



Business New Construction Program Impact Evaluation Report

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

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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	2
5.1 Impact Parameter Estimates	2
5.2 Findings and Recommendations	3
Appendix A. Impact Analysis Methodology	A-1
A.1 Engineering Methodology	A-1
A.2 Sampling Approach.....	A-1
Appendix B. Impact Analysis Supplemental Information	B-1
B.1 Engineering Desk Review Results	B-1
Appendix C. Program-Specific Inputs for the Illinois TRC	C-1

List of Tables, Figures, and Equations

Table 2-1. 2022 Volumetric Findings Detail.....	1
Table 3-1. 2022 Annual Energy Savings Summary	2
Table 5-1. Verified Gross Savings Parameters.....	3
Table A-1. Profile of Gross Impact Sample for Projects (MMBtu)	A-2
Table A-2. Profile of Gross Impact Sample for Projects and Realization Rate	A-3
Table B-1. Researched Gross Savings for Sampled Projects.....	B-2
Table C-1. Verified Cost-Effectiveness Inputs	C-1

1. Introduction

This report presents the results of the impact evaluation of the Nicor Gas 2022 Business New Construction (BNC) program. The appendices present the impact analysis methodology, detailed engineering desk review results, and Illinois total resource cost (TRC) inputs. Program year 2022 covers January 1, 2022, through December 31, 2022.

2. Program Description

The BNC program is offered jointly to commercial and industrial (C&I) and public sector (PS) customers served by ComEd, Nicor Gas, Peoples Gas, and North Shore Gas. The program aims to capture immediate and long-term energy efficiency opportunities that are available during the design and construction of non-residential and multifamily buildings. The program covers new buildings, additions, and major renovations.

Slipstream (formerly Seventhwave) implements the program by reaching out to design professionals, commercial real estate developers, and customers at the beginning of the design process. The implementation team provides technical assistance in building design to reduce energy use beyond what is required by existing building codes and standards. The Nicor Gas BNC program coordinates with ComEd where their service areas overlap. Nicor Gas purchases therm savings from the program using a dollar per therm payment model on a project-by-project basis.

Overall, the program had 65 participants in 2022 and completed 65 projects. Of them, 56 projects were jointly coordinated between ComEd and a gas utility, 40 of which were served jointly by ComEd and Nicor Gas, as Table 2-1 shows.

Table 2-1. 2022 Volumetric Findings Detail

Participation	ComEd (Overall with Gas Utilities)	Nicor Gas
Participants *	56	40
Installed Projects †	56	40
Measure Types Installed	Whole Building	Whole Building

* Participants are defined as completed commercial and industrial (C&I) and public sector (PS) new construction projects.

† Installed Projects are defined as completed C&I and PS new construction projects.

Source: Nicor Gas tracking data and Guidehouse evaluation team analysis

3. Program Savings Detail

Table 3-1 summarizes the energy savings the Nicor Gas BNC 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)
All Projects	439,759	0.97	427,035	0.43	183,625
Total	439,759	0.97	427,035	0.43	183,625

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

Source: Guidehouse evaluation team analysis

4. Program Savings by Measure

The BNC program claim savings at the whole building level, so this report does not present measure-level savings. Evaluation-verified savings for the program are based on a random sample of projects and reported at the project level (whole building analysis). **Error! Reference source not found.** provides more information about sampled project-level savings.

5. Impact Analysis Findings and Recommendations

5.1 Impact Parameter Estimates

BNC program participants completed 65 electric and gas projects (56 with gas savings) in 2022. The evaluation team used a stratified random sampling approach to select 30 projects to receive an engineering desk review. Of the 30 sampled projects, 28 projects had gas savings. Of the 28 with gas savings, 20 were served jointly by ComEd and Nicor Gas (see 5.2 Appendix A for more detail on the sampling approach). For most projects, the desk reviews resulted in realization rates (RR) of 1.0 and therefore independently confirmed ex ante savings and required no adjustments.

The evaluation team calculated RR with and without interactive effects (see Appendix A for more detail on interactive effects). The final RR for projects with gas savings was 96% for therms without interactive effects and 94% for therms with interactive effects.

The evaluation team calculated verified gross and net savings for energy using participant-specific whole-building energy models developed for baseline and projected design scenarios. For each participant, the design energy model estimates the proposed building's annual whole-building energy consumption based on architectural; building envelope; heating, ventilation, and air conditioning (HVAC); lighting; and other parameters from the building design plans. The baseline energy model for a project estimates the counterfactual annual energy consumption the building would be expected to consume if it were built to meet the energy

performance baseline standards. The estimated first-year savings is the difference in annual electric and gas consumption between the two models.

Table 5-1 shows the parameters used in the verified gross and net savings calculations and indicates which were calculated through evaluation activities and which were deemed. Following the table, Section 5.2 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

Gross Savings Input Parameters	Deemed or Evaluated	Source*
Program Model Inputs	Evaluated	Program-supplied building models and savings calculation spreadsheet
Evaluation Model Inputs	Mixture	Desk review of project documentation; TRM v10.0
Evaluation Model Results	Evaluated	eQuest/DOE2.2/DOE2.1E/Project Calculations
Realization Rate - All Projects	Evaluated	Program savings and evaluated savings
NTG - Electric and Gas	Deemed	Illinois SAG Consensus
EUL	Mixture	TRM v10.0 – Volume 4 Attachment B

*TRM is the Illinois Technical Reference Manual version 10.0: <https://www.ilsag.info/technical-reference-manual/il-statewide-technical-reference-manual-version-10-0/>. The NTG values can be found on the Illinois SAG website: <https://www.ilsag.info/evaluator-ntg-recommendations-for-2022/>.

Source: Guidehouse evaluation team analysis

5.2 Findings and Recommendations

The evaluation team developed several recommendations based on findings from the 2022 evaluation of Nicor Gas projects.

Finding 1: The verified savings are different from ex ante due to installed equipment specifications being inconsistent with performance characteristics included in the building models or calculations:

- The evaluation team updated installed lighting wattages for five projects (1191, 1322, 1335, 1374, and 1377). Due to the changes in building heating loads, this update resulted in changes to the savings for the installed high-efficiency HVAC equipment and other measures.
- The evaluation team updated the installed insulation U-value for project 1321 due to an error in calculating an average U-value. The ex ante analysis used an area-weighted R-value to characterize the overall wall insulation level; however, heat transfer is non-linear with respect to R-value. The evaluation team updated the analysis to reflect an area-weighted U-value approach.
- The evaluation team updated the installed insulation U-value for project 1377.
- The evaluation team updated the installed lighting power density for project 1322 due to incorrect counts of fixture quantities.

Recommendation 1. Increase quality assurance/quality control (QA/QC) processes to ensure building simulations or savings calculations accurately reflect the final building design and equipment selection.

Finding 2: The evaluation team reduced the savings for both the wall insulation and the insulated doors for project 1335 due to errors in the application of stratification effect workarounds in the building simulation resulting in incorrect temperature differentials across the insulated surface.¹

- The program implementer calculated the temperature at different heights using the stratification levels (°F/ft) specified in the Illinois TRM Section 4.4.34. The savings due to the wall insulation were then calculated based on a modeled space temperature equal to the temperature at two-thirds building height. The evaluation updated the analysis to reflect the temperature at half height, which better represents the average temperature for the entire height of the wall.
- Similarly, the savings for the insulated garage doors were calculated based on an interior space temperature set to the stratified temperature at two-thirds building height. However, as the garage doors are at ground level, no stratification effects should be considered for this measure. The temperature at a height of 4-feet is more appropriate for insulated door savings, to reflect the average stratified temperature over an 8-foot door.

Recommendation 2. Ensure savings for insulation in stratified spaces are calculated based on the average interior temperature across the surface of the installed insulation.

¹ Building simulations, such as DOE2, do not include stratification effects but instead assume a uniform space temperature. Therefore, workarounds, such as adjusting space temperature setpoints to reflect average space temperature, are required to model savings for highly stratified spaces. However, if the insulated surface is not located across the full height of the space, the average space temperature will not be equal to the average temperature on the insulated surface.

Appendix A. Impact Analysis Methodology

A.1 Engineering Methodology

Table 5-1 includes description of the building energy models used in the measurement and verification (M&V) engineering analysis. The analysis included the following:

- Adjusting the model inputs in the executable files to match the as-built conditions identified in the evaluation team's review of the BNC program's project files and then rerunning the model
- Quantifying impacts by comparing two simulations representing the projected design and baseline scenarios

The baseline model is the Illinois Energy Conservation Code for Commercial Buildings, which references and incorporates the applicable International Energy Conservation Code (IECC). The Illinois Energy Conservation Code for Commercial Buildings explicitly allows for the use of American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 90.1 as an alternate compliance method.

The program assumes the appropriate baseline based on the program application date. Project applications dated through 2019 used IECC 2015 (based on ASHRAE 90.1-2013) with more recent projects (2020 or sooner) using IECC 2018 (based on ASHRAE 90.1-2016). The evaluation team relied on the same software, methods, and approach to assigning baseline assumptions that the program implementers used to estimate the ex ante models.

The team also calculated interactive effects for each fuel type, where applicable. Interactive effects are the resulting changes to savings that occur when the installation of one measure has a positive or negative effect on the savings for another fuel type. Interactive effects are calculated in the model. For utilities' goal tracking, the evaluation team provides the savings without the penalties from interactive effects. The implementation team calculated savings for joint projects including interactive effects. However, the evaluation team calculated savings with and without interactive effects for reporting purposes. Unless noted, the results in this report exclude penalties from cross-fuel interactive effects.

The evaluation team calculated verified net energy savings by multiplying the verified gross savings estimates by a net-to-gross (NTG) ratio. In 2022, the NTG values used to calculate the net verified savings were based on past evaluation research and approved by the Illinois SAG.

The evaluation team selected a stratified random sample for the BNC program to support the engineering desk reviews. The team designed the sample to provide 90/10 confidence and precision for evaluated therms savings estimates.

A.2 Sampling Approach

Consistent with previous evaluations, the evaluation team developed an MMBtu stratified random sample of projects to support the engineering desk reviews. This approach focused on electric and gas savings. The team designed the sample to provide 90/10 precision for evaluated therms savings, considering savings with and without interactive effects.

The team sampled 2022 projects in two waves. The Wave 1 sample frame contained all 27 projects with electric or gas savings completed as of June 30, 2022. The Wave 2 sample frame contained the remaining 38 projects completed between July 1, 2022, and December 31, 2022. For each wave, the evaluation team divided the sample frame into strata based on the overall MMBtu savings of each project and randomly selected projects within those strata. The evaluation team included a certainty stratum in both waves to capture larger projects than those in the highest MMBtu stratum. After completing the desk reviews and calculating project-specific realization rates (RR), the team developed case weights to extrapolate the results to similar projects, ensuring the engineering results represent the population of 2022 participants. Table A 1 shows the MMBtu profile of the sample selection, and Table A 2 shows the profile of the sample for therms savings and roll up gross realization rate and precision estimate.

Table A-1. Profile of Gross Impact Sample for Projects (MMBtu)

Population Summary*†				Sample Summary*		
Program	Sampling Strata	Number of Projects (N)	Ex Ante Gross Savings (MMBtu)	n	Ex Ante Gross Savings (MMBtu)	Sampled % of Population (% MMBtu)
Coordinated Business New Construction	1	28	11,595	7	2,929	25%
	2	20	31,041	7	11,169	36%
	3	13	54,435	12	49,014	90%
	Certainty	4	68,644	4	68,644	100%
TOTAL		65	165,715	30	131,756	80%

*The gross impact population and sample include MMBtu savings not only claimed only from Nicor Gas, but also PGL, NSG and ComEd.

†Two PGL projects (CINC-1303, CINC-1064) were included in population during sampling but not selected. Their electric savings were claimed by ComEd, but PGL elected to claim the gas savings in program year 2023.

Source: Guidehouse evaluation team analysis.

Table A-2. Profile of Gross Impact Sample for Projects and Realization Rate

Population Summary**†				Sample Summary*			Statistical Verification Results	
Program	Sampling Strata	Number of Projects (N)	Ex Ante Gross Savings (Therms)	n	Ex Ante Gross Savings (Therms)	Sampled % of Population (% Therms)	RR	Precision
Coordinated Business New Construction	1	25	76,281	7	21,243	28%		
	2	18	159,296	10	103,080	65%		
	3	9	243,591	7	198,264	81%		
	Certainty	4	371,880	4	371,880	100%		
TOTAL		56	851,048	28	694,467	82%	0.97	3.1%

*The gross impact population and sample included combined projects and therms savings not only from Nicor Gas, but also PGL, NSG and ComEd projects for a combined sample design and roll up of the program verified gross realization estimate.

† Two PGL projects (CINC-1303, CINC-1064) were included in population during sampling but not selected. Their electric savings were claimed by ComEd, but PGL elected to claim the gas savings in program year 2023.

Source: Guidehouse evaluation team analysis.

Appendix B. Impact Analysis Supplemental Information

B.1 Engineering Desk Review Results

Table B-1 shows the results of the engineering desk review for Nicor Gas projects, including the ex ante savings, verified savings, and the resulting RR for each project in the desk review sample. The table also includes, where applicable, a narrative describing the reasons for any discrepancies between ex ante and verified savings. RR below 100% indicates that a project received a downward adjustment to energy savings while RR above 100% indicates that a project received an upward adjustment to energy savings. All energy savings exclude interactive effects.

Table B-1. Researched Gross Savings for Sampled Projects

Project ID	Gas Utility	Ex Ante		Verified		Realization Rate	
		Electric Savings (kWh/yr)	Gas Savings (therm/yr)	Electric Savings (kWh/yr)	Gas Savings (therm/yr)	Electric (kWh) Savings Realization Rate	Gas (therm) Savings Realization Rate
CINC-1174	Nicor Gas	422,889	8,200	410,672	8,200	0.97	1.00
	Interior lighting and occupancy controls measures were adjusted due to incorrect fixture count. The ex ante savings use (256) F1 fixtures serving the warehouse space. The facility lighting grid is a 32x9 (288) layout. The ex ante savings did not account for one row of lights heading north to south (Ex ante used 32x8).						
CINC-1191	Nicor Gas	110,252	5,020	102,860	4,072	0.93	0.81
	Minor change to LPD.						
CINC-1221	Nicor Gas	20,551	3,829	20,551	3,829	1.00	1.00
	No adjustments.						
CINC-1225	Nicor Gas	273,934	9,361	273,780	9,361	1.00	1.00
	No adjustments.						
CINC-1230	Nicor Gas	913,804	25,563	913,804	25,563	1.00	1.00
	No adjustments.						
CINC-1242	Nicor Gas	213,342	23,385	213,342	23,385	1.00	1.00
	No adjustments.						
CINC-1252	Nicor Gas	441,909	16,522	441,909	16,523	1.00	1.00
	No adjustments.						
CINC-1279	Nicor Gas	13,370	963	13,370	963	1.00	1.00
	No adjustments.						
CINC-1283	Nicor Gas	109,884	4,355	109,884	4,355	1.00	1.00
	No adjustments.						
CINC-1285	Nicor Gas	23,917	1,338	21,694	1,338	0.91	1.00
	The following changes were made: 1. The area of the facility was updated to reflect the area given in the issued for construction drawings. This change influenced the savings for interior lighting due to the change in LPD. The ex ante area was less than 3% off from the area used in the construction drawings. 2. The ex ante savings assumed occupancy controls throughout the facility. There are several institutional areas that require 24/7 operation and do not have occupancy controls. Savings were updated accordingly.						
CINC-1321	Nicor Gas	735,898	13,821	696,410	6,201	0.95	0.45
	The savings were adjusted primarily due to an error in U-value calculations. The original analysis used an area-weighted R-value. However, as heat transfer is non-linearly related to R-value, using a weighted average of the R-values does not produce the correct U-value. The evaluation team calculated an area-weighted U-value of 0.135, consistent with the manufacturer information but higher than the baseline of 0.09 and the 0.08 value that was used in ex ante savings calculations.						
CINC-1322	Nicor Gas	249,518	19,020	239,115	19,729	0.96	1.04
	The savings were adjusted due to increases in LPD based on the provided documentation. It appears that some F1/F1A fixtures may have been missed in the original analysis.						
CINC-1335	Nicor Gas	38,438	14,787	9,981	8,514	0.26	0.58
	The savings for several measures were changed due to changes in stratification effects. The evaluation team adjusted the space heat temperature setpoint in the eQUEST model. Specifically, the average height temperature was changed from 2/3 height to 1/2 height and the insulated door savings were based on the temperature at 4' rather than at 1/2 building height. Additionally, the ex ante exterior light power analysis did not include lighting for several exterior locations (covered storage, salt dome, and fuel canopy). These lights were added as along with the corresponding area of the exterior locations. According to the spec sheets, some of the light fixtures were determined to have a higher wattage than provided on the issued drawings.						
CINC-1341	Nicor Gas	2,190,946	118,516	2,131,212	118,516	0.97	1.00
	The ex ante analysis included a penalty for below-code exterior lighting controls. However, based on the information provided it appears that the lighting controls did not meet the best practice requirements but do meet code. Therefore, the penalty was removed. Additionally, per the customer interview the exterior lighting controls were not installed as claimed.						
CINC-1356	Nicor Gas	127,182	9,020	127,182	9,020	1.00	1.00
	The ex ante analysis included an "interactive" penalty for exterior lighting. This appears to be an error. As this is not a gas efficiency measure the electric penalty should not be an interactive penalty. However, based on a review of the information included the controls meet code and no penalty should be assessed. Therefore, the penalty was set to zero. This change only affects the "interactive effects included" savings for C/B analysis. It does not affect the "interactive effects removed" savings used to determine program realization rates.						
CINC-1362	Nicor Gas	2,062,156	5,999	2,047,987	5,999	0.99	1.00
	The exterior lighting controls do not exceed code requirements and therefore savings for any exterior lighting controls were removed.						
CINC-1370	Nicor Gas	56,615	2,622	56,311	2,622	0.99	1.00
	Small change to exterior lighting for loading dock spaces.						
CINC-1374	Nicor Gas	508,081	26,595	112,345	28,572	0.22	1.07
	Slight change to LPD. However, ex ante didn't include penalty for over-code lighting energy. Care should be taken to ensure that penalties associated with below-code installations are not removed, even if the below-code installation results in alternate utility energy savings due to interactive effects.						
CINC-1377	Nicor Gas	57,589	3,664	57,817	3,785	1.00	1.03
	Slight adjustments to interior and exterior lighting and U-value.						
CINC-1382	Nicor Gas	718,125	28,988	732,420	28,998	1.02	1.00
	The exterior lighting baseline LPD was adjusted to account for loading dock area.						

LPD – Lighting Power Density

ERV – Energy Recovery Ventilation

C/B – Cost-Benefit

Source: ComEd and Nicor Gas tracking data and evaluation team analysis

Appendix C. Program-Specific Inputs for the Illinois TRC

Table C-1 shows the 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. Verified Cost-Effectiveness Inputs

Program Path	Savings Category	Units	Quantity	Effective Useful Life	Ex Ante Gross Savings (Therms)	Verified Gross Savings (Therms)	Gross Heating Penalty (Therms)	Verified Net Savings (Therms)	Net Heating Penalty (Therms)
Whole Building	All Projects	Project	40	20.6	439,759	427,035	-120,381	183,625	-51,764
Total			40	20.6	439,759	427,035	-120,381	183,625	-51,764

Source: Nicor Gas tracking data and Guidehouse evaluation team analysis