



# Nicor Gas and ComEd Residential New Construction Impact Evaluation Report

Energy Efficiency / Demand Response Plan:  
Program Year 2018 (CY2018)  
(1/1/2018-12/31/2018)

Presented to  
ComEd  
Nicor Gas

**FINAL**

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## Nicor Gas and ComEd Residential New Construction Impact Evaluation Report

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## 1. INTRODUCTION

This report presents the results of the impact evaluation of the joint Nicor Gas and ComEd CY2018 Residential New Construction (RNC) Program. It presents a summary of the program structure as well as both program total and measure-level energy and demand impacts. The appendix presents the impact analysis methodology. CY2018 covers January 1, 2018 through December 31, 2018.

## 2. PROGRAM DESCRIPTION

Nicor Gas and ComEd jointly offer the RNC Program. Nicor Gas is the lead utility as most of the avoided costs come from natural gas savings. Residential Science Resources (RSR) implemented the program for Nicor Gas while Slipstream (formerly known as Seventhwave) implemented the program for ComEd.

At the beginning of the third quarter the program introduced a lower level tier that required homes achieve, at minimum, 15% better than code compared to the initial minimum 20% requirement. The program ranks homes in one of the following tiers based on performance:

- Tier 1: 15.00-19.99% above code (new in CY2018)
- Tier 2: 20.00-24.99% above code (Tier 1 in GPY6/EPY9)
- Tier 3: 25.00-29.99% above code (Tier 2 in GPY6/EPY9)
- Tier 4: 30.00% or more above code (Tier 3 in GPY6/EPY9)

The RNC Program included a total of 695 homes in CY2018, with 95% in joint Nicor Gas and ComEd service territory, and the remaining 5% in Nicor Gas territory only. Thirty-three builders and eight Home Energy Rating Score (HERS) rating companies completed homes in CY2018. The following table and figure show the number of homes in each tier.

**Table 2-1. CY2018 Volumetric Findings Detail**

Participation	Joint ComEd/ Nicor Gas Homes	Nicor Gas Only Homes	Total Homes
Tier 1	83	4	87
Tier 2	247	11	258
Tier 3	205	15	220
Tier 4	125	5	130
<b>Total</b>	<b>660</b>	<b>35</b>	<b>695</b>

*Source: ComEd and Nicor Gas tracking data and Navigant team analysis.*

Figure 2-1 shows the total number of homes in each tier in CY2018. Approximately 70% of RNC participation occurs for homes that perform between 20% and 30% above code, compared to 82% in GPY6/EPY9 and 85% in GPY5/EPY8.

Figure 2-1. Number of Participants by Tier

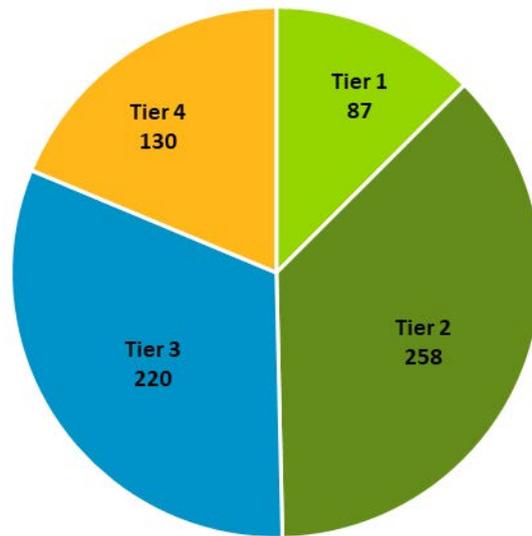


Table 2-2 shows the number of homes in each tier from GPY5/EPY8 through CY2018.

Table 2-2. Number of Homes by Tier Level Comparison (GPY5/EPY8 – CY2018)

Participation Category	CY2018 Total Homes	CY2018 Share of Total*	GPY6/EPY9 Total Homes†	GPY6/EPY9 Share of Total*	GPY5/EPY8 Total Homes	GPY5/EPY8 Share of Total*
Tier 1	87	13%	0	0%	0	0%
Tier 2	258	37%	570	40%	443	49%
Tier 3	220	32%	594	42%	323	36%
Tier 4	130	19%	260	18%	129	14%
<b>Total</b>	<b>695</b>	<b>100%</b>	<b>1,424</b>	<b>100%</b>	<b>895</b>	<b>100%</b>

\* Values may not sum exactly due to rounding.

† Due to the inclusion of the bridge period, GPY6/EPY9 was a 19 month period, as compared to a 12 month period for other program years, and participation was accordingly higher in GPY6/EPY9 than other program years.

Source: Navigant analysis of ComEd and Nicor Gas CY2018, GPY6/EPY9, and GPY5/EPY8 program tracking data.

### 3. PROGRAM SAVINGS DETAIL

Table 3-1 summarizes the incremental electric energy and demand savings the RNC Program achieved in CY2018. Table 3-2 shows the gas savings.

**Table 3-1. CY2018 Total Annual Incremental Electric Savings - ComEd**

Savings Category	Energy Savings (kWh)	Demand Savings (kW)	Summer Peak Demand Savings (kW)
<b>Electricity</b>			
Ex Ante Gross Savings	470,194	NR	NR
Program Gross Realization Rate	0.76	NA	NA
Verified Gross Savings	357,717	41	148
Program Net-to-Gross Ratio (NTG)	0.65	0.65	0.65
Verified Net Savings	232,516	26	96
<b>Converted from Gas*</b>			
Ex Ante Gross Savings	NA	NA	NA
Program Gross Realization Rate	NA	NA	NA
Verified Gross Savings	NA	NA	NA
Program Net-to-Gross Ratio (NTG)	NA	NA	NA
Verified Net Savings	NA	NA	NA
<b>Total Electric Plus Gas</b>			
Ex Ante Gross Savings	470,194	NR	NR
Program Gross Realization Rate	0.76	NA	NA
Verified Gross Savings	357,717	41	148
Program Net-to-Gross Ratio (NTG)	0.65	0.65	0.65
Verified Net Savings	232,516	26	96

\* Ex ante savings generated using REM/Rate building models and verified savings generated using BEopt building models created for the CY2018 evaluation. Both ex ante and verified savings include interactive effects.

\* Gas savings converted to kWh by multiplying therms \* 29.31 (which is based on 100,000 Btu/therm and 3,412 Btu/kWh).

Note: The coincident Summer Peak period is defined as 1:00-5:00 PM Central Prevailing Time on non-holiday weekdays, June through August. The demand is defined as difference in kW in the baseline and energy efficient period.

NA = Not applicable

NR = Not reported

Source: ComEd tracking data and Navigant team analysis.

**Table 3-2. CY2018 Total Annual Incremental Therm Savings – Nicor Gas**

Savings Category	Nicor Gas (therms)
<b>Natural Gas</b>	
Ex Ante Gross Savings*	214,750
Program Gross Realization Rate	1.18
Verified Gross Savings*	252,636
Program Net-to-Gross Ratio (NTG)	0.65
Verified Net Savings	164,213

\* Ex ante savings generated using REM/Rate building models and verified savings generated using BEopt building models created for the CY2018 evaluation. Both ex ante and verified savings include interactive effects.

Source: Nicor Gas tracking data and Navigant team analysis.

#### 4. CUMULATIVE PERSISTING ANNUAL SAVINGS

The measure-specific and total verified gross electric savings for the RNC Program and the cumulative persisting annual savings (CPAS) for the measures installed in CY2018 are shown in the following table and figure. The total CY2018 CPAS across all measures is 232,516 kWh. There are no CPAS equivalent of gas savings converted to electricity for this program that may be counted towards ComEd's goal. The CPAS calculations shown in this section only apply for ComEd.

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

End Use Type	Research Category	EUL	CY2018 Verified Gross Savings	NTG*	Lifetime Net Savings†	Verified Net kWh Savings									
						2018	2019	2020	2021	2022	2023	2024	2025	2026	
Whole Home	Tier 1	18.0	30,994	0.65	362,626	20,146	20,146	20,146	20,146	20,146	20,146	20,146	20,146	20,146	20,146
Whole Home	Tier 2	18.0	117,502	0.65	1,374,771	76,376	76,376	76,376	76,376	76,376	76,376	76,376	76,376	76,376	76,376
Whole Home	Tier 3	18.0	113,981	0.65	1,333,574	74,087	74,087	74,087	74,087	74,087	74,087	74,087	74,087	74,087	74,087
Whole Home	Tier 4	18.0	95,241	0.65	1,114,320	61,907	61,907	61,907	61,907	61,907	61,907	61,907	61,907	61,907	61,907
CY2018 Program Total Electric CPAS			357,717		4,185,293	232,516	232,516	232,516	232,516	232,516	232,516	232,516	232,516	232,516	232,516
CY2018 Program Expiring Electric Savings‡															

End Use Type	Research Category	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
Whole Home	Tier 1	20,146	20,146	20,146	20,146	20,146	20,146	20,146	20,146	20,146					
Whole Home	Tier 2	76,376	76,376	76,376	76,376	76,376	76,376	76,376	76,376	76,376					
Whole Home	Tier 3	74,087	74,087	74,087	74,087	74,087	74,087	74,087	74,087	74,087					
Whole Home	Tier 4	61,907	61,907	61,907	61,907	61,907	61,907	61,907	61,907	61,907					
CY2018 Program Total Electric CPAS		232,516	232,516	232,516	232,516	232,516	232,516	232,516	232,516	232,516	-	-	-	-	-
CY2018 Program Expiring Electric Savings‡		-	-	-	-	-	-	-	-	-	232,516	232,516	232,516	232,516	232,516

Note: The green highlighted cell shows program total first year electric savings.

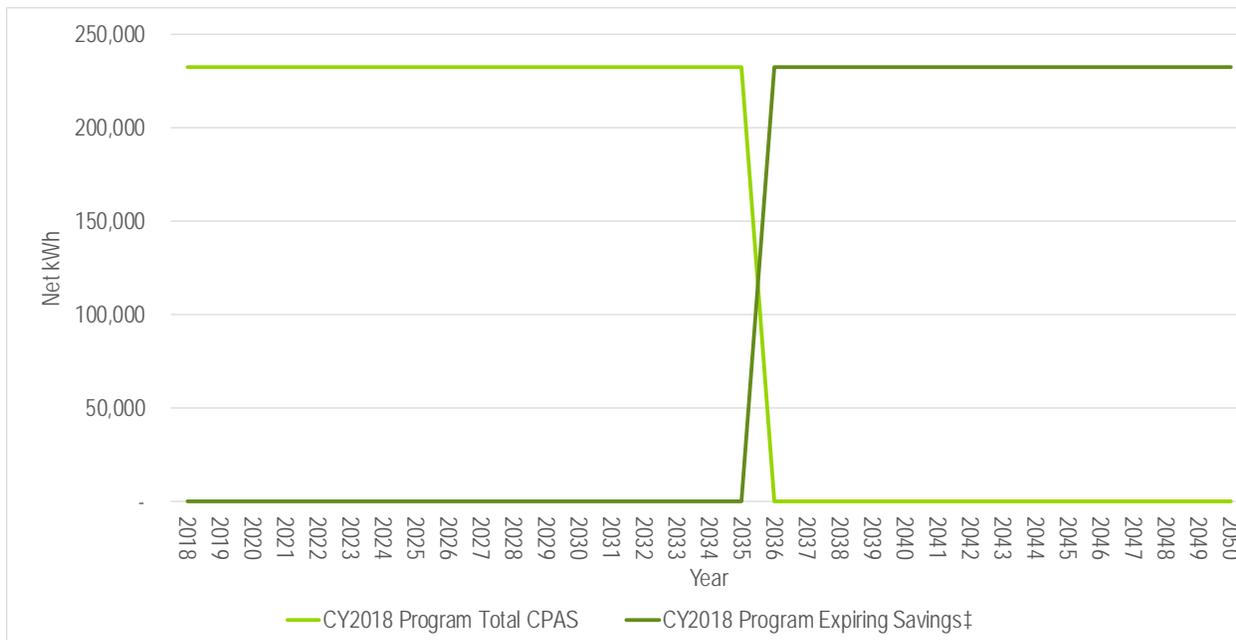
\* A deemed value. Source: ComEd\_NTG\_History\_and\_PY10\_Recommendations\_2017-03-01.xlsx, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>.

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

‡ Expiring savings are equal to CPAS Yn-1 - CPAS Yn + Expiring Savings Yn-1.

Source: Navigant analysis

Figure 4-1. Cumulative Persisting Annual Savings



‡ Expiring savings are equal to CPAS Yn-1 - CPAS Yn + Expiring Savings Yn-1.

Source: Navigant analysis

## 5. PROGRAM SAVINGS BY MEASURE

The RNC Program includes four home performance tiers that vary by performance above code. Table 5-1 summarizes the electric energy savings from the RNC Program by tier. Tier 2 homes contributed the most savings (33% of total ex ante gross kWh savings), followed by Tier 3 and Tier 4 homes. The savings in Tier 1 are comparatively less than other tiers, as Tier 1 was introduced in the third quarter of the year.

Verified electric savings derived from calibrated simulations conducted for the CY2018 evaluation are significantly smaller than ex ante savings. Verified gas savings significantly exceed ex ante savings. The evaluation team observed that not all home characteristics met code requirements. Additionally, some characteristics met or exceeded code more consistently than others. A detailed discussion of the CY2018 calibrated simulation results are provided in Appendix 1. Impact Analysis Methodology and Appendix 2. Impact Analysis Detail. Because Tier 1 homes are a new tier in CY2018, the evaluation team applied realization rates from Tier 2, as Tier 2 homes most closely resemble Tier 1 homes. The verified gross realization rates presented in Table 5-1 and Table 5-4 are weighted based on the number of one-story and two+ story homes. Since the weights vary by tier, the weighted Tier 1 and Tier 2 realization rates vary slightly.

**Table 5-1. CY2018 Energy Savings by Tier – Electric**

End Use Type	Research Category	Ex Ante Gross Savings (kWh)	Verified Gross Realization Rate	Verified Gross Savings (kWh)	NTG*	Verified Net Savings (kWh)	Effective Useful Life
Whole Home	Tier 1	41,003	0.76	30,994	0.65	20,146	18.0
Whole Home	Tier 2	155,712	0.75	117,502	0.65	76,376	18.0
Whole Home	Tier 3	154,348	0.74	113,981	0.65	74,087	18.0
Whole Home	Tier 4	119,131	0.80	95,241	0.65	61,907	18.0
<b>Total</b>		<b>470,194</b>	<b>0.76</b>	<b>357,717</b>	<b>0.65</b>	<b>232,516</b>	<b>18.0</b>

\* A deemed value. Source: ComEd\_NTG\_History\_and\_PY10\_Recommendations\_2017-03-01.xlsx, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>.  
 Source: ComEd tracking data and Navigant team analysis.

Table 5-2 shows the verified gross and net demand savings. Because ComEd does not track demand savings, the evaluation team is unable to provide demand realization rates. The evaluation team calculated verified demand savings using hourly model outputs from the modeling software.

**Table 5-2. CY2018 Demand Savings by Tier**

End Use Type	Research Category	Ex Ante Gross Demand Reduction (kW)	Verified Gross Realization Rate	Verified Gross Demand Reduction (kW)	NTG*	Verified Net Demand Reduction (kW)
Whole Home	Tier 1	NR	NA	3.54	0.65	2.30
Whole Home	Tier 2	NR	NA	13.41	0.65	8.72
Whole Home	Tier 3	NR	NA	13.01	0.65	8.46
Whole Home	Tier 4	NR	NA	10.67	0.65	6.94
<b>Total</b>		<b>NR</b>	<b>NA</b>	<b>40.63</b>	<b>0.65</b>	<b>26.41</b>

NR = Not reported  
 NA = Not applicable

\* A deemed value. Source: ComEd\_NTG\_History\_and\_PY10\_Recommendations\_2017-03-01.xlsx, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>.  
 Source: ComEd tracking data and Navigant team analysis.

Table 5-3 shows the verified gross and net peak demand savings.

**Table 5-3. CY2018 Summer Peak Demand Savings by Tier**

End Use Type	Research Category	Ex Ante Gross Peak Demand Reduction (kW)	Verified Gross Realization Rate	Verified Gross Peak Demand Reduction (kW)	NTG*	Verified Net Peak Demand Reduction (kW)
Whole Home	Tier 1	NR	NA	13.03	0.65	8.47
Whole Home	Tier 2	NR	NA	49.38	0.65	32.10
Whole Home	Tier 3	NR	NA	47.84	0.65	31.09
Whole Home	Tier 4	NR	NA	37.76	0.65	24.55
<b>Total</b>		<b>NR</b>	<b>NA</b>	<b>148.01</b>	<b>0.65</b>	<b>96.21</b>

NR = Not reported  
 NA = Not applicable

\* A deemed value. Source: ComEd\_NTG\_History\_and\_PY10\_Recommendations\_2017-03-01.xlsx, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>.

Source: ComEd tracking data and Navigant team analysis.

Table 5-4 summarizes the natural gas energy savings from the RNC Program by tier for Nicor Gas.

**Table 5-4. CY2018 Natural Gas Energy Savings by Tier – Nicor Gas**

End Use Type	Research Category	Ex Ante Gross Savings (therms)	Verified Gross Realization Rate	Verified Gross Savings (therms)	NTG*	Verified Net Savings (therms)
Whole Home	Tier 1	14,050	1.33	18,727	0.65	12,172
Whole Home	Tier 2	62,845	1.34	84,018	0.65	54,611
Whole Home	Tier 3	74,756	1.13	84,135	0.65	54,688
Whole Home	Tier 4	63,099	1.04	65,756	0.65	42,742
<b>Total†</b>		<b>214,750</b>	<b>1.18</b>	<b>252,636</b>	<b>0.65</b>	<b>164,213</b>

\* A deemed value. Source: Nicor\_Gas\_GPY7\_NTG\_Values\_2017-03-01\_Final.xlsx, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>.

† The total includes interactive effects.

Source: Nicor Gas tracking data and Navigant team analysis.

## 6. IMPACT ANALYSIS FINDINGS AND RECOMMENDATIONS

### 6.1 Impact Parameter Estimates

The evaluation team conducted research to validate the parameters used to determine verified gross and net savings. Table 6-1 indicates which parameters were examined through evaluation activities and which were deemed.

**Table 6-1. Savings Parameters**

Gross Savings Input Parameters	Value Units	Deemed* or Evaluated?	Source
Home Quantity, Tier, HERS Score	Varies Varies	Evaluated	Tracking Database
Model Inputs	Varies Varies	Evaluated	REM/Rate files, gas and electric billing data
Model Results	Varies kWh, Therms	Evaluated	Calibrated energy simulation using BEopt modeling software
NTG	0.65 NA	Deemed	IL SAG Consensus†
Verified Gross Realization Rates	Varies NA	Evaluated	Tracking database, calibrated energy simulation
Effective Useful Life (EUL)	Varies Years	Deemed	IL TRM v6.0

\* State of Illinois Technical Reference Manual version 6.0 from <http://www.ilsag.info/technical-reference-manual.html>.

† A deemed value. Source: ComEd\_NTG\_History\_and\_PY10\_Recommendations\_2017-03-01.xlsx, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>.

### 6.2 Other Impact Findings and Recommendations

The evaluation team developed several recommendations based on findings from the CY2018 evaluation, as follows:

#### 6.2.1 Verified Impacts and Realization Rate

**Finding 1.** The CY2018 RNC Program achieved 232,516 kWh of verified net energy savings and 164,213 therms of verified net gas savings. The overall verified program realization rate was 76% for electric energy savings and 118% for gas savings.

**Finding 2.** The modeling software chosen for this evaluation (BeOpt) is extremely sensitive to changes made to mechanical ventilation parameters. Small changes made to these parameters can drive significant changes to program-level realization rates, which has been observed throughout the course of this evaluation. It is critical to ensure that mechanical ventilation parameters are appropriately specified when estimating savings using this model.

## 7. APPENDIX 1. IMPACT ANALYSIS METHODOLOGY

In EPY8/GPY5, the evaluation team used calibrated energy simulation to calculate verified kWh and therm gross impacts and realization rates by tier. The Illinois residential building code has since changed (i.e., IECC 2012 to IECC 2015), and therefore, applying realization rates from the EPY8/GPY5 evaluation is no longer appropriate. Given the change in code, the evaluation team found it necessary to reperform the calibration simulation in CY2018 using IECC 2015 guidelines with Illinois-specific amendments. The evaluation team followed the same approach used in EPY8/GPY5 as outlined below.

### 7.1 Impact Sample

Given the evaluation relies on historical billing data, the evaluation team identified homes from past program years to serve as the basis for the analysis. Program homes from GPY6/EPY9 and CY2018 that met the following four criteria were included in the CY2018 impact sample:

1. Excluded from GPY5/EPY8 calibrated energy simulation impact sample
2. Have a minimum 12 months of both electric and gas billing data
3. Received REM/Rate file
4. At minimum, must meet IECC 2015 code standards<sup>1</sup>

### 7.2 Model Bins

The evaluation team analyzed homes by grouping them into six models. Each model varies by tier and number of stories. The evaluation team did not create models for Tier 1 homes since they were newly introduced in CY2018 and do not have historical billing data. The following six models serve as the basis for the analysis:

- Tier 2 – One Story
- Tier 2 – Two+ Story
- Tier 3 – One Story
- Tier 3 – Two+ Story
- Tier 4 – One Story
- Tier 4 – Two+ Story

Table 7-1 shows the total number of homes associated with each model bin, as well as the number of homes included in the analysis.

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<sup>1</sup> Includes Residential Energy Code for Illinois Amendments to IECC 2015.

**Table 7-1. Distribution of Total Program Homes and Impact Sample Homes by Model Bin**

Model Bin	Total CY2018 ComEd Homes	Total CY2018 Nicor Gas Homes	Total CY2018 Homes	Total Impact Sample Homes	Total Impact Sample CY2018 Homes	Total Ex Ante Gross Therm Savings	Mean Ex Ante Gross Therms per Home	Total Ex Ante Gross kWh	Mean Ex Ante Gross kWh per Home
Tier 1 One Story	12	12	12	0	-	1,755	146	4,363	364
Tier 1 Two+ Story	71	75	75	0	-	12,295	164	36,640	516
Tier 2 One Story	26	26	26	30	1	5,388	207	11,085	426
Tier 2 Two+ Story	221	232	232	132	1	57,457	248	144,628	654
Tier 3 One Story	21	31	31	41	2	8,771	283	12,802	610
Tier 3 Two+ Story	184	189	189	163	2	65,985	349	141,546	769
Tier 4 One Story	4	4	4	7	-	1,504	376	2,221	555
Tier 4 Two+ Story	121	126	126	98	4	61,595	489	116,910	966
<b>Total</b>	<b>660</b>	<b>695</b>	<b>695</b>	<b>471</b>	<b>10</b>	<b>214,750</b>	<b>309</b>	<b>470,194</b>	<b>712</b>

\* Includes homes from GPY6/EPY9 and CY2018.

### 7.3 Calibrated Energy Efficient Models

The evaluation team extracted home characteristics for all homes in the impact sample from the final REM/Rate files. The team built models for each bin using the Building Energy Optimization interface tool (BEopt)<sup>2</sup> incorporating average home characteristics from the homes within each bin for floor area, R-values, infiltration rates, and equipment specifications. Where REM/Rate did not contain data on the characteristics needed for the BEopt model inputs, the evaluation team defaulted to built-in Building America Benchmark data for new construction. For example, the “Tier 2 – One Story” model incorporates average characteristics from all “Tier 2 – One Story” homes in the impact sample.

The evaluation team calibrated each model to the corresponding billing data from program homes in each bin, excluding the consecutive “zero” readings prior to each home becoming occupied. The team calibrated the models based on the total billing consumption for all months between May 2017 through April 2018. The evaluation team calibrated the models to match monthly loads.

Table 7-2 and Table 7-3 show the results of the calibration adjustments for natural gas and electricity for each model bin. The evaluation team calibrated each model to within less than 1% of the billing data energy consumption.

<sup>2</sup> Created by the National Renewable Energy Laboratory (NREL)

**Table 7-2. Calibrated Gas Results by Model Bin**

Model Bin	Ex Ante Consumption* (therms)	Billed Calibration Period Consumption (therms)	Modeled Calibration Period Consumption (therms)	Difference (therms)†	Percent Difference
Tier 1 One Story	NA	NA	NA	NA	NA
Tier 1 Two+ Story	NA	NA	NA	NA	NA
Tier 2 One Story	940	910	913	4	0.39%
Tier 2 Two+ Story	1,057	1,134	1,139	5	0.42%
Tier 3 One Story	929	881	884	3	0.29%
Tier 3 Two+ Story	1,028	1,106	1,108	1	0.13%
Tier 4 One Story++	NA	NA	NA	NA	NA
Tier 4 Two+ Story	1,088	1,163	1,164	2	0.13%

\* Includes all gas end use

NA= Not applicable

† The difference between Modeled Calibration and Billed Calibration therm consumption.

‡ The evaluation team was unable to calibrate the Tier 4 One Story model bin that had only 7 homes in the impact sample.

Source: Navigant team analysis.

**Table 7-3. Calibrated Electric Results by Model Bin**

Model Bin	Ex Ante Consumption* (kWh)	Billed Calibration Period Consumption (kWh)	Modeled Calibration Period Consumption (kWh)	Difference (kWh)†	Percent Difference
Tier 1 One Story	NA	NA	NA	NA	NA
Tier 1 Two+ Story	NA	NA	NA	NA	NA
Tier 2 One Story	6,735	6,645	6,642	-3	-0.04%
Tier 2 Two+ Story	7,608	8,183	8,175	-8	-0.10%
Tier 3 One Story	7,066	6,902	6,902	1	0.01%
Tier 3 Two+ Story	7,913	9,207	9,210	4	0.04%
Tier 4 One Story++	NA	NA	NA	NA	NA
Tier 4 Two+ Story	8,388	9,884	9,892	8	0.08%

\* Includes all electric end uses

NA = Not applicable

† The difference between Modeled Calibration and Billed Calibration electric (kWh) consumption.

‡ The evaluation team was unable to calibrate the Tier 4 One Story model bin that had only 7 homes in the impact sample.

Source: Navigant team analysis.

## 7.4 Baseline Models

For each calibrated model, the evaluation team developed a corresponding “base case” scenario that complies with both the residential Illinois energy code (i.e., IECC 2015 with Illinois-specific amendments) and the Department of Energy (DOE) standards.

## 7.5 Modeled Energy Consumption

The evaluation team calculated kWh and therm savings by subtracting the calibrated energy efficient home consumption from the baseline home consumption for each model. The evaluation team generated hourly output data from an add-on component in BeOpt (i.e., DView) to determine demand and peak

demand reduction. Peak demand reduction used the coincident Summer Peak period defined as 1:00-5:00 PM Central Prevailing Time on non-holiday weekdays, June through August. The evaluation team chose to keep the mechanical ventilation consistent across the calibrated and baseline models. The Illinois energy code specifies a minimum mechanical ventilation that is dependent on the total finished floor area (FFA) and number of bedrooms. The average mechanical ventilation for the impact sample homes met this requirement.

## 7.6 Extrapolate to the CY2018 Population

The evaluation team extrapolated modeled results to the CY2018 population using the Home Energy Rating Score (HERS) and conditioned floor area provided in the tracking database. Because Tier 1 homes are a new tier in CY2018, the evaluation team applied realization rates from Tier 2, as Tier 2 homes most closely resemble Tier 1 homes.

## 7.7 Verified Net Savings

The evaluation team calculated verified net energy and demand savings by multiplying the verified gross savings estimates by a deemed NTG of 0.65. In CY2018, the NTG estimates used to calculate the verified net savings were based on past evaluation research and approved through a consensus process managed through the Illinois Energy Efficiency Stakeholder Advisory Group (SAG).

## 8. APPENDIX 2. IMPACT ANALYSIS DETAIL

Due to the variability in realization rates in past evaluations, the evaluation team revisited the calibrated energy simulation to calculate gross impacts for CY2018. Table 8-1 summarizes realization rates and energy savings by program year.

**Table 8-1. Realization Rates and Energy Savings by Program Year**

Program Year	Gas Realization Rate	Verified Gross Energy Savings (therms)	Electric Realization Rate	Verified Gross Energy Savings (kWh)	Impact Approach
GPY1/EPY4	NA	NA	NA	NA	NA
GPY2/EPY5	0.91	220,300	0.90	250,645	Calibrated Simulation
GPY3/EPY6	0.91	232,557	0.92	507,943	Applied realization rates from GPY2/EPY5
GPY4/EPY7	0.76	232,651	1.23	647,072	Calibrated Simulation
GPY5/EPY8	0.94	314,237	1.01	547,451	Calibrated Simulation
GPY6/EPY9	0.94	463,568	1.01	1,450,191	Applied realization rates from GPY5/EPY8
CY2018	1.18	252,636	0.76	357,717	Calibrated Simulation

NA = Not applicable

Source: Navigant team analysis.

## 8.1 Impact Sample

The evaluation team attempted a census approach of projects from GPY6/EPY9 and CY2018, for a total of 1,816 homes. The evaluation team required REM/Rate files, 12 months of electric and gas billing data for homes not included in previous program years' calibrated sample and required to comply with the IECC 2015 based Illinois energy code. Table 8-2 shows that 471 of the 1,816 homes met all criteria and were included in the CY2018 impact sample.

**Table 8-2. Impact Sample Homes by Model Bin**

Model Bin	GPY6/EPY9 Homes	CY2018 Homes	Total Homes	Total Impact Sample Homes
Tier 1 One Story	NA	NA	NA	NA
Tier 1 Two+ Story	NA	NA	NA	NA
Tier 2 One Story	57	1	58	30
Tier 2 Two+ Story	336	1	337	132
Tier 3 One Story	69	4	73	41
Tier 3 Two+ Story	407	3	410	163
Tier 4 One Story	11	-	11	7
Tier 4 Two+ Story	173	5	178	98
<b>Total</b>	<b>1,053</b>	<b>14</b>	<b>1,067</b>	<b>471</b>

NA = Not applicable  
 Source: Navigant team analysis.

## 8.2 Home Performance

The evaluation team observed that, on average, certain characteristics met or exceeded individual code requirements more consistently than others. Table 8-3 compares calibrated building inputs to code requirements to demonstrate where homes fell short of IECC 2015 based Illinois energy code requirements and showcases differences in homes across each model bin. Inputs that do not reach code are indicated with orange shading and those that substantially exceed code are represented in green.

**Table 8-3. Model Inputs by Building Type**

Category	IECC 2015 or DOE Standard	Tier 1 One Story	Tier 1 Two+ Story	Tier 2 One Story	Tier 2 Two+ Story	Tier 3 One Story	Tier 3 Two+ Story	Tier 4 One Story	Tier 4 Two+ Story
Above Grade Wall	R-13 + R-5	NA	NA	R-15.8 + R-0.6 xps	R-16.4 + R-0.5 xps	R-16.2 + R-0.8 xps	R-17.7 + R-0.6 xps	NA	R-17.9 + R-0.6 xps
Unfinished Attic	R-49	NA	NA	R-39.7	R-39.5	R-40.4	R-42.9	NA	R-44
Finished Ceiling	R-49	NA	NA	R-32.7	R-34.4	R-33.4	R-34.1	NA	R-35.7
Basement Wall	R-10	NA	NA	R-10	R-10	R-10	R-10	NA	R-10
Crawlspace	R-15	NA	NA	R-11.9	R-11.6	R-11.2	R-11.6	NA	R-12.0
Slab	2 ft, R-10	NA	NA	NA	0.16 ft, R-10	0.22 ft, R-10	0.13 ft, R-10	NA	0.13 ft, R-7.5
Windows	U-0.32 SHGC-0.40	NA	NA	U-0.32 SHGC 0.29	U-0.33 SHGC 0.29	U-0.33 SHGC 0.30	U-0.33 SHGC 0.31	NA	U-0.32 SHGC 0.32
Overhangs	None	NA	NA	1.04 ft	0.87 ft	1.02 ft	1.17 ft	NA	1.00 ft
Air Sealing	5.0 ACH50	NA	NA	2.2 ACH50	2.7 ACH50	2.1 ACH50	2.4 ACH50	NA	1.9 ACH50
Cooling Equipment	13 SEER	NA	NA	13.1 SEER	13.0 SEER	13.1 SEER	13.1 SEER	NA	13.2 SEER
Heating Equipment	80% AFUE	NA	NA	92.5% AFUE	92.4% AFUE	93.0% AFUE	92.8% AFUE	NA	93.4% AFUE
Mechanical Ventilation	ASHRAE 62.2 2010 Standard*	NA	NA	95.8 cfm	93.2 cfm	84.8 cfm	87.3 cfm	NA	89.4 cfm
Duct Leakage	4 cfm/100 sf	NA	NA	0.62 cfm25 per 100 sf	0.95 cfm25 per 100 sf	0.44 cfm25 per 100 sf	0.69 cfm25 per 100 sf	NA	0.48 cfm25 per 100 sf
Duct Insulation	R-8.0	NA	NA	R-8.0	R-7.9	R-8.6	R-7.3	NA	R-7.6
Water Heating	0.60 EF	NA	NA	0.65 EF	0.66 EF	0.66 EF	0.66 EF	NA	0.66 EF

\* Varies by FFA and number of rooms per home using the following formula: CFM = 0.01\*FFA + (# bedrooms +1) \* 7.5

Note: Inputs that do not reach code are indicated with orange shading and those that substantially exceed code are represented in green.

Source: Navigant team analysis.

### 8.3 Modeled Energy Consumption per Tier

Table 8-4 and Table 8-5 show the resulting gas and electric outputs for the calibrated and corresponding IECC 2015 based Illinois energy code baseline models.<sup>3</sup> The evaluation team was unable to successfully calibrate the Tier 4, One Story model and therefore removed it as one of the model bins. This model included an insufficient number of homes (n=7) where the billing data shows variability and the embedded model load shapes are unable to replicate its shape. However, because the Tier 4, One Story model impacts less than 1% of CY2018 homes (n=4), the evaluation team is confident that it will not impact the accuracy of the Tier 4 realization rates.

**Table 8-4. Average per Home Verified Gas Savings by Home Tier Level**

Participation Category	Baseline Model Gas Consumption (therms)	Efficient Model Gas Consumption (therms)	Gross Verified Therm Savings	Gross Verified Percent Savings
Tier 1*	NA	NA	NA	NA
Tier 2	1,476	1,116	361	24%
Tier 3	1,490	1,076	414	28%
Tier 4	1,711	1,164	546	32%
<b>Weighted Average†</b>	<b>1,530</b>	<b>1,111</b>	<b>419</b>	<b>27%</b>

\* Tier 1 is a new tier in CY2018. Because no historical billing data exists for these homes, all Tier 1 homes were removed from the impact sample.

NA = Not applicable

† The weighted average reflects the contribution of each model bin to the total program savings.

Source: Navigant team analysis.

**Table 8-5. Average per Home Verified Electric Savings by Home Tier Level**

Participation Category	Baseline Model Electric Consumption (kWh)	Efficient Model Electric Consumption (kWh)	Gross Verified kWh Savings	Gross Verified Percent Savings
Tier 1*	NA	NA	NA	NA
Tier 2	8,548	8,013	535	6%
Tier 3	9,582	8,974	608	6%
Tier 4	10,721	9,892	829	8%
<b>Weighted Average†</b>	<b>9,377</b>	<b>8,754</b>	<b>623</b>	<b>7%</b>

\* Tier 1 is a new tier in CY2018. Because no historical billing data exists for these homes, all Tier 1 homes were removed from the impact sample.

NA = Not applicable

† The weighted average reflects the contribution of each model bin to the total program savings.

Source: Navigant team analysis.

<sup>3</sup> The evaluation team included lighting and appliances in the electric total consumption in both the baseline and calibrated model case. All consumption values include interactive effects. In GPY5/EPY8, the evaluation team conducted the analysis with and without interactive effects and found that the impact on savings was insignificant. The weighted average per home savings was reduced by 0.6% for gas savings and increased by 0.6% for electric savings.

## 8.4 Extrapolation

To calculate the overall gross savings realization rate, the evaluation team adjusted the gross savings by the HERS and floor area to account for differences in efficiency at the individual home level. Table 8-6 shows the average HERS and floor area for both the impact sample and the program overall.

**Table 8-6. Average HERS and Floor Area by Model Bin**

Model Bin	Impact Sample Average HERS	CY2018 Average HERS	Impact Sample Average Area (ft <sup>2</sup> )	CY2018 Average Area (ft <sup>2</sup> )
Tier 1 One Story	NA	59.4	NA	3,186
Tier 1 Two+ Story	NA	61.5	NA	3,327
Tier 2 One Story	55.8	58.8	3,622	3,624
Tier 2 Two+ Story	56.4	59.1	3,994	3,750
Tier 3 One Story	54.0	54.0	3,886	4,489
Tier 3 Two+ Story	54.1	58.0	4,273	4,160
Tier 4 One Story	51.7	50.3	4,555	4,617
Tier 4 Two+ Story	51.4	55.3	4,755	4,779
<b>Total</b>	<b>54.5</b>	<b>57.7</b>	<b>4,223</b>	<b>4,120</b>

Source: Navigant analysis of CY2018 program tracking data.

The evaluation team found overall gross realization rates of 118% for natural gas and 76% for electric energy savings. Table 8-7 and Table 8-8 show these results as well as the calculated realization rates for each model bin.

**Table 8-7. Ex Ante and Verified Gross Gas Savings by Model Bin**

Model Bin	Ex Ante Gross Gas Savings per Home (therms)	Verified Gross Gas Savings per Home (therms)	Ex Ante Total Gross Gas Savings (therms)	Gross Realization Rate	Verified Total Gross Gas Savings (therms)
Tier 1 One Story*	146	182	1,755	1.24	2,181
Tier 1 Two+ Story*	164	221	12,295	1.35	16,546
Tier 2 One Story	207	258	5,388	1.24	6,697
Tier 2 Two+ Story	248	333	57,457	1.35	77,321
Tier 3 One Story	283	315	8,771	1.11	9,773
Tier 3 Two+ Story	349	393	65,985	1.13	74,361
Tier 4†	485	506	63,099	1.04	65,756
<b>Total</b>	<b>309</b>	<b>364</b>	<b>214,750</b>	<b>1.18</b>	<b>252,636</b>

\* The evaluation team was unable to include Tier 1 homes in the calibrated simulation since the homes do not have twelve months of billing data. Instead, the evaluation team applied Tier 2 realization rates to Tier 1 to calculate verified savings for Tier 1 homes as Tier 2 homes most closely resemble the Tier 1 homes.

† The evaluation team was unable to calibrate the Tier 4 One Story home and instead used Tier 4 Two+ Story results. The number of homes in the Tier 4 One Story bin impact sample represented 1.4% (n=7 of 471) of all impact sample homes and 0.6% (n=4 of 695) of all CY2018 homes.

Source: CY2018 program tracking data and Navigant team analysis.

**Table 8-8. Ex Ante and Verified Gross Electric Savings by Model Bin**

Model Bin	Ex Ante Gross Electric Savings per Home (kWh)	Verified Gross Electric Savings per Home (kWh)	Ex Ante Total Gross Electric Savings (kWh)	Gross Realization Rate	Verified Total Gross Electric Savings (kWh)
Tier 1 One Story*	364	287	4,363	0.79	3,440
Tier 1 Two+ Story*	516	388	36,640	0.75	27,554
Tier 2 One Story	426	336	11,085	0.79	8,739
Tier 2 Two+ Story	654	492	144,628	0.75	108,763
Tier 3 One Story	610	484	12,802	0.79	10,172
Tier 3 Two+ Story	769	564	141,546	0.73	103,809
Tier 4†	953	772	119,131	0.80	95,241
<b>Total</b>	<b>712</b>	<b>542</b>	<b>470,194</b>	<b>0.76</b>	<b>357,717</b>

\* The evaluation team was unable to include Tier 1 homes in the calibrated simulation since the homes do not have twelve months of billing data. Instead, the evaluation team applied Tier 2 realization rates to Tier 1 to calculate verified savings for Tier 1 homes as Tier 2 homes most closely resemble the Tier 1 homes.

† The evaluation team was unable to calibrate the Tier 4 One Story home and instead used Tier 4 Two+ Story results. The number of homes in the Tier 4 One Story bin impact sample represented 1.4% (n=7 of 471) of all impact sample homes and 0.6% (n=4 of 660) of all CY2018 homes.

Source: CY2018 program tracking data and Navigant team analysis.

## 9. APPENDIX 3. TOTAL RESOURCE COST DETAIL

Table 9-1 and Table 9-2, below, show the Total Resource Cost (TRC) results for electric and gas. The tables include only the 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) are not included in this table and will be provided later.

**Table 9-1. Total Resource Cost Savings Summary for ComEd**

End Use Type	Research Category	Units	Quantity	Effective Useful Life	Verified Gross Savings (kWh)	NTG*	Verified Net Savings (kWh)
Whole Home	Tier 1	Home	83	18.0	30,994	0.65	20,146
Whole Home	Tier 2	Home	247	18.0	117,502	0.65	76,376
Whole Home	Tier 3	Home	205	18.0	113,981	0.65	74,087
Whole Home	Tier 4	Home	125	18.0	95,241	0.65	61,907

\* A deemed value. Source: ComEd\_NTG\_History\_and\_PY10\_Recommendations\_2017-03-01.xlsx, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>.

Source: ComEd tracking data and Navigant team analysis.

**Table 9-2. Total Resource Cost Savings Summary for Nicor Gas**

End Use Type	Research Category	Units	Quantity	Effective Useful Life	Verified Gross Savings (therms)	NTG*	Verified Net Savings (therms)
Whole Home	Tier 1	Home	87	18.0	18,727	0.65	12,172
Whole Home	Tier 2	Home	258	18.0	84,018	0.65	54,611
Whole Home	Tier 3	Home	220	18.0	84,135	0.65	54,688
Whole Home	Tier 4	Home	130	18.0	65,756	0.65	42,742

\* A deemed value. Source: Nicor\_Gas\_GPY7\_NTG\_Values\_2017-03-01\_Final.xlsx, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>.  
Source: Navigant analysis of tracking data.