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Joint Residential New Construction Program GPY2/EPY5 Evaluation Report

Final

Energy Efficiency / Demand Response Plan:
Nicor Gas Plan Year 2
Commonwealth Edison Company Plan Year 5
(6/1/2012-5/31/2013)

Presented to
Nicor Gas
Commonwealth Edison Company

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E. Executive Summary

This report presents a summary of the findings and results from the Impact and Process Evaluation of the GPY2/EPY5 [1] Joint Residential New Construction Program (RNC Program). The RNC Program is jointly offered by Nicor Gas and Commonwealth Edison (ComEd). The program provides incentives to builders and HERS raters for building new homes at least 10% more efficient than current code and installing qualifying energy efficiency equipment in new homes. The RNC program launched in GPY1/EPY4, but this is the first program year where it is claiming savings.

E.1. Program Savings

Table E-1 summarizes the natural gas and electricity savings from the RNC Program.

Table E-1. GPY2/EPY5 Total Program Savings

Savings Category †	Energy Savings (therms)	Energy Savings (kWh)	Average Peak Demand Savings (kW)	Coincident Peak Demand Savings (kW)
Ex Ante Gross Savings	242,112	279,042*	-	-
Verified Gross Savings	220,300	250,645	29.3	66.6
Verified Net Savings	176,240	200,516	23.5	53.3

Source: Utility tracking data and Navigant analysis.
† See the Glossary in the Appendix for definitions
**Based on tracking data; ComEd reported net savings of 30 MWh*

E.2. Program Savings by Home Type

Navigant built four aggregate models for the impact analysis, grouping homes into the following categories: single-story detached, two or more story detached, single-story attached, and two or more story attached. The following two tables summarize the program natural gas and electric savings by home type.

[1] The GPY2/EPY5 program year began June 1, 2012 and ended May 31, 2013.

Table E-2. GPY2 Program Results by Home Type: Therms

Research Category	Ex Ante Gross Savings **(therms)**	Verified Gross Realization Rate	Verified Gross Savings **(therms)**	Free Ridership	Spillover	NTG	Verified Net Savings **(therms)**
Detached 1 Story	53,567	104% ‡	55,674	0.2 †	0 †	0.8 †	44,539
Detached 2+ Story	122,729	86% ‡	105,185	0.2 †	0 †	0.8 †	84,148
Attached 1 Story	18,300	100% ‡	18,258	0.2 †	0 †	0.8 †	14,607
Attached 2+ Story	47,516	87% ‡	41,183	0.2 †	0 †	0.8 †	32,946
Total	**242,112**	**91% ‡**	**220,300**	**0.2 †**	**0 †**	**0.8 †**	**176,240**

Source: Utility tracking data and Navigant analysis.
† *A deemed value.*
‡ *Based on evaluation research findings.*

Table E-3. EPY5 Program Results by Home Type: kWh

Research Category	Ex Ante Gross Savings **(kWh)**	Verified Gross Realization Rate	Verified Gross Savings **(kWh)**	Free Ridership	Spillover	NTG	Verified Net Savings **(kWh)**
Detached 1 Story	42,460	112% ‡	47,532	0.2 †	0 †	0.8 †	38,026
Detached 2+ Story	141,658	83% ‡	117,562	0.2 †	0 †	0.8 †	94,050
Attached 1 Story	26,069	84% ‡	21,821	0.2 †	0 †	0.8 †	17,457
Attached 2+ Story	68,855	93% ‡	63,730	0.2 †	0 †	0.8 †	50,984
Total	**279,042**	**90% ‡**	**250,645**	**0.2 †**	**0 †**	**0.8 †**	**200,516**

Source: Utility tracking data and Navigant analysis.
† *A deemed value.*
‡ *Based on evaluation research findings.*

E.3. Impact Estimate Parameters

The evaluation team used a custom calibrated modeling approach to evaluate the gross energy savings from the RNC program, which was not covered by the Illinois TRM. The models drew on numerous inputs from program home and code building characteristics, none of which are deemed. The net-to-gross value was deemed for this program year, and the gross realization rate is based on this evaluation research, as shown in the following table.

Table E-4. Impact Estimate Parameters

Parameter	Data Source	Deemed or Evaluated?
NTG	SAG Spreadsheet †	Deemed
RR	GPY2/EPY5 Research	Evaluated

† http://ilsagfiles.org/SAG_files/Meeting_Materials/2013/August 5-6, 2013 Meeting/Nicor Gas GPY2-PY6 Proposal Comparisons with SAG.xls
http://ilsagfiles.org/SAG_files/Meeting_Materials/2013/August 5-6, 2013 Meeting/ComEd PY5-PY6 Proposal Comparisons with SAG.xls

E.4. Participation Information

The program had 29 active builders and five active HERS raters in GPY2/EPY5 and paid incentives on a total of 688 homes, as shown in the following table.

Table E-5. GPY2/EPY5 Primary Participation Detail

Participation	Nicor Gas Only	Nicor Gas and ComEd
Completed Homes	196	492
Active* Builders	29	
Active* HERS Rating Companies	5	

Source: Utility tracking data and Navigant analysis.
**One or more homes completed*

E.5. Conclusions and Recommendations

The following provides insight into key program findings and recommendations.

Impact Evaluation

Finding 1. The program exceeded its gross therm and kWh energy savings goals by 23% and 18%, respectfully, despite a gross realization rate of less than 100%. These goals were surpassed because the program completed more homes than targeted for Nicor Gas and because kWh savings per home exceeded planning estimates.

Finding 2. The program achieved a gross savings realization rate of 92% for both gas and electricity.

Finding 3. The evaluation team estimated coincident demand impacts of 66.6 kW for GPY2/EPY5.

Finding 5. Although program homes all exceeded code on a performance basis by at least 10%, Navigant observed that on average certain characteristics met individual code requirements more consistently than others.

Recommendation. Work with builders and raters to improve areas below code, such as wall and foundation insulation levels, as well as those that are at or just above code, such as

window U-values, major appliances, and cooling equipment. Since IECC 2012 has stricter requirements for air sealing and duct sealing, efficiency in these areas alone may not bring homes up to program standards as reliably as in GPY2/EPY5.

Process Evaluation

Finding 10. Raters were satisfied with the program, specifically with their interactions with program staff and the application process. Given the recent launch of the program (Spring 2012), it is operating smoothly and has been able to move on from early roadblocks.

Finding 11. Builders were satisfied with their interaction with HERS raters, but many builders did not have significant interaction with the program and did not view their HERS raters as agents of the program. This lack of connection to the program could lead to low self-reported attribution in future evaluations.

Recommendation. Increase direct builder outreach in order to build stronger relationships with them through the following avenues:

- One-on-one meetings with builders
- Builder training sessions for both technical skills and marketing techniques
- Having a clear "go-to" person or contact list for builders seeking technical support or looking for guidance on program requirements

Finding 12. Builders and raters both expressed a desire for marketing materials to help them spread program awareness and explain the benefits of program homes.

Recommendation. Create separate marketing materials for both builders and prospective homeowners, tailored to the needs of each group. For example:

- Builder materials should advertise the program and provide clear examples of ways to qualify for the program
- Customer materials should help builders market to their clients by explaining the benefits of a program home in terms the average prospective homeowner can understand

Overall, the program performed well in its first full year, exceeding energy and participation targets and enrolling several new builders and raters with homes in the pipeline moving into GPY3/EPY6. The program has moved well beyond just "getting off the ground" and is looking forward to increasing marketing and outreach to expand the program. As described above, the program will benefit from increasing direct outreach to builders and developing additional marketing materials and support.

Future Evaluation Risk

Although the GPY2/EPY5 evaluation did not produce a net-to-gross value, with the IECC 2009 code in place and code shifting to IECC 2012, it was clear that several factors were contributing to changes in builders' practices. Raters indicated that most of the builders they worked with were typically meeting code or exceeding it by up to 6-8%: they confirmed that the program was definitely influential in getting builders to make the necessary changes to meet the program threshold of 10% savings, but this means that the program's actual net savings could be limited to the savings beyond 6-8% above code. While the evaluation team expects that with the IECC 2012 code in place the program is likely playing a larger role in driving efficiency levels beyond code, if Illinois continues to increase code requirements regularly the program could see an ongoing issue with code being a "competing" driver of efficiency improvements.

1. Introduction

1.1 Program Description

The Residential New Construction Program is jointly offered by Nicor Gas and Commonwealth Edison (ComEd). Nicor Gas is the lead utility as the majority of the avoided cost benefits are from natural gas. Residential Science Resources (RSR) implements the program for both utilities. The program launched in early 2012 and did not claim any savings in the first plan year but met or exceeded gas and electric savings goals for GPY2/EPY5 and the planning goal of completing 600 homes. RSR uses completed REM/Rate files for each home to calculate whole-house savings. In addition, ComEd incentivizes several ENERGY STAR electric appliances and claims savings from these installations.

The program relies on networks of builders and HERS raters to garner participation and has already attracted several raters and builders to the program. The current program structure relies heavily on raters to recruit builders to the program, and the current incentives are as such weighted towards raters. The Residential New Construction Program pays incentives of $500 per home to raters and $300 per home to builders; builders receive additional incentives from ComEd for installing program-qualified ENERGY STAR electric appliances. To qualify for the program, homes must achieve savings of at least 10% over an equivalent code-compliant new home based on REM/Rate modeling. The residential energy code in Illinois changed mid-program year: homes permitted through December 2012 were under IECC 2009, and homes permitted in 2013 were under IECC 2012. Due to the length of construction, this resulted in just five of the 688 GPY2/EPY5 homes being permitted under IECC 2012.

1.2 Evaluation Objectives

The objectives of the Nicor Gas Plan Year 2 and ComEd Plan Year 5 (GPY2/EPY5) Residential New Construction Program evaluation were to (1) identify ways in which the program can be improved; (2) determine process-related program strengths and weaknesses; and (3) verify the gross and net kilowatt-hour (kWh), kilowatt (kW), and therm impacts of the program.

The Evaluation Team identified the following key researchable questions for GPY2/EPY5:

1.2.1 Impact Questions

1. What are the gross annual energy and demand savings induced by the program?
2. What are the net impacts from the program? What is the level of free ridership associated with this program? What is the level of spillover associated with this program?
3. Did the program meet its energy and demand savings goals? If not, why not?
4. What is the current level of energy efficient home building education among participating and non-participating builders? How has the program changed this to date?
5. Are the program's due diligence and verification procedures designed and implemented effectively?
6. Does the tracking system meet the program's needs?

1.2.2 Process Questions

1.2.2.1 Marketing and Participation

1. Is the marketing effort sufficient to meet current and future program participation goals?
2. How do participating builders and raters become aware of the program?
3. Is the program outreach to participating builders, raters and customers effective in increasing awareness of the program opportunities?
    a. What is the format of the outreach?
    b. How often does the outreach occur?
    c. Are the outreach messages clear and actionable?
    d. What marketing strategies could be used to boost program awareness?
4. What has been the effect on builders of the transition to the new IECC 2012 residential energy code?

1.2.2.2 Program Characteristics and Barriers

1. What are the key barriers to participation in the program for builders, raters and customers, and how can these be addressed by the program?
2. How do builders perceive the incentives and costs related to this program?
    a. Are program incentives sufficient to encourage participation?
    b. Are there particular program characteristics that could be changed to improve builder satisfaction while maintaining program effectiveness?

1.2.2.3 Administration and Delivery

1. Has the program as implemented changed from the original plan? If so, how, why, and was this an advantageous change?
2. Is program administration being documented and program tracking being conducted in a way that makes the program evaluable?
3. Is the program efficient and well managed? How are problems resolved?
4. Are program tracking data being used to both assess program effectiveness in meeting program savings goals, and inform adjustments to program delivery?
5. What influence does program administration and delivery have on program participation? What could be done to improve program administration and delivery?

1.2.2.4 Participant Satisfaction

1. Overall, are participant builders and raters satisfied with this program?
2. Are participating buildings and raters satisfied with the following program components:
    - Application, home submission and payment processes
    - Interactions with program raters
    - Marketing
    - Education and training

1.2.3 Selected GPY1/EPY4 Evaluation Follow-Up Questions

1. What is the status of the implementation of Navigant's recommendations detailed in the team's Verification, Due Diligence and Tracking System Review memo dated September 14, 2102?
2. What is the status of the implementation of Navigant's recommendations for key performance indicators (KPIs) detailed in Navigant's GPY1/EPY4 Logic Model and Program Theory memo? What are the tracked results for each KPI?

2. Evaluation Approach

Given the program's growth, Navigant expanded on the high-level process evaluation conducted in GPY1/EPY4 by including builder and rater interviews. The evaluation team completed seven builder interviews and four rater interviews. Navigant conducted the impact evaluation in GPY2/EPY5 using calibrated simulation models to estimate both gas savings for Nicor Gas and electric savings for ComEd.

2.1 Overview of Data Collection Activities

The core data collection activities included in-depth interviews and aggregating home characteristics data. The full set of data collection activities is shown in the following table.

Table 2-1. Core Data Collection Activities

N	What	Who	Target Completes	Completes Achieved	When	Comments
Impact Assessment						
1	REM/Rate Data Collection	Completed Homes*	326	326	June 2013	Extracted model inputs from REM/Rate files
2	Gas Billing Data Request	Completed Homes*	326	326	June 2013	Billing data supporting calibrated simulation
3	Electric Billing Data Request	Completed Homes in ComEd Service Territory*,**	92	92	August 2013	Billing data supporting calibrated simulation
Process Assessment						
5	In Depth Interviews	Program Managers/Implementer Staff	3	3	April 2013	Includes staff from Nicor Gas, ComEd, and RSR
6	In Depth Interviews	Program Builders	10-12	7	July-October 2013	Supporting process evaluation and qualitative net-to-gross research
7	In Depth Interviews	Program HERS Raters	3-5	4	July 2013	Supporting process evaluation and qualitative net-to-gross research

**Sample only included homes inspected by November 2012 in order to ensure sufficient billing data. This total includes homes in joint territory as well as homes in Nicor Gas territory only.*
***Of the 126 joint homes completed by November 2012, ComEd provided billing data for 92.*

2.2 Verified Savings Parameters

The RNC program uses a custom modeling approach to determining whole-home savings which is not covered by the Illinois TRM. The evaluation team also used a whole-home modeling approach and did not rely on any deemed algorithms or savings parameters in the gross savings analysis.

The only deemed parameter for the RNC program is the net-to-gross value of 0.80. This value was the planning value for both natural gas and electric savings and the SAG consensus has deemed this value for GPY2/EPY5 and GPY3/EPY6.

2.3 Verified Gross Program Savings Analysis Approach

Navigant used data from program REM/Rate files to build four energy models which represent average program homes: attached single story, attached two or more story, detached single story, and attached two or more story. For each category, Navigant compiled average home characteristics from all homes to determine the correct model inputs.

Navigant used the Building Energy Optimization interface tool (BEOpt, version 2.0) created by the National Renewable Energy Laboratory (NREL) to build these models in EnergyPlus (version 7.2), a modeling software also developed by NREL.[2] For each "energy efficient" model built using program data, Navigant developed a corresponding "base case" scenario based on Illinois energy code. All but six homes in GPY2/EPY5 were built under IECC 2009, and so the evaluation team built the baseline home using specifications from this code.

Once 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 therm and kWh savings. The team used billing data from all homes in each category to calibrate the models. For example, the single-story single-family detached model incorporated characteristics and billing data from all single-story single-family homes in the program.

2.4 Verified Net Program Savings Analysis Approach

Verified net energy and demand (coincident peak and overall) savings were calculated by multiplying the Verified Gross Savings estimates by a net-to-gross ratio (NTGR). In GPY2/EPY5, the NTGR estimates used to calculate the Net Verified Savings were based on past evaluation research and defined through a negotiation process through SAG as documented in a spreadsheet for each utility.[3]

Although the NTGR is deemed for GPY2/EPY5, the evaluation team used rater and builder interviews to collect some qualitative feedback on free-ridership and spillover levels. This methodology and the accompanying results are presented in the appendix (Sections 7.2.3 and 7.2.4).

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[2] For a full discussion of modeling options, see the appendix (Section 7.2.1)

[3] http://ilsagfiles.org/SAG_files/Meeting_Materials/2013/August 5-6, 2013 Meeting/Nicor Gas GPY2-PY6 Proposal Comparisons with SAG.xls
http://ilsagfiles.org/SAG_files/Meeting_Materials/2013/August 5-6, 2013 Meeting/ComEd PY5-PY6 Proposal Comparisons with SAG.xls

2.5 Process Evaluation

In the process evaluation, the Navigant team analyzed four key sources of data:

- In-depth interviews with program staff
- In-depth interviews with participating builders
- In-depth interviews with participating HERS raters
- Program literature (tracking system, marketing and training materials)

Navigant used these data sources to gather information and inform conclusions on the following key aspects of the program:

- Marketing and Participation
- Program Characteristics and Barriers
- Administration and Delivery
- Rater and Builder Satisfaction

2.5.1 Program Staff Interviews

Navigant conducted interviews with the Nicor Gas and ComEd program managers as well as with the RSR implementation staff in June 2013. These interviews discussed the program's progress towards energy savings and participation, as well as changes that occurred in GPY2/EPY5 or were planned for GPY3/EPY6.

2.5.2 Builder Interviews

Navigant conducted in-depth interviews with seven active builders in the program. Unfortunately, the timing of the interviews in the summer and fall coincided with peak construction season and contributed to a low response rate (24%). Although this response rate is not significantly lower than typical interviews with builder and contractor populations, Navigant was unable to reach many of the most active builders, with the result that the respondents only represented 16% of program therm savings and 10% of program kWh savings.

2.5.3 Rater Interviews

Navigant completed in-depth interviews with four of the five HERS rating companies that completed homes in GPY2/EPY5. These raters represented over 90% of the homes and energy savings claimed by the program this year.

3. Gross Impact Evaluation

The RNC program achieved researched gross savings realization rates of 92% for both natural gas and electricity savings, and also accrued 66.6 kW of coincident demand savings. The resulting researched gross savings for GPY2/EPY5 are 221,865 therms and 250,801 kWh. The tracking system is collecting all of the data necessary to support program operations, quality assurance and quality control (QA/QC) procedure, and evaluation activities.

3.1 Program Volumetric Findings

The RNC program completed a total of 688 homes in GPY2/EPY5, exceeding the overall goal of 600 homes set for this program year. Of these homes, 72% were in joint Nicor Gas and ComEd service territory, while the remaining 28% were in Nicor Gas territory only. These homes were submitted by 29 builders working with five HERS rating companies. In addition to these active participants, the program has enrolled 13 builders and 12 rating companies for future participation. As of the end of GPY2/EPY5, the program had enrolled a total of 834 homes.[4] This exceeded the goal of 750 first-year enrollments by 11%.

Key findings include:

1. Enrollment and completion totals exceeded goals for Nicor Gas, but fell short for ComEd due to the number of homes outside of ComEd service territory.[5]
2. High builder and rater enrollment numbers indicate that the program is growing quickly
3. Uptake has been low on electric prescriptive measures. As shown in Table 3-1, most electric measures were installed in 1% of program homes or fewer. The exception is ENERGY STAR® refrigerators, which were installed in 9.5% of joint homes.

[4] Enrollments represent the total number of homes that builders and raters have submitted through the program, including those which are not yet completed.

[5] Although the program initially intended to only incent homes in joint service territory, the implementation team decided to allow Nicor Gas only homes to participate. This change allowed the program to capitalize on some areas with high new construction rates which do not fall in ComEd service territory. Due to the greater than expected electric savings per home, the program still met electric savings targets.

Table 3-1. GPY2/EPY5 Volumetric Findings Detail

	Detail	Joint Homes	Nicor Gas Only Homes
Completed Home Data	Completed Homes	492	196
	Active* Builders	29	5
	Active* Raters		
Prescriptive Electric Measure Data (Completed Homes)	ECM Furnace Fans	5	*2***
	Central Air Conditioners >=14.5 SEER	2	*3***
	ENERGY STAR ® Refrigerators	64	*16***
	ENERGY STAR ® Exhaust Fans	1	*0***
	Homes with 100% CFL Lighting	3	*1***
Enrollment Data	Enrolled Homes		
	Enrolled Builders		42
	Enrolled Raters		17

Source: Program tracking data, EM&V analysis
**Completed one or more homes in GPY2/EPY5*
*** Electric prescriptive measures installed in Nicor Gas only homes did not receive incentives.*

3.2 Tracking System Review

Navigant worked with the tracking system in three different ways over the course of the GPY2/EPY5 evaluation:

- The evaluation team was given read-only access to the HouseRater database. Navigant used this access to download REM/Rate files for sampled homes in the impact analysis.
- RSR provided two different tracking system data extracts:
  - The original "Dashboard" extract developed for Nicor Gas and ComEd
  - A new extract for Nicor Gas' TrakSmart system, which will be updated automatically from HouseRater

3.2.1 HouseRater Online Database

Navigant found the HouseRater database fairly easy to navigate. The system contained complete file documentation for all program homes, which was invaluable to the evaluation effort for collecting household characteristics. However, not all functionality was complete. For example, the evaluation team could not filter results by date although the system appeared to have the capability. One disadvantage to the database structure was that the evaluation team could not "batch" download REM/Rate files, instead needing to download them individually.

3.2.2 Tracking Data Extracts

Initially, Navigant received "Dashboard" extracts from RSR. These extracts provided critical information such as home addresses, builder and rater contact information, home gas and electric consumption data by high-level end-use (heating, cooling, lights and appliances, etc.), and data on the presence of electric prescriptive measures. The program then transitioned to a new extract template designed to automatically export to Nicor Gas' TrakSmart system. This extract contained most of the same information, although it only provides consumption data at the home level and does not indicate the presence of electric prescriptive measures since it was designed for Nicor Gas.

3.2.3 Key Findings

Key findings include:

1. HouseRater is collecting sufficient data to meet the needs of the program and evaluation.
2. Electric savings are not tracked consistently across the Dashboard and TrakSmart data extracts, making it difficult to analyze the entire program through one set of tracking data.
3. RSR could improve HouseRater by enabling batch downloads of REM/Rate files and correcting date filtering functionality for all users.

3.3 Verified Gross Program Impact Results

Table 3-2 and Table 3-3 show the resulting gas and electric calibrated model outputs for the program homes and corresponding IECC 2009 baseline models.[6] These results reflect the use of a Typical Meteorological Year 3 (TMY3) weather file for Chicago O'Hare airport. The weighted average results reflect the contribution of each model bin to the total program savings.

Table 3-2. Average Gross Ex Post Therm Savings per Home by Model Bin

Model Bin	Baseline Model Gas Consumption (TMY)	Efficient Model Gas Consumption (TMY)	Gross Ex Post Therm Savings	Gross Ex Post Percent Savings
Detached 1 Story	1149	831	318	28%
Detached 2+ Story	1563	1138	425	27%
Attached 1 Story	869	676	193	22%
Attached 2+ Story	750	549	201	27%
Weighted Average	**1135**	**832**	**303**	**27%**

Source: Evaluation Team analysis

[6] There were five homes in GPY2/EPY5 built under the IECC 2012 code; none of these homes were included in the evaluation sample because they had not been completed prior to the heating season. Navigant applied the same realization rate to these homes for this year given their small contribution to overall gross savings.

Table 3-3. Average Gross Ex Post kWh Savings per Home by Model Bin

Model Bin	Baseline Model kWh Consumption (TMY)	Efficient Model kWh Consumption (TMY)	Gross Ex Post kWh Savings	Gross Ex Post Percent Savings
Detached 1 Story	7201	6700	501	7%
Detached 2+ Story	9279	8664	615	7%
Attached 1 Story	6111	5721	390	6%
Attached 2+ Story	6852	6342	510	7%
Weighted Average	**7790**	**7255**	**535**	**7%**

Source: Evaluation Team analysis.

Table 3-4 shows the ex-ante savings, realization rates, and researched gross savings for GPY2/EPY5. The overall realization rate was 91% for therm energy savings and 90% for kWh energy savings. ComEd did not claim any demand savings; Navigant estimated coincident peak demand savings using hourly model outputs.

Table 3-4. GPY2/EPY5 Research Gross Impact Savings Estimates

		Sample Size	Energy Savings (therms)	Energy Savings (kWh)	Coincident Peak Demand Savings (kW)
Detached 1 Story	Ex-Ante Gross Savings		53,567	41,069	-
	Realization Rate	59	104%	116%	-
	Research Gross Savings		55,674	47,532	14.3
Detached 2+ Story	Ex-Ante Gross Savings		122,729	138,027	-
	Realization Rate	102	86%	85%	-
	Research Gross Savings		105,185	117,562	28.5
Attached 1 Story	Ex-Ante Gross Savings		18,300	24,587	-
	Realization Rate	53	100%	89%	-
	Research Gross Savings		18,258	21,821	6.4
Attached 2+ Story	Ex-Ante Gross Savings		47,516	67,943	-
	Realization Rate	112	87%	94%	-
	Research Gross Savings		41,183	63,730	17.4
Total	Ex-Ante Gross Savings		242,112	279,042	-
	Realization Rate	326	91.0%	89.8%	-
	Research Gross Savings		220,300	250,645	66.6

Source: Evaluation Team analysis.

Although program homes all exceeded code on a performance basis by at least 10%, Navigant observed that on average certain characteristics met individual code requirements more consistently than others. These average trends are shown in Table 3-5, where "above" code means more efficient than code and "below" code means less efficient than code. Well above and well below code areas are indicated with green and red shading, respectively. Program homes gained the most savings from air sealing, duct sealing, and heating equipment efficiency, but on average were below code for wall and foundation insulation. The gains from above-code characteristics exceeded the losses from below-code components enough for all homes to still achieve net energy savings of at least 10% beyond code.

Table 3-5. Average Program Home Characteristics7

Category	Program Homes Relative to IECC 2009 and Current Standards
Wall Insulation	Well below code
Ceilings/Roofs	At or just above code
Foundation/Floor Insulation	At or below code
Window U-values	Equal to code
Air Sealing	Well above code
Major Appliances	At or just above standards
Lighting	Mostly at or above code
Heating Equipment	Well above standard
Cooling Equipment	At or just above standard
Duct Sealing	Well above code
Duct Insulation	At or just above code
Water Heating	Above standard

Source: Navigant Analysis. Code reference is IECC 2009.

3.3.1 Estimated Electric Prescriptive Measure Savings

Navigant analyzed the electric tracking data to provide an estimate of the savings from prescriptive measures only. The team used the Illinois TRM to estimate these values, using actual model-specific data where possible for both refrigerators and air conditioners. Due to the interactive nature of some of these measures with other residential end uses, Navigant does not consider these estimates verified savings, and recommends claiming the whole-house savings produced by the energy models.

[7] These averages are based on the evaluation team's gross impact modeling sample, which was drawn from the first half of GPY2/EPY5. Tracking data shows that HERS scores did improve throughout the rest of the program year, indicating that builders may already have increased efficiency levels in some of these areas.

Table 3-6. Electric Prescriptive Savings Estimates

	Ex Ante Quantity	Verified Quantity	Ex Ante Per Unit Savings	Ex Post Per Unit Savings	Ex Ante Total Savings	Ex Post Total Savings
ECM Furnace Motor	5	5	732	732	3,660	3,660
Air Conditioner >=14.5 SEER	2	2	152	304	304	609
ENERGY STAR ® Refrigerator	46	64	114	147	5,244	9,395
ENERGY STAR ® Exhaust Fan	1	1	89	89	89	89
100% CFL Lighting	3	3	593	1,612	1,779	4,837
Total					11,076	18,588

Source: Navigant Analysis.

4. Net Impact Evaluation

SAG[8] deemed the NTG value of 0.80 to be used to calculate PY5 verified net savings.

The evaluation calculated verified net savings of 176,240 therms, 201 MWh and 0.05 MW, as shown in the following table.

Table 4-1. GPY2/EPY5 Verified Net Impact Savings Estimates by Measure Type

	Sample Size	Energy Savings (therms)	Energy Savings (kWh)	Coincident Peak Demand Savings (kW)
Ex-Ante GPY2/EPY5 Gross Savings	688	242,112	279,042	-
Realization Rate	326	91.0%	89.8%	-
Verified Gross Savings	688	220,300	250,645	66.6
Free Ridership	n/a	0.20	0.20	0.20
Spillover	n/a	0.00	0.00	0.00
NTG	n/a	0.80	0.80	0.80
Verified Net Savings	688	176,240	200,516	53.3

Source: Evaluation Team analysis.

Although Navigant did not conduct a full net-to-gross analysis, the team did collect information on attribution through the builder and rater interviews. A discussion of this analysis can be found in the appendix (Section 7.2.4).

[8] http://ilsagfiles.org/SAG_files/Meeting_Materials/2013/August 5-6, 2013 Meeting/Nicor Gas GPY2-PY6 Proposal Comparisons with SAG.xls
http://ilsagfiles.org/SAG_files/Meeting_Materials/2013/August 5-6, 2013 Meeting/ComEd PY5-PY6 Proposal Comparisons with SAG.xls

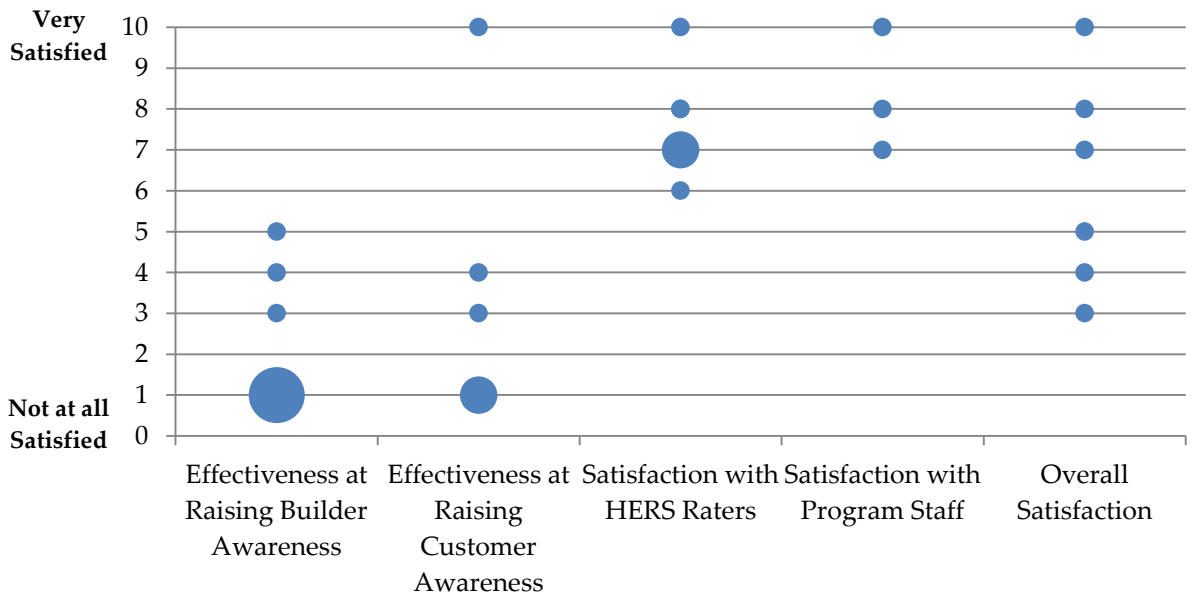
5. Process Evaluation

This section describes high-level findings from Navigant's in-depth interviews with program staff, HERS raters, and builders. This is the first year that the program has completed homes. Overall, Navigant found that the program experienced some process difficulties as it launched, but has greatly improved in many areas over the course of GPY2/EPY5 and continues to work on additional process improvements. For a more thorough discussion of process findings, please see the appendix (Section 7.3).

5.1 Participant Satisfaction

As shown in Figure 5-1, builders were generally satisfied with their interactions with HERS raters, and those who had interactions with program staff were very satisfied. Additionally, four of the seven respondents said that they felt better qualified to build program-eligible homes as a result of their interactions with their HERS raters. The size of each circle indicates the number of raters giving a single response.

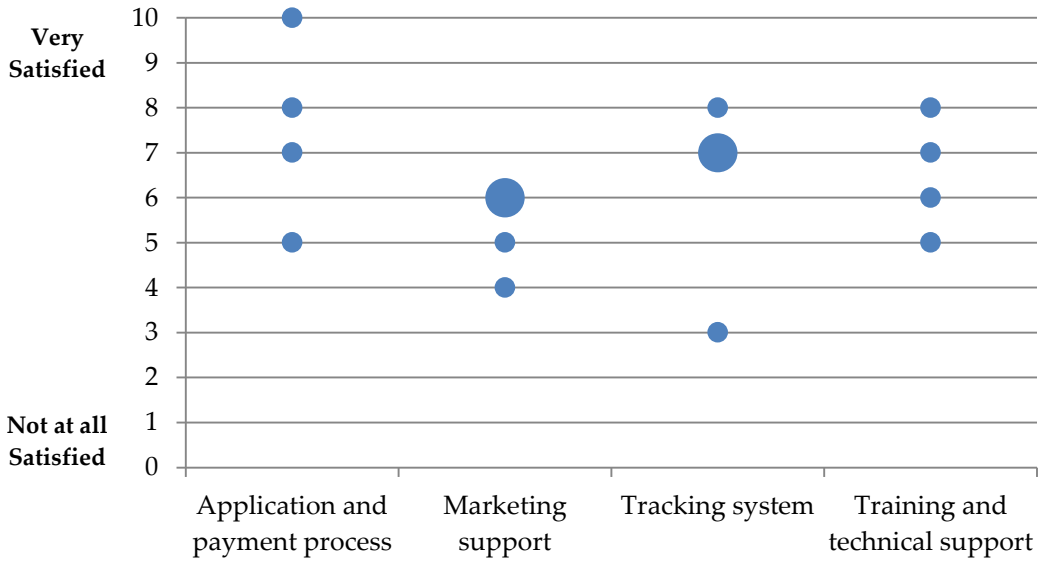
Figure 5-1. Builder Satisfaction and Program Effectiveness Ratings



Source: Navigant analysis

As shown in Figure 5-2, raters were most satisfied with the application and payment process and least satisfied with marketing support. Some were very satisfied with the HouseRater tracking system, but others felt it was cumbersome and required more time and data entry than other programs.

Figure 5-2. Rater Satisfaction with Program (Score out of 10)



Source: Navigant analysis

5.2 Marketing and Participation

In PY2, the program succeeded in enrolling and completing enough homes to exceed the implementation contractor's participation and savings goals for Nicor Gas,[9] exceed savings goals for ComEd, and achieve over 70% of the joint home participation goal. The program's approach of leveraging raters to recruit builders has been effective, as several builders heard about the program through their raters. However, this approach has kept some builders from interacting directly with program staff, and many do not credit the program for the assistance that they get from their raters.

As shown above in Figure 5-1, builders did not feel that the program has been effective to date at raising customer or builder awareness of the program and energy efficient building practices. Some indicated that this was because many builders and customers already knew about energy efficient building practices, but others felt that program awareness was low among customers and that the program could do more to help builders market the program. Raters also noted that marketing was a weak area for the program: one rater described the marketing support as "light" and another indicated that while the program has "been there for whatever they have needed, [they] would like to have some marketing material in hand."

5.3 Program Characteristics and Barriers

Builders cited the cost of participation relative to the incentives offered as the most common barrier to participation. Two builders also indicated that they did not understand program requirements; one rater also commented on this, saying that builders needed concrete examples of steps they could take in order to meet the program's requirements.

[9] The program also exceeded the original savings goals filed in Nicor Gas' Energy Efficiency Plan filed in 2011 for GPY2.

For some raters, glitches and the amount of information required by the tracking database presented another barrier. One large rater indicated that sometimes the effort to provide all of the documentation was not worth the time, and that this aspect of the program could be streamlined.

5.4 Administration and Delivery

Program staff, raters and builders all confirmed that although early in the program year the program was not delivered smoothly, program staff had increased the level of service throughout the year and made significant progress. Over the course of GPY2/EPY5, the following changes have contributed to this improvement:

- RSR increased the frequency of payments to raters and builders from monthly to bi-weekly.
- The program elected to pay incentives on homes outside of the ComEd electric service territory (Nicor Gas only homes) in order to capitalize on construction "hot spots" in some areas of Nicor Gas-only service territory.
- RSR brought on additional staff dedicated to the program.

One rater said that "the program has come a long way," and one builder said that although his first interaction with the program was "less than satisfactory, the second was beyond [his] wildest dreams." This shows that the program is working hard to learn from early challenges and keep participants satisfied. In addition, program staff reported that rater and builder trainings were well attended and that raters were generally satisfied with the training offerings. Utility staff also noted that a next step for the program should be to extend more formal and one-on-one training offerings to builders, and that the program has already begun to work more closely with some of the larger builders.

6. Conclusions and Recommendations

This section summarizes the key impact and process findings and recommendations.

Overall, the program performed well in its first full year, exceeding energy and participation targets and enrolling several new builders and raters with homes in the pipeline moving into GPY3/EPY6. The program has moved well beyond just "getting off the ground" and is looking forward to increasing marketing and outreach to expand the program in future years. The following findings and recommendations provide additional suggestions for how to improve the program as it grows.

Gross Impact Findings

Finding 1. The program exceeded RSR's GPY2/EPY5 gross therm and kWh energy savings goals by 23% and 18%, respectfully, despite a gross realization rate of less than 100%.[10] These goals were surpassed because the program completed more homes than targeted for Nicor Gas and because kWh savings per home exceeded planning estimates. The program devised successful outreach strategies such as identifying and targeting areas with high construction rates to gain new participants.

Finding 2. The program achieved a gross savings realization rate of 92% for both gas and electricity. The gross impact evaluation was limited by the amount of billing data available.

Finding 3. The evaluation team estimated demand impacts of 66.6 kW for GPY2/EPY5.

Finding 4. A 2011 study for the Midwest Energy Efficiency Alliance (MEEA) and the Illinois Department of Commerce and Economic Opportunity (DCEO) indicated that compliance with IECC 2009 is below 100% in Illinois.[11] Unfortunately, the study did not provide data in a format that could support evaluation adjustments to the code baseline.

Recommendation. Conduct or leverage further research on regional compliance with IECC 2012 in order to determine whether the baseline should be adjusted in future evaluations.

Finding 5. Although program homes all exceeded code on a performance basis by at least 10%, Navigant observed that on average certain characteristics met individual code requirements more consistently than others.

Recommendation. Work with builders and raters to improve areas below code, such as wall and foundation insulation levels, as well as those that are at or just above code, such as window U-values, major appliances, and cooling equipment. Since IECC 2012 has stricter requirements for air sealing and duct sealing, efficiency in these areas alone may not bring homes up to program standards as reliably as in GPY2/EPY5.

[10] The program also exceeded the gas savings goals for GPY2 as filed in Nicor Gas' Energy Efficiency Plan by 286%.

[11] "Measuring the Baseline Compliance Rate for Residential and Non-Residential Buildings in Illinois Against the 2009 International Energy Conservation Code." Association of Professional Energy Consultants, Inc. June 30, 2011.

Finding 6. Although whole-home electric savings exceeded expectations, uptake has been low on electric prescriptive measures. Most electric measures were installed in 1% of program homes or fewer. The exception is ENERGY STAR® refrigerators, which were installed in 9.5% of joint homes.

Recommendation. Provide additional marketing material or sales pitch ideas to help builders and raters to increase the prevalence of these measures.

Recommendation. Estimate savings for all electric measures through whole-home models in order to more accurately capture whole-home savings and interactive effects.

Finding 7. Raters described that achieving 100% CFL lighting is very difficult due to the popularity of specialty fixtures which may not have CFL options.

Recommendation. Consider changing this requirement to 90% or 95%, or require ENERGY STAR® lighting not limited to CFLs (e.g. LED).

Net Impact Findings

Finding 8. Navigant's qualitative analysis of rater interview data indicated that free-ridership could be as high as 33% to 67% for homes built under IECC 2009 code.

Recommendation. Increase educational opportunities for builders and raters in order to increase the program's influence on building practices

Finding 9. Code enforcement is reportedly high in this region and meeting code is a clear area of influence for many builders.

Process Findings

Finding 10. Raters were satisfied with the program, specifically with their interactions with program staff and the application process. Given the recent launch of the program (Spring 2012), it is operating smoothly and has been able to move on from early roadblocks.

Finding 11. Builders were satisfied with their interaction with HERS raters, but many did not have significant interaction with the program and did not view their HERS raters as agents of the program. This lack of connection to the program could lead to low self-reported attribution in future evaluations.

Recommendation. Increase direct builder outreach in order to build stronger relationships with them through the following avenues:

- One-on-one meetings with builders
- Builder training sessions for both technical skills and marketing techniques
- Having a clear "go-to" person or contact list for builders seeking technical support or looking for guidance on program requirements

Finding 12. Builders and raters both expressed a desire for marketing materials to help them spread program awareness and explain the benefits of program homes.

Recommendation. Create separate marketing materials for both builders and prospective homeowners, tailored to the needs of each group. For example:

- Builder materials should advertise the program and provide clear examples of ways to qualify for the program

- Customer materials should help builders market to their clients by explaining the benefits of a program home in terms the average prospective homeowner can understand

7. Appendix

7.1 Glossary

High Level Concepts

Program Year

- EPY1, EPY2, etc. Electric Program Year where EPY1 is June 1, 2008 to May 31, 2009, EPY2 is June 1, 2009 to May 31, 2010, etc.
- GPY1, GPY2, etc. Gas Program Year where GPY1 is June 1, 2011 to May 31, 2012, GPY2 is June 1, 2012 to May 31, 2013.

There are two main tracks for reporting impact evaluation results, called Verified Savings and Impact Evaluation Research Findings.

Verified Savings composed of

- Verified Gross Energy Savings
- Verified Gross Demand Savings
- Verified Net Energy Savings
- Verified Net Demand Savings

These are savings using deemed savings parameters when available and after evaluation adjustments to those parameters that are subject to retrospective adjustment for the purposes of measuring savings that will be compared to the utility's goals. Parameters that are subject to retrospective adjustment will vary by program but typically will include the quantity of measures installed. In EPY5 ComEd's deemed parameters were defined in its filing with the ICC. The Gas utilities agreed to use the parameters defined in the TRM, which came into official force for EPY5/GPY2.

Application: When a program has deemed parameters then the Verified Savings are to be placed in the body of the report. When it does not (e.g., Business Custom, Retro-commissioning), the evaluated impact results will be the Impact Evaluation Research Findings.

Impact Evaluation Research Findings composed of

- Research Findings Gross Energy Savings
- Research Findings Gross Demand Savings
- Research Findings Net Energy Savings
- Research Findings Net Demand Savings

These are savings reflecting evaluation adjustments to any of the savings parameters (when supported by research) regardless of whether the parameter is deemed for the verified savings analysis. Parameters that are adjusted will vary by program and depend on the specifics of the research that was performed during the evaluation effort.

Application: When a program has deemed parameters then the Impact Evaluation Research Findings are to be placed in an appendix. That Appendix (or group of appendices) should be labeled Impact Evaluation Research Findings and designated as "ER" for short. When a program does not have deemed parameters (e.g., Business Custom, Retro-commissioning), the Research Findings are to be in the body of the report as the only impact findings. (However, impact findings may be summarized in the body of the report and more detailed findings put in an appendix to make the body of the report more concise.)

Program-Level Savings Estimates Terms

N	Term Category	Term to Be Used in Reports‡	Application†	Definition	Otherwise Known As (terms formerly used for this concept)§
1	Gross Savings	Ex-ante gross savings	Verification and Research	Savings as recorded by the program tracking system, unadjusted by realization rates, free ridership, or spillover.	Tracking system gross
2	Gross Savings	Verified gross savings	Verification	Gross program savings after applying adjustments based on evaluation findings for only those items subject to verification review for the Verification Savings analysis	Ex post gross, Evaluation adjusted gross
3	Gross Savings	Verified gross realization rate	Verification	Verified gross / tracking system gross	Realization rate
4	Gross Savings	Research Findings gross savings	Research	Gross program savings after applying adjustments based on all evaluation findings	Evaluation-adjusted ex post gross savings
5	Gross Savings	Research Findings gross realization rate	Research	Research findings gross / ex-ante gross	Realization rate
6	Gross Savings	Evaluation-Adjusted gross savings	Non-Deemed	Gross program savings after applying adjustments based on all evaluation findings	Evaluation-adjusted ex post gross savings
7	Gross Savings	Gross realization rate	Non-Deemed	Evaluation-Adjusted gross / ex-ante gross	Realization rate
1	Net Savings	Net-to-Gross Ratio (NTGR)	Verification and Research	1 – Free Ridership + Spillover	NTG, Attribution
2	Net Savings	Verified net savings	Verification	Verified gross savings times NTGR	Ex post net
3	Net Savings	Research Findings net savings	Research	Research findings gross savings times NTGR	Ex post net
4	Net Savings	Evaluation Net Savings	Non-Deemed	Evaluation-Adjusted gross savings times NTGR	Ex post net
5	Net Savings	Ex-ante net savings	Verification and Research	Savings as recorded by the program tracking system, after adjusting for realization rates, free ridership, or spillover and any other factors the program may choose to use.	Program-reported net savings

‡ "Energy" and "Demand" may be inserted in the phrase to differentiate between energy (kWh, Therms) and demand (kW) savings.

† **Verification** = Verified Savings; **Research** = Impact Evaluation Research Findings; **Non-Deemed** = impact findings for programs without deemed parameters. We anticipate that any one report will either have the first two terms or the third term, but never all three.

§ Terms in this column are not mutually exclusive and thus can cause confusion. As a result, they should not be used in the reports (unless they appear in the "Terms to be Used in Reports" column).

Individual Values and Subscript Nomenclature

The calculations that compose the larger categories defined above are typically composed of individual parameter values and savings calculation results. Definitions for use in those components, particularly within tables, are as follows:

Deemed Value – a value that has been assumed to be representative of the average condition of an input parameter and documented in the Illinois TRM or ComEd's approved deemed values. Values that are based upon a deemed measure shall use the superscript "D" (e.g., delta watts, HOU-Residential).

Non-Deemed Value – a value that has not been assumed to be representative of the average condition of an input parameter and has not been documented in the Illinois TRM or ComEd's approved deemed values. Values that are based upon a non-deemed, researched measure or value shall use the superscript "E" for "evaluated" (e.g., delta watts^{E}, HOU-Residential^{E}).

Default Value – when an input to a prescriptive saving algorithm may take on a range of values, an average value may be provided as well. This value is considered the default input to the algorithm, and should be used when the other alternatives listed for the measure are not applicable. This is designated with the superscript "DV" as in X^{DV} (meaning "Default Value").

Adjusted Value – when a deemed value is available and the utility uses some other value and the evaluation subsequently adjusts this value. This is designated with the superscript "AV" as in X^{AV}

Glossary Incorporated From the TRM

Below is the full Glossary section from the TRM Policy Document as of October 31, 2012[12].

Evaluation: Evaluation is an applied inquiry process for collecting and synthesizing evidence that culminates in conclusions about the state of affairs, accomplishments, value, merit, worth, significance, or quality of a program, product, person, policy, proposal, or plan. Impact evaluation in the energy efficiency arena is an investigation process to determine energy or demand impacts achieved through the program activities, encompassing, but not limited to: *savings verification*, *measure level research*, and *program level research*. Additionally, evaluation may occur outside of the bounds of this TRM structure to assess the design and implementation of the program.

Synonym: **Evaluation, Measurement and Verification (EM&V)**

> **Measure Level Research**: An evaluation process that takes a deeper look into measure level savings achieved through program activities driven by the goal of providing Illinois-specific research to facilitate updating measure specific TRM input values or algorithms. The focus of this process will primarily be driven by measures with high savings within Program Administrator portfolios, measures with high uncertainty in TRM input values or algorithms (typically informed by previous savings verification activities or program level research), or measures where the TRM is lacking Illinois-specific, current or relevant data.

[12] IL-TRM_Policy_Document_10-31-12_Final.docx

Program Level Research: An evaluation process that takes an alternate look into achieved program level savings across multiple measures. This type of research may or may not be specific enough to inform future TRM updates because it is done at the program level rather than measure level. An example of such research would be a program billing analysis.

Savings Verification: An evaluation process that independently verifies program savings achieved through prescriptive measures. This process verifies that the TRM was applied correctly and consistently by the program being investigated, that the measure level inputs to the algorithm were correct, and that the quantity of measures claimed through the program are correct and in place and operating. The results of savings verification may be expressed as a program savings realization rate (verified ex post savings / ex ante savings). Savings verification may also result in recommendations for further evaluation research and/or field (metering) studies to increase the accuracy of the TRM savings estimate going forward.

Measure Type: Measures are categorized into two subcategories: custom and prescriptive.

Custom: Custom measures are not covered by the TRM and a Program Administrator's savings estimates are subject to retrospective evaluation risk (retroactive adjustments to savings based on evaluation findings). Custom measures refer to undefined measures that are site specific and not offered through energy efficiency programs in a prescriptive way with standardized rebates. Custom measures are often processed through a Program Administrator's business custom energy efficiency program. Because any efficiency technology can apply, savings calculations are generally dependent on site-specific conditions.

Prescriptive: The TRM is intended to define all prescriptive measures. Prescriptive measures refer to measures offered through a standard offering within programs. The TRM establishes energy savings algorithms and inputs that are defined within the TRM and may not be changed by the Program Administrator, except as indicated within the TRM. Two main subcategories of prescriptive measures included in the TRM:

Fully Deemed: Measures whose savings are expressed on a per unit basis in the TRM and are not subject to change or choice by the Program Administrator.

Partially Deemed: Measures whose energy savings algorithms are deemed in the TRM, with input values that may be selected to some degree by the Program Administrator, typically based on a customer-specific input.

In addition, a third category is allowed as a deviation from the prescriptive TRM in certain circumstances, as indicated in Section 3.2:

Customized basis: Measures where a prescriptive algorithm exists in the TRM but a Program Administrator chooses to use a customized basis in lieu of the partially or fully deemed inputs. These measures reflect more customized, site-specific calculations (e.g., through a simulation model) to estimate savings, consistent with Section 3.2.

7.2 Detailed Impact Analysis

7.2.1 Rationale for Use of BEopt in Gross Impact Evaluation

Navigant typically uses hourly simulation software for evaluations that require building modeling, both residential and commercial. In recent evaluations we have used the EnergyPlus engine with NREL's Building Energy Optimization (BEopt) software as a front end. BEopt allows us to run multiple building scenarios simultaneously and simplifies the data entry process. BEopt can also be used with the DOE-2 engine, which is used in many industry standard tools such as eQuest.

Navigant believes that the implementation team is fully justified in using REM/Rate as a tool to estimate ex ante savings for homes in the Residential New Construction program: it is the industry standard for home rating, is widely used by HERS raters across the country, and provides reasonably accurate savings estimates. However, as an evaluator, Navigant's aim is to provide the most accurate savings estimates possible, and we believe that using software which is capable of hourly simulation is the best option for our impact analysis. The Department of Energy's Building America Research program gives the following explanation for using an hourly simulation:

> *An hourly simulation is often necessary to fully evaluate the time-dependent energy impacts of advanced systems used in Building America houses. Thermal mass, solar heat gain, and wind-induced air infiltration are examples of time-dependent effects that can be accurately modeled only by using a model that calculates heat transfer and temperature in short time intervals. In addition, an hourly simulation program is necessary to accurately estimate peak energy loads.*[13]

7.2.2 Gross Impact Results

Navigant analyzed homes by grouping them into four "model bins." Table 7-1 shows the total number of homes and gross ex ante savings associated with each bin, as well as the number of homes included in the analysis. Navigant only included homes inspected by November 2012 in order to ensure that there would be sufficient heating season billing data available to calibrate the models.

[13] Hendron, Robert and Cheryn Engebrecht. "Building America House Simulation Protocols." National Renewable Energy Laboratory, October 2010. http://apps1.eere.energy.gov/buildings/publications/pdfs/building_america/house_simulation_revised.pdf

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

Model Bin	Total GPY5/EPY2 Homes	Sampled Homes	Total Ex Ante Gross Therms	Mean Ex Ante Gross Therms per Home	Total Ex Ante Gross kWh	Mean Ex Ante Gross kWh per Home
Detached 1 Story	156	59	53,567	343	41,069	399
Detached 2+ Story	236	102	122,729	520	138,027	715
Attached 1 Story	91	53	18,300	201	24,587	424
Attached 2+ Story	205	112	47,516	232	67,943	492
Total	**688**	**326**	**242,112**	**352**	**271,626**	**552**

Source: RSR TrakSmart export, Navigant analysis

Navigant extracted all home characteristics for the sampled homes from the final REM Rate files stored in the HouseRater system. The team then built models for each bin incorporating average home characteristics such as 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, Navigant defaulted to built-in Building America Benchmark data for new construction. One example of this is electric plug loads. Navigant incorporated the characteristics of the prescriptive electric measures in the models, such that the model output results include savings from these measures. Navigant 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.

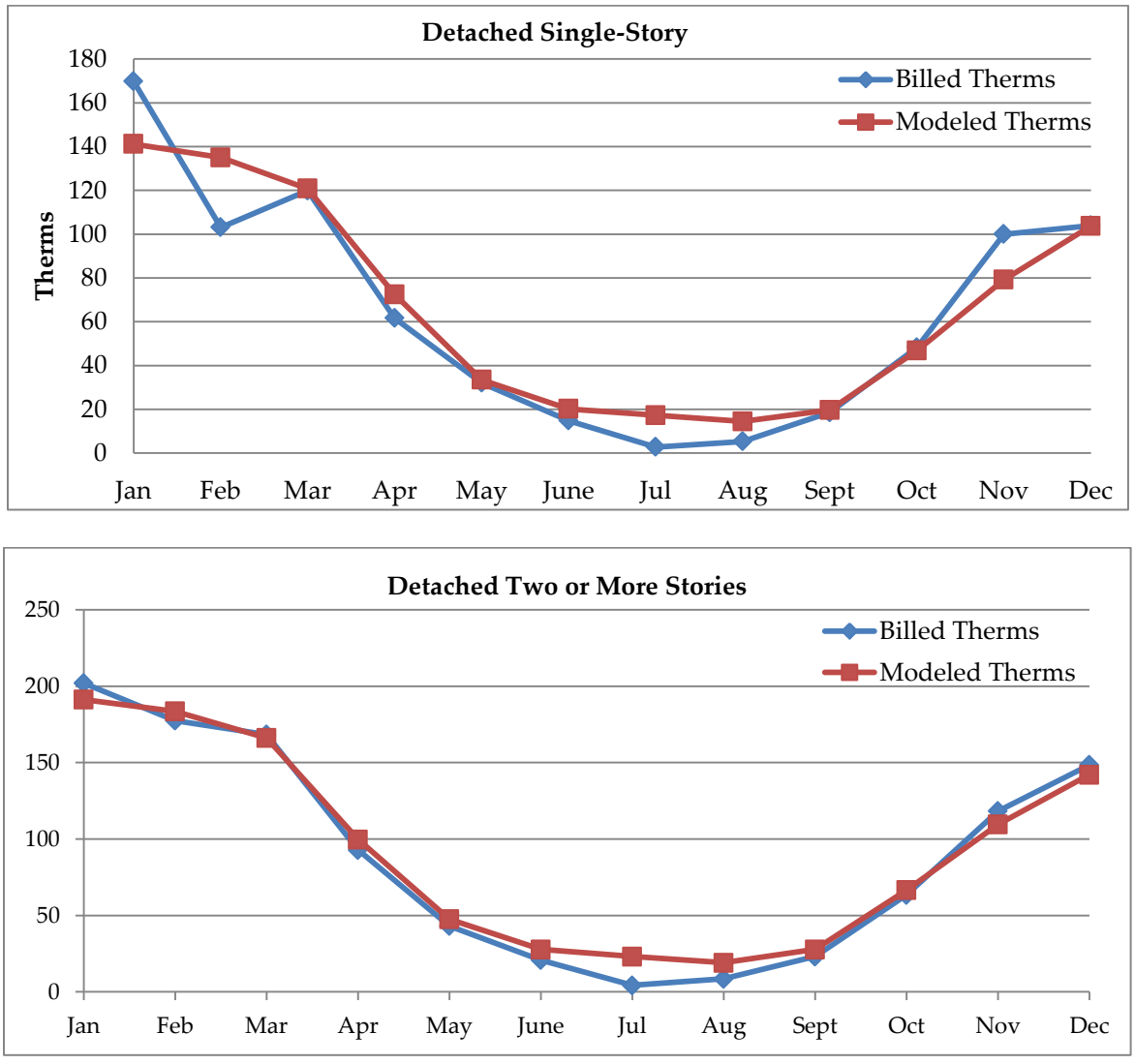
Navigant typically calibrates models to match monthly loads, but the accelerated evaluation timeline and resulting limited amount of billing data made this infeasible for two reasons. First, without a full summer of data, Navigant could not accurately calibrate the "base" or non-heating load, which is an important part of characterizing monthly use. Second, the fact that Nicor Gas does not read residential meters every month resulted in some billing records having unusual spikes and dips that may not reflect when the home actually consumed the therms billed.[14] In a larger sample these irregularities often average out, but with the limited number of homes available this was not the case. Navigant thus elected to calibrate based on the total therms billed for all months where at least 90% of homes showed non-zero billing records (October 2012 through June 2013). This period covered the majority of the heating season, when the bulk of residential gas use occurs. Navigant calibrated each model to within 1% of the total therms billed for this period.

Figure 7-1 shows the billed therms and modeled therms for two of the four model bins; the billing data is smoother for the two or more story bin, which had a larger sample size (n = 102) than the single-story bin (n = 59). Both billed consumption trends reflect little or no billing data available for

[14] For example, if Nicor Gas bills 200 therms for a December to January period based on predictive algorithms, but finds that by a meter read in February that a total of only 240 therms have been consumed over the two months since the last meter read, the data will show 200 therms for January and only 40 for February. In reality, the consumption is likely closer to 50% of the total in each month.

July through September; these months were not included in the calibration totals.[15] Although ComEd provided billing data as well, Navigant determined that the sample size was too small for this program year to calibrate the electric usage as well (n = 92 homes across all four models for electric instead of n = 326 for gas), and furthermore due to the timeline of the evaluation data was not available for all homes for the full cooling season. Navigant used the electricity consumption outputs from the calibrated gas models to estimate electric savings; the model output for months with usable billing data ranged from 9% below billing data totals to 11% above billing data totals, indicating additional uncertainty in the electric results.

Figure 7-1. Example Calibration for Detached Single and Two or More Story Models



Source: Navigant analysis

[15] Navigant believes that the BEopt load shapes are more realistic than the limited billing data for these months; savings are still captured from water heater efficiency improvements for this period although the exact "base load" could not be calibrated.

Table 7-2 shows the results of the calibration adjustments for therms for each model bin. Navigant calibrated each model to within less than 0.5% of the billing data total therms. For the calibration modeling, Navigant used an actual weather file for Chicago O'Hare airport for July 2012 - June 2013.

Table 7-2. Calibrated Gas Results by Model Bin

Model Bin	Billed Calibration Period Therms	Modeled Calibration Period Therms	Modeled - Billed Therms	Percent Difference
Detached 1 Story	753	753	-0.4	-0.1%
Detached 2+ Story	1035	1034	-0.7	-0.1%
Attached 1 Story	604	603	-1.2	-0.2%
Attached 2+ Story	479	478	-0.8	-0.2%

Source: Navigant analysis

Table 7-3 and Table 3-3 show the resulting gas and electric calibrated model outputs for the program homes and corresponding IECC 2009 baseline models.[16] These results reflect the use of a Typical Meteorological Year 3 (TMY3) weather file for Chicago O'Hare airport. The weighted average results reflect the contribution of each model bin to the total program savings.

Table 7-3. Average Gross Ex Post Therm Savings per Home by Model Bin

Model Bin	Baseline Model Gas Consumption (TMY)	Efficient Model Gas Consumption (TMY)	Gross Ex Post Therm Savings	Gross Ex Post Percent Savings
Detached 1 Story	1149	831	318	28%
Detached 2+ Story	1563	1138	425	27%
Attached 1 Story	869	676	193	22%
Attached 2+ Story	750	549	201	27%
Weighted Average	**1135**	**832**	**303**	**27%**

Source: Navigant analysis

[16] There were five homes in GPY2/EPY5 built under the IECC 2012 code; none of these homes were included in the evaluation sample because they had not been completed prior to the heating season. Navigant applied the same realization rate to these homes for this year given their small contribution to overall gross savings.

Table 7-4. Average Gross Ex Post kWh Savings per Home by Model Bin

Model Bin	Baseline Model kWh Consumption (TMY)	Efficient Model kWh Consumption (TMY)	Gross Ex Post kWh Savings	Gross Ex Post Percent Savings
Detached 1 Story	7201	6700	501	7%
Detached 2+ Story	9279	8664	615	7%
Attached 1 Story	6111	5721	390	6%
Attached 2+ Story	6852	6342	510	7%
Weighted Average	**7790**	**7255**	**535**	**7%**

Source: Navigant analysis

To calculate the overall gross savings realization rate, Navigant adjusted the gross savings by HERS score and square footage in order to account for differences in efficiency at the individual home level. Table 7-5 shows the average HERS score and floor area for both the sample and the program overall; the average HERS score for the overall program was better than the sample average, yielding higher per home savings at the program level than for the sample.

Table 7-5. Average HERS Scores and Square Footages by Model Bin, Sample and Program

Model Bin	Sample Average HERS Score	Program Average HERS Score	Sample Average Area (ft^2)	Program Average Area (ft^2)
Detached 1 Story	63.9	60.8	3,180	3,135
Detached 2+ Story	62.8	60.3	4,267	4,224
Attached 1 Story	66.3	65.7	2,379	2,283
Attached 2+ Story	61.0	60.9	2,245	2,225
Total	**63.0**	**61.3**	**3,168**	**3,125**

Source: RSR TrakSmart export

Navigant found overall gross realization rates of 91% for natural gas and 90% for electric energy savings. Table 7-6 and Table 7-7 show these results as well as the calculated realization rates for each model bin.

Table 7-6: Ex Ante and Ex Post Gross Therm Savings by Model Bin

Model Bin	Ex Ante Gross Therm Savings per Home	Ex Post Gross Therm Savings per Home	Ex Ante Total Gross Therm Savings	Gross Realization Rate	Ex Post Total Gross Therm Savings
Detached 1 Story	343	357	53,567	104%	55,674
Detached 2+ Story	520	446	122,729	86%	105185
Attached 1 Story	201	201	18,300	100%	18,258
Attached 2+ Story	232	201	47,516	87%	41,183
Total	**352**	**320**	**242,112**	**91%**	**220,300**

Source: RSR TrakSmart export, Navigant analysis

Table 7-7. Ex Ante and Ex Post Gross kWh Savings by Model Bin

Model Bin	Ex Ante Gross kWh Savings per Home	Ex Post Gross kWh Savings per Home	Ex Ante Total Gross kWh Savings	Gross Realization Rate	Ex Post Total Gross kWh Savings
Detached 1 Story	399	461	42,460	112%	47,532
Detached 2+ Story	715	609	141,658	83%	117,562
Attached 1 Story	424	376	26,069	84%	21,821
Detached 2+ Story	492	462	68,855	93%	63,730
Total	**552**	**509**	**279,042**	**90%**	**250,645**

Source: RSR Dashboard export, Navigant analysis

7.2.2.1 Electric Prescriptive Measure Inputs

Navigant used the following algorithms and inputs from the Illinois TRM to estimate savings.

ECM Furnace Fans
The Illinois TRM specifies the following algorithm and inputs for ECM furnace fans:

ΔkWh = Heating Savings + Cooling Savings + Shoulder Season Savings

Where:

Heating Savings = Blower motor savings during heating season
= 418 kWh

Cooling Savings = Blower motor savings during cooling season
If Central AC = 263 kWh
If No Central AC = 175 kWh
If unknown (weighted average)
= 241 kWh

Shoulder Season Savings = Blower motor savings during shoulder seasons
= 51 kWh

Since program homes with furnace fans had central AC, Navigant calculated the total savings per home as follows:

$$\Delta kWh = 418\ kWh + 263\ kWh + 51\ kWh = 732\ kWh$$

Central Air Conditioning
Navigant used the Illionis TRM algorithm with the following inputs for central air conditioners:

$$\Delta kWH = (FLHcool * BtuH * (1/SEERbase - 1/SEERee))/1000$$

Table 7-8. Central Air Conditioning Inputs

Input	Value	TRM Default or Actual
FLHcool	570	Default: Single Family Zone 2
BtuH	Variable	Actual
SEERbase	13	Default
SEERee	Variable	Actual

Source: 2012 Illinois TRM, Navigant Analysis

Refrigerators
Navigant used the Illinois TRM algorithm to determine refrigerator savings:

$$\Delta kWh = UEC_{BASE} - UEC_{EE}$$

Navigant then verified the adjusted volume (AV) of the incented refrigerators and calculated the appropriate baseline and efficient usage. In some cases, Navigant verified lower efficient energy usage than required by ENERGY STAR® using the ENERGY STAR® list of qualified units. In these cases Navigant used the higher efficiency verified values. Navigant also used the ENERGY STAR® revision which added category 5a for bottom-mounted freezer units with through-the-door ice service. Navigant observed in the tracking data that the implementation contractor did not incent some qualified units installed in homes in ComEd service territory.

Table 7-9. Illinois TRM Refrigerator Inputs

Product Category	UEC_{BASE}	UEC_{EE} (Maximum)
1. Refrigerators and Refrigerator-freezers with manual defrost	8.82*AV+248.4	7.056*AV+198.72
2. Refrigerator-Freezer--partial automatic defrost	8.82*AV+248.4	7.056*AV+198.72
3. Refrigerator-Freezers--automatic defrost with top-mounted freezer without through-the-door ice service and all-refrigerators--automatic defrost	9.80*AV+276	7.84*AV+220.8
4. Refrigerator-Freezers--automatic defrost with side-mounted freezer without through-the-door ice service	4.91*AV+507.5	3.928*AV+406
5. Refrigerator-Freezers--automatic defrost with bottom-mounted freezer without through-the-door ice service	4.60*AV+459	3.68*AV+367.2
6. Refrigerator-Freezers--automatic defrost with top-mounted freezer with through-the-door ice service	10.20*AV+356	8.16*AV+284.8
7. Refrigerator-Freezers--automatic defrost with side-mounted freezer with through-the-door ice service	10.10*AV+406	8.08*AV+324.8

Source: 2012 Illinois TRM

ENERGY STAR® Exhaust Fans
Navigant used the deemed TRM savings of 88.6 kWh per fan.

100% CFL Lighting
For per CFL savings, Navigant used the TRM to estimate impacts for each lamp. None of the homes which received incentives for 100% CFL lighting provided a count of lamps per home. Navigant used the average number of lamps per home reported in the GPY2/EPY5 tracking data to estimate whole-home lighting savings (36.4).

$$\Delta kWh = ((WattsBase - WattsEE) / 1000) * ISR * Hours * WHFe$$

Table 7-10. CFL Algorithm Inputs and Assumptions

Input	Value	Source & Notes
WattsEE	14	Assumed
CFL Lumens	800	Estimated based on assumed wattage
Lumen Bin	750 - 1049	Illinois TRM
WattsBase	60	Illinois TRM
WHFe	1.06	Illinois TRM
Hours	938	Illinois TRM, Single-family
ISR	0.969	Illinois TRM, Direct-install
ΔkWh per CFL	44.3	Calculated per Illinois TRM
Total ΔkWh	1,618	Based on 36.4 lamps per home (program average)

Source: 2012 Illinois TRM

7.2.3 Net Impact Evaluation Methodology

The evaluation team used rater and builder interviews to collect some qualitative feedback on free-ridership and spillover levels.

7.2.3.2 Free-Ridership

The methodology for the RNC program net-to-gross analysis centered on the following questions:

- In what percentage of homes did builders incorporate high-efficiency practices prior to participating in the program?
- In what percentage of program homes did builders incorporate high-efficiency practices during GPY2/EPY5?
- In what percentage of non-program homes did builders incorporate high-efficiency practices during GPY2/EPY5?
- How much did the program influence any increase in the incorporation of high-efficiency practices inside and/or outside of the program?
- How effectively did builders incorporate high-efficiency practices before and after joining the program?

Navigant asked both builders and raters about the following high-efficiency building practices which the program encourages. For complete builder and rater interview guides, please see Section 0.

Table 7-11: High-Efficiency Practices Included in Builder and Rater Interview Guides

Category	Practice
Framing & Insulation	Air Sealing all Penetrations
	Capping Chases
	Floors (insulating conditioned to unconditioned space, insulating basement walls)
	Backing Knee Walls
	Insulation in Full Contact w/ Air Barrier
HVAC	Proper Sizing
	Duct Leakage / Sealing
	Pressure Balancing
	Proper RC&AF
Other Equipment	High Efficiency Central Air Conditioning (SEER ≥ 14.5)
	ECM Furnace Fan
	ENERGY STAR® Refrigerator or Exhaust Fan
	100% CFL Lighting
	Power-vented Water Heater (EF ≥ 0.62)
	High Efficiency Furnace (AFUE ≥ 92%)

For builders, Navigant asked about the percent of homes in which builders used each technique before and during participation in the program. If the percentage during participation increased from the percentage before participation, the interviewer asked about program influence and other factors which may have contributed to the change.

For raters, Navigant also asked about the builders' implementation of these practices and whether their ability to successfully use these techniques had improved as a result of working with the program.

7.2.3.3 Spillover

The free-ridership methodology described above also sought to capture participant spillover. Navigant did not investigate non-participant spillover at this time since the program is still ramping up and has not had much time to influence the broader market.

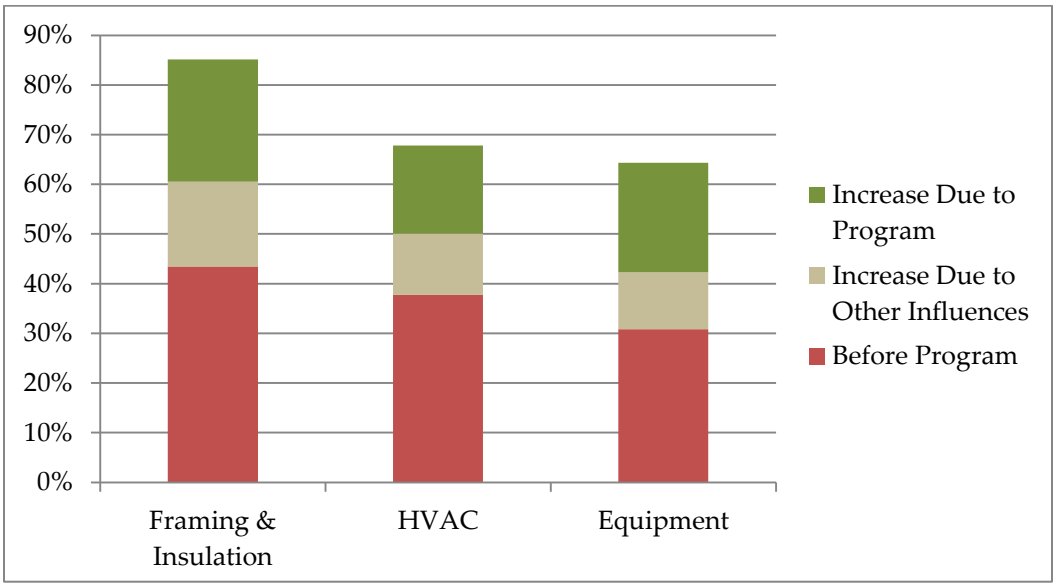
7.2.4 Net Program Impact Results

Although Navigant did not conduct a full net-to-gross analysis, the team did collect information on attribution through the builder and rater interviews. With the IECC 2009 code in place and code shifting to IECC 2012, it was clear that several factors were contributing to changes in builders' practices. Raters indicated that most of the builders they worked with were typically meeting code or exceeding it by up to 6-8%: they confirmed that the program was definitely influential in getting builders to make the necessary changes to meet the program threshold of 10% savings, but this means that the program's actual net savings could be limited to the savings beyond 6-8% above code.

The evaluation team asked raters about the prevalence of high-efficiency building practices in their homes before and after participating in the program. For practices where raters reported an increase in implementation, the team asked them to rate program influence on that increase. The results in

Figure 7-2 show that while the percent of homes using these practices did increase significantly over the first year of the program, the program was not solely responsible for these improvements. Raters cited already strict code enforcement of IECC 2009 and the upcoming changes required by IECC 2012 as the main other source of influence. Raters also estimated that of the program homes reviewed in GPY2/EPY5, 10% or fewer would have met IECC 2012 requirements. This indicates that the program may have greater influence on efficiency improvements above the IECC 2012 code in future program years.

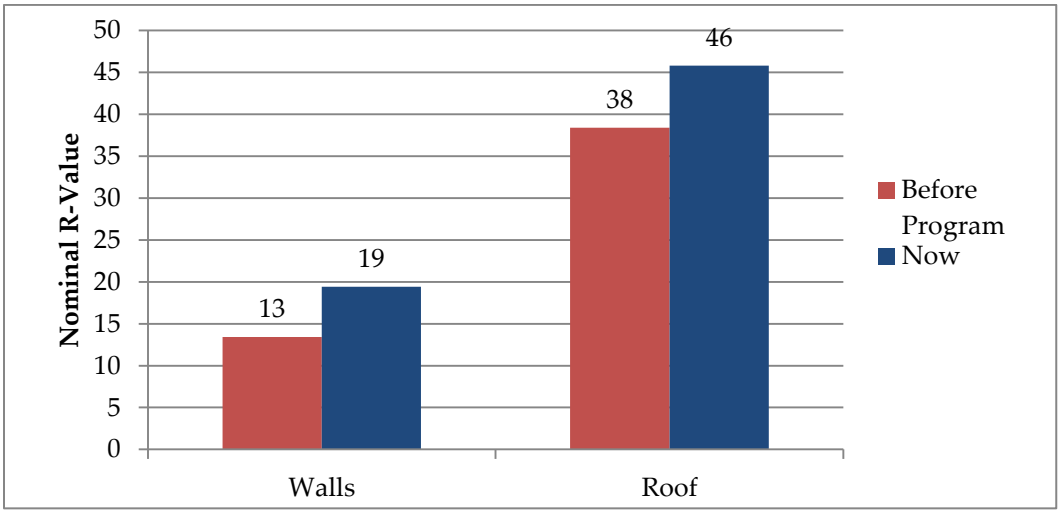
Figure 7-2. Percent of Program Builder Homes Using Efficient Practices (As Reported by HERS Raters, n=4)



Source: Navigant Analysis

For insulation and framing, interviewers also asked raters for the typical nominal wall and roof insulation R-values builders they worked with used at the beginning of the program compared to the values they are using now. Figure 7-3 shows that raters reported a notable increase in R-values, especially on wall insulation.

Figure 7-3. Average Nominal R-values Before and During Program Participation (As Reported by HERS Raters, n=4)



Source: Navigant Analysis

Navigant used this data to calculate rough estimates of minimum and maximum net-to-gross. The maximum net-to-gross reflects a minimum free-ridership case, in which all of the increase in efficiency in program homes is attributed the program. This is calculated as follows:

$$FR_{min} = \frac{\%\ Efficient, pre-program\ -\%\ Efficient\ outside, during}{\%\ Efficient\ inside, during}$$

Where:

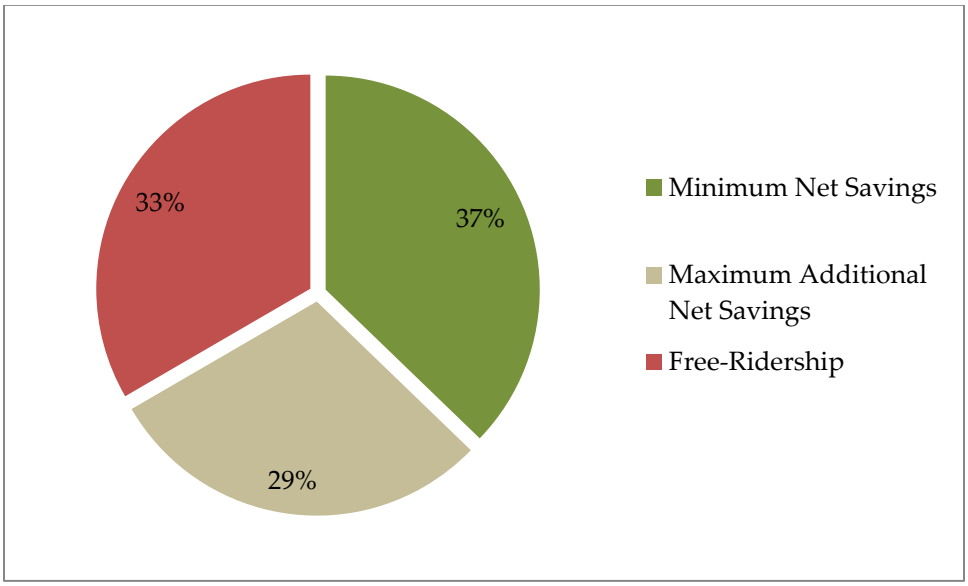
- *% Efficient, pre-program* is the percent of all program builders' homes using the measure prior to the program's launch
- *%Efficient outside, during* is the percent of all program builders' homes using the measure in non-program homes during the program year
- *%Efficient inside, during* is the percent of all program builders' homes using the measure in program homes

The minimum net-to-gross reflects the raters' influence scores, which increased the free-ridership estimate because they did not attribute all increases in efficiency to the program:

$$FR_{max} = FR_{min} + (1 - FR_{min}) \times (1 - Influence)$$

The overall results for the RNC program are shown below in Figure 7-4, where the minimum net-to-gross is 37%, and the maximum net-to-gross is 67%: the sum of the minimum net savings (37%) and the maximum additional net savings (29%).

Figure 7-4. Rough Estimates of Net-to-Gross



Source: Navigant Analysis

The evaluation team also asked raters about how well the program builders they work with implemented advanced framing, insulation, and HVAC installation practices before and after working with the program. Navigant asked raters to rank average builder implementation on the following scale:

Score	Description
1	Not Using
2	Poor
3	Fair
4	Good
5	Excellent

Raters observed a shift from an average ranking of 3.78 to 4.78 for builders that they worked with in the program. This difference is not accounted for in the rough NTGR estimate shown above.

Overall, this analysis showed that while the program is definitely causing program builders to change their practices, other influences such as code enforcement and custom homeowner demand for efficient homes are also contributing to this shift and reducing the program's net savings potential. It is likely that some of the code influence on program home efficiency gains may lessen once IECC 2012 is in place and builders must go beyond it in order to qualify.

7.3 Detailed Process Results

This section contains the complete process analysis for the GPY2/EPY5 RNC program.

7.3.1 Marketing and Participation

The program's recruitment strategy has been successful to date in enrolling enough builders and raters to fulfill program goals. However, builders and raters both identified marketing support as a weak point in the program. One rater described the marketing support as "light" and another

indicated that while the program has "been there for whatever they have needed, [they] would like to have some marketing material in hand."

Builders found out about the program through program staff, HERS raters, subcontractors, clients, and their own research. Four of the seven respondents had worked with their HERS raters prior to working with the program, and these respondents also indicated that they work with HERS raters on non-program homes. One other custom builder reported working with another HERS rater on a LEED project outside of the program. Three out of four raters were recruited directly by the program; the fourth heard about it through a builder that was trying to build an ENERGY STAR ® home.

Overall, builders did not feel that the program has been effective to date at raising customer or builder awareness of the program and energy efficient building practices: some indicated that this was because many builders and customers already knew about energy efficient building practices, but others felt that program awareness was low among customers and that the program could do more to help builders market the program. Only one builder felt that customer demand for high efficiency homes was high, and others indicated that customers either were not aware of the benefits of energy efficiency or only valued energy efficient appliances. One builder expressed specific interest in "how to better communicate with clients about the benefits of an energy efficient home."

7.3.2 Program Characteristics and Barriers

Program raters indicated that in GPY2/EPY5 with the IECC 2009 code in place, most builders were already meeting and exceeding code on a performance basis, and only required "tweaks" to their practices in order to achieve the program requirement of 10% savings above code. Raters cited equipment efficiency increases as the most common adjustment to hit the 10% threshold. However, when asked about the incentive levels, builders felt that the cost of complying with the program was far more than the incentive they got from the program. Two builders indicated that equipment costs to comply with program requirements were typically $1,000 per home above their standard practices.

With the upcoming change to IECC 2012, one builder indicated that they would no longer participate in the program because the costs of reaching 10% above the higher standard would not be cost effective. One rater echoed this, saying that "the impending 2012 code change took a lot of builders out of the program." Other raters felt that while most builders would need the program's assistance to still meet and exceed code, some were already looking ahead to above-code practices and would not have trouble participating with the new code.

Another barrier for some builders was lack of certainty around program requirements. Two of the seven builders interviewed said that they were not sure what program requirements were. One rater agreed that builders needed more direction from the program. This rater suggested creating a brochure with "simple benchmarks that need to be hit," or showing builders a sample process or options of ways to meet program requirements. For example, some builders may not understand what steps they have to take or what tests they need to have performed in order to meet program air tightness requirements.

7.3.3 Administration and Delivery

Over the course of GPY2/EPY5, the program made three significant changes:

- Increased frequency of payments to raters and builders from monthly to bi-weekly

- Elected to pay incentives on homes outside of the ComEd electric service territory (Nicor Gas only homes)
- Increased the number of RSR staff dedicated to the program.

Builders and raters both indicated satisfaction with the increased payment frequency. Changing the program requirements to allow homes outside of the ComEd service territory allowed the program to complete additional homes and exceed therm savings goals, although it led to the program falling short of the goal of 600 joint homes completed. Both utilities noted that their satisfaction with the program's implementation increased once RSR added new staff to the program. Both raters and builders also noted that the program has improved significantly since they began participating; one rater said that "the program has come a long way," and one builder said that although his first interaction with the program was "less than satisfactory, the second was beyond [his] wildest dreams." This shows that the program is working hard to learn from early mistakes and keep participants satisfied.

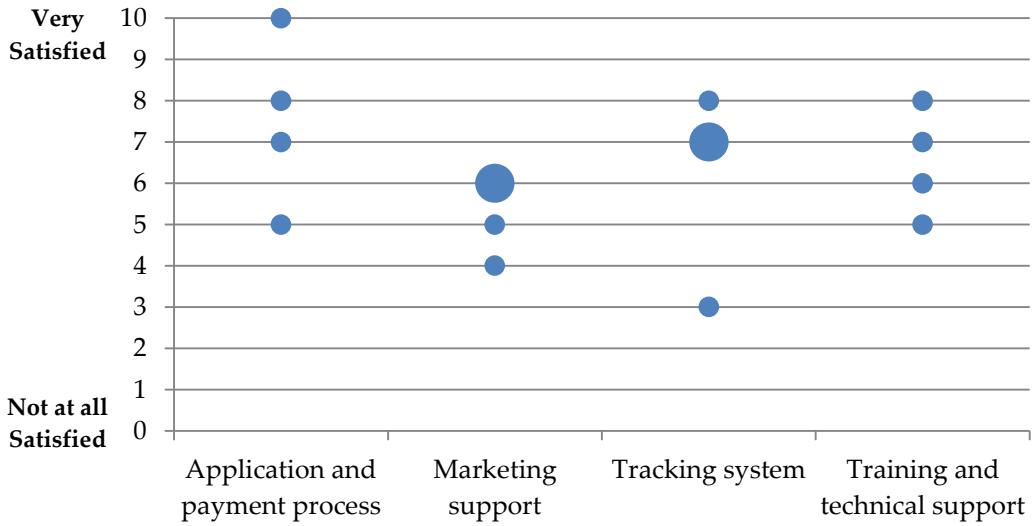
As discussed in the tracking system review, HouseRater collects extensive data on all program homes and allows the program to conduct comprehensive QA/QC reviews of submitted homes. While some raters indicated frustration with the level of detail required in HouseRater, the availability of this data benefits both the program's internal due diligence processes as well as the evaluation effort.

7.3.4 Participant Satisfaction

Overall, raters and builders seemed satisfied with the program, although many offered suggestions for improvement.

As shown in Figure 7-5, raters were most satisfied with the application and payment process, and least satisfied with marketing support. Some were very satisfied with the HouseRater tracking system, but others felt it was cumbersome and required more time and data than other programs.

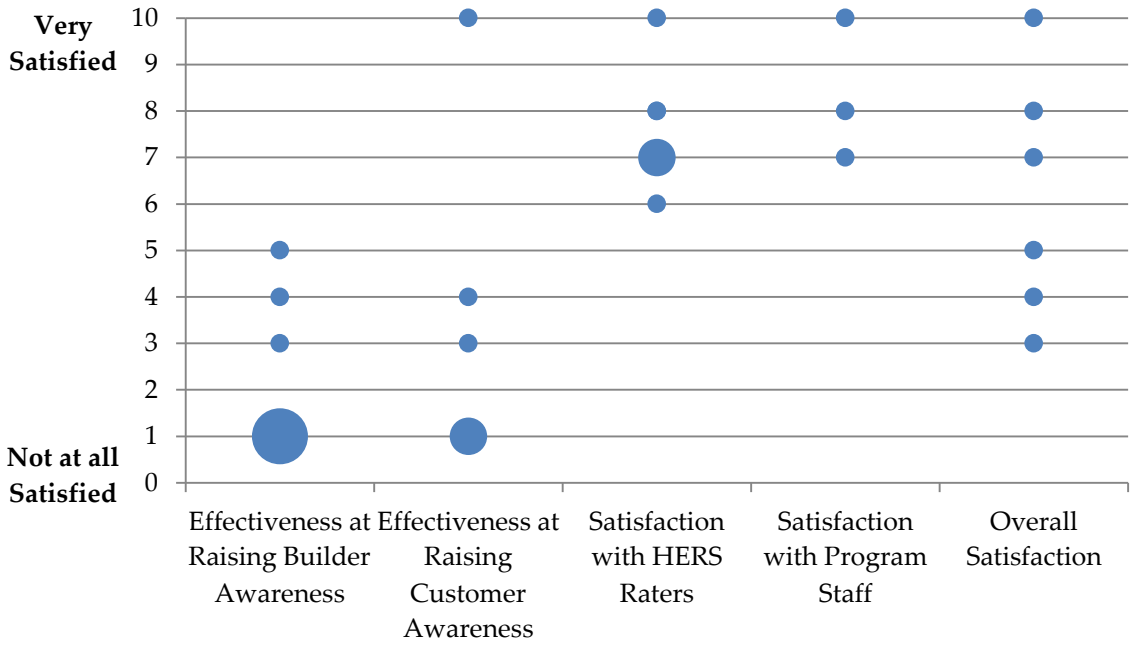
Figure 7-5. Rater Satisfaction With Program (Score out of 10, n = 4)



Source: Navigant analysis

Overall, the builders who responded to the interview were fairly satisfied with the program. Only three out of seven respondents had significant interactions with program staff, but those who had were very satisfied. Satisfaction with HERS Raters was also high. Builders did not think that the program had been successful to date at raising builder or customer awareness of the benefits of energy efficient homes.

Figure 7-6. Builder Satisfaction and Program Effectiveness Ratings (Score out of 10)



Source: Navigant Analysis

7.4 PJM Data and Findings

Residential New Construction Program EPY5
Coincident Peak Demand = 0.067 MW
Estimate based on average demand savings between baseline and efficient home model hourly output during PJM peak hours.

Realization Rate on Demand Savings: N/A, no demand savings claimed.
Precision Estimate on Demand Savings (90% confidence, two-tail): Not calculated; estimate based on calibrated aggregate models rather than a sample of homes.

Non-Peak Demand or Non-Coincident Peak Demand: Not estimated.

7.5 Data Collection Instruments

7.5.1 Nicor Gas and ComEd Joint Residential New Construction Program Builder Interview Guide

Nicor Gas and Commonwealth Edison
Joint Residential New Construction Program
Builder Interview Guide
FINAL

Screener

Hi, may I please speak to _____? My name is ____ and I'm calling from Navigant Consulting on behalf of Nicor Gas and ComEd and their Residential New Construction program that is implemented by Residential Science Resources (RSR). We are talking to builders who participated in the Residential New Construction program to gather feedback on the program. This is not a sales call. I would like to talk with you for about 20 minutes to help assess the program based on your experience with it. We are hoping you can give us insights on your experience that will help identify improvements in the program and its support to you as a participating builder in the program.

[*If needed*: We received your name from RSR and are authorized to make these calls. You can verify our credentials by contacting Mike Topitzhofer at RSR at 651-200-3417.]

Would you like to do the interview now or is there a better time that we can schedule for this?

Date: _____ **Time**: _____

And should we call you back at the same phone number?
IF NO → **Alternate Phone #**: _____

1. First, I'd like to confirm that you are a primary decision maker for your firm. Is that correct?

   Yes ____
   No ____
   Refused/unsure/don't know ___

   [*If No or Refused/unsure/don't know:*]
   We need to speak with a primary decision maker who determines whether to participate in the program, and is responsible for incorporating energy efficiency improvements into your company's new home projects. Would you please put me in touch with that person?

   [*If willing to refer to other person, get that person's contact information and restart the interview process with that other person. Acknowledge you were referred by the initial contact person.*]

[*Confirm name and title; proceed to Introduction*]

[*If directed to a voice mail system:*]
Hello, my name is ____. I'm calling from Navigant Consulting on behalf of Nicor Gas and ComEd and their Residential New Construction program that is implemented by Residential Science Resources (RSR). We are talking to builders who participated in the Residential New Construction program to gather feedback on the program. I would like to talk with you for about 20 minutes to help assess the program based on your experience with it. I will continue trying to get hold of you directly, but meantime if you wish, feel free to call me back at your earliest convenience to schedule the interview. My phone number is _____ [*repeat phone number for clarity*]. Thank you in advance for your cooperation, as we greatly value your thoughts on the program. I look forward to talking with you. Goodbye.

I. INTRODUCTION

Ok, thanks for taking time to talk with me about the program. We'll discuss your experience during the recently completed program year which spanned the last 12 months, so keep that in mind as we talk. I will ask questions in three topic areas:

1. Program incentives,
2. Marketing and sales
3. Technical requirements and technical support

2. In the past year (June 1, 2012-May 31, 2013), roughly how many homes **in total** did your company build altogether? [*An approximate number is ok.*]

   # _____

3. I realize that you may not build only in Nicor Gas and ComEd service territory. About what percentage of that total, roughly, was built in Nicor Gas and ComEd territory?

   % ____ Nicor Gas and ComEd
   % ____ Nicor Gas only
   %_____ComEd only
   [*Calculate #*: _____]

[IF RESPONDENT BUILDS HOMES OUTSIDE OF NICOR GAS / COMED TERRITORY] For the remainder of our conversation, please do your best to keep your responses focused only on your company's activity in the Nicor Gas / ComEd service territory. [INTERVIEWER SHOULD BE PREPARED TO SUMMARIZE WHAT THE TERRITORY INCLUDES.]

4. About what percentage of the homes your company built in PY2 were production (spec-built) homes, and what percentage were custom-built homes?

   % Production/Spec ____
   % Custom ____

5. Before participating in the program, did you have any homes rated by a HERS rater?
   a. If yes, what percent? About what HERS score did they typically achieve? A range or average value is ok.

6. Our records show that you built [xx] homes through the program during the last year. Approximately what % of all the homes you built in the Nicor/ComEd service territories does this represent?

7. We'll get into more specifics, but overall, how satisfied are you with the program at this point? Please rate your experience on a scale from zero to ten, where zero is very dissatisfied and ten is very satisfied.

II. PROGRAM INCENTIVES

Now I'd like to get your thoughts on the program incentives.

1. Are the incentives, as **currently** structured, sufficient to offset a meaningful fraction of the incremental cost of building to the program's standards? [PROBE FOR ACTUAL INCREMENTAL COSTS, IN TERMS OF % ADDITIONAL COSTS OVER AND ABOVE STANDARD PRACTICE.]

2. From your perspective is the program's design achieving a good balance of incentives and information and technical support? That is, if you were to trade off the program's resources between incentives and field support, including marketing and technical support, what trade-offs would you suggest, if any, that would improve the program's performance?
   [*If needed*:] Think about the situation in this way: The program budget is capped. Thus, changing the program design by shifting its limited resources in various ways to try and increase its impact and productivity – say to increase incentives, for example – likely means having to reduce other support the program provides. Marketing and technical support likely would have to be reduced. What insights do you have about shifting resources either toward higher incentives with less information, marketing and field support, or lower incentives with greater information, marketing and field support?

3. Have you been satisfied with the timeliness of incentive payments?

III. NET-TO-GROSS

I'd like to ask some questions about specific energy saving building practices and measures that you may be using in your homes, including framing, insulation, HVAC and some additional equipment categories. Remember to think specifically about homes that you have built in the Nicor Gas and ComEd service territories.
[Repeat for each major section. Use detailed measures as prompts for examples of advanced framing techniques, insulation levels, HVAC installation techniques, and high-efficiency equipment.]

	Measure Type
Framing & Insulation	Air Sealing all Penetrations
	Capping Chases
	Floors (insulating conditioned to unconditioned space, insulating basement walls)
	Backing Knee Walls
	Insulation in Full Contact w/ Air Barrier
HVAC	Proper Sizing
	Duct Leakage / Sealing
	Pressure Balancing
	Proper RC&AF
Other Equipment	High Efficiency Central Air Conditioning (SEER ≥ 14.5)
	ECM Furnace Fan
	ENERGY STAR® Refrigerator or Exhaust Fan
	100% CFL Lighting
	Power-vented Water Heater (EF ≥ 0.62)
	High Efficiency Furnace (AFUE ≥ 92%)

For each measure category: I'd like you to think about how often you incorporated these measures/techniques in your homes, both before and after you started participating in the program.

1. Before participating in the program, in what percent of your homes did you incorporate these practices/measures?

2. Of the homes that you **submitted** to the program this year, in what percent did you incorporate these practices/measures?

3. [Skip this question if I6c = 100%] Of the homes that you did **not submit** to the program this year, in what percent did you incorporate these practices/measures?
   •
4. [Skip this question if I6c = 100%] Based on those answers, it sounds like you used these measures/practices in about XX% of all of the homes you built this year. Does that sound about right? *If not, adjust answers to #2 and #3 accordingly.*
   •
5. *If calculated % increase with measure:* It sounds like you have increased your use of these measures/practices since participating in the program. Did the program increase your knowledge of how to implement these measures/practices?
   •
6. *If #2 > #1:* On a scale from 0 to 10, where 10 is very influential and 0 is not at all influential, how important would you say the program was in your decision to increase the use of these

measures/practices in homes that you submitted to the program? [If necessary, clarify that you mean an increase above pre-program levels as specified in #1]

•

7. *If #3 > #1:* On a scale from 0 to 10, where 10 is very influential and 0 is not at all influential, how important would you say the program was in your decision to increase the of use these measures/practices in more homes outside of the program, compared to your standard practices prior to participating in the program?

•

8. What other factors, if any, contributed to the increase of your use of these measures/practices?

•

9. Just to confirm that I've interpreted your responses correctly, it sounds like the program had a low/high/moderate influence on your decision, and <other factors> also had some influence/did not affect your decision. I'd like to ask this in a different way: if you had a total of 10 points that reflect the importance in your decision to increase your use of these measures/practices, and you had to divide those 10 points between the program and these other factors, how many points would you give to the program?

•

    a. *If answer inconsistent with #6/7, read back both answers and ask if one should be changed.*

•

10. *If decrease calculated:* It sounds like you have decreased your use of these measures/practices in your homes. What factors have caused this decrease?

11. Have you had any problems with your subcontractors getting up to speed on this measure? Please describe:

IV. MARKETING AND SALES

Now I'll ask how the program got you involved through its builder development effort, and your experience with the marketing and sales training and support the program has provided.

1. What was the main reason you got involved in the program?

2. Was there a recruitment tactic the program used that was particularly compelling to you? Are there any program outreach and recruitment strategies the program uses that you think could benefit from improvement?

3. How **effective** has the program been overall in raising builders' awareness about strategies and opportunities for achieving significantly higher efficiency in new homes? **Please rate the program on a scale from zero to ten, where zero is very ineffective and ten is very effective.**

    a. What things stand out to you in saying that (good or bad)? [*Probe for additional.*]

    b. What barriers has the program addressed most effectively – including both barriers to builders participating in the program as well as barriers to customers buying homes built by participating builders like you? [*Probe for additional.*]

4. [if I4 custom home % is significant, i.e. >30%,] What percentage of the custom home plans that you receive from architects already meet the requirements of the program? Who would you say is primarily responsible for encouraging these custom homes to meet the project requirements: you [the builder], the architect or the client?

5. Are there any areas in which the program could improve that would make it easier or more compelling for you and other builders to participate?

6. [if I6c < 100%,] What would it take for you to build 100% of your homes to program specifications?

7. To the best of your knowledge, how **effective** has the program been overall in raising ***customers'*** awareness about achieving significantly higher efficiency in new homes? **Please rate the program on a scale from zero to ten, where zero is very ineffective and ten is very effective.**

8. Do you see your company's efforts to build high efficiency, program-eligible homes as a competitive differentiator between you and other builders? Why or why not? Do you have any thoughts on the advantages or disadvantages of advertising a home as energy efficient?
    a. How would you describe the level of customer demand for higher efficiency new homes? *[Probe: high, low, moderate]*
    b. [If I6c < 100%] For homes that are not custom-built, do you find that there is any difference in time on the market between standard homes and high-efficiency program homes? If so, what are typical times on the market for each?

9. From your perspective, how receptive are realtors and appraisers to attributing added value to high-efficiency, program-qualified homes (e.g.,lower energy bills, comfort or other benefits the program promotes)? Have you observed changes in the level of knowledge and awareness of the realtor and appraiser community during the last year, and to what extent would you attribute that change to the program's efforts?

10. Do you have any other thoughts about the program's marketing and sales effectiveness and support to you as a builder? Are there any lessons you learned that the program staff should consider for improving the program's marketing and sales efforts, either in the form of recruiting new builders, or generating more consumer demand for energy-efficient new homes?

V. RELATIONSHIP WITH HERS RATERS AND PROGRAM STAFF

1. Please describe how you began your relationship with HERS rater(s) that you work with through the program.

2. Do you work with any HERS raters outside of the program?

3. Do you feel that you are better qualified to build program-eligible homes as a result of your interactions with program HERS raters?

    a. What areas do HERS raters help you the most with? Where have you learned the most from them?

    b. Are there areas where you would like additional technical support, either from HERS raters or program staff?

    c. Have you been satisfied with the quality and type of feedback you have gotten from your HERS rater? [Probe for written vs. verbal feedback, if needed]

4. Overall, how satisfied have you been with your relationship with HERS raters in the program? **Please rate your experience on a scale from zero to ten, where one is very ineffective and four is very effective.**

5. How satisfied have you been with your interaction with program staff? *Clarify if needed: RSR staff, not your HERS rater.* **Please rate your experience on a scale from zero to ten, where zero is very ineffective and ten is very effective.**

VI. TECHNICAL REQUIREMENTS AND SUPPORT

Let's talk about your experience with the program's technical requirements and technical support.

1. Do you feel that the program has clearly communicated participation requirements to you?

2. What do you think of the program's eligibility requirements for construction standards and quality assurance? Do you have any major concerns or insights? Please explain.

3. What are your thoughts regarding Illinois' residential energy code moving from IECC 2009 to IECC 2012? Has the program helped you to learn about what changes to expect with the new code?
    a. How will the new code change the extent to which the program drives incremental improvements in energy efficiency? Are there certain areas (e.g., building envelope or HVAC) in which the code is particularly lax or stringent, and where the program will make a big difference in improving efficiency over code?

4. What strengths and weaknesses have you experienced with the program's inspection processes? Have any inspections caused delays in the construction schedule?
    •
5. Do you have any other thoughts on technical requirements and support? Please describe:

VIII. WRAP UP

1. And in closing, do you have any last thoughts on any aspect of the program, insights or lessons learned that would help improve it, or that would make participation in program more compelling for you and other builders ?

Those are all the questions I have. Thank you very much for your time and help! Have a good day.

7.5.2 Nicor Gas and ComEd Joint Residential New Construction Program Rater Interview Guide

Nicor Gas and Commonwealth Edison
Joint Residential New Construction Program
Rater Interview Guide
FINAL

Screener

Hi, may I please speak to _____? My name is ____ and I'm calling from Navigant Consulting on behalf of Nicor Gas and ComEd and their Residential New Construction energy efficiency program. We are talking to HERS raters who participated in the Residential New Construction program to gather feedback on the program. This is not a sales call. I would like to talk with you for about 20 minutes to help assess the program based on your experience with it. We are hoping you can give us insights on your experience that will help identify improvements in the program and its support to you as a participating rater in the program.
[*If needed*: We got your name from Residential Science Resources (RSR) and are authorized by Nicor Gas and ComEd to make these calls. You can verify our credentials by contacting Mike Topitzhofer of Residential Science Resources at 651-200-3417.]

Would you like to do the interview now or is there a better time that we can schedule for this?

Date: _____ **Time**: _____
And should we call you back at the same phone number?
IF NO → **Alternate Phone #**: _____

[*Confirm name and title; proceed to Introduction*]
[*If directed to a voice mail system:*]

Hello, my name is ____. I'm calling from Navigant Consulting on behalf of Nicor Gas and ComEd and their Residential New Construction energy efficiency program. We are talking to HERS raters who participated in the Residential New Construction program to gather feedback on the program. I would like to talk with you for about 20 minutes to help assess the program based on your experience with it. I will continue trying to get hold of you directly, but meantime if you wish, feel free to call me back at your earliest convenience to schedule the interview. My phone number is _____ [*repeat phone number for clarity*]. Thank you in advance for your cooperation, as we greatly value your thoughts on the program. I look forward to talking with you. Goodbye.

I. Introduction/Program Satisfaction

1. How long have you participated in the NICOR GAS AND COMED program for residential new construction? When did you first get involved?

2. How did you first hear about the program? Why did you want to get involved?

3. What percent of your business occurs in the Nicor Gas and ComEd service territory?
   -
   a. Nicor Gas and ComEd:
   b. Nicor Gas only:
   c. ComEd only:

4. Of the work you do in the Nicor Gas and ComEd service territory, what percent is through the program?

5. Do you participate in other utility energy efficiency programs? If yes, which ones?

6. Please describe your participation in the Residential New Construction program. Would you say you are very active, moderately active, or not very active with the program?
   -
   -
7. I'd like you to rate your satisfaction with the following aspects of Nicor Gas and ComEd program on a scale from zero to ten, where zero is dissatisfied and ten is satisfied.
   -
   a. Application and payment process
   b. Marketing support
   c. Tracking system (HouseRater)
   d. Training and technical support

8. [FOR ANY EXTREMELY HIGH OR LOW VALUES] Can you comment on why you gave the ratings that you did?

9. What do you think the Nicor Gas and ComEd program does well?

10. Are there any areas in which the program could improve, that would make it easier for you to participate?
    -

II. Experience with builders in program

1. At what point in the plan development process do you typically begin interacting with builders for each home?
   PROBE FOR % of cases in which they get involved:
   a. During the initial design phase
   b. During the design review phase, prior to design completion
   c. After the design is finalized
   d. Is this different for custom vs. production homes?

2. In your experience, what percentage of home plans submitted by builders participating in the program achieve a program-qualifying level of efficiency upon your initial review of the plan? If you are familiar with markets in other parts of the country, how do you think this compares to experiences in other regions of the country?

3. In the cases where a home plan does not achieve a qualifying level of efficiency upon your initial review, how would you characterize the extent to which plans require revisions? [PROBE: Significant revisions required, moderate revisions required, minor revisions required] What are the most common plan failings? [PROBE: Thermal bypass checklist issues, Window to wall ratio, Insulation levels, HVAC system, etc] How many iterations of the plan are typically needed?

Of the HERS rated plans that move forward to the construction phase, about what percentage actually adhere strictly to the construction plans? In other words, are there many instances where the final plan is strong but the actual building, as constructed, falls short of the design in the plan? [PROBE: Does it take builders a while to learn how to build a home such that it will pass your inspections?]

4. To what degree do home builders use you as a resource for addressing issues associated with meeting the requirements specified in approved plans? Specifically, after the plans are approved how frequently do you interact with the builder during the construction phase? Is it more than just during the inspections? Is there regular consultation provided to builders on each home design? What is the nature of these interactions?

   •

5. What percentage of the builders that participate in the program needed to make changes to their standard/established construction practices to build homes that meet program standards? Excluding changes to the original plans, how would you characterize the magnitude of the changes to construction practices that builders must make to build homes that meet program standards? (Major, minor, none) *[Keep this discussion short and high-level; if needed say that we will discuss specifics of these changes in the next section]*

   •

6. Are there areas the program could focus on encouraging more substantial changes in building practices (e.g., insulation, air sealing, ducts, etc.) that would help position the builders to keep pace with the new IECC 2012 code and program requirements through additional trainings, relationships with trade allies, etc.?

III. Net-to-Gross

- I'd like to talk now about some specific building practices that you might be helping program-participating builders with. I want you to think about how often and how well the builders that you work with used these practices when you first started working with them in the program, and how often and how well they are using them today after the first program year.

Framing & Insulation

1. Now I'd like to talk about framing and insulation.
    a. In what percent of homes did you see builders using advanced framing and proper insulation techniques consistent with the Thermal Bypass Checklist when they first entered the program? [*If needed, prompt with practices below]*)
    b. In what percent of homes do you see them using these techniques now?
    c. What were typical insulation R-values in builders' homes when they first entered the program? *Probe for walls, attic, foundation.*
    d. What are typical R-values now?

Framing & Insulation	Air Sealing all Penetrations
	Capping Chases
	Floors (insulating conditioned to unconditioned space, insulating basement walls)
	Backing Knee Walls
	Insulation in Full Contact w/ Air Barrier

2. Now I want you to think about how well the builders you work with implemented these techniques prior to their experience in the program, and now that they have participated in the program.
    a. At the beginning of the program year, would you say their implementation was…
        i. Excellent
        ii. Good
        iii. Fair
        iv. Poor
        v. Not using technique
    b. At the end of the program year, would you say their implementation was…
        i. Excellent
        ii. Good
        iii. Fair
        iv. Poor
        v. Not using technique
3. (If noted improvement and/or increase in use of techniques) On a scale from 0 to 10, where 0 is not at all influential and 10 is very influential, how important do you think the program was in this improvement in advanced framing techniques among the builders you work with? [PROBE FOR SPECIFIC WAYS IN WHICH THE PROGRAM HAD AN INFLUENCE, E.G., INCREASED KNOWLEDGE THROUGH TRAININGS, EDUCATIONAL MATERIALS, EXPOSURE TO VENDORS OFFERING EFFICIENT PRODUCTS, ETC.]
    •

HVAC

1. Now I'd like to talk about HVAC.
    a. In what percent of homes did you see builders using the following practices when specifying and installing HVAC systems when they first entered the program?
    b. In what percent of homes do you see them using these practices now?

HVAC	Proper Sizing
	Duct Leakage / Sealing
	Pressure Balancing
	Proper RC&AF

2. Now I want you to think about how well the builders you work with implemented these practices prior to their experience in the program, and how well they implement them now.
    a. At the beginning of the program year, would you say their implementation was…
        i. Excellent
        ii. Good
        iii. Fair
        iv. Poor
        v. Not using technique
    b. At the end of the program year, would you say their implementation was…
        i. Excellent
        ii. Good
        iii. Fair
        iv. Poor
        v. Not using technique
3. (If noted improvement and/or increase in use of practices) On a scale from 0 to 10, where 0 is not at all influential and 10 is very influential, how important do you think the program was in this improvement in insulation levels and advanced insulation techniques among the builders you work with? [PROBE FOR SPECIFIC WAYS IN WHICH THE PROGRAM HAD AN INFLUENCE]

Other Equipment

1. Now I'd like to talk about some other high-efficiency equipment.
    a. In what percent of homes did you see builders installing the following high-efficiency equipment when they first entered the program?
    b. In what percent of homes do you see them installing this equipment now?

Equipment	High Efficiency Central Air Conditioning (SEER 14.5)
	ECM Furnace Fan
	ENERGY STAR® Refrigerator or Exhaust Fan
	100% CFL Lighting
	Power-vented Water Heater (0.62 EF or higher)
	High Efficiency Furnace (92% AFUE or higher)

2. (If noted increase in use of equipment) On a scale from 0 to 10, where 0 is not at all influential and 10 is very influential, how important do you think the program was in this improvement in insulation levels and advanced insulation techniques among the builders you work with? [PROBE FOR SPECIFIC WAYS IN WHICH THE PROGRAM HAD AN INFLUENCE]

7. Thinking back to when IECC 2009 was code, if the program was not available, do you think builders would construct homes equal to the program's standards? If no, how close do you think they would come? Once involved in the program, do you see builders translating these building practices to non-program homes? If yes, which ones and to what extent?
    a. How do you think this situation will change when IECC 2012 is code?
    b. Have you seen homes coming through prior to the code change that you think would meet the program's requirements under IECC 2012?

Those are all the questions I have. Thank you very much for your time and help! Have a good day.

7.6 Follow-up on GPY1/EPY4 Recommendations

This section provides the results of Navigant's review of the status of GPY1/EPY4 recommendations on key performance indicators (KPIs) and the verification, due diligence and tracking system review (VDDTS).

7.6.1 KPI Evaluation

Table 7-12 below lists the current implementation status of key performance indicators that Navigant recommended in the GPY1 memo reviewing the program's logic model.

Table 7-12. Status of Implementation of KPIs from GPY1 Program Logic Model Review

KPI Recommendations			
Outputs	Indicators	Data Sources and Potential Collection Approaches	Status of Implementation June 2013
Program secures working contracts with RESNET certified HERS raters	Number of raters contracting with program	Interviews with program staff, program implementers	Implemented: Program tracks number of raters enrolled
Raters are well equipped to sell program and provide technical support to builders	Number of training sessions held for raters, number of raters able to successfully support builders without assistance from implementation contractor	Interviews with program staff	Implemented. Program staff able to provide list of training events and describe level of assistance given to raters.
Program "brand" is developed and publicized, gains consumer awareness	Level of homebuyer awareness	Homebuyer surveys, market research, builder and rater surveys	Not implemented; too early in program and may require evaluation research
Program supports participating builders and raters, maintaining satisfaction of both groups	Training sessions held, marketing materials held, level of positive feedback from program surveys.	Interviews with program staff, print or digital copies of marketing materials, surveys conducted by implementation contractor, builder and rater surveys conducted in evaluation.	Implemented. Program staff able to provide list of training events and marketing materials. Evaluation surveys will determine satisfaction levels.
Rebates for builders and raters reduce cost of building and rating more energy efficient homes	Number of rebates offered and amount of each rebate	Program tracking data	Implemented. Data available in tracking database extracts.
Growing population of program HERS raters available to recruit and support builders	Number of active HERS raters in program	Interviews with program staff, program tracking data	Implemented. Program staff able to provide number of raters with enrolled and submitted homes

KPI Recommendations			
Homebuyers purchase program homes	**Purchase rate** or **time to purchase** for program homes, program homes' **market share** in target area	Program tracking data, residential new construction market data	Implementation in progress. Program staff have discussed options for estimating this metric and are working with evaluation team to determine the best approach.
Raters and builders submit homes through the program	Number of homes rebated by the program	Program tracking data	Implemented. Data available in program tracking database extracts.
Builders learn to build homes meeting program requirements	Level of assistance required by builders in program	Rater interviews, interviews with program staff	Implemented. Program staff work closely with raters and builders. Evaluation will also assess with rater interviews.
Program achieves energy savings	Therms, kWh, and kW saved by program homes	Program tracking data	Implemented. Data available in tracking database extracts.
Homebuyer demand for energy efficient homes rises	Level of demand observed by builders and realtors, comparative time to purchase (program and non-program homes)	Builder surveys, homeowner surveys, market data	Not implemented. Will require evaluation research.

7.6.2 VDDTS Evaluation

Table 7-13 below lists the current implementation status of recommendations related to the verification, due diligence, and tracking system (VDDTS) review that Navigant conducted in GPY1/EPY4.

Table 7-13. Status of Implementation of Recommendations from GPY1/EPY4 Review of VDDTS

VDDTS Recommendation	Status of Implementation June 2013
QUALITY ASSURANCE AND VERIFICATION RECOMMENDATIONS	
Navigant recommends continuing to follow well-defined quality assurance and verification procedures including the following: • Random sampling for field and paper inspections by both the HERS Providers and RSR staff • Review of data submitted to HouseRater • Formalizing protocols for "problem" raters or builders	Implemented.
DATA TRACKING SYSTEM AND REPORTING RECOMMENDATIONS	
We recommend linking HouseRater to utility customer databases so that Nicor Gas and ComEd customers living in Program homes can be identified.	No Implementation Planned. However, program can link participating homes to homeowner account information, which is the primary reason for this recommendation.
Navigant recommends that the Program identify key **market transformation** metrics to track in HouseRater such as **time to purchase** and **market share** (percentage of new construction homes in service territory participating in program).	Implementation Pending. The program is subscribing to new construction market reports and looking into methods for tracking **time to purchase**, but still lacks formal market transformation goals.

Navigant recommends developing a detailed **data dictionary** with the following information:
• For each table:
  ○ Summary of fields included
  ○ Purpose of table
• For each field:
  ○ Definition of field
  ○ Field type, e.g. string, integer, number
  ○ Data validation rules, e.g. range restrictions
  ○ Method of entry, e.g. entered by builder/rater or pulled from REM/Rate file
	Not implemented.

Navigant recommends that the Program start to collect and track home cost and price data	Partially implemented. The program has developed incremental capital cost estimates but does not plan to collect actual home cost or price data as it is not cost effective to do so.