Guidehouse

Income Eligible Multi-Family Programs Impact Evaluation Report

Energy Efficiency Plan:
Plan Year 2019
(1/1/2019-12/31/2019)

Presented to
Peoples Gas and North Shore Gas

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1. Introduction

This report presents the results of the impact evaluation of the Peoples Gas (PGL) and North Shore Gas (NSG) 2019 Income Eligible Multi-Family 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. Program year 2019 covers January 1, 2019 through December 31, 2019.

The Multi-Family Income Eligible Program provides energy efficiency upgrades to customers in the PGL and NSG territories with incomes below 80 percent of the Area Median Income (AMI) level as defined by the geography or location of the building and/or the subsidy status and rent levels of the building. The program offers assessments, direct installation of energy efficiency measures, replacement of inefficient equipment, technical assistance, and educational information through two program components.

There are two different components for this program. The first is the Income-Eligible Multi-Family Savings (IEMS) Program, jointly implemented with ComEd with Elevate Energy operating as the implementer of the program. The evaluation of that component is presented in Section 2. The second component is the Illinois Home Weatherization Assistance Program (IHWAP) which is jointly implemented with ComEd and Nicor Gas, with Resource Innovation operating as the implementer of the program. The evaluation of that component is presented in Section 3.

Verified savings in this report reflect the percent of total therm savings PGL and NSG claimed from each measure. For the IHWAP program joint with ComEd, PGL claimed 15 percent and NSG claimed 95 percent of total therm savings. For the IEMS program, both PGL and NSG claimed 46 percent of the total therm savings.

2. Income Eligible Multifamily Savings Program

2.1 Program Description

The IEMS eligible natural gas measures include in-unit (IU) and common area (CA) measures such as steam trap repair or replacement, common area steam boiler, CA pipe insulation, attic insulation, and air sealing, among others.

The PGL program had 227 participants in 2019 and completed 327 projects as shown in the following table.

Table 2-1. 2019 Volumetric Summary for PGL

Participation	Quantity
Participants *	227
Installed Projects †	327

* Participants are defined as unique property addresses.
† Installed Projects are defined as unique Project IDs.
Source: Peoples Gas tracking data and Guidehouse team analysis.

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

Table 2-2. 2019 Installed Measure Quantities for PGL

Measure	Quantity Unit	Installed Quantity
Common Area (CA) Steam Trap Repair/Replace	Each	1,083
CA Pipe Insulation	Linear Feet	39,447
CA Steam Boiler	kBtu/hr	84,073
CA Pipe Steam Averaging Controls	Projects	287
CA Air Sealing	Linear Feet	47,966
CA Attic Insulation	Square Feet	129,696
CA Hydronic Boiler	kBtu/hr	5,029
In-Unit (IU) Gas Showerhead	Each	913
IU Gas Aerator – Kitchen	Each	922
CA Domestic Hot Water (DHW) Boiler	Apt Units	281
CA Boiler Reset Controls	kBtu/hr	4,020
IU Programmable Thermostats	Each	118
IU Air Conditioner (AC) Cover and Gap Sealer	Each	492
IU Furnace	Each	16
IU Advanced Thermostats	Each	38
CA Boiler Tune-Up	kBtu/hr	5,997
IU Gas Aerator – Bathroom	Each	395
CA Foundation Sidewall Insulation	Square Feet	1,304
IU DHW Boiler	Each	8

Source: People Gas tracking data and Guidehouse team analysis.

The NSG program had 21 participants in 2019 and completed 23 projects as shown in the following table.

Table 2-3. 2019 Volumetric Summary for NSG

Participation	Quantity
Participants *	21
Installed Projects †	23

* Participants are defined as unique property addresses.
† Installed Projects are defined as unique Project IDs.
Source: North Shore Gas tracking data and Guidehouse team analysis.

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

Table 2-4. 2019 Installed Measure Quantities for NSG

Measure	Quantity Unit	Installed Quantity
IU AC Cover and Gap Sealer	Each	284
CA Air Sealing	Linear Feet	2,016
CA Attic Insulation	Square Feet	6,988
CA Pipe Insulation	Linear Feet	345
IU Programmable Thermostats	Each	7
IU Gas Showerhead	Each	8
IU Gas Aerator – Kitchen	Each	5
IU Gas Aerator – Bathroom	Each	3

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

2.2 Savings Summary

Table 2-5 summarizes the energy savings the PGL Income Eligible Multi-Family Savings program achieved in 2019.

Table 2-5. 2019 Annual Energy Savings Summary for PGL

Program Path	Ex Ante Gross Savings (Therms)	Verified Gross RR*	Verified Gross Savings (Therms)	NTG†	Verified Net Savings (Therms)
IEMS	318,512	101%	320,708	1.00	320,708
Total	**318,512**	**101%**	**320,708**	**1.00**	**320,708**

* Realization Rate (RR) is the ratio of verified gross savings to ex ante gross savings, based on evaluation research findings.
† Net-to-Gross (NTG) is the ratio of verified net savings to verified gross savings. The NTG is a deemed value. Source: PGL-NSG_NTG_History_and_2019_Recommendations_2018-10-01_Final Faucet Aerator and Showerhead Correction 2019-04-12.xlsx, which is to be found on the Illinois SAG web site: http://ilsag.info/net-to-gross-framework.html.
Source: Peoples Gas tracking data and Guidehouse team analysis.

Table 2-5 summarizes the energy savings the NSG Income Eligible Multi-Family Savings program achieved in 2019.

Table 2-6. 2019 Annual Energy Savings Summary for NSG

Program Path	Ex Ante Gross Savings (Therms)	Verified Gross RR*	Verified Gross Savings (Therms)	NTG†	Verified Net Savings (Therms)
IEMS	1,885	100%	1,891	1.00	1,891
Total	**1,885**	**100%**	**1,891**	**1.00**	**1,891**

* Realization Rate (RR) is the ratio of verified gross savings to ex ante gross savings, based on evaluation research findings.
† Net-to-Gross (NTG) is the ratio of verified net savings to verified gross savings. The NTG is a deemed value. Source: PGL-NSG_NTG_History_and_2019_Recommendations_2018-10-01_Final Faucet Aerator and Showerhead Correction 2019-04-12.xlsx, which is to be found on the Illinois SAG web site: http://ilsag.info/net-to-gross-framework.html.
Source: North Shore Gas tracking data and Guidehouse team analysis.

2.3 Program Savings by Measure

The PGL program includes 19 measures as shown in the following table. The CA steam trap repair/replace and CA pipe insulation measures contributed the most savings.

Table 2-7. 2019 Annual Energy Savings by Measure for PGL

Research Category	Ex Ante Gross Savings (Therms)	Verified Gross RR	Verified Gross Savings (Therms)	NTG	Verified Net Savings (Therms)
CA Steam Trap Repair/Replace	159,058	100%	159,058	1.00	159,058
CA Pipe Insulation	59,489	100%	59,483	1.00	59,483
CA Steam Boiler	35,447	108%	38,166	1.00	38,166
CA Pipe Steam Averaging Controls	16,731	100%	16,731	1.00	16,731
CA Air Sealing	10,640	100%	10,640	1.00	10,640
CA Attic Insulation	9,897	100%	9,897	1.00	9,897
CA Hydronic Boiler	6,971	98%	6,803	1.00	6,803
IU Gas Showerhead	4,753	100%	4,753	1.00	4,753
IU Gas Aerator – Kitchen	3,337	100%	3,337	1.00	3,337
CA DHW Boiler	2,781	100%	2,781	1.00	2,781
CA Boiler Reset Controls	2,300	100%	2,300	1.00	2,300
IU Programmable Thermostats	2,198	100%	2,198	1.00	2,198
IU AC Cover and Gap Sealer	1,270	86%	1,093	1.00	1,093
IU Furnace	1,373	78%	1,071	1.00	1,071
IU Advanced Thermostats	986	100%	986	1.00	986
CA Boiler Tune-Up	866	100%	866	1.00	866
IU Gas Aerator – Bathroom	298	100%	298	1.00	298
CA Foundation Sidewall Insulation	36	458%	164	1.00	164
IU DHW Boiler	82	105%	86	1.00	86
Total	**318,512**	**101%**	**320,708**	**1.00**	**320,708**

Source: Peoples Gas tracking data and Guidehouse team analysis.

The NSG program includes 8 measures as shown in the following table. The IU AC cover and gap sealer and CA air sealing measures contributed the most savings.

Table 2-8. 2019 Annual Energy Savings by Measure for NSG

Research Category	Ex Ante Gross Savings (Therms)	Verified Gross RR	Verified Gross Savings (Therms)	NTG	Verified Net Savings (Therms)
IU AC Cover and Gap Sealer	821	101%	827	1.00	827
CA Air Sealing	386	100%	386	1.00	386
CA Attic Insulation	266	100%	266	1.00	266
CA Pipe Insulation	221	100%	221	1.00	221
IU Programmable Thermostats	130	100%	130	1.00	130
IU Gas Showerhead	42	100%	42	1.00	42
IU Gas Aerator – Kitchen	18	100%	18	1.00	18
IU Gas Aerator – Bathroom	2	100%	2	1.00	2
Total	**1,885**	**100%**	**1,891**	**1.00**	**1,891**

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

2.4 Impact Analysis Findings and Recommendations

2.4.1 Impact Parameter Estimates

Table 2-9 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 2-9. Verified Gross Savings Parameters

Measure	Unit Basis	Ex Ante Gross (therms/unit)	Verified Gross (therms/unit)	Realization Rate	Data Source(s)
CA Steam Trap Repair/Replace	Each	Varies	Varies	100%	PGL/NSG Program Tracking Data (PTD*), Illinois TRM, v7.0† Section 4.4.16
CA Pipe Insulation	Linear Feet	Varies	Varies	Varies	Illinois TRM, v7.0, Section 4.4.14
CA Steam Boiler	kBtu/hr	Varies	Varies	Varies	Illinois TRM, v7.0, Section 4.4.10 and PTD
CA Pipe Steam Averaging Controls	Projects	Varies	Varies	100%	Illinois TRM, v7.0, Section 4.4.36 and PTD
CA Air Sealing	Linear Feet	Varies	Varies	100%	Illinois TRM, v7.0, Section 5.6.1 and PTD
CA Attic Insulation	Square Feet	Varies	Varies	100%	Illinois TRM, v7.0, Section 5.6.5 and PTD
CA Hydronic Boiler	kBtu/hr	Varies	Varies	Varies	Illinois TRM, v7.0, Section 4.4.10 and PTD
IU Gas Showerhead	Each	11.32	11.32	100%	Illinois TRM, v7.0, Section 5.4.5
IU Gas Aerator – Kitchen	Each	7.87	7.87	100%	Illinois TRM, v7.0, Section 5.4.4
CA DHW Boiler	Apt Units	Varies	Varies	100%	Illinois TRM, v7.0, Section 4.3.7 and PTD
CA Boiler Reset Controls	kBtu/hr	Varies	Varies	100%	Illinois TRM, v7.0, Section 4.4.4 and PTD
IU Programmable Thermostats	Each	40.50	40.50	100%	Illinois TRM, v7.0, Section 5.3.11
IU AC Cover and Gap Sealer	Each	Varies	Varies	Varies	Illinois TRM, v7.0, Section 4.4.38 and PTD
IU Furnace	Each	Varies	Varies	Varies	Illinois TRM, v7.0, Section 5.3.7 and 5.3.5, and PTD
IU Advanced Thermostats	Each	Varies	Varies	100%	Illinois TRM, v7.0, Section 5.3.16
CA Boiler Tune-Up	kBtu/hr	Varies	Varies	100%	Illinois TRM, v7.0, Section 4.4.2 and PTD
IU Gas Aerator – Bathroom	Each	1.64	1.64	100%	Illinois TRM, v7.0, Section 5.4.4
CA Foundation Sidewall Insulation	Square Feet	0.06	0.27	458%	Illinois TRM, v7.0, Section 5.6.4 and PTD
IU DHW Boiler	Each	Varies	Varies	Varies	Illinois TRM, v7.0, Section 5.4.2 and PTD

* Program Tracking Data (PTD) provided by Peoples Gas and North Shore Gas, extract dated January 30, 2020.
† State of Illinois Technical Reference Manual version 7.0 from http://www.ilsag.info/technical-reference-manual.html.

2.4.2 Findings and Recommendations

2.4.2.1 CA Pipe Insulation

The ex ante savings for these measures are calculated using the Heating Equivalent Full Load Hours (EFLH) corresponding to the Mid-Rise Multifamily building type. However, since the tracking data indicates that some of these measures are installed in High-Rise Multifamily buildings, the evaluation team calculated the verified savings using the corresponding EFLH values.

Recommendation 1. Guidehouse recommends using EFLH values corresponding to the building type in which the measures are installed when calculating savings for these measures as per Section 4.4.14 of the TRM v7.0.

2.4.2.2 CA Steam Boiler and CA Hydronic Boiler

Incorrect baseline boiler efficiency values are used in the ex ante savings for 24 out of the 55 projects (Example Project IDs: 10002981, 10002938, and 10005172). The evaluation team calculated the verified savings using the updated baseline efficiency values for corresponding boiler types and capacities as deemed by the Section 4.4.10 of the TRM v7.0.

Recommendation 2. Guidehouse recommends using baseline boiler efficiency values of the corresponding boiler types and capacities as deemed by the Section 4.4.10 of the TRM v7.0.

Incorrect heating EFLH values for the building type are used in the ex ante savings for eight out of the 55 projects (Example Project IDs: 10002952, 10003433, and 10003581). The evaluation team calculated the verified savings using heating EFLH values for the corresponding building types provided in the tracking data, as deemed by the Section 4.4.10 of the TRM v7.0.

Recommendation 3. Guidehouse recommends using heating EFLH values for the corresponding building types as deemed by the Section 4.4.10 of the TRM v7.0.

2.4.2.3 IU AC and Gap Sealer

The ex ante savings for these measures are calculated using the Heating EFLH values corresponding to the Mid-Rise Multifamily building type. However, since the tracking data indicates that some of these measures are installed in High-Rise Multifamily buildings, the evaluation team calculated the verified savings using the corresponding EFLH values.

Recommendation 4. Guidehouse recommends using EFLH values corresponding to the building type in which the measures are installed when calculating savings for these measures as per Section 4.4.14 of the TRM v7.0.

2.4.2.4 IU Furnace

The ex ante savings for this measure assume verified quality installation is performed. The evaluation team calculated the verified savings on the basis that “verified quality installation”, as defined by Section 5.3.7 of TRM v7, is not performed. Documentation of verified quality installation was not provided in the

tracking data, and the implementer acknowledged with the ComEd 2019 report[1] for this program that the savings calculation should not include quality installation adjustment.

Recommendation 5. Guidehouse recommends using the assumption that verified quality installation is not performed when calculating savings for this measure if verified quality installation is not performed according to the requirements in the TRM.

For the project IDs 10002769, 10003117, and 10003258, the ex ante savings did not include the heating penalty from the electronically commutated motor (ECM). The verified savings include this heating penalty calculated as per Section 5.3.5 of the TRM v7.0.

Recommendation 6. Guidehouse recommends including the heating penalty from ECM when calculating savings for this measure.

2.4.2.5 CA Foundation Sidewall Insulation

The ex ante savings for this measure do not align with the input assumptions provided in the tracking data, shown in Table 2-10 below. Since this measure only accounts for 0.39% of the overall savings of the program the evaluation team will continue using the input assumptions provided with the 2019 tracking data to calculate the verified savings.

Recommendation 7. Guidehouse requests a detailed breakdown of the input assumptions and the algorithms used to calculate the ex ante savings in 2020.

Table 2-10. Tracking Data Input Assumptions for CA Foundation Sidewall Insulation Measure

Parameter	Value
R Old AG	1
R Added Floor	13
L Wall Total	186.2
H Wall AG	4
R Old BG	7.42
R Added Basement Wall	13
H Wall Total	9
Framing Factor	0.25
HDD	3,079
Eff Heat	0.72
ADJ Heat	0.6

Source: Tracking data and evaluation team analysis

2.4.2.6 IU DHW Boiler

The ex ante savings for one measure were calculated using a custom tank temperature (T_out) for Project ID 10004273. However, Section 5.4.2 of the TRM v7.0 does not allow the use of a custom tank

[1] Guidehouse, *ComEd Multi-Family Retrofits - IE Impact Evaluation Report,* April 30, 2020.

temperature. The evaluation team calculated the verified savings using the TRM deemed tank temperature of 125°F.

Recommendation 8. Guidehouse recommends using the tank temperature value deemed in the Section 5.4.2 of the TRM v7.0.

2.4.3 Historical Realization Rates and NTG Values

Table 2-11 below shows the historical gross realization rates and NTG values for the Income Eligible Multi-Family Savings Program.

Table 2-11. Historical Realization Rates and NTG Values

Program Year	PGL Verified Gross RR	NSG Verified Gross RR	PGL NTG	NSG NTG
GPY6 – IEMF	104%	NA	1.00	1.00
2018 – IEMS	97%	100%	1.00	1.00
2019 – IEMS	101%	100%	1.00	1.00

Source: Guidehouse evaluation research.

2.5 Appendix 1. Impact Analysis Methodology

Guidehouse determined verified gross savings for each program measure by:

1. Reviewing the savings algorithm inputs in the measure workbook for agreement with the TRM or evaluation research for non-deemed measures.
2. Validating that the savings algorithm was applied correctly.
3. Cross-checking per-unit savings values in the tracking data with the verified values in the measure workbook or in Navigant's calculations if the workbook did not agree with the TRM.
4. Multiplying the verified per-unit savings value by the quantity reported in the tracking data.

2.6 Appendix 2. Program-Specific Inputs for the Illinois TRC

Table 2-12 and Table 2-13 shows the Total Resource Cost (TRC) cost-effectiveness analysis inputs available at the time of drafting this impact evaluation report for PGL and NSG respectively. Additional required cost data (e.g., measure costs, program level incentive and non-incentive costs) are not included in this table and will be provided to the evaluation team later.

Table 2-12. TRC Inputs for PGL

Research Category	Units	Quantity	Effective Useful Life	Ex Ante Gross Savings (Therms)	Verified Gross Savings (Therms)	Verified Net Savings (Therms)
CA Steam Trap Repair/Replace	Each	1,083	6.0	159,058	159,058	159,058
CA Pipe Insulation	Linear Feet	39,447	15.0	59,489	59,483	59,483
CA Steam Boiler	kBtu/hr	84,073	20.0	35,447	38,166	38,166
CA Pipe Steam Averaging Controls	Projects	287	20.0	16,731	16,731	16,731
CA Air Sealing	Linear Feet	47,966	20.0	10,640	10,640	10,640
CA Attic Insulation	Square Feet	129,696	20.0	9,897	9,897	9,897
CA Hydronic Boiler	kBtu/hr	5,029	20.0	6,971	6,803	6,803
IU Gas Showerhead	Each	913	10.0	4,753	4,753	4,753
IU Gas Aerator – Kitchen	Each	922	10.0	3,337	3,337	3,337
CA DHW Boiler	Apt Units	281	15.0	2,781	2,781	2,781
CA Boiler Reset Controls	kBtu/hr	4,020	20.0	2,300	2,300	2,300
IU Programmable Thermostats	Each	118	8.0	2,198	2,198	2,198
IU AC Cover and Gap Sealer	Each	492	5.0	1,270	1,093	1,093
IU Furnace	Each	16	20.0	1,373	1,071	1,071
IU Advanced Thermostats	Each	38	11.0	986	986	986
CA Boiler Tune-Up	kBtu/hr	5,997	3.0	866	866	866
IU Gas Aerator – Bathroom	Each	395	10.0	298	298	298
CA Foundation Sidewall Insulation	Square Feet	1,304	20.0	36	164	164
IU DHW Boiler	Each	8	13.0	82	86	86
Total		**322,085**	**11.6**	**318,512**	**320,708**	**320,708**

Source: PGL tracking data and Guidehouse team analysis.

Table 2-13. TRC Inputs for NSG

Research Category	Units	Quantity	Effective Useful Life	Ex Ante Gross Savings (Therms)	Verified Gross Savings (Therms)	Verified Net Savings (Therms)
IU AC Cover and Gap Sealer	Each	284	5.0	821	827	827
CA Air Sealing	Linear Feet	2,016	20.0	386	386	386
CA Attic Insulation	Square Feet	6,988	20.0	266	266	266
CA Pipe Insulation	Linear Feet	345	15.0	221	221	221
IU Programmable Thermostats	Each	7	8.0	130	130	130
IU Gas Showerhead	Each	8	10.0	42	42	42
IU Gas Aerator – Kitchen	Each	5	10.0	18	18	18
IU Gas Aerator – Bathroom	Each	3	10.0	2	2	2
Total		**9,656**	**11.7**	**1,885**	**1,891**	**1,891**

Source: NSG tracking data and Guidehouse team analysis.

3. Multi-Family Savings IHWAP

3.1 Program Description

The IHWAP eligible natural gas measures include hot water measures, attic insulation, high efficiency furnaces, and custom measures.

The PGL program had two participants in CY2019 and completed 15 projects as shown in the following table.

Table 3-1. 2019 Volumetric Summary for PGL

Participation	Total
Participants *	2
Installed Projects †	15

* Participants are defined as unique utility IDs. These were two housing authorities with multiple units.
† Installed Projects are defined as unique measure IDs
Source: Peoples Gas tracking data and Guidehouse team analysis.

Table 3-2 summarizes the installed measure quantities that are the basis for verified energy savings.

Table 3-2. 2019 Installed Measure Quantities for PGL

Measure	Quantity Unit	Installed Quantity
Custom Measure	Projects	7
Hot Water Pipe Insulation	Linear Feet	434
Low Flow Faucet Aerators	Each	147
Low Flow Showerhead	Each	69

Source: People Gas tracking data and Guidehouse team analysis.

The NSG program had 121 participants in 2019 and completed 358 projects as shown in the following table.

Table 3-3. 2019 Volumetric Summary for NSG

Participation	Total
Participants *	121
Installed Projects †	358

* Participants are defined as unique utility IDs. This was a single housing development with multiple individual units.
† Installed Projects are defined as unique measure IDs
Source: North Shore Gas tracking data and Guidehouse team analysis.

Table 3-4 summarizes the installed measure quantities that are the basis for verified energy savings.

Table 3-4. 2019 Installed Measure Quantities for NSG

Measure	Quantity Unit	Installed Quantity
Advanced Thermostats	Each	21
Custom Measure	Project	97
Domestic Hot Water Pipe Insulation	Linear Feet	1,164
Gas High Efficiency Furnace	Each	20
Gas Water Heater	Each	5
Low Flow Faucet Aerator	Each	97
Attic Insulation	Square Feet	19,935

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

3.2 Savings Summary

Table 3-5 summarizes the energy savings the PGL IHWAP portion of the IE Multifamily program achieved in 2019.

Table 3-5. 2019 Annual Energy Savings Summary for PGL

Program Path	Ex Ante Gross Savings (Therms)	Verified Gross RR*	Verified Gross Savings (Therms)	NTG†	Verified Net Savings (Therms)
IHWAP	18,642	115%	21,409	1.00	21,409
Total	**18,642**	**115%**	**21,409**	**1.00**	**21,409**

* Realization Rate (RR) is the ratio of verified gross savings to ex ante gross savings, based on evaluation research findings.
† Net-to-Gross (NTG) is the ratio of verified net savings to verified gross savings. The NTG is a deemed value. Source: PGL-NSG_NTG_History_and_2019_Recommendations_2018-10-01_Final Faucet Aerator and Showerhead Correction 2019-04-12.xlsx, which is to be found on the Illinois SAG web site: http://ilsag.info/net-to-gross-framework.html.
Source: Peoples Gas tracking data and Guidehouse team analysis.

Table 3-6 summarizes the energy savings the NSG IHWAP portion of the IE Multifamily program achieved in 2019.

Table 3-6. 2019 Annual Energy Savings Summary for NSG

Program Path	Ex Ante Gross Savings (Therms)	Verified Gross RR*	Verified Gross Savings (Therms)	NTG†	Verified Net Savings (Therms)
IHWAP	24,147	92%	22,108	1.00	22,108
Total	**24,147**	**92%**	**22,108**	**1.00**	**22,108**

* Realization Rate (RR) is the ratio of verified gross savings to ex ante gross savings, based on evaluation research findings.
† Net-to-Gross (NTG) is the ratio of verified net savings to verified gross savings. The NTG is a deemed value. Source: PGL-NSG_NTG_History_and_2019_Recommendations_2018-10-01_Final Faucet Aerator and Showerhead Correction 2019-04-12.xlsx, which is to be found on the Illinois SAG web site: http://ilsag.info/net-to-gross-framework.html.
Source: North Shore Gas tracking data and Guidehouse team analysis.

3.3 Program Savings by Measure

The PGL program includes seven measures as shown in the following table. The custom domestic hot water heaters and custom boilers contributed the most savings.

Table 3-7. 2019 Annual Energy Savings by Measure for PGL

Research Category	Ex Ante Gross Savings (Therms)	Verified Gross RR	Verified Gross Savings (Therms)	NTG	Verified Net Savings (Therms)
Custom - Boiler	14,534	123%	17,904	1.00	17,904
Custom - DHW Heater	2,449	77%	1,876	1.00	1,876
Custom - Air Sealing	1,117	99%	1,107	1.00	1,107
Custom - BAS Controls	413	95%	392	1.00	392
Domestic Hot Water Pipe Insulation	57	100%	57	1.00	57
Low Flow Faucet Aerators (Kitchen)	43	100%	43	1.00	43
Low Flow Showerheads	20	100%	20	1.00	20
Low Flow Faucet Aerators (Bath)	10	100%	10	1.00	10
Total	**18,642**	**115%**	**21,409**	**1.00**	**21,409**

Source: Peoples Gas tracking data and Guidehouse team analysis.

The NSG program includes thirteen measures as shown in the following table. The custom air sealing and gas high efficiency furnace measures contributed the most savings.

Table 3-8. 2019 Annual Energy Savings by Measure for NSG

Research Category	Ex Ante Gross Savings (Therms)	Verified Gross RR	Verified Gross Savings (Therms)	NTG	Verified Net Savings (Therms)
Custom - Air Sealing	15,305	87%	13,267	1.00	13,267
Gas High Efficiency Furnace	3,633	100%	3,633	1.00	3,633
Attic Insulation	3,196	100%	3,196	1.00	3,196
Domestic Hot Water Pipe Insulation	973	100%	973	1.00	973
Advanced Thermostats	730	100%	730	1.00	730
Low Flow Faucet Aerators (Bath)	151	100%	151	1.00	151
Custom - Gas Water Heater	93	100%	93	1.00	93
Gas Water Heater	65	100%	65	1.00	65
Total	**24,147**	**92%**	**22,108**	**NA**	**22,108**

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

3.4 Impact Analysis Findings and Recommendations

Table 3-9 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 3-9. Verified Gross Savings Parameters

Measure	Unit Basis	Ex Ante Gross (therms/unit)	Verified Gross (therms/unit)	Realization Rate	Data Source(s)
Custom - Air Sealing	Project	Varies	Varies	Varies. Adjusted lower	Project File Review
Low Flow Showerhead	Each	0.288	0.288	100%	TRM Section 5.4.05
Low Flow Faucet Aerator - Bath	Each	Varies	Varies	100%	TRM Section 5.4.04
Low Flow Faucet Aerator – Kitchen	Each	0.618	0.618	100%	TRM Section 5.4.04
Advanced Thermostat	Each	34.75	34.75	100%	TRM Section 5.3.16
Gas High Efficiency Furnace	Each	Varies	Varies	100%	TRM Section 5.3.07
Gas Water Heater	Each	32.66	32.66	100%	TRM Section 5.4.02
Attic Insulation	Square Feet	Varies	Varies	100%	TRM Section 5.6.05
Hot Water Pipe Insulation	Linear Feet	Varies	Varies	100%	TRM Section 5.4.01
Custom – BAS Controls	Project	412.57	392.21	95%	Project File Review
Custom – Boiler	Project	Varies	Varies	Varies. Adjusted higher	Project File Review
Custom - DHW Heater	Project	Varies	Varies	Varies	Project File Review

* Program Tracking Data (PTD) provided by Peoples Gas and North Shore Gas, extract dated January 30, 2020.
† State of Illinois Technical Reference Manual version 7.0 from http://www.ilsag.info/technical-reference-manual.html.
‡ Project files and monthly billing data provided by Peoples Gas and North Shore Gas. Site data collected by Guidehouse as needed.

3.4.1 Peoples Gas Findings and Recommendations

3.4.1.1 Custom - Boiler

For the Custom – Boiler (MEA-2019.08.07-92788), the ex ante savings are calculated using incorrect hours for the temperature bin (-10 °F to 39 °F) and incorrect combustion efficiency for the efficient boiler. Guidehouse updated the hours for the temperature bin (-10 °F to 39 °F) and updated the combustion efficiency for the boiler using specification sheets. Guidehouse also used a scaling factor, calculated as the ratio of normalized usage (using utility bill analysis) at the facility to the baseline usage as predicted by the custom calculations to ensure calibration. The savings calculated using the custom approach were multiplied by the scaling factor.

Recommendation 1. Guidehouse recommends updating the hours for the temperature bin (-10 °F to 39 °F) and updating the combustion efficiency for the boiler to match the specification sheets. Guidehouse also recommends the implementer calibrate the savings calculation to match the predicted baseline consumption with the actual usage at the facility.

For the Custom – Boiler (MEA-2019.09.20-99547), the baseline boiler consumption is calculated using incorrect hours for the temperature bins (0 °F to 5 °F and 20 °F to 39 °F) and incorrect % Run Hours for the medium firing rate. The classification of the firing rate in the analysis for the efficient boiler consumption does not correspond to the specified outside air temperature (OAT) range. Both the baseline and efficient boiler consumption are calculated using the % Run Hours rather than the % Run Time per Hour.

Recommendation 2. Guidehouse recommends using the % Run Time per Hour instead of the % Run Hours when calculating consumption for the boilers. Guidehouse also recommends updating the hours for the temperature bins (0 °F to 5 °F and 20 °F to 39 °F), updating the % Run Hours for the medium firing rate of the baseline boiler and updating the classification of the firing rate for the efficient boiler based on OAT range.

For the Custom – DHW Boiler (MEA-2019.09.20-99547), the normalized usage at the facility calculated using utility bill analysis does not align with the baseline usage calculated using the custom approach, and is low when compared with the size of the building.

Recommendation 3. Guidehouse recommends collecting gas utility bills that reflect the actual gas consumption at the site for all meters going forward.

3.4.1.2 Custom – DHW Heater

For the Custom – DHW Heater projects (MEA-2019.08.07-92789 and MEA-2019.09.20-99548), the ex ante savings were calculated using the quantity information that does not align with the values provided in the tracking data. Additionally, an annual hour value of 8,760 was used for the ex ante calculations instead of the TRM v7.0 deemed value of 8,766 hours.

Recommendation 4. Guidehouse recommends updating the number of units for this measure based on tracking data and using the TRM deemed annual hours.

For the Custom – DHW Heater projects (MEA-2019.08.07-92789), Guidehouse used a scaling factor calculated as the ratio of normalized usage (using utility bill analysis) at the facility to the baseline usage as predicted by the custom calculations to ensure calibration. The savings calculated using the custom approach were multiplied by the scaling factor.

Recommendation 5. Guidehouse recommends the implementer calibrate the savings calculation to match the predicted baseline consumption with the actual usage at the facility.

For the Custom – DHW Heater projects (MEA-2019.09.20-99548), Guidehouse updated the efficiency of the baseline boiler and the volume of the tank as per the engineering report. The normalized usage at the facility calculated using utility bill analysis does not align with the baseline usage calculated using the custom approach and is low as compared to the size of the building.

Recommendation 6. Guidehouse recommends updating the baseline efficiency and volume of the tank as per the engineering report. Additionally, Guidehouse also recommends collecting gas utility bills that reflect the actual gas consumption at the site for all meters going forward.

3.4.1.3 Custom – Air Sealing

For the Custom – Air Sealing measure (MEA-2019.09.20-99549), the ex ante savings for air sealing gaskets were calculated using 0.70 therms per gasket. Guidehouse calculated verified savings using 0.47 therms per gasket as per TRM v7.0 Section 5.6.1.

Recommendation 7. Guidehouse recommends updating the per unit savings from installation of a gasket on an electrical outlet to 0.47 therms as per TRM v7.0 Section 5.6.1.

3.4.1.4 Custom – BAS Controls

For the Custom – BAS Controls (MEA-2019.08.07-92790), the ex ante savings are calculated using the deemed approach from TRM v7.0 Section 4.4.21 and custom (1,540 hours) heating effective full load hours (EFLH). In the absence of any documentation supporting the use of custom EFLH values, Guidehouse calculated the verified savings using the TRM deemed heating EFLH values corresponding to the MF – High Rise – Residential building type.

Recommendation 8. Guidehouse recommends using TRM deemed heating EFLH values corresponding to the appropriate building type for this measure unless custom values are well founded.

3.4.2 North Shore Gas Findings and Recommendations

3.4.2.1 Custom – Air Sealing

For the Custom – Air Sealing measure, the ex ante savings for window weather-stripping were calculated using the linear feet for the window caulking measure. Guidehouse calculated verified savings using the linear feet for the weather-stripping installed on window bottoms instead.

Recommendation 1. Guidehouse recommends calculating the energy savings for the window weather-stripping measure using the using the linear feet of weather-stripping installed on window bottoms.

3.4.3 Historical Realization Rates and NTG Values

Table 3-10 below shows the historical gross realization rates and NTG values for the Income Eligible Multi-Family Program.

Table 3-10. Historical Realization Rates and NTG Values

Program Year	PGL Verified Gross RR	NSG Verified Gross RR	PGL NTG	NSG NTG
GPY6 – IEMF	104%	NA	1.00	1.00
2018 – IHWAP	37%	89%	1.00	1.00
2019 – IHWAP	115%	92%	1.00	1.00

Source: Guidehouse evaluation research.

3.5 Appendix 1. Impact Analysis Methodology

Guidehouse determined verified gross savings for each program measure by:

1. Reviewing the savings algorithm inputs in the measure workbook for agreement with the TRM or evaluation research for non-deemed measures.
2. Validating that the savings algorithm was applied correctly.

3. Cross-checking per-unit savings values in the tracking data with the verified values in the measure workbook or in Navigant's calculations if the workbook did not agree with the TRM.
4. Multiplying the verified per-unit savings value by the quantity reported in the tracking data.
5. Conducting engineering desk file review of a subset of custom projects.

Engineering Review of Custom Project Files

The evaluation team conducted engineering desk file reviews of the custom projects in existing facilities installed in the 2019 PGL and NSG program, to verify project savings that were not based on measures specified in the TRM.

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

To support this review, the implementation contractor provided project documentation in electronic format for each 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, post inspection reports and photos, and calculation spreadsheets.

3.6 Appendix 2. Program-Specific Inputs for the Illinois TRC

Table 3-11 and Table 3-12 show the Total Resource Cost (TRC) cost-effectiveness analysis inputs available at the time of drafting this impact evaluation report. Additional required cost data (e.g., measure costs, program level incentive and non-incentive costs) are not included in this table and will be provided to the evaluation team later.

Table 3-11. TRC Inputs for PGL

Measure Category	Unit Basis	Quantity	EUL	Ex Ante Gross Savings (Therms)	Verified Gross Savings (Therms)	Verified Net Savings (Therms)
Custom - Boiler	Project	2	25	14,534	17,904	17,904
Custom - DHW Heater	Project	2	13	2,449	1,876	1,876
Custom - Air Sealing	Project	2	20	1,117	1,107	1,107
Custom - BAS Controls	Project	1	8	413	392	392
Domestic Hot Water Pipe Insulation	Linear Feet	434	15	57	57	57
Low Flow Faucet Aerators (Kitchen)	Each	69	10	43	43	43
Low Flow Showerheads	Each	69	10	20	20	20
Low Flow Faucet Aerators (Bath)	Each	78	10	10	10	10
Total		**657**	**23.3**	**18,642**	**21,409**	**21,409**

Source: Peoples Gas tracking data and Guidehouse team analysis.

Table 3-12. TRC Inputs for NSG

Measure Category	Unit Basis	Quantity	Effective Useful Life (Years)	Ex Ante Gross Savings (Therms)	Verified Gross Savings (Therms)	Verified Net Savings (Therms)
Custom - Air Sealing	Project	97	20	15,305	13,267	13,267
Gas High Efficiency Furnace	Each	20	20	3,633	3,633	3,633
Attic Insulation	Square Feet	19,935	20	3,196	3,196	3,196
Domestic Hot Water Pipe Insulation	Linear Feet	1,164	15	973	973	973
Advanced Thermostats	Each	21	11	730	730	730
Low Flow Faucet Aerators (Bath)	Each	97	10	151	151	151
Custom - Gas Water Heater	Project	3	13	93	93	93
Gas Water Heater	Each	2	13	65	65	65
Total		**21,408**	**19.4**	**24,147**	**22,108**	**22,108**

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