Guidehouse

Income Eligible Multi-Family Programs Impact Evaluation Report

Energy Efficiency Plan Year 2020 (1/1/2020-12/31/2020)

Prepared for:

Peoples Gas and North Shore Gas

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Table of Contents

List of Tables, Figures, and Equations

1. Introduction

This report presents the results of the impact evaluation of the Peoples Gas (PGL) and North Shore Gas (NSG) 2020 Income Eligible Multi-Family Programs. It presents a summary of the energy impacts for each program component and broken out by relevant measure and program structure details. Program year 2020 covers January 1, 2020 through December 31, 2020.

The Income Eligible Multi-Family Programs provide 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 programs offer assessments, direct installation of energy efficiency measures, rebates for replacement of inefficient equipment, technical assistance, and educational information through two program components.

There are several components offered to multi-family income eligible customers. The first is the Income Eligible Multi-Family Savings (IEMS) Program, jointly implemented with ComEd and with Elevate Energy operating as the implementer of the program. The Multi-Family Income Eligible Partner Trade Ally (PTA) Program is a non-joint offering, delivered by vetted Partner Trade Allies. Trade Allies are given higher rebate amounts to serve geographically income-eligible customers with retrofit measures. The evaluation of these two components is presented in Section 2.

A third component is the Income Eligible Retrofits Multi-Family (IER – MF) Program, which is in partnership with the Illinois Home Weatherization Assistance Program (IHWAP). This program 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.

2. Income Eligible Multi-Family IEMS and PTA Programs

2.1 Program Description

The IEMS Program direct installs eligible natural gas measures, including in-unit (IU) and common area (CA) measures such as CA steam boiler, CA pipe insulation, steam boiler averaging controls, IU showerhead, IU aerator, and attic insulation and air sealing, among others. The Partner Trade Ally (PTA) Program installs eligible natural gas measures, including controls for central domestic hot water (DHW), steam trap replacement or repair, CA pipe insulation, boiler tune up, and steam boiler averaging controls, among others.

The PGL programs had 900 participants in 2020 and completed 1,200 projects as shown in Table 2-1.

Table 2-1. 2020 Volumetric Summary for PGL

Participation	IEMS	PTA	Total
Participating Buildings *	145	755	900
Installed Projects †	192	1,008	1,200

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

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

Table 2-2. 2020 Installed Measure Quantities for PGL

Program Path	Measure	Quantity Unit	Installed Quantity
IEMS	CA Steam Boiler	kBtu/hr	89,107
	CA Pipe Insulation	Linear Feet	23,318
	CA Pipe Steam Averaging Controls	Projects	395
	CA Attic Insulation and Air Sealing	Square Feet	179,969
	IU Showerhead	Each	737
	IU Aerator	Each	1,332
	CA Hydronic Boiler	kBtu/hr	1,349
	CA DHW Controls	Apt Units	56
	IU Shower Timer	Each	533
	CA DHW Boiler	Apt Units	76
	IU Furnace	Each	10
	IU Programmable Thermostat	Each	30
	CA Air Sealing	Linear Feet	201
	IU Reprogram Thermostat	Each	6
	IU Advanced Thermostat	Each	11
	IU AC Cover and Gap Sealer	Each	28
PTA	Controls for Central DHW	Apt Units	14,150
	Steam Traps Replacement or Repair	Each	2,163
	Pipe Insulation	Linear Feet	121,695
	Boiler Tune Up	kBtu/hr	439,933
	Steam Boiler Averaging Controls	Apt Units	2,123
	Boiler Reset Controls	kBtu/hr	22,601
	Linkageless Boiler Controls	kBtu/hr	17,840
	DHW Storage Tank Insulation	Square Feet	661
	Condensate Tank Insulation	Square Feet	101

Source: Peoples Gas tracking data and Guidehouse evaluation team analysis.

The NSG programs had 22 participants in 2020 and completed 22 projects as shown in Table 2-3.

Table 2-3. 2020 Volumetric Summary for NSG

Participation	IEMS	PTA	Total
Participating Buildings *	6	16	22
Installed Projects †	6	16	22

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

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

Table 2-4. 2020 Installed Measure Quantities for NSG

Program Path	Measure	Quantity Unit	Installed Quantity
IEMS	IU Showerhead	Each	104
	IU Aerator	Each	125
	IU Shower Timer	Each	34
PTA	Boiler Tune Up	kBtu/hr	14,150
	Pipe Insulation	Linear Feet	306
	High Efficiency Boiler - HW	kBtu/hr	600

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

2.2 Savings Summary

Table 2-5 summarizes the energy savings the PGL IEMS and PTA programs achieved by path in 2020.

Table 2-5. 2020 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	88,661	101%	89,296	1.00	89,296
PTA	2,682,756	100%	2,691,119	1.00	2,691,119
Total or Weighted Average	**2,771,416**	**100%**	**2,780,415**	**1.00**	**2,780,415**

* Realization Rate (RR) is the ratio of verified gross savings to ex ante gross savings, based on evaluation research findings.
† A deemed value. Available on the SAG web site: https://www.ilsag.info/ntg_2020.
Source: Peoples Gas tracking data and Guidehouse evaluation team analysis.

Table 2-5 summarizes the energy savings the NSG IEMS and PTA programs achieved by path in 2020.

Table 2-6. 2020 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	623	100%	623	1.00	623
PTA	8,402	104%	8,710	1.00	8,710
Total or Weighted Average	**9,025**	**103%**	**9,333**	**1.00**	**9,333**

* Realization Rate (RR) is the ratio of verified gross savings to ex ante gross savings, based on evaluation research findings.
† A deemed value. Available on the SAG web site: https://www.ilsag.info/ntg_2020.
Source: North Shore Gas tracking data and Guidehouse evaluation team analysis.

2.3 Program Savings by Measure

The PGL programs include 25 measures as shown in the Table 2-7. The controls for central DHW and steam traps replacement or repair measures contributed the most savings.

Table 2-7. 2020 Annual Energy Savings by Measure for PGL

Program Path	Research Category	Ex Ante Gross Savings (Therms)	Verified Gross RR*	Verified Gross Savings (Therms)	NTG†	Verified Net Savings (Therms)
IEMS	CA Steam Boiler	30,189	101%	30,402	1.00	30,402
	CA Pipe Insulation	25,676	101%	26,052	1.00	26,052
	CA Pipe Steam Averaging Controls	15,395	100%	15,454	1.00	15,454
	CA Attic Insulation and Air Sealing	8,256	100%	8,257	1.00	8,257
	IU Showerhead	2,419	100%	2,419	1.00	2,419
	IU Aerator	1,999	101%	2,012	1.00	2,012
	CA Hydronic Boiler	1,345	103%	1,380	1.00	1,380
	CA DHW Controls	873	100%	873	1.00	873
	IU Shower Timer	547	100%	547	1.00	547
	CA DHW Boiler	544	100%	544	1.00	544
	IU Furnace	586	74%	432	1.00	432
	IU Programmable Thermostat	352	100%	352	1.00	352
	CA Air Sealing	226	100%	226	1.00	226
	IU Reprogram Thermostat	70	233%	164	1.00	164
	IU Advanced Thermostat	129	100%	129	1.00	129
	IU AC Cover and Gap Sealer	55	93%	51	1.00	51
	IEMS subtotal	***88,661***	***101%***	***89,296***	***1.00***	***89,296***
PTA	Controls for Central DHW	887,205	100%	887,022	1.00	887,022
	Steam Traps Replacement or Repair	882,504	100%	882,487	1.00	882,487
	Pipe Insulation	538,911	100%	540,098	1.00	540,098
	Boiler Tune Up	199,774	103%	206,218	1.00	206,218
	Steam Boiler Averaging Controls	129,694	100%	129,690	1.00	129,690
	Boiler Reset Controls	29,087	103%	30,032	1.00	30,032
	Linkageless Boiler Controls	11,261	100%	11,260	1.00	11,260
	DHW Storage Tank Insulation	3,542	100%	3,533	1.00	3,533
	Condensate Tank Insulation	778	100%	778	1.00	778
	PTA Subtotal	***2,682,756***	***100%***	***2,691,119***	***1.00***	***2,691,119***
	Total or Weighted Average	**2,771,416**	**100%**	**2,780,415**	**1.00**	**2,780,415**

* Realization Rate (RR) is the ratio of verified gross savings to ex ante gross savings, based on evaluation research findings.
† A deemed value. Available on the SAG web site: https://www.ilsag.info/ntg_2020.
Source: Peoples Gas tracking data and Guidehouse evaluation team analysis.

The NSG programs include six measures as shown in Table 2-8. The boiler tune up and pipe insulation measures contributed the most savings.

Table 2-8. 2020 Annual Energy Savings by Measure for NSG

Program Path	Research Category	Ex Ante Gross Savings (Therms)	Verified Gross RR*	Verified Gross Savings (Therms)	NTG†	Verified Net Savings (Therms)
IEMS	IU Showerhead	341	100%	341	1.00	341
	IU Aerator	247	100%	247	1.00	247
	IU Shower Timer	35	100%	35	1.00	35
	IEMS Subtotal	***623***	***100%***	***623***	***1.00***	***623***
PTA	Boiler Tune Up	6,426	103%	6,633	1.00	6,633
	Pipe Insulation	1,296	104%	1,348	1.00	1,348
	High Efficiency Boiler – Hot Water (HW)	680	107%	729	1.00	729
	PTA Subtotal	***8,402***	***104%***	***8,710***	***1.00***	***8,710***
	Total or Weighted Average	**9,025**	**103%**	**9,333**	**1.00**	**9,333**

* Realization Rate (RR) is the ratio of verified gross savings to ex ante gross savings, based on evaluation research findings.
† A deemed value. Available on the SAG web site: https://www.ilsag.info/ntg_2020.
Source: North Shore Gas tracking data and Guidehouse evaluation 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, the evaluation team provides findings and recommendations, including discussion of all measures with realization rates above or below 100 percent. Appendix A provides a description of the impact analysis methodology. Appendix B provides the Total Resource Cost (TRC) cost-effectiveness analysis inputs available at the time of drafting this impact evaluation report.

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 Boiler	kBtu/hr	Varies	Varies	Varies	IEMS Program Tracking Data (PTD*), Illinois TRM, v8.0†, Section 4.4.10
CA Pipe Insulation	Linear Feet	Varies	Varies	Varies	Illinois TRM, v8.0, Section 4.4.14 and PTD
CA Pipe Steam Averaging Controls	Projects	Varies	Varies	Varies	Illinois TRM, v8.0, Section 4.4.36 and PTD
CA Attic Insulation and Air Sealing	Square Feet	Varies	Varies	100%	Illinois TRM, v8.0, Section 5.6.5 and PTD
IU Showerhead	Each	11.32	11.32	100%	Illinois TRM, v8.0, Section 5.4.5
IU Aerator	Each	Varies	Varies	100%	Illinois TRM, v8.0, Section 5.4.4
CA Hydronic Boiler	kBtu/hr	Varies	Varies	Varies	Illinois TRM, v8.0, Section 4.4.10 and PTD
CA DHW Controls	Apt Units	Varies	Varies	100%	Illinois TRM, v8.0, Section 4.3.8 and PTD
IU Shower Timer	Each	3.54	3.54	100%	Illinois TRM, v8.0, Section 5.4.9
CA DHW Boiler	Apt Units	Varies	Varies	100%	Illinois TRM, v8.0, Section 4.3.7 and PTD
IU Furnace	Each	Varies	Varies	74%	Illinois TRM, v8.0, Section 5.3.5 and 5.3.7 and PTD
IU Programmable Thermostat	Each	40.50	40.50	100%	Illinois TRM, v8.0, Section 5.3.11
CA Air Sealing	Linear Feet	Varies	Varies	100%	Illinois TRM, v8.0, Section 5.6.1 and PTD

Measure	Unit Basis	Ex Ante Gross (therms/unit)	Verified Gross (therms/unit)	Realization Rate	Data Source(s)
IU Reprogram Thermostat	Each	40.50	40.50	100%	Illinois TRM, v8.0, Section 5.3.11
IU Advanced Thermostat	Each	Varies	Varies	100%	Illinois TRM, v8.0, Section 5.3.16
IU AC Cover and Gap Sealer	Each	Varies	Varies	93%	Illinois TRM, v8.0, Section 4.4.38 and PTD
Controls for Central DHW	Apt Units	62.70	62.69	Varies	Illinois TRM, v8.0, Section 4.3.8
Steam Traps Replacement or Repair	Each	408.00	407.99	100%	Illinois TRM, v8.0, Section 4.4.16
Pipe Insulation	Linear Feet	Varies	Varies	Varies	Illinois TRM, v8.0, Section 4.4.14
Boiler Tune Up	kBtu/hr	0.45	0.47	103%	Illinois TRM, v8.0, Section 4.4.2
Steam Boiler Averaging Controls	Apt Units	61.09	61.09	100%	Illinois TRM, v8.0, Section 4.4.36
Boiler Reset Controls	kBtu/hr	1.29	1.33	103%	Illinois TRM, v8.0, Section 4.4.4
Linkageless Boiler Controls	kBtu/hr	0.63	0.63	100%	Illinois TRM, v8.0, Section 4.4.21
DHW Storage Tank Insulation	Square Feet	5.36	5.34	100%	Illinois TRM, v8.0, Section 4.4.14
Condensate Tank Insulation	Square Feet	7.70	7.70	100%	Illinois TRM, v8.0, Section 4.4.14
High Efficiency Boiler - HW	kBtu/hr	1.13	1.22	107%	Illinois TRM, v8.0, Section 4.4.10

* Program Tracking Data (PTD) provided by Peoples Gas and North Shore Gas, extract dated February 1, 2021.
† State of Illinois Technical Reference Manual version 8.0 from http://www.ilsag.info/technical-reference-manual.html.
Source: Peoples Gas and North Shore Gas tracking data and Guidehouse evaluation team analysis

2.4.2 Findings and Recommendations

2.4.2.1 IEMS – Common Area Steam Boiler and Common Area Hydronic Boiler

The ex ante savings for two projects, project ID #10005587 and #10007100, were calculated using the EFLH heating hours from TRM v7.0. The evaluation team relied on the TRM v8.0 for program year 2020 and adjusted the verified savings accordingly. These measures have a gross realization rate is 101%.

Recommendation 1. Use the latest version of the TRM for determining the appropriate EFLH heating hours for the common area steam boiler and common area hydronic boiler measures.

The ex ante savings for a Common Area Steam Boiler measure (project ID 10005842) with a capacity of 2,403 kBtu/hr was calculated using a baseline efficiency of 80%. However, the appropriate baseline efficiency for this boiler size is 79%, as deemed by the TRM v8.0.

Recommendation 2. Use the latest version of the TRM to determine the appropriate baseline efficiency for the common area steam boiler measure.

2.4.2.2 IEMS – Common Area Pipe Insulation

The ex ante savings for this measure are calculated using the EFLH heating values for measures installed in mid-rise multi-family buildings, however the tracking data indicates measures are installed in both high rise and mid-rise multi-family buildings. The mid-rise EFLH value used in the ex ante calculations was 1,728 hours, but the correct TRM v8.0 value is 1,782 hours. The gross realization rate is 101%.

Recommendation 3. Use the EFLH heating value of 1,782 and 1,540 for mid-rise and high-rise buildings, respectively.

2.4.2.3 IEMS – Common Area Pipe Steam Averaging Controls

The ex ante savings for the project ID #10006567 and #10004887 were calculated using the EFLH heating hours from the TRM v7.0. The evaluation team relied on the TRM v8.0 for program year 2020 and adjusted the verified savings accordingly.

Recommendation 4. Use the EFLH heating hours deemed in the latest version of the TRM.

2.4.2.4 IEMS – In Unit Furnace

The ex ante savings calculations for this measure assumed that a quality installation was performed by the implementer, as defined by TRM v8.0. The evaluation team found no documentation for the claim of quality installation, and therefore adjusted the verified savings with a 74% gross realization rate.

Recommendation 5. Do not include the savings adjustment for quality installation when calculating savings for furnaces if no relevant documentation is available to support this assumption.

2.4.2.5 IEMS – In Unit AC Cover and Gap Sealer

The ex ante savings for this measure are calculated using the TRM v8.0 deemed effective full load hours (EFLH) heating value of 1,782 hours for mid-rise multi-family buildings. However, the measure was installed in a high-rise multi-family residential (EFLH = 1,666 hours). The adjusted gross realization rate is 93%.

Recommendation 6. Use the appropriate building type-specific EFLH heating values for the In Unit AC Cover and Gap Sealer measure as tracked.

2.4.2.6 IEMS – Therms Allocation

The tracking data did not include the gas utility name for the project ID 10005880 and Peoples Gas did not claim any therms savings for this project. After confirming the gas utility name with the implementer, Guidehouse allocated 29% of the verified therm savings for this project ID to Peoples Gas based on the approved therms allocation.

Recommendation 7. The implementer provide the gas utility name for all applicable projects and claim the approved therms in the tracking data.

2.4.2.7 PTA – High Efficiency Boiler – HW

The ex ante savings for this measure are calculated using an incorrect savings algorithm. In the ex ante calculations, the difference between the efficient and baseline boiler efficiency rating is divided by the efficient boiler efficiency rating. This is incorrect as the difference between the efficient and baseline boiler efficiency rating should be divided by the baseline boiler efficiency rating as per the TRM v8.0. This NSG project has a gross realization rate of 107%.

Recommendation 8. The implementer update the savings algorithm to divide the difference between the efficient and baseline boiler efficiency rating by the baseline boiler efficiency rating as per the TRM v8.0.

2.4.2.8 PTA – Boiler Tune Up and Boiler Reset Controls

The ex ante savings for this measure are calculated using an average of the EFLH heating hours from the TRM v7.0. However, the EFLH heating values from the TRM v8.0 (MF – High Rise and MF – Mid Rise) are appropriate for 2020 measures. These measures had a 103% gross realization rate.

Recommendation 9. Use the EFLH heating hours deemed in the latest version of the TRM.

2.4.2.9 PTA – Controls for Central DHW

The measure name in the tracking data for project ID 6738121 is “On Demand DHW Circulation System - PG MF PTA 20” and the per unit net savings for this project ID are calculated using a NTG value of 0.87. The gross savings for this measure are calculated as per the TRM v8.0.

Recommendation 10. Ensure all projects under this program use measure names and NTG values corresponding to the income eligible program.

2.4.2.10 PTA – CA Pipe Insulation (HW Medium 2.1” to 4”)

The nominal therms/ft and WSFU to Pipe diameter adjustment calculations are not properly aligned by size in the 2020 MMDB[1] ex ante calculator for this measure. The evaluation team acknowledges that this issue has been addressed in the 2021 MMDB[2].

[1] Franklin Energy Master Measure Database, Excel file *2020 MMDB - Res and MF,* provided January 23, 2020.

[2] Franklin Energy Master Measure Database, Excel file *2021 MMDB - Res and MF,* version dated February 8, 2021.

2.4.2.11 PTA – CA Pipe Insulation (Steam Large Fitting and Steam X-Large Fitting)

The ex ante savings for these measures are calculated using the 'MF Steam' values in the ex ante calculator. Verified savings for these measures are calculated using the 'Weighted MF Steam' values in the ex ante calculator to be consistent with the small fitting and medium fitting measures and the steam valve measures.

Recommendation 11. Update the calculations for the CA Pipe Insulation measure to use the 'Weighted MF Steam' values in the ex ante calculator to be consistent with other steam fitting and steam valve measures.

2.4.3 Historical Realization Rates and NTG Values

Table 2-10 shows the historical gross realization rates and NTG values for the IEMS and PTA programs.

Table 2-10. Historical Realization Rates and NTG Values – IEMS and PTA

Program Year	PGL Verified Gross RR	NSG Verified Gross RR	PGL NTG	NSG NTG
GPY6 – IEMF(2017)	104%	NA	1.00	1.00
2018 - IEMS	97%	100%	1.00	1.00
2019 - IEMS	101%	100%	1.00	1.00
2020 – IEMS	101%	100%	1.00	1.00
2020 – PTA	100%	104%	1.00	1.00

Source: Guidehouse evaluation research.

Appendix A. Impact Analysis Methodology

Guidehouse determined verified gross savings for each program measure by:

1. Reviewing the savings algorithm inputs in the 2020 Master Measure Database (MMDB)[3] for agreement with the TRM v8.0[4] 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 MMDB or in Guidehouse'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.

[3] Franklin Energy Master Measure Database, Excel file *2020 MMDB - Res and MF,* provided January 23, 2020.

[4] Available on the Illinois SAG web site: http://www.ilsag.info/technical-reference-manual.html

Appendix B. Program-Specific Inputs for the Illinois TRC

Table B-1. and Table B-2 show 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. Guidehouse will include annual and lifetime water savings and greenhouse gas reductions in the end of year summary report.

Table B-1. TRC Inputs for PGL – IEMS and PTA

Program Path	Research Category	Units	Quantity	Effective Useful Life	Ex Ante Gross Savings (Therms)	Verified Gross Savings (Therms)	Verified Net Savings (Therms)
IEMS	CA Steam Boiler	kBtu/hr	89,107	25.0	30,189	30,402	30,402
	CA Pipe Insulation	Linear Feet	23,318	15.0	25,676	26,052	26,052
	CA Pipe Steam Averaging Controls	Projects	395	20.0	15,395	15,454	15,454
	CA Attic Insulation and Air Sealing	Square Feet	179,969	20.0	8,256	8,257	8,257
	IU Showerhead	Each	737	10.0	2,419	2,419	2,419
	IU Aerator	Each	1,332	10.0	1,999	2,012	2,012
	CA Hydronic Boiler	kBtu/hr	1,349	25.0	1,345	1,380	1,380
	CA DHW Controls	Apt Units	56	15.0	873	873	873
	IU Shower Timer	Each	533	2.0	547	547	547
	CA DHW Boiler	Apt Units	76	15.0	544	544	544
	IU Furnace	Each	10	20.0	586	432	432
	IU Programmable Thermostat	Each	30	8.0	352	352	352
	CA Air Sealing	Linear Feet	201	20.0	226	226	226
	IU Reprogram Thermostat	Each	6	2.0	70	164	164
	IU Advanced Thermostat	Each	11	11.0	129	129	129
	IU AC Cover and Gap Sealer	Each	28	5.0	55	51	51
PTA	Controls for Central DHW	Apt Units	14,150	15.0	887,205	887,022	887,022
	Steam Traps Replacement or Repair	Each	2,163	6.0	882,504	882,487	882,487
	Pipe Insulation	Linear Feet	121,695	15.0	538,911	540,098	540,098
	Boiler Tune Up	kBtu/hr	439,933	3.0	199,774	206,218	206,218
	Steam Boiler Averaging Controls	Apt Units	2,123	20.0	129,694	129,690	129,690
	Boiler Reset Controls	kBtu/hr	22,601	20.0	29,087	30,032	30,032
	Linkageless Boiler Controls	kBtu/hr	17,840	16.0	11,261	11,260	11,260
	DHW Storage Tank Insulation	Square Feet	661	15.0	3,542	3,533	3,533
	Condensate Tank Insulation	Square Feet	101	15.0	778	778	778
Total or Weighted Average			**NA**	**11.7**	**2,771,416**	**2,780,415**	**2,780,415**

Source: Peoples Gas tracking data and Guidehouse evaluation team analysis.

Table B-2. TRC Inputs for NSG – IEMS and PTA

Program Path	Research Category	Units	Quantity	Effective Useful Life	Ex Ante Gross Savings (Therms)	Verified Gross Savings (Therms)	Verified Net Savings (Therms)
IEMS	IU Showerhead	Each	104	10.0	341	341	341
	IU Aerator	Each	125	10.0	247	247	247
	IU Shower Timer	Each	34	2.0	35	35	35
PTA	Boiler Tune Up	kBtu/hr	14,150	3.0	6,426	6,633	6,633
	Pipe Insulation	Linear Feet	306	15.0	1,296	1,348	1,348
	High Efficiency Boiler - HW	kBtu/hr	600	25.0	680	729	729
Total or Weighted Average			**NA**	**6.9**	**9,025**	**9,333**	**9,333**

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

3. Multi-Family Savings IHWAP

3.1 Program Description

The IHWAP eligible natural gas measures include programmable thermostats, weatherization and water efficiency equipment, and custom measures. The PGL portion of the program had one participant in 2020 and completed one project as shown in Table 3-1.

Table 3-1. 2020 Volumetric Summary for PGL

Participation	Total
Participants *	1
Installed Projects †	1
Measure Types Installed	2

* Participants are defined as the count of unique customer addresses
† Installed Projects are defined as the unique amount of Gas Account Numbers
Source: Peoples Gas tracking data and Guidehouse evaluation team analysis.

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

Table 3-2. 2020 Installed Measure Quantities for PGL

Program Path	Measure	Quantity Unit	Quantity Installed
IHWAP	Custom Measure	Projects	2
IHWAP	Air Sealing	Varies	3,622

Source: Peoples Gas tracking data and Guidehouse evaluation team analysis.

The NSG program had five participants in 2020 and completed 19 projects as shown in Table 3-3.

Table 3-3. 2020 Volumetric Summary for NSG

Participation	Total
Participants *	5
Installed Projects †	19
Measure Types Installed	7

* Participants are defined as the count of unique customer addresses
† Installed Projects are defined as the unique amount of Gas Account Numbers
Source: North Shore Gas tracking data and Guidehouse evaluation team analysis.

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

Table 3-4. 2020 Installed Measure Quantities for NSG

Program Path	Measure	Quantity Unit	Quantity Installed
IHWAP	Low Flow Faucet Aerators	Units	38
IHWAP	Low Flow Showerhead	Units	19
IHWAP	Air Sealing	Varies	19
IHWAP	Advanced Thermostats	Units	19
IHWAP	Ceiling/Attic Insulation	Sq. Ft.	9,453
IHWAP	Domestic Hot Water Pipe Insulation	Ln. Ft.	208
IHWAP	Gas High Efficiency Furnace	Units	9

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

3.2 Savings Summary

Table 3-5 summarizes the energy savings the PGL IHWAP portion of the IE Multifamily program achieved in 2020.

Table 3-5. 2020 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	**7,854**	**96%**	**7,543**	**1.00**	**7,543**

* Realization Rate (RR) is the ratio of verified gross savings to ex ante gross savings, based on evaluation research findings.
† A deemed value. Available on the SAG web site: https://www.ilsag.info/ntg_2020.
Source: Peoples Gas tracking data and Guidehouse evaluation team analysis.

Table 3-6 summarizes the energy savings the NSG IHWAP portion of the IE Multifamily program achieved in 2020.

Table 3-6. 2020 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	**4,262**	**100%**	**4,262**	**1.00**	**4,262**

* Realization Rate (RR) is the ratio of verified gross savings to ex ante gross savings, based on evaluation research findings.
† A deemed value. Available on the SAG web site: https://www.ilsag.info/ntg_2020.
Source: North Shore Gas tracking data and Guidehouse evaluation team analysis.

3.3 Program Savings by Measure

The PGL program includes two measures as shown in Table 3-7. The custom measures contributed the most savings.

Table 3-7. 2020 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 Measure	6,275	95%	5,963	1.00	5,963
Air Sealing	1,579	100%	1,580	1.00	1,580
Total or Weighted Average	**7,854**	**96%**	**7,543**	**1.00**	**7,543**

* Realization Rate (RR) is the ratio of verified gross savings to ex ante gross savings, based on evaluation research findings.
† A deemed value. Available on the SAG web site: https://www.ilsag.info/ntg_2020.
Source: Peoples Gas tracking data and Guidehouse evaluation team analysis.

The NSG program includes seven measures as shown in Table 3-8. The Advanced Thermostats and Ceiling/Attic Insulation measures contributed the most savings.

Table 3-8. 2020 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)
Low Flow Faucet Aerators	63	100%	63	1.00	63
Low Flow Showerhead	54	100%	54	1.00	54
Air Sealing	474	100%	474	1.00	474
Advanced Thermostats	1,092	100%	1,092	1.00	1,092
Ceiling/Attic Insulation	1,538	100%	1,538	1.00	1,538
Domestic Hot Water Pipe Insulation	183	100%	183	1.00	183
Gas High Efficiency Furnace	758	100%	758	1.00	758
Total or Weighted Average	**4,262**	**100%**	**4,262**	**1.00**	**4,262**

* Realization Rate (RR) is the ratio of verified gross savings to ex ante gross savings, based on evaluation research findings.
† A deemed value. Available on the SAG web site: https://www.ilsag.info/ntg_2020.
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, the evaluation team provide findings and recommendations, including discussion of all measures with realization rates above or below 100 percent. Appendix C provides a description of the impact analysis methodology. Appendix D provides the Total Resource Cost (TRC) cost-effectiveness analysis inputs available at the time of drafting this impact evaluation report.

Table 3-9. Verified Gross Savings Parameters

Measure	Unit Basis	Ex Ante Gross (therms/unit)	Verified Gross (therms/unit)	Realization Rate	Data Source(s)
Low Flow Faucet Aerators	Units	4.28	4.28	100%	Illinois TRM, v8.0†, Section 5.4.4 and PTD
Low Flow Showerhead	Units	2.85	2.85	100%	Illinois TRM, v8.0†, Section 5.4.5 and PTD
Air Sealing	Varies	0.56	0.56	100%	Illinois TRM, v8.0, Section 5.6.1 and PTD
Advanced Thermostats	Units	57.49	57.49	100%	Illinois TRM, v8.0, Section 5.3.16 and PTD
Ceiling/Attic Insulation	Sq. Ft.	0.16	0.16	100%	Illinois TRM, v8.0, Section 5.6.5 and PTD
Domestic Hot Water Pipe Insulation	Ln. Ft.	0.88	0.88	100%	Illinois TRM, v8.0, Section 5.4.1 and PTD
Gas High Efficiency Furnace	Units	84.27	84.27	100%	Illinois TRM, v8.0, Section 5.3.7 and PTD
Custom Measure	Projects	Vary	Vary	95%	Project File Review, Monthly Billing Data, Site Verification‡

* Program Tracking Data (PTD) provided by Peoples Gas and North Shore Gas, extract dated February 2, 2021.
† State of Illinois Technical Reference Manual version 8.0 from http://www.ilsag.info/technical-reference-manual.html.
‡ Project files and monthly billing data provided by Peoples Gas and North Shore Gas. When conducted, on-site and telephone interview data collected by Guidehouse.
Source: Peoples Gas and North Shore Gas tracking data and Guidehouse team analysis.

3.4.1 Findings and Recommendations

3.4.1.1 Custom Measures

Standby loss for the high efficiency Domestic Hot Water (DHW) boiler efficiency upgrade measure in the ex ante savings are calculated using the input rating of the boiler in MBH (1,000 BTH per hour) and the TRM v8.0 algorithm. However, the algorithm used to calculate the energy savings requires the input rating of the boiler to be in Btuh (1 Btu per hour).

> **Recommendation 1.** Update the standby loss calculation for the Domestic Hot Water measure to use the Btuh input rating of the boiler.

No verified savings were calculated for the DHW boiler turndown improvement measure because the boiler percent load always exceeded the minimum turndown ratio, resulting in no energy loss due to cycling for both the baseline and efficient cases.

> **Recommendation 2.** Update the algorithm for the energy loss due to cycling parameter to use 0% when the boiler percent load exceeds the minimum turndown ratio.

The ex ante savings for the HHW boiler efficiency upgrade measure were calculated using deemed parameters (Effective Full Load Hours, EFLH) corresponding to the mid-rise multi-

family building type from the TRM v8.0. The evaluation team verified this building to be a high-rise multi-family building based on the building type definition from the TRM v8.0 and consequently used deemed parameters corresponding to the high-rise building type.

Recommendation 3. Use the building type definitions from the TRM v8.0 when classifying the buildings as high-rise or mid-rise.

3.4.2 Historical Realization Rates and NTG Values

Table 3-10 shows the historical gross realization rates and NTG values for the Income Eligible Retrofits Multi-Family Program. Beginning in GPY6, the NTG values shown are a savings weighted average from the various measures and deemed NTGs that vary by measure and program path.

Table 3-10. Historical Realization Rates and NTG Values - IHWAP

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	114%	92%	1.00	1.00
2020 – IHWAP	96%	100%	1.00	1.00

Source: Guidehouse evaluation research.

Appendix C. 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 v8.0[5].
2. Comparing reported measures to the ComEd program tracking data for any overlap, to both ensure there was no double counting of therm savings and to bring in the actual percentage of therms savings going to PGL and NSG.
3. Validating that the savings algorithm was applied correctly to the ex-ante reported savings.
4. Cross-checking per-unit savings values in the tracking data with the verified values Guidehouse calculated in the measure workbook.
5. Multiplying the verified per-unit savings value by the quantity reported in the tracking data.
6. Conducting engineering desk file review of a subset of custom projects to determine their verified savings and effective useful life.

For the custom projects, an in-depth application review was performed by a Guidehouse engineer to assess the engineering methods, parameters and assumptions used to generate all ex ante impact estimates. We reviewed project documentation in application forms and supporting documentation from the applicant. Table C-1 provides a summary of M&V results for the custom projects reviewed by Guidehouse.

Table C-1. Custom Project Summary - IHWAP

Project ID	Measure Description	Ex Ante Gross Savings (Therms)	Gross Realization Rate	Verified Gross Savings (Therms)	Summary of Adjustment
PID-2020.06.08-69369	HHW Boiler Efficiency Upgrade	2,447	86%	2,115	Updated EFLH to correspond to the updated building type classification
	DHW Boiler Efficiency Upgrade	3,818	101%	3,848	Updated input rating of the boiler used in the standby loss calculations
	DHW Boiler Turndown Improvement	8.7	0%	0	Updated energy loss to be zero when Boiler Load % is greater than Turndown Ratio

Source: Guidehouse evaluation team analysis.

Engineering Review of Custom Project Files

The evaluation team conducted engineering desk file reviews of the custom projects in existing facilities installed in the 2020 PGL 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

[5] Available on the Illinois SAG web site: http://www.ilsag.info/technical-reference-manual.html

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.

Appendix D. Program-Specific Inputs for the Illinois TRC

Table D-1 and Table D-2 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. Guidehouse will include annual and lifetime water savings and greenhouse gas reductions in the end of year summary report.

Table D-1. TRC Inputs for PGL - IHWAP

Program Path	Research Category	Units	Quantity	Effective Useful Life	Ex Ante Gross Savings (Therms)	Verified Gross Savings (Therms)	Verified Net Savings (Therms)
IHWAP	Custom Measure	Projects	2	18.5	6,275	5,963	5,963
	Air Sealing	Varies	3,622	20.0	1,579	1,580	1,580
Total or Weighted Average			**3,624**	**18.8**	**7,854**	**7,543**	**7,543**

Source: Peoples Gas tracking data and Guidehouse evaluation team analysis.

Table D-2. TRC Inputs for NSG - IHWAP

Program Path	Research Category	Units	Quantity	Effective Useful Life	Ex Ante Gross Savings (Therms)	Verified Gross Savings (Therms)	Verified Net Savings (Therms)
IHWAP	Low Flow Faucet Aerators	Units	38	10.0	63	63	63
	Low Flow Showerhead	Units	19	10.0	54	54	54
	Air Sealing	Varies	19	20.0	474	474	474
	Advanced Thermostats	Units	19	11.0	1,092	1,092	1,092
Prescriptive	Ceiling/Attic Insulation	Sq. Ft.	9,453	20.0	1,538	1,538	1,538
	Domestic Hot Water Pipe Insulation	Ln. Ft.	208	15.0	183	183	183
	Gas High Efficiency Furnace	Units	9	20.0	758	758	758
Total or Weighted Average			**9,765**	**17.0**	**4,262**	**4,262**	**4,262**

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