



Affordable Housing New Construction Program Impact Evaluation Report

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

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Nicor Gas Company

FINAL

May 22, 2023

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1. Introduction

This report presents the results of the impact evaluation of the Nicor Gas 2022 Affordable Housing New Construction (AHNC) Program. It summarizes the total gas savings impacts and broken out by relevant measures. The appendices provide the impact analysis methodology and details of the total resource cost (TRC) analysis inputs. Program year 2022 covers January 1, 2022 through December 31, 2022.

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 2022, the AHNC Program had 14 total projects with 634 total units and 598 income eligible residential units, as Table 2-1 shows. Nicor Gas served seven of these projects, including 273 total units and 269 income-eligible units.

Table 2-1. 2022 Volumetric Findings Detail

| Participation | Quantity (Total ComEd / Nicor Gas) | Quantity (Nicor Gas) | Units |
|-----------------------------|------------------------------------|----------------------|-------------------|
| Participants* | 14 | 7 | Projects |
| Number of Affordable Units† | 598 | 269 | Residential Units |
| Number of Total Units‡ | 634 | 273 | Residential Units |
| Building Area | 633,986 | 289,217 | 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 gas energy savings.

Table 2-2. 2022 Installed Measure Quantities

| End Use Type | Research Category | Quantity Unit | Nicor Installed Quantity |
|--------------|--|---------------|--------------------------|
| Appliances | Efficient Appliances | Units | 17 |
| Hot Water | High-Performance Water Heating Equipment | Units | 18 |
| Hot Water | Hot Water Conservation | Units | 273 |
| HVAC | Advanced HVAC Controls | Units | 257 |
| HVAC | Efficient Ventilation | Units | 5 |
| HVAC | High-Performance HVAC Equipment | Units | 306 |
| Shell | High-Performance Windows | SF | 25082 |
| Shell | Reduced Infiltration | CFM50 | 61506 |
| Shell | Reduced Thermal Bridging | SF | 226667 |

Heating, ventilation, air condition (HVAC). The 306 units include common area equipment in affordable multifamily units.

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

High-performance appliances include dishwasher, clothes washer, and clothes dryer measures.

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 2022. The program completed seven projects in 2022, with project realization rates (RR) ranging from 64% to 111%. The overall 2022 program RR for Nicor Gas AHNC Program was 91%.

Table 3-1. 2022 Nicor Gas Annual Energy Savings Summary

| Project ID | Ex Ante Gross Savings (Therms) | Verified Gross RR* | Verified Gross Savings (Therms) | NTG† | Verified Net Savings (Therms) |
|----------------------------------|--------------------------------|--------------------|---------------------------------|-------------|-------------------------------|
| AH0109‡ | 16,043 | 100% | 16,087 | 1.00 | 16,087 |
| AH0074 | 13,768 | 99% | 13,635 | 1.00 | 13,635 |
| AH0099 | 11,366 | 64% | 7,324 | 1.00 | 7,324 |
| AH0079 | 6,243 | 88% | 5,508 | 1.00 | 5,508 |
| AH0114 | 2,777 | 99% | 2,758 | 1.00 | 2,758 |
| AH0122 | 2,146 | 99% | 2,134 | 1.00 | 2,134 |
| AH0066c | 768 | 111% | 856 | 1.00 | 856 |
| Total or Weighted Average | 53,110 | 91% | 48,301 | 1.00 | 48,301 |

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 website: <https://www.ilsag.info/evaluator-ntg-recommendations-for-2022>.

‡ Ex Ante Gross Savings value from Nicor Gas tracking data was 15,333 therms which included HVAC interactive effects. The implementer calculated savings for completed measures is 16,043 therms without interactive effect. The tracking total ex ante 52,401 therms was updated to remove the interactive effect to a total of 53,110 therms to match Table 4-1.

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

4. Program Savings by Measure

The 2022 projects completed in the Nicor Gas AHNC Program include measures in nine research categories with natural gas savings as Table 4-1 shows. High-Performance HVAC Equipment contributed the most savings, at 39% of the program natural gas savings.

Table 4-1. 2022 Nicor Gas 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 HVAC Equipment | 20,754 | 97% | 20,147 | 1.00 | 20,147 |
| Hot Water Conservation | 8,229 | 100% | 8,229 | 1.00 | 8,229 |
| High-Performance Water Heating Equipment | 7,317 | 100% | 7,317 | 1.00 | 7,317 |
| Reduced Thermal Bridging | 5,579 | 104% | 5,782 | 1.00 | 5,782 |
| Reduced Infiltration | 2,604 | 100% | 2,594 | 1.00 | 2,594 |
| Advanced HVAC Controls | 2,298 | 101% | 2,330 | 1.00 | 2,330 |
| Efficient Ventilation | 5,662 | 21% | 1,198 | 1.00 | 1,198 |
| High-Performance Windows | 534 | 104% | 553 | 1.00 | 553 |
| Efficient Appliances | 134 | 113% | 152 | 1.00 | 152 |
| Total or Weighted Average | 53,110 | 91% | 48,301 | 1.00 | 48,301 |

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 website: <https://www.ilsaq.info/evaluator-ntg-recommendations-for-2022>.

‡ Ex ante gross savings value is from implementer project files. Nicor Gas tracking system total savings value was 52,401 therms.

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 input parameters verified in the evaluation team’s review for each measure type. Following the table, Section **Error! Reference source not found.** provides findings and recommendations, including discussion of all measures with RR above or below 100%.

5.2 Appendix A provides a description of the impact analysis methodology.

Table 5-1. Verified Gross Savings Parameters

| Research Category | Savings Input Parameters | Source* |
|--|--|--|
| 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 |
| Clothes Dryer | 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, | L-TRM – Section 5.1.4 Project Documentation |
| Energy Recovery Ventilation | HDD, ΔEnthalpy, daily_hrs ventilation, daily_hrs_fan_use | IL-TRM – Section 5.3.20 Project Documentation |
| High-Performance Water Heating Equipment | Baseline UEF, gallons per day, Household, T_in, T_out, Location factor, LM, gaste heat portion resulting in cooling savings, gaste heat increasing heating load, CF, Hours | IL-TRM – Section 5.4.3 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 |
| 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 |

Illinois Technical Reference Manual (IL-TRM, v6.0, v7.0, v8.0)

Source: 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 reduced the Efficient Ventilation savings for one project (AH0099). For this project, the ex ante included savings due to the installation of an energy recovery ventilator (ERV). However, from the Illinois Energy Conservation Code (IECC-2015 (Section C403.2.7), an ERV with a minimum effectiveness of 50% was required. The evaluation

team updated the baseline to be consistent with the code requirements. This update resulted in a 79% reduction in the Efficient Ventilation natural gas savings for the project.

Recommendation 1. Update the analysis methodology for Efficient Ventilation type projects to include only the incremental energy reduction beyond code-required energy recovery installations.

Finding 2. One project (AH0079) included dual-fuel heat pumps. The heat pumps operate to meet the heating load for most of the heating season, with the gas furnace operating at extremely low temperatures. The program implementer did not calculate any electric heating savings (traditional or electrification) for this project and instead calculated natural gas savings for the high-efficiency natural gas furnaces installed for backup heating.

The evaluation team updated the savings to include electric heating savings for the heat pumps and the gas furnaces. Specifically, electric savings (traditional and electrification) were calculated for 41% of the heating full load operating hours with the remaining full load hours remaining with the gas furnaces. This change reduced the High-Performance HVAC Equipment and Advanced HVAC controls natural gas savings for this project by 41%.

Recommendation 2. Update the analysis methodology for furnaces installed as part of dual fuel heat pump systems to reflect the reduced heating equivalent full load hours (EFLH) values for the furnace, due to the operation of the heat pump at higher temperatures and the gas equipment only at low temperatures.

Finding 3. The evaluation team adjusted several projects due to inconsistency in equipment quantities and specifications in the calculations compared with the information in the project documentation. The evaluation team's adjustments included:

- Changed window areas or types (fixed versus operable), wall or roof areas, or U-values for four projects (AH0074, AH0079, AH0099, AH0114, and AH0122). However, these changes were generally minor and resulted in a slight increase in the savings for the shell measures (High-Performance Windows, Reduced Infiltration, and Reduced Thermal Bridging) of 1.9% and a negligible change in the overall program natural gas energy savings.
- Project (AH0074) was adjusted due to inconsistencies in appliance specifications. Specifically, 10 clothes dryers were claimed as electric dryers. However, from the project documentation, the installed clothes dryers were natural gas dryers. Updating the dryer type increased the appliance savings by 27%. However, as Efficient Appliances account for less than 0.3% of the overall program savings, the impact on the overall program savings was negligible.
- Two projects were adjusted due to inconsistencies in HVAC equipment specifications. The ex ante efficient boiler savings for AH0066c were calculated based on the boiler output capacity, rather than input capacity as specified in the Illinois TRM. Similarly, the heating capacity of the make-up air unit in the calculation for project AH0099 were inconsistent with the manufacturer's specifications. Both adjustments were minor and resulted in less than a 3% change to the savings.

Recommendation 3. Conduct additional quality assurance / quality control steps to ensure calculations accurately reflect installed equipment quantities and specifications.

Finding 4. The evaluation team adjusted savings for one project due to a tracking error. The savings for project AH0109 in the Nicor Gas tracking system were 15,333 therms. However, the calculated savings for this project, per the implementer project files, were 16,043 therms. The 15,333 therms included both the calculated gas savings for the project and the gas penalties due to the installation of high-efficiency electric equipment. The program ex ante savings reported in the tracking data of 52,401 therms was corrected to 53,100 therms to reflect the implementer data.

Recommendation 4. Conduct additional quality assurance / quality control steps to ensure claimed savings are consistent with calculated savings values and avoid using savings with or without HVAC interactive effects interchangeably.

Appendix A. Impact Analysis Methodology

The program provided project savings calculations and documentation for the evaluation team’s review. Project documentation included program forms and applications; architectural, landscape, mechanical, and plumbing drawings; and appliance, lighting, HVAC, and window specifications. The program also provided photos and reports from site visits and testing results.

The evaluation team analyzed all documentation and verified that savings and measure counts reported in the project calculators aligned with the provided project documentation and program tracking data, except for project AH0109, which ex ante in the tracking data were found to include HVAC interactive effects. We corrected this in Table 3-1. **Error! Reference source not found.** describes the natural gas savings measures included in each research category.

Table A-1. Equipment by Savings Category

| Research Category | Savings Measures Included | Project ID |
|--|--|---|
| Advanced HVAC Controls | Advanced Thermostats | AH0066c, AH0079, AH0109, AH0114 |
| Efficient Appliances | ENERGY STAR Clothes Washer ENERGY STAR Clothes Dryer ENERGY STAR Dishwasher | AH0074, AH0109 |
| Efficient Ventilation | Energy Recovery Ventilators | AH0079, AH0099 |
| High-Performance HVAC Equipment | High Efficiency Furnaces High Efficiency Boilers | All |
| High-Performance Water Heating Equipment | In-Unit Gas Storage Water Heater In-Unit Gas Tankless Water Heaters Central Gas Water Heater | AH0066c, AH0074, AH0079, AH0099, AH0109, AH0114 |
| 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 Insulation | All |

*Project AH0114 did not include ex ante savings for reduced infiltration. However, the evaluation identified an error in the project calculations. Correcting this error resulted in natural gas savings for reduced infiltration for this project.
 Source: Guidehouse evaluation team analysis.

The natural gas savings for each measure are calculated by the template 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. Two of the

projects were based on IL-TRM v6.0, two projects were based on IL-TRM v7.0, and three were based on IL-TRM v8.0.

The team verified that these algorithms and appropriate deemed input parameters were applied correctly 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. Savings Parameters

| 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 | II TRM – Sections vary |
| Gross Savings per Unit, Deemed Measures | Varies | Therms | Deemed | II TRM – Sections vary |
| Gross Savings per Unit, Deemed Measures | Varies | Therms | Deemed | Project Documentation |
| Effective Useful Life (EUL) | Varies | Years | Mixture | 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.

†The NTG values are deemed per the Illinois Energy Efficiency Policy Manual. Source: Illinois SAG website: <https://www.ilsag.info/evaluator-ntg-recommendations-for-2022>.

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. Verified 2022 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 HVAC Equipment | Units | 306 | 19.4 | 20,754 | 20,147 | 20,147 |
| Hot Water Conservation | Units | 273 | 9.9 | 8,229 | 8,229 | 8,229 |
| High-Performance Water Heating Equipment | Units | 18 | 15.1 | 7,317 | 7,317 | 7,317 |
| Reduced Thermal Bridging | SF | 226,667 | 21.3 | 5,579 | 5,782 | 5,782 |
| Reduced Infiltration | CFM50 | 61,506 | 19.5 | 2,604 | 2,594 | 2,594 |
| Advanced HVAC Controls | Units | 257 | 10.9 | 2,298 | 2,330 | 2,330 |
| Efficient Ventilation | Units | 5 | 15.0 | 5,662 | 1,198 | 1,198 |
| High-Performance Windows | SF | 25,082 | 20.2 | 534 | 553 | 553 |
| Efficient Appliances | Unit | 17 | 13.2 | 134 | 152 | 152 |
| Total or Weighted Average | | | 16.8 | 53,110 | 48,301 | 48,301 |

Note: Totals may not sum due to rounding.

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