thermostat - Programmable	94,382	100%	94,382	0.81	76,449
Smart Thermostat - Unknown	130,249	103%	133,866	0.81	108,431
Total	809,749	100%	808,880	0.81	655,193

Source: Peoples Gas tracking data and Navigant team analysis.

*Totals may not sum due to rounding

† 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: PG-NSG_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>.

The NSG program includes 13 measures as shown in the following table. The high efficiency furnace and duct sealing measures contributed the most savings.

Table 4-2. PY6 Annual Energy Savings by Measure for NSG

Research Category	Ex Ante Gross Savings (Therms)	Verified Gross RR†	Verified Gross Savings (Therms)	NTGR‡	Verified Net Savings (Therms)
Air Sealing	61,544	100%	61,251	0.81	49,613
Attic Insulation	31,475	94%	29,616	0.81	23,989
Duct Sealing	201,035	100%	200,929	0.81	162,752
Foundation Wall Insulation	1,710	100%	1,709	0.81	1,384
Wall Insulation	1,474	93%	1,378	0.81	1,116
Gas Water Heater - Indirect	146	100%	146	0.81	118
Gas Water Heater - Tankless Whole House	779	100%	779	0.81	631
High Efficiency Boiler	2,036	100%	2,036	0.81	1,649
High Efficiency Furnace	320,948	100%	320,948	0.81	259,968
Programmable Thermostat - Furnace	1,989	100%	1,989	0.81	1,611
Smart Thermostat - Manual	32,723	100%	32,723	0.81	26,506
Smart Thermostat - Programmable	38,552	100%	38,552	0.81	31,227
Smart Thermostat - Unknown	42,114	103%	43,283	0.81	35,059
Total	736,525	100%	735,339	0.81	595,625

Source: North Shore Gas tracking data and Navigant team analysis.

*Totals may not sum due to rounding

† 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: PG-NSG_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>.

5. IMPACT ANALYSIS FINDINGS AND RECOMMENDATIONS

Impact Parameter Estimates

Table 5-1 shows the unit therms savings and realization rate findings by measure from our review. The realization rate is the ratio of the verified gross savings to the ex ante gross savings. Following the table, we provide findings and recommendations, including a 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 Category	Unit Basis	Ex Ante Gross (Therms/unit)	Verified Gross (Therms/unit)	Realization Rate	Data Source(s)†
Air Sealing	CFM Reduced	0.09	0.09	100%	IL TRM v5.0 - Section 5.6.1
Attic Insulation	Projects	Varies	Varies	94%	IL TRM v5.0 - Section 5.6.4
Duct Sealing	CFM Reduced	0.71	0.71	100%	IL TRM v5.0 - Section 5.3.4
Foundation Wall Insulation	Projects	Varies	Varies	100%	IL TRM v5.0 - Section 5.6.2
Wall Insulation	Projects	Varies	Varies	93%	IL TRM v5.0 - Section 5.6.4
Gas Water Heater - Indirect	Each	48.70	48.70	100%	IL TRM v5.0 - Section 5.4.2
Gas Water Heater - Tankless Whole House	Each	27.83	27.83	100%	IL TRM v5.0 - Section 5.4.2
High Efficiency Boiler	Each	Varies	Varies	100%	IL TRM v5.0 - Section 5.3.6
High Efficiency Furnace	Each	204.56	204.56	100%	IL TRM v5.0 - Section 5.3.7
Programmable Thermostat - Furnace	Each	Varies	Varies	100%	IL TRM v5.0 - Section 5.3.11
Smart Thermostat – Manual Baseline	Each	88.44	88.44	100%	IL TRM v5.0 - Section 5.3.16
Smart Thermostat – Programmable Baseline	Each	56.28	56.28	100%	IL TRM v5.0 - Section 5.3.16
Smart Thermostat – Unknown Baseline	Each	72.36	74.37	103%	IL TRM v5.0 - Section 5.3.16

Source: Program Tracking Data (PTD) provided by Peoples Gas and North Shore Gas, extract dated March 9, 2018.

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

The manual and programmable baseline scenarios for advanced (smart) thermostats had a 100 percent realization rate. For a baseline of an unknown existing thermostat type (blended), the Franklin Energy “Master Measure Database” file (MMDB),¹ which feeds into the tracking system savings input, applies an average 7.2 percent reduction in total household heating energy consumption for the advanced thermostat. The deemed value in version 5 of the Illinois Technical Reference Manual² (TRM) is 7.4 percent. Adjustment to the savings input produced a 103 percent verified gross savings realization rate.

Recommendation 1: Navigant recommends the implementer corrects the algorithm input in the MMDB and the tracking system to a 7.4 percent heating reduction for an advanced (smart) thermostat with an unknown existing thermostat baseline.

¹ File name: PGNSG MMDB PY6-Navigant013017, produced by Franklin Energy.

² State of Illinois Technical Reference Manual version 5.0 from <http://www.ilsag.info/technical-reference-manual.html>.

The custom parameters used in the ex ante savings calculation for insulation measures (R-values and area of space insulated) are not directly accessible in the tracking data extract, but reside in project specific documents.

Navigant selected a sample of 24 insulation projects from a population of 1,360 projects with 90 percent confidence and 10 percent precision at the measure level. Navigant reviewed the project documentation, including the spreadsheet-based insulation calculators the program implementer used for estimating project savings and the custom insulation parameters used in the savings calculation. Navigant identified some discrepancies in the savings estimates from the calculators regarding the application of TRM deemed inputs.

Navigant found that some of the sampled attic and wall insulation projects calculated ex ante savings using an outdated version of the insulation calculator that was based on input assumptions from the previous version (v4.0) of the TRM (e.g., attic insulation was based on a 70 percent heating system efficiency and a 74 percent attic heating adjustment factor). These values have been updated in a revised version of the insulation calculator that uses the approved version 5 TRM (72 percent heating system efficiency and 60 percent attic heating adjustment factor for GPY6).

For each sampled project, Navigant verified the gas savings and used the realization rates for the measure level sample to apply to the population of the corresponding measure within the whole program.

For attic insulation, Navigant found that three of the 21 sampled projects used the outdated version of the insulation calculator and one project had a realization rate of 58 percent due to tracking data that did not match the calculator and project files. The other 17 projects had realization rates of 100 percent. Navigant rolled up these results to get a measure level realization rate of 94 percent.

For wall insulation, Navigant found that one of the 10 sampled projects used the outdated version of the insulation calculator and the other 9 projects had realization rates of 100 percent. Navigant rolled up these results to get a measure level realization rate of 93 percent. Sampled projects for foundation wall insulation had a realization rate of 100 percent. Appendix 2 includes tables with the projects sampled, the ex ante and ex post values, and the realization rates.

For all three insulation measures, Navigant found that the calculators were using 100,000 Btu/therm instead of the value deemed in TRM version 5: 100,067 Btu/therm. This did not result in a noticeable change in realization rates but did cause a slight decrease in verified savings.

Recommendation 2: Navigant recommends that the implementer include the existing and final R-values of insulation and the installed square footage in the tracking system database extract to facilitate real-time impact evaluation. Taking this action will remove the necessity for evaluation to sample insulation projects and review hardcopy documents at the end of the year to estimate verified savings, thereby facilitating real-time evaluation feedback to the program during the program year.³

Recommendation 3: Update the calculators to use 100,067 Btu/therm instead of 100,000 Btu/therm.

³ Navigant may still sample project documents for evaluation review purposes but, if the custom insulation inputs are directly accessible in the tracking system extract, we can do an automated check of all projects and installed measures to identify discrepancies. In 2018, we plan to conduct TRM-based measure checks early in the program year.

6. APPENDIX 1. IMPACT ANALYSIS METHODOLOGY

Navigant downloaded the final tracking data for the Home Energy Rebate Program evaluation from Franklin Energy Services' Efficiency Manager data management platform on March 9, 2018. The evaluation team reviewed the tracking data to verify the completeness and accuracy of the tracking system data to identify any issues that would affect the impact evaluation of the program. We compared the tracking system savings input assumptions to the MMDB that documents the implementer's approach to compliance with the Illinois TRM. We verified that the program tracking system was accurately recording measure counts and savings, but have one recommendation to update the heating reduction factor for advanced (smart) thermostat with an unknown existing thermostat baseline.

Navigant determined verified gross savings for each program measure by multiplying the verified per-unit savings value by the quantity reported in the tracking data. Navigant calculated verified net energy savings by multiplying the verified gross savings estimates by a deemed net-to-gross ratio (NTGR). In PY6, the NTGR estimates used to calculate the net verified savings were based on past evaluation research and deemed by a consensus process through the Illinois Energy Efficiency Stakeholder Advisory Group (SAG).

For attic, foundation wall, and wall insulation the implementer used custom values and calculators that were not provided with the tracking data extract. Therefore, Navigant pulled a statistically significant sample of insulation project files at the program level to determine the realization rates for each sampled insulation project and rolled those results up to the insulation population at the measure level. Navigant downloaded a sample of 24 project files from the Franklin Energy Services' Efficiency Manager data management platform on March 28, 2018.⁴ The evaluation team reviewed the project calculators and applications to verify the accuracy of the algorithms used in the calculations and that the calculator inputs matched the final applications.

Table 6-1. Profile of Gross Impact Sample for Insulation Projects

Population Summary			Sample Summary			
Program Path	Sampling Strata	Number of Projects (N)	Ex Ante Gross Savings (Therms)	n†	Ex Ante Gross Savings (Therms)	Sampled % of Population (% Therms)
Weatherization	Attic Insulation	1098	66,257	21	1,160	2%
	Wall Insulation	253	12,452	10	602	5%
	Foundation Wall Insulation	9	2,113	2	690	33%
TOTAL		1,360	80,822	33	2,453	3%

Source: Analysis of Program Tracking Data (PTD) provided by Peoples Gas and North Shore Gas, extract of project files March 28, 2018.

† Overall, 24 projects were selected but 10 had both attic insulation and wall insulation, making a total of 33 measure level data for analysis.

Table 6-2 below shows the summary of adjustments to the insulation project savings and the realization rate estimates at the project level. The insulation projects' overall realization rate was 94 percent at a 90 percent confidence level and a 5 percent relative precision (the overall realization rate was not used in the analysis but measure level estimates were used).

⁴ A total of 24 sample points were selected, but 10 had both attic and wall insulation, making for a total of 33 sample points for impact analysis.

Table 6-2. Gross Therm Realization Rates and Relative Precision at 90% Confidence Level

Program	Strata	Relative Precision +or-%	Mean RR	Standard Error
Weatherization	Attic Insulation	8%	0.94	0.04
	Wall Insulation	6%	0.93	0.03
	Foundation Wall Insulation	19%	1.00	0.03
Insulation Total RR (90/10)		5%	94%	0.03

Source: Navigant analysis

7. APPENDIX 2. IMPACT ANALYSIS SUPPLEMENTAL INFORMATION

Table 7-1, Table 7-2, and Table 7-3 show the detail of the projects included in the weatherization (insulation) sample.

Table 7-1. Attic Insulation Project Detail

Project ID	Ex Ante Net Therms	Verified Net Therms	Realization Rate
1418625	81.91	64.52	79%
1445062	141.88	111.76	79%
1496997	21.25	21.23	100%
1497228	99.82	99.75	100%
1588708	29.67	29.65	100%
1618924	30.09	30.07	100%
1628327	45.13	45.10	100%
1640554	62.91	62.87	100%
1691300	38.48	30.47	79%
1710999	52.91	52.87	100%
1715804	23.31	23.30	100%
1715831	84.99	84.94	100%
1716282	55.76	55.73	100%
1761977	41.94	41.58	99%
1801027	57.99	57.96	100%
1861186	75.63	75.58	100%
1880426	41.45	23.87	58%
1901938	44.50	44.48	100%
1988748	52.97	52.94	100%
2742813	41.01	40.99	100%
2744585	36.59	36.57	100%
Roll-up Total	1,160.18	1,084.64	94%

Source: Program Tracking Data (PTD) provided by Peoples Gas and North Shore Gas, extract dated March 9, 2018.

Table 7-2. Foundation Wall Insulation Project Detail

Project ID	Ex Ante Net Therms	Verified Net Therms	Realization Rate
1800506	230.92	230.77	100%
1901938	459.46	459.16	100%
Roll-up Total	690.39	689.92	100%

Source: Program Tracking Data (PTD) provided by Peoples Gas and North Shore Gas, extract dated March 9, 2018.

Table 7-3. Wall Insulation Project Detail

Project ID	Ex Ante Net Therms	Verified Net Therms	Realization Rate
1418625	259.20	204.19	79%
1496997	55.08	55.05	100%
1497228	12.30	12.29	100%
1710999	34.43	34.40	100%
1713778	28.78	28.76	100%
1715831	37.37	37.35	100%
1761977	34.29	34.27	100%
1801027	32.61	32.59	100%
2742813	30.11	30.09	100%
2744585	77.82	77.77	100%
Roll-up Total	601.98	546.75	93%

Source: Program Tracking Data (PTD) provided by Peoples Gas and North Shore Gas, extract dated March 9, 2018.

8. APPENDIX 3. PROGRAM-SPECIFIC INPUTS FOR THE ILLINOIS TRC

Table 8-1 and Table 8-2, the Total Resource Cost (TRC) variable tables, only include cost-effectiveness analysis inputs available at the time of finalizing the PY6 Home Energy Rebate 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 evaluation 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 8-1. TRC Inputs for PGL

Measure	Units	Quantity	Effective Useful Life*	Ex Ante Gross Savings (Therms)	Verified Gross Savings (Therms)	Verified Net Savings (Therms)
Air Sealing	CFM	1,442,451	15	126,437	125,834	101,926
Attic Insulation	Projects	646	25	50,324	47,352	38,355
Duct Sealing	CFM	13,570	20	9,633	9,628	7,799
Foundation Wall Insulation	Projects	3	25	898	897	727
Wall Insulation	Projects	240	25	13,899	12,990	10,522
Gas Water Heater - Indirect	Each	4	13	195	195	158
Gas Water Heater - Tankless Whole House	Each	63	13	1,753	1,753	1,420
High Efficiency Boiler	Each	50	25	6,733	6,734	5,455
High Efficiency Furnace	Each	1,304	20	266,740	266,741	216,060
Programmable Thermostat - Furnace	Each	91	5	3,175	3,175	2,572
Smart Thermostat - Manual	Each	1,191	10	105,331	105,332	85,319
Smart Thermostat - Programmable	Each	1,677	10	94,382	94,382	76,449
Smart Thermostat - Unknown	Each	1,800	10	130,249	133,866	108,431

Source: Program Tracking Data (PTD) provided by Peoples Gas and North Shore Gas, extract dated March 9, 2018.

* Illinois Statewide Technical Reference Manual for Energy Efficiency Version 5.0 from <http://www.ilsag.info/technical-reference-manual.html>.

Table 8-2. TRC Inputs for NSG

Measure	Units	Quantity	Effective Useful Life*	Ex Ante Gross Savings (Therms)	Verified Gross Savings (Therms)	Verified Net Savings (Therms)
Air Sealing	CFM	702,126	15	61,544	61,251	49,613
Attic Insulation	Projects	452	25	31,475	29,616	23,989
Duct Sealing	CFM	283,198	20	201,035	200,929	162,752
Foundation Wall Insulation	Projects	6	25	1,710	1,709	1,384
Wall Insulation	Projects	13	25	1,474	1,378	1,116
Gas Water Heater - Indirect	Each	3	13	146	146	118
Gas Water Heater - Tankless Whole House	Each	28	13	779	779	631
High Efficiency Boiler	Each	15	25	2,036	2,036	1,649
High Efficiency Furnace	Each	1,569	20	320,948	320,948	259,968
Programmable Thermostat - Furnace	Each	57	5	1,989	1,989	1,611
Smart Thermostat - Manual	Each	370	10	32,723	32,723	26,506
Smart Thermostat - Programmable	Each	685	10	38,552	38,552	31,227
Smart Thermostat - Unknown	Each	582	10	42,114	43,283	35,059

Source: Program Tracking Data (PTD) provided by Peoples Gas and North Shore Gas, extract dated March 9, 2018.

* Illinois Statewide Technical Reference Manual for Energy Efficiency Version 5.0 from <http://www.ilsag.info/technical-reference-manual.html>.