



Affordable Housing New Construction Impact Evaluation Report

Energy Efficiency Plan: Program Year 2023
(1/1/2023-12/31/2023)

Prepared for:

Nicor Gas Company

FINAL

April 9, 2024

Prepared by:

Neil Curtis
Guidehouse

Ryan Kroll
Driftless Energy



Submitted to:

Nicor Gas Company
1844 Ferry Road
Naperville, IL 60563

Submitted by:

Guidehouse
150 N. Riverside Plaza, Suite 2100
Chicago, IL 60606

Contact:

Ted Weaver
Partner
404.602.3463
ted.walker@guidehouse.com

Stu Slote
Director
802.526.5113
stu.slote@guidehouse.com

Laura Agapay-Read
Associate Director
312.583.4178
laura.agapay.read@guidehouse.com

Charles Ampong
Associate Director
608.446.3172
charles.ampong@guidehouse.com

Disclaimer: This report was prepared by Guidehouse for Nicor Gas based upon information provided by Nicor Gas and from other sources. Use of this report by any other party for whatever purpose should not, and does not, absolve such party from using due diligence in verifying the report's contents. Neither Guidehouse nor any of its subsidiaries or affiliates assumes any liability or duty of care to such parties, and hereby disclaims any such liability.

Table of Contents

1. Introduction	1
2. Program Description.....	1
3. Program Savings Detail	2
4. Program Savings by Measure	2
5. Impact Analysis Findings and Recommendations.....	3
5.1 Impact Parameter Estimates	3
5.2 Findings and Recommendations	4
Appendix A. Impact Analysis Methodology.....	A-1
Appendix B. Program Specific Inputs for the Illinois TRC	B-1

List of Tables, Figures, and Equations

Table 2-1. 2023 AHNC Program Volumetric Findings Detail	1
Table 2-2. 2023 AHNC Program Installed Measure Quantities.....	2
Table 3-1. 2023 Annual Energy Savings Summary	2
Table 4-1. 2023 AHNC Program Annual Energy Savings by Measure	3
Table 5-1. AHNC Program Verified Gross Savings Parameters	4
Table A-1. AHNC Program Equipment by Savings Category	A-1
Table A-2. AHNC Program Equipment by Savings Category	A-2
Table B-1. AHNC Program Verified Cost Effectiveness Inputs	B-1

1. Introduction

This report presents the results of the impact evaluation of the Nicor Gas 2023 Affordable Housing New Construction (AHNC) Program. It summarizes the total gas savings impacts and is broken out by relevant measures. The appendices provide the impact analysis methodology and details of the total resource cost (TRC) analysis inputs. Program year 2023 covers January 1, 2023 through December 31, 2023.

2. Program Description

The AHNC Program provides technical assistance and incentives for energy efficient construction and major renovation of affordable multifamily housing. The program targets developers and owners constructing housing for households with incomes at or below 80% of the area median income. The program also aims to educate developers on cost-effective energy efficient building practices. The program has two participation levels: (1) major renovation and (2) new multifamily. The AHNC Program is offered jointly to affordable housing developers and owners served by ComEd and Nicor Gas, where their service territories overlap. Slipstream implemented the program.

In 2023, the AHNC Program had six total projects with 320 total units and 269 income eligible residential units, as Table 2-1 shows. Nicor Gas served three of these projects, including 142 total and income-eligible units.

Table 2-1. 2023 AHNC Program Volumetric Findings Detail

Participation	Quantity Total (ComEd & Nicor Gas)	Quantity (Nicor Gas)	Units
Participants *	6	3	Projects
Number of Affordable Units†	269	142	Residential Units
Number of Total Units‡	320	142	Residential Units
Building Area	372,026	145,321	Square Feet

* Participants are defined as completed projects.

† Affordable units are defined as income-eligible apartment units.

‡ Total units are defined as total of income-eligible and market rate apartment units.

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

Natural gas savings for these projects were due to improvements to HVAC, shell, appliances, and hot water end-use types. Table 2-2 summarizes the installed measure quantities that are the basis for verified energy savings.

Table 2-2. 2023 AHNC Program Installed Measure Quantities

End Use Type	Measure Category	Quantity Unit	Installed Quantity
Appliances	Efficient Appliances†	Units	22
Hot Water	High-Performance Water Heating Equipment	Units	12
Hot Water	Hot Water Conservation	Units	142
HVAC	Advanced HVAC Controls	Units	7
HVAC	High-Performance HVAC Equipment	Units	12
Shell	High-Performance Windows	SF	13,948
Shell	Reduced Infiltration	CFM50	55,952
Shell	Reduced Thermal Bridging	SF*	34,903

* Shell square footage includes a combination of wall area and roof/attic area.

† Efficient appliances include dishwasher, clothes washer, and clothes dryer installations.

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

3. Program Savings Detail

Table 3-1 summarizes the energy savings the Nicor Gas AHNC Program achieved in 2023. The program completed three projects in 2023, with project realization rates (RR) ranging from 97.8% to 102.8%. The overall 2023 program RR for the Nicor Gas AHNC Program was 100.4%.

Table 3-1. 2023 Annual Energy Savings Summary

Project ID	Ex Ante Gross Savings (Therms)	Verified Gross RR*	Verified Gross Savings (Therms)	NTG†	Verified Net Savings (Therms)
AH0128	4,089	103%	4,205	1.00	4,205
AH0177	9,394	100%	9,403	1.00	9,403
AH0209	2,948	98%	2,882	1.00	2,882
Total or Weighted Average	16,432	100%	16,491	1.00	16,491

Note: Totals may not sum due to rounding.

* 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-2023/>

Source: Guidehouse evaluation team analysis.

4. Program Savings by Measure

The 2023 projects completed in the Nicor Gas AHNC Program include measures in eight research categories with natural gas savings, as Table 4-1 shows. High-Performance Water Heating Equipment contributed the most savings, at 44% of the program natural gas savings.

Table 4-1. 2023 AHNC Program Annual Energy Savings by Measure

Savings Category	Ex Ante Gross Savings (Therms)	Verified Gross RR*	Verified Gross Savings (Therms)	NTG†	Verified Net Savings (Therms)
High-Performance Water Heating Equipment	7,300	100%	7,300	1.00	7,300
Hot Water Conservation	3,823	100%	3,823	1.00	3,823
High-Performance HVAC Equipment	1,723	100%	1,723	1.00	1,723
Reduced Infiltration	1,639	96%	1,573	1.00	1,573
Advanced HVAC Controls	612	100%	612	1.00	612
High-Performance Windows	608	123%	748	1.00	748
Reduced Thermal Bridging	601	97%	586	1.00	586
Efficient Appliances	127	100%	127	1.00	127
Total or Weighted Average	16,432	100%	16,491	1.00	16,491

Note: Totals may not sum due to rounding.

* 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-2023/>.

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 the evaluation team'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 above or below 100%. Appendix 1 provides a description of the impact analysis methodology.

Table 5-1. AHNC Program Verified Gross Savings Parameters

Measure	Savings Input Parameter	Data Source(s)*
Advanced HVAC Controls (Smart Thermostats)	%Elec heat, CF_pjm, Fe, Heating_reduction, Household factor, Eff_ISR_heat, FLH, Cooling_reduction, Eff_IST_cool, Cooling_DemandReduction	IL-TRM v11.0 – Section 5.3.16† Project Documentation‡
Air Sealing - Infiltration	N_heat, N_cool, HDD, CDD, FLH_cooling, LM, ADJ_AirSealingCooling, ADJ_AirSealingHeatFan, IE_NetCorrection	IL-TRM v11.0 – Section 5.6.1† Project Documentation‡
Bathroom Aerators	GPM_base, GPM_Low, L_base, L_low, faucets per household (FPH), drain factor (DF), EPG_electric, CF, NTG, %DHW, Household, ISR, Hours, gallons per hour (GPH), throttling factor, Supply temperature	IL-TRM v11.0 – Section 5.4.4† Project Documentation‡
Kitchen Aerators	GPM_base, GPM_Low, L_base, L_low, faucets per household (FPH), drain factor (DF), EPG_electric, CF, NTG, %DHW, Household, ISR, Hours, gallons per hour (GPH), throttling factor, supply temperature	IL-TRM v11.0 – Section 5.4.4† Project Documentation‡
Clothes Dryers	Load, Ncycles, CF, CEF_base, %Electric	IL-TRM v11.0 – Section 5.1.10† Project Documentation‡
Clothes Washer	Ncycles, IMEF_base, %CW, %DHW, %dryer, Hours, IWF_base, CF	IL-TRM v11.0 – Section 5.1.2† Project Documentation‡
Dishwasher	Maximum kWh/year, Maximum gallons/cycle, %kWh_op, %kWh_heat, Hours, CF,	IL-TRM v11.0 – Section 5.1.4† Project Documentation‡
High-Performance Water Heating Equipment	Baseline UEF, gallons per day, Household, T_in, T_out, Location factor, LM, waste heat portion resulting in cooling savings, waste heat increasing heating load, CF, Hours	IL-TRM v11.0 – Section 5.4.3† Project Documentation‡
Low Flow Showerhead	GPM_base, GPM_Low, L_base, L_low, showerheads per household (SPH), showers per capita per day (SPCD), EPG_electric, CF, NTG, %DHW, Household, ISR, Hours	IL-TRM† v11.0 – Section 5.4.5 Project Documentation‡

* Program Tracking Data (PTD) provided by Nicor Gas, extract dated January 30, 2024.

† State of Illinois Technical Reference Manual version based on application date and includes versions 7-11.0 from <http://www.ilsag.info/technical-reference-manual.html>.

‡ Project files provided by Nicor Gas. Where conducted, on-site or telephone interview data collected by Guidehouse.

5.2 Findings and Recommendations

The evaluation team developed several recommendations for Nicor Gas and the implementation team based on findings from the 2022 evaluation.



Finding 1. The evaluation team adjusted two of the three projects due to inconsistencies in equipment quantities and specifications in the calculations compared with the information in the project documentation. The evaluation team's adjustments included:

- The window area for project AH0177 was slightly increased based on the supplied building plans. Adjusting the area resulted in a 6% increase in the window savings for this project, with a negligible change (<0.1%) in the overall program natural gas energy savings.
- The high-performance window savings for project AH0128 did not include the area of the glass sliding doors in the tenant spaces. Adding this area increased the window savings for this project by 31% and the overall program savings by 0.8%.
- Project AH0128 included two roof constructions with slightly different R-values. The original analysis included only one of the two types. Adjusting the R-value decreased the Reduced Thermal Bridging savings for this project by 3%, with a negligible change (<0.1%) in the overall program natural gas energy savings.

Recommendation 1. Conduct additional quality assurance and quality control steps to ensure calculations accurately reflect installed equipment quantities and specifications.

Finding 2. The savings for one project (AH0209) were adjusted due to the level of reduced infiltration being calculated based on the blower door test results and the assumption of an unguarded blower door test type. An unguarded blower door test¹ would be completed at a multifamily building, which would include leakage to other spaces in the building (in addition to leakage to the outdoors). However, this project included seven single-family homes. Updating the analysis to reflect a whole-building test reduced the Reduced Infiltration savings for this project by 43%, which decreased the overall program savings by 0.4%.

Recommendation 2. Ensure analyses accurately reflect the blower door test type completed.

¹ An unguarded blower door test refers to an infiltration test of a single unit in a multifamily building where the surrounding units are not pressurized. In this case, the measured infiltration includes air leakage from the outdoors as well as from surrounding spaces.

Appendix A. Impact Analysis Methodology

For each selected project, the evaluation team performed an in-depth review to assess the engineering methods, parameters and assumptions that the program used to generate all ex ante impact estimates. For each measure in the sampled project, evaluation 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.

Table A-1 describes the natural gas savings measures included in each research category.

Table A-1. AHNC Program Equipment by Savings Category

Savings Category	Units	Quantity
Advanced HVAC Controls	Advanced Thermostats	AH0209
Efficient Appliances	ENERGY STAR Clothes Washer	AH0177, AH0209
	ENERGY STAR Clothes Dryer	
	ENERGY STAR Dishwasher	
High-Performance HVAC Equipment	High Efficiency Furnaces	AJ0209
	High Efficiency Boilers	
High-Performance Water Heating Equipment	In-Unit Gas Storage Water Heater	All
	In-Unit Gas Tankless Water Heater	
	Central Gas Water Heater	
High-Performance Windows	High Performance Windows	All
Hot Water Conservation	Low-flow Showerhead	All
	Bathroom Faucet Aerator	
	Kitchen Faucet Aerator	
Reduced Infiltration	Air-Sealing	All
Reduced Thermal Bridging	Wall Insulation	AH0128
	Roof/Attic Insulation	

Source: Guidehouse evaluation team analysis.

The evaluation team calculated the natural gas savings for each measure based on the specifications for the individual equipment installed and the calculation approach specified in the Illinois TRM for the installed measure.

The evaluation team applied algorithms outlined in the IL-TRM in use when the project applications were submitted to calculate AHNC program verified gross savings. One project was based on IL-TRM v8.0, one project was based on IL-TRM v9.0, and one was based on IL-TRM v10.0.

The team verified that these algorithms and appropriate deemed input parameters were applied correctly by the program and validated any custom parameters through project documentation and actual equipment specifications. The evaluation team calculated verified net savings by multiplying the verified gross savings by the net-to-gross (NTG) ratio approved through a consensus process managed through the Illinois State Advisory Group (SAG). Table A-2 presents the parameters used in the verified gross and net savings calculations and indicates which were calculated through evaluation activities and which were deemed.

Table A-2. AHNC Program Equipment by Savings Category

Gross Savings Impact Parameters	Value	Units	Deemed or Evaluated	Data source(s)
Quantity	Varies	Units	Evaluated	Project Documentation
NTG	1.00	%	Deemed	IL SAG†
Hours of Use	Varies	Hours/Year	Deemed	II TRM--Sections Vary*
Gross Savings per Unit, Deemed Measures	Varies	Therms	Deemed	II TRM--Sections Vary*
Effective Useful Life (EUL)	Varies	Years	Deemed	II TRM--Sections Vary*

* IL-TRM is the Illinois Technical Reference Manual from <http://www.ilsag.info/technical-reference-manual.html>.

Project application date determined the applicable IL-TRM version used.

† A deemed value. Available on the SAG web site: <https://www.ilsag.info/evaluator-ntg-recommendations-for-2023/>Source: 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. AHNC Program Verified Cost Effectiveness Inputs

Savings Category	Units	Quantity	Effective Useful Life	Ex Ante Gross Savings (Therms)	Verified Gross Savings (Therms)	Verified Net Savings (Therms)
High-Performance Water Heating Equipment	Units	12	15.0	7,300	7,300	7,300
Hot Water Conservation	Units	142	10.0	3,823	3,823	3,823
High-Performance HVAC Equipment	Units	12	20.0	1,723	1,723	1,723
Reduced Infiltration	CFM50	55,952	20.0	1,639	1,573	1,573
Advanced HVAC Controls	Units	7	11.0	612	612	612
High-Performance Windows	SF	13,948	20.0	608	748	748
Reduced Thermal Bridging	SF	34,903	20.0	601	586	586
Efficient Appliances	Units	165	14.5	127	127	127
Total or Weighted Average			15.1	16,432	16,491	16,491

Note: Totals may not sum due to rounding.

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