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Combined Utility Non-Residential New Construction Impact Evaluation Report

Energy Efficiency/Demand Response Plan: Program Year 2021 (CY2021) (1/1/2021-12/31/2021)

Prepared for:

ComEd
Nicor Gas
Peoples Gas
North Shore Gas

FINAL

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List of Figures and Tables

1. Introduction

The CY2021 Non-Residential New Construction Program (New Construction Program) is offered jointly to non-residential customers served by ComEd, Nicor Gas, Peoples Gas, and North Shore Gas. This report presents results for all utilities.

This report summarizes the total energy and demand impacts for the program and program structure details. The appendices provide the impact analysis methodology and details of the total resource cost (TRC) analysis inputs. CY2021 covers January 1, 2021 through December 31, 2021.

2. Program Description

The New Construction 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 in ComEd's service territory. 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 New Construction Program coordinates with Nicor Gas, Peoples Gas, and North Shore Gas where their service areas overlap with ComEd's service area. Nicor Gas, Peoples Gas, and North Shore Gas each purchase therm savings from the program using a dollars per therm payment model on a project-by-project basis.

In CY2021, the program served 88 projects, with 66 projects served jointly by ComEd and one of the gas utilities and 22 projects served by ComEd alone (see Table 2-1).

Table 2-1. Number of Participants and Projects

Participation	Count of Projects
ComEd Only	22
ComEd and Nicor Gas	38
ComEd and Peoples Gas	21
ComEd and North Shore Gas	7
Total Projects	**88**

Source: ComEd tracking data and evaluation team analysis

3. Program Savings Detail

Table 3-1 summarizes the incremental energy and demand savings achieved by ComEd's portion of the New Construction Program CY2021.[1] The reported gas savings in this table are only those that ComEd may be able to claim, which excludes savings the gas utilities claim.[2]

Table 3-1. Total Annual Incremental Electric Savings

Savings Category	Units	Ex Ante Gross Savings	Program Gross Realization Rate	Verified Gross Savings	Program Net-to-Gross Ratio (NTG)	CY2019 Net Carryover Savings	CY2020 Net Carryover Savings	Verified Net Savings
Electric Energy Savings - Direct	kWh	30,049,173	0.99	29,881,254	0.53	N/A	N/A	15,837,065
Electric Energy Savings - Converted from Gas‡	kWh	2,374,813	0.97	2,313,336	0.53	N/A	N/A	1,226,068
Total Electric Energy Savings	kWh	32,423,986	0.99	32,194,590	0.53	N/A	N/A	17,063,133
Summer Peak§ Demand Savings	kW	4,470	0.98	4,400	0.53	N/A	N/A	2,332

N/A = not applicable (refers to a piece of data that cannot be produced or does not apply).
‡ Gas savings are converted to kilowatt-hours (kWh) by multiplying therms by 29.31 (which is based on 100,000 Btu/therm and 3,412 Btu/kWh). The evaluation team will determine which gas savings will be converted to kWh and counted toward ComEd's electric savings goal while producing the portfolio-wide Summary Report. According to Section 8-103B(b-25) of the Illinois Public Utilities Act, "In no event shall more than 10% of each year's applicable annual incremental goal as defined in paragraph (7) of subsection (g) of this Section be met through savings of fuels other than electricity."
The "Verified Net Savings" in row one (Electric Energy Savings – Direct) includes primary kWh savings as a result of measure implementation and secondary kWh savings from wastewater treatment. It does not include carryover savings as they do not apply to this program. Unless noted, both the electric and natural gas results in this report exclude penalties from cross-fuel interactive effects.
§ The coincident summer peak period is defined as 1:00-5:00 p.m. Central Prevailing Time on non-holiday weekdays, June through August.

Source: ComEd tracking data and evaluation team analysis

Table 3-2 summarizes the incremental therm savings the New Construction Program achieved in CY2021 that are claimed by the gas utilities.

Table 3-2. CY2021 Total Annual Incremental Therm Savings

Savings Category	Nicor Gas (therms)	Peoples Gas (Therms)	North Shore Gas (Therms)
Natural Gas			
Ex Ante Gross Savings	395,159	370,871	87,453
Program Gross Realization Rate	0.97	0.97	0.97
Verified Gross Savings	384,929	361,270	85,189
Program Net-to-Gross Ratio (NTG)*	0.54	0.54	0.54
Verified Net Savings	207,862	195,086	46,002

* Peoples Gas and North Shore Gas ex ante net savings used an incorrect NTG value of 0.58.
Source: ComEd, Nicor Gas, Peoples Gas, and North Shore Gas tracking data and evaluation team analysis

[1] Unless noted, both the electric and natural gas results in this report exclude penalties from cross-fuel interactive effects (e.g., gas heating penalty from electric lighting measures).

[2] The evaluation will determine which gas savings will be counted toward goal while producing the portfolio-wide Summary Report.

4. Cumulative Persisting Annual Savings

Table 4-1 to Table 4-3 and Figure 4-1 show the total verified gross savings for the New Construction Program and the cumulative persisting annual savings (CPAS) for the measures installed in CY2021. The electric CPAS across all measures installed in 2021 is shown in Table 4-1. The CY2021 gas contribution to CPAS (converted to equivalent electricity) is shown in Table 4-2. The combined savings are shown in Table 4-3. The historic rows in each table are the CPAS contribution back to CY2018. The Program Total Electric CPAS and the Program Total Gas CPAS are the sum of the CY2021 contribution and the historic contribution. Figure 4-1 shows the savings across the effective useful life (EUL) applied to all electric savings.

Table 4-1. Cumulative Persisting Annual Savings – Electric

End Use Type	Research Category	EUL	CY2021 Verified Gross Savings (kWh)	NTG*	Lifetime Net Savings (kWh)†	Verified Net kWh Savings 2018	2019	2020	2021	2022	2023	2024	2025	2026
Whole Building	All Projects	17.4	29,881,254	0.53	275,564,929				15,837,065	15,837,065	15,837,065	15,837,065	15,837,065	15,837,065
CY2021 Program Total Electric Contribution to CPAS			**29,881,254**		**275,564,929**				**15,837,065**	**15,837,065**	**15,837,065**	**15,837,065**	**15,837,065**	**15,837,065**
Historic Program Total Electric Contribution to CPAS‡						**22,239,823**	**40,976,658**	**58,403,275**	**58,403,275**	**58,403,275**	**58,403,275**	**58,403,275**	**58,403,275**	**58,403,275**
Program Total Electric CPAS						**22,239,823**	**40,976,658**	**58,403,275**	**74,240,339**	**74,240,339**	**74,240,339**	**74,240,339**	**74,240,339**	**74,240,339**
CY2021 Program Incremental Expiring Electric Savings§										-	-	-	-	-
Historic Program Incremental Expiring Electric Savings||									-	-	-	-	-	-
Program Total Incremental Expiring Electric Savings#									-	-	-	-	-	-

End Use Type	Research Category	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Whole Building	All Projects	15,837,065	15,837,065	15,837,065	15,837,065	15,837,065	15,837,065	15,837,065	15,837,065	15,837,065	15,837,065	15,837,065	6,334,826
CY2021 Program Total Electric Contribution to CPAS		**15,837,065**	**15,837,065**	**15,837,065**	**15,837,065**	**15,837,065**	**15,837,065**	**15,837,065**	**15,837,065**	**15,837,065**	**15,837,065**	**15,837,065**	**6,334,826**
Historic Program Total Electric Contribution to CPAS‡		**58,403,275**	**58,403,275**	**58,403,275**	**58,403,275**	**58,403,275**	**58,403,275**	**58,403,275**	**58,403,275**	**45,059,381**	**24,921,350**	**6,970,647**	-
Program Total Electric CPAS		**74,240,339**	**74,240,339**	**74,240,339**	**74,240,339**	**74,240,339**	**74,240,339**	**74,240,339**	**74,240,339**	**60,896,445**	**40,758,415**	**22,807,711**	**6,334,826**
CY2021 Program Incremental Expiring Electric Savings§		-	-	-	-	-	-	-	-	-	-	-	**9,502,239**
Historic Program Incremental Expiring Electric Savings||		-	-	-	-	-	-	-	-	**13,343,894**	**20,138,030**	**17,950,704**	**6,970,647**
Program Total Incremental Expiring Electric Savings#		-	-	-	-	-	-	-	-	**13,343,894**	**20,138,030**	**17,950,704**	**16,472,885**

End Use Type	Research Category	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Whole Building	All Projects	-	-	-	-	-	-	-	-	-	-	-	-
CY2021 Program Total Electric Contribution to CPAS		-	-	-	-	-	-	-	-	-	-	-	-
Historic Program Total Electric Contribution to CPAS‡		-	-	-	-	-	-	-	-	-	-	-	-
Program Total Electric CPAS		-	-	-	-	-	-	-	-	-	-	-	-
CY2021 Program Incremental Expiring Electric Savings§		**6,334,826**	-	-	-	-	-	-	-	-	-	-	-
Historic Program Incremental Expiring Electric Savings||		-	-	-	-	-	-	-	-	-	-	-	-
Program Total Incremental Expiring Electric Savings#		**6,334,826**	-	-	-	-	-	-	-	-	-	-	-

Note: The green highlighted cell shows program total first-year electric savings. The gray cells are blank, indicating values irrelevant to the CY2021 contribution to CPAS.

* A deemed value. Source: Illinois Stakeholder Advisory Group (SAG) website: **https://www.ilsag.info/evaluator-ntg-recommendations-for-2021**.

† Lifetime savings are the sum of CPAS savings through the EUL.

‡ Historic savings go back to CY2018.

§ Incremental expiring savings are equal to CPAS Y_{n-1} - CPAS Y_n.

|| Historic incremental expiring savings are equal to Historic CPAS Y_{n-1} - Historic CPAS Y_n.

Program total incremental expiring savings is equal to current year total incremental expiring savings plus historic total incremental expiring savings.

Source: Evaluation team analysis

Table 4-2. Cumulative Persisting Annual Savings – Gas

End Use Type	Research Category	EUL	CY2021 Verified Gross Savings (Therms)	NTG*	Lifetime Net Savings (Therms)†	Verified Net Therms Savings 2018	2019	2020	2021	2022	2023	2024	2025	2026
Whole Building	All Projects	17.4	78,927	0.53	727,860				41,831	41,831	41,831	41,831	41,831	41,831
CY2021 Program Total Gas Contribution to CPAS (Therms)			**78,927**		**727,860**				**41,831**	**41,831**	**41,831**	**41,831**	**41,831**	**41,831**
CY2021 Program Total Gas Contribution to CPAS (kWh Equivalent)‡						-	-	-	**1,226,068**	**1,226,068**	**1,226,068**	**1,226,068**	**1,226,068**	**1,226,068**
Historic Program Total Gas Contribution to CPAS (kWh Equivalent)§						**981,763**	**2,500,239**	**3,713,955**	**3,713,955**	**3,713,955**	**3,713,955**	**3,713,955**	**3,713,955**	**3,713,955**
Program Total Gas CPAS (kWh Equivalent)						**981,763**	**2,500,239**	**3,713,955**	**4,940,022**	**4,940,022**	**4,940,022**	**4,940,022**	**4,940,022**	**4,940,022**
CY2021 Program Incremental Expiring Gas Savings (Therms)										-	-	-	-	-
CY2021 Program Incremental Expiring Gas Savings (kWh Equivalent)‖										-	-	-	-	-
Historic Program Incremental Expiring Gas Savings (kWh Equivalent)#									-	-	-	-	-	-
Program Total Incremental Expiring Gas Savings (kWh Equivalent)*†									-	-	-	-	-	-

End Use Type	Research Category	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Whole Building	All Projects	41,831	41,831	41,831	41,831	41,831	41,831	41,831	41,831	41,831	41,831	41,831	16,732
CY2021 Program Total Gas Contribution to CPAS (Therms)		**41,831**	**41,831**	**41,831**	**41,831**	**41,831**	**41,831**	**41,831**	**41,831**	**41,831**	**41,831**	**41,831**	**16,732**
CY2021 Program Total Gas Contribution to CPAS (kWh Equivalent)‡		**1,226,068**	**1,226,068**	**1,226,068**	**1,226,068**	**1,226,068**	**1,226,068**	**1,226,068**	**1,226,068**	**1,226,068**	**1,226,068**	**1,226,068**	**490,427**
Historic Program Total Gas Contribution to CPAS (kWh Equivalent)§		**3,713,955**	**3,713,955**	**3,713,955**	**3,713,955**	**3,713,955**	**3,713,955**	**3,713,955**	**3,713,955**	**3,124,897**	**1,821,106**	**485,486**	-
Program Total Gas CPAS (kWh Equivalent)		**4,940,022**	**4,940,022**	**4,940,022**	**4,940,022**	**4,940,022**	**4,940,022**	**4,940,022**	**4,940,022**	**4,350,965**	**3,047,174**	**1,711,554**	**490,427**
CY2021 Program Incremental Expiring Gas Savings (Therms)		-	-	-	-	-	-	-	-	-	-	-	**25,099**
CY2021 Program Incremental Expiring Gas Savings (kWh Equivalent)‖		-	-	-	-	-	-	-	-	-	-	-	**735,641**
Historic Program Incremental Expiring Gas Savings (kWh Equivalent)#		-	-	-	-	-	-	-	-	**589,058**	**1,303,791**	**1,335,620**	**485,486**
Program Total Incremental Expiring Gas Savings (kWh Equivalent)*†		-	-	-	-	-	-	-	-	**589,058**	**1,303,791**	**1,335,620**	**1,221,127**

End Use Type	Research Category	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Whole Building	All Projects	-	-	-	-	-	-	-	-	-	-	-	-
CY2021 Program Total Gas Contribution to CPAS (Therms)		-	-	-	-	-	-	-	-	-	-	-	-
CY2021 Program Total Gas Contribution to CPAS (kWh Equivalent)‡		-	-	-	-	-	-	-	-	-	-	-	-
Historic Program Total Gas Contribution to CPAS (kWh Equivalent)§		-	-	-	-	-	-	-	-	-	-	-	-
Program Total Gas CPAS (kWh Equivalent)		-	-	-	-	-	-	-	-	-	-	-	-
CY2021 Program Incremental Expiring Gas Savings (Therms)		**16,732**	-	-	-	-	-	-	-	-	-	-	-
CY2021 Program Incremental Expiring Gas Savings (kWh Equivalent)‖		**490,427**	-	-	-	-	-	-	-	-	-	-	-
Historic Program Incremental Expiring Gas Savings (kWh Equivalent)#		-	-	-	-	-	-	-	-	-	-	-	-
Program Total Incremental Expiring Gas Savings (kWh Equivalent)*†		**490,427**	-	-	-	-	-	-	-	-	-	-	-

Note: The green highlighted cell shows program total first-year gas savings in kWh equivalents. The gray cells are blank, indicating no values or do not contribute to calculating CPAS in CY2021.

* A deemed value. Source: Illinois SAG website: **https://www.ilsag.info/evaluator-ntg-recommendations-for-2021**.

† Lifetime savings are the sum of CPAS savings through the EUL.

‡ kWh equivalent savings are calculated by multiplying therm savings by 29.31.

§ Historic savings go back to CY2018.

‖ Incremental expiring savings are equal to CPAS Y_{n-1} - CPAS Y_n.

Historic incremental expiring savings are equal to Historic CPAS Y_{n-1} - Historic CPAS Y_n.

*† kWh equivalent portfolio total incremental savings are calculated by multiplying therm savings by 29.31.

Source: Evaluation team analysis

Table 4-3. Cumulative Persisting Annual Savings – Total

End Use Type	Research Category	EUL	CY2021 Verified Gross Savings (kWh)	NTG*	Lifetime Net Savings (kWh)†	Verified Net kWh Savings (Including Those Converted from Gas Savings) 2018	2019	2020	2021	2022	2023	2024	2025	2026
Whole Building	All Projects	17.4	32,194,590	0.53	296,898,511				17,063,133	17,063,133	17,063,133	17,063,133	17,063,133	17,063,133
CY2021 Program Total Contribution to CPAS			**32,194,590**		**296,898,511**				**17,063,133**	**17,063,133**	**17,063,133**	**17,063,133**	**17,063,133**	**17,063,133**
Historic Program Total Contribution to CPAS‡						**23,221,586**	**43,476,897**	**62,117,229**	**62,117,229**	**62,117,229**	**62,117,229**	**62,117,229**	**62,117,229**	**62,117,229**
Program Total CPAS						**23,221,586**	**43,476,897**	**62,117,229**	**79,180,362**	**79,180,362**	**79,180,362**	**79,180,362**	**79,180,362**	**79,180,362**
CY2021 Program Incremental Expiring Savings§										-	-	-	-	-
Historic Program Incremental Expiring Savings||									-	-	-	-	-	-
Program Total Incremental Expiring Savings#									-	-	-	-	-	-

End Use Type	Research Category	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Whole Building	All Projects	17,063,133	17,063,133	17,063,133	17,063,133	17,063,133	17,063,133	17,063,133	17,063,133	17,063,133	17,063,133	17,063,133	6,825,253
CY2021 Program Total Contribution to CPAS		**17,063,133**	**17,063,133**	**17,063,133**	**17,063,133**	**17,063,133**	**17,063,133**	**17,063,133**	**17,063,133**	**17,063,133**	**17,063,133**	**17,063,133**	**6,825,253**
Historic Program Total Contribution to CPAS‡		**62,117,229**	**62,117,229**	**62,117,229**	**62,117,229**	**62,117,229**	**62,117,229**	**62,117,229**	**62,117,229**	**48,184,277**	**26,742,456**	**7,456,133**	-
Program Total CPAS		**79,180,362**	**79,180,362**	**79,180,362**	**79,180,362**	**79,180,362**	**79,180,362**	**79,180,362**	**79,180,362**	**65,247,410**	**43,805,589**	**24,519,265**	**6,825,253**
CY2021 Program Incremental Expiring Savings§		-	-	-	-	-	-	-	-	-	-	-	**10,237,880**
Historic Program Incremental Expiring Savings||		-	-	-	-	-	-	-	-	**13,932,952**	**21,441,821**	**19,286,324**	**7,456,133**
Program Total Incremental Expiring Savings#		-	-	-	-	-	-	-	-	**13,932,952**	**21,441,821**	**19,286,324**	**17,694,012**

End Use Type	Research Category	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Whole Building	All Projects	-	-	-	-	-	-	-	-	-	-	-	-
CY2021 Program Total Contribution to CPAS		-	-	-	-	-	-	-	-	-	-	-	-
Historic Program Total Contribution to CPAS‡		-	-	-	-	-	-	-	-	-	-	-	-
Program Total CPAS		-	-	-	-	-	-	-	-	-	-	-	-
CY2021 Program Incremental Expiring Savings§		**6,825,253**	-	-	-	-	-	-	-	-	-	-	-
Historic Program Incremental Expiring Savings||		-	-	-	-	-	-	-	-	-	-	-	-
Program Total Incremental Expiring Savings#		**6,825,253**	-	-	-	-	-	-	-	-	-	-	-

Note: The green highlighted cell shows program total first-year electric savings (including direct electric savings and those converted from gas). The gray cells are blank, indicating no values or do not contribute to calculating CPAS in CY2021.

* A deemed value. Source: Illinois SAG website: **https://www.ilsag.info/evaluator-ntg-recommendations-for-2021**.

† Lifetime savings are the sum of CPAS savings through the EUL.

‡ Historic savings go back to CY2018.

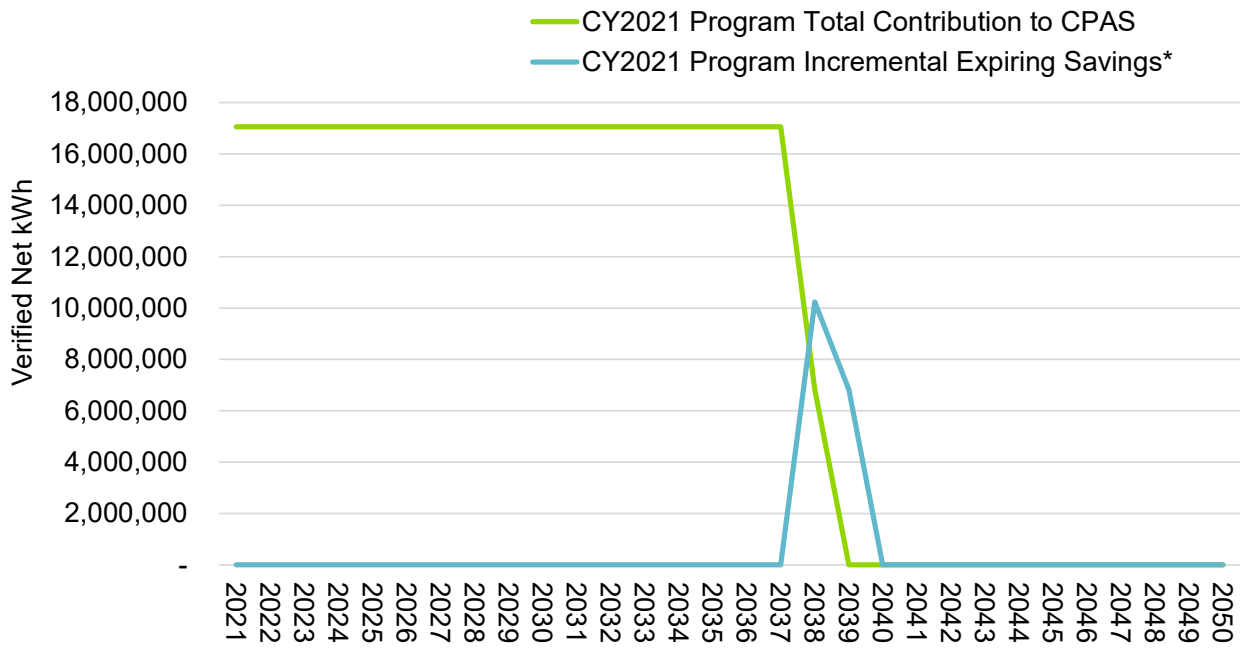
§ Incremental expiring savings are equal to CPAS Y_{n-1} - CPAS Y_n.

|| Historic incremental expiring savings are equal to Historic CPAS Y_{n-1} - Historic CPAS Y_n

Program total incremental expiring savings is equal to current year total incremental expiring savings plus historic total incremental expiring savings.

Source: Evaluation team analysis

Figure 4-1. Cumulative Persisting Annual Savings



* Expiring savings are equal to CPAS Y_{n-1} - CPAS Y_n.

Source: Evaluation team analysis

5. Program Savings by Measure

All measures in this program are combined for calculating savings through a whole building analysis, so measure-level results are the same as the program-level results discussed in the previous section.

6. Impact Analysis Findings and Recommendations

6.1 Impact Parameter Estimates

Participants completed 88 projects through the New Construction Program in CY2021. The evaluation team used a stratified random sampling approach to select 30 projects to receive an engineering desk review. Of the 30 sampled projects, 27 projects also had gas savings. For most projects, the desk reviews resulted in realization rates of 1.0 and therefore independently confirmed ex ante savings and required no adjustments.

The evaluation team calculated realization rates with and without interactive effects (see Appendix A for more detail on interactive effects). The final realization rate was 0.99 for kWh with interactive effects removed and 0.99 for kWh including interactive effects. For peak demand, the final realization rate was 0.98 with interactive effects removed and 0.98 with interactive effects. The final realization rate for projects with gas savings was 0.97 for therms with interactive effects removed and 0.97 for therms with interactive effects.

The team calculated verified gross and net savings for energy and coincident peak demand 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. See Appendix A for a detailed description of the impact analysis methodology.

Table 6-1 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 6-1. 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 v9.0
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 v9.0 – Volume 4 Attachment B

*TRM is the Illinois Technical Reference Manual version 9.0 **https://www.ilsag.info/technical-reference-manual/il-trm-version-9/.** The net-to-gross (NTG) values can be found on the Illinois SAG website: **https://www.ilsag.info/evaluator-ntg-recommendations-for-2021**.

6.2 Other Impact Findings and Recommendations

Table 6-2 summarizes the CY2021 incremental electric energy and demand savings the New Construction Program achieved for ComEd and the therm savings achieved for each gas utility.

The CY2021 evaluation achieved a 90/10 confidence and precision level for electric energy, demand, and therm savings.[3]

Table 6-2. CY2021 Total Annual Incremental Electric and Gas Savings by Utility

Utility	Metric	Ex Ante Gross Savings	Verified Gross Realization Rate	Verified Gross Savings	NTG*	Verified Net Savings	Effective Useful Life
ComEd	kWh	29,516,121	0.99	29,246,090	0.53	15,500,428	17.4
	kWh removing interactive effects	30,049,173	0.99	29,863,565	0.53	15,827,689	17.4
	Total kW	6,407	0.97	6,186	0.53	3,279	17.4
	Total kW removing interactive effects	6,407	0.97	6,186	0.53	3,279	17.4
	Summer Peak kW	4,470	0.98	4,400	0.53	2,332	17.4
	Winter Peak kW	4,266	0.98	4,192	0.53	2,222	17.4
	Therms	1,180	0.97	1,147	0.53	608	17.4
	Therms removing interactive effects	81,024	0.97	78,927	0.53	41,831	17.4
	Water (gallons)	5,412,633	0.83	4,493,230	0.53	2,381,412	17.4
	Water (kWh)	21,309	0.83	17,690	0.53	9,375	17.4
Nicor Gas	Therms	279,610	0.97	271,864	0.54	146,806	20.6
	Therms removing interactive effects	395,159	0.97	384,929	0.54	207,862	20.6
Peoples Gas	Therms	311,074	0.97	302,456	0.54	163,326	20.6
	Therms removing interactive effects	370,871	0.97	361,270	0.54	195,086	20.6
North Shore Gas	Therms	79,337	0.97	77,139	0.54	41,655	20.6
	Therms removing interactive effects	87,453	0.97	85,189	0.54	46,002	20.6

* A deemed value. Source: Illinois SAG website: **https://www.ilsag.info/evaluator-ntg-recommendations-for-2021**.
Source: Evaluation team analysis

The overall program realization rate and nearly all of the individual project realization rates are close to 1.0. This indicates the current level of analysis and quality assurance/quality control (QA/QC) is high. The issues that had the largest effect on adjusting ex ante gross savings were incorrect cooling efficiencies and typographical errors.

The evaluation team developed several recommendations based on findings from the CY2021 evaluation.

Finding 1. Several projects (1275, 1214, 1261) included an incorrect cooling efficiency used in the building simulation. This appears to be due to an error in the approach used to calculate the total unit energy efficiency rating (EER) to the energy input ratio (EIR) parameter required by the building simulation program, resulting in the fan energy being included in the compressor cooling efficiency values.

> **Recommendation 1.** Correctly calculate EIR from unit EER by removing the fan energy from the EER rating to convert to compressor EIR.

Finding 2. Several projects were adjusted due to apparent typographical errors. Project 0924, for example, was adjusted due to the boiler aquastat setpoint being input as 0°F instead of 140°F. Additionally, the lighting fixture wattages were input incorrectly in project 1068, and the

[3] The evaluation achieved relative precisions of 4%, 1%, and 3% for demand, energy, and therm savings, respectively, at the 90% confidence level.

baseline energy recovery ventilation (ERV) effectiveness was inadvertently input as 5% rather than 50% in project 1254, resulting in a significant reduction in natural gas savings.

> **Recommendation 2.** Perform QA/QC of project documentation to ensure parameter values are documented correctly.

Finding 3. The savings for several projects were built up from parametric runs completed across multiple models, yet for project 1273, the evaluation team identified inconsistent adjustments across the multiple models, resulting in a mismatch in operation. This mismatch resulted in the appearance of greater electric savings and less natural gas savings than were calculated in the evaluation when the parametric runs were combined into a single model. Therefore, the electric savings for this project were adjusted down and gas savings were adjusted up.

> **Recommendation 3.** When multiple independent models are used, take extra care to ensure updates to parameters are consistently transferred across the different models.

Appendix A. Impact Analysis Methodology

A.1 Engineering Methodology

The building energy models used in the engineering analysis are included in Table 6-1. 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 New Construction 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 project construction permit date. Projects with a construction permit date prior to June 30, 2019 used IECC 2015 (based on ASHRAE 90.1-2013) and those with a construction permit date after July 1, 2019 used 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. Peak demand values are only shown with interactive effects as required for PJM reporting. 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 and demand savings by multiplying the verified gross savings estimates by a NTG ratio. In CY2021, 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 New Construction Program to support the engineering desk reviews. The team designed the sample to provide 90/10 confidence and precision for evaluated kWh, kW, therm, and Million British Thermal Unit (MMBtu) savings estimates.

A.2 Sampling Approach

Consistent with previous evaluations, the evaluation team developed a 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 kW, kWh, and therm savings, considering savings with and without interactive effects. This approach also targeted 90/10 precision at the MMBtu level.

The team sampled CY2021 projects in two waves. Wave 1 included all projects completed during the first half of the year, while Wave 2 included all projects completed thereafter. The Wave 1 sample frame contained all 31 projects with electric or gas savings completed as of July 14, 2021. The Wave 2 sample frame contained the remaining 57 projects completed between July 15, 2021 and December 31, 2021. For each wave, the evaluation divided the sample frame into strata based on the overall MMBtu savings of each project and randomly selected projects within those strata. In Wave 2, the evaluation team included a certainty stratum to capture larger projects than those in the highest MMBtu stratum. After completing the desk reviews and calculating project-specific realization rates, the team developed case weights to extrapolate the results to similar projects, ensuring the engineering results represent the population of CY2021 participants.

Table A-1, Table A-2, Table A-3, and Table A-4 describe the sample frame for electric and gas projects in Wave 1 and Wave 2, respectively.

Table A-1. Wave 1 Sample Characterization – Electric Projects

Stratum	Boundaries (MWh)	Electric Projects in Sample Frame	Sample Frame Ex Ante Savings (MWh)	Electric Projects in Sample	Sample Ex Ante Savings (MWh)	% of Electric Projects in Sample	% of Electric Savings in Sample
1	>0 - 200	19	1,575	5	457	26%	29%
2	>200 - 700	7	2,583	3	750	43%	29%
3	>700	5	5,122	4	4,177	80%	82%
Total		**31**	**9,279**	**12**	**5,384**	**39%**	**58%**

Source: ComEd tracking data and evaluation team analysis

Table A-2. Wave 1 Sample Characterization – Gas Projects

Stratum	Boundaries (Therms)	Gas Projects in Sample Frame	Sample Frame Ex Ante Savings (Therms)	Gas Projects in Sample	Sample Ex Ante Savings (Therms)	% of Gas Projects in Sample	% of Gas Savings in Sample
1	>0 - 6,500	11	30,119	3	9,995	27%	33%
2	>6,500 - 11,500	10	87,621	3	23,319	30%	27%
3	>11,500	8	151,317	6	120,615	75%	80%
Total		**29**	**269,057**	**12**	**153,929**	**41%**	**57%**

Source: ComEd tracking data and evaluation team analysis

Table A-3. Wave 2 Sample Characterization – Electric Projects

Stratum	Boundaries (MWh)	Electric Projects in Sample Frame	Sample Frame Ex Ante Savings (MWh)	Electric Projects in Sample	Sample Ex Ante Savings (MWh)	% of Electric Projects in Sample	% of Electric Savings in Sample
1	>0 - 160	28	2,178	3	351	11%	16%
2	>160 - 600	17	4,826	6	1,828	35%	38%
3	>600	9	8,018	7	6,727	78%	84%
4	Certainty Stratum	2	5,748	2	5,748	100%	100%
Total		**56**	**20,770**	**18**	**14,654**	**32%**	**71%**

Source: ComEd tracking data and evaluation team analysis

Table A-4. Wave 2 Sample Characterization – Gas Projects

Stratum	Boundaries (Therms)	Gas Projects in Sample Frame	Sample Frame Ex Ante Savings (Therms)	Gas Projects in Sample	Sample Ex Ante Savings (Therms)	% of Gas Projects in Sample	% of Gas Savings in Sample
1	>0 - 10,000	35	108,014	5	22,252	14%	21%
2	>10,000 - 20,000	6	87,430	2	31,729	33%	36%
3	>20,000	9	433,918	7	383,361	78%	88%
4	Certainty Stratum	1	36,088	1	36,088	100%	100%
Total		**51**	**665,450**	**15**	**473,430**	**29%**	**71%**

Source: ComEd tracking data and evaluation team analysis

Appendix B. Impact Findings Detailed Results

B.1 Engineering Desk Review Results

Table B-1 shows the results of the engineering desk review, including the ex ante savings, verified savings, and the resulting realization rate 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. Realization rates below 1.00 indicate that a project received a downward adjustment to energy savings, while realization rates above 1.00 indicate that a project received an upward adjustment to energy savings. Projects with gas savings that did not receive a gas incentive are not claimable by a gas utility. All energy savings include 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-0924	Nicor Gas	690,967	4,992	634,405	4,750	0.92	0.95
	Minor DHW adjustments (pump and setpoint temp). A negative electric adjustment was made due to incorrect handling of ERV pressure drops.						
CINC-0956	Peoples Gas	236,239	10,721	229,744	10,730	0.97	1.00
	Adjustment for accidental inclusion of cooling in garage ventilation system.						
CINC-1025	Nicor Gas	1,070,473	9,492	1,086,111	9,492	1.01	1.00
	Substantial, but offsetting corrections for VRF and Smart Thermostat modeling methodologies. Other minor adjustments to lighting and DHW.						
CINC-1066	North Shore Gas	180,934	28,654	180,935	28,653	1.00	1.00
	No adjustments.						
CINC-1068	Nicor Gas	300,073	1,535	278,528	2,063	0.93	1.34
	Adjusted LPD to account for typo in takeoff. Gas changed because of interactive lighting effects.						
CINC-1089	Nicor Gas	115,277	13,074	117,030	12,893	1.02	0.99
	Correcting wall insulation R-value, exterior lighting calculation, and cooling EIR calc.						
CINC-1116	Nicor Gas	206,342	3,477	206,342	3,477	1.00	1.00
	No adjustments.						
CINC-1149	Nicor Gas	800,799	15,049	800,719	15,049	1.00	1.00
	No adjustments.						
CINC-1188	No Gas Utility	65,055	505	64,875	505	1.00	1.00
	No adjustments.						
CINC-1267	Nicor Gas	38,522	6,734	38,522	6,734	1.00	1.00
	Correction of window glass conductance calculation. Minor overall impact.						
CINC-1275	Nicor Gas	54,917	4,700	56,574	4,716	1.03	1.00
	Minor changes to DHW calculation and Exterior Lighting power.						
CINC-1288	No Gas Utility	1,571,471	-	1,571,479	-	1.00	N/A
	No adjustments.						
CINC-0885	No Gas Utility	101,126	-	101,126	-	1.00	N/A
	No adjustments.						
CINC-0932	Nicor Gas	287,450	12,062	287,450	12,062	1.00	1.00
	No adjustments.						
CINC-0980	Peoples Gas	631,670	83,916	631,670	83,916	1.00	1.00
	No adjustments.						

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-1022	No Gas Utility	767,973	-	766,738	-	1.00	N/A
	The baseline U-value was slightly adjusted. The U-value of the metal-framed wall was listed as 0.64. However, per AHSREA-90.1-2013 this should have been 0.055. Since this only accounted for 15% of the wall area, the overall impact was very small, changing the U-value from 0.086 to 0.0846.						
CINC-1029	Peoples Gas	657,704	93,141	657,704	93,141	1.00	1.00
	No adjustments.						
CINC-1133	Nicor Gas	1,021,910	8,187	1,021,910	8,389	1.00	1.02
	It was determined that thermal efficiency of the condensing boilers is 96% rather than 95% as stated in the ex ante analysis. Savings were updated.						
CINC-1143	No Gas Utility	3,321,909	-	3,321,909	-	1.00	N/A
	No adjustments.						
CINC-1164	Nicor Gas	1,040,307	32,391	1,040,307	32,391	1.00	1.00
	No adjustments.						
CINC-1169	Peoples Gas	230,728	25,138	230,728	25,138	1.00	1.00
	No adjustments.						
CINC-1179	Peoples Gas	132,763	910	132,763	910	1.00	1.00
	No adjustments.						
CINC-1214	Nicor Gas	168,678	4,600	172,881	4,600	1.02	1.00
	A prorated approach was used to determine ex post savings due to a change in baseline U-factor requirements. IECC table 402.1.4 indicates that a U-factor of .064 shall be used in metal framed buildings in climate zone 2. The U-factor that was used to determine ex ante savings was .066. A prorated method based on the ex post and ex ante U-values was used to determine adjusted energy savings. This reduced the savings by approximately 17% for this measure to account for an improvement over baseline of .010 in the ex post case instead of an improvement of 0.012.						
CINC-1233	Peoples Gas	410,237	14,979	403,955	14,949	0.98	1.00
	In the model, the kitchen hood controls are completed changing the SP on five small kitchen constant volume units to reduce the fan kW and energy usage. This approach is unusual but not unreasonable. However, each of the five fans in the baseline had a demand of 0.792 kW, for a total of 3.96 kW. Based on the as-builts, the installed vent fan was 3 HP fan with a BHP of 2.25 (1.92 kW). The savings for this measure were reduced proportionally. The savings for this measure were reduced by 52%, but the overall savings impact is still negligible.						
CINC-1254	Nicor Gas	221,588	12,576	220,559	5,018	1.00	0.40
	For the shop model, the baseline ERV effectiveness was input as 5%. This appears to be a typo and should have been 50%.						
CINC-1261	No Gas Utility	2,426,058	-	2,404,434	-	0.99	N/A
	The savings were calculated using an incorrect formula for EIR. Specifically, EIR was calculated as 1/COP instead of EIR = ((1/EER)-0.012167)/((1/3.413)+0.012167) to remove the fan portion of the energy consumption.						
CINC-1273	Nicor Gas	995,975	49,224	884,205	52,930	0.89	1.08
	It appears that there was an error made in the original analysis that likely occurred when the operation of the facility was adjusted from 24/7 to 5 days a week. In the original 24/7 operation analysis, the destrat fans save 18,992 therms, but require 148,866 kWh per year to operate. In the 5/7 operation model, the gas savings are 14,057 therms (approximately 5/7 of the original savings estimate). However, the electric penalty was reduced by more than 80%, to 29,605 kWh. A penalty of 111,777 is more reasonable. The models were rerun with increased internal gains based on the higher expected fan operation, which reduced the (interactive effects) electric savings but increased the gas savings.						
CINC-1274	North Shore Gas	117,109	4,359	117,089	4,276	1.00	0.98
	Only a baseline model INP was provided. The parametric runs were recreated based on the information in the project file. However, the resulting gas savings were inconsistent with the claimed gas savings. Note that the LPD may be slightly better than claimed, depending on the specific voltage of the installed LED lights. The project documentation confirms the efficiency upgrades listed but the resulting savings differ slightly. The causes for the discrepancy is unknown						
CINC-1281	Nicor Gas	1,581,927	7,401	1,576,357	(942)	1.00	-0.13
	The majority of the gas savings were due to demand controlled ventilation of the retail space. Based on the information in the file, the DCV was included in the plans. However, the sequence of operation was to increase the OA levels anytime the CO2 levels exceed 500 PPM and then ramp down when CO2 levels drop below 450 CFM. Atmospheric CO2 levels are approximately 415 PPM worldwide and 440 PPM in urban areas. Typical DCV setpoints are in the 1,000 to 1,100 PPM range. The lower CO2 setpoint will reduce the savings potential for this measure. To account for this, the minimum OA level for the HVAC system was set to no less than 0.1 CFM/SF based on engineering judgement. It should also be noted that the claimed gas savings for the upgraded heating efficiency based on the recreated models was 1,330 therms, slightly higher than the 1,094 claimed. The source of the discrepancy is not known.						
CINC-1312	No Gas Utility	471,182	-	472,649	-	1.00	N/A
	Very minor differences in lighting fixture counts. Updating results in less than a 0.3% difference in wattage.						

Source: ComEd tracking data and evaluation team analysis
N/A = not applicable (refers to a piece of data that cannot be produced or does not apply).
DHW – Domestic Hot Water
VRF – Variable Refrigerant Flow
LPD – Lighting Power Density
SP – Static Pressure
HP – Heat Pump
BHP – Brake Horsepower
INP – This is a file type.
OA – Outdoor Air
CFM – Cubic Feet per Minute
PPM – Parts per Million
DCV – Demand Controlled Ventilation

Appendix C. Total Resource Cost Detail

Table C-1 shows the TRC cost-effectiveness analysis inputs available at the time of finalizing this impact evaluation report. This table does not include additional required cost data (e.g., measure costs, program-level incentives, and non-incentive costs). ComEd will provide this data to the evaluation team later.

Table C-1. Total Resource Cost Savings Summary

Utility	Research Category	Units	Quantity	EUL (years)*	ER Flag†	Gross Electric Energy Savings (kWh)	Gross Peak Demand Reduction (kW)	Gross Gas Savings (Therms)	Gross Secondary Savings due to Water Reduction (kWh)	Gross Heating Penalty (kWh)	Gross Heating Penalty (Therms)	NTG (kWh)	NTG (kW)	NTG (Therms)	Net Electric Energy Savings (kWh)	Net Peak Demand Reduction (kW)	Net Gas Savings (Therms)	Net Secondary Savings due to Water Reduction (kWh)	Net Heating Penalty (kWh)	Net Heating Penalty (Therms)
ComEd	Electric Saving	Project	22	17.4	No	29,863,565	4,400.43	78,927	17,690	-617,475	-77,779	0.53	0.53	0.53	15,827,689	2,332.23	41,831	9,375	-327,262	-41,223
Nicor Gas	Gas Savings	Project	38	20.6	No	0	0.00	384,929	0	0	-113,066	N/A	N/A	0.54	0	0.00	207,862	0	0	-61,056
Peoples Gas	Gas Savings	Project	21	20.6	No	0	0.00	361,270	0	0	-58,814	N/A	N/A	0.54	0	0.00	195,086	0	0	-31,760
North Shore Gas	Gas Savings	Project	7	20.6	No	0	0.00	85,189	0	0	-8,050	N/A	N/A	0.54	0	0.00	46,002	0	0	-4,347

Note: To avoid double counting, the verified gross kWh and net kWh used in the TRC analysis exclude secondary energy savings from water reduction measures.

N/A = not applicable (refers to a piece of data that cannot be produced or does not apply).

The program saved 4,493,230 gallons of water representing 17,690 gross kWh and 9,375 net kWh.

* The total of the EUL column is the weighted average measure life (WAML) and is calculated as the sum product of EUL and measure savings divided by total program savings.

† Early replacement (ER) measures are flagged as YES, otherwise a NO is indicated in the column.

Source: ComEd tracking data and evaluation team analysis