Guidehouse
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Multi-Family Program Impact Evaluation Report

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

Prepared for:

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) 2021 Multi-Family (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. Appendix A presents the impact analysis methodology. Program year 2021 covers January 1, 2021 through December 31, 2021.

2. Program Description

The Multi-Family Program is designed to provide a “one-stop-shop” to multi-family property owners and managers of buildings with three or more units to achieve comprehensive improvements in energy efficiency that previously would have required accessing multiple programs. The Multi-Family Program delivery approach consists of six paths, described below.

1. The Direct Install (DI) and Energy Assessment “Jumpstart” path of the program provides free energy efficiency products in residential dwelling units (IU) and common areas (CA). The energy assessment identifies additional comprehensive efficiency upgrades that allow participants to implement deeper retrofit measures through other delivery paths.
2. The Prescriptive Rebate path provides standardized incentives for energy efficient equipment based on the size and efficiency of the equipment installed or on a per unit basis.
3. The Partner Trade Ally (PTA) path also provides standardized incentives for energy efficient equipment based on the size and efficiency of the equipment installed or on a per unit basis while providing higher incentives to a network of trade allies (TAs) selected, screened, and registered with the Multi-Family Program. These PTAs in turn offer better rebates to their customers to install energy-efficient products.
4. The Direct Distribution Path is jointly delivered by ComEd, Peoples Gas and North Shore Gas. The implementation contractor delivers project measures to the property manager to install. The implementation contractor then visits the site to ensure the measures were installed in a sample of the apartment units.
5. The program’s Custom path provides technical services and custom rebates for non-standard building improvement upgrades. The program also provides incentive opportunity for energy efficient new construction projects in multi-family buildings.
6. Multi-family property owners and managers may also participate in the PGL and NSG Gas Optimization Study Program that provides gas optimization assessments for multi-family buildings for operation and maintenance issues that, if corrected, deliver energy and cost savings to building owners and managers supported by financial incentives.

All program paths, except for the gas optimization study program participated in 2021.

The PGL program had 612 participants in 2021 and completed 5,053 projects as shown in Table 2-1.

Table 2-1. 2021 Volumetric Summary for PGL

Participation	Direct Install	Prescriptive	PTA	Custom	Direct Distribution	Total
Participants*	202	42	362	3	3	612
Installed Projects†	4,501	43	503	3	3	5,053
Measure Types Installed‡	28	31	32	3	4	98

* Participants are defined as unique site addresses from tracking data.
† Installed projects are defined as unique project IDs from tracking data.
‡ Measure types are defined as unique measure types in tracking data, including assessments.
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
Direct Install	IU Showerhead	Each	1,649
	Programmable Thermostat	Each	349
	Advanced Thermostat	Each	178
	CA Pipe Insulation	LN FT	2,640
	IU Kitchen Aerator	Each	2,243
	IU Bathroom Aerator	Each	2,197
	IU Shower Timer	Each	899
	Reprogram Thermostat	Each	25
	CA Bathroom Aerator	Each	20
	CA Showerhead	Each	4
	IU Pipe Insulation	LN FT	87
	CA Kitchen Aerator	Each	4
Prescriptive	High Efficiency Boiler	MBH	57,181
	CA Pipe Insulation	LN FT	1,476
	Boiler Tune Up	MBH	44,241
	Prescriptive Steam Trap	Each	8,144
	Central Plant Water Heater	MBH	583
	IU Furnace	MBH	24
	IU Advanced Thermostat	Each	49
	Domestic Hot Water (DHW) Controls	Apt Units	45
	Draft Controls	Each	14,286
	Boiler Reset Controls	MBH	1,720
	Averaging Controls	Each	22

Program Path	Measure	Quantity Unit	Installed Quantity
	Water Heater	MBH	204
	CA Furnace	Each	1
	CA Advanced Thermostat	Each	1
PTA	CA Pipe Insulation	LN FT	93,075
	DHW Controls	Apt Units	6,091
	Steam Trap	Each	1,073
	Boiler Tune Up	MBH	352,074
	Prescriptive Change Steam Trap	Each	86,544
	Averaging Controls	Each	917
	Boiler Reset Controls	MBH	20,682
	High Efficiency Boiler	MBH	28,666
	DHW Storage Tank Insulation	SQ FT	1,469
	Programmable Thermostat	Each	200
	Central Plant Water Heater	MBH	112
Direct Distribution	IU Showerhead	Each	123
	IU Shower Timer	Each	108
	IU Kitchen Aerator	Each	109
	IU Bathroom Aerator	Each	117
Custom	Custom	Project	3

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

The NSG program had 19 participants in 2021 and completed 622 projects as shown in Table 2-3.

Table 2-3. 2021 Volumetric Summary for NSG

Participation	Direct Install	PTA	Total
Participants*	9	10	19
Installed Projects†	612	10	622
Measure Types‡	12	14	26

* Participants are defined as unique site addresses from tracking data.
† Installed projects are defined as unique project IDs from tracking data.
‡ Measure types are defined as unique measure types in tracking data, including assessments.
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. 2021 Installed Measure Quantities for NSG

Program Path	Measure	Quantity Unit	Installed Quantity
Direct Install	Programmable Thermostat	Each	193
	CA Pipe Insulation	LN FT	1,107
	IU Showerhead	Each	151
	IU Kitchen Aerator	Each	306
	IU Shower Timer	Each	185
	Reprogram Thermostat	Each	14
	IU Bathroom Aerator	Each	124
PTA	CA Pipe Insulation	LN FT	4,024
	DHW Controls	Apt Units	70

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

3. Program Savings Detail

Table 3-1 summarizes the energy savings the PGL program achieved by path in 2021.

Table 3-1. 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)
Direct Install	66,205	100%	66,289	0.90/0.96/1.01	64,305
Prescriptive	129,931	104%	135,499	0.90/0.87	117,984
PTA	1,482,067	100%	1,489,422	0.87	1,295,797
Direct Distribution	2,231	100%	2,235	0.96/1.01	2,239
Custom	21,739	85%	18,421	0.87	16,027
Total or Weighted Average	**1,702,174**	**101%**	**1,711,867**	**0.87**	**1,496,352**

* Realization Rate (RR) is the ratio of verified gross savings to ex ante gross savings, based on evaluation research findings.
† Deemed NTG values vary by measure. Details provided in Section 4. Deemed values 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 3-2 summarizes the energy savings the NSG program achieved by path in 2021.

Table 3-2. 2021 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)
Direct Install	14,662	100%	14,670	0.96/1.01	14,217
PTA	19,223	100%	19,222	0.87	16,723
Total or Weighted Average	**33,884**	**100%**	**33,892**	**0.91**	**30,941**

* Realization Rate (RR) is the ratio of verified gross savings to ex ante gross savings, based on evaluation research findings.
† Deemed NTG values vary by measure. Details provided in Section 4. Deemed values 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.

4. Program Savings by Measure

The PGL program includes 23 measures as shown in Table 4-1. The Pipe Insulation and DHW Circulation System measures contributed the most savings.

Table 4-1. 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)
Direct Install	IU Showerhead	18,661	100%	18,662	1.01	18,849
	Programmable Thermostat	14,387	100%	14,388	0.96	13,812
	Advanced Thermostat	12,069	100%	12,069	0.90	10,862
	CA Pipe Insulation	7,556	100%	7,556	0.96	7,254
	IU Kitchen Aerator	5,654	101%	5,698	1.01	5,755
	IU Bathroom Aerator	3,422	101%	3,461	1.01	3,495
	IU Shower Timer	3,181	100%	3,181	0.96	3,054
	Reprogram Thermostat	1,013	100%	1,013	0.96	972
	CA Bathroom Aerator	122	100%	122	0.96	117
	CA Showerhead	80	100%	80	0.96	76
	IU Pipe Insulation	30	100%	30	0.96	29
	CA Kitchen Aerator	30	100%	30	0.96	29
Prescriptive	High Efficiency Boiler	57,925	107%	62,017	0.87	53,955
	CA Pipe Insulation	21,367	100%	21,366	0.87	18,589
	Boiler Tune Up	20,143	103%	20,738	0.87	18,042
	Prescriptive Steam Trap	8,144	100%	8,144	0.87	7,086
	Central Plant Water Heater	5,372	100%	5,372	0.87	4,673
	IU Furnace	3,255	143%	4,649	0.87	4,045
	IU Advanced Thermostat	3,365	97%	3,265	0.90	2,938
	DHW Circulation System	2,822	100%	2,822	0.87	2,455
	Draft Controls	2,373	100%	2,373	0.87	2,064
	Boiler Reset Controls	2,627	87%	2,286	0.87	1,988
	Averaging Controls	1,344	100%	1,344	0.87	1,169
	Water Heater	874	92%	801	0.87	697
	CA Furnace	237	100%	237	0.87	206
	CA Advanced Thermostat	86	100%	86	0.90	77
PTA	CA Pipe Insulation	537,796	100%	537,795	0.87	467,882
	DHW Circulation System	381,913	100%	381,906	0.87	332,258

Program Path	Research Category	Ex Ante Gross Savings (Therms)	Verified Gross RR	Verified Gross Savings (Therms)	NTG†	Verified Net Savings (Therms)
	Steam Trap	199,748	100%	199,765	0.87	173,796
	Boiler Tune Up	159,850	103%	165,034	0.87	143,580
	Prescriptive Change Steam Trap	86,544	100%	86,544	0.87	75,293
	Averaging Controls	56,021	100%	56,018	0.87	48,735
	Boiler Reset Controls	26,625	103%	27,482	0.87	23,910
	High Efficiency Boiler	22,340	105%	23,457	0.87	20,407
	DHW Storage Tank Insulation	5,623	103%	5,814	0.87	5,058
	Programmable Thermostat	4,536	100%	4,536	0.87	3,946
	Central Plant Water Heater	1,071	100%	1,071	0.87	932
Direct Distribution	IU Showerhead	1,392	100%	1,392	1.01	1,406
	IU Shower Timer	382	100%	382	0.96	367
	IU Kitchen Aerator	275	101%	277	1.01	280
	IU Bathroom Aerator	182	101%	184	1.01	186
Custom	Custom	21,739	85%	18,421	0.87	16,027
	Total or Weighted Average	**1,702,174**	**101%**	**1,711,867**	**0.87**	**1,496,352**

† 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.

The NSG program includes 8 measures as shown in Table 4-2. The Pipe Insulation and Programmable Thermostat measures contributed the most savings.

Table 4-2. 2021 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)
Direct Install	Programmable Thermostat	7,816	100%	7,817	0.96	7,504
	CA Pipe Insulation	2,950	100%	2,950	0.96	2,832
	IU Showerhead	1,709	100%	1,709	1.01	1,726
	IU Kitchen Aerator	771	101%	777	1.01	785
	IU Shower Timer	655	100%	655	0.96	628
	Reprogram Thermostat	567	100%	567	0.96	544
	IU Bathroom Aerator	193	101%	195	1.01	197
PTA	Pipe Insulation	14,833	100%	14,833	0.87	12,905
	DHW Circulation System	4,389	100%	4,389	0.87	3,818
	Total or Weighted Average	**33,884**	**100%**	**33,892**	**0.91**	**30,941**

† 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 team analysis.

5. Impact Analysis Findings and Recommendations

5.1 Impact Parameter Estimates

Table 5-1 shows the unit therm savings and realization rate findings by measure from our review. The realization rate is the ratio of the verified savings to the ex ante savings. Following the table, we provide findings and recommendations, including discussion of all measures with realization rates above or below 100%. Appendix A provides a description of the impact analysis methodology. Appendix C provides the Total Resource Cost (TRC) cost-effectiveness analysis inputs available at the time of producing this impact evaluation report.

Table 5-1. Verified Gross Savings Parameters

Measure	Unit Basis	Ex Ante Gross (therms/unit)	Verified Gross (therms/unit)	Realization Rate	Data Source(s)*
Bathroom Aerator	Each	CA = 6.10	CA = 6.10	100%	Illinois TRM, v9.0†, Section 4.3.2
	Each	IU = 1.56	IU = 1.58	101%	Illinois TRM, v9.0, Section 5.4.4
Kitchen Aerator	Each	CA = 7.44	CA = 7.44	100%	Illinois TRM, v9.0, Section 4.3.2
	Each	IU = 2.52	IU = 2.54	101%	Illinois TRM, v9.0, Section 5.4.4
Prog./Reprogram T-Stat	Each	Prescriptive IU = 22.68	Prescriptive IU = 22.68	100%	Illinois TRM, v9.0, Section 5.3.11
	Each	IU Boiler = 59.94	IU Boiler = 59.93	100%	Illinois TRM, v9.0, Section 5.3.11
	Each	IU Furnace = 40.50	IU Furnace = 40.50	100%	Illinois TRM, v9.0, Section 5.3.11
Pipe Insulation	LN FT	Varies	Varies	Varies	Illinois TRM, v9.0, Section 4.4.14
Programmable Baseline, Advanced T-Stat	Each	IU Furnace & AC = 46.38	IU Furnace & AC = 46.38	100%	Illinois TRM, v9.0, Section 5.3.16
	Each	IU Boiler & Chiller = 68.63	IU Boiler & Chiller = 68.63	100%	Illinois TRM, v9.0, Section 5.3.16
Showerhead	Each	CA = 19.92	CA = 19.92	100%	Illinois TRM, v9.0, Section 4.3.3
	Each	IU = 11.32	IU = 11.32	100%	Illinois TRM, v9.0, Section 5.4.5
Shower Timer	Each	3.54	3.54	100%	Illinois TRM, v9.0, Section 5.4.9
Manual Baseline, Advanced T-Stat	Each	68.67	66.63	97%	Illinois TRM, v9.0, Section 5.3.16
Pipe Steam Avg. Controls	Each	61.09	61.09	100%	Illinois TRM, v9.0, Section 4.4.36
Boiler	MBH	Steam >=1,500 MBH = 0.81	Steam >=1,500 MBH = 0.85	105%	Illinois TRM, v9.0, Section 4.4.10
	MBH	Steam >=300 MBH = 0.62	Steam >=300 MBH = 0.64	104%	Illinois TRM, v9.0, Section 4.4.10
	MBH	HW >2,500 MBtu = 1.13	HW >2,500 MBtu =1.22	107%	Illinois TRM, v9.0, Section 4.4.10

Measure	Unit Basis	Ex Ante Gross (therms/unit)	Verified Gross (therms/unit)	Realization Rate	Data Source(s)*
	MBH	HW >=300 & <=2,500 MBtu = 1.51	HW >=300 & <=2,500 MBtu = 1.66	110%	Illinois TRM, v9.0, Section 4.4.10
	MBH	HW <=300 Mbtu = 1.13	HW <=300 Mbtu = 1.22	107%	Illinois TRM, v9.0, Section 4.4.10
Boiler Reset Controls	MBH	PTA = 1.53	1.33	87%	Illinois TRM, v9.0, Section 4.4.4
	MBH	Px = 1.29	1.33	103%	Illinois TRM, v9.0, Section 4.4.4
Boiler Tune Up	MBH	PTA = 0.45	0.47	103%	Illinois TRM, v9.0, Section 4.4.2
	MBH	Px = 0.5	0.47	94%	Illinois TRM, v9.0, Section 4.4.2
Draft Controls	MBH	0.17	0.17	100%	Illinois TRM, v9.0, Section 4.4.23
Furnace	Each	CA = 236.90	CA = 237.41	100%	Illinois TRM, v9.0, Section 4.4.11
	Each	IU = 135.63	IU = 193.70	143%	Illinois TRM, v9.0, Section 5.3.7
Water Heater	MBH	3.44	3.44	100%	Illinois TRM, v9.0, Section 4.3.1
DHW Circulation System	MBH	62.7	62.7	100%	Illinois TRM, v9.0, Section 4.3.8
Steam Trap	Each	Audit PTA (High Rise) = 180.92	Audit PTA (High Rise) = 180.93	100%	Illinois TRM, v9.0, Section 4.4.16
	Each	Audit PTA (Mid Rise) = 209.31	Audit PTA (Mid Rise) = 209.36	100%	Illinois TRM, v9.0, Section 4.4.16
	Each	Px Change = 1.00	Px Change = 1.00	100%	Illinois TRM, v9.0, Section 4.4.16
CA Advanced Thermostat	Each	85.56	85.56	100%	Illinois TRM, v9.0, Section 4.4.48
High Eff. Water Heater	Each	UEF>0.64 = 46.39	UEF>0.64 = 31.81	69%	Illinois TRM, v9.0, Section 4.3.1
	Each	UEF>0.68 = 46.39	UEF>0.68 = 17.44	38%	Illinois TRM, v9.0, Section 4.3.1
Central Domestic Hot Water Plant	Each	36.52	36.52	100%	Illinois TRM, v9.0, Section 4.3.7
	Units	9.07	9.07	100%	Illinois TRM, v9.0, Section 4.3.7
DHW Tank Insulation	SQ FT	3.83	3.96	103%	Illinois TRM, v9.0, Section 4.3.12
Custom	Project	Varies	Varies	Varies	Project File Review, Evaluation‡

Px = Prescriptive
* Program Tracking Data (PTD) provided by Peoples Gas and North Shore Gas.
† State of Illinois Technical Reference Manual version 9.0 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.

5.2 Findings and Recommendations

5.2.1 IU Bathroom Aerator – Direct Install/Direct Distribution

Ex ante savings are calculated using a deemed baseline flow rate (GPM_base) of 1.53 GPM as per TRM Section 5.4.4. Verified savings are calculated using a measured full throttle flow of 1.85 GPM per the MMDB based on a metering study and a throttling factor of 0.83 for the GPM_base parameter as per the TRM.

Recommendation 1. Use measured flow rate and throttling factor to calculate the flow rate for both the GPM_base and GPM_low parameters when available.

5.2.2 IU Kitchen Aerator – Direct Install/Direct Distribution

Ex ante savings are calculated using a deemed baseline flow rate (GPM_base) of 1.63 GPM as per TRM Section 5.4.4. Verified savings are calculated using a measured full throttle flow of 1.97 GPM per the MMDB based on a metering study and a throttling factor of 0.83 for the GPM_base parameter as per the TRM.

Recommendation 2. Use measured flow rate and throttling factor to calculate the flow rate for both the GPM_base and GPM_low parameters when available.

5.2.3 High Efficiency Boilers – Prescriptive and PTA

Ex ante savings for this measure are calculated using an incorrect energy savings algorithm. The ex ante algorithm divides the difference between the efficiency of the efficient and baseline boiler by the efficient boiler efficiency rather than by the baseline boiler efficiency.

Recommendation 3. Update the energy savings algorithm for this measure per the TRM v9.0 Section 4.4.10.

5.2.4 IU Smart Thermostat – Prescriptive

Ex ante net savings for this measure are calculated using a NTG ratio of 0.87. Verified savings for this measure are calculated using a NTG ratio of 0.90.

Recommendation 4. Use a NTG ratio of 0.90 for Smart/Advanced Thermostats for all non-income qualified programs.

Ex ante savings for this measure are not consistent with the MMDB and the evaluation team could not recreate the ex ante savings for this measure. The verified savings for this measure are consistent with the TRM v9.0 and errata, Section 5.3.16 and the MMDB. This measure has a 97% realization rate.

Recommendation 5. Ensure ex ante savings for this measure are consistent with the MMDB.

5.2.5 IU Furnace – Prescriptive

The input capacity of the furnace in the ex ante savings estimate is calculated using the household heating load, equivalent full load hours (EFLH) and household factor. Verified savings are calculated using an input capacity of 84,305 Btuh per the TRM v9.0 Section 5.3.7.

Recommendation 6. Update the input capacity as per the TRM v9.0 Section 5.3.7.

Ex ante savings are calculated using a deemed early replacement (ER) rate of 14%, corresponding to the ER rate for a furnace in a combined system replacement project. Verified savings are calculated using a deemed ER rate of 7% for furnace-only participants.

Recommendation 7. Use the deemed ER rate of 7%, corresponding to furnace-only projects per TRM v9.0, Section 5.3.7.

Ex ante savings are calculated using an efficient furnace annual fuel utilization efficiency (AFUE) of 95.5%. Verified savings are calculated using an efficient furnace AFUE of 96.0% per the TRM v9.0 Section 5.3.7.

Recommendation 8. Use an efficient furnace AFUE of 96.0% per the TRM v9.0, Section 5.3.7.

5.2.6 High Efficiency Water Heater – Prescriptive

5.2.6.1 Water Heater – High Draw UEF >0.68 (Com)

Ex ante savings for this measure are calculated using a baseline uniform energy factor (UEF) of 0.57 calculated using the algorithm for a medium draw pattern for residential-duty commercial water heaters. Verified savings are calculated using UEF_base of 0.62 calculated using the algorithm for a high draw pattern for residential-duty commercial water heaters.

Recommendation 9. Calculate UEF_base for the Water Heater – High Draw measure using the algorithm corresponding to the draw pattern.

5.2.6.2 Water Heater – Medium Draw UEF >0.64 (Com)

Ex ante savings for this measure are calculated using a UEF_eff of 0.68 corresponding to the Water Heater – High Draw UEF >0.68 (Com) measure. Verified savings are calculated using a UEF_eff of 0.64.

Recommendation 10. Update the UEF_eff for the Water Heater – Medium Draw measure to 0.64.

5.2.7 Boiler Reset Controls – Prescriptive

Ex ante net savings for this measure are calculated using a NTG ratio of 1.00. Verified net savings for this measure are calculated using a NTG ratio of 0.87.

Recommendation 11. Use a NTG ratio of 0.87 for Boiler Reset Controls.

5.2.8 Boiler Tune-Up – Prescriptive

The tracking data includes a Project ID 8137712 with the measure name Boiler Tune-Up (COM) - PG SB TA 2021. Ex ante net savings for this measure are calculated using a NTG ratio of 0.93. Verified net savings for this measure are calculated using a Multi-Family program NTG ratio of 0.87.

Recommendation 12. Use a NTG ratio of 0.87 for the Boiler Tune-Up measure in the Multi-Family program.

5.2.9 Boiler Tune-Up – Prescriptive and PTA, Boiler Reset Controls – Prescriptive

Ex ante savings for this measure are calculated using equivalent full load hours (EFLH) for heating value of 1,609, which represents the average EFLH value for multifamily high rise and multifamily mid-rise building types from the TRM v7.0.

Recommendation 13. Update the EFLH to 1,661, which represents the average of EFLH values for multifamily high rise and multifamily mid-rise buildings from the TRM v9.0. This value also aligns with the EFLH used for the high efficiency boiler measure.

5.2.10 DHW Storage Tank Insulation (CA) – PTA

Ex ante savings are calculated with a heating equipment efficiency of 81.7%. Verified savings are calculated using a heating equipment efficiency of 79% per the TRM v9.0 Section 4.3.12.

Recommendation 14. Update the heating equipment efficiency for the DHW Storage Tank Insulation measure. 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 CY2022.

5.2.11 CA Pipe Insulation – PTA

The measure names for Project IDs 8014042 and 8142690 installed in North Shore Gas territory indicate these measures are installed in Peoples Gas territory.

- CA - Gas - Pipe Insulation - HW Small 1" to 2" - PG MF PTA 21
- CA - Gas - Pipe Insulation - DHW Small <=1.25" - PG MF PTA 21
- CA - Gas - Pipe Insulation - HW Medium 2.1" to 4" - PG MF PTA 21
- CA - Gas - Pipe Insulation - DHW Medium 1.26-2" - PG MF PTA 21
- CA - Gas - Pipe Insulation - DHW Large >2" - PG MF PTA 21

Guidehouse included savings for these measures under North Shore Gas based on Program Name and Gas Utility Name information provided in the tracking data.

Recommendation 15. Ensure measure names are consistent with the utility service territory.

5.2.12 Custom Project #7408859

Ex ante savings for this project were calculated using a baseline boiler efficiency of 64.8%. The evaluation team classified the project as time of sale based on the age of the existing boiler and calculated verified savings using a baseline boiler efficiency of 80.0%.

Recommendation 16. Use a baseline boiler efficiency corresponding to the classification of the existing boiler (time of sale or early replacement).

5.2.13 Custom Project #7268440

Ex ante savings for this project were calculated using door width of 8.5 feet and door height of 11.5 feet. Verified savings were calculated using door width of 8.3 feet and door height of 12.1 feet based on the contractor invoice.

Recommendation 17. Ensure parameters like door width and door height are consistent across documentation and use the most accurate data to calculate savings.

5.3 Historical Realization Rates and Net-to-Gross (NTG) Values

Table 5-2 shows the historical gross realization rates and NTG values for the Multi-Family Program. Beginning in GPY4, the NTG values shown are a savings weighted average from the various measures and deemed NTGs that vary by measure and program path.

Table 5-2. Historical Realization Rates and NTG Values

Program Year	PGL Verified Gross RR	NSG Verified Gross RR	PGL NTG	NSG NTG
GPY1 (2011-2012)	100%	100%	0.90	0.90
GPY2 (2012-2013)	100%	98%	0.90	0.90
GPY3 (2013-2014)	100%	100%	0.90	0.90
GPY4 (2014-2015)	100%	102%	0.95	0.92
GPY5 (2015-2016)	103%	100%	0.95	0.95
GPY6 (2016-2017)	100%	100%	0.90	0.92
2018	107%	110%	0.84	0.86
2019	100%	97%	0.85	0.92
2020	100%	97%	0.85	0.92
2021	101%	100%	0.87	0.91

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 (MMDB) for agreement with the Illinois Technical Reference Manual (TRM) version 9.0[1] 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 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.
5. Conducting engineering desk file review of a sample (census in 2021) of custom projects.

The evaluation team conducted an engineering desk file review for all three custom projects installed in 2021, to verify project savings that were not based on measures specified in the TRM. Table A-1 shows a summary of the custom project engineering desk file reviews.

Table A-1. Summary of Custom M&V Results

Program Path	Project ID	Measure Description	Ex Ante Gross Savings (Therms)	Gross Realization Rate	Verified Gross Savings (Therms)	Summary of Adjustment
Custom	7408859	Process - Other	6,515	26%	1,676	Thermal efficiency of the base unit was updated to 80% as per the IL TRM v9.0 Section 4.3.7.
Custom	7268440	HVAC – Other	14,351	111%	15,871	Verified savings were updated to use door width and door height dimensions documented in the contractor invoice.
Custom	7917331	Process - Insulation	874	100%	874	

Source: Guidehouse evaluation team analysis.

Engineering Review of Project Files

For each selected 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 sampled project, engineers estimated ex post gross savings based on their review of documentation and engineering analysis.

[1] Because the Illinois TRM provides multiple options for selecting input assumptions, Franklin Energy produces a "Master Measure Database" spreadsheet that documents their approach to compliance with the Illinois TRM.

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

Appendix B. Impact Analysis Supplemental Information

In Table B-1, we show the list of projects characterized as “prescriptive change” that the implementer describes as having the ex ante savings capped at 20% of the customer annual gas usage. Guidehouse determined that the assumptions used to calculate the reported savings for these projects were reasonable.

Table B-1. Projects with Capped Percentage Savings “Prescriptive Change”

Project ID	Type of Measure	Ex Ante Gross Therms (Capped savings)	Verified Gross Therms
7884678	Prescriptive Change Steam Trap - Savings - PG MF P 21	8,144	8,144

Appendix C. Program Specific Inputs for the Illinois TRC

Table C-1 and Table C-2 show the Total Resource Cost (TRC) cost-effectiveness analysis inputs available at the time of producing 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 C-1. Verified Cost Effectiveness Inputs – PGL

Program Path	Research Category	Units	Quantity	Effective Useful Life	Ex Ante Gross Savings (Therms)	Verified Gross Savings (Therms)	Verified Net Savings (Therms)
Direct Install	IU Showerhead	Each	1,649	10.0	18,661	18,662	18,849
	Programmable Thermostat	Each	349	16.0	14,387	14,388	13,812
	Advanced Thermostat	Each	178	11.0	12,069	12,069	10,862
	CA Pipe Insulation	LN FT	2,640	15.0	7,556	7,556	7,254
	IU Kitchen Aerator	Each	2,243	10.0	5,654	5,698	5,755
	IU Bathroom Aerator	Each	2,197	10.0	3,422	3,461	3,495
	IU Shower Timer	Each	899	2.0	3,181	3,181	3,054
	Reprogram Thermostat	Each	25	2.0	1,013	1,013	972
	CA Bathroom Aerator	Each	20	10.0	122	122	117
	CA Showerhead	Each	4	10.0	80	80	76
	IU Pipe Insulation	LN FT	87	15.0	30	30	29
	CA Kitchen Aerator	Each	4	10.0	30	30	29
Prescriptive	High Efficiency Boiler	MBH	57,181	25.0	57,925	62,017	53,955
	CA Pipe Insulation	LN FT	1,476	15.0	21,367	21,366	18,589
	Boiler Tune Up	MBH	44,241	3.0	20,143	20,738	18,042
	Prescriptive Steam Trap	Each	8,144	6.0	8,144	8,144	7,086
	Central Plant Water Heater	MBH	583	15.0	5,372	5,372	4,673
	IU Furnace	MBH	24	20.0	3,255	4,649	4,045
	IU Advanced Thermostat	Each	49	11.0	3,365	3,265	2,938
	DHW Controls	Apt Units	45	15.0	2,822	2,822	2,455
	Draft Controls	Each	14,286	15.0	2,373	2,373	2,064
	Boiler Reset Controls	MBH	1,720	16.0	2,627	2,286	1,988
	Averaging Controls	Each	22	20.0	1,344	1,344	1,169
	Water Heater	MBH	204	15.0	874	801	697

Program Path	Research Category	Units	Quantity	Effective Useful Life	Ex Ante Gross Savings (Therms)	Verified Gross Savings (Therms)	Verified Net Savings (Therms)
	CA Furnace	Each	1	16.5	237	237	206
	CA Advanced Thermostat	Each	1	11.0	86	86	77
PTA	CA Pipe Insulation	LN FT	93,653	15.0	537,796	537,795	467,882
	DHW Circulation System	Each	6,091	15.0	381,913	381,906	332,258
	Steam Trap	Each	6,365	6.0	199,748	199,765	173,796
	Boiler Tune Up	MBH	352,074	3.0	159,850	165,034	143,580
	Prescriptive Change Steam Trap	Each	223,239	6.0	86,544	86,544	75,293
	Averaging Controls	Each	917	20.0	56,021	56,018	48,735
	Boiler Reset Controls	MBH	20,682	16.0	26,625	27,482	23,910
	High Efficiency Boiler	MBH	28,666	25.0	22,340	23,457	20,407
	DHW Storage Tank Insulation	SQ FT	1,469	15.0	5,623	5,814	5,058
	Programmable Thermostat	Each	200	16.0	4,536	4,536	3,946
	Central Plant Water Heater	MBH	112	15.0	1,071	1,071	932
Direct Distribution	IU Showerhead	Each	123	10.0	1,392	1,392	1,406
	IU Shower Timer	Each	108	2.0	382	382	367
	IU Kitchen Aerator	Each	109	10.0	275	277	280
	IU Bathroom Aerator	Each	117	10.0	182	184	186
Custom	Custom	Project	3	15.7	21,739	18,421	16,027
Total or Weighted Average				**12.7**	**1,702,174**	**1,711,867**	**1,496,352**

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

Table C-2. Verified Cost Effectiveness Inputs – NSG

Program Path	Research Category	Units	Quantity	Effective Useful Life	Ex Ante Gross Savings (Therms)	Verified Gross Savings (Therms)	Verified Net Savings (Therms)
Direct Install	Programmable Thermostat	Each	193	16.0	7,816	7,817	7,504
	CA Pipe Insulation	LN FT	1,107	15.0	2,950	2,950	2,832
	IU Showerhead	Each	151	10.0	1,709	1,709	1,726
	IU Kitchen Aerator	Each	306	10.0	771	777	785
	IU Shower Timer	Each	185	2.0	655	655	628
	Reprogram Thermostat	Each	14	2.0	567	567	544
	IU Bathroom Aerator	Each	124	10.0	193	195	197
PTA	CA Pipe Insulation	LN FT	4,024	15.0	14,833	14,833	12,905
	DHW Controls	Apt Units	70	15.0	4,389	4,389	3,818
Total or Weighted Average				**14.4**	**33,884**	**33,892**	**30,941**

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