Multi-Family Income Qualified Program Impact Evaluation Report

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

Prepared for:

Nicor Gas

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1. Introduction

This report presents the results of the impact evaluation of the Nicor Gas 2021 Multi-Family Income Qualified Program. The program includes the Illinois Home Weatherization Assistance Program (IHWAP), Contractor Channel, and the Kits Program. It presents a summary of the energy impacts for the total program and is broken out by relevant measure and program structure details. The appendix presents the impact analysis methodology. Program year 2021 covers January 1, 2021 through December 31, 2021.

2. Program Description

The Nicor Gas Multi-Family Income Qualified Program offers weatherization (Wx) products and energy saving measures for income-qualified customers in multi-family dwellings within the Nicor Gas service territory. The 2021 IHWAP and contractor channels included direct installation of water heating efficiency measures (faucet aerators, showerheads, gas water heaters); programmable thermostats; attic insulation; air leakage reduction; and furnace and boiler tune-ups. The program also provided free energy saving kits of water efficiency or air sealant measures. The offering “Kit 2” included low-flow showerheads (SH, 2 per kit), kitchen aerators (KA), shower timers (ST), and bathroom aerators (BA, 2 per kit). The “Kit 4” offering included 12 gaskets, 1 sweep, 30 linear feet of caulk, and 34 linear feet of weather stripping. The program provided one or two kits per customer depending on their request.

The program had 790 participants in 2021 and completed 1,333 projects as shown in Table 2-1.

Table 2-1. 2021 Volumetric Findings Detail

Participation	IHWAP	Contractor Channel	Kits	Total
Participants *	1	21	768	790
Installed Projects †	4	556	773	1,333
Measure Types Installed	4	12	8	24

* Participants are defined as unique business names
† Installed Projects are defined as the unique count of Vendor Project IDs
Source: Nicor Gas tracking data and Guidehouse evaluation team analysis.

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

Table 2-2. 2021 Measure Quantities

Program Path	Measure	Quantity Unit	Installed Quantity
MF	Air Sealing - Sealing Tape	Unit	17,857
	Ceiling/Attic Insulation	Sq Ft	114,696
Contractor Channel	Custom - Domestic Hot Water Boiler	Unit	2
	Custom - Heating Plant Improvement	Unit	2
	Air Sealing	Unit	15
	Air Sealing - Sealing Tape	Ln Ft	477,386
	Ceiling/Attic Insulation	Sq Ft	614,290
	Custom Measure - Multifamily Central Domestic Hot Water Plants	Unit	15
	DWH Pipe Insulation	Ln Ft	222
	Low-Flow Faucet Aerator	Unit	2,187
Kits	Low-Flow Showerhead	Unit	970
	Pipe Insulation	Varies	81,905
	Programmable Thermostats	Unit	96
	Residential Furnace Tune-Up	Unit	139
	Space Heating Boiler Tune-Up	Unit	74
	Wall Insulation	Sq Ft	25,058
	Showerheads	Each	1,398
	Bathroom Faucet Aerators	Each	1,398

* Measure quantities are installed except Kits measures are quantity distributed.
Source: Nicor Gas tracking data and Guidehouse evaluation team analysis.

3. Program Savings Detail

Table 3-1 summarizes the energy savings the Multi-Family Income Qualified Program achieved by path in 2021.

Table 3-1. 2021 Annual Energy Savings Summary

Program Path	Ex Ante Gross Savings (Therms)	Verified Gross RR*	Verified Gross Savings (Therms)	NTG†	Verified Net Savings (Therms)
IHWAP	37,871	38%	14,548	1.00	14,548
Contractor Channel	743,221	100%	745,013	1.00	745,013
Kits	73,605	100%	73,606	1.00	73,606
Total or Weighted Average	**854,698**	**97%**	**833,168**	**1.00**	**833,168**

* 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: Nicor Gas tracking data and Guidehouse evaluation team analysis.

4. Program Savings by Measure

The program includes 19 unique measures as shown in Table 4-1. The verified gross realization rate for the programs combined is 97%. The pipe insulation, air sealing, and attic insulation measures contributed the most savings.

Table 4-1. 2021 Annual Energy Savings by Measure

Program Path	Research Category	Ex Ante Gross Savings (Therms)	Verified Gross RR	Verified Gross Savings (Therms)	NTG	Verified Net Savings (Therms)
IHWAP	Air Sealing - Sealing Tape	7,429	29%	2,154	1.00	2,154
	Ceiling/Attic Insulation	7,911	29%	2,294	1.00	2,294
	Custom - Domestic Hot Water Boiler	2,139	47%	1,011	1.00	1,011
	Custom - Heating Plant Improvement	20,392	45%	9,089	1.00	9,089
Contractor Channel	Air Sealing	6,874	98%	6,708	1.00	6,708
	Air Sealing - Sealing Tape	198,593	100%	198,593	1.00	198,593
	Ceiling/Attic Insulation	128,549	99%	127,798	1.00	127,798
	Custom Measure - Multifamily Central Domestic Hot Water Plants	21,119	100%	21,119	1.00	21,119
	DWH Pipe Insulation	195	100%	195	1.00	195
	Low-Flow Faucet Aerator	7,913	124%	9,809	1.00	9,809
	Low-Flow Showerhead	3,829	125%	4,770	1.00	4,770
	Pipe Insulation	338,646	100%	338,518	1.00	338,518
	Programmable Thermostats	3,888	100%	3,888	1.00	3,888
	Residential Furnace Tune-Up	10,329	100%	10,329	1.00	10,329
	Space Heating Boiler Tune-Up	22,787	100%	22,787	1.00	22,787
	Wall Insulation	500	100%	500	1.00	500
Kits	Showerheads	12,817	100%	12,817	1.00	12,817
	Bathroom Faucet Aerators	1,471	100%	1,471	1.00	1,471
	Kitchen Faucet Aerators	3,505	100%	3,505	1.00	3,505
	Shower Timers	2,474	100%	2,474	1.00	2,474
	Gaskets	5,900	100%	5,900	1.00	5,900
	Weatherstrip	21,625	100%	21,625	1.00	21,625
	Door Sweep	9,528	100%	9,528	1.00	9,528
	Caulking	16,288	100%	16,288	1.00	16,288
	Total or Weighted Average	**854,699**	**97%**	**833,168**	**1.00**	**833,168**

Source: Nicor Gas tracking data and Guidehouse evaluation 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. The realization rate is the ratio of the verified savings to the ex ante savings. Following the table, the evaluation team provides findings and recommendations, including discussion of all measures with realization rates above or below 100%. Appendix A provides a description of the impact analysis methodology. Appendix B provides the Total Resource Cost (TRC) cost-effectiveness analysis inputs available at the time of producing this impact evaluation report.

Table 5-1. Verified Gross Savings Parameters

Program Path	Measure	Unit Basis	Ex Ante Gross (therms/unit)	Verified Gross (therms/unit)	Realization Rate	Data Source(s)
IHWAP	Air Sealing - Sealing Tape	Unit	0.42	0.42	29%	TRM v9.0*, section 5.6.1 and PTD†
	Ceiling/Attic Insulation	Sq Ft	0.07	0.07	29%	TRM v9.0, section 5.6.5 and PTD
	Custom - Domestic Hot Water Boiler	Unit	Varies	Varies	47%	Project File Review‡ and PTD
	Custom - Heating Plant Improvement	Unit	Varies	Varies	45%	Project File Review and PTD
Contractor Channel	Air Sealing	Unit	Varies	Varies	98%	TRM v9.0, section 5.6.1 and PTD
	Air Sealing - Sealing Tape	Ln Ft	0.42	0.42	100%	TRM v9.0, section 5.6.1 and PTD
	Ceiling/Attic Insulation	Sq Ft	Varies	Varies	99%	TRM v9.0, section 5.6.5 and PTD
	Custom Measure - Multifamily Central Domestic Hot Water Plants	Unit	1,407.92	1,407.92	100%	TRM v9.0, section 4.3.7 and PTD
	DWH Pipe Insulation	Ln Ft	0.88	0.88	100%	TRM v9.0, section 5.4.1 and PTD
	Low-Flow Faucet Aerator	Unit	Varies	Varies	124%	TRM v9.0, section 5.4.4 and PTD
	Low-Flow Showerhead	Unit	Varies	Varies	125%	TRM v9.0, section 5.4.5 and PTD
	Pipe Insulation	Ln Ft	Varies	Varies	100%	TRM v9.0, section 4.4.14 and PTD
	Programmable Thermostats	Unit	40.50	40.50	100%	TRM v9.0, section 5.3.11 and PTD
	Residential Furnace Tune-Up	Unit	Varies	Varies	100%	TRM v9.0, section 5.3.13 and PTD
	Space Heating Boiler Tune-Up	Unit	Varies	Varies	100%	TRM v9.0, section 4.4.2 and PTD
	Wall Insulation	Unit	Varies	Varies	100%	TRM v9.0, section 5.6.4 and PTD
Kits	Kit 2 (2 SH, 2 BA, 1 KA, 1 ST)	Each	28.99	28.99	100%	TRM v9.0, section 5.4.4, section 5.4.5, section 5.4.9 and PTD
	Kit 4 (12 gasket, 1 sweep, 30 LF caulk, 34 LF Wx)	Each	35.49	35.49	100%	TRM v9.0, section 5.6.1 and PTD

* State of Illinois Technical Reference Manual version 9.0 (TRM v9.0) from https://www.ilsag.info/technical-reference-manual/il-trm-version-9/.
† Program Tracking Data (PTD) provided by Nicor Gas; extract dated February 2, 2022.
‡ Project files and monthly billing data provided by Nicor Gas. Where conducted, on-site or telephone interview data collected by Guidehouse.

5.1.1 Joint Measures with ComEd

Finding 1. The evaluation team found many measures in the IHWAP program path exist in both the ComEd MF IHWAP and Nicor Gas MF IHWAP tracking data. This includes two Air Sealing – Sealing Tape measures (MEA-2020.12.18-187384 and MEA-2021.02.05-200727), two Ceiling/Attic Insulation measures (MEA-2020.12.18-187397 and MEA-2021.02.05-200728), both

Custom – Domestic Hot Water Boiler measures (MEA-2021.03.26-217546 and MEA-2021.03.26-217549, both Custom – Heating Plant Improvement measures (MEA-2021.03.26-217545 and MEA-2021.03.26-217548). ComEd claims 71% of therms for joint measures, thus indicating Nicor Gas claims the other 29%. The evaluation team found the Nicor Gas ex ante savings values for most of these measures did not take the split into consideration, therefore these measures have a realization rate of 29%. MEA-2021.03.26-217549 and MEA-2021.03.26-217548 incorporate the split into their respective ex ante savings value.

> **Recommendation 1.** Ensure the ex ante savings account for joint measure savings with the ComEd program. The tracking data should consistently reflect this overlap, which will help avoid discrepancies moving forward.

5.1.2 Ceiling/Attic Insulation and Air Sealing

Finding 2. The evaluation team found three Ceiling/Attic Insulation measures (MEA-2021.02.12-201657, MEA-2021.02.12-201656, and MEA-2021.06.10-233816) were not in the same Building Premise ID as an air sealing measure type, indicating they were installed without air sealing and should use an IE_netcorrection value of 1.0. Ex ante savings values for these measures used an IE_netcorrection value of 1.10 which aligns with an attic insulation measure that is installed with air sealing. This discrepancy results in a realization rate of 91% for affected installations.

Finding 3. The evaluation team found two Air Sealing measures (MEA-2021.09.16-254767 and MEA-2021.12.13-268740) that were installed in the same Building Premise ID as a Ceiling/Attic Insulation measure, but ex ante savings did not use the proper savings inputs. Verified savings for these measures used a gas heating savings adjustment ($ADJ_{AirSealingGasHeat}$) value of 72% and an IE_netcorrection value of 110%. This results in a realization rate of 79% for these two measures.

> **Recommendation 2.** Ensure ex ante savings properly account for measure details found in the tracking data. The evaluation team recommends a tracking data field be added to identify an air sealing and attic insulation project moving forward.

5.1.3 Custom – Domestic Hot Water Boiler

Finding 4. Baseline DHW consumption was not calibrated at the facility using a scaling factor. Guidehouse used a scaling factor calculated as the ratio of the benchmarked DHW usage (using utility bill analysis) at the building to the baseline usage as predicted by the custom calculations (using TRM v9.0, Section 4.3.7) to ensure calibration. Guidehouse then multiplied the savings calculated using the custom approach by the scaling factor.

> **Recommendation 3.** Calibrate the baseline consumption calculated using the TRM v9.0 algorithm and the DHW consumption using a scaling factor.

Finding 5. Ex ante standby loss for this measure was calculated by dividing the tank volume by the number of tanks and using the input rating of the boiler in MBH and the TRM v9.0 algorithm. The tank volume used in the calculations corresponds to a single tank and the TRM algorithm requires the boiler input rating in Btuh. Guidehouse calculated the standby loss for this measure using the boiler input rating in Btuh and the TRM v9.0 algorithm.

Recommendation 4. Use the tank volume corresponding to a single tank and use the boiler input rating in Btuh and the TRM algorithm to calculate the standby loss for this measure.

5.1.4 Custom – Heating Plant Improvement

Finding 6. Ex ante 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 5. Only calculate normalized HHW usage for months with HDD greater than 100 to be consistent with the approach used to determine the regression coefficients.

Finding 7. Ex ante equivalent full load heating hours (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 6. Use the input capacity, efficiency of the installed boiler, and HHW usage adjusted for the installed boiler to calculate EFLH.

Finding 8. Ex ante savings for the HHW boiler efficiency measure were calculated using the input capacity of the boiler and Equation 5-1. The Equation 5-1 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 5-2 per the TRM v9.0, Section 4.4.10.

Equation 5-1. Ex Ante Savings Algorithm

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

Equation 5-2. Verified Savings Algorithm

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

Recommendation 7. Use Equation 5-2 along with the input capacity of the boiler to calculate savings for this measure.

Finding 9. Ex ante weighted average proposed boiler efficiency was calculated using standard boiler efficiency curves and typical meteorological year (TMY3) for Chicago O'Hare International Airport weather station data for one custom project site. Guidehouse calculated the weighted average proposed boiler efficiency using standard boiler efficiency curves and TMY3 weather data for the Midway International Airport weather station based on proximity to the site address and to be consistent with the TMY3 weather data used for the normalized HHW usage determination.

Recommendation 8. Use TMY3 weather data for the weather station closest to the site address for all aspects of a custom project.

Finding 10. For the HHW boiler efficiency measure, ex ante savings for all boilers for one project were calculated using a baseline efficiency of 80% irrespective of the boiler capacity. Guidehouse calculated verified savings for this project using a baseline efficiency of 82% for boilers less than 300 kBtu/hr and 80% for boilers greater than or equal to 300 kBtu/hr per the TRM v9.0 Section, 4.4.10.

Recommendation 9. Use a baseline boiler efficiency corresponding to the boiler capacity per the TRM v9.0, Section 4.4.10.

Finding 11. For the HHW boiler turndown measure, the program calculated energy loss due to cycling for temperature bins where the percentage of boiler load was greater than the turndown ratio in the baseline and efficient cases. Guidehouse only calculated energy loss due to cycling for temperature bins where the percentage of boiler load was less than or equal to the turndown ratio in the baseline and efficiency cases per the TRM v9.0, Section 4.4.20

Recommendation 10. Only calculate energy loss due to cycling for temperature bins where the percentage of boiler load is less than or equal to the turndown ratio per the TRM v9.0, Section 4.4.20.

5.1.5 Low-Flow Faucet Aerator

Finding 12. The evaluation team found many Kitchen aerator measures produced a realization rate of 150%. Verified savings use custom provided values for all inputs except for drain factor (DF), faucets per household (FPH), energy per gallon of hot water supplied by gas (EPG_gas), and in-service rate (ISR) as those values are deemed in the TRM v9.0. The evaluation team believes these measures could be using the MF Bathroom FPH value of 1.5 rather than the Kitchen FPH value of 1. Table 5-2 outlines the inputs used in verified savings equations for both faucet types.

Finding 13. The kitchen faucet aerator MEA-2021.05.12-226197 has an individual realization rate of 133%. The evaluation team used the custom values provided and TRM v9.0 values where deemed. A cause for discrepancy could not be identified. Table 5-3 shows the savings values used in the verified equation, and the discrepancy between ex ante and verified savings.

Recommendation 11. Ensure the ex ante savings values reflect the information provided in the tracking data and TRM v9.0 inputs for the given measure.

Table 5-2. Low-Flow Faucet Aerator Savings Inputs

Faucet Type	% FossilDHW	GPM_base	GPM_low	L_base	L_low	Household	DF	FPH	EPG_gas	ISR
Kitchen MF	100%	Custom	Custom	Custom	Custom	Custom	75%	1	0.00484	0.91
Bathroom MF	100%	Custom	Custom	Custom	Custom	Custom	90%	1.5	0.00397	0.95

Source: Nicor Gas tracking data, Guidehouse evaluation team analysis and TRM v9.0.

Table 5-3. MEA-2021.05.12-226197 Savings Inputs

Measure Name	GPM _low	GPM _base	Household	L_base, L_low	ISR	EPG_gas	FPH	DF	Ex Ante Therms	Verified Therms	RR
Low-Flow Aerator - Kitchen (DI) MF-IU	0.94	1.63	2.1	4.5	0.91	0.00484	1	0.75	5.93	7.87	133%

Source: Nicor Gas tracking data, Guidehouse evaluation team analysis and TRM v9.0.

Finding 14. The evaluation team found a misalignment in the tracking data that suggests ex ante savings inputs have been switched for two bathroom aerators and two kitchen aerators. The two measure groupings have the same inputs respective of one another except for quantity and household. See Table 5-4 below for more details.

Recommendation 12. Ensure the measure information captured in the tracking data aligns with the rest of the project information.

Table 5-4. Low-Flow Faucet Aerator Measure-Level Discrepancy

Project ID	Measure ID	Measure Name	Quantity	Household	Ex Ante Therms	Verified Therms	RR
PID-2021.07.15-89936	MEA-2021.07.28-244623	Low-Flow Aerator - Bath (DI) MF-IU	8	8	1.64	49.94	3048%
PID-2021.08.12-91979	MEA-2021.08.12-246669	Low-Flow Aerator - Bath (DI) MF-IU	1	2.1	49.94	1.64	3%
PID-2021.07.15-89936	MEA-2021.07.28-244622	Low-Flow Aerator - Kitchen (DI) MF-IU	8	8	5.24	239.76	4572%
PID-2021.08.12-91979	MEA-2021.08.12-246875	Low-Flow Aerator - Kitchen (DI) MF-IU	1	2.1	239.76	7.87	3%

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

Finding 15. The evaluation team found the tracking data reported zero ex ante savings for two bathroom faucet aerators (MEA-2021.05.12-225864 and MEA-2021.05.12-226025) and two kitchen faucet aerators (MEA-2021.05.12-226099 and MEA-2021.05.12-226193). Nicor Gas provided supplemental data[1] that showed savings calculation adjustments. Guidehouse found differences between the supplemental data calculations and ex ante savings from both the Wave 1 mid-year review and year-end tracking data. Guidehouse also observed the supplemental file was missing 38 measure ID entries that are in the year-end tracking data. Guidehouse concluded that the year-end tracking data[2] provides the most up-to-date and complete set of information to estimate the year-end program impact and hence did not change the measures with zero savings.

Recommendation 13. Provide project documentation or other supporting information when a measure is reported as having no savings. A short explanation can also be provided in the existing tracking data field “Measure Notes”.

[1] File name: *2021 Anura Water Savings Measures_PUP Style_Updated 2021_09_23*.

[2] File name: *IQ Evaluation Participation Report,* provided January 31, 2022.

Finding 16. The evaluation team found ex ante savings values used custom inputs for GPM_base, GPM_low, L_low, L_base, and Household. The verified savings calculations used these inputs as well.

> **Recommendation 14.** Provide project documentation to show inputs and calculations supporting custom GPM_base and GPM_low values.. Guidehouse determined the photos provided in response to our request for CY2021 were sufficient support.

5.1.6 Low-Flow Showerheads

Finding 17. The evaluation team was unable to determine the cause behind discrepancies between ex ante and verified savings values. The realization rates for individual showerhead measures range from 46% to 714%, with most measures at 140%. Table 5-5 provides the measure inputs Guidehouse used in the verified savings equations. Note that the TRM v9.0 does not provide a custom option for GPM_base so the evaluation team used the TRM deemed value of 2.24. The evaluation team believes this is a source of discrepancy.

> **Recommendation 15.** Ensure tracking data inputs and measure details match the ex ante savings value. These inputs should align with TRM v9.0 definitions and deemed values where appropriate.

Table 5-5. Low-Flow Showerheads Savings Inputs

%FossilDHW	GPM_base	GPM_low	L_base	L_low	Household	SPCD	SPH	ISR	EPG_gas
100%	2.24	Custom	7.8	7.8	Custom	0.6	1.3	0.95	0.00583

Source: Nicor Gas tracking data and TRM v9.0.

5.1.7 Pipe Insulation

Finding 18. The provided tracking data does not contain information for thermal regain factor (TRF). The evaluation team used the TRM v9.0 deemed value of 0.7 for hot water (HW) and steam pipe insulation measures, and a custom TRF value of 0.83 for domestic hot water (DHW) pipe insulation measures. The custom 0.83 value was provided in feedback from Nicor Gas during the Wave 1 evaluation. Table 5-6 below outlines savings input details that go into the Pipe Insulation verified savings equation.

Finding 19. Some DHW pipe insulation measures used an equivalent full load hours (EFLH) value of 8766 in their ex ante savings, however the tracking data provided a value of 4963. The evaluation team calculated verified savings under the assumption that all DHW pipe insulation measures use a year round recirculation EFLH value of 8766, and all HW and steam pipe insulation measures used a heating season recirculation climate zone 2 EFLH value of 4963.

> **Recommendation 16.** Ensure the tracking data contains all information used to calculate ex ante savings. The evaluation team recommends adding a TRF tracking data field moving forward. If a custom value is used, provide project documentation or additional notes supporting the values.

Table 5-6. Pipe Insulation Measure Details

Measure Name	Bare Pipe Heat Loss	Insulated Pipe Heat Loss	Equipment Efficiency	Tracking Data EFLH	Evaluated EFLH	TRF	Calculation Method
Pipe Insulation, DHW Large >2" - CPO	99.028	17.795	0.819	4963	8766	0.83	
Pipe Insulation, DHW Large >2" - CPO	99.028	17.795	0.819	4963	8766	0.83	
Pipe Insulation, DHW Large >2" - CPO	99.028	17.795	0.819	8766	8766	0.83	
Pipe Insulation, DHW Large >2" - CPO	99.028	17.795	0.819	8766	8766	0.83	
Pipe Insulation, DHW Medium 1.26-2" - CPO	59.515	12.225	0.819	4963	8766	0.83	
Pipe Insulation, DHW Medium 1.26-2" - CPO	59.515	12.225	0.819	4963	8766	0.83	
Pipe Insulation, DHW Medium 1.26-2" - CPO	59.515	12.225	0.819	8766	8766	0.83	
Pipe Insulation, DHW Medium 1.26-2" - CPO	59.515	12.225	0.819	8766	8766	0.83	
Pipe Insulation, DHW Small <=1.25" - CPO	35.888	8.778	0.819	4963	8766	0.83	
Pipe Insulation, DHW Small <=1.25" - CPO	35.888	8.778	0.819	4963	8766	0.83	
Pipe Insulation, DHW Small <=1.25" - CPO	35.888	8.778	0.819	8766	8766	0.83	
Pipe Insulation, DHW Small <=1.25" - CPO	35.888	8.778	0.819	8766	8766	0.83	
Pipe Insulation, HW Large >4" - CPO	254.071	40.94	0.819	4963	4963	0.70	Recirculation-heating season only
Pipe Insulation, HW Medium 2.1" to 4" - CPO	150.954	27.207	0.819	4963	4963	0.70	Recirculation-heating season only
Pipe Insulation, HW Small - CPO	79.421	16.741	0.819	4963	4963	0.70	Recirculation-heating season only
Pipe Insulation, Steam Large 5.1" to 8" - CPO	692.549	111.829	0.648	4963	4963	0.70	Recirculation-heating season only
Pipe Insulation, Steam Large Fitting - CPO	692.549	111.829	0.648	4963	4963	0.70	Recirculation-heating season only

Measure Name	Bare Pipe Heat Loss	Insulated Pipe Heat Loss	Equipment Efficiency	Tracking Data EFLH	Evaluated EFLH	TRF	Calculation Method
Pipe Insulation, Steam Med 2.1" to 5" - CPO	355.188	57.6	0.648	4963	4963	0.70	Recirculation-heating season only
Pipe Insulation, Steam Med Fitting - CPO	355.188	57.6	0.648	4963	4963	0.70	Recirculation-heating season only
Pipe Insulation, Steam Small 1" to 2" - CPO	93.426	19.431	0.648	4963	4963	0.70	Recirculation-heating season only
Pipe Insulation, Steam X-Large Fitting - CPO	986.304	150.411	0.648	4963	4963	0.70	Recirculation-heating season only

Source: Nicor Gas tracking data and TRM v9.0.

Appendix A. Impact Analysis Methodology

The evaluation team determined verified gross savings for each program measure by:

1. Reviewing the savings algorithm inputs in the tracking data for agreement with the TRM v9.0[3] or evaluation research for non-deemed measures.
2. Validating that the savings algorithm was applied correctly.
3. Multiplying the verified per-unit savings value by the quantity reported in the tracking data.

Engineering Review of Custom Project Files

The evaluation team conducted an engineering desk file review for all custom projects installed in 2021, to verify project savings that were not based on measures specified in the TRM. 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 ex ante impact estimates. We reviewed project documentation in application forms and supporting documentation from the applicant. Table A-1 shows a summary of the custom project engineering desk file reviews.

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

Project ID	Measure Description	Ex Ante Gross Savings (Therms)	Gross Realization Rate	Verified Gross Savings (Therms)
PID-2021.03.26-83652	Domestic Hot Water	1,721	36%	618
PID-2021.03.26-83652	Heating Plant Improvement	15,921	29%	4,646
PID-2021.03.26-83653	Domestic Hot Water	418	94%	393
PID-2021.03.26-83653	Heating Plant Improvement	4,471	99%	4,443
PID-2021.04.07-84025	Multifamily Central Domestic Hot Water Plants	1,408	100%	1,408
PID-2021.04.07-84026	Multifamily Central Domestic Hot Water Plants	1,408	100%	1,408
PID-2021.04.07-84027	Multifamily Central Domestic Hot Water Plants	1,408	100%	1,408
PID-2021.04.07-84029	Multifamily Central Domestic Hot Water Plants	1,408	100%	1,408
PID-2021.04.07-84031	Multifamily Central Domestic Hot Water Plants	1,408	100%	1,408
PID-2021.04.07-84032	Multifamily Central Domestic Hot Water Plants	1,408	100%	1,408
PID-2021.04.07-84035	Multifamily Central Domestic Hot Water Plants	1,408	100%	1,408
PID-2021.04.07-84036	Multifamily Central Domestic Hot Water Plants	1,408	100%	1,408
PID-2021.04.07-84039	Multifamily Central Domestic Hot Water Plants	1,408	100%	1,408

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

Project ID	Measure Description	Ex Ante Gross Savings (Therms)	Gross Realization Rate	Verified Gross Savings (Therms)
PID-2021.04.07-84040	Multifamily Central Domestic Hot Water Plants	1,408	100%	1,408
PID-2021.04.07-84041	Multifamily Central Domestic Hot Water Plants	1,408	100%	1,408
PID-2021.04.07-84042	Multifamily Central Domestic Hot Water Plants	1,408	100%	1,408
PID-2021.04.07-84045	Multifamily Central Domestic Hot Water Plants	1,408	100%	1,408
PID-2021.04.07-84046	Multifamily Central Domestic Hot Water Plants	1,408	100%	1,408
PID-2021.04.07-84049	Multifamily Central Domestic Hot Water Plants	1,408	100%	1,408
Total		43,651	72%	31,219

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

Appendix B. Program Specific Inputs for the Illinois TRC

Table B-1 shows 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 B-1. Verified Cost Effectiveness Inputs

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 - Sealing Tape	Unit	17,857	20.0	7,429	2,154	2,154
	Ceiling/Attic Insulation	Sq Ft	114,696	20.0	7,911	2,294	2,294
	Custom - Domestic Hot Water Boiler	Unit	2	15.0	2,139	1,011	1,011
	Custom - Heating Plant Improvement	Unit	2	23.4	20,392	9,089	9,089
Contractor Channel	Air Sealing	Unit	15	20.0	6,874	6,708	6,708
	Air Sealing - Sealing Tape	Ln Ft	477,386	20.0	198,593	198,593	198,593
	Ceiling/Attic Insulation	Sq Ft	614,290	20.0	128,549	127,798	127,798
	Custom Measure - Multifamily Central Domestic Hot Water Plants	Unit	15	15.0	21,119	21,119	21,119
	DWH Pipe Insulation	Ln Ft	222	15.0	195	195	195
	Low-Flow Faucet Aerator	Unit	2,187	10.0	7,913	9,809	9,809
	Low-Flow Showerhead	Unit	970	10.0	3,829	4,770	4,770
	Pipe Insulation	Varies	81,905	15.0	338,646	338,518	338,518
	Programmable Thermostats	Unit	96	16.0	3,888	3,888	3,888
	Residential Furnace Tune-Up	Unit	139	3.0	10,329	10,329	10,329
	Space Heating Boiler Tune-Up	Unit	74	3.0	22,787	22,787	22,787
	Wall Insulation	Sq Ft	25,058	20.0	500	500	500
Kits	Kit 2 (2 SH, 2 BA, 1 KA, 1 ST)	Each	699	10.0	20,264	20,266	20,266
	Kit 4 (12 gasket, 1 sweep, 30 LF caulk, 34 LF Wx)	Each	1,503	20.0	53,341	53,340	53,340
	Total or Weighted Average			**17.6**	**854,698**	**833,168**	**833,168**

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