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| Affordable Housing New Construction Impact Evaluation Report  Energy Efficiency Plan: Program Year 2023  (1/1/2023-12/31/2023) | | | | | | | |
| Prepared for:  Nicor Gas Company  DRAFT  March 5, 2024 | | | | | | | |
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# 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.

# 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.

# 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/ntg\_2023.

Source: Guidehouse evaluation team analysis.

# 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/ntg\_2023.

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

# Impact Analysis Findings and Recommendations

## 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 – 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 – Section 5.6.1† Project Documentation‡ |
| Bathroom Aerators | GPM\_base, 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 – Section 5.4.4† Project Documentation‡ |
| Kitchen Aerators | GPM\_base, 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 – Section 5.4.4† Project Documentation‡ |
| Clothes Dryers | Load, Ncycles, CF, CEF\_base, %Electric | IL-TRM – Section 5.1.10† Project Documentation‡ |
| Clothes Washer | Ncycles, IMEF\_base, %CW, %DHW, %dryer, Hours, IWF\_base, CF | IL-TRM – Section 5.1.2† Project Documentation‡ |
| Dishwasher | Maximum kWh/year, Maximum gallons/cycle, %kWh\_op, %kWh\_heat, Hours, CF, | IL-TRM – 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 – Section 5.4.3†  Project Documentation‡ |
| Low Flow Showerhead | GPM\_base, L\_base, L\_low, showerheads per household (SPH), showers per capita per day (SPCD), EPG\_electric, CF, NTG, %DHW, Household, ISR, Hours | IL-TRM† – 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.

## 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 test 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.

##### 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  ENERGY STAR Clothes Dryer  ENERGY STAR Dishwasher | AH0177, AH0209 |
| High-Performance HVAC Equipment | High Efficiency Furnaces  High Efficiency Boilers | AJ0209 |
| High-Performance Water Heating Equipment | In-Unit Gas Storage Water Heater  In-Unit Gas Tankless Water Heater  Central Gas Water Heater | All |
| High-Performance Windows | High Performance Windows | All |
| Hot Water Conservation | Low-flow Showerhead  Bathroom Faucet Aerator  Kitchen Faucet Aerator | All |
| Reduced Infiltration | Air-Sealing | All |
| Reduced Thermal Bridging | Wall Insulation  Roof/Attic Insulationl | AH0128 |

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 were 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 | 100 | % | Deemed | Illinois Energy Efficiency Policy Manual† |
| Hours of Use | Varies | Hours/Year | Deemed | Il TRM--Sections Vary\* |
| Gross Savings per Unit, Deemed Measures | Varies | Therms | Deemed | Il TRM--Sections Vary\* |
| Effective Useful Life (EUL) | Varies | Years | Deemed | Il 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/ntg_2023>,

Source: Guidehouse evaluation team analysis.

##### Program Specific Inputs for the Illinois TRC

Table C‑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 C‑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.*