Guidehouse

Income Qualified Multi-Family Program Impact Evaluation Report

Energy Efficiency Plan: Program Year 2019 (1/1/2019-12/31/2019)

Presented to
Nicor Gas Company

Final

June 5, 2020

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1. Introduction

This report presents the results of the impact evaluation of the Nicor Gas 2019 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 broken out by relevant measure and program structure details. The appendix presents the impact analysis methodology. Program year 2019 covers January 1, 2019 through December 31, 2019.

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 2019 IHWAP and contractor channels included direct installation of water heating efficiency measures (faucet aerators, showerheads, gas water heaters); advanced programmable thermostats; attic, duct, and basement sidewall insulation; air leakage reduction; and furnaces. The program also provided free energy savings kits of water efficiency or air sealant measures (reported as "Kit 2" and "Kit 4" in the Nicor Gas program tracking data). 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 electrical switch/outlet gaskets, 1 door 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.

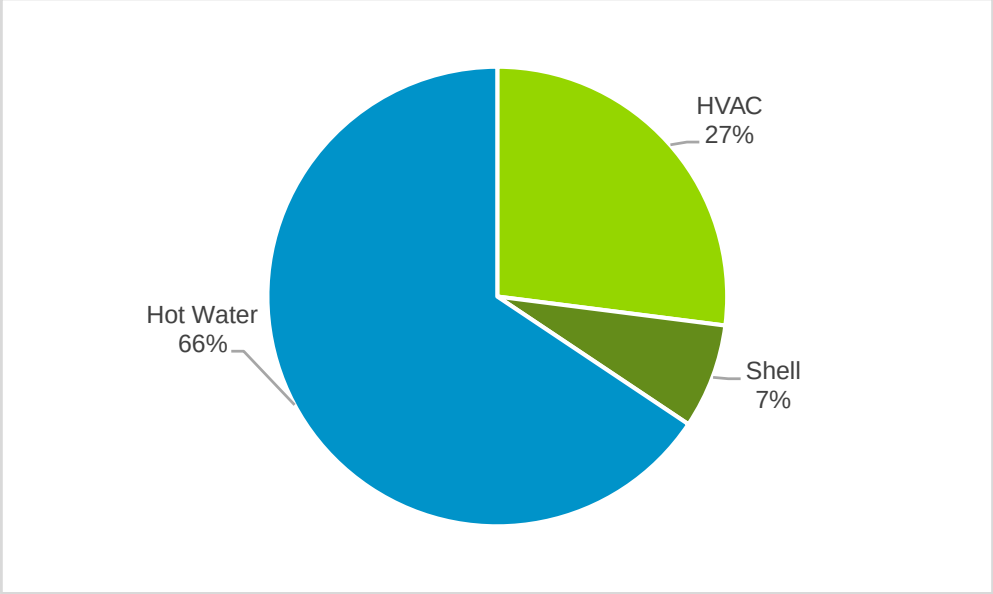
The program had 1,412 participants total in 2019 who completed 9,022 projects as shown in Table 2-1.

Table 2-1. 2019 Volumetric Findings Detail

Participation	IHWAP	Contractor Channel	Kits	Total
Participants *	21	575	816	1,412
Installed Projects †	165	7,883	974	9,022
Number of Measures	217	8,261	4,923	13,401
Advanced Thermostat	18	1		19
Air Sealing (Projects, Kit 4)	12	88	219	319
Attic Insulation (Projects)	12	21		33
Basement Sidewall Insulation (Projects)	12			12
Duct Insulation and Sealing	12			12
Residential Furnace Tune-up		1,708		1,708
Gas High Efficiency Furnace	5			5
Low Flow Showerhead	19	782	1,568	2,369
Hot Water Pipe Insulation (Linear Feet)	48	4		52
Low Flow Faucet Aerator – Bathroom	27	965	1,568	2,560
Low Flow Faucet Aerator – Kitchen	12	728	784	1,524
Gas Water Heater	11			11
Shower Timer			784	784
Custom – Roof Replacement	1			1
Custom – Air Sealing Projects‡	8			8

* Participants are defined as unique Vendor Project ID
† Installed Projects are defined as the total count of Vendor project IDs
‡ These are prescriptive air sealing projects tracked as custom projects
Source: Nicor Gas tracking data and Guidehouse team analysis.

Figure 2-1. Number of Projects Installed by End Use – Whole Program



Source: Nicor Gas tracking data and Guidehouse team analysis

3. Program Savings Detail

Table 3-1 summarizes the gas savings the Multi-Family Income Qualified Program achieved in 2019.

Table 3-1. 2019 Total Annual Incremental Therm Savings

Program Path	Ex Ante Gross Savings (Therms)	Verified Gross RR*	Verified Gross Savings (Therms)	NTG †	Verified Net Savings (Therms)
IHWAP	5,976	37%	2,210	1.00	2,210
Contractor Channel	187,430	100%	187,431	1.00	187,431
Kits	30,500	100%	30,504	1.00	30,504
Total	**223,906**	**98%**	**220,145**	**1.00**	**220,145**

* Realization Rate (RR) is the ratio of verified gross savings to ex ante gross savings, based on evaluation research findings.
† Net-to-Gross (NTG) is the ratio of verified net savings to verified gross savings. The NTG is a deemed value. Source: Nicor_Gas_NTG_History_and_2019_Recommendations_2018-10-01_Final Aerator Showerhead Correction 2019-04-12.xlsx, which is to be found on the Illinois SAG web site: http://ilsag.info/net-to-gross-framework.html.

4. Program Savings by Measure

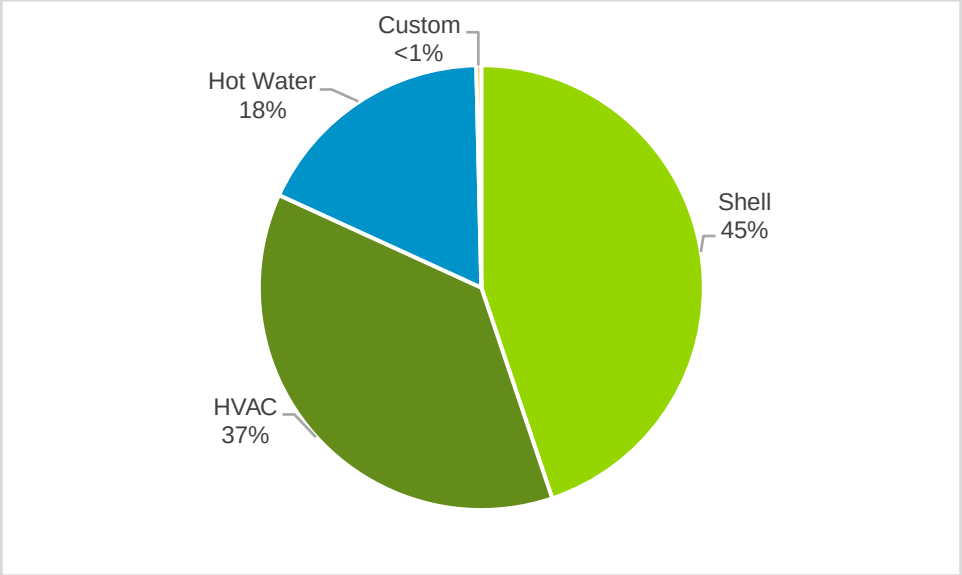
The Multi-Family Income Qualified Program includes the 15 unique measures shown in the following table. The verified gross realization rate for the programs combined is 98 percent. The shell and HVAC research categories contributed the most savings (see Figure 4 1).

Table 4-1. 2019 Annual Energy Savings by Measure

Program Path	End Use Type	Research Category	Ex Ante Gross Savings (Therms)	Verified Gross Realization Rate *	Verified Gross Savings (Therms)	NTG †	Verified Net Savings (Therms)
IHWAP	Shell	Custom - Air Sealing	514	100%	514	1.00	514
	HVAC	Advanced Thermostat	324	100%	324	NA	324
	Shell	Custom - Roof Replacement	829	34%	280	1.00	280
	HVAC	Gas High Efficiency Furnace	217	100%	217	1.00	217
	Hot Water	Gas Water Heater	191	100%	191	1.00	191
	Shell	Basement/Sidewall Insulation	136	118%	160	1.00	160
	HVAC	Duct Insulation and Sealing	327	100%	327	1.00	327
	Hot Water	Hot Water Pipe Insulation	42	100%	42	1.00	42
	Shell	Air Sealing	40	118%	47	1.00	47
	Shell	Attic Insulation	36	98%	36	1.00	36
	Hot Water	Low Flow Showerhead	31	100%	31	1.00	31
	Hot Water	Low Flow Faucet Aerator - Bathroom	3,272	1%	25	1.00	25
	Hot Water	Low Flow Faucet Aerator - Kitchen	15	100%	15	1.00	15
		Sub-Total	**5,976**	**37%**	**2,210**	**NA**	**2,210**
Contractor Channel	HVAC	Residential Furnace Tune-Up‡	80,516	100%	80,517	1.00	80,517
	Shell	Air Sealing	79,299	100%	79,299	1.00	79,299
	Shell	Attic Insulation	11,387	100%	11,387	1.00	11,387
	Hot Water	Low Flow Showerhead	8,844	100%	8,844	1.00	8,844
	Hot Water	Low Flow Aerator - Kitchen	5,727	100%	5,727	1.00	5,727
	Hot Water	Low Flow Aerator - Bathroom	1,596	100%	1,596	1.00	1,596
	HVAC	Advanced Thermostat	57	100%	57	NA	57
	Hot Water	Hot Water Pipe Insulation	3	111%	4	1.00	4
		Sub-Total	**187,430**	**100%**	**187,431**	**NA**	**187,431**
Kits	Hot Water	Kit 2 (2 SH, 2 BA, 1 KA, 1 ST)	22,728	100%	22,731	1.00	22,731
	Shell	Kit 4 (12 gasket, 1 sweep, 30 LF caulk, 34 LF wx)	7,772	100%	7,773	1.00	7,773
		Sub-Total	**30,500**	**100%**	**30,504**	**NA**	**30,504**
		Total	**223,906**	**98%**	**220,145**	**NA**	**220,145**

* Realization Rate (RR) is the ratio of verified gross savings to ex ante gross savings, based on evaluation research findings.
† Net-to-Gross (NTG) is the ratio of verified net savings to verified gross savings. The NTG is a deemed value. Source: Nicor_Gas_NTG_History_and_2019_Recommendations_2018-10-01_Final Aerator Showerhead Correction 2019-04-12.xlsx, which is to be found on the Illinois SAG web site: http://ilsag.info/net-to-gross-framework.html.
‡ Differences between ex ante savings and verified savings total values for marked measures are due to rounding errors.
Source: Nicor Gas tracking data and Guidehouse team analysis.

Figure 4-1. Verified Net Savings by End Use – Therm



Source: Nicor 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 percent. Appendix 1 provides a description of the impact analysis methodology.

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) *
Contractor Channel	Residential Furnace Tune-Up	Each	Varies	Varies	100%	Illinois TRM, v7.0† (TRM) Section 5.3.13
IHWAP/ Contractor Channel	Air Sealing, Custom – Air Sealing	Linear Feet	Varies	Varies	Varies, Adjusted upward	TRM Section 5.6.01
IHWAP/ Contractor Channel	Attic Insulation	Square Feet	Varies	Varies	Varies, Adjusted upward	TRM Section 5.6.05
IHWAP/ Contractor Channel	Low Flow Showerhead	Each	Varies	Varies	100%	TRM Section 5.4.05
IHWAP/ Contractor Channel	Low Flow Faucet Aerator	Each	Varies	Varies	Varies, Adjusted down	TRM Section 5.4.04
IHWAP/ Contractor Channel	Advanced Thermostat	Each	Varies	Varies	100%	TRM Section 5.3.16
IHWAP	Gas High Efficiency Furnace	Each	Varies	Varies	100%	TRM Section 5.3.07
IHWAP	Gas Water Heater	Each	Varies	Varies	100%	TRM Section 5.4.02
IHWAP	Duct Insulation	Each	Varies	Varies	100%	TRM Section 5.3.04
IHWAP	Custom – Roof Replacement	Each	829	280	34%	Program Tracking Data
IHWAP/ Contractor Channel	Hot Water Pipe Insulation	Linear Feet	Varies	Varies	Varies, Adjusted upward	TRM Section 5.4.01
Kits	Kit 2 (2 SH, 2 BA, 1 KA, 1 ST)	Kit	28.99	28.99	100%	TRM Section 5.4.4 / TRM Section 5.4.5
Kits	Kit 4 (12 gasket, 1 sweep, 30 LF caulk, 34 LF wx)	Kit	35.49	35.49	100%	TRM Section 5.6.01

* Program Tracking Data (PTD) provided by Nicor Gas, extract dated February 7, 2020.
† State of Illinois Technical Reference Manual version 7.0 from http://www.ilsag.info/technical-reference-manual.html.
‡ Eight prescriptive air sealing projects were tracked as custom projects.

5.1.1 IHWAP Program Findings and Recommendations

5.1.1.1 Low Flow Faucet Aerator - Bathroom

The total ex ante therm savings for the seven bathroom aerator measures shown in the table below are incorrect and inconsistent with the inputs assumptions provided in the tracking data. The savings values are very high outliers. Guidehouse requested further information from Nicor Gas who explained there was a data transfer error in the export from the implementer's database to the Nicor Gas participation file. Nicor Gas confirmed the quantities listed are correct and the savings values that Guidehouse is calculating are accurate and align with what they calculated in their database. Nicor Gas indicated other measures exported at the same time were not affected.

Table 5-2. Outlier Low Flow Bathroom Faucet Aerator Measures

Measure ID	Quantity	Ex Ante Gross Savings (Therms)	Verified Gross Savings (Therms)
MEA-2019.10.08-102032	1	42.73	1.56
MEA-2019.10.08-102034	1	42.73	1.56
MEA-2019.10.07-101969	1	88.94	1.56
MEA-2019.10.08-101973	1	731.26	1.64
MEA-2019.10.08-102036	1	2265.44	1.64
MEA-2019.10.30-109615	2	42.73	3.12
MEA-2019.10.30-109631	2	42.73	4.68

Source: Nicor Gas tracking data and Guidehouse team analysis

Recommendation 1. Guidehouse recommends data validation checks to ensure tracking data reflects reasonable estimates of per unit savings.

5.1.1.2 Custom – Roof Replacement

For the Custom – Roof Replacement (MEA-2019.04.03-70944) project, the annual normalized usage at the facility calculated using utility bill analysis aligns with the baseline annual usage calculated using the custom approach. The ex ante calculations assume the entire annual therms usage at the facility corresponds to space heating usage. However, a utility billing analysis indicates that a significant portion of the annual therms usage at the facility is independent of the outdoor air temperature (possibly used for domestic hot water consumption) and therefore not used for space heating. Guidehouse calculated savings for this measure for the estimated space heating portion of the annual therms usage as indicated by the utility bill analysis using a monthly scaling factor.

Table 5-3. Adjusted Baseline Therms Based on Billing Data Analysis

Month	Total Therms Ex Ante Baseline	Total Therms Normalized (Utility Bill Analysis)
January	6,688	3,448
February	5,106	3,119
March	4,198	2,777
April	1,677	2,345
May	270	1,976
June	0	1,713
July	0	1,641
August	0	1,665
September	0	1,786
October	1,057	2,223
November	3,405	2,672
December	6,050	3,371
Annual	**28,451**	**28,736**

Source: Nicor Gas tracking data and Guidehouse team analysis

Table 5-4. Comparison of Therms Usage by Application

Assumption	Total Therms	Space Heating Therms	Weather Independent Therms
Ex Ante Assumption	28,451	28,451	0
Ex Post Assumption (Utility Bill Analysis)	28,736	9,233	19,504

Source: Nicor Gas tracking data and Guidehouse team analysis

Recommendation 2. Guidehouse recommends calibrating the building simulation models to ensure that the models use the relevant usage history depending on whether the measure impacts weather independent equipment (domestic hot water) or space heating consumption.

5.1.1.3 Shell End Use Furnace Efficiency Deration

The ex ante therm savings for some of the air sealing, attic insulation, and basement sidewall insulation measures were calculated without derating the equipment efficiency values by 15% to account for the furnace heating system efficiency as deemed by the IL TRM v7.0. The evaluation team calculated verified savings for these measures by derating the equipment efficiencies.

Recommendation 3. Guidehouse recommends derating the equipment efficiency using a derating factor as deemed by the IL TRM v7.0 to determine the heating system efficiency.

5.1.2 Contractor Channel Findings and Recommendations

5.1.2.1 Hot Water Pipe Insulation

The tracking data for the hot water pipe insulation measure (MEA-2019.11.07-113267) was blank for the "Rnew" insulation resistance input value (column "PostInstallValue"). Guidehouse averaged the Rnew values of the other provided hot water pipe insulation measures and applied it to this measure. The applied value is 5 and the realization rate for the measure is 111 percent.

Recommendation 4. Guidehouse recommends ensuring the tracking data includes the Rnew value for all installed hot water pipe insulation measures.

5.1.3 Kits Program Findings and Recommendations

5.1.3.1 Kit 4 Climate Zone

The ex ante savings for Kit 4 are currently calculated using deemed savings values from Section 5.6.1 of the IL TRM v7.0 for an average climate zone (CZ) calculated as a weighted average of CZ 1 Rockford (30%), CZ 2 Chicago (60%) and CZ 3 Springfield (10%). The verified savings are calculated using the same weighted average values. The tracking data includes climate zone information for a majority of the customers but others are blank. Guidehouse found that ex ante savings based on the weighted average of climate zones matched the savings from reported climate zones within less than one percent.

5.1.3.2 Kit Distribution Quantity

During 2019, Nicor Gas distributed a total of 1,003 kits to multi-family participants. A total of 784 kits were "Kit 2" type kits and 219 kits were "Kit 4" type. Based on the evaluation teams review of 2019 data, 13 percent of participants that received the "Kit 4" type kit were provided two kits each. The TRM does not limit the number of kits, or the individual measures, which can be distributed to customers. However, distributing more than one kit may have an impact on the rate at which customers install all of the kit measures (the In-Service Rate, or ISR).

Recommendation 5. The evaluation team recommends that installation rate research be conducted with Kit 4 participants to validate that the ISRs for weatherization measures in the TRM are appropriate for customers who receive two kits. The evaluation team acknowledges that ISR research is planned for 2020/2021 program implementation and evaluation period.

6. Appendix 1. Impact Analysis Methodology

Guidehouse followed algorithms outlined in the IL TRM v7.0 to calculate verified gross savings for the Income Qualified programs. The evaluation team verified that these algorithms and appropriate deemed input parameters were correctly applied and validated custom parameters that were used. Guidehouse calculated verified net savings by multiplying verified gross savings by a NTG of 1.00 which is deemed in the IL TRM v7.0.

7. Appendix 2. Program-Specific Inputs for the Illinois TRC

Table 7-1, the Total Resource Cost (TRC) variable table, only includes cost-effectiveness analysis inputs available at the time of finalizing the 2019 Multi-Family Income Qualified Program impact evaluation report. Additional required cost data (e.g., measure costs, program level incentive and non-incentive costs) are not included in the tables and will be provided to the evaluation team later. Detail in the TRC tables (e.g., EULs), other than final 2019 savings and program data, are subject to change and are not final.

Table 7-1. Total Resource Cost Savings Summary

Program Path	End Use Type	Research Category	Units	Quantity	EUL (years)*	Ex Ante Gross Savings (Therms)	Verified Gross Gas Savings (Therms)	Verified Net Gas Savings (Therms)
IHWAP	Shell	Custom - Air Sealing	Project	8	20.0	514	514	514
	HVAC	Advanced Thermostat	Each	18	11.0	324	324	324
	Shell	Custom - Roof Replacement	Project	1	20.0	829	280	280
	HVAC	Gas High Efficiency Furnace	Each	5	20.0	217	217	217
	Hot Water	Gas Water Heater	Each	11	13.0	191	191	191
	Shell	Basement/Sidewall Insulation	Sq. Feet	4,272	20.0	136	160	160
	HVAC	Duct Insulation and Sealing	Project	12	20.0	327	327	327
	Hot Water	Hot Water Pipe Insulation	Linear Feet	48	15.0	42	42	42
Contractor Channel	Shell	Air Sealing	Project	12	20.0	40	47	47
	Shell	Attic Insulation	Sq. Feet	10,919	20.0	36	36	36
	Hot Water	Low Flow Showerhead	Each	19	10.0	31	31	31
	Hot Water	Low Flow Faucet Aerator - Bathroom	Each	27	10.0	3,272	25	25
	Hot Water	Low Flow Faucet Aerator - Kitchen	Each	12	10.0	15	15	15
	HVAC	Residential Furnace Tune-up	Each	1,708	2.0	80,516	80,517	80,517
	Shell	Air Sealing	Linear Feet	190,623	20.0	79,299	79,299	79,299
	Shell	Attic Insulation	Sq. Feet	72,243	20.0	11,387	11,387	11,387
	Hot Water	Low Flow Showerhead	Each	782	10.0	8,844	8,844	8,844
	Hot Water	Low Flow Faucet Aerator - Kitchen	Each	728	10.0	5,727	5,727	5,727
	Hot Water	Low Flow Faucet Aerator - Bathroom	Each	965	10.0	1,596	1,596	1,596
Kits	HVAC	Advanced Thermostat	Each	1	13.0	57	57	57
	Hot Water	Hot Water Pipe Insulation	Linear Feet	4	15.0	3	4	4
	Hot Water	Kit 2 (2 SH, 2 BA, 1 KA, 1 ST)	Each	784	10.0	22,728	22,731	22,731
	Shell	Kit 4 (12 gasket, 1 sweep, 30 LF caulk, 34 LF wx)	Each	219	20.0	7,772	7,773	7,773
		Total		**283,421**	**11.6**	**223,906**	**220,145**	**220,145**

* The total of the EUL column is the weighted average measure life (WAML), and is calculated as the sum product of EUL and measure savings divided by total program savings.
Source: Guidehouse analysis of tracking data.