Guidehouse

Combined Utility Non-Residential New Construction Impact Evaluation Report

Energy Efficiency / Demand Response Plan:
Program Year 2020 (CY2020)
(1/1/2020-12/31/2020)

Prepared for:
ComEd
Nicor Gas
Peoples Gas
North Shore Gas

FINAL

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1. Introduction

This report presents results from the CY2020 impact evaluation of the Combined Utility Non-Residential New Construction Program (New Construction Program) implemented for ComEd, Nicor Gas, Peoples Gas, and North Shore Gas. It summarizes the energy and demand impacts for the total program broken out by utility and program structure details. The appendices provide the impact analysis methodology and details of the total resource cost (TRC) inputs. CY2020 covers January 1, 2020 through December 31, 2020.

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 designs 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 CY2020, the program had 101 participants, with 68 projects served jointly by ComEd and one of the gas utilities, as Table 2-1 shows.

Table 2-1. CY2020 Volumetric Findings Detail

Participation	Count of Projects
ComEd Only	33
ComEd and Nicor Gas	46
ComEd and Peoples Gas	20
ComEd and North Shore Gas	2
Total	**101**

Source: ComEd tracking data and evaluation team analysis

3. Program Savings Detail

Table 3-1 summarizes the incremental energy and demand savings the New Construction Program achieved in CY2020. Natural gas savings are only those that ComEd may be able to claim, which excludes savings the gas utilities claim, either via joint or non-joint programs.[1]

[1] The evaluation determines which gas savings are counted toward the goal while producing the portfolio-wide summary report.

Table 3-2 summarizes the incremental therm savings the New Construction Program achieved in CY2020 claimed by the gas utilities. Total verified net electric savings for CY2020 are 18,640,332 kWh, including 17,426,616 kWh in electric savings and 1,213,715 kWh from gas savings converted to electricity.[2]

Table 3-1. CY2020 Total Annual Incremental Electric Savings

Savings Category	Energy Savings (kWh)	Summer Peak* Demand Savings (kW)
Electricity		
Ex Ante Gross Savings	30,586,186	5,085
Program Gross Realization Rate	0.97	0.87
Verified Gross Savings	29,536,638	4,444
Program Net-to-Gross Ratio (NTG)	0.59	0.59
Verified Net Savings	17,426,616	2,622
Converted from Gas†		
Ex Ante Gross Savings	2,313,702	NA
Program Gross Realization Rate	0.89	NA
Verified Gross Savings	2,057,145	NA
Program Net-to-Gross Ratio (NTG)	0.59	NA
Verified Net Savings	1,213,715	NA
Total Electric Plus Gas		
Ex Ante Gross Savings	32,899,888	5,085
Program Gross Realization Rate	0.96	0.87
Verified Gross Savings	31,593,782	4,444
Program Net-to-Gross Ratio (NTG)	0.59	0.59
Verified Net Savings	18,640,332	2,622

NA = not applicable (refers to a piece of data that cannot be produced or does not apply)
*The coincident summer peak period is defined as 1:00 p.m.- 5:00 p.m. Central Prevailing Time on non-holiday weekdays, June through August.
† Gas savings 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 determines which gas savings are 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."
Source: ComEd tracking data and evaluation team analysis

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

Table 3-2. CY2020 Total Annual Incremental Therm Savings

Savings Category	Nicor Gas (therms)	Peoples Gas (therms)	North Shore Gas (therms)
Gas*			
Ex Ante Gross Savings	532,718	492,851	7,127
Program Gross Realization Rate	0.89	0.89	0.89
Verified Gross Savings	473,647	438,201	6,337
Program Net-to-Gross Ratio (NTG)	0.58	0.58	0.58
Verified Net Savings	274,715	254,156	3,675

*Gas savings with electric interactive effects removed.

Source: ComEd, Nicor Gas, Peoples Gas, and North Shore Gas tracking data and evaluation team analysis

4. Cumulative Persisting Annual Savings

Table 4-1 to Table 4-3 shows the total verified gross savings for the New Construction Program and the cumulative persisting annual savings (CPAS) for the measures installed in CY2020. Figure 4-1 shows the savings across the useful life of the measures. The electric CPAS in 2020 is 17,426,616 kWh (Table 4-1). The CY2020 gas contribution to CPAS (converted to equivalent electricity) is 1,213,715 kWh (Table 4-2). Adding the gas and electric contributions produces 18,640,332 kWh of total CY2020 contribution to CPAS (Table 4-3). The historic rows in each table are the CPAS contribution back to CY2018. The Program Total Electric CPAS and Program Total Gas CPAS rows are the sum of the CY2020 contribution and the historic contribution.

Table 4-1. Cumulative Persisting Annual Savings (CPAS) – Electric

End Use Type	Research Category	EUL	CY2020 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	29,536,638	0.59	303,223,124			17,426,616	17,426,616	17,426,616	17,426,616	17,426,616	17,426,616	17,426,616
CY2020 Program Total Electric Contribution to CPAS			29,536,638		303,223,124			17,426,616	17,426,616	17,426,616	17,426,616	17,426,616	17,426,616	17,426,616
Historic Program Total Electric Contribution to CPAS‡						22,239,823	40,976,658	40,976,658	40,976,658	40,976,658	40,976,658	40,976,658	40,976,658	40,976,658
Program Total Electric 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
CY2020 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	17,426,616	17,426,616	17,426,616	17,426,616	17,426,616	17,426,616	17,426,616	17,426,616	17,426,616	17,426,616	6,970,647	
CY2020 Program Total Electric Contribution to CPAS		17,426,616	17,426,616	17,426,616	17,426,616	17,426,616	17,426,616	17,426,616	17,426,616	17,426,616	17,426,616	6,970,647	-
Historic Program Total Electric Contribution to CPAS‡		40,976,658	40,976,658	40,976,658	40,976,658	40,976,658	40,976,658	40,976,658	40,976,658	27,632,764	7,494,734	-	-
Program Total Electric 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	-
CY2020 Program Incremental Expiring Electric Savings§		-	-	-	-	-	-	-	-	-	-	10,455,970	6,970,647
Historic Program Incremental Expiring Electric Savings‡§		-	-	-	-	-	-	-	-	13,343,894	20,138,030	7,494,734	-
Program Total Incremental Expiring Electric Savings§		-	-	-	-	-	-	-	-	13,343,894	20,138,030	17,950,704	6,970,647

Note: The green highlighted cell shows program total first-year electric savings. The gray cells are blank, indicating values irrelevant to the CY2020 contribution to CPAS.

*A deemed value. Source found on the Illinois Stakeholder Advisory Group (SAG) website: https://www.ilsag.info/ntg_2020.

† Lifetime savings are the sum of CPAS savings through the effective useful life (EUL).

‡ Historic savings go back to CY2018.

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

Source: Evaluation team analysis

Table 4-2. Cumulative Persisting Annual Savings (CPAS) – Gas

End Use Type	Research Category	EUL	CY2020 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	70,186	0.59	720,527			41,410	41,410	41,410	41,410	41,410	41,410	41,410
CY2020 Program Total Gas Contribution to CPAS (Therms)			70,186		720,527			41,410	41,410	41,410	41,410	41,410	41,410	41,410
CY2020 Program Total Gas Contribution to CPAS (kWh Equivalent)‡						-	-	1,213,715	1,213,715	1,213,715	1,213,715	1,213,715	1,213,715	1,213,715
Historic Program Total Gas Contribution to CPAS (kWh Equivalent)‡§						981,763	2,500,239	2,500,239	2,500,239	2,500,239	2,500,239	2,500,239	2,500,239	2,500,239
Program Total Gas 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
CY2020 Program Incremental Expiring Gas Savings (Therms)‖									-	-	-	-	-	-
CY2020 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	41,410	41,410	41,410	41,410	41,410	41,410	41,410	41,410	41,410	41,410	16,564	-
CY2020 Program Total Gas Contribution to CPAS (Therms)		41,410	41,410	41,410	41,410	41,410	41,410	41,410	41,410	41,410	41,410	16,564	-
CY2020 Program Total Gas Contribution to CPAS (kWh Equivalent)‡		1,213,715	1,213,715	1,213,715	1,213,715	1,213,715	1,213,715	1,213,715	1,213,715	1,213,715	1,213,715	485,486	-
Historic Program Total Gas Contribution to CPAS (kWh Equivalent)‡§		2,500,239	2,500,239	2,500,239	2,500,239	2,500,239	2,500,239	2,500,239	2,500,239	1,911,182	607,391	-	-
Program Total Gas 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	-
CY2020 Program Incremental Expiring Gas Savings (Therms)‖		-	-	-	-	-	-	-	-	-	-	24,846	16,564
CY2020 Program Incremental Expiring Gas Savings (kWh Equivalent)‡‖		-	-	-	-	-	-	-	-	-	-	728,229	485,486
Historic Program Incremental Expiring Gas Savings (kWh Equivalent)‡§‖		-	-	-	-	-	-	-	-	589,058	1,303,791	607,391	-
Program Total Incremental Expiring Gas Savings (kWh Equivalent)‡‖		-	-	-	-	-	-	-	-	589,058	1,303,791	1,335,620	485,486

Note: The green highlighted cell shows program total first-year gas savings in kWh equivalents. The gray cells are blank, indicating no values or no contribution to calculating CPAS in CY2020.

*A deemed value. Source found on the Illinois SAG website: https://www.ilsag.info/ntg_2020.

† 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 Yn-1 - CPAS Y_n.

Source: Evaluation team analysis

Table 4-3. Cumulative Persisting Annual Savings (CPAS) – Total

End Use Type	Research Category	EUL	CY2020 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	31,593,782	0.59	324,341,770			18,640,332	18,640,332	18,640,332	18,640,332	18,640,332	18,640,332	18,640,332
CY2020 Program Total Contribution to CPAS			31,593,782		324,341,770			18,640,332	18,640,332	18,640,332	18,640,332	18,640,332	18,640,332	18,640,332
Historic Program Total Contribution to CPAS‡						23,221,586	43,476,897	43,476,897	43,476,897	43,476,897	43,476,897	43,476,897	43,476,897	43,476,897
Program Total 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
CY2020 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	18,640,332	18,640,332	18,640,332	18,640,332	18,640,332	18,640,332	18,640,332	18,640,332	18,640,332	18,640,332	7,456,133	-
CY2020 Program Total Contribution to CPAS		18,640,332	18,640,332	18,640,332	18,640,332	18,640,332	18,640,332	18,640,332	18,640,332	18,640,332	18,640,332	7,456,133	-
Historic Program Total Contribution to CPAS‡		43,476,897	43,476,897	43,476,897	43,476,897	43,476,897	43,476,897	43,476,897	43,476,897	29,543,946	8,102,125	-	-
Program Total 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	-
CY2020 Program Incremental Expiring Savings§		-	-	-	-	-	-	-	-	-	-	11,184,199	7,456,133
Historic Program Incremental Expiring Savings‡§		-	-	-	-	-	-	-	-	13,932,952	21,441,821	8,102,125	-
Program Total Incremental Expiring Savings§		-	-	-	-	-	-	-	-	13,932,952	21,441,821	19,286,324	7,456,133

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 no contribution to calculating CPAS in CY2020.

*A deemed value. Source found on the Illinois SAG website: https://www.ilsag.info/ntg_2020.

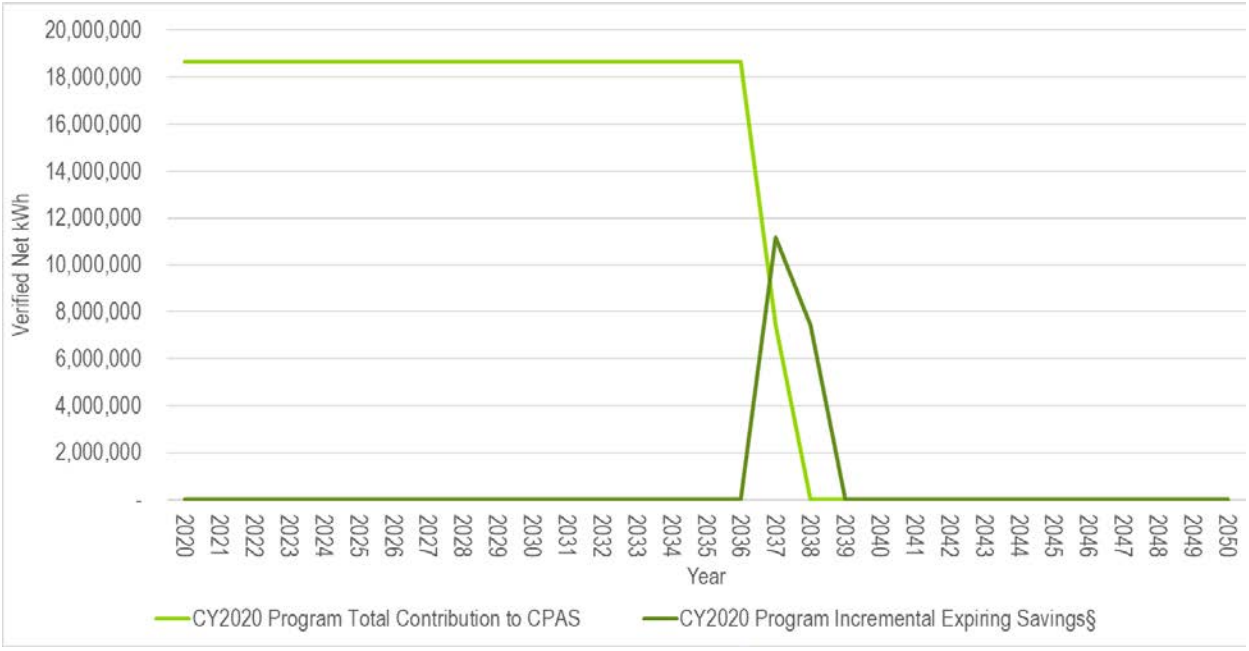
† Lifetime savings are the sum of CPAS savings through the EUL.

‡ Historic savings go back to CY2018.

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

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

The program only includes one measure, so the 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 101 projects through the New Construction Program in CY2020. Using a stratified random sampling approach, the evaluation team selected 30 projects to receive an engineering desk review. All 30 projects also had gas savings. For most projects, the desk reviews independently confirmed the estimation of 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 0.97 for kWh with interactive effects removed and 0.98 for kWh including interactive effects. For Summer peak kW, the final realization rate was 0.87 with interactive effects removed and 0.87 with interactive effects. For projects with gas savings, the final realization rate was 0.89 for therms with interactive effects removed and 0.85 for therms with interactive effects.

The evaluation team calculated verified gross and net savings for energy and coincident peak demand by using participant-specific whole building energy models developed for baseline and projected design scenarios. For each participant, the design energy model estimates the annual

whole building energy consumption of the proposed building based on architectural, building envelope, 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 v8.0
Evaluation Model Results	Evaluated	eQuest/DOE2.2/DOE2.1E
Realization Rate – All Projects	Evaluated	Program savings and evaluated savings
NTG – Electric and Gas	Deemed	Illinois SAG Consensus
EUL	Mixture	TRM v8.0 – Volume 4 Attachment B

*TRM is the Illinois Statewide Technical Reference Manual version 8.0 from http://www.ilsag.info/technical-reference-manual.html. The NTG values can be found on the Illinois SAG website: https://www.ilsag.info/ntg_2020.

6.2 Other Impact Findings and Recommendations

Table 6-2 summarizes the incremental electric energy and demand savings the New Construction Program achieved for ComEd and the therm savings achieved in this period for each gas utility. The CY2020 evaluation achieved a 90/10 confidence and precision level for electric energy and therm savings and 90/20 confidence and precision for demand savings.[3]

[3] The evaluation achieved relative precisions of 19%, 2%, and 5% for demand, energy, and therm savings, respectively, at the 90% confidence level.

Table 6-2. CY2020 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	29,748,185	0.98	29,193,597	0.59	17,224,222	17.4
	kWh removing interactive effects	30,547,215	0.97	29,503,492	0.59	17,407,060	17.4
	Total kW	6,523	1.12	7,285	0.59	4,298	17.4
	Total kW removing interactive effects	6,523	1.12	7,285	0.59	4,298	17.4
	Summer Peak kW	5,085	0.87	4,444	0.59	2,622	17.4
	Winter Peak kW	4,176	0.78	3,250	0.59	1,918	17.4
	Therms	21,432	0.85	18,295	0.59	10,794	17.4
	Therms removing interactive effects	78,939	0.89	70,186	0.59	41,410	17.4
Nicor Gas	Therms	411,871	0.85	351,593	0.58	203,924	20.6
	Therms removing interactive effects	532,718	0.89	473,647	0.58	274,715	20.6
Peoples Gas	Therms	419,844	0.85	358,400	0.58	207,872	20.6
	Therms removing interactive effects	492,851	0.89	438,201	0.58	254,156	20.6
North Shore Gas	Therms	5,869	0.85	5,010	0.58	2,906	20.6
	Therms removing interactive effects	7,127	0.89	6,337	0.58	3,675	20.6

Source: Evaluation team analysis

The evaluation team developed several recommendations based on findings from the CY2020 evaluation listed below. These findings suggest ways to improve realization rates, enhance the efficiency of evaluations, and promote transparency in the implementation contractor's calculations and analyses. All of the recommendations are applicable to natural gas and electric projects.

Finding 1. Most of the major adjustments in this cycle were due to project-specific errors, not widely generalizable issues. For example, where multiple fans exist and operate in parallel on a fan power calculation, the fan power calculated was only for a single fan rather than all the fans operating. This adjustment reduced claimed savings by approximately 480,000 kWh and reduced the project's realization rate by almost one third.

Recommendation 1. Guidehouse recommends the implementation team continue the general collaborative process built with the evaluation team over the past several years. The implementation team should consider additional quality assurance/quality control (QA/QC) for measures that amount to greater than 10% of the claimed savings.

Finding 2. ComEd claimed savings for one project (NCID-1145) based off a previous project with no substantiating evidence that the projects were indeed similar enough. In this case, Guidehouse believes the measure should save energy and – using engineering estimates and rules of thumb – the savings appeared to be reasonable. However, the evaluation team would have had to rely on conservative assumptions or re-engineered calculations had the savings not appeared reasonable.

Recommendation 2. Guidehouse reiterates that any custom savings calculations should be specific to that project and able to clearly demonstrate verifiable savings strategies. The implementation contractor should include all supporting documentation in the project files.

Finding 3. A few projects did not contain verification photos, which are helpful to document installed system performance, particularly if claimed performance data differ from design documentation. If the implementation team updates savings during the verification phase without sufficient documentation, those savings may be at risk because they are not supported by the project documentation.

Recommendation 3. Guidehouse recommends that verification photos be included on all future projects, to the extent possible.

Finding 4. Guidehouse believes the implementation team typically attempts to use load profiles (e.g., lighting, equipment, etc.) that reflect the most likely actual usage of the facility during the design phase. However, some projects received upwards adjustments to their lighting profiles for reasons unclear to the evaluation team. If these adjustments do not reflect the actual building profiles, these adjustments may put the savings at risk in future evaluations.

Recommendation 4. Guidehouse recommends that the implementation team attempt to match actual load profiles from the building during the verification phase. For example, using data such as lighting control trend data or interval data from the building meter to calibrate the modeled schedules to actual lighting and HVAC schedules. Guidehouse also recommends documenting these adjusted load profiles and how they were calculated or calibrated in the project files.

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 scenario and the baseline scenario.

The energy performance baseline 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 specifically allows for 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 date that the project applied to the program. Projects that applied prior to June 30, 2019 used the IECC 2015 (based on ASHRAE 90.1-2013), and those that applied after July 1, 2019 use IECC 2018 (based on ASHRAE 90.1-2016). The evaluation team used a variety of modeling programs and methods, relying on the same software or methods program implementors used to estimate the ex ante models. Although the applicable energy codes may change by the time a project obtains a building permit, the evaluation team believes this is rare and the program's approach of using the application date to determine the applicable building code is reasonable and justified.

The team also calculated interactive effects, where applicable, for each fuel type. 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 the other fuel type. Interactive effects are calculated in the model. Peak kW values are only shown with interactive effects because it is required for PJM reporting. For utilities' goals tracking, the 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 both 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 net-to-gross (NTG) ratio. In CY2020, the NTG values used to calculate the net verified savings were based on past evaluation research and approved by the Illinois SAG.

As in prior years, the evaluation team selected a stratified random sample for the New Construction Program to support the engineering desk reviews. The approach focused on electric and gas savings. The team designed the sample to provide 90/10 confidence and precision for both evaluated kWh and therm savings estimates. This approach was also designed to provide 90/10 precision for MMBtu and kW savings at the program level.

A.2 Sampling Approach

Consistent with previous evaluations, the evaluation team developed a 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 evaluation team sampled CY2020 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 35 projects with electric or gas savings completed as of June 30, 2020. The Wave 2 sample frame contained the remaining 66 projects completed between July 1, 2020 and December 31, 2020. 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 both waves, the evaluation team included a certainty stratum to capture projects much larger 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 are representative of the population of CY2020 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)	Sample % of Electric Projects	Sample % of Electric Savings
1	>0 – 200	14	1,313	3	227	21%	17%
2	>200 – 400	12	3,632	5	1,522	42%	42%
3	>400	8	5,156	3	1,963	38%	38%
4	Certainty Stratum	1	4,467	1	4,467	100%	100%
Total		35	14,569	12	8,180	34%	56%

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 – 6,000	14	33,339	2	6,878	14%	21%
2	6,001 – 20,000	13	135,104	4	38,921	31%	29%
3	>20,000	6	176,517	5	155,079	83%	88%
4	Certainty Stratum	1	5,440	1	5,440	100%	100%
Total		34	350,400	12	206,318	35%	59%

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)	Sample % of Electric Projects	Sample % of Electric Savings
1	>0 – 100	27	1,088	4	84	15%	8%
2	>100 – 350	27	5,216	7	1,461	26%	28%
3	>350	9	4,873	4	2,499	44%	51%
4	Certainty Stratum	3	4,801	3	4,801	100%	100%
Total		66	15,978	18	8,845	27%	55%

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 – 6,000	34	72,264	5	7,815	15%	11%
2	>6,000 – 18,000	16	176,997	5	53,450	31%	30%
3	>18,000	6	182,236	5	149,067	83%	82%
4	Certainty Stratum	3	329,738	3	329,738	100%	100%
Total		59	761,235	18	540,070	31%	71%

Source: ComEd tracking data and evaluation team analysis

Appendix B. Impact Analysis Detail

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 also table 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

		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-0736	Peoples Gas	1,200,426	126,015	1,460,721	115,717	1.22	0.92
	An adjustment was made because fan energy was not subtracted from EER and COP for WSHPs and the MAU.						
CINC-0750	Nicor Gas	229,325	16,468	222,388	16,468	0.97	1.00
	A small downward adjustment was made because fan energy was not subtracted from EER for packaged equipment cooling performance.						
CINC-0776	Peoples Gas	113,606	7,656	113,606	7,656	1.00	1.00
	No adjustments.						
CINC-0833	Nicor Gas	206,455	18,291	198,935	18,291	0.96	1.00
	A small downward adjustment was made because fan energy was not subtracted from EER for packaged equipment cooling performance.						
CINC-0848	No Gas Incentive	275,629	374	263,857	374	0.96	1.00
	A small downward adjustment was made to maintain the area-based ventilation requirements for the DCV measure.						
CINC-0868	Nicor Gas	46,096	1,794	46,096	1,794	1.00	1.00
	No adjustments.						
CINC-0917	No Gas Incentive	9,850	209	9,850	209	1.00	1.00
	No adjustments.						
CINC-0918	Nicor Gas	1,666,409	123,717	1,241,530	56,115	0.75	0.45
	Some fans were not counted in fan savings calcs. ERV effectiveness was not handled properly.						
CINC-0942	Nicor Gas	310,913	35,596	308,350	35,504	0.99	1.00
	Minor adjustment made as a result of a referencing error in the applications calculation.						

		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-0948	Peoples Gas	237,055	21,057	237,055	21,057	1.00	1.00
	No adjustments.						
CINC-0954	Peoples Gas	790,124	5,058	823,576	3,432	1.04	0.68
	An adjustment was made because fan energy was not subtracted from EER and COP for WSHPs and the MAU. Another adjustment was made because the clothes washer measure savings did not match the TRM.						
CINC-0961	Nicor Gas	385,287	24,514	385,287	24,514	1.00	1.00
	Adjusted demand savings upward for missed credit on ENERGY STAR appliances.						
CINC-0964	Peoples Gas	67,571	15,103	67,571	9,394	1.00	0.62
	Gas savings were adjusted based on a new evaluation simulation. kW values in the tracking database were incorrect and adjusted to properly reflect the implementer's model.						
CINC-0970	Peoples Gas	265,663	57,389	268,474	58,663	1.01	1.02
	A minor adjustment was made on window performance values using IECC rather than 90.1.						
CINC-0988	Peoples Gas	306,426	20,327	306,426	20,326	1.00	1.00
	No adjustments. Some comments on approaches.						
CINC-1011	Nicor Gas	203,113	22,187	202,940	8,772	1.00	0.40
	Makeup air unit savings were not modeled correctly (fan speed minimum incorrect). Savings were adjusted to zero in the window u-value measure because the windows were IECC minimum windows. An adjustment was made to the DHW measure because the analyst used commercial calculations rather than residential.						
CINC-1038	Peoples Gas	718,602	33,966	718,601	33,966	1.00	1.00
	No adjustments. Some comments on approaches.						
CINC-1046	Nicor Gas	184,986	7,193	184,987	7,193	1.00	1.00
	No adjustments. Some comments on approaches.						
CINC-1052	No Gas Incentive	499,979	-	499,954	-	1.00	NA
	Adjustment rescinded.						
CINC-1067	Peoples Gas	134,492	11,148	131,995	10,634	0.98	0.95
	A minor adjustment was made to boiler efficiency values, which were 1% too high in the ex ante model. The remaining minor inconsistencies are likely due to inconsistent weather files.						
CINC-1073	No Gas Incentive	744,715	-	625,126	-	0.84	NA
	A TRM-based calculation was used to calculate savings for the compressed air project.						
CINC-1077	No Gas Incentive	4,467,317	-	4,454,236	-	1.00	NA
	Very minor differences in the simulation runs. Unclear why there are differences—it may be due to minor differences in the weather files used.						

Project ID	Gas Utility	Ex Ante Electric Savings (kWh/yr)	Ex Ante Gas Savings (therm/yr)	Verified Electric Savings (kWh/yr)	Verified Gas Savings (therm/yr)	Realization Rate Electric (kWh) Savings Realization Rate	Realization Rate Gas (therm) Savings Realization Rate
CINC-1112	North Shore Gas	32,166	891	32,166	891	1.00	1.00
	No adjustments.						
CINC-1113	Nicor Gas	206,253	8,806	197,023	8,807	0.96	1.00
	The summer schedule was adjusted to end Sep 5 rather than Jul 5. An adjustment was made because fan energy was not subtracted from the EER and COP for on GSHPs.						
CINC-1129	No Gas Incentive	1,761,409	-	1,761,409	-	1.00	NA
	No adjustments.						
CINC-1145	Nicor Gas	782,748	11,815	782,756	11,815	1.00	1.00
	No adjustments, though information in the project file was insufficient to verify all savings for the ice rink.						
CINC-1194	Nicor Gas	434,566	910	434,566	827	1.00	0.91
	Slight adjustment to baseline door insulation, which had been entered incorrectly.						
CINC-1196	Nicor Gas	108,826	4,262	108,826	4,262	1.00	1.00
	No adjustments.						
CINC-1248	Peoples Gas	28,483	6,007	28,462	6,001	1.00	1.00
	A small downward adjustment was made because fan energy was not subtracted from EER for packaged equipment cooling performance.						
CINC-1263	No Gas Incentive	12,679	-	12,538	-	0.99	NA
	A small downward adjustment was made because fan energy was not subtracted from EER for packaged equipment cooling performance.						

Note: Electric and gas savings include interactive effects. Realization rates are not applicable ("NA") for projects with no ex ante savings.

Source: Evaluation team analysis

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. Additional required cost data (e.g., measure costs, program-level incentive and non-incentive costs) is not included in this table and will be provided 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 Savings	Project	33	17.4	No	29,503,492	4,444.34	70,186	33,146	-309,895	-51,890	0.59	0.59	0.59	17,407,060	2,622.16	41,410	19,556	-182,838	-30,615
Nicor Gas	Gas Savings	Project	46	20.6	No	0	0.00	473,647	0	0	-122,053	NA	NA	0.58	0	0.00	274,715	0	0	-70,791
Peoples Gas	Gas Savings	Project	20	20.6	No	0	0.00	438,201	0	0	-79,801	NA	NA	0.58	0	0.00	254,156	0	0	-46,285
North Shore Gas	Gas Savings	Project	2	20.6	No	0	0.00	6,337	0	0	-1,327	NA	NA	0.58	0	0.00	3,675	0	0	-769

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. The program saved 13,065,087 gallons of water representing 33,146 gross kWh and 19,556 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