



Multi-Family Income Qualified Program Impact Evaluation Report

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

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Nicor Gas

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1. Introduction

This report presents the results of the impact evaluation of the Nicor Gas 2020 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 2020 covers January 1, 2020 through December 31, 2020.

2. Program Description

The Nicor Gas Multi-Family Income Qualified Program offers free weatherization for income-qualified customers in the Nicor Gas service territory. The 2020 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; furnace and boiler tune-up. The program also provided free energy savings kits of water efficiency or air sealant measures. Kit 2 included low-flow showerheads (SH, 2 per kit), kitchen aerators (KA), shower timers (ST), and bathroom aerators (BA, 2 per kit). Kit 4 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 508 participants in 2020 and completed 1,140 projects as shown in Table 2-1.

Table 2-1. 2020 Volumetric Findings Detail

Participation	IHWAP	Contractor Channel	Kits	Total
Participants *	3	120	385	508
Installed Projects †	3	571	566	1,140

* Participants are defined as unique site addresses

† 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. 2020 Measure Quantities

Program Path	Measure	Quantity Unit	Installed or Distributed Quantity*
IHWAP	IQ Custom Projects	Projects	5
	Air Sealing	Varies	4,118
Contractor Channel	Attic Insulation	Sq. Ft.	773,906
	Low Flow Aerator	Each	2,367
	Low Flow Showerhead	Each	1,072
	Air Sealing	Varies	658,832
	Programmable Thermostats	Each	200
	Residential Furnace Tune-Up	Each	434
	Space Heating Boiler Tune-up	Each	20
	Pipe Insulation	Ln. Ft.	1,470
	Showerheads	Each	982
	Bathroom Faucet Aerators	Each	982
Kits	Kitchen Faucet Aerators	Each	491
	Shower Timers	Each	491
	Gaskets	Each	11,820
	Weatherstrip	Ln. Ft.	33,490
	Door Sweep	Each	985
	Caulking	Ln. Ft.	29,550

* 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 Retrofits Program achieved by path in 2020.

Table 3-1. 2020 Annual Energy Savings Summary

Program Path	Ex Ante Gross Savings (Therms)	Verified Gross RR*	Verified Gross Savings (Therms)	NTG†	Verified Net Savings (Therms)
IHWAP	15,604	101%	15,775	1.00	15,775
Contractor Channel	449,183	103%	461,057	1.00	461,057
Kits	49,192	100%	49,192	1.00	49,192
Total or Weighted Average	513,980	102%	526,024	1.00	526,024

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

4. Program Savings by Measure

The program includes 14 unique measures as shown in Table 4-1. The verified gross realization rate for the programs combined is 102 percent. The attic insulation and air sealing measures contributed the most savings.

Table 4-1. 2020 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	IQ Custom Project	13,286	101%	13,456	1.00	13,456
	Air Sealing	2,318	100%	2,318	1.00	2,318
Contractor Channel	Attic Insulation	124,606	110%	136,480	1.00	136,480
	Low Flow Aerator	10,839	100%	10,839	1.00	10,839
	Low Flow Showerhead	3,917	100%	3,917	1.00	3,917
	Air Sealing	274,074	100%	274,074	1.00	274,074
	Programmable Thermostats	8,100	100%	8,100	1.00	8,100
	Residential Furnace Tune-Up	16,265	100%	16,265	1.00	16,265
	Space Heating Boiler Tune-up	6,219	100%	6,219	1.00	6,219
	Pipe Insulation	5,162	100%	5,162	1.00	5,162
	Showerheads	9,003	100%	9,003	1.00	9,003
	Bathroom Faucet Aerators	1,033	100%	1,033	1.00	1,033
Kits	Kitchen Faucet Aerators	2,462	100%	2,462	1.00	2,462
	Shower Timers	1,738	100%	1,738	1.00	1,738
	Gaskets	3,867	100%	3,867	1.00	3,867
	Weatherstrip	14,172	100%	14,172	1.00	14,172
	Door Sweep	6,244	100%	6,244	1.00	6,244
	Caulking	10,674	100%	10,674	1.00	10,674
	Total or Weighted Average		513,980	102%	526,024	1.00

* 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: 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	IQ Custom Project	Project	Vary	Vary	101%	Project File Review, Monthly Billing Data, Site Verification‡
	Air Sealing	Varies	0.56	0.56	100%	Illinois TRM, v8.0†, Section 5.6.1 and PTD
	Attic Insulation	Sq. Ft.	0.16	0.18	110%	Illinois TRM, v8.0†, Section 5.6.5 and PTD
	Low Flow Aerator	Each	4.58	4.58	100%	Illinois TRM, v8.0†, Section 5.4.4 and PTD
	Low Flow Showerhead	Each	3.65	3.65	100%	Illinois TRM, v8.0†, Section 5.4.5 and PTD
Contractor Channel	Air Sealing	Varies	0.42	0.42	100%	Illinois TRM, v8.0†, Section 5.6.1 and PTD
	Programmable Thermostats	Each	40.50	40.50	100%	Illinois TRM, v8.0†, Section 5.3.11 and PTD
	Residential Furnace Tune-Up	Each	37.48	37.48	100%	Illinois TRM, v8.0†, Section 5.3.13 and PTD
	Space Heating Boiler Tune-up	Each	310.93	310.93	100%	Illinois TRM, v8.0†, Section 4.4.2 and PTD
	Pipe Insulation	Ln. Ft.	3.51	3.51	100%	Illinois TRM, v8.0†, Section 4.4.14 and PTD
Kits	Kit 2 (2 SH, 2 BA, 1 KA, 1 ST)	Each	28.99	28.99	100%	Illinois TRM, v8.0†, 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%	Illinois TRM, v8.0†, Section 5.6.1 and PTD

* Program Tracking Data (PTD) provided by Nicor Gas, extract dated January 28, 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 Nicor Gas. Where conducted, on-site or telephone interview data collected by Guidehouse.

5.1.1 Attic Insulation

The ex ante energy savings for this measure incorrectly assumes that the measures are installed in locations that did not receive an air sealing measure. Guidehouse reviewed the tracking data to determine that all the projects that received the attic insulation measure also received air sealing measures. The Illinois TRM v8.0 deems using an $IE_{NetCorrection}$ factor of 110% while calculating the savings in these cases.

Recommendation 1. Track the attic insulation measures that were installed in locations that also received air sealing measures and apply the $IE_{NetCorrection}$ factor while calculating the energy savings for these measures.

5.1.2 Custom Project (PID-2019.08.28-48710)

The ex ante energy savings for the Custom Kitchen Variable Speed Drive measure installed as a part of the project did not include the 62.5°F temperature bin while calculating the percentage heating hours. The verified realization rate was 116% for the measure.

Recommendation 2. Use the 62.5°F temperature bin while calculating the percentage of heating hours for this type of project.

5.1.3 Custom Project (PID-2020.02.24-64738)

The ex ante savings for the Custom Heating Hot Water (HHW) Boiler installed as a part of the project are calculated using an efficient boiler efficiency of 97.0%, adjusted to 91.5% using a typical condensing boiler efficiency curve. This calculation was incorrect as this value did not align with the value provided in the specification sheet of the boiler, which included a value of 95.0% instead.

Recommendation 3. Use the boiler efficiency that is consistent with the specification sheets.

The ex ante savings for the HHW Boiler turndown measure installed as a part of the project are calculated using an energy loss due to cycling for both the baseline and efficient cases, despite the boiler percent load exceeding the minimum turndown ratio for the boiler. This calculation was incorrect as there was not any energy loss due to cycling when the boiler percent load exceeds the minimum turndown ratio. The verified realization rate was 99% for the project.

Recommendation 4. Update the savings calculation to use a 0% energy loss due to cycling parameter when the boiler percent load exceeds the minimum turndown ratio.

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 v8.0¹ 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 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

Project ID	Measure Description	Ex Ante Gross Savings (Therms)	Gross Realization Rate	Verified Gross Savings (Therms)	Summary of Adjustment
PID-2019.08.28-48710	DHW Boiler Retrofit, and Pipe Insulation	1,351	100%	1,351	OK
PID-2019.08.28-48710	Kitchen Make-up Air Heater Retrofit	1,492	116%	1,724	Project did not include the 62.5°F temperature bin while calculating the percentage heating hours.
PID-2019.10.22-51508	Boiler: Laars, NTH 600	3,467	100%	3,455	Updated boiler efficiency used in the boiler efficiency curve to match the efficiency of the actual boiler installed. Updated energy algorithms.
PID-2020.02.24-64738	Hot Water Pipe Insulation	1,273	100%	1,275	Slight discrepancy in the savings due to updated boiler efficiency.
PID-2020.02.24-64738	Heating Hot Water System	5,703	99%	5,652	Updated boiler efficiency used in the boiler efficiency curve to match the efficiency of the actual boiler installed. Updated the energy loss algorithm to calculate zero energy loss due to cycling when boiler load is >= turndown ratio for both baseline and proposed cases
Total or Weighted Average		13,286	101%	13,456	

Source: Guidehouse evaluation team analysis.

¹ Available on the SAG web site: <http://www.ilsag.info/technical-reference-manual.html>

For each custom 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. 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	IQ Custom Project	Project	5	20.8	13,286	13,456	13,456
	Air Sealing	Varies	4,118	20.0	2,318	2,318	2,318
	Attic Insulation	Sq. Ft.	773,906	20.0	124,606	136,480	136,480
	Low Flow Aerator	Each	2,367	10.0	10,839	10,839	10,839
	Low Flow Showerhead	Each	1,072	10.0	3,917	3,917	3,917
Contractor Channel	Air Sealing	Varies	658,832	20.0	274,074	274,074	274,074
	Programmable Thermostats	Each	200	8.0	8,100	8,100	8,100
	Residential Furnace Tune-Up	Each	434	3.0	16,265	16,265	16,265
	Space Heating Boiler Tune-up	Each	20	3.0	6,219	6,219	6,219
	Pipe Insulation	Ln. Ft.	1,470	15.0	5,162	5,162	5,162
Kits	Kit 2 (2 SH, 2 BA, 1 KA, 1 ST)	Unit	491	9.0	14,236	14,236	14,236
	Kit 4 (12 gasket, 1 sweep, 30 LF caulk, 34 LF wx)	Unit	985	20.0	34,957	34,957	34,957
Total or Weighted Average				18.5	513,980	526,024	526,024

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