Income Eligible Multi-Family Programs Impact Evaluation Report

Energy Efficiency Plan Year 2021 (1/1/2021-12/31/2021)

Prepared for:

Peoples Gas and North Shore Gas

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Prepared by:

Sophie Berne
Guidehouse

Sagar Phalke
Guidehouse

Submitted to:

Peoples Gas
North Shore Gas
200 East Randolph Street
Chicago, IL 60601

Submitted by:

Guidehouse
150 N. Riverside Plaza, Suite 2100
Chicago, IL 60606

Contact:

Ed Balbis	Stu Slote	Kevin Grabner
Partner	Director	Associate Director
561.644.9407	802.526.5113	608.616.5805
ebalbis@guidehouse.com	stu.slote@guidehouse.com	kevin.grabner@guidehouse.com

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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) 2021 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 2021 covers January 1, 2021 through December 31, 2021.

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 (DI) 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 IEMS program component is administered by ComEd, Peoples Gas, and North Shore Gas with resulting savings distributed between the utilities based on an agreed upon therms disposition. For all projects implemented in Peoples Gas territory, 88% savings are claimed by ComEd, and the remaining 12% savings are claimed by Peoples Gas. For all projects implemented in North Shore Gas territory, 100% savings are claimed by ComEd. For the PTA program, no projects were installed in North Shore Gas territory. Thus, no savings were verified for North Shore Gas for the IEMS and PTA programs.

The PGL programs had 690 participants in 2021 and completed 1,027 projects as shown in Table 2-1.

Table 2-1. 2021 Volumetric Summary for PGL

Participation	IEMS	PTA	Total
Participating Buildings *	260	430	690
Installed Projects †	385	642	1,027

* 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. 2021 Installed Measure Quantities for PGL

Program Path	Measure	Quantity Unit	Installed Quantity
IEMS	CA Pipe Insulation	Varies	46,638
	CA Steam Boiler	MBH	97,890
	CA Attic Insulation and Air Sealing	Square Feet	245,025
	CA Averaging Controls	Apt Units	242
	IU Showerhead	Each	971
	IU Kitchen Aerator	Each	1,851
	CA Hydronic Boiler	Varies	199
	IU Programmable Thermostat	Each	182
	CA On-Demand DHW Control	Apt Units	81
	CA Steam Trap	Each	98
	CA Sidewall Insulation	Square Feet	1,560
	IU Shower Timer	Each	966
	IU Advanced Thermostat	Each	39
	IU Furnace	MBH	843
	IU Bathroom Aerator	Each	989
	CA Door Weatherstrip	Doors	143
	CA Door Sweep	Each	130
	IU Reprogram Thermostat	Each	19
	CA Wall Insulation	Square Feet	6,100
	IU AC Cover and Gap Sealer	Each	51
PTA	Pipe Insulation	Varies	99,776
	Controls for Central DHW	Apt Units	7,179
	Steam Traps	Each	808
	Boiler Averaging Controls	Apt Units	1,623
	Boiler Tune Up	MBH	207,341
	Prescriptive Change - Steam Traps	Project	38,285
	Boiler Reset Controls	MBH	13,879
	Prescriptive Change - Other	Project	14,467
	DHW Storage Tank Insulation	Square Feet	623
	Linkageless Controls	MBH	2,500
	Condensate Tank Insulation	Square Feet	137

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

2.2 Savings Summary

Table 2-3 summarizes the energy savings the PGL IEMS and PTA programs achieved by path in 2021.

Table 2-3. 2021 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	60,148	101%	60,988	1.00	60,988
PTA	1,472,465	100%	1,472,151	1.00	1,472,151
Total or Weighted Average	**1,532,613**	**100%**	**1,533,139**	**1.00**	**1,533,139**

* 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/evaluator-ntg-recommendations-for-2021/.
Source: Peoples Gas tracking data and Guidehouse evaluation team analysis.

2.3 Program Savings by Measure

The PGL programs include 31 measures as shown in the Table 2-4. The pipe insulation and controls for central domestic hot water (DHW) measures in the PTA path contributed the most savings.

Table 2-4. 2021 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 Pipe Insulation	22,769	104%	23,650	1.00	23,650
	CA Steam Boiler	15,442	100%	15,442	1.00	15,442
	CA Attic Insul. and Air Sealing	9,938	100%	9,911	1.00	9,911
	CA Averaging Controls	4,753	100%	4,753	1.00	4,753
	IU Showerhead	1,240	99%	1,229	1.00	1,229
	IU Kitchen Aerator	1,195	98%	1,173	1.00	1,173
	CA Hydronic Boiler	870	100%	870	1.00	870
	IU Programmable Thermostat	851	99%	846	1.00	846
	CA On-Demand DHW Control	633	100%	633	1.00	633
	CA Steam Trap	518	100%	518	1.00	518
	CA Sidewall Insulation	460	100%	460	1.00	460
	IU Shower Timer	389	100%	389	1.00	389
	IU Advanced Thermostat	310	100%	310	1.00	310
	IU Furnace	207	100%	207	1.00	207
	IU Bathroom Aerator	168	98%	166	1.00	166
	CA Door Weatherstrip	134	100%	134	1.00	134
	CA Door Sweep	114	100%	114	1.00	114
	IU Reprogram Thermostat	78	94%	73	1.00	73
	CA Wall Insulation	54	156%	84	1.00	84
	IU AC Cover and Gap Sealer	25	100%	25	1.00	25
	IEMS subtotal	***60,148***	***101%***	***60,988***	***1.00***	***60,988***
PTA	Pipe Insulation	601,528	100%	601,688	1.00	601,688
	Controls for Central DHW	450,123	100%	450,031	1.00	450,031
	Steam Traps	147,934	100%	147,953	1.00	147,953
	Boiler Averaging Controls	99,149	100%	99,146	1.00	99,146
	Boiler Tune Up	97,181	100%	97,191	1.00	97,191
	Prescriptive Change-Steam Traps	38,285	100%	38,285	1.00	38,285
	Boiler Reset Controls	17,862	103%	18,442	1.00	18,442
	Prescriptive Change - Other	14,467	100%	14,467	1.00	14,467
	DHW Storage Tank Insulation	3,452	71%	2,466	1.00	2,466
	Linkageless Controls	1,578	100%	1,578	1.00	1,578
	Condensate Tank Insulation	904	100%	904	1.00	904
	PTA Subtotal	***1,472,465***	***100%***	***1,472,151***	***1.00***	***1,472,151***
	Total or Weighted Average	**1,532,613**	**100%**	**1,533,139**	**1.00**	**1,533,139**

* 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/evaluator-ntg-recommendations-for-2021/.
Source: Peoples Gas tracking data and Guidehouse evaluation team analysis.

2.4 Impact Analysis Findings and Recommendations

2.4.1 Impact Parameter Estimates

Table 2-5 shows the unit therm savings and realization rate findings by measure from our review. Following the table, the evaluation team provides findings and recommendations, including discussion of all measures with realization rates above or below 100 percent. **Error! Reference source not found.** provides a description of the impact analysis methodology. Appendix B provides the Total Resource Cost (TRC) cost-effectiveness analysis inputs.

Table 2-5. Verified Gross Savings Parameters

Measure	Unit Basis	Ex Ante Gross (therms/unit)	Verified Gross (therms/unit)	Realization Rate	Data Source(s)
CA Pipe Insulation – IEMS	Linear Feet Each	Varies	Varies	Varies	IEMS or PTA Program Tracking Data (PTD*), Illinois TRM, v9.0†, Section 4.4.14
CA Steam Boiler – IEMS	kBtu/hr	Varies	Varies	100%	Illinois TRM, v9.0, Section 4.4.10 and PTD
CA Attic Insulation and Air Sealing – IEMS	Square Feet	Varies	Varies	Varies	Illinois TRM, v9.0, Section 5.6.5 and PTD
CA Averaging Controls – IEMS	Project	Varies	Varies	100%	Illinois TRM, v9.0, Section 4.4.36 and PTD
IU Showerhead – IEMS	Each	11.32	11.32	100%	Illinois TRM, v9.0, Section 5.4.5 and PTD
IU Kitchen Aerator – IEMS	Each	7.87	7.87	100%	Illinois TRM, v9.0, Section 5.4.4 and PTD
CA Hydronic Boiler – IEMS	kBtu/hr Each	Varies	Varies	100%	Illinois TRM, v9.0, Section 4.4.10 and PTD
IU Programmable Thermostat – IEMS	Each	HDD 1=42.40 HDD 2=40.50	HDD 1=42.40 HDD 2=40.50	100%	Illinois TRM, v9.0, Section 5.3.11 and PTD
CA On-Demand DHW Control – IEMS	Apt Units	Varies	Varies	100%	Illinois TRM, v9.0, Section 4.3.8 and PTD
CA Steam Trap – IEMS	Each	Varies	Varies	100%	Illinois TRM, v9.0, Section 4.4.16 and PTD
CA Sidewall Insulation – IEMS	Linear Feet	2.46	2.46	100%	Illinois TRM, v9.0, Section 5.6.2 and PTD
IU Shower Timer – IEMS	Each	3.54	3.54	100%	Illinois TRM, v9.0, Section 5.4.9 and PTD
IU Advanced Thermostat – IEMS	Each	Varies	Varies	100%	Illinois TRM, v9.0 Errata, Section 5.3.16 and PTD
IU Furnace – IEMS	kBtu/hr	Varies	Varies	100%	Illinois TRM, v9.0, Section 5.3.7 and PTD

Measure	Unit Basis	Ex Ante Gross (therms/unit)	Verified Gross (therms/unit)	Realization Rate	Data Source(s)
IU Bathroom Aerator – IEMS	Each	1.64	1.64	100%	Illinois TRM, v9.0, Section 5.4.4 and PTD
CA Door Weatherstrip – IEMS	Linear Feet	7.81	7.81	100%	Illinois TRM, v9.0, Section 5.6.1 and PTD
CA Door Sweep – IEMS	Sweep	7.30	7.30	100%	Illinois TRM, v9.0, Section 5.6.1 and PTD
IU Reprogram Thermostat – IEMS	Each	Varies	Varies	100%	Illinois TRM, v9.0, Section 5.3.11 and PTD
CA Wall Insulation – IEMS	Square Feet	Varies	Varies	Varies	Illinois TRM, v9.0, Section 5.6.4 and PTD
IU AC Cover and Gap Sealer – IEMS	Each	Varies	Varies	100%	Illinois TRM, v9.0, Section 4.4.38 and PTD
Pipe Insulation – PTA	Linear Feet Each	Varies	Varies	Varies	Illinois TRM, v9.0, Section 4.4.14 and PTD
Controls for Central DHW – PTA	Apt Units	62.70	62.69	100%	Illinois TRM, v9.0, Section 4.4.38 and PTD
Steam Traps – PTA	Each	Mid Rise = 209.40 High Rise = 180.90	Mid Rise = 209.36 High Rise = 180.93	100%	Illinois TRM, v9.0, Section 4.4.16 and PTD
Boiler Averaging Controls – PTA	Apt Units	61.09	61.09	100%	Illinois TRM, v9.0, Section 4.4.36 and PTD
Boiler Tune Up – PTA	kBtu/hr	0.47	0.47	100%	Illinois TRM, v9.0, Section 4.4.2 and PTD
Prescriptive Change - Steam Traps – PTA	Project	1.00	1.00	100%	Illinois TRM, v9.0, Section and PTD
Boiler Reset Controls – PTA	kBtu/hr	1.29	1.33	103%	Illinois TRM, v9.0, Section 4.4.4 and PTD
Prescriptive Change - Other – PTA	Project	1.00	1.00	100%	Illinois TRM, v9.0, Section and PTD
DHW Storage Tank Insulation – PTA	Square Feet	5.54	3.96	71%	Illinois TRM, v9.0, Section 4.3.12 and PTD
Linkageless Controls – PTA	kBtu/hr	0.63	0.63	100%	Illinois TRM, v9.0, Section 4.4.21 and PTD
Condensate Tank Insulation – PTA	Square Feet	6.60	6.60	100%	Illinois TRM, v9.0, Section 4.3.12 and PTD

* Program Tracking Data (PTD) provided by Peoples Gas and North Shore Gas; extract dated February 1, 2022.
† State of Illinois Technical Reference Manual version 9.0 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 – CA Pipe Insulation

Ex ante savings for 16 out of 309 records were calculated using custom delta heat loss values that Guidehouse was unable to verify from the tracking data. The evaluation team calculated verified savings for all records using delta heat loss values calculated using 3E Plus software and approved in the ex ante calculators.

> **Recommendation 1.** Ensure delta heat loss values are consistent with the approved ex ante calculators for all records. Provide additional documentation supporting the use of custom delta heat loss values if applicable.

Two domestic hot water (DHW) measures (Project ID 10009096) had electric hot water fuel per the tracking data. Guidehouse verified no therms savings for these records.

> **Recommendation 2.** Only claim therm savings for domestic hot water measures if the corresponding heating fuel is natural gas.

2.4.2.2 IEMS – CA Attic Insulation and Air Sealing

Ex ante calculations claimed therm savings for two projects that have an electric resistance heating system (IDs 10009042 and 10009040). Guidehouse verified no therm savings for these projects based on the heating system type at the property.

> **Recommendation 3.** Calculate and claim therm savings based on the heating system type at the property

Ex ante therm savings for multiple project IDs (25 projects) with a natural gas heating system were calculated using a custom heating system efficiency. Guidehouse assumed heating system efficiency for equipment and distribution was not measured for these projects and hence verified therm savings for all projects using a deemed heating system efficiency of 72% per the TRM v9.0, Section 5.6.5 for existing systems. The heating system efficiency should account for both the equipment efficiency and the distribution efficiency.

> **Recommendation 4.** Use a deemed existing heating system efficiency of 72% to calculate therm savings for attic insulation and air sealing measures per TRM v9.0, Section 5.6.2 unless it is possible to measure and calculate the existing heating system's actual efficiency.

2.4.2.3 IEMS – Therms Disposition – IU Showerhead, IU Kitchen Aerator, and IU Bathroom Aerator

Ex ante therms for project IDs 10006012 and 10005581 jointly implemented with ComEd were calculated using an incorrect ComEd Therms Allocation of 71%. Guidehouse calculated verified therms for these projects using a ComEd Therms Allocation of 88%.

> **Recommendation 5.** Ensure the Therms Allocation parameter is accurately applied for all projects.

2.4.2.4 IEMS – IU Programmable Thermostat and IU Reprogram Thermostat

For two properties, ex ante calculations claimed savings for more thermostats than the number of units at the property (see Table 2-6). Guidehouse updated the quantity of IU programmable, and IU reprogram thermostats installed at these properties and verified savings for only one thermostat per household.

Table 2-6. IU Programmable and IU Reprogram Thermostat – Quantity Adjustment

Property	Number of Units	Ex Ante Quantity		Verified Quantity	
		IU Programmable Thermostat	IU Reprogram Thermostat	IU Programmable Thermostat	IU Reprogram Thermostat
Property 1	3	3	1	3	0
Property 2	5	6	0	5	0

Source: PTD and evaluation team analysis

Recommendation 6. Claim savings for only one thermostat per household for this measure to be consistent with the TRM, Section 5.3.16. Track the apartment or unit number as part of the site address for thermostats.

2.4.2.5 IEMS – CA Wall Insulation

The ex ante calculations claimed electric energy and negligible therm savings for project ID 10007752 with a gas boiler heating system type and no cooling system (see Table 2-7). Guidehouse verified therm savings and no electric kWh and peak demand savings for this project because there was no cooling system identified.

Table 2-7. CA Wall Insulation – Project Savings

Savings Category	Ex Ante Savings	Verified Savings
Electric Energy kWh	1,531	0
Peak Demand kW	1.41	0
Natural Gas Therms	1	253

Source: PTD and evaluation team analysis

Recommendation 7. Ensure the savings claimed are consistent with the heating and cooling system installed at the property.

2.4.2.6 PTA – 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 v9.0 (MF – High Rise and MF – Mid Rise) are appropriate for 2021 measures. This measure had a 103% gross realization rate.

Recommendation 8. Use the EFLH heating hours deemed in the latest version of the TRM.

2.4.2.7 PTA – DHW Storage Tank Insulation

The ex ante savings for this measure are calculated using a custom thermal regain factor (TRF) of 0.84. However, the TRM v9.0, Section 4.3.12 does not allow a custom TRF for this measure. Guidehouse verified savings for this measure using a TRF of 0.60 corresponding to an indoor, semi-heated tank location consistent with the TRF assumption for this measure in the 2021 Master Measure Database (MMDB).

> **Recommendation 9.** The TRM v10.0, Section 4.3.12 allows a custom TRF for this measure. Use the year-round TRF assumption of 0.84 to calculate savings for this measure in the 2022 program.

2.4.2.8 PTA – Pipe Insulation for Project 8001531

Following Multifamily measure names have been included in the tracking data for this program, all associated with project ID 8001531:

- CA - Gas - Pipe Insulation - Steam Large 5.1" to 8" - PG MF PTA 21
- CA - Gas - Pipe Insulation - Steam Large Fitting - PG MF PTA 21
- CA - Gas - Pipe Insulation - Steam Med 2.1" to 5" - PG MF PTA 21
- CA - Gas - Pipe Insulation - Steam Med Fitting - PG MF PTA 21
- CA - Gas - Pipe Insulation - Steam Small 1" to 2" - PG MF PTA 21

Ex ante net savings for these measures appear to be based on the NTG ratio corresponding to the non-income-eligible Multifamily program, while the project is tracked with the income eligible program name. The project was not duplicated in the non-income-eligible Multifamily tracking data. Guidehouse calculated ex ante gross savings and verified net savings for these measures using a NTG of 1.00 corresponding to income eligible programs as these measures were reported as part of this program, and confirmed by Franklin Energy as an income eligible project.

2.4.3 Historical Realization Rates and NTG Values

Table 2-8 shows historical realization rates and NTG values for the IEMS and PTA programs.

Table 2-8. 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%	No Projects	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
2021 – IEMS	101%	No Projects	1.00	1.00
2021 – PTA	100%	No Projects	1.00	1.00

Source: Guidehouse evaluation research.

3. Multi-Family Savings IHWAP

3.1 Program Description

The IHWAP eligible natural gas measures include advanced thermostats, weatherization and water efficiency equipment, and custom measures. The PGL portion of the program had three participants in 2021 and completed four projects as shown in Table 3-1.

Table 3-1. 2021 Volumetric Summary for PGL - IHWAP

Participation	Total
Participants *	3
Installed Projects †	4
Measure Types Installed	4

* Participants are defined as the count of unique Gas Account Numbers
† Installed Projects are defined as the unique amount of Project IDs
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. 2021 Installed Measure Quantities for PGL - IHWAP

Program Path	Measure	Quantity Unit	Quantity Installed
IHWAP	Air Sealing	Varies*	36,241
	Custom - DHW Boiler	Each	2
	Custom - Heating Plant Improvements	Each	2
	Low Flow Faucet Aerators	Each	84

* Air Sealing measures have quantities of each or linear feet based on the specific type of sealing.
Source: Peoples Gas tracking data and Guidehouse evaluation team analysis.

The NSG program had five participants in 2021 and completed five projects as shown in Table 3-3.

Table 3-3. 2021 Volumetric Summary for NSG - IHWAP

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

* Participants are defined as the count of unique Gas Account Numbers
† Installed Projects are defined as the unique amount of Project IDs
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. 2021 Installed Measure Quantities for NSG - IHWAP

Program Path	Measure	Quantity Unit	Quantity Installed
IHWAP	Advanced Thermostats	Each	5
	Air Sealing	Varies*	225
	Ceiling/Attic Insulation	Sq Ft	2,895
	Gas Water Heater	Each	2
	Low Flow Faucet Aerators	Each	9
	Low Flow Showerheads	Each	1
	Residential Furnace Tune-Up	Each	4

* Air Sealing measures have quantities of each or linear feet based on the specific type of sealing.
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 2021.

Table 3-5. 2021 Annual Energy Savings Summary for PGL - IHWAP

Program Path	Ex Ante Gross Savings (Therms)	Verified Gross RR*	Verified Gross Savings (Therms)	NTG†	Verified Net Savings (Therms)
IHWAP	28,817	85%	24,604	1.00	24,604

* 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/evaluator-ntg-recommendations-for-2021/.
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 2021.

Table 3-6. 2021 Annual Energy Savings Summary for NSG - IHWAP

Program Path	Ex Ante Gross Savings (Therms)	Verified Gross RR*	Verified Gross Savings (Therms)	NTG†	Verified Net Savings (Therms)
IHWAP	1,169	101%	1,177	1.00	1,177

* 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/evaluator-ntg-recommendations-for-2021/.
Source: North Shore Gas tracking data and Guidehouse evaluation team analysis.

3.3 Program Savings by Measure

The PGL program includes four measures as shown in Table 3-7. The Air Sealing measures contributed the most savings.

Table 3-7. 2021 Annual Energy Savings by Measure for PGL - IHWAP

Research Category	Ex Ante Gross Savings (Therms)	Verified Gross RR	Verified Gross Savings (Therms)	NTG	Verified Net Savings (Therms)
Air Sealing	15,639	100%	15,639	1.00	15,639
Custom - DHW Boiler	2,894	105%	3,037	1.00	3,037
Custom - Heating Plant Improvements	5,960	98%	5,827	1.00	5,827
Low Flow Faucet Aerators	4,324	2%	101	1.00	101
Total or Weighted Average	**28,817**	**85%**	**24,604**	**1.00**	**24,604**

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. 2021 Annual Energy Savings by Measure for NSG - IHWAP

Research Category	Ex Ante Gross Savings (Therms)	Verified Gross RR	Verified Gross Savings (Therms)	NTG	Verified Net Savings (Therms)
Advanced Thermostats	333	100%	333	1.00	333
Air Sealing	116	101%	117	1.00	117
Ceiling/Attic Insulation	483	100%	483	1.00	483
Gas Water Heater	27	124%	34	1.00	34
Low Flow Faucet Aerators	19	100%	19	1.00	19
Low Flow Showerheads	2	100%	2	1.00	2
Residential Furnace Tune-Up	188	100%	188	1.00	188
Total or Weighted Average	**1,169**	**101%**	**1,177**	**1.00**	**1,177**

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. 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 - IHWAP

Measure	Unit Basis	Ex Ante Gross (therms/unit)	Verified Gross (therms/unit)	Realization Rate	Data Source(s)
Advanced Thermostats	Each	66.63	66.63	100%	Illinois TRM v9.0† 5.3.16, PTD‡
Air Sealing	Varies*	Varies	Varies	100%	Illinois TRM v9.0 5.6.1, PTD
Ceiling/Attic Insulation	Sq Ft	Varies	Varies	100%	Illinois TRM v9.0 5.6.5, PTD
Custom - DHW Boiler	Each	Varies	Varies	105%	Illinois TRM v9.0 4.3.7, PTD, Project Files§
Custom - Heating Plant Improvements	Each	13.71	17.06	98%	Illinois TRM v9.0 4.4.10, PTD, Project Files
Gas Water Heater	Each	Varies	Varies	124%	Illinois TRM v9.0 5.4.2, PTD
Low Flow Faucet Aerators	Each	Varies	Varies	3%	Illinois TRM v9.0 5.4.4, PTD
Low Flow Showerheads	Each	1.75	1.75	100%	Illinois TRM v9.0 5.4.5, PTD
Residential Furnace Tune-Up	Each	Varies	Varies	100%	IL TRM v9.0 .3.13, PTD

* Air Sealing measures have quantities of each or linear feet based on the specific type of sealing.
† State of Illinois Technical Reference Manual version 9.0 from https://www.ilsag.info/technical-reference-manual/il-trm-version-9/.
‡ Program Tracking Data (PTD) provided by Peoples Gas and North Shore Gas; extract dated February 7, 2022.
§ 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 – HHW Boiler Efficiency

Normalized space heating hot water (HHW) usage was calculated for months with heating degree days (HDD) less than 100. Guidehouse calculated normalized HHW usage only for months with HDD greater than 100 and assumed zero HHW usage for months with HDD less than 100 consistent with the approach used to develop the regression coefficients used to calculate the normalized HHW usage in the TRM v9.0.

> **Recommendation 11.** Only calculate normalized HHW usage for months with HDD greater than 100 to be consistent with the approach used to determine the regression coefficients.

The ex ante EFLH were calculated using the normalized HHW usage, the input capacity of the installed boiler, and efficiency of the existing or baseline boiler. When using the input capacity of the boiler to calculate savings, the EFLH should correspond to the equivalent full load hours of the installed high efficiency unit. Guidehouse calculated the EFLH using the normalized HHW usage adjusted for the efficiency of the installed boiler, the input capacity, and the efficiency of the installed boiler.

> **Recommendation 12.** Use the input capacity, efficiency of the installed boiler, and HHW usage adjusted for the installed boiler to calculate EFLH.

Ex ante savings for the HHW boiler efficiency measure were calculated using the input capacity of the boiler and Equation 3-1. This Equation 3-1 savings algorithm is valid when using the output capacity of the boiler. Guidehouse calculated verified savings for this measure using the input capacity of the boiler and Equation 3-2 per the TRM v9.0, Section 4.4.10.

Equation 3-1. Ex Ante Savings Algorithm

$$Savings = Capacity * EFLH * (\frac{1}{Efficiency_{Base}} - \frac{1}{Efficiency_{EE}})$$

Equation 3-2. Verified Savings Algorithm

$$Savings = Capacity * EFLH * \left(\frac{Efficiency_{EE} - Efficiency_{Base}}{Efficiency_{Base}}\right)$$

Recommendation 13. Use Equation 3-2 along with the input capacity of the boiler to calculate savings for this measure.

3.4.1.2 Custom – DHW Boiler Efficiency

Standby loss for this measure was calculated by dividing the tank volume by the number of tanks for both projects. The tank volume used in the calculations corresponds to a single tank and the TRM v9.0 algorithm requires the tank volume to be the rated volume of the tank in gallons. Guidehouse calculated the standby loss for this measure using the tank volume for a single tank and the TRM v9.0 algorithm.

Recommendation 14. Use the tank volume corresponding to a single tank and TRM v9.0 algorithm to calculate the standby loss for the DHW boiler efficiency measure.

3.4.1.3 Air Sealing

The evaluation team found that most air sealing measures use the TRM v9.0 methodology 2 to calculate ex ante savings. The evaluation team used the deemed values in the TRM v9.0 and the reported ex ante savings value to back out the specific type of air sealing for each applicable measure. This allowed verified savings values to be as accurate as possible with the provided information, however some measures' realization rates showed ex ante savings did not align with the verified savings value obtained using the TRM v9.0 deemed information. Table 3-10 shows the calculation inputs and savings discrepancies in more detail.

Recommendation 15. Ensure ex ante savings values properly align with the deemed values provided in the TRM v9.0. The tracking data should contain a field detailing the specific type of air sealing for each measure.

Table 3-10. Air Sealing Methodology 2 Savings Details

Gas Utility	Measure ID	Sealing Type	Quantity	Δtherms (TRM v9)	ADJ_Rx Airsealing	ISR	Ex Ante Therms	Verified Therms	RR
NSG	MEA-2021.10.07-259792	Sealing Tape	37	0.52	80%	1.0	15.18	15.39	101%
NSG	MEA-2021.10.07-259780	Sealing Tape	37	0.52	80%	1.0	15.18	15.39	101%
NSG	MEA-2021.10.07-259793	Sealing Tape	37	0.52	80%	1.0	15.18	15.39	101%
NSG	MEA-2021.10.07-259791	Sealing Tape	37	0.52	80%	1.0	15.18	15.39	101%
NSG	MEA-2021.10.07-259795	Weather Stripping	19	0.61	80%	1.0	9.11	9.27	102%
NSG	MEA-2021.10.07-259782	Weather Stripping	19	0.61	80%	1.0	9.11	9.27	102%
NSG	MEA-2021.10.07-259796	Weather Stripping	19	0.61	80%	1.0	9.11	9.27	102%
NSG	MEA-2021.10.07-259794	Weather Stripping	19	0.61	80%	1.0	9.11	9.27	102%
PGL	MEA-2020.12.16-185624	Door Sweep	118	9.13	80%	1.0	861.87	861.87	100%
PGL	MEA-2021.08.13-249805	Door Sweep	122	9.13	80%	1.0	891.09	891.09	100%
PGL	MEA-2021.09.27-256532	Door Sweep	110	9.13	80%	1.0	329.41	329.41	100%
PGL	MEA-2021.03.02-203392	Door Sweep	56	9.13	80%	1.0	409.02	409.02	100%
PGL	MEA-2020.12.16-185621	Sealing Tape	10327	0.52	80%	1.0	4,296.23	4,296.03	100%
PGL	MEA-2021.08.13-249807	Sealing Tape	7151	0.52	80%	1.0	2,974.82	2,974.82	100%
PGL	MEA-2021.09.27-256533	Sealing Tape	7151	0.52	80%	1.0	1,219.67	1,219.67	100%
PGL	MEA-2021.03.02-203391	Sealing Tape	4219	0.52	80%	1.0	1,755.20	1,755.10	100%
PGL	MEA-2020.12.16-185623	Weather Stripping	2345	0.61	80%	1.0	1,144.27	1,144.36	100%
PGL	MEA-2021.08.13-249806	Weather Stripping	1952	0.61	80%	1.0	952.58	952.58	100%
PGL	MEA-2021.09.27-256534	Weather Stripping	1763	0.61	80%	1.0	352.74	352.74	100%
PGL	MEA-2021.03.02-203390	Weather Stripping	927	0.61	80%	1.0	452.14	452.38	100%

Source: Peoples Gas and North Shore Gas tracking data, TRM v9.0, and Guidehouse team analysis.

3.4.1.4 Gas Water Heater

The evaluation team used the information in the tracking data and the deemed values in the TRM v9.0 section 5.4.2 to determine the verified savings values for the two Gas Water Heater measures. The reported ex ante savings values for these measures could not be replicated with the information provided. Table 3-11 shows more details behind the savings discrepancy. Values not shown in this table are deemed in the TRM v9.0.

> **Recommendation 16.** Provide all necessary calculation inputs in the tracking data to ensure the tracking data properly reflects the values used to obtain the ex ante savings.

Table 3-11. Gas Water Heater Savings Details

Gas Utility	Measure ID	Measure Name	Quantity	Baseline Energy Factor (TRM v9)	Energy Factor of New Unit (tracking data)	Household (TRM v9)	Ex Ante Therms	Verified Therms	RR
NSG	MEA-2021.10.04-256841	Gas Water Heater	1	0.563	0.64	2.1	13.71	17.06	124%
NSG	MEA-2021.10.04-256842	Gas Water Heater	1	0.563	0.64	2.1	13.71	17.06	124%

Source: Peoples Gas and North Shore Gas tracking data, TRM v9.0, and Guidehouse team analysis.

3.4.1.5 Low Flow Faucet Aerator

The evaluation team found two Low Flow Faucet Aerator measures, MEA-2021.08.12-249738 and MEA-2021.09.27-256525, had a Household Factor value of 90 in the tracking data and used this value in their ex ante savings calculation. The evaluation team did not have supporting documentation for these values, so verified savings use the TRM v9.0 deemed Household Factor value of 2.1.

> **Recommendation 17.** Provide supporting documentation for custom savings input values and ensure these values are in alignment with expectations of the TRM.

3.4.2 Historical Realization Rates and NTG Values

Table 3-12 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 3-12. 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
2021 – IHWAP	85%	101%	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 measure workbook for agreement with the TRM v9.0[1].
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 allocated 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 A-1 provides a summary of M&V results for the custom projects reviewed by Guidehouse.

Table A-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-2021.08.12-92314	HHW Boiler Efficiency Upgrade	4,227	98%	4,133	Updated normalized HHW usage, EFLH and savings algorithm
	DHW Boiler Efficiency Upgrade	2,068	106%	2,185	Updated tank volume used in standby loss calculation
PID-2021.09.23-93920	HHW Boiler Efficiency Upgrade	1,733	98%	1,694	Updated normalized HHW usage, EFLH and savings algorithm
	DHW Boiler Efficiency Upgrade	826	103%	853	Updated tank volume used in standby loss calculation

Source: Guidehouse evaluation team analysis.

[1] Available on the Illinois SAG web site: https://www.ilsag.info/technical-reference-manual/il-trm-version-9/

Appendix B. Program-Specific Inputs for the Illinois TRC

Table B-1, Table B-2, and Table B-3 show the Total Resource Cost (TRC) cost-effectiveness analysis inputs available at the time of drafting this impact evaluation report for PGL. 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 Pipe Insulation	Varies	46,638	15.0	22,769	23,650	23,650
	CA Steam Boiler	MBH	97,890	25.0	15,442	15,442	15,442
	CA Attic Insulation and Air Sealing	Square Feet	245,025	20.0	9,938	9,911	9,911
	CA Averaging Controls	Apt Units	242	20.0	4,753	4,753	4,753
	IU Showerhead	Each	971	10.0	1,240	1,229	1,229
	IU Kitchen Aerator	Each	1,851	10.0	1,195	1,173	1,173
	CA Hydronic Boiler	Varies	199	25.0	870	870	870
	IU Programmable Thermostat	Each	182	16.0	851	846	846
	CA On-Demand DHW Control	Apt Units	81	15.0	633	633	633
	CA Steam Trap	Each	98	6.0	518	518	518
	CA Sidewall Insulation	Square Feet	1,560	20.0	460	460	460
	IU Shower Timer	Each	966	2.0	389	389	389
	IU Advanced Thermostat	Each	39	11.0	310	310	310
	IU Furnace	MBH	843	20.0	207	207	207
	IU Bathroom Aerator	Each	989	10.0	168	166	166
	CA Door Weatherstrip	Doors	143	20.0	134	134	134
	CA Door Sweep	Each	130	20.0	114	114	114
	IU Reprogram Thermostat	Each	19	2.0	78	73	73
	CA Wall Insulation	Square Feet	6,100	20.0	54	84	84
	IU AC Cover and Gap Sealer	Each	51	5.0	25	25	25
PTA	Pipe Insulation	Varies	99,776	15.0	601,528	601,688	601,688
	Controls for Central DHW	Apt Units	7,179	15.0	450,123	450,031	450,031
	Steam Traps	Each	808	6.0	147,934	147,953	147,953
	Boiler Averaging Controls	Apt Units	1,623	20.0	99,149	99,146	99,146
	Boiler Tune Up	MBH	207,341	3.0	97,181	97,191	97,191
	Prescriptive Change - Steam Traps	Project	38,285	6.0	38,285	38,285	38,285
	Boiler Reset Controls	MBH	13,879	16.0	17,862	18,442	18,442
	Prescriptive Change - Other	Project	14,467	3.0	14,467	14,467	14,467
	DHW Storage Tank Insulation	Square Feet	623	15.0	3,452	2,466	2,466
	Linkageless Controls	MBH	2,500	16.0	1,578	1,578	1,578
	Condensate Tank Insulation	Square Feet	137	15.0	904	904	904
Total or Weighted Average				**13.5**	**1,532,613**	**1,533,139**	**1,533,139**

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

Table B-2. 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	Air Sealing	Varies	36,241	20.0	15,639	15,639	15,639
	Custom - DHW Boiler	Each	2	15.0	2,894	3,037	3,037
	Custom - Heating Plant Improvements	Each	2	25.0	5,960	5,827	5,827
	Low Flow Faucet Aerators	Each	84	10.0	4,324	101	101
Total or Weighted Average				**20.5**	**28,817**	**24,604**	**24,604**

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

Table B-3. 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	Advanced Thermostats	Each	5	11.0	333	333	333
	Air Sealing	Varies	225	20.0	116	117	117
	Ceiling/Attic Insulation	Sq Ft	2,895	20.0	483	483	483
	Gas Water Heater	Each	2	13.0	27	34	34
	Low Flow Faucet Aerators	Each	9	10.0	19	19	19
	Low Flow Showerheads	Each	1	10.0	2	2	2
	Residential Furnace Tune-Up	Each	4	3.0	188	188	188
Total or Weighted Average				**14.3**	**1,169**	**1,177**	**1,177**

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