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ComEd and Nicor Gas Residential New Construction Program Impact Evaluation Report

Energy Efficiency / Demand Response Plan:
Gas Plan Year 6 (GPY6)
Electric Plan Year 9 (EPY9)
(6/1/2016-12/31/2017)

Presented to
ComEd
Nicor Gas Company

FINAL

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1. INTRODUCTION

This report presents the results of the impact evaluation of the Nicor Gas and ComEd GPY6/EPY9 Residential New Construction (RNC) Program. It presents a summary of the energy and demand impacts for the total program and broken out by relevant program structure details. The appendix presents the impact analysis methodology. GPY6/EPY9 covers June 1, 2016 through December 31, 2017.

2. PROGRAM DESCRIPTION

Nicor Gas and ComEd jointly offer the RNC Program. Nicor Gas is the lead utility since the majority of the avoided costs are from natural gas savings. Residential Science Resources (RSR) implemented the program for both utilities in GPY6/EPY9. Although the effective date for the IECC 2015 energy code was January 1, 2016, about 12 percent of GPY6/EPY9 program homes were permitted prior to this date and therefore built using the IECC 2012 energy code. Program participation requires a minimum efficiency of 20 percent above code for each home, and the program ranks homes in tiers based on performance:

- Tier 1: 20.00-24.99 percent above code
- Tier 2: 25.00-29.99 percent above code
- Tier 3: 30 percent or more above code

RSR uses completed REM/Rate files for each home to calculate whole-house savings. The program relies on networks of builders and HERS raters to garner participation and continues to attract raters and builders to the program.

As shown in Table 2-1, the RNC Program included a total of 1,424 homes in GPY6/EPY9, representing about 98 percent of the overall target of 1,458 homes set for this program year. Of these homes, 85 percent were in joint Nicor Gas and ComEd service territory, while the remaining 15 percent were in Nicor Gas territory only. Fifty-seven builders and 10 HERS rating companies completed homes in GPY6/EPY9. Table 2-1 also shows the number of homes in each tier.

Table 2-1. GPY6/EPY9 Volumetric Findings Detail

Participation	Joint Nicor Gas/ ComEd Homes	Nicor Gas Only Homes	Total Homes
Tier 1	466	104	570
Tier 2	523	71	594
Tier 3	220	40	260
Total	1,209	215	1,424

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

Figure 2-1 shows the total number of homes in each tier in GPY6/EPY9. The portion of homes in the higher two efficiency tiers (at least 25 percent above code) was about 60 percent, compared to about 50 percent in GPY5/EPY8 and GPY4/EPY7. Additionally, the portion of homes in Tier 3 increased from 14 percent in GPY5/EPY8 to 18 percent in GPY6/EPY9. Table 2-2 shows the number of homes in each tier from GPY4/EPY7 through GPY6/EPY9.

Figure 2-1. Number of Homes by Tier
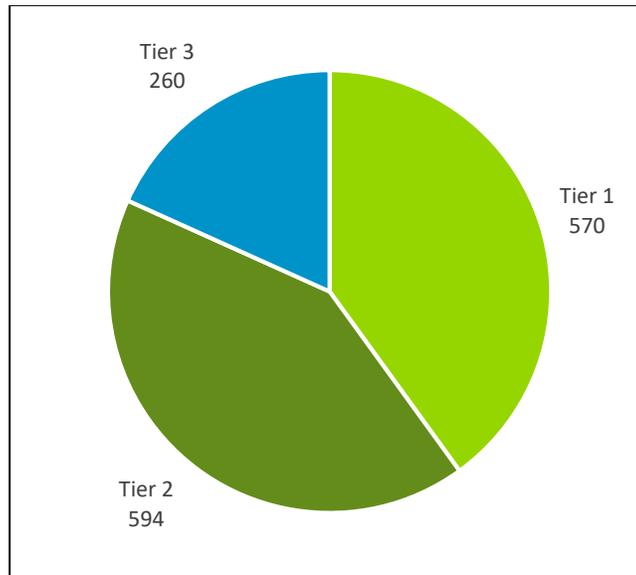
Source: Evaluation Analysis

Table 2-2. Number of Homes by Tier Level Comparison

Participation Category	GPY6/EPY9 Total Homes	GPY6/EPY9 Share of Total*	GPY5/EPY8 Total Homes	GPY5/EPY8 Share of Total*	GPY4/EPY7 Total Homes	GPY4/EPY7 Share of Total*
Tier 1	570	40%	443	49%	440	50%
Tier 2	594	42%	323	36%	273	31%
Tier 3	260	18%	129	14%	161	18%
Total	1,424	100%	895	100%	874	100%

* Values may not sum exactly due to rounding.
Source: Navigant analysis of GPY6/EPY9, GPY5/EPY8, and GPY4/EPY7 program tracking data. The GPY6/EPY9 program year was 19 months long and the GPY4/EPY7 and GPY5/EPY8 programs years were 12 months long.

3. PROGRAM SAVINGS

Table 3-1 summarizes the energy and demand savings the RNC Program achieved in GPY6/EPY9.

Table 3-1. GPY6/EPY9 Total Annual Incremental Savings

Savings Category	Energy Savings (kWh)	Demand Savings (kW)	Peak Demand Savings (kW)	Energy Savings (Therms)
Ex Ante Gross Savings	1,415,604	Not recorded	Not recorded	463,568
Program Gross Realization Rate	102%	NA	NA	93%
Verified Gross Savings	1,450,191	137	712	431,918
Program Net-to-Gross Ratio (NTGR)	0.650	0.650	0.650	0.650
Verified Net Savings	942,624	89	463	280,747

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

4. PROGRAM SAVINGS BY MEASURE

The program includes three home performance tier levels based on energy performance above code. Table 4-1 summarizes the electricity savings from the RNC Program by home tier level. Tier 2 homes contributed the most savings, followed by Tier 1 and Tier 3 homes.

Table 4-1. ComEd PY9 Energy Savings by Tier

End Use Type	Research Category	Ex Ante Gross Savings (kWh)	Verified Gross Realization Rate	Verified Gross Savings (kWh)	NTGR *	Verified Net Savings (kWh)	Technical Measure Life	Persistence	Effective Useful Life (EUL)†
Whole Home	Tier 1	456,583	99%	450,065	0.65	292,543	NA	NA	18
Whole Home	Tier 2	592,409	97%	575,480	0.65	374,062	NA	NA	18
Whole Home	Tier 3	366,612	116%	424,645	0.65	276,020	NA	NA	18
	Total	1,415,604	102%	1,450,191	0.65	942,624	NA	NA	18

* A deemed value. Source: ComEd_NTG_History_and_PY9_Recommendations_2016-02-26_Final.xlsx, which is found on the IL SAG web site here: http://ilsag.info/net-to-gross-framework.html.
† EUL is a combination of technical measure life and persistence. The technical measure life and persistence values are NA because the EUL is not explicitly broken down into technical measure life and persistence. Source: Median value, Energy Savings Lifetimes and Persistence: Practices, Issues and Data. Based on LBNL DSM Program Database.[1]
Source: ComEd tracking data and Navigant team analysis.

Table 4-2 shows the verified gross and net demand savings, and Table 4-3 shows the verified gross and net peak demand savings. ComEd did not claim any ex ante demand savings; Navigant estimated coincident peak demand savings using hourly model outputs.

Table 4-2. ComEd PY9 Demand Savings by Tier

End Use Type	Research Category	Ex Ante Gross Demand Reduction (kW)	Verified Gross Realization Rate	Verified Gross Demand Reduction (kW)	NTGR*	Verified Net Demand Reduction (kW)
Whole Home	Tier 1	Not recorded	NA	43	0.65	28
Whole Home	Tier 2	Not recorded	NA	54	0.65	35
Whole Home	Tier 3	Not recorded	NA	40	0.65	26
	Total†	Not recorded	NA	137	0.65	89

* A deemed value. Source: ComEd_NTG_History_and_PY9_Recommendations_2016-02-26_Final.xlsx, which is found on the IL SAG web site here: http://ilsag.info/net-to-gross-framework.html.
†Totals may not sum exactly due to rounding.
Source: ComEd tracking data and Navigant team analysis.

[1] Source: LBNL DSM Program Database 2014 (https://emp.lbl.gov/sites/all/files/lbnl-179191.pdf)

Table 4-3. ComEd PY9 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)	NTGR*	Verified Net Peak Demand Reduction (kW)
Whole Home	Tier 1	Not recorded	NA	232	0.65	150
Whole Home	Tier 2	Not recorded	NA	285	0.65	185
Whole Home	Tier 3	Not recorded	NA	195	0.65	127
	Total†	Not recorded	NA	712	0.65	463

*A deemed value. Source: ComEd_NTG_History_and_PY9_Recommendations_2016-02-26_Final.xlsx, which is found on the IL SAG web site here: http://ilsag.info/net-to-gross-framework.html.
†Totals may not sum exactly due to rounding.
Source: ComEd tracking data and Navigant team analysis.

Table 4-4 summarizes the natural gas savings from the RNC Program by home tier level.

Table 4-4. Nicor Gas PY6 Energy Savings by Tier

End Use Type	Research Category	Ex Ante Gross Savings (Therms)	Verified Gross Realization Rate	Verified Gross Savings (Therms)	NTGR *	Verified Net Savings (Therms)
Whole Home	Tier 1	138,817	103%	143,352	0.65	93,179
Whole Home	Tier 2	202,916	89%	180,231	0.65	117,150
Whole Home	Tier 3	121,835	89%	108,335	0.65	70,418
	Total†	463,568	93%	431,918	0.65	280,747

* A deemed value. Source: Nicor_Gas_GPY6_NTG_Values_2016-02-29_Final.xlsx, which is found on the IL SAG web site here: http://ilsag.info/net-to-gross-framework.html.
†Totals may not sum exactly due to rounding.
Source: Nicor Gas tracking data and Navigant team analysis.

5. IMPACT ANALYSIS FINDINGS AND RECOMMENDATIONS

5.1 Impact Parameter Estimates

The GPY5/EPY8 evaluation used a rigorous approach of calibrated energy simulation to determine gross realization rates for gas and electric savings and to estimate gross electric demand savings. Since the calculation method for determining ex ante savings did not change for GPY6/EPY9, the evaluation team applied the GPY5/EPY8 realization rates to the ex ante savings to determine verified gross impacts for GPY6/EPY9. Navigant applied the GPY5/EPY8 realization rates by home tier level and home type (number of stories), as shown in Table 5-1. As in GPY2/EPY5 and GPY4/EPY7, billing data annual gas consumption for the sampled homes in the GPY5/EPY8 evaluation was lower than the ex ante models predicted. This led to lower gas savings despite Navigant's models' similar percent savings results. Appendix 1. Impact Analysis Methodology describes the impact evaluation methodology in more detail.

Table 5-1. GPY5/EPY8 Realization Rates by Home Tier Level and Home Type

Participation Category	Verified Gross Realization Rate (Gas)	Verified Gross Realization Rate (Electric)
Tier 1, One Story	119%	99%
Tier 1, Two+ Story	100%	99%
Tier 2, One Story	99%	89%
Tier 2, Two+ Story	87%	98%
Tier 3, One Story	111%	181%
Tier 3, Two+ Story	87%	114%

Source: Navigant team analysis.

Table 5-2 presents the parameters used in the verified gross and net savings calculations and indicates which were examined through evaluation activities and which were deemed.

Table 5-2. Verified Savings Parameter Data Sources

Savings Input Parameters	Data Sources	Deemed or Evaluated?
Home Quantity, Home Type, and Tier Level	ComEd* and Nicor Gas† program tracking data	Evaluated
Ex Ante Energy and Demand Savings per Home	ComEd and Nicor Gas† program tracking data	Evaluated
Verified Gross Realization Rate	GPY5/EPY8 calibrated energy simulation	Evaluated
NTGR – Electric and Gas	Illinois Stakeholder Advisory Group	Deemed

* Program tracking data provided by ComEd, extract dated January 25, 2018.
† Program tracking data provided by Nicor Gas, extract dated February 4, 2018.

Table 5-3 shows the energy savings per home and realization rate findings by tier level.

Table 5-3. Verified Gross Savings Parameters

Measure	Ex Ante Gross (kWh/home)	Verified Gross (kWh/home)	Electric Realization Rate (%)	Ex Ante Gross (therms/home)	Verified Gross (therms/home)	Gas Realization Rate (%)
Tier 1	980	966	99%	244	251	103%
Tier 2	1,133	1,100	97%	342	304	89%
Tier 3	1,666	1,930	116%	482	428	89%
Total	1,171	1,199	102%	327	305	93%

Source: Navigant team analysis.

The program achieved a gross savings realization rate of 93 percent for natural gas and 102 percent for electricity. The resulting verified gross savings for GPY6/EPY9 are 431,918 therms and 1,450,191 kWh. The evaluation team estimated peak demand impacts of 712 kW.

The RNC Program completed a total of 1,424 homes in GPY6/EPY9, virtually reaching the overall target of 1,458 homes set for this program year. The verified gross electric savings exceeded the GPY6/EPY9 gross savings target by five percent, while the gas savings fell short of the target by 14 percent. However, the portion of homes in the higher two efficiency tiers (at least 25 percent above code) increased from about 50 percent in GPY5/EPY8 to about 60 percent in GPY6/EPY9. Additionally, the portion of homes in Tier 3 increased from 14 percent in GPY5/EPY8 to 18 percent in GPY6/EPY9.

Recommendation 1. Continue to emphasize the higher efficiency tiers and encourage builders to go beyond standard improvements through program marketing, training sessions, and/or outreach to individual builders who have a large share of homes in the lowest tier level.

Recommendation 2. Continue to attract builders to the program through program marketing, direct outreach efforts, and training sessions offered to the wider trade ally network including both participating and non-participating builders.

The ex ante savings calculations use REM/Rate to estimate energy savings for heating, cooling, and water heating end uses while adding prescriptive savings estimates for lighting and appliances.

Recommendation 3. Revisit the savings calculations for lighting and appliances each year to ensure the inputs and calculations are from the TRM version for the corresponding program year.

6. APPENDIX 1. IMPACT ANALYSIS METHODOLOGY

Navigant used a calibrated energy simulation to calculate gross impacts for GPY5/EPY8. The team used data from program REM/Rate files to build six energy models which represent average program homes based on tier level and home type:

- Tier 1, One Story
- Tier 1, Two+ Story
- Tier 2, One Story
- Tier 2, Two+ Story
- Tier 3, One Story
- Tier 3, Two+ Story

For each category, Navigant compiled average home characteristics from all homes in that sample category to determine the model inputs. The team used the Building Energy Optimization interface tool (BEopt, version 2.7) created by the National Renewable Energy Laboratory (NREL) to build these models in EnergyPlus (version 8.6), a modeling software also developed by NREL. For each "energy efficient" model built using program data, Navigant developed a corresponding "base case" scenario based on Illinois energy code.[2]

After the models were built, Navigant used actual billing data from program homes to calibrate the "energy efficient" home scenario to consumption to date and then ran the "base case" scenario to determine gas and electric savings. The team used billing data from all homes in each sample category to calibrate the models. For example, the Tier 2, Two+ Story model incorporated characteristics and billing data from all Tier 2, Two+ Story homes in that sample category. Navigant extrapolated the results to the rest of the GPY5/EPY8 population using HERS score and floor area.

As the calculation method for determining ex ante savings did not change for GPY6/EPY9, the evaluation team applied the GPY5/EPY8 realization rates to the ex ante savings to determine verified gross impacts for GPY6/EPY9. Although the IECC 2015 energy code came into effect in January 2016, there are no major changes to the code that affect energy consumption.

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[2] A code baseline is not always appropriate if code compliance studies provide data to support adjustments to the "base case" code baseline scenario. Navigant concluded in GPY4/EPY7 that the IECC 2012 code compliance study did not provide data in a format that could support evaluation adjustments to the code baseline.

Navigant calculated verified net energy and demand savings by multiplying the verified gross savings estimates by a deemed NTGR. In GPY6/EPY9, the NTGR 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). Table 6-1 presents the deemed NTGR.

Table 6-1. NTGR for Evaluation of the GPY6/EPY9 RNC Program

Program Path	GPY6/EPY9 Deemed NTGR
Residential New Construction	0.65

Source: ComEd_NTG_History_and_PY9_Recommendations_2016-02-26_Final.xlsx and Nicor_Gas_GPY6_NTG_Values_2016-02-29_Final.xlsx, which are found on the IL SAG web site here: http://ilsag.info/net-to-gross-framework.html.

7. APPENDIX 2. TOTAL RESOURCE COST DETAIL

The Total Resource Cost (TRC) variable table, Table 7-1, only includes cost-effectiveness analysis inputs available at the time of finalizing this GPY6/EPY9 RNC impact evaluation report. Additional required cost data (e.g., measure costs, program level incentive and non-incentive costs) are not included in this table and will be provided to evaluation at a later date. EULs are subject to change and are not final.

Table 7-1. GPY6/EPY9 Gross Energy and Demand Savings for TRC

End Use Type	Research Category	Units	Joint Nicor Gas/ComEd Quantity	Nicor Gas Quantity	Effective Useful Life*	Ex Ante Gross Savings (kWh)	Ex Ante Gross Peak Demand Reduction (kW)	Verified Gross Savings (kWh)	Verified Gross Peak Demand Reduction (kW)	Ex Ante Gross Savings (therms)	Verified Gross Savings (therms)
Whole Home	Tier 1	Home	466	570	18	456,583	Not recorded	450,065	232	138,817	143,352
Whole Home	Tier 2	Home	523	594	18	592,409	Not recorded	575,480	285	202,916	180,231
Whole Home	Tier 3	Home	220	260	18	366,612	Not recorded	424,645	195	121,835	108,335

*EUL is a combination of technical measure life and persistence. Source: Median value, Energy Savings Lifetimes and Persistence: Practices, Issues and Data. Based on LBNL DSM Program Database, https://emp.lbl.gov/sites/all/files/lbnl-179191.pdf