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Outwit Complexity

# Business New Construction Program Impact Evaluation Report

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

**Prepared for:**

**Peoples Gas and North Shore Gas**

**FINAL**

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# 1. Introduction

This report presents the results of the impact evaluation of the Peoples Gas (PGL) and North Shore Gas (NSG) 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, PGL, and NSG. 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 building design technical assistance to aide participants in reducing energy use beyond what is required by existing building codes and standards. The PGL and NSG BNC program coordinate with ComEd where their service areas overlap. PGL and NSG acquire therms 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, nine of which were served jointly by ComEd and PGL, as Table 2-1 shows.

**Table 2-1. 2022 Volumetric Summary for PGL**

| Participation | ComEd (Overall with Gas Utilities) | PGL |
|---|---|---|
| Participants* | 56 | 9 |
| Installed Projects† | 56 | 9 |
| Measure Types Installed | Whole Building | Whole Building |

* Participants are defined as completed C&I and PS new construction projects.
† Installed projects are defined as completed C&I and PS new construction projects.
*Source: Peoples Gas tracking data and Guidehouse evaluation team analysis*

The NSG program had two participants in 2022 and completed two projects as Table 2-2 shows.

**Table 2-2. 2022 Volumetric Summary for NSG**

| Participation | NSG |
|---|---|
| Participants* | 2 |
| Installed Projects† | 2 |
| Measure Types Installed | Whole Building |

* Participants are defined as completed C&I and PS new construction projects.
† Installed projects are defined as completed C&I and PS new construction projects.
*Source: NSG tracking data and Guidehouse evaluation team analysis*

# 3. Program Savings Detail

Table 3-1 summarizes the energy savings the PGL BNC program achieved in 2022.

**Table 3-1. 2022 Annual Energy Savings Summary for PGL**

| Program Path | Ex Ante Gross Savings (therms) | Verified Gross RR* | Verified Gross Savings (therms) | NTG† | Verified Net Savings (therms) |
|---|---|---|---|---|---|
| All Projects | 439,126 | 97% | 426,420 | 0.43 | 183,361 |
| **Total or Weighted Average** | **439,126** | **97%** | **426,420** | **0.43** | **183,361** |

* Realization rate (RR) is the ratio of verified gross savings to ex ante gross savings based on evaluation research findings.
† Net-to-gross (NTG): A deemed value. Available on the Stakeholder Advisory Group (SAG) website: **https://www.ilsag.info/evaluator-ntg-recommendations-for-2022**.
*Source: Peoples Gas tracking data and Guidehouse evaluation team analysis*

Table 3-2 summarizes the energy savings the NSG BNC program achieved in 2022.

**Table 3-2. 2022 Annual Energy Savings Summary for NSG**

| Program Path | Ex Ante Gross Savings (therms) | Verified Gross RR* | Verified Gross Savings (therms) | NTG† | Verified Net Savings (therms) |
|---|---|---|---|---|---|
| All Projects | 24,100 | 97% | 23,403 | 0.43 | 10,063 |
| **Total or Weighted Average** | **24,100** | **97%** | **23,403** | **0.43** | **10,063** |

* 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: NSG tracking data and 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, five were served jointly by ComEd and PGL, and one was served jointly by ComEd and NSG (see Appendix A for more detail on the sampling approach). For most projects, the desk reviews resulted in realization rates (RR) of 100% 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 are the difference in annual electricity 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, the report provides findings and recommendations, including discussion of all measures with RR above or below 100%. 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 |
| End of Useful Life (EUL) | Mixture | TRM v10.0 – Volume 4 Attachment B |

*TRM is the Illinois Statewide Technical Reference Manual version 10.0: **https://www.ilsag.info/technical-reference-manual/il-statewide-technical-reference-manual-version-10-0/**. The net-to-gross (NTG) values can be found on the Illinois SAG website: **https://www.ilsag.info/evaluator-ntg-recommendations-for-2022/**.
*Source: PGL and NSG tracking data and Guidehouse evaluation team analysis*

## 5.2 Findings and Recommendations

The evaluation team developed several recommendations based on findings from the 2022 evaluation of PGL and NSG projects.

**Finding 1.** The evaluation team reduced the savings for project 0659 due to the installed equipment efficiency for the boiler and hot water heater systems being inconsistent with performance characteristics included in the building models or calculations.

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

**Finding 2.** The program documentation for project 1042 included a workbook for the calculation of savings from ENERGY STAR clothes washers. The evaluation team re-created the savings based on an ENERGY STAR calculator tool used for other similar projects, but the savings from the verification did not match the ex ante calculation. The evaluation team reduced the gas savings from the clothes washers significantly by 84%. The overall project gross RR was 89%.

> **Recommendation 2.** The program implementer should ensure project documentation is complete and consistent with claimed savings from using the ENERGY STAR tools.

**Finding 3.** The evaluation team found discrepancies between the tracking data provided by ComEd and PGL/NSG for projects 0659 and 1220. These two projects were part of the stratified random sample for 2022 evaluation. The evaluation team was able to confirm the ex ante gross savings from the project files provided in the ComEd database. Details of the evaluation findings from these projects are provided in Appendix Table B-1.

**Recommendation 3.** The program implementer should ensure that project data provided to ComEd, Nicor Gas, PGL, and NSG are consistent across their respective tracking data submitted for evaluation. The data should clarify which projects the coordinated utilities are claiming savings for the program year under evaluation and clarify where there are cost or therms percentage allocations for specific projects and respective utilities.

## 5.3 Historical Realization Rates and NTG Values

Table 5-2 shows the historical gross realization rates and NTG values for the BNC program.

**Table 5-2. Historical Realization Rates and NTG Values**

| Program Year* | PGL-Verified Gross RR | NSG-Verified Gross RR | PGL NTG | NSG NTG |
|---|---|---|---|---|
| 2018 | 84% | 84% | 77% | 77% |
| 2019 | 99% | 99% | 70% | 70% |
| 2020 | 89% | 89% | 58% | 58% |
| 2021 | 97% | 97% | 54% | 54% |
| 2022 | 97% | 97% | 43% | 43% |

*Source: Guidehouse evaluation research*

# Appendix A. Impact Analysis Methodology

## A.1 Engineering Methodology

The description of building energy models used in the measurement and verification engineering analysis are included in Table 5-1. 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. Projects through CY2019 used IECC 2015 (based on ASHRAE 90.1-2013) with more recent projects using IECC 2018 (based on ASHRAE 90.1-2016). The evaluation team relied on the same software, methods, and approach to assigning baseline assumptions 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 therms savings by multiplying the verified gross savings estimates by an 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 Stakeholder Advisory Group (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

electricity and gas savings. The team designed the sample to provide 90/10 precision for evaluated kW, kWh, and therms savings, considering savings with and without interactive effects. This approach also targeted 90/10 precision at the MMBtu level.

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 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 RR 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 by PGL and NSG but also Nicor Gas 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 RR

| 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 PGL and NSG but also Nicor Gas 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 PGL and NSG 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 1.00 indicate that a project received a downward adjustment to energy savings, while RR above 1.00 indicate 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**

| | | Ex Ante | | Verified | | Realization Rate | |
|---|---|---|---|---|---|---|---|
| Project ID | Gas Utility | 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-0659 | Peoples Gas | 1,538,610 | 170,818 | 1,784,068 | 168,799 | 1.16 | 0.99 |
| | Several changes were made including:<br>M3 Interior Lighting Power - Condo LPD was adjusted due to the verification report calculated LPD.<br>M4 Parking Garage Lighting Power - Parking garage LPD was adjusted based on fixture counts, lighting spec sheet wattages, and parking garage area provided from drawings.<br>M6 Condensing Boilers - Boiler efficiency was adjusted based on verification photos of boiler nameplates.<br>M7 Chiller Cooling Efficiency - Chiller baseline full load and IPLV values were adjusted using the chiller efficiencies spreadsheet and ASHRAE Table 6.8.1C values for centrifugal water cooled chillers. Proposed full load and IPLV were adjusted based on the equipment specifications from the provided drawings. The result is an increase in savings.<br>M8 Heat Rejection Plant - GPM/HP appears to be worse than code according to ASHRAE 90.1 - 2010 Table 6.8.1G. Ex ante savings used a baseline of an open circuit cooling tower with centrifugal fans rather than an axial fan which was actually installed. This adjusts the GPM/HP from 20 to 38.2 based on the referenced table values.<br>M10 Condensing DHW Heaters - Boiler efficiency was adjusted from 95% to 94.5% as specified by verification photos of the boiler nameplates. This influences the savings for this measure as DHW is provided by heat exchangers from the building space heating system. | | | | | | |
| CINC-0982 | Peoples Gas | 3,427,378 | 76,547 | 2,984,573 | 76,547 | 0.87 | 1.00 |
| | Only one change was made to the model. The savings for the parking garage DCV were reduced due to the fan motor HP being overestimated in the model. This was due to both the CFM flow rate being overetimated and the kW/CFM being overestimated. Specifically, the modeled CFM is based on approximately 1.5 CFM/sf for a total of 842,000 CFM of ventilation air, compared to 473,000 CFM based on the plans. Additionally, the modeled fan energy was 0.0003 kW/CFM compared to ~0.000212 kW/CFM for the fans installed. | | | | | | |
| CINC-1042 | Peoples Gas | 898,598 | 27,710 | 765,264 | 24,768 | 0.85 | 0.89 |
| | The clothes washer savings were found to be inconsistent with the Energy Star calculator values. It is unclear how the savings were calculated. | | | | | | |
| CINC-1238 | Peoples Gas | 651,109 | 43,786 | 624,278 | 43,786 | 0.96 | 1.00 |
| | The analysis was completed in a proprietary model. The savings for each measure were reviewed and the savings for the cooling tower fans appeared higher than expected. The evaluation imported the model into equest and reran using a two-speed fan baseline and then updating to a VFD fan. This resulted in a decrease in the project savings of 4%. | | | | | | |
| CINC-1300 | Peoples Gas | 451,750 | 6,987 | 451,750 | 6,987 | 1.00 | 1.00 |
| | No adjustments. | | | | | | |
| CINC-1220 | North Shore Gas | 370,242 | 22,237 | 370,242 | 22,237 | 1.00 | 1.00 |
| | No adjustments. | | | | | | |

DHW – Domestic Hot Water
LPD – Lighting Power Density
IPLV – Integrated Part Load Values
GPM – Gallons Per Minute
HP – Horsepower

DCV – Demand Controlled Ventilation
CFM – Cubic Feet per Minute
VFD – Variable Frequency Drives
*Source: ComEd, PGL, and NSG tracking data and evaluation team analysis*

# Appendix C. Program-Specific Inputs for the Illinois TRC

Table C-1 and Table C-2 show 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 – PGL

| 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 | 9 | 20.6 | 439,126 | 426,420 | -95,178 | 183,361 | -40,927 |
| **Total or Weighted Average** | | | **9** | **20.6** | **439,126** | **426,420** | **-95,178** | **183,361** | **-40,927** |

*Source: Peoples Gas tracking data and Guidehouse evaluation team analysis*

### Table C-2. Verified Cost-Effectiveness Inputs – NSG

| 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 | 2 | 20.6 | 24,100 | 23,403 | -16,079 | 10,063 | -6,914 |
| **Total or Weighted Average** | | | **2** | **20.6** | **24,100** | **23,403** | **-16,079** | **10,063** | **-6,914** |

*Source: NSG tracking data and Guidehouse evaluation team analysis*