Guidehouse

Multi-Family Program 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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1. Introduction

This report presents the results of the impact evaluation of the Peoples Gas (PGL) and North Shore Gas (NSG) 2020 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 2020 covers January 1, 2020 through December 31, 2020.

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 five 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 Partner TA's in turn offer better rebates to their customers to install energy-efficient products.
4. 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.
5. 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 2020.

The PGL program had 940 participants in 2020 and completed 2,928 projects as shown in Table 2-1.

Table 2-1. 2020 Volumetric Summary for PGL

Participation	Direct Install	Prescriptive	PTA	Custom	Total
Participants *	150	69	718	3	940
Installed Projects †	1,878	72	975	3	2,928
Measure Types ‡	28	34	29	3	94

* 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. 2020 Installed Measure Quantities for PGL

Program Path	Measure	Quantity Unit	Installed Quantity
Direct Install	IU Showerhead	Each	1,160
	Advanced Thermostat	Each	132
	Programmable Thermostat	Each	130
	Reprogram Thermostat	Each	120
	IU Shower Timer	Each	1,306
	CA Pipe Insulation	LN FT	1,229
	IU Kitchen Aerator	Each	790
	IU Bathroom Aerator	Each	653
	CA Showerhead	Each	20
	CA Bathroom Aerator	Each	9
	CA Kitchen Aerator	Each	3
	IU Pipe Insulation	LN FT	18
Prescriptive	CA Pipe Insulation	LN FT	15,888
	High Efficiency Boiler	MBH	37,204
	Boiler Tune Up	MBH	80,110
	Averaging Controls	Apt Units	493
	Central Plant Water Heater	Apt Units Central Plants	722 4
	IU Furnace	Each	32
	Water Heater	MBH/Each	1,127
	Boiler Reset Controls	MBH	3,163
	Linkageless Controls	MBH	4,200
	Programmable Thermostat	Each	90
	Advanced Thermostat	Each	29
	Draft Controls	MBH	7,470

Program Path	Measure	Quantity Unit	Installed Quantity
	CA Furnace	Each	2
	Prescriptive Change	Project	263
PTA	Steam Traps	Each	3,201
	On Demand Domestic Hot Water (DHW) Circulation System	Apt Units	14,850
	CA Pipe Insulation	LN FT	103,734
	Boiler Tune Up	MBH	604,415
	Averaging Controls	Apt Units	2,961
	Boiler Reset Controls	MBH	21,117
	High Efficiency Boiler	MBH	21,435
	DHW Storage Tank Insulation	SQ FT	2,717
	Linkageless Controls	MBH	6,600
	Condensate Tank Insulation	SQ FT	104
Custom	Custom	Project	3

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

The NSG program had 43 participants in 2020 and completed 485 projects as shown in Table 2-3.

Table 2-3. 2020 Volumetric Summary for NSG

Participation	Direct Install	Prescriptive	PTA	Custom	Total
Participants *	7	2	34	0	43
Installed Projects †	443	2	40	0	485
Measure Types ‡	10	4	15	0	29

* 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. 2020 Installed Measure Quantities for NSG

Program Path	Measure	Quantity Unit	Installed Quantity
Direct Install	Programmable Thermostat	Each	83
	IU Shower Timer	Each	360
	IU Showerhead	Each	99
	IU Kitchen Aerator	Each	30
	CA Showerhead	Each	1
	CA Bathroom Aerator	Each	3
	CA Kitchen Aerator	Each	1
Prescriptive	Water Heater	MBH	120
	CA Furnace	Each	1
	High Efficiency Boiler	MBH	120
PTA	CA Pipe Insulation	LN FT	23,486
	On Demand DHW Circulation System	Apt Units	883
	Boiler Tune Up	MBH	33,087
	Steam Traps	Unit	7
	DHW Storage Tank Insulation	SQ FT	120

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 2020.

Table 3-1. 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)
Direct Install	38,287	110%	41,974	IU Showerheads =1.01 IU Aerators =1.01 Advanced Thermostats =NA‡ All Other Measures =0.96	41,348
Prescriptive	200,596	102%	205,383	Comprehensive =0.87 Advanced Thermostats=NA‡	178,900
PTA	3,281,749	100%	3,292,470	Comprehensive =0.87	2,864,448
Custom	9,726	101%	9,797	Comprehensive =0.87	8,524
Total or Weighted Average	**3,530,357**	**101%**	**3,549,624**	**0.87**	**3,093,220**

* 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.
‡ The TRM v8.0 algorithm for advanced thermostats is deemed to calculate net savings, so no NTG adjustment is applicable.
Source: Peoples Gas tracking data and Guidehouse evaluation team analysis.

Table 3-2 summarizes the energy savings the NSG program achieved by path in 2020.

Table 3-2. 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)
Direct Install	5,698	103%	5,877	IU Showerheads =1.01 IU Aerators =1.01 Advanced Thermostats =NA‡ All Other Measures =0.96	5,703
Prescriptive	786	102%	804	Comprehensive =0.87 Advanced Thermostats=NA‡	699
PTA	144,410	101%	145,299	Comprehensive =0.87	126,411
Total or Weighted Average	**150,894**	**101%**	**151,980**	**0.87**	**132,813**

* 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.
‡ The TRM v8.0 algorithm for advanced thermostats is deemed to calculate net savings, so no NTG adjustment is applicable.
Source: North Shore Gas tracking data and Guidehouse evaluation team analysis.

4. Program Savings by Measure

The PGL program includes 28 measures as shown in Table 4-1. The Steam Trap and DHW Circulation System measures contributed the most savings.

Table 4-1. 2020 Annual Energy Savings by Measure for PGL

Program Path	Measure	Ex Ante Gross Savings (Therms)	Verified Gross RR*	Verified Gross Savings (Therms)	NTG †	Verified Net Savings (Therms)
Direct Install	IU Showerhead	13,123	100%	13,128	1.01	13,259
	Advanced Thermostat	3,094	198%	6,125	NA	6,125
	Programmable Thermostat	5,479	100%	5,479	0.96	5,260
	Reprogram Thermostat	4,860	100%	4,860	0.96	4,666
	IU Shower Timer	3,971	116%	4,622	0.96	4,437
	CA Pipe Insulation	4,243	100%	4,243	0.96	4,073
	IU Kitchen Aerator	2,007	100%	2,007	1.01	2,027
	IU Bathroom Aerator	1,028	100%	1,029	1.01	1,039
	CA Showerhead	398	100%	398	0.96	382
	CA Bathroom Aerator	55	100%	55	0.96	53
	CA Kitchen Aerator	22	100%	22	0.96	21
	IU Pipe Insulation	6	100%	6	0.96	6
Prescriptive	CA Pipe Insulation	68,315	101%	69,043	0.87	60,067
	High Efficiency Boiler	38,178	107%	40,858	0.87	35,546
	Boiler Tune Up	36,372	103%	37,551	0.87	32,670
	Averaging Controls	30,118	100%	30,116	0.87	26,201
	Central Plant Water Heater	6,696	100%	6,697	0.87	5,826
	IU Furnace	4,340	100%	4,341	0.87	3,777
	Water Heater	4,168	101%	4,222	0.87	3,673
	Boiler Reset Controls	4,072	103%	4,203	0.87	3,657
	Linkageless Controls	2,651	100%	2,651	0.87	2,306
	Programmable Thermostat	2,041	100%	2,041	0.87	1,776
	Advanced Thermostat	1,667	100%	1,667	NA	1,667
	Draft Controls	1,241	100%	1,241	0.87	1,079
	CA Furnace	474	103%	489	0.87	426
	Prescriptive Change	263	100%	263	0.87	229
PTA	Steam Traps	1,246,578	100%	1,246,416	0.87	1,084,382
	On Demand DHW Circulation System	931,112	100%	931,095	0.87	810,053
	CA Pipe Insulation	583,819	100%	584,221	0.87	508,272

Program Path	Measure	Ex Ante Gross Savings (Therms)	Verified Gross RR*	Verified Gross Savings (Therms)	NTG †	Verified Net Savings (Therms)
	Boiler Tune Up	276,125	103%	284,981	0.87	247,933
	Averaging Controls	180,893	100%	180,881	0.87	157,367
	Boiler Reset Controls	27,185	103%	28,060	0.87	24,412
	High Efficiency Boiler	16,514	105%	17,327	0.87	15,074
	DHW Storage Tank Insulation	14,556	100%	14,522	0.87	12,634
	Linkageless Controls	4,166	100%	4,166	0.87	3,624
	Condensate Tank Insulation	801	100%	801	0.87	697
Custom	Custom	9,726	101%	9,797	0.87	8,524
	Total or Weighted Average	**3,530,357**	**101%**	**3,549,624**	**0.87**	**3,093,220**

* 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 13 measures as shown in Table 4-2. The Pipe Insulation and DHW Circulation System measures contributed the most savings.

Table 4-2. 2020 Annual Energy Savings by Measure for NSG

Program Path	Measure	Ex Ante Gross Savings (Therms)	Verified Gross RR*	Verified Gross Savings (Therms)	NTG†	Verified Net Savings (Therms)
Direct Install	Programmable Thermostat	3,362	100%	3,362	0.96	3,227
	IU Shower Timer	1,095	116%	1,274	0.96	1,223
	IU Showerhead	1,120	100%	1,120	1.01	1,132
	IU Kitchen Aerator	76	100%	76	1.01	77
	CA Showerhead	20	100%	20	0.96	19
	CA Bathroom Aerator	18	100%	18	0.96	18
	CA Kitchen Aerator	7	100%	7	0.96	7
Prescriptive	Water Heater	413	100%	413	0.87	359
	CA Furnace	237	103%	245	0.87	213
	High Efficiency Boiler	136	107%	146	0.87	127
PTA	CA Pipe Insulation	70,524	101%	70,929	0.87	61,708
	On Demand DHW Circulation System	55,365	100%	55,364	0.87	48,167
	Boiler Tune Up	15,022	103%	15,509	0.87	13,493
	Steam Traps	2,856	100%	2,856	0.87	2,485
	DHW Storage Tank Insulation	643	100%	641	0.87	558
	Total or Weighted Average	**150,894**	**101%**	**151,980**	**0.87**	**132,813**

* 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.

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 = 6.11	CA = 6.11	100%	Illinois TRM, v8.0†, Section 4.3.2
	Each	IU = 1.58	IU = 1.58	100%	Illinois TRM, v8.0, Section 5.4.4
Kitchen Aerator	Each	CA = 7.44	CA = 7.44	100%	Illinois TRM, v8.0, Section 4.3.2
	Each	IU = 2.54	IU = 2.54	100%	Illinois TRM, v8.0, Section 5.4.4
Prog./Reprogram T-Stat	Each	Prescriptive IU = 22.68	Prescriptive IU = 22.68	100%	Illinois TRM, v8.0, Section 5.3.11
	Each	IU Boiler = 59.94	IU Boiler = 59.93	100%	Illinois TRM, v8.0, Section 5.3.11
	Each	IU Furnace = 40.50	IU Furnace = 40.50	100%	Illinois TRM, v8.0, Section 5.3.11
Pipe Insulation	LN FT	Varies	Varies	varies	Illinois TRM, v8.0, Section 4.4.14
Prog. Advanced T-Stat	Each	IU Furnace = 36.58	IU Furnace = 36.58	100%	Illinois TRM, v8.0, Section 5.3.16
	Each	IU Boiler & Chiller = 0.00	IU Boiler & Chiller = 54.13	NA	Illinois TRM, v8.0, Section 5.3.16
Showerhead	Each	CA = 19.92	CA = 19.92	100%	Illinois TRM, v8.0, Section 4.3.3
	Each	IU = 11.31	IU = 11.32	100%	Illinois TRM, v8.0, Section 5.4.5
Shower Timer	Each	3.04	3.54	116%	Illinois TRM, v8.0, Section 5.4.9
Manual Baseline, Advanced T-Stat	Each	57.49	57.49	100%	Illinois TRM, v8.0, Section 5.3.16
Pipe Steam Avg. Controls	Each	61.09	61.09	100%	Illinois TRM, v8.0, Section 4.4.36
High Efficiency Boiler	MBH	Steam >=1,500 MBH = 0.81	Steam >=1,500 MBH = 0.85	105%	Illinois TRM, v8.0, Section 4.4.10
	MBH	Steam >=300 MBH = 0.62	Steam >=300 MBH = 0.64	104%	Illinois TRM, v8.0, Section 4.4.10
	MBH	HW >2,500 MBtu = 1.13	HW >2,500 MBtu =1.22	107%	Illinois TRM, v8.0, 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, v8.0, Section 4.4.10
	MBH	HW <=300 Mbtu = 1.13	HW <=300 Mbtu = 1.22	107%	Illinois TRM, v8.0, Section 4.4.10
Boiler Reset Controls	MBH	1.29	1.33	103%	Illinois TRM, v8.0, Section 4.4.4
Boiler Tune Up	MBH	0.45	0.47	103%	Illinois TRM, v8.0, Section 4.4.2
Draft Controls	MBH	0.17	0.17	100%	Illinois TRM, v8.0, Section 4.4.23
Furnace	Each	CA = 236.90	CA = 244.58	103%	Illinois TRM, v8.0, Section 4.4.11
	Each	IU = 135.63	IU = 135.66	100%	Illinois TRM, v8.0, Section 5.3.7
Water Heater	MBH	3.44	3.44	100%	Illinois TRM, v8.0, Section 4.3.1
Boiler Control (Linkageless)	MBH	0.63	0.63	100%	Illinois TRM, v8.0, Section 4.4.21
DHW Circulation System	Units	62.7	62.7	100%	Illinois TRM, v8.0, Section 4.3.8
Steam Trap	Each	Audit Px = 408.05	Audit Px = 407.99	100%	Illinois TRM, v8.0, Section 4.4.16
	Each	Audit PTA = 408.05	Audit PTA = 407.99	100%	Illinois TRM, v8.0, Section 4.4.16
	Each	No Audit = 110.16	No Audit = 110.16	100%	Illinois TRM, v8.0, Section 4.4.16
Advanced Thermostat (Prescriptive)	Each	57.49	57.49	100%	Illinois TRM, v8.0, Section 5.3.16
High Eff. Water Heater	Each	0.67 EF =35.44	0.67 EF =56.25	159%	Illinois TRM, v8.0, Section 4.3.1
	Each	UEF>0.68 = 40.36	UEF>0.68 = 40.36	100%	Illinois TRM, v8.0, Section 4.3.1
Central Domestic Hot Water Plant	Each	36.52	36.52	100%	Illinois TRM, v8.0, Section 4.3.7
	Units	9.07	9.07	100%	Illinois TRM, v8.0, Section 4.3.7
Condensate Tank Insulation	SQ FT	7.70	7.70	100%	Illinois TRM, v8.0, Section 4.4.14
DHW Tank Insulation	SQ FT	5.36	5.34	100%	Illinois TRM, v8.0, Section 4.4.14
Custom	Project	Varies	Varies	101%	Project File Review, Evaluation‡

* 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.
‡ 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.

5.1.1 Advanced Thermostat – Direct Install

No ex ante therm savings are claimed in the tracking data for 56 advanced thermostats under the measure name “IU - Gas - Nest ($150) - Base Prog-FanCoil-Boiler&Chiller-MFES 20”. This finding only applies to PGL. The evaluation team brought this issue to the attention of PGL, and they confirmed the installations had occurred and this was a tracking system error. The evaluation team added 54.13 gross therms to the verified savings for each thermostat (3,031 gross therms total).

Recommendation 1. Update the tracking data to claim savings of 54.13 therms per unit for IU - Gas - Nest ($150) - Base Prog-FanCoil-Boiler&Chiller-MFES 20 measure.

5.1.2 Shower Timer – Direct Install

Ex ante savings for this measure are calculated using an energy per gallon of hot water supplied by gas (EPG_Gas) value for single-family homes (0.00501 Therm/gallon) instead of for multi-family homes.

Recommendation 2. Update the EPG_Gas value to 0.00583 Therms/gallon corresponding to multi-family homes as per Illinois Technical Reference Manual (TRM) v8.0 Section 5.4.9.

5.1.3 Boiler Tune Up, Boiler Reset Controls, CA Furnace – Prescriptive and PTA

Ex ante savings for these measures are calculated using an equivalent full Load hours (EFLH) value of 1,609, which represents the average EFLH value for multi-family high rise and multi-family mid-rise building types from the TRM v7.0.

Recommendation 3. Update the EFLH to 1,661, which represents the average of EFLH values for multi-family high-rise and multi-family mid-rise buildings from the TRM v8.0 and TRM v9.0. This value also aligns with the EFLH used for high efficiency boiler and linkageless controls measures.

5.1.4 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 4. For high efficiency boilers, update the energy savings algorithm for this measure as per the TRM v8.0 Section 4.4.10.

5.1.5 CA Pipe Insulation (HW Medium 2.1” to 4”) – Prescriptive and PTA

The nominal therms/ft and WSFU to Pipe diameter adjustment calculations are not properly aligned by size in the ex ante calculator for this measure.

Recommendation 5. Update the calculations for pipe insulation so that the input values correspond to the correct pipe sizes. The evaluation team acknowledges that this issue is being addressed in the 2021 MMDB.

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

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 6. Update the calculations for large and extra-large steam fitting insulation to use the 'Weighted MF Steam' values in the ex ante calculator to be consistent with other steam fitting and steam valve measures.

5.1.7 DHW Storage Tank Insulation – PTA

The ex ante savings for this measure are calculated using a boiler efficiency of 81.7% instead of 81.9%, which is the standard default for water boilers in TRM v8.0 for insulation measures.

Recommendation 7. Update the boiler efficiency to 81.9% as per the TRM v8.0 for water boilers.

5.1.8 Water Heater (Water Heater 0.67 EF (Com) - PG MF P 20) – Prescriptive

The ex ante savings for this measure are calculated using consumption per gallon of usable tank capacity of 558 Consumption/Cap and a baseline boiler efficiency of 0.5925 (0.675 – 55*0.0015) from the TRM v6.0 Section 4.3.1.

Recommendation 8. Update the consumption per gallon of usable tank capacity to 894 Consumption/Cap corresponding to the multi-family building type, and update the baseline boiler efficiency to 0.5548 (0.6483 – 55*0.0017) as per the TRM v8.0 Section 4.3.1.

5.1.9 On Demand DHW Circulation System – PTA

The tracking data for this measure includes two entries for Project ID 4955170 representing two separate central heating plants. However, based on just the information in the tracking data, these entries appeared to duplicate entries. The evaluation team included savings for both entries based on additional information provided by the implementation contractor.

Recommendation 9. Use a unique Project ID for each separate central DHW plant or include a note in the tracking data indicating the same to ensure multiple control systems installed at the same building are not interpreted and disallowed as duplicate entries in the tracking data.

5.1.10 Steam Boiler Averaging Controls – PTA

The tracking data for this measure includes two entries for Project ID 5537095 representing two separate central heating plants. However, based on just the information in the tracking data, these entries appeared to be duplicate entries. The evaluation team included savings for both entries based on additional information provided by the implementation contractor.

Recommendation 10. Use a unique Project ID for each separate central heating plant or include a note in the tracking data indicating the same to ensure multiple control systems installed at the same building are not interpreted and disallowed as duplicate entries in the tracking data.

5.1.11 Cross-Cutting

The "Site Address" field in the tracking data has "Bldg." at the end of the address with no actual unique building identifier reported for many measures. Unique building identifiers are important to report to verify that projects at site addresses with multiple buildings are not being reported in duplicate. Duplicate entries are assigned zero verified savings. Evaluation analysis confirmed that multiple projects completed at the same site address were conducted at different buildings, but unique building identifiers in the address were not provided in the tracking data.

Recommendation 11. Report all unique building identifiers in the "Site Address" field of the tracking data to ensure evaluators can confirm multiple separate projects conducted at the same site address are not mistaken for duplicate entries.

5.1.12 Custom – Project 6048212

The project involved replacement of the existing steam-based domestic hot water heating system with two 750-MBH direct heating water heaters with storage tanks. Verified savings for this project were adjusted to use a scaling factor to calibrate the DHW energy consumption as predicted by the TRM algorithm and project inputs with the actual DHW energy consumption at the facility based on billing data. Verified savings also accounted for stand-by loss for the new installed system. The project had a 101% verified gross savings realization rate.

Recommendation 12. Ensure that the baseline gas consumption at the facility as calculated using the TRM algorithm and project inputs is calibrated to the actual gas consumption at the facility as indicated by the billing data. The evaluation team also recommends the implementer account for stand-by loss, when applicable.

5.2 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 (2012-2015)	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	101%	101%	0.87	0.87

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)[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 2020) of custom projects.

The evaluation team conducted an engineering desk file review for all three custom projects installed in 2020, 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	Project ID	Measure Description	Ex Ante Gross Savings (Therms)	Gross Realization Rate	Verified Gross Savings (Therms)	Summary of Adjustment
Custom	6048212	Efficient Direct Heating Water Heaters with Storage	6,676	101%	6,748	Verified savings used a scaling factor to calibrate the DHW energy consumption as predicted by the TRM algorithm and project inputs to the actual DHW energy consumption at the facility based on billing data. Verified savings also included stand-by loss for the proposed hot water heaters.
Custom	5963754	HVAC – Other	2,037	100%	2,037	
Custom	6039127	HVAC – Demand Control Ventilation	1,012	100%	1,012	

Source: Guidehouse evaluation team 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.

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.

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. Based on our review of installed quantity and the reported savings for a sample of these projects, 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
3802554	Prescriptive Change Other - Savings - PG MF P 20	177	177
3802335	Prescriptive Change Other - Savings - PG MF P 20	52	52

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	Measure	Units	Quantity	Effective Useful Life	Ex Ante Gross Savings (Therms)	Verified Gross Savings (Therms)	Verified Net Savings (Therms)
Direct Install	IU Showerhead	Each	1,160	10.0	13,123	13,128	13,259
	Advanced Thermostat	Each	132	11.0	3,094	6,125	6,125
	Programmable Thermostat	Each	130	8.0	5,479	5,479	5,260
	Reprogram Thermostat	Each	120	2.0	4,860	4,860	4,666
	IU Shower Timer	Each	1,306	2.0	3,971	4,622	4,437
	CA Pipe Insulation	LN FT	1,229	15.0	4,243	4,243	4,073
	IU Kitchen Aerator	Each	790	10.0	2,007	2,007	2,027
	IU Bathroom Aerator	Each	653	10.0	1,028	1,029	1,039
	CA Showerhead	Each	20	10.0	398	398	382
	CA Bathroom Aerator	Each	9	10.0	55	55	53
	CA Kitchen Aerator	Each	3	10.0	22	22	21
	IU Pipe Insulation	LN FT	18	15.0	6	6	6
Prescriptive	CA Pipe Insulation	LN FT	15,888	15.0	68,315	69,043	60,067
	High Efficiency Boiler	MBH	37,204	20.0	38,178	40,858	35,546
	Boiler Tune Up	MBH	80,110	3.0	36,372	37,551	32,670
	Averaging Controls	Apts.	493	20.0	30,118	30,116	26,201
	Central Plant Water Heater	Apts. / Plants	722 4	15.0	6,696	6,697	5,826
	IU Furnace	Each	32	20.0	4,340	4,341	3,777
	Water Heater	MBH/ Each	1,127	15.0	4,168	4,222	3,673
	Boiler Reset Controls	MBH	3,163	20.0	4,072	4,203	3,657
	Linkageless Controls	MBH	4,200	16.0	2,651	2,651	2,306
	Programmable Thermostat	Each	90	8.0	2,041	2,041	1,776
	Advanced Thermostat	Each	29	11.0	1,667	1,667	1,667
	Draft Controls	MBH	7,470	16.0	1,241	1,241	1,079
	CA Furnace	Each	2	16.5	474	489	426
	Prescriptive Change	Project	263	3.0	263	263	229
PTA	Steam Traps	Each	3,201	6.0	1,246,578	1,246,416	1,084,382

Program Path	Measure	Units	Quantity	Effective Useful Life	Ex Ante Gross Savings (Therms)	Verified Gross Savings (Therms)	Verified Net Savings (Therms)
	On Demand DHW Circulation System	Apt Units	14,850	15.0	931,112	931,095	810,053
	CA Pipe Insulation	LN FT	103,734	15.0	583,819	584,221	508,272
	Boiler Tune Up	MBH	604,415	3.0	276,125	284,981	247,933
	Averaging Controls	Apts.	2,961	20.0	180,893	180,881	157,367
	Boiler Reset Controls	MBH	21,117	20.0	27,185	28,060	24,412
	High Efficiency Boiler	MBH	21,435	20.0	16,514	17,327	15,074
	DHW Storage Tank Insulation	SQ FT	2,717	15.0	14,556	14,522	12,634
	Linkageless Controls	MBH	6,600	16.0	4,166	4,166	3,624
	Condensate Tank Insulation	SQ FT	104	15.0	801	801	697
Custom	Custom	Project	3	14.0	9,726	9,797	8,524
	Total or Weighted Average			**11.1**	**3,530,357**	**3,549,624**	**3,093,220**

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

Table C-2. Verified Cost Effectiveness Inputs – NSG

Program Path	Measure	Units	Quantity	Effective Useful Life	Ex Ante Gross Savings (Therms)	Verified Gross Savings (Therms)	Verified Net Savings (Therms)
Direct Install	Programmable Thermostat	Each	83	8.0	3,362	3,362	3,227
	IU Shower Timer	Each	360	2.0	1,095	1,274	1,223
	IU Showerhead	Each	99	10.0	1,120	1,120	1,132
	IU Kitchen Aerator	Each	30	10.0	76	76	77
	CA Showerhead	Each	1	10.0	20	20	19
	CA Bathroom Aerator	Each	3	10.0	18	18	18
	CA Kitchen Aerator	Each	1	10.0	7	7	7
Prescriptive	Water Heater	MBH	120	15.0	413	413	359
	CA Furnace	Each	1	16.5	237	245	213
	High Efficiency Boiler	MBH	120	20.0	136	146	127
PTA	CA Pipe Insulation	LN FT	23,486	15.0	70,524	70,929	61,708
	On Demand DHW Circulation System	Apt Units	883	15.0	55,365	55,364	48,167
	Boiler Tune Up	MBH	33,087	3.0	15,022	15,509	13,493
	Steam Traps	Unit	7	6.0	2,856	2,856	2,485
	DHW Storage Tank Insulation	SQ FT	120	15.0	643	641	558
	Total or Weighted Average			**13.3**	**150,894**	**151,980**	**132,813**

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