Residential New Construction Program Impact Evaluation Report

Energy Efficiency Plan: Program Year 2022 (1/1/2022-12/31/2022)

Prepared for:

Nicor Gas

FINAL

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1. Introduction

This report presents the results of the impact evaluation of the Nicor Gas 2022 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 and Illinois total resource cost (TRC) inputs. Program year 2022 covers January 1, 2022 through December 31, 2022.

2. Program Description

The objective of the 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 1,986 participants with 7,758 measures in 2022 as shown in Table 2-1.

Table 2-1. 2022 Volumetric Findings Detail

Participation	Residential New Construction	Total
Participants *	1,986	1,986
Installed Measures †	7,758	7,758

* Participants are defined as the total number of unique vendor project IDs.
† Installed Measures is the total quantity of measures installed.
Source: Nicor 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. 2022 Installed Measure Quantities

Participation	Measure	Quantity Unit	Installed Quantity
Residential New Construction	Advanced Thermostat	Each	1,889
	Air Sealing	Project	994
	Duct Insulation and Sealing	Project	994
	Gas High Efficiency Furnace >92% AFUE	Each	130
	Gas High Efficiency Furnace >95% AFUE*	Each	1,872
	On Demand Water Heater	Each	724
	Storage Water Heater	Each	1,155

** The total quantity of Gas High Efficiency Furnaces measures 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 2022.

Table 3-1. 2022 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	666,699	93%	620,481	0.80/0.90 ‡	509,873
Total	**666,699**	**93%**	**620,481**		**509,873**

* Realization Rate (RR) is the ratio of verified gross savings to ex ante gross savings, based on evaluation research findings.
† Net-to-Gross. A deemed value. Available on the SAG website: **https://www.ilsag.info/evaluator-ntg-recommendations-for-2022/**.
‡ NTG value is 0.90 for Advanced Thermostat measure, and 0.80 for all other measures.
Source: Guidehouse evaluation team analysis.

4. Program Savings by Measure

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

Table 4-1. 2022 Annual Energy Savings by Measure

End-Use	Savings Category	Ex Ante Gross Savings (Therms)	Verified Gross RR*	Verified Gross Savings (Therms)	NTG†	Verified Net Savings (Therms)
HVAC	Gas High Efficiency Furnace >95% AFUE	257,910	100%	258,222	0.80	206,577
HVAC	Advanced Thermostat	134,875	100%	134,875	0.90	121,387
Shell	Air Sealing	116,025	60%	69,561	0.80	55,649
HVAC	Duct Insulation and Sealing	57,917	100%	57,917	0.80	46,334
Hot Water	On Demand Water Heater	51,800	100%	51,692	0.80	41,353
Hot Water	Storage Water Heater	34,514	100%	34,556	0.80	27,645
HVAC	Gas High Efficiency Furnace >92% AFUE	13,659	100%	13,659	0.80	10,927
	Total	**666,699**	**93%**	**620,481**		**509,873**

* Realization Rate (RR) is the ratio of verified gross savings to ex ante gross savings, based on evaluation research findings.
† Net-to-Gross. A deemed value. Available on the SAG web site: https://www.ilsag.info/evaluator-ntg-recommendations-for-2022/.
Source: Nicor Gas tracking data and Guidehouse evaluation team analysis.
Note: Subtotals may not sum due to rounding.

5. Impact Analysis Findings and Recommendations

5.1 Impact Parameter Estimates

Table 5-1 shows the unit therms 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 are 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 (therms/unit)	Verified Gross (therms/unit)	Realization Rate	Data Source(s)
Advanced Thermostat	Unit	71.4	71.4	100%	Illinois TRM v10.0 (TRM)† – Section 5.3.16
Air Sealing	Project	116.7	70.0	60%	TRM v10.0 – Section 5.6.1; Illinois Energy Conservation Code‡
Duct Insulation and Sealing	Project	58.3	58.3	100%	TRM v10.0 – Section 5.3.4; Illinois Energy Conservation Code
Gas High Efficiency Furnace >92% AFUE	Unit	105.1	105.1	100%	TRM v10.0 – Section 5.3.7
Gas High Efficiency Furnace >95% AFUE	Unit	137.8	137.9	100%	TRM v10.0 – Section 5.3.7
On Demand Water Heater	Unit	71.5	71.4	100%	TRM v10.0 – Sections 5.4.2 and 4.3.1
Storage Water Heater	Unit	29.9	29.9	100%	TRM v10.0 – Sections 5.4.2 and 4.3.1

* Program Tracking Data (PTD) provided by Nicor Gas, extract dated February 02, 2023.
† Illinois Statewide Technical Reference Manual version 10.0 from http://www.ilsag.info/technical-reference-manual.html.
‡ Illinois Energy Conservation Code, July 1, 2018. **https://www.ilga.gov/commission/jcar/admincode/071/07100600ZZ9996AR.html**

5.2 Findings and Recommendations

5.2.1 Air Sealing

Finding 1. The evaluation team found ex ante calculation of this measure was based on 5 air changes per hour (ACH). The Illinois Energy Conservation Code[1] requires the building be tested and verified with an air leakage rate not exceeding 4 ACH. Verified savings were calculated based on 4 ACH, resulting in a realization rate of 60%.

The submitted program participation report did not include the actual conditioned volume data of the buildings. That data was necessary to quantify the savings of this measure and was requested and received during evaluation.

[1] Illinois Energy Conservation Code, July 1, 2018.

Recommendation 1a. Utilize a baseline of 4 ACH instead of 5 ACH for the Air Sealing measures, to be consistent with the Illinois Energy Conservation Code.

Recommendation 1b. Include the actual conditioned building volume data in the program participation report.

5.2.2 Duct Insulation and Sealing

Finding 2. The submitted program participation report did not include the actual conditioned building area data. That data was necessary to quantify the measure savings and was requested and received during evaluation.

Recommendation 2. Include the actual conditioned building area data for the Duct Insulation and Sealing measures in the program participation report.

5.2.3 Gas High Efficiency Furnace

Finding 3. Five gas high efficiency furnace installations had a realization rate other than 100%. Two of these measures have realization rates below 100%, and three 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 with all measures with discrepancies have a quantity of two. The values used in the verified savings calculations were based on Illinois Statewide Technical Reference Manual (IL-TRM) version 10.0 and Nicor Gas RNC program tracking data, as 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
192715	976	98,000	96.0%	80.0%	108%
193236	976	120,000	96.5%	80.0%	200%
193955	976	120,000	96.0%	80.0%	120%
202694	976	58,000	96.1%	80.0%	98%
205464	976	70,000	95.0%	80.0%	83%

Source: Nicor Gas tracking data and Guidehouse evaluation team analysis; Illinois Statewide Technical Reference Manual version 10.0.

Recommendation 3. Perform quality control and confirm the input values used in ex ante savings calculations are accurate and consistent with the claimed savings and provide all the input values in the tracking data.

5.2.4 Gas Storage Water Heaters

Finding 4. For gas storage water heaters less than 55 gallons and 75,000 Btu/hr, three installations had a realization rate other than 100% when Guidehouse calculated savings based on tracking data inputs. Guidehouse could not identify a cause for these discrepancies.

The evaluation team identified 35 projects that had installed 75-gallon storage water heaters. During evaluation, the Btu per hour (Btu/hr) input rating for 75-gallon water heaters were assumed to be greater than 75,000 Btu/hr. Therefore, these water heaters are covered under the non-residential TRM measure 4.3.1 as a high-input residential-duty commercial equipment type. Based on secondary research conducted in the 2021 Nicor Gas RNC program evaluation for an above 75-gallon water heater draw pattern and first hour rating, the UEFbaseline value for the 75-gallon water heaters was calculated to be 0.5922.[2]

Evaluation calculated gross realization rates for most 75-gallon water heater installations to be 104%. One of the 75-gallon storage water heater project resulted in a 113% realization rate. Four of the 75-gallon storage water heater projects resulted in negative savings, and evaluation set the savings to zero with 0% realization rate due to no improvement in the uniform energy factor rating (UEF) of the equipment compared to the baseline values.

The values used in the calculation are shown in Table 5-3.

Table 5-3. Gas Storage Water Heater Savings Discrepancies

VendorProjectID	Size (Gallon)	UEF_eff	UEF_baseline	Verified Realization Rate
206004	50	0.690	0.563	142%
206024	50	0.720	0.563	168%
206241	50	0.690	0.563	129%
192715	75	0.700	0.592	113%
191915	75	0.590	0.592	0%
192198	75	0.590	0.592	0%
192253	75	0.590	0.592	0%
196247	75	0.590	0.592	0%
Other 75-Gallon Projects	75	Varies	0.592	104%

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

Recommendation 4a. Confirm the input values used in ex ante savings calculations are accurate and provided as input values in the tracking data.

Recommendation 4b Include the heat input capacity for units above 75-gallon in the program participation report.

Recommendation 4c. Include the water heater draw pattern (or first hour rating) in the program participation report.

5.2.5 Gas On Demand Water Heaters

Finding 5. Project 198513 post installation efficiency was listed as 93 in the participation report, which was inconsistent with other projects' efficiencies in the range of 0-1. The evaluation team updated Project 198513 post installation efficiency to 0.93, which resulted in a 40% realization

[2] Nicor Gas RNC 2021 Impact Evaluation Report 2022-05-10 Final.pdf

rate for this project. All other gas on demand water heater projects had a gross realization rate of 100%.

Recommendation 5. Utilize a consistent unit for the water heater efficiency values.

Appendix A. Impact Analysis Methodology

Guidehouse followed algorithms outlined in the Illinois Technical Reference Manual (TRM) v10.0 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 the Illinois Energy Conservation code[3] 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 2022.

[3] 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. Currently, 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	Savings Category	Units	Quantity	Effective Useful Life	Ex Ante Gross Savings (Therms)	Verified Gross Savings (Therms)	Verified Net Savings (Therms)
HVAC	Advanced Thermostat	Each	1,889	11	134,875	134,875	121,387
Shell	Air Sealing	Project	994	20	116,025	69,561	55,649
HVAC	Duct Insulation and Sealing	Project	994	20	57,917	57,917	46,334
HVAC	Gas High Efficiency Furnace >92% AFUE	Each	130	20	13,659	13,659	10,927
HVAC	Gas High Efficiency Furnace >95% AFUE	Each	1,872	20	257,910	258,222	206,577
Hot Water	On Demand Water Heater	Each	724	13	51,800	51,692	41,353
Hot Water	Storage Water Heater	Each	1,155	13	34,514	34,556	27,645
Total			**7,758**	**17.1**	**666,699**	**620,481**	**509,873**

Note: Totals may not sum due to rounding.
Source: Nicor Gas tracking data and Guidehouse evaluation team analysis.