Residential New Construction Program Impact Evaluation Report

Energy Efficiency Plan: Program 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 Residential New Construction (RNC) 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 2021 covers January 1, 2021 through December 31, 2021.

2. Program Description

The objective of the Residential New Construction (RNC) program is to obtain energy savings by increasing the energy efficiency of new construction single-family detached homes and townhomes. The program provides participating new home builders a financial incentive to either a) exceed state and local building code requirements regarding duct and air sealing, along with the installation of specific high-efficiency equipment, or b) install prescriptive high-efficiency equipment only.

The RNC program had 2,003 participants in 2021 as shown in Table 2-1.

Table 2-1. 2021 Volumetric Findings Detail

Participation	Unit	Quantity
Participants	Unique VendorProjectIDs	2,003
Advanced Thermostat	Installed	1,868
Gas High Efficiency Furnace*	Installed	2,025
Duct Insulation and Sealing	Projects	1,277
Gas Water Heater	Installed	
Storage Water Heater		1,407
On-Demand Water Heater		396
Air Sealing	Projects	1,277

* The quantity of Gas High Efficiency Furnaces may be greater than the number of participants because larger homes may install two furnaces for more efficient air distribution.
Source: Nicor Gas tracking data and Guidehouse evaluation team analysis.

3. Program Savings Detail

Table 3-1 summarizes the energy savings the RNC Program achieved 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)
Residential New Construction	618,134	104%	645,334	0.82	529,461
Total or Weighted Average	**618,134**	**104%**	**645,334**	**0.82**	**529,461**

* 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: Guidehouse evaluation team analysis.

4. Program Savings by Measure

The program includes five measures as shown in Table 4-1. The Gas High Efficiency Furnace and Advanced Thermostat measures contributed the most savings.

Table 4-1. 2021 Annual Energy Savings by Measure

End-use	Research Category	Ex Ante Gross Savings (Therms)	Verified Gross RR	Verified Gross Savings (Therms)	NTG	Verified Net Savings (Therms)
HVAC	Duct Insulation and Sealing	76,530	100%	76,529	0.80	61,223
HVAC	Gas High Efficiency Furnace	287,230	100%	287,363	0.80	229,890
HVAC	Advanced Thermostat	104,608	126%	131,935	0.90	118,742
Hot Water	Gas Water Heater	67,016	100%	66,756	0.80	53,405
Shell	Air Sealing	82,751	100%	82,751	0.80	66,201
Total or Weighted Average		**618,134**	**104%**	**645,334**	**0.82**	**529,461**

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 from Guidehouse's 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 other than 100%. Appendix A provides a description of the impact analysis methodology. Appendix B shows 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 Average (therms/unit)	Verified Gross Average (therms/unit)	Realization Rate	Data Source(s)*
Duct Insulation and Sealing	Project	59.93	59.93	100%	Illinois TRM v9.0 (TRM)† – Section 5.3.4; Illinois Energy Code‡
Gas High Efficiency Furnace (average)	Each	141.86	141.89	100%	TRM v9.0 – Section 5.3.7
Advanced Thermostat – Programmable Baseline	Each	56.0	71.4	127%	TRM v9.0 – Section 5.3.16 Errata
Gas Water Heater	Each	Varies	Varies	100%	TRM v9.0 – Section 5.4.2 and Section 4.3.1.
Air Sealing	Project	64.80	64.80	100%	TRM v9.0 – Section 5.6.1; Illinois Energy Code

* Program Tracking Data (PTD) provided by Nicor Gas, extract dated January 28, 2022.
† State of Illinois Technical Reference Manual version 9.0 from http://www.ilsag.info/technical-reference-manual.html.
‡ Illinois Energy Conservation Code, July 1, 2018.
https://www2.illinois.gov/cdb/business/codes/IllinoisAccessibilityCode/Documents/2018%20Illinois%20Specific%20Amendments%20with%20Modifications%20Shown.pdf

5.1.1 Gas High Efficiency Furnace

The evaluation team found 8 gas high efficiency furnace installations with realization rates other than 100%. Five of these measures (Project IDs 173889, 175426, 176206, 181472, 183359) have realization rates below 100% and three (Project IDs 171210, 176833, 183879) have realization rates above 100%. The evaluation team was unable to identify a cause for the discrepancies in the realization rates for the measures. However, we identified a pattern in that all measure with discrepancies have a quantity of 2. The values used in the calculation are shown in Table 5-2.

Table 5-2. Gas High Efficiency Furnace Savings Discrepancies

VendorProjectID	EFLH	Input Capacity*	AFUE_eff	AFUE_base	Verified Realization Rate
171210	976	60000	0.921	0.80	146%
173889	976	110000	0.95	0.80	82%
175426	976	80000	0.972	0.80	87%
176206	976	120000	0.95	0.80	77%
176833	976	80000	0.962	0.80	112%
181472	976	60000	0.96	0.80	88%
183359	976	84000	0.96	0.80	92%
183879	976	85000	0.95	0.80	109%

* Larger homes may install two furnaces for more efficient air distribution.
Source: Nicor Gas tracking data and Guidehouse evaluation team analysis.

Recommendation 1. Consistently confirm the input values used in ex ante savings calculations are accurate and provided as input values in the tracking data.

5.1.2 Advanced Thermostats

The advanced thermostat measure shows a realization rate of 127% due to an update for 2021 provided in the TRM v9.0 Errata. The heating reduction value has changed to 7.1%, increasing savings for each thermostat.

Recommendation 2. Base ex ante calculations on the current year TRM and check for TRM Errata prior to year-end.

There were 19 project sites that had installed two advanced thermostats, and Nicor Gas claimed therm savings for two thermostats at 18 of the sites. TRM v9.0 deems savings for advanced thermostats on a per home basis, regardless of the number of thermostats installed per home. Guidehouse based verified savings on a per home (Project ID) basis.

Recommendation 3. Ensure that savings for only one thermostat is claimed per home, consistent with the TRM savings methodology.

5.1.3 Gas Storage Water Heaters

For gas storage water heaters less than 75 gallons, 38 installations had a realization rate other than 100% when Guidehouse calculated savings based on tracking data inputs. Twelve of these installations reported a tank size of zero in the tracking data and Guidehouse revised these to a 40 gallon or 50 gallon tank using the tracked model number. Guidehouse could not identify a cause for the remaining discrepancies. These discrepancies resulted in slightly less than a 100% verified gross realization rate for the water heater measure overalls.

Recommendation 4. Include tank size (in gallons) in the tracking data for all projects.

One water heater project reported a tank size of 497 gallons in the tracking data. This size is unlikely in a residential setting and was assumed to be a typo. The ex ante savings and model number were consistent with a 50 gallon storage tank.

Recommendation 5. Check that all tracked savings inputs are consistent with claimed savings.

The evaluation team found 40 projects that had installed 75 gallon storage water heaters. The Btu per hour (Btu/hr) input rating for these water heaters is more than 75,000 Btu/hr (typically 76,000 Btu/hr) and these are covered under the non-residential TRM measure 4.3.1 as a high-input residential-duty commercial equipment type. Therefore, to calculate verified therms for 75-gallon tanks, the evaluation team used the algorithm for TRM measure 4.3.1.

To determine the appropriate UEFeff, UEFbaseline, and draw pattern for these residential-duty commercial water heaters, Guidehouse conducted secondary research based on the tracking data manufacturer and model names. Using the 75 gallon tank size and the first hour rating for the models shown in Table 5-3, the UEFbaseline value was calculated to be 0.5922.

Table 5-3. 75 Gallon Water Heater Research

Manufacturer	Model	First Hour Rating (gallons)	Source
AO Smith	GPVX-75L 310	116	https://www.hotwater.com/support/gpvx-75l/
Bradford White	RG2PV75H6N	121	https://www.bradfordwhite.com/uniform-energy-factor-water-heaters/
State	GS6-75-YRVHTL 310	116	https://www.statewaterheaters.com/support/gs6-75-yrvhtl/

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

Recommendation 6. Include draw pattern or first hour rating in the tracking data

Appendix A. Impact Analysis Methodology

Guidehouse followed algorithms outlined in the Illinois Technical Reference Manual (TRM) v9.0 to calculate verified gross savings for residential programs. The evaluation team verified that these algorithms and appropriate deemed input parameters were correctly applied and validated custom parameters that were used. Baseline assumptions were derived from Illinois energy code[1] or the TRM.

Guidehouse calculated verified net savings by multiplying verified gross savings by a net-to-gross (NTG) of 0.90 for advanced thermostats and 0.80 for all other measures, as deemed by the Illinois Stakeholder Advisory Group (SAG) for 2021.

[1] Illinois Energy Conservation Code, July 1, 2018. https://www2.illinois.gov/cdb/business/codes/IllinoisAccessibilityCode/Documents/2018%20Illinois%20Specific%20Amendments%20with%20Modifications%20Shown.pdf

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

End Use	Research Category	Units	Quantity	Effective Useful Life	Ex Ante Gross Savings (Therms)	Verified Gross Savings (Therms)	Verified Net Savings (Therms)
HVAC	Duct Insulation and Sealing	Each	1,277	20.0	76,530	76,529	61,223
HVAC	Gas High Efficiency Furnace	Each	2,025	20.0	287,230	287,363	229,890
HVAC	Advanced Thermostat – Programmable Baseline	Each	1,868	11.0	104,608	131,935	118,742
Hot Water	Gas Water Heater	Each	1,800	13.0	67,016	66,756	53,405
Shell	Air Sealing	ΔCFM	1,277	20.0	82,751	82,751	66,201
Total or Weighted Average				**17.4**	**618,134**	**645,334**	**529,461**

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