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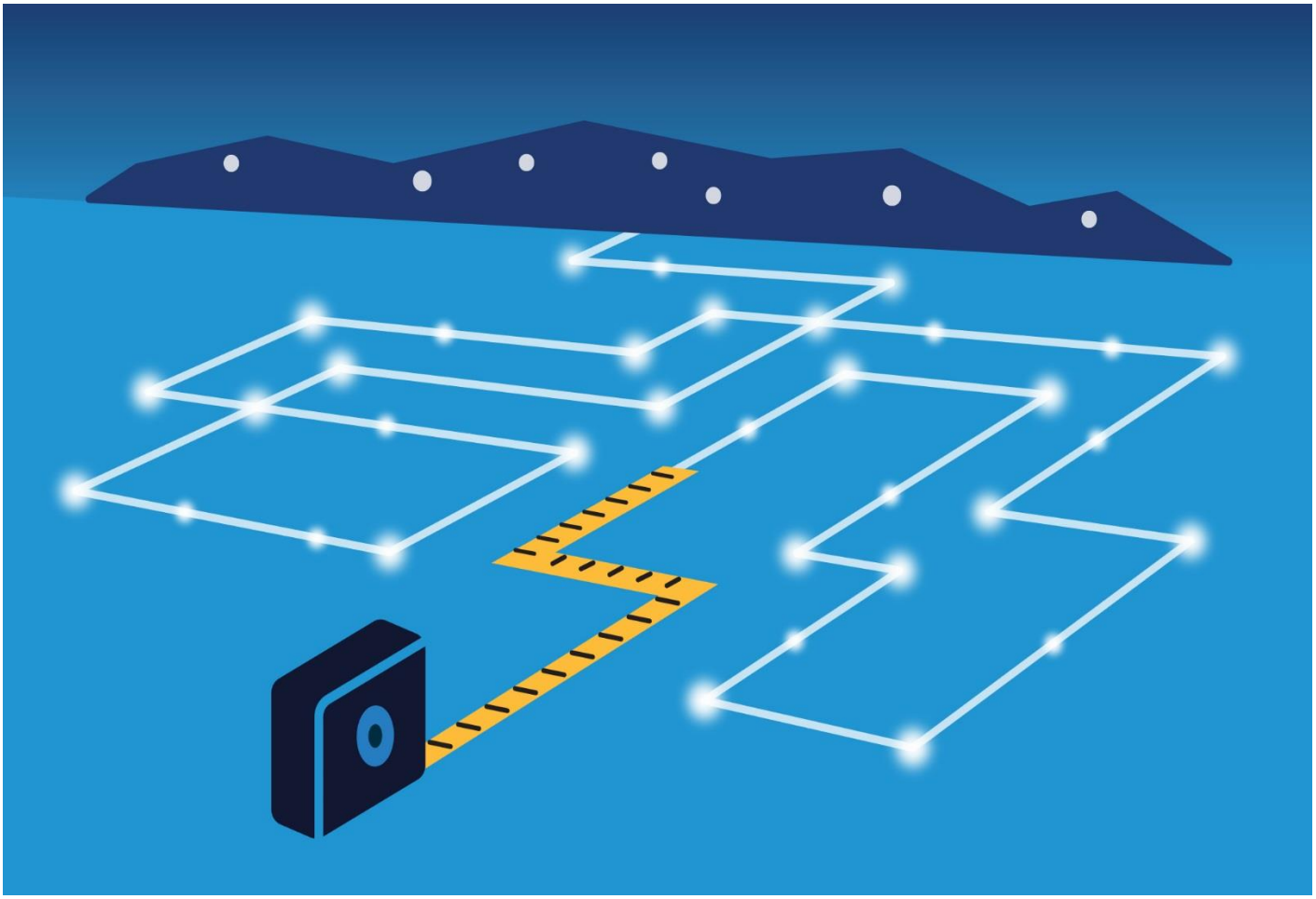

Impact and Process Evaluation of 2013 (PY6) Ameren Illinois Company ENERGY STAR® New Homes Program

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Table of Contents

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Table of Tables

Table of Figures

1. Executive Summary

The Ameren Illinois Company (AIC) ENERGY STAR® New Homes Program, implemented by Conservation Services Group (CSG), offers builders training, technical information, marketing materials, and incentives for the construction of eligible homes. Specifically, the program offers incentives for homes that meet the ENERGY STAR 3.0 or 2.5 standards or that achieve a Home Energy Rating System (HERS) index of 70 or less (a lower HERS index indicates a more efficient home) for single-family homes and 85 or less for multifamily units. Builders constructing single-family homes and duplexes heated with any fuel provided by AIC become eligible for program incentives. Builders must hire a HERS rater to verify savings achieved by energy-efficient practices. In most cases, the rater also provides technical assistance and program application processing throughout the building process.

AIC refrained from making major program design changes during Program Year 6 (PY6) (June 1, 2013–May 31, 2014) to allow program participants time to learn and adapt to the program changes implemented in PY5, including adoption of ENERGY STAR 3.0; addition of the multifamily component; entry-level, non-certified HERS-only option; and Illinois statewide adoption of the 2012 Illinois energy code. Furthermore, many communities in Illinois did not begin enforcing the revised energy code until January 2014, causing uncertainty with respect to setting appropriate baseline and program savings assumptions.

This report summarizes the evaluation of program activities implemented during the sixth year of program implementation (PY6). To support the evaluation, the evaluation team conducted in-depth interviews with program staff, builders, and building inspection departments; reviewed REM/Rate™[1] models; and analyzed the tracking database. The expected savings from this program are 0.1% of the overall PY6 portfolio of electric savings and 0.3% of PY6 portfolio therm savings.[2] This program was expanded in the Illinois Power Agency 2013 Electricity Procurement Plan Docket 12-0544..

1.1 Impact Results

This program achieves energy savings by incentivizing builders to produce homes that use less energy than homes built to current baseline specifications. This analysis defined a home built to current baseline specifications as one built to local code requirements. Illinois has adopted International Energy Conservation Code (IECC) 2012 as a statewide code, yet many jurisdictions within the AIC service territory have not enforced or officially adopted the code. The evaluation team evaluated homes in each jurisdiction based on their adoption of code. An area not enforcing an energy code had a lower baseline than an area enforcing IECC 2012.

The evaluation team verified participating homes and ex ante savings estimates by reviewing energy analysis models for a random sample of 75 participating homes in the tracking database. We verified that the model runs used input values consistent with identifying information in the tracking database, and that HERS ratings levels matched the model outputs. We verified that all participants in the sample frame were correctly categorized by HERS index, incentive level, and building type. We found that no homes were missing or mis-categorized in the sample of 75 homes, resulting in a 100% verification rate.

[1] REM/Rate is software developed by Architectural Energy Corporation that calculates heating, cooling, hot water, lighting, and appliance energy loads for new and existing homes.

[2] Note that the percentage of expected savings is calculated based on the AIC filing dated January 20, 2011, which includes Non-Residential New Construction.

Table 1 below applies these participation results to the project population, showing 100% verification overall.

Table 1. Summary of Program Participation Verification Results

Home Type	Incentive Level	Fuel Type	Tracking Participants	Verified Participants	Verification Rate
Single-Family	ENERGY STAR 2.5 or 3.0 Base	Electric	5	5	100%
		Gas	10	10	100%
		Combo	133	133	100%
	HERS 71–85	Electric	3	3	100%
		Gas	0	0	–
		Combo	2	2	100%
	HERS 56–70	Electric	1	1	100%
		Gas	3	3	100%
		Combo	18	18	100%
	HERS ≤ 55	Electric	2	2	100%
		Gas	0	0	–
		Combo	31	31	100%
Multifamily	ENERGY STAR 2.5 or 3.0 Base	Electric	0	0	–
		Gas	0	0	–
		Combo	0	0	–
	HERS 71–85	Electric	19	19	100%
		Gas	0	0	–
		Combo	0	0	–
	HERS 56–70	Electric	75	75	100%
		Gas	0	0	–
		Combo	0	0	–
	HERS ≤ 55	Electric	0	0	–
		Gas	0	0	–
		Combo	0	0	–
Total			**302**	**302**	**100%**

The evaluation team calculated savings for each participant, by comparing the REM/Rate model estimated energy consumption to that of a similar home meeting the local energy codes. We then applied a deemed 0.8 net-to-gross ratio (NTGR) to estimate net savings. As shown in Table 2, ex ante and ex post net savings differ, as we estimated ex post savings from PY6 participant REM/Rate models and ex ante savings allocated between gas and electricity.

Table 2. PY6 ENERGY STAR New Homes Program Impacts

Savings	Ex Ante Gross	Realization Rate	Ex Post Gross	NTGR	Ex Post Net
Energy Savings (MWh)					
Total kWh	777	57%	443	0.80	354
Demand Savings (MW)					
Total kW	0.27	35%	0.10	0.80	0.08
Gas Savings (Therms)					
Total Therms	33,826	69%	23,193	0.80	18,554

Based on the evaluation of program data, the evaluation team presents the following key findings:

- Energy savings planning estimates (ex ante estimates in the tracking database) have not kept pace with changing energy codes in Illinois. While enforcement of those codes appears low, we defined the baseline for each home in this program year as the current adopted code.
- Multifamily homes achieved greater electric savings than anticipated, partially due to program multifamily homes using electric heating systems; those homes exceeded their planning estimates by 20%.

1.2 Process Results

After major program changes in PY5, PY6 represented a growth and building year for the program. Although program participation fell short of its PY6 goal, program-tracking data show a 74% increase in participation over PY5, with more builders and raters participating than ever before. Further, program-eligible homes accounted for approximately 11% of all new homes built within the AIC service territory. Single-family builders tended to participate in the HERS-only, non-certified category, with 71% of all single-family participation. By contrast, 80% of all multifamily participation occurred in the double bonus ENERGY STAR-certified category. Multifamily units were on average less efficient than single-family homes built through the program, with many homes and units exceeding a HERS index of 70.

Despite the increase in participation, program awareness appears relatively low among non-participating builders and even among some participating builders (who appeared to confuse the program with the new 2012 code), suggesting that the program could benefit from additional branding or training. Additionally, many builders reported that homebuyers do not prioritize energy efficiency, nor do the builders make an effort to market their program homes any differently than their non-program homes.

Builders generally expressed satisfaction with their participation in the program, identifying only such areas as speed of rebate processing and regular communications as areas for improvement.

Finally, the program currently conducts a desk review of qualifying homes. This system has worked well for the program at its current size; however, as program participation continues to grow, the addition of an on-site verification component may help mitigate any quality control issues in the future.

1.3 Recommendations

Based on the PY6 evaluation, the evaluation team offers the following recommendations:

- Establish communications milestones with builders (such as "application received" and "rebate being processed") to quickly and easily maintain communications and improve satisfaction levels. The new CSG account managers hired to process paperwork could also track and follow up on missing paperwork from new builders, thus circumventing future rebate processing delays.

- Given a relatively small pool of raters and a growing pool of participating builders, an opportunity exists for program staff to establish regular and consistent communication with builders and raters and/or to recruit additional raters and builders to support the program. A simple quarterly email update (also provided by regular mail) could help build the program's brand and remind builders of the value of participating in the program.

- Consider offering sales training for builders, teaching them to market the benefits of an energy-efficient program home; this would include methods to use AIC marketing materials and key points for sales discussions.

- Consider implementing an enforceable maximum HERS (such as 70 or 65) and a sliding incentive scale. For example, offer builders a $50 additional incentive for every HERS point they achieve below a specified level. One southwestern U.S. utility successfully employed this model for its new homes program and consequently achieved greater savings from the program.

- Consider conducting on-site verification for a small portion of program homes (such as 10%) to maintain a high level of quality control as the program grows.

2. Introduction

2.1 Program Description

The Ameren Illinois Company (AIC) ENERGY STAR® New Homes Program, implemented by Conservation Services Group (CSG), offers builders training, technical information, marketing materials, and incentives for the construction of homes meeting ENERGY STAR 3.0 or 2.5 standards ("Certified") or achieving a Home Energy Rating System (HERS) index of 70 or less ("Non-certified") for single-family homes and 85 or less for multifamily units.

ENERGY STAR 3.0 specifies that participating new homes must be at least 20% more efficient than homes built to the 2009 International Energy Conservation Code (IECC). The 2.5 and 3.0 standards differ due to the inclusion of new checklists for 3.0 that detail mandatory requirements for thermal enclosures, HVAC quality installation, and water management. The program requires that homes be built using the new *ENERGY STAR Reference Design*,[3] which includes a comprehensive set of specifications for HVAC equipment, the building envelope, lighting, and appliances. However, as Illinois adopted the 2012 Illinois energy code, which encompasses most 2012 IECC aspects, builders who choose to build ENERGY STAR will be required in 2015 to use version 3.1 guidelines, developed specifically for locations adopting the 2012 IECC or equivalent.

Builders constructing single-family homes and duplexes heated with fuel provided by AIC become eligible for program services. Builders hire a HERS rater to verify savings achieved by energy-efficient practices and often to provide technical assistance and program application processing throughout the building process.

In PY6, CSG added two account managers to assist with account management tasks, such as engaging with raters and builders and processing application paperwork. No other major program changes occurred in PY6.

In PY5, the program adopted ENERGY STAR 3.0 guidelines and the 2012 Illinois energy code took effect. To allow builders time to adapt to the new ENERGY STAR 3.0 requirements, the program allows builders to build to the previous ENERGY STAR standard (2.5) or to have the home rated by a HERS rater as an introductory step to participating in the program. Additionally, through a base-, double-, and triple-incentive structure, the program defrays costs of hiring HERS raters and/or additional costs of energy-efficient equipment and materials. The base incentive offsets the cost of hiring a rater, while the double and triple incentives contribute to covering expenses and time required to install more expensive or technically advanced measures.

While program staff hoped to enforce a more stringent HERS requirement in PY6, uncertainty around which communities adopted and enforced the 2012 Illinois energy code caused program staff to rethink this requirement, thus allowing homes to participate under the PY5 incentive structure. Table 3 and Table 4 detail incentives offered through the program in PY6.

[3] http://www.energystar.gov/ia/partners/bldrs_lenders_raters/downloads/2011_Reference_Design_Definition.pdf.

Table 3. Single-Family Home Incentive Structure

	Heat Provider	Base Incentive (HERS ≤ 70 for non-certified; HERS 71–85 for ENERGY STAR)	Double Incentive (HERS 56–70)	Triple Incentive (HERS ≤ 55)
Certified ENERGY STAR 3.0 (with some exceptions, 2.5)	AIC Gas Heat	$450	$900	$1,350
	AIC Gas and Electric Heat	$750	$1,500	$2,250
	AIC Electric Heat	$750	$1,500	$2,250
HERS Only, Non-Certified	AIC Gas Heat	$450	–	–
	AIC Gas and Electric Heat	$750	–	–
	AIC Electric Heat	$750	–	–

Source: PY5 Implementation Plan

Table 4. Multifamily Unit Incentive Structure

	Heat Provider	Base Incentive (HERS 71–85)	Double Incentive (HERS 56–70)	Triple Incentive (HERS ≤ 55)
Certified ENERGY STAR 3.0	AIC Gas Heat	$250	$500	$750
	AIC Gas and Electric Heat	$450	$900	$1,350
	AIC Electric Heat	$450	$900	$1,350
HERS Only, Non-Certified	AIC Gas Heat	$250	–	–
	AIC Gas and Electric Heat	$250	–	–
	AIC Electric Heat	$450	–	–

Source: PY5 Implementation Plan

2.2 Research Objectives

The PY6 ENERGY STAR New Homes Program evaluation sought to estimate gross and net electric and gas savings associated with the program. In addition, the evaluation explored the following process-related questions:

- How well do the program's processes work, and what opportunities for improvement exist?
- How well do market actors adapt to the program's transition to ENERGY STAR 3.0 (which occurred in PY5)?
- Has contractor understanding of the HVAC checklist improved and, if so, what contributed to this improvement?
- What are the understanding and enforcement levels for the recently adopted 2012 Illinois energy code among builders and building inspectors?
- How satisfied are builders with the program?
- Why do non-participant builders not participate?
- What changes could the program make to improve customer or trade ally experiences and to generate greater participation or savings?

3. Evaluation Methods

Table 5 summarizes evaluation tasks conducted for PY6.

Table 5. Summary of ENERGY STAR New Homes Evaluation Activities for PY6

Activity	PY6 Impact	PY6 Process	Forward Looking	Details
Program Staff Interviews		✓	✓	One interview with AIC's program manager and one with CSG's program manager to discuss program design, implementation, marketing, and market trends
Materials and Data Review		✓		Review of marketing materials, the program database, and program fact sheets
REM/Rate™[4] File Review	✓			Review of 75 REM/Rate project files to verify savings against an equivalent house built to meet the local code
Participant and Non-Participant Builder Interviews		✓	✓	Interviews with participant and non-participant builders on program awareness, satisfaction, building practices, and the 2012 Illinois energy code
Building Inspector Interviews		✓	✓	Interviews with building code departments in AIC's territory regarding enforcement and implementation of the 2012 Illinois energy code

3.1 Data Collection

The following activities informed the PY6 evaluation of the ENERGY STAR New Homes Program.

3.1.1 Program Staff Interviews

The evaluation team conducted two interviews with program staff: one with AIC's program manager and one with CSG's program manager. These interviews explored questions about the program's design and implementation, application processes, marketing tactics, and trends in the new homes market. The evaluation team also inquired about data tracking related to the program.

3.1.2 Review of Program Materials and Data

The evaluation team reviewed program data, including marketing materials and the program-tracking database.

3.1.3 REM/Rate™ File Review

The evaluation team reviewed a sample of REM/Rate files comparing results to home characteristics and HERS index information in the tracking database to ensure consistency.

[4] REM/Rate is software developed by Architectural Energy Corporation that calculates heating, cooling, hot water, lighting, and appliance energy loads for new and existing homes.

3.1.4 Builder and Building Inspector Interviews

The evaluation team conducted interviews with participant and non-participant builders and with representatives from building, zoning, and code departments within the AIC service territory. AIC provided the list of all contacts[5]. The evaluation team attempted to reach every building department and participant builder contact up to three times. We selected non-participant builders randomly from the AIC-provided list, and attempted contacts until the quota was reached. Interviews with participant builders covered such topics as program awareness, program satisfaction, building practices, the transition to the 2012 Illinois energy code, and program processes. Interviews with non-participant builders covered program awareness, building practices, and the 2012 Illinois energy code. Interviews with building code officials sought to gain insight into the different enforcement practices of the 2012 energy code within jurisdictions inside the AIC service territory and code officials' observations about how builders adapted to the change in energy code.

Table 6. Summary of Interview Response Rates

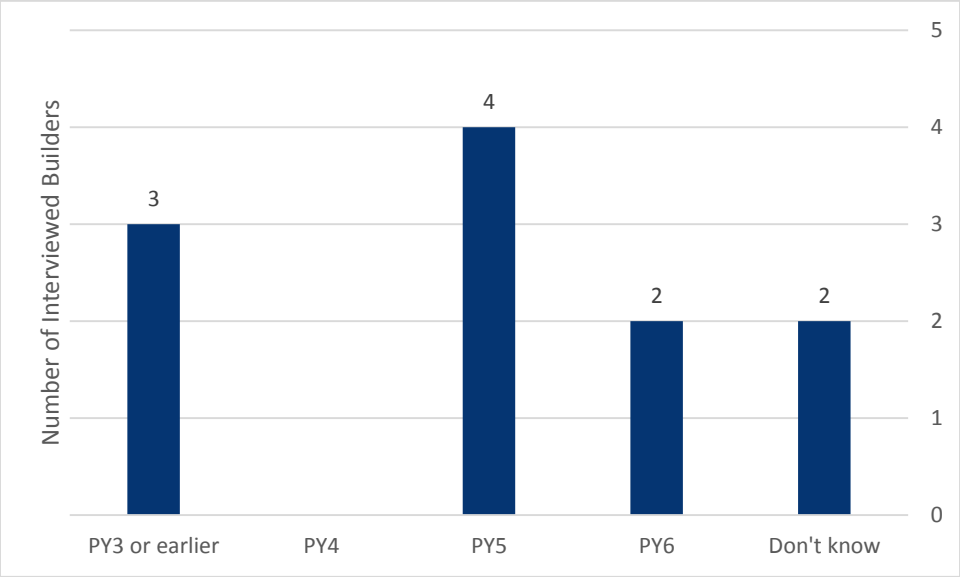
Activity	Number in Sample	Number in Sample Attempted	Refused/Bad Number/ Does Not Build in IL	Quota	Interviews Completed	Overall Response Rate*
Participant Builders	37	37	4	10	11	30%
Non-Participant Builders	242	45	10	5	6	13%
Building Inspectors	24	23	0	5	5	22%

* Number of samples attempted (up to three times) compared to number of completed interviews.

Though the evaluation team sought to interview builders who joined the program at different times, the builder sample file provided by AIC did not contain this information. Hence, the evaluation team relied on self-report data to categorize participation start years. None of the builders interviewed reported joining the program in PY4. Figure 1 shows the approximate program year each interviewed builder joined the program.

[5] Based on our review of home builder association websites for central and southern Illinois, AIC's list appears to be comprehensive.

Figure 1. When Builders Joined the Program



Q4. When did you first join the program? (n=11)

3.2 Analytical Methods

3.2.1 Gross Impacts

The evaluation team determined ex post gross impacts through a thorough review of the program database and a review of REM/Rate files for a sample of 75 program homes. The database review consisted of cross-referencing program requirements (HERS index, home type, and incentive levels) to appropriate savings categories. The REM/Rate review consisted of comparing a program home to its equivalent baseline home (the report refers to these home conditions as as-built and baseline).

Database Review

The program-tracking database contains: project names and addresses, builder information, fuel types, incentive information, ex ante energy savings, and associated tracking ID and account numbers. The database also includes information regarding home type, home size, HERS index, and fuel type(s). Ex ante energy and demand savings are provided for each project listed in the database based on the fuel type(s) and HERS index. The evaluation team cross-referenced tracked energy and demand savings by home type, HERS index, fuel type, and ENERGY STAR certification to the appropriate ex ante savings values to verify correct categorization. The evaluation team also examined the database for duplicate entries and out-of-range values.

REM/Rate Review

The evaluation team reviewed a sample of 75 REM/Rate files stratified by HERS index and builder. The stratified sample selected one file from each builder (45 files) and one file from each HERS tier (3 files) to ensure complete representativeness; we selected the remaining 27 files randomly among the remaining sample. Each sampled file contained all energy-related features of the subject home, such as insulation levels, HVAC information, and lighting and appliances installed. The REM/Rate analysis included a built-in feature

that compared the relative energy usage of the program home to an equivalent home built to code-minimum requirements. That feature, however, did not account for upgraded HVAC systems and appliances (as these were energy code requirements). Consequently, the evaluation team designed a User Defined Reference Home (UDRH) for each sampled home to compare an as-built home to both minimum requirements of the energy code and the minimum federal standard for appliances and HVAC.

A UDRH contains a set of baseline parameters used to compare a home to an equivalent home built to another standard. The UDRH builds another energy model of the home, at the same size and orientation, but modifies all the components. The UDRH models used in this report allowed the evaluation team to compare the relative energy usage of 75 sampled homes.

3.2.2 Net Impacts

To estimate net savings, the team applied the net-to-gross ratio (NTGR) of 0.8, as specified in the work plan, to the ex post gross savings.[6] This deemed NTGR was used in all past program evaluations, since the program has been historically too small to warrant the research expenditures. All NTGR research conducted during PY6 is for prospective use, beginning in PY8, should the program continue to be offered.

3.3 Sources and Mitigation of Error

Table 7 provides a summary of possible sources of error associated with data collection conducted for the ENERGY STAR New Homes Program that contributed to numerical analysis. We discuss each item in detail below.

Table 7. Potential Sources of Error

Analytical Task	Survey Errors		Non-Survey Errors
	Sampling Errors	Non-Sampling Survey Errors	
Participant Builder Interviews	• Yes	• Measurement errors • Non-response bias and self-selection bias • Data processing errors • External validity	• N/A
Non-Participant Builder Interviews	• Yes	• Non-response bias and self-selection bias	• Data processing errors
Building Inspector Interviews	• Yes	• Non-response bias and self-selection bias	• Data processing errors
Gross Savings Calculations (REM/Rate files review)	• Yes	• N/A	• Data processing errors • Modeling errors
Net Savings Calculations	• N/A	• N/A	• Data processing errors
Future Planning Estimates (NTGR)	• Same as participant builder interviews	• Same as participant builder interviews	• Data processing errors

The evaluation team took a number of steps to mitigate against potential sources of error throughout the planning and implementation of the PY6 evaluation.

[6] The evaluation team describes NTGR research conducted during PY6 in Section 4.4, Future Planning Inputs.

Survey Errors

- Sampling Errors
  - **Participant Builder Interviews:** The evaluation team designed the participant builder interview sample to achieve a maximum error of ±6.2% of homes or ±22% of builders with 90% confidence assuming a coefficient of variation of 0.5. We surveyed 11 builders representing 113 participating homes out of a population of 45 builders representing 302 participating homes. The actual precision of each survey question differed depending on the variance of the responses to each question.
  - **Non-Participant Builder and Building Inspector Interviews:** We interviewed 5 non-participant builders from a list of 242 and 5 building inspectors from a list of 24. Since these were qualitative interviews to inform the process evaluation, we did not attempt to achieve a prescribed maximum sampling error.
  - **REM/Rate File Review:** We reviewed a sample of 75 REM/Rate models out of 302 participants chosen, to obtain representation of every builder and every HERS rating. Since the sample was stratified, errors will be slightly lower than the calculated simple random error of ±8% at 90% confidence based on a simple random sample.
- Non-Sampling Errors
  - **Measurement Errors:** Both the validity and reliability of quantitative data were addressed through multiple strategies. First, we relied on the experience of the evaluation team to design a research instrument that accurately measured the variables or concepts that were the focus of the research. We reviewed each research instrument and revised any double-barreled questions (i.e., questions that asked about two subjects, but that had only one response) and leading questions (i.e., questions that were slanted one way or another). We also assessed the logical flow of the questionnaire to minimize respondent confusion and increase reliability.

    A senior member of the evaluation team reviewed and AIC and ICC staff had the opportunity to review all survey instruments prior to fielding. In addition, to determine if the wording of the questions was clear, we pretested each survey instrument, monitored telephone interviews, and reviewed the pretest survey data. We also used the pretests to assess whether the length of the survey was reasonable, and reduced survey length as needed.
  - **Non-Response Bias:** Given that the response rate for the builder survey was 30%, there is the potential for non-response bias. However, we attempted to mitigate possible bias by contacting each contact in the sample at least two times or unless a hard refusal was received, and by calling at different times of the day as appropriate. In addition, the team used all available data at its disposal to assess whether evidence of non-response bias existed.
  - **Data Processing Errors:** The team addressed processing errors through interviewer training, as well as quality checks of completed survey data. Evaluation team interviewers went through rigorous training before they began interviewing. Interviewers received a general overview of the research goals and the intent of each survey instrument. Through survey monitoring, members of the evaluation team also provided guidance on proper coding of survey responses.
  - **External Validity:** We addressed external validity (the ability to generalize any findings to the population of interest) through development of an appropriate research design. Given that we

attempted a census of participants, we did not need to worry about having a sample that was representative of customers who participated in the program.

- Data Processing Errors
  - **Gross Impact Calculations:** We estimated gross impacts by comparing REM/Rate models of a sample of homes to a model of a similar home that met the local building codes. To minimize data processing errors, the evaluation team had all calculations reviewed by a separate team member to verify that calculations were performed accurately.
  - **Net Impact Calculations:** We applied the prospective deemed NTGR to estimate the program's net impacts. To minimize data processing errors, the evaluation team had all calculations reviewed by a separate team member to verify that calculations were performed accurately.
  - **Modeling Errors:** We used REM/Rates automated User Defined Reference Home feature to process the files to minimize user errors. Additionally, we processed the modeling results using a Microsoft® Access database then exported into Excel to minimize data entry errors.

4. Evaluation Findings

4.1 Program Description and Participation

The AIC ENERGY STAR New Homes Program offers builders training, technical information, marketing materials, and incentives for the construction of homes meeting ENERGY STAR 3.0 or 2.5 standards or achieving a HERS index of 70 or less for single-family homes and 85 or less for multifamily units. In PY5, the program adopted ENERGY STAR 3.0 guidelines and the 2012 Illinois energy code took effect. To allow builders time to adapt to the new ENERGY STAR 3.0 requirements, the program allows builders to build to the previous ENERGY STAR standard (2.5) or to have the home rated by a HERS rater as an introductory step to participating in the program.

Builders constructing single-family homes and duplexes heated with fuel provided by AIC become eligible for program services. Builders hire a HERS rater to verify savings achieved by energy-efficient practices and often to provide technical assistance and program application processing throughout the building process.

Additionally, through a base-, double-, and triple-incentive structure, the program defrays costs of hiring HERS raters and/or additional costs of energy-efficient equipment and materials. The base incentive offsets the cost of hiring a rater, while the double and triple incentives contribute to covering expenses and time required to install more expensive or technically advanced measures.

AIC and CSG set annual participation goals based on the prior year's participation and market and program changes, while balancing realistic and best-case scenarios. In PY6, the program had a participation goal of 432 homes (240 multifamily units and 192 single-family homes). While the program did not achieve its target, 45 participant builders[7] completed 302 homes for program incentives in PY6, representing a 74% increase over PY5's completed homes. Table 8 shows the program participation during PY6.

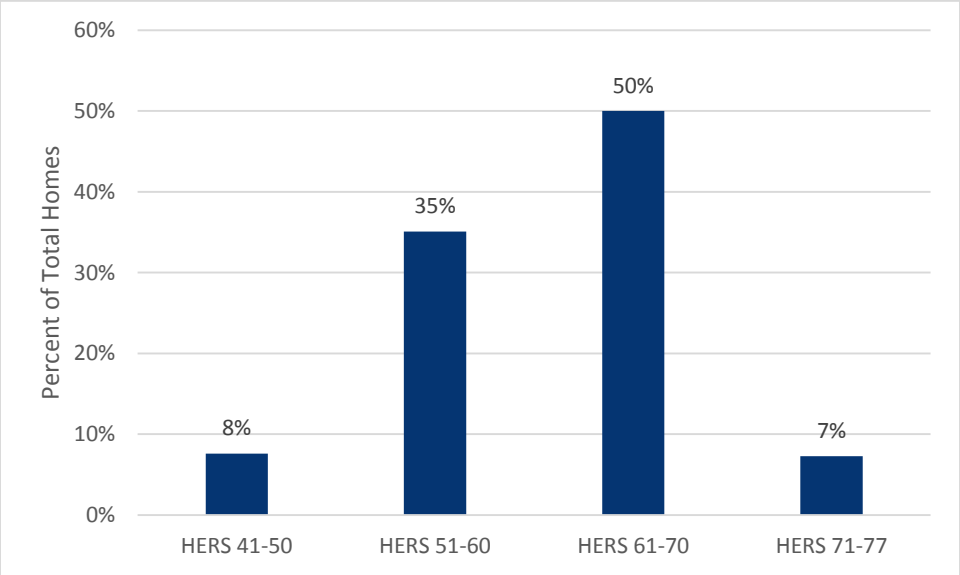
Table 8. Program Participation

Home Type	Goal	Actual	Percent Achieved
Single-Family	192	208	108%
Multifamily	240	94	39%
Total	**432**	**302**	**70%**

In PY6, 10 HERS raters and 45 builders participated in the program. A majority of completed homes (57%) achieved a HERS index of 61–77, as shown in Figure 2. Larger volume builders (building more than five program homes) averaged a HERS index of 62, while smaller custom builders (building five or fewer homes) achieved a slightly more efficient home with an average HERS index of 58. Interviewed custom builders expressed pride in their craftsmanship and use of energy-efficient techniques. One out-of-state builder said Illinois residents seek him out for his energy-efficient homes. The most efficient category of ENERGY STAR-certified homes—receiving the triple incentive—had an average HERS index of 51.

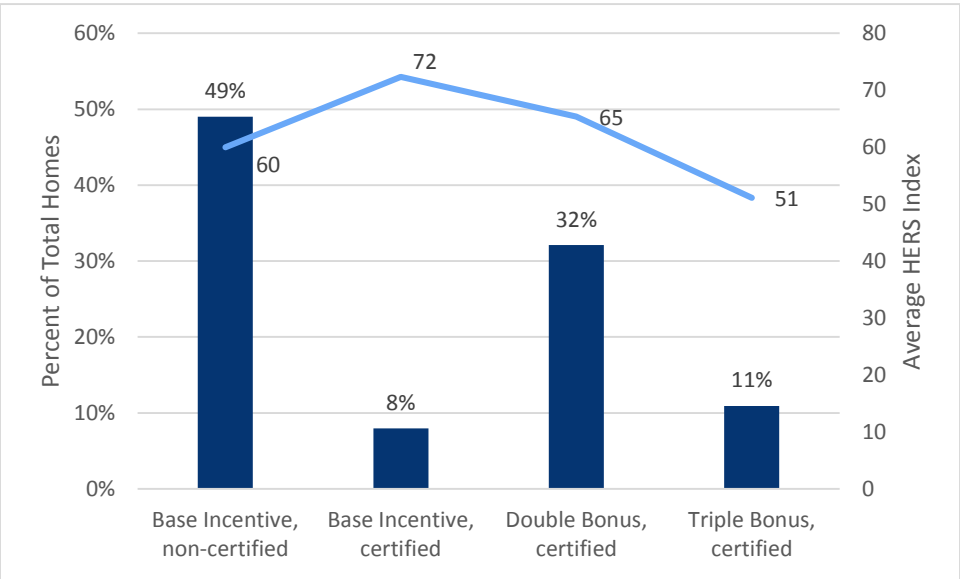
[7] A total of 45 builders participated in the program in PY6. The implementer provided a builder sample of 37 contact names, which is why the builder call sample differs from the total number of builders who participated.

Figure 2. HERS Indices of PY6 Homes (n=302)



Builders may pursue ENERGY STAR 2.5 or 3.0 certification through the program, and approximately one-half of all homes submitted to the program qualified as ENERGY STAR, as shown in Figure 3. Most certified homes were ENERGY STAR 3.0 since, as program staff reported, most raters no longer verify and certify an ENERGY STAR 2.5 home due to its outdated standard. Only one builder submitted some 2.5 homes in the certified category during PY6. ENERGY STAR program homes averaged a HERS index of 63, while non-certified program homes averaged a HERS index of 60. More custom, small-volume builders elected to use the non-certified HERS option because of the added paperwork required for ENERGY STAR.

Figure 3. Incentives and Average HERS Index by Incentive Category (n=302)



The blue bars and left axis represent the percentage of program homes in each incentive category. The blue line and right axis represent the average HERS index for homes within each incentive category. A lower HERS index indicates a more efficient home.

Upon closer examination of the average HERS index achieved in each incentive category, key differences emerged between single-family and multifamily units. For example, 71% of all single-family participation occurred in the HERS-only, non-certified category, where builders achieved an average HERS index of 60. By contrast, 80% of all multifamily participation occurred in the double-bonus ENERGY STAR-certified category, where builders achieved a less-efficient unit, averaging a 67 HERS index. Table 9 illustrates these differences.

Table 9. Participation and Average HERS Index by Incentive Type

Incentive Type	Single-Family Average HERS Index	Percent of Single-Family Homes in Category	Multifamily Average HERS Index	Percent of Multifamily Homes in Category
Base Incentive, Non-Certified	60	71%	–	0%
Base Incentive, Certified	68	2%	73	20%
Double Bonus, Certified	59	11%	67	80%
Triple Bonus, Certified	51	16%	–	0%
Average	**59**		**68**	

Although the program set a maximum HERS of 70, the program manager noted the program has allowed some homes below the threshold if they qualified as ENERGY STAR 2.5, because it is almost impossible to find raters that certify 2.5. ENERGY STAR 2.5 does not have an established HERS requirement. The program wanted to use this exception to introduce builders to the ENERGY STAR process and its required checklists, hoping that, in future years, builders would choose ENERGY STAR as the recognizable energy-efficient home standard. This exception applied to 17 homes in PY6 (14 multifamily and three single-family), all of which received a base incentive. Since the evaluation team evaluated savings by comparing energy use of participant homes as-built to that of those meeting minimum local codes, we capture the reduced savings from these participating homes not meeting program requirements.

Table 10 and Table 11 show the HERS index by incentive type. Single-family builders outperformed multifamily builders in terms of the HERS index. Most single-family, non-certified homes achieved a HERS index between 56 and 70, with a small portion of non-certified homes achieving a very low HERS index comparable to indices achieved by those pursuing ENERGY STAR. In the multifamily category, certified units did not achieve a very low HERS index, with all base incentive recipients achieving a HERS index of 71 to 75, and the lowest double-bonus recipient achieving a 61.

Table 10. Single-Family HERS Index by Incentive Type

Incentive Type	Number of Homes within HERS Index Category							
	41–45	46–50	51–55	56–60	61–65	66–70	71–75	76 or more
Base Incentive, Non-Certified	5	4	22	45	42	30	0	0
Base Incentive, Certified	0	0	1	0	1	0	2	1
Double Bonus, Certified	0	0	0	19	2	1	0	0
Triple Bonus, Certified	2	12	19	0	0	0	0	0
Total Homes	**7**	**16**	**42**	**64**	**45**	**31**	**2**	**1**

Table 11. Multifamily HERS Index by Incentive Type

Incentive Type	HERS Index			
	61–65	66–70	71–75	76 or more
Base Incentive, Certified	0	0	16	3
Double Bonus, Certified	10	65	0	0
Total	**10**	**65**	**16**	**3**

4.2 Process Assessment

Illinois New Homes Market

The new homes market improved in Illinois from PY5 to PY6, as did the share of program-eligible homes. Statewide, single-family building permits increased by 8% and multifamily building permits increased by 48%.[8] Last year, the evaluation team estimated the AIC program's market share of new homes at around 8%–10%. For PY6, it appears the percentage of program-eligible homes improved slightly, to 11% for all new homes built within AIC's service territory.[9]

While the new homes market may have improved, program staff noted that Illinois historically has not been a strong building state, and builders said that their customers rarely prioritized energy efficiency. At least four builders constructing custom and tract homes described southern Illinois homebuyers as cost-conscious consumers who lack awareness and interest in energy-efficient homes. One builder described the challenge of promoting energy-efficient homes in southern Illinois: "Most of them think we're playing games. Think it's a way to raise the price of the home because they can't physically see the benefit and the things we're doing to make their home tighter and better and more efficient and an all-around better product. That's extremely difficult to sell to someone."

Despite these findings, two builders said the concept of minimizing monthly utility costs resonated with customers on fixed incomes or those seeing energy prices rise.

Incentive Levels

Table 12 lists AIC and three other utilities adopting performance-based program models for their residential new construction programs. As shown, performance-based program models typically offer tiered incentives, based on savings achieved by the completed home compared to a baseline home. EmPOWER, Maryland's program, is most comparable to AIC's in program design because it is based on ENERGY STAR 3.0 and Maryland adopted the 2012 IECC. While the majority of Maryland's participation occurred in the most efficient tiers, this participation largely occurred in urban areas larger than those in AIC territory. AIC's incentives are similar, albeit higher at the top end than Maryland's incentives.

[8] Building permits issued from January to July 2014, as compared to the same period in 2013.

[9] From January to July 2014, 1,564 building permits were issued for single-family homes and multifamily units in AIC service areas. Adjusting program participation of 302 for 7/12 of the year provides a market share of approximately 11%.

Table 12. Single-Family Incentive Model Comparison

Program Sponsor	Program Name	Incentive Model	Incentive Structure	Requirements
AIC	AIC ENERGY STAR New Homes (2013–2014)	Tiered and Performance	HERS only, non-certified = $450 (gas and electric)	HERS index ≤ 70
			ENERGY STAR 3.0 = $750/$1,500/$2,250 (gas and electric)	No HERS maximum for ENERGY STAR 3.0 homes
Entergy Arkansas	Entergy Arkansas New Homes Program (2013)	Tiered and Performance	Special Rate = $300/home	≥ 15% kWh saved over Arkansas Development Finance Authority
			High Performance = $600/home	ENERGY STAR 2.5
			ENERGY STAR certification = $1,000/home	ENERGY STAR 3.0
EmPOWER Maryland	EmPOWER Maryland ENERGY STAR New Homes (2013)	Tiered and Performance	Tier 1 = $1,000	HERS 66–70 and 90% CFLs
			Tier 2 = $1,300	HERS 61–65 and 90% CFLs
			Tier 3 = $1,600	HERS ≤ 60 and 90% CFLs
Wisconsin Focus on Energy	Focus on Energy New Homes Program (2013)	Tiered and Performance	Tier 1 = $200 (gas and electric) or $100 (electric only)	10%–19.9% more efficient than 2006 IECC
			Tier 2 = $750 or $200	20%–29.9% more efficient than 2006 IECC
			Tier 3 = $1,000 or $300	30%–39.9% more efficient than 2006 IECC
			Tier 4 = $1,500 or $400	40$–100% more efficient than 2006 IECC

Program Processes

Program staff described PY5 as a "building" year and anticipated that PY6 would build on the momentum developed during PY5. Program staff noted three reasons for the program's continued momentum in PY6: the addition of an entry-level HERS-only tier in PY5; the addition of the multifamily low-rise component in PY5; and the participation of large-volume builders, such as McBride & Sons and Homeway Homes (which contributed significantly to the program's increased participation).

One unanticipated factor may have been a natural disaster. Builders and code officials in the cities of Washington and Pekin noted the devastating tornado that occurred in November 2013 that destroyed more than 1,000 homes, resulting in a great deal of new construction during the summer of 2014. While only three Washington homes were submitted to the program in PY6, construction activity in these areas has positively affected PY7 performance and represents an immediate program marketing and/or partnership opportunity.

Increased staff capacity also positively influenced the program in PY6. CSG added two account managers who work with raters and builders and who process rebate paperwork. These account managers develop and manage relationships with homebuilder associations, which have played an important role in the program's outreach strategy. Program staff anticipate that these staff will allow the program manager to focus on higher-level management, such as improving the HERS average of each home and developing new ways to engage raters and builders.

Data Tracking, Rebate Processing, and Builder Training

In terms of data tracking, builders (or their raters) send program staff an enrollment form with a preliminary REM/Rate file containing fuel type, square footage, and equipment plans. While program staff did not use the information in the enrollment form other than to flag homes that did not qualify for the program (such as propane-fueled), the process sought to elicit conversations between raters and builders to help builders improve preliminary HERS index. Typically, raters managed the program paperwork processes for builders, which program staff described as a quality control mechanism.

To participate in the program, builders sign a builder ally agreement, but the program neither requires nor offers formal training. Program staff rely on raters to communicate program specifics to the builders. Program staff, however, remain available to provide resources for builders seeking help. Program staff noted (and builder interviews confirmed) that builders often defer all paperwork and program questions to the rater. Raters also sign a rater ally agreement to participate in the program and a required Residential Energy Services Network (RESNET)[10] certification. If a rater works on ENERGY STAR homes, he or she has to be a U.S. Environmental Protection Agency (EPA) partner.[11] Account managers conducted trainings as needed for new raters, addressing expectations, paperwork, and sales skills.

Although the program did not require training, program staff expressed optimism that, as the program grows, they will be able to offer more specialized certification trainings and workshops. In PY6, program staff offered an ENERGY STAR seminar on HVAC checklists and invited raters, builders, and contractors. While program staff did not track whether training attendees went on to become more active participants, they hope to do so in the future, thus identifying additional opportunities to bring more raters and builders into the program.

Quality assurance consisted of quality assurance desk reviews on 100% of the projects. Program staff checked that REM/Rate files matched the HERS index, and staff reported that they usually do. The CSG program manager also reviewed the REM/Rate file for accuracy. If the home was non-certified HERS, staff reviewed the home energy rating certificate checklist. If the home was ENERGY STAR, staff reviewed the ENERGY STAR checklist. Program staff did not conduct on-site quality assurance.

Interviewed builders suggested rebate processing times could be improved. Three of 11 builders reported it took from 6 to 9 months to receive a program rebate, and complained of little to no communication from program staff about the status of their rebate applications. One dissatisfied builder suggested AIC could implement an online rebate tracking system so builders or raters could easily see the status. Program staff noted that, for many builders new to the program, rebate processing times could seem long due to builders often not submitting in a timely manner the required paperwork to receive the incentive. Such paperwork includes W-9 forms and insurance documentation. Often, delays in receipt of this documentation and/or completion of the REM/Rate file (done by the HERS rater) slowed processing times.

ENERGY STAR 3.0 Transition

Program staff anticipated that the ENERGY STAR 3.0 requirement would prove a challenging adjustment for participating builders. ENERGY STAR 2.5 and 3.0 differ primarily in the additional paperwork required by 3.0, including multiple checklists. Five of 11 participant builders interviewed built at least some of their homes to ENERGY STAR 2.5 or 3.0. Of those five, two said that they had not experienced challenges with the transition (although one of the two tended to build to the 2.5 standard due the 3.0 paperwork requirements; thus, avoiding a potential challenge). The program incentivized builders to use 3.0 by offering eligibility in the double-

[10] RESNET provides accreditation to home energy raters.

[11] Businesses registered with EPA as ENERGY STAR partners.

and triple-bonus categories (for which 2.5 did not qualify). The evaluation team could not verify which program homes achieved 2.5 or 3.0 based on program tracking data, and program staff reported they did not track this information. One builder said that he had not encountered challenges with ENERGY STAR 3.0 or the HVAC checklist, as he clearly informed his subcontractors that, if they did not conduct the work properly the first time, the subcontractor would be responsible for the additional time and cost for corrections.

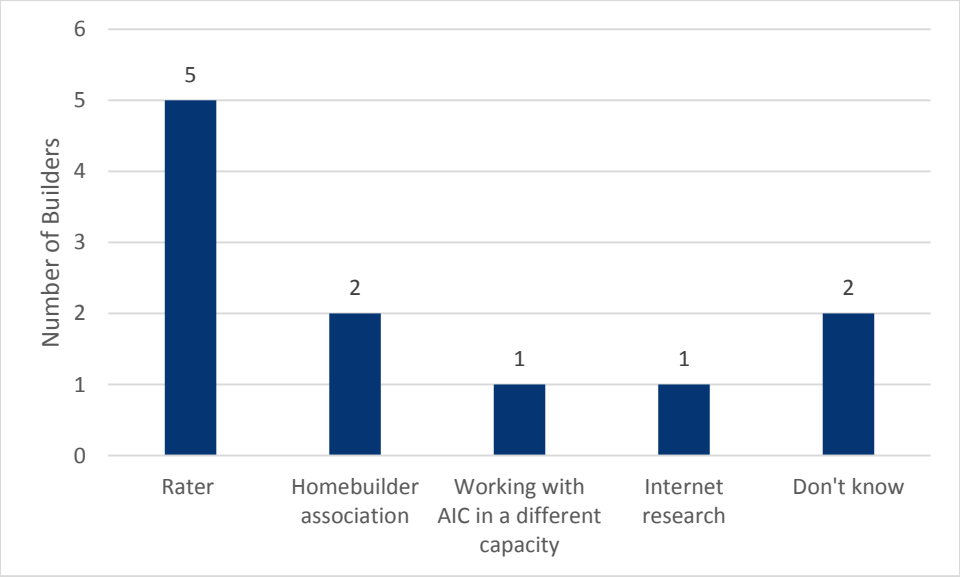
The remaining three builders agreed that the HVAC checklist continued to pose various challenges. One builder reported a tendency to build more 2.5 homes than 3.0 because HVAC paperwork requirements proved troublesome and time consuming for his contractors. Another builder said that building ENERGY STAR 3.0 required more subcontractors to complete the HVAC process correctly, so he sometimes built to 2.5 for simplicity. Finally, a third builder said that he encountered challenges finding the right mechanical contractor and general contractor certified in ENERGY STAR 3.0. This contractor also reported difficulty in finding lighting suppliers that carried ENERGY STAR certified bulbs, noting: "In lighting, people were walking away from ENERGY STAR 3.0 because it was becoming too expensive…to get the certification."

Builder Awareness and Reasons for Participation

Participant builders expressed moderate awareness about the program. For example, 9 of 11 builders knew about the AIC program and knew that they participated, while two builders interviewed expressed uncertainty and even unfamiliarity with such terms as HERS rater, ActOnEnergy, and ENERGY STAR (even though program staff identified them as participant builders and the database reflected their participation).

Participant builders most commonly learned of the program through a rater, and none of the builders learned about the program through customer inquiries. Figure 4 shows the ways that participant builders learned about the program.

Figure 4. How Participant Builders Learned about the Program

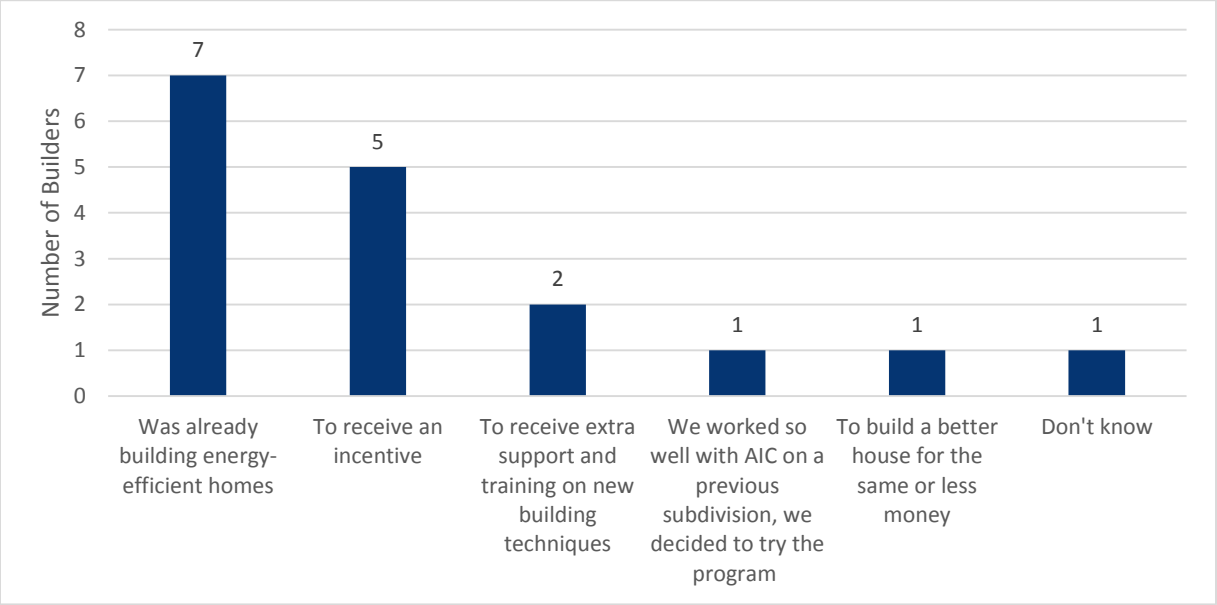


Q11. How did you first learn about the Ameren Illinois program? (n=11)

Builders cited a variety of reasons for choosing to join the program, the most common of which is that they already built energy-efficient homes, as shown in Figure 5. Builders who indicated that they already built

energy-efficient homes could be doing so because of the previous program influencing their building practices, or as free-riders in this program year. We discuss this in more detail in the NTGR analysis described in Appendix B.

Figure 5. Why Builders Joined the Program



Q12. What were the reasons you decided to participate? (n=11, multiple responses allowed)

All seven non-participant builders said that they had heard of the program, learning of it in the following ways:

- Might have heard about it through an email, and maybe even participated 3 or 4 years ago (one builder)
- Through a homebuilder association (one builder)
- At a home show in Mount Vernon (one builder)
- Contacted ENERGY STAR directly 6 years ago regarding insulated panels and learned about AIC at that time (one builder)
- Did not recall how they learned about the program (three builders)

A lack of awareness regarding program details, which is possibly the result of a lack of outreach by program staff, could explain why most of these builders did not participate. Three of five builders reported not participating in the program as they had not been approached about it and/or did not know of the incentive. A fourth builder said his company build net-zero homes, already beyond ENERGY STAR and code.

Builder Satisfaction

Most participating builders expressed satisfaction with their participation in the program. Seven of 10 builders said that they were very satisfied with the program overall, 1 was somewhat satisfied, and 2 were not too satisfied (one of whom did not build program homes in PY6). The two builders expressed that they were

dissatisfied due to a lack of communication from the program or a loss of interest in the program. The builder who lost interest indicated that the incentive did not motivate him to build the energy-efficient homes he built, especially as the code was so similar to program requirements.

Despite the two dissatisfied builders, the other builders praised the program and provided the following comments when asked what they thought the AIC program did particularly well:

- "Not complicated to qualify and get the rebates. If they did away with it I wouldn't do as much as I do."
- "Check helped me reimburse myself for the extra requirement."
- "It's nice to have a source [of funding] to help us meet our energy-efficiency goals."
- "We think having the HERS ratings on MLS (Multiple Listing Service) will be huge. I don't know if Ameren did that or not….This will be huge for resale."
- "The communication is good with our rater."
- "It's forcing knowledge to consumer."
- "Rebates are the best thing. That helps cover some of that cost, so the consumer isn't eating all of it."
- "It served its purpose for a time."

Builders also expressed satisfaction with their HERS raters, although two builders noted a shortage of raters in the area sometimes resulted in long turnaround times on paperwork required by the program, contributing to overall delays in rebate processing (as described earlier).

Marketing and Communication

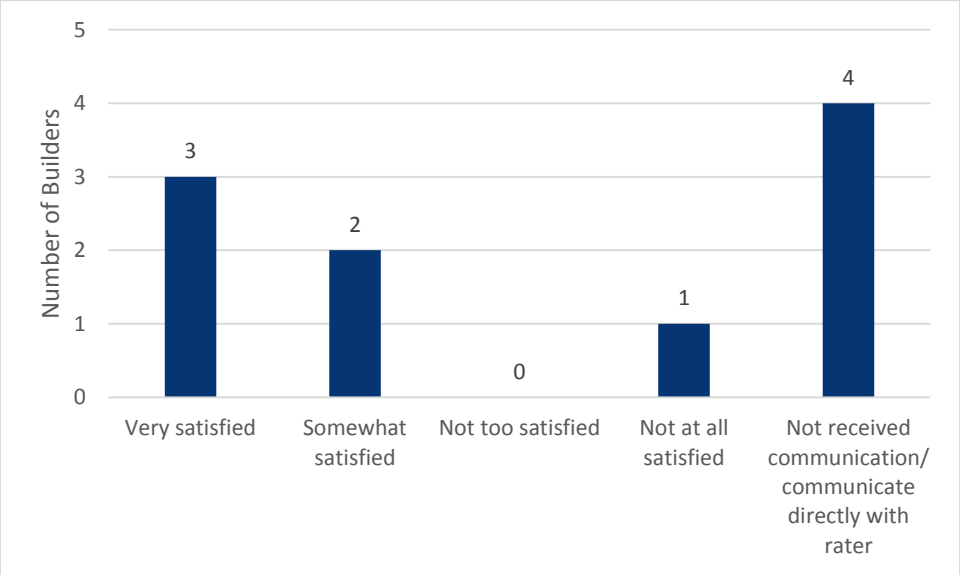
Program staff identified marketing as an opportunity for program improvement. Currently, the website serves as the primary information source for builders, raters, and homebuyers. AIC also creates consumer awareness through participation in the Parade of Homes and other home shows. The program and EPA offer ENERGY STAR New Home materials, but do not routinely distribute these to builders. The program provides an ENERGY STAR brochure, 6x9 placards explaining the benefits of an ENERGY STAR home, and lawn signs for homes under construction. Based on anecdotal evidence gathered during builder interviews, builders did not actively use these marketing materials.

None of the 11 participating builders interviewed marketed their program homes differently than their non-program homes. Two builders noted they did not have marketing materials from the program, with one saying: "That's the one thing I feel is lacking." One builder noted he called his program homes "HERS-rated homes" as opposed to describing the AIC program due to the ease of describing HERS-rated to customers.

Figure 6 illustrates the satisfaction ratings builders provided regarding communication that they received from the program. Builders acknowledging receipt of direct communication from program staff expressed satisfaction. Four of 10 builders, however, said that they did not receive program communication or receive their information directly from a rater. Five of 10 builders did not identify ways to improve program communications. Two builders said regular emails offered the best way to receive program information, with one builder finding mail preferable to email, and one builder saying having their rater take care of program communication worked best for him.

A fifth builder said he did not know whom to contact at the program with a question. A sixth builder, who did not build homes in PY6 but had in the past, noted: "If I were to get involved again, I would want to be able to submit my info online and track where the process was to know when payment was coming."

Figure 6. Builder Satisfaction with Program Communication



Q36. How satisfied are you with the communication you receive from program staff about the program? (n=10)

2012 Illinois Energy Code

The evaluation team interviewed five building inspectors or code officials at five municipalities within AIC's service territory: Washington, Springfield, Champaign, Urbana, and Edwardsville. These five municipalities represent 63 program homes or 21% of PY6 homes. The evaluation team attempted to reach all building department contacts provided by AIC. While Illinois state law requires cities to adopt the code adopted by the state, all municipalities except for Springfield adopted the 2012 Illinois energy code, although they enforced it using various methods and with varying degrees of stringency. Three of the four interviewees in communities adopting the 2012 code said manpower, time, and money presented the biggest impediments to enforcing the code. A fourth interviewee said education of contractors and builders presented the greatest limitation, noting: "I'm an educator more than an inspector. If they know what the answer was I would inspect, but I need to educate them at the same time. Most are receptive, and we make it a discussion."

Interviewees stated the following about their enforcement of the new code:

- "If we had more manpower, we would be looking at more. We would love to do insulation inspections, but can't fit it into our schedules."
- "We have been doing the energy code since 2003; until 2012 code wasn't as complicated. We built it into the existing inspections….There's a lot of plan review that takes a lot longer—up to two extra hours per permit."

- "We chose to do the best we could for enforcement with the resources we have. It's an unfunded regulation, so that's tough…we did everything we could up to hiring someone to do energy inspections."

According to a Springfield code official, Springfield did not adopt any energy code due to strenuous objections from homebuilder associations, which argued that "people would be priced out of new buildings." He further noted that that argument persuaded the city council that requiring a blower door test and introducing an outside air system because a house was so tight did not prove logical. As a result, Springfield officials remind builders that the state law exists, "…but frankly if you put up a new house in Springfield, we can't do anything."

Code Enforcement and Compliance

The four municipalities enforcing the 2012 code echoed a common theme: Though good for residents and contractors, the unfunded nature of the new code's mandate presented a considerable burden for enforcement. All five interviewees attended training on the 2012 Illinois energy code offered by the state or the IECC at some point during the past 2 years. All interviewees said training prepared them to understand and enforce the code. One inspector suggested that further training on HVAC systems would prove helpful, especially for architects that "don't like to look at the code and aren't connecting the dots in calculating the load."

The evaluation team found municipalities used and accepted a wide array of reports, documentation, or tests for compliance. Table 13 illustrates compliance methods used by each jurisdiction.

Table 13. Compliance Mechanisms and Requirements

Compliance Mechanism	Washington	Springfield	Champaign	Urbana	Edwardsville
RES check compliance report	Not required, but accepted	Not used	Not required, but accepted	Not required, but accepted	Required for UA[12] trade off method
REM/Rate compliance report	Not used	Not used	Not required, but accepted	Not required, but accepted	Not used because REM/Rate software is proprietary; would like to use it
Manual J, S, and D documentation	Not used	Reviewed by mechanical inspector as part of HVAC inspection, not in relation to energy code	Not used	Not used	Required

[12] UA is U-value times area and refers to how well the entire house is insulated. The UA trade off method allows the builder to insulate the walls to less than code as long as the entire house meets a minimum amount of insulation.

Compliance Mechanism	Washington	Springfield	Champaign	Urbana	Edwardsville
Thermal break/ bypass inspections	Not used	Not used	Required if related to concrete floor slab	Required as part of site inspections	Required
Insulation inspections	Limited to framing inspections	Not used	Not required, but spot checks performed	Not required; insulation plans reviewed	Required
Blower door testing/ compliance report	Not used	Not used	Required	Required	Required
Duct blaster/ duct tightness testing	Not used	Not used	Required	Required	Required if HVAC unit is outside of conditioned space
HERS rating	Not used	Not used	Not required, but accepted	Not required	Not required
Other					City uses 24-page checklist for inspection items

Code Officials' Perspectives on Builder Preparedness

Two interviewees reported builders and contractors would benefit from attending energy code training. Despite invitations to training offered by the state, many chose not to attend. "The state provided educational seminars, but contractors didn't really show up," said one interviewee. "Building inspectors and code officials came.... A lot of communities, especially the small ones, don't know about it or ignore it."

Despite low attendance by builders and contractors at educational seminars, interviewees agreed that builders generally met the code requirements, but lacked the technical expertise to understand the finer points of the HVAC requirements. As one interviewee said regarding builders: "They aren't doing bad; it's just they are busy running a business and rely on others." Interviewees offered the following suggestions to help builders and contractors better understand and comply with the code:

- "Training could have videos of certain procedures taking place, such as ceiling insulation at the wall lines and putting baffles in so that attic ventilation can still occur."
- "The training they are doing is adequate, but they should simplify it. The installers aren't engineers, but the trainers are. They need a way to simplify things to show an installer a 'rule of thumb' to reference and easily select what they need for the home without calculations."
- "I'm sure builders could use more training, but it should come from the state showing the provisions of the code and reinforcing that it is state law."

Builder Perspective on 2012 Code

Participant and non-participant builders generally agreed the transition to the 2012 Illinois energy code occurred smoothly, but compliance sometimes costs more, and jurisdictions enforce it differently (if at all). Table 14 shows the variety of responses builders provided when asked how they experienced the transition to the new code.

Table 14. Builder Comments Regarding Transition to 2012 Illinois Energy Code

Response	Participant Builders	Non-Participant Builders	Selected Comments	Percent of All Builders Interviewed
It's been easy—already building to 2012 code in other areas.	6	1	"We were focused on zero net energy homes. We were beyond that."	39%
It's been easy, but it costs us more.	1	1	"Not challenging at all, just expensive. Changes in product and practice."	11%
It's been easy.	2	4	"It's been an easy transition, but there is no longer an incentive to participate in the program." "Once you find out the particulars you just adapt. One county doesn't have building inspectors, but we still attempt to meet all the requirements. None of the aspects have been very difficult." "I work in Knox County so we don't get inspected on anything.... I use a Peoria company for insulation so they are up on the code." "It's relatively easy to understand. The fact is that it's written poorly and hard to interpret.... My competitors are cutting corners and I am not, which takes the competitive edge from me."	33%
The basement requirements are challenging.	1	0	"The basement requirements are the only real challenge, especially because a lot of cities aren't enforcing the code for basements."	6%

Response	Participant Builders	Non-Participant Builders	Selected Comments	Percent of All Builders Interviewed
The challenge is that jurisdictions enforce it differently or not at all.	1	1	"In the beginning it was awful. Inspectors in different jurisdictions did not agree on how you should do something." "What's challenging is that Springfield does not enforce it. They have no energy code. We are following most of it but not all. A lot of builders don't follow it—it's bad for us because we do."	11%
Total Builders Interviewed	**11**	**7**	**18**	**100%**

4.3 Impact Assessment

4.3.1 Gross Impacts

Though Illinois adopted IECC 2012 statewide in 2013, the evaluation team's literature review and interviews with code enforcement officials indicated that the enforcement of codes was less stringent than IECC 2012 in many jurisdictions. Because of varied enforcement, the evaluation team varied the baseline by jurisdiction using the stated adopted code in each jurisdiction. Some jurisdictions did not enforce an energy code at all. Given this variation, the code used to design the UDRH files drew on the stated code adoption of each jurisdiction; if a jurisdiction did not have an energy code, the evaluation team assumed IECC 2006 as the baseline code. Based on our discussion regarding code enforcement in Section 4.2, we believe this to be a conservative approach, and more accurately represents the true baseline. Further research to better assess baselines might include sampling non-participant homes and assessing baseline annual energy use.

Table 15 details the UDRH features for each code. Overall, UDRH files used heat transfer coefficients[13] as they represented the average insulation level required by code.

[13] Overall heat transfer coefficients also are known as equivalent U-values. Smaller U-values represent more insulation.

Table 15. UDRH Features and Jurisdictions

Component	IECC 2006	IECC 2009	IECC 2012
Ceiling*	U-0.030	U-0.030	U-0.026
Walls	U-0.060	U-0.057	U-0.057
Floors	U-0.033	U-0.033	U-0.033
Slab	R-10, 2ft	R-10, 2ft	R-10, 2ft
Windows*	U-0.35	U-0.35	U-0.32
Infiltration*	0.00036 SLA	7ACH50	3ACH50
Duct Leakage*	12%–20% Duct Loss (RESNET Default)	8CFM/100CFA	4CFM/100CFA
Duct Insulation	R-8 Attic Supply, R-6 Otherwise	R-8 Attic Supply, R-6 Otherwise	R-8 Attic Supply, R-6 Otherwise
Heat Pump	7.7 HSPF	7.7 HSPF	7.7 HSPF
Furnace	80 AFUE	80 AFUE	80 AFUE
Boiler	82 AFUE	82 AFUE	82 AFUE
AC	13 SEER	13 SEER	13 SEER
Lighting*	0% CFL	50% CFL	75% CFL
Appliances	RESNET Default	RESNET Default	RESNET Default
Gas Water Heat	0.59 EF	0.59 EF	0.59 EF
Electric Water Heat	0.91 EF	0.91 EF	0.91 EF
Jurisdictions	Swansea, O'Fallon, Urbana, East Peoria, Peoria, Champaign, Ottawa, Belleville, Dunlap, Millstadt, Shiloh, Peoria Heights, Bartonville	Caseyville, Canton, Troy	Galesburg, Toulon, Sparta, Springfield, Washington, Fairview Heights, Savoy
Number of Homes in Sample	11	17	47

Source: IECC codes for 2006, 2009, and 2012 provide these example values for IECC Zone 5; IECC Zone 4 uses slightly different values.

* Increased energy efficiency requirements in IECC 2012.

The IECC has become incrementally more stringent with each code change. The IECC 2009 increased wall insulation levels, tightened sealing requirements, and introduced a CFL[14] requirement. The National Association of Home Builders (NAHB) estimates 11%[15] energy cost savings from adoption of IECC 2009 over IECC 2006. The 2012 version of IECC represents a 36%[16] energy cost savings over IECC 2006. IECC 2012 requires significant increases in attic and window insulation levels, as well as much more stringent air-sealing and testing requirements. The 2012 code requires 75% of lighting to be CFLs. None of the three energy codes set specific efficiency requirements for heating, cooling, and water heating systems, with the efficiency of these systems established by federal appliance standards. Law prohibits manufacturing or importing systems less efficient than the values[17] shown in

[14] Though the code does not explicitly state CFLs, the industry recognizes them as meeting the code requirement of 50% "high-efficacy" lamps.
[15] NAHB Research Center. *2009 IECC Cost Effectiveness Analysis.* 2012. Available online: www.nahbrc.com.
[16] NAHB Research Center. *2012 IECC Cost Effectiveness Analysis.* 2012. Available online: www.nahbrc.com.
[17] Furnaces have a federal minimum of 78 AFUE, though no manufacturer produces units with less than an 80 AFUE.

Table 15.

Applying the UDRH to the 75 REM/Rate files determined kWh, kW, and therm impacts for each home. The UDRH file determined the energy consumption of the baseline home using the built-in energy simulation engine in REM/Rate. The evaluation team estimated ex post savings by calculating the difference between the baseline energy consumption and the as-built energy consumption and calculating realization rates by dividing this difference by ex ante savings. The evaluation team determined ex post savings using realization rates from the 75 homes in the sample:

$$ex\ post\ gross\ savings = ex\ ante\ gross\ savings * realization\ rate$$

Table 16 shows ex post savings.

Table 16. Ex Post Gross Savings

Building Type	Ex Ante			Ex Post		
	MWh	MW	Therms	MWh	MW	Therms
Single-Family	525	0.211	33,826	139	0.051	23,193
Multifamily	252	0.063	–	304	0.044	–
Total	**777**	**0.274**	**33,826**	**443**	**0.095**	**23,193**

The evaluation team used REM/Rate analysis to determine the realization rates shown in Table 17 for single-family and multifamily homes. Electric heat proved very common among multifamily participants, partially explaining the high realization rate for MWh; ground source heat pumps also prove relatively common and further increased savings. Single-family homes received relatively low realization rates. The evaluation team speculated this resulted primarily from optimistic planning estimates. The majority of the homes in the sample fell within jurisdictions adopting IECC 2012. Energy code changes may have also outpaced ex ante savings estimates.

$$realization\ rate = \frac{\sum modeled\ ex\ post\ gross\ energy\ savings}{\sum ex\ ante\ gross\ energy\ savings}$$

Table 17. PY6 ENERGY STAR New Homes Gross Realization Rates

Building Type	MWh	MW	Therms
Single-Family	26%	24%	69%
Multifamily	120%	69%	–
Total	**57%**	**35%**	**69%**

4.3.2 Net Impacts

Applying the NTGR value of 0.8 to gross savings resulted in the program net impacts shown in Table 18.

Table 18. PY6 ENERGY STAR New Homes Program Net Impacts

Building Type	Ex Post Gross			NTGR	Ex Post Net		
	MWh	MW	Therms		MWh	MW	Therms
Single-Family	138.6	.05	23,193	80.0%	110.9	0.04	18,554
Multifamily	303.9	.04	–		243.1	0.03	–

Total	442.5	.09	23,193		354.0	0.07	18,554

4.4 Conclusions and Recommendations

- **Conclusion 1:** Interviewed builders identified rebate processing and rebate application tracking as areas for improvements; this constituted the only major dissatisfaction source among builders. With three builders stating it took from 6 to 9 months to receive a program rebate, and complaining of little to no communication with program staff regarding the status of their applications, the program has an opportunity to incorporate more sophisticated rebate processing milestones into the database. Program staff noted delayed rebates resulted from builders new to the program not providing all the paperwork required and/or HERS raters taking a long time to complete the REM/Rate file.
  - **Recommendation 1:** Establish communication milestones with builders—such as "application received" and "rebate being processed"—to quickly and easily maintain communications and improve satisfaction levels. The two new CSG account managers hired to process paperwork could also track and follow up on missing paperwork from new builders, thus circumventing future rebate processing delays.
- **Conclusion 2:** Raters have served as the primary communicators resources throughout the program's history. Surprisingly, 2 of 11 participating builders lacked familiarity with the program, 4 did not receive communication from the program, and most builders did not market their program homes differently than their other homes.
  - **Recommendation 2:** Given a relatively small pool of raters and a growing pool of participating builders, an opportunity exists for program staff to establish regular and consistent communication with builders and raters and/or to recruit additional raters and builders to support the program. A simple quarterly email update (also provided by regular mail) could help build the program's brand and remind builders of the value of participating in the program. Additionally, the program could consider outreach strategies to recruit new raters, such by recruiting raters through the home performance program or through area technical schools.
  - **Recommendation 3:** Consider offering sales training for builders, teaching them to market the benefits of an energy-efficient program home; this would include ways to use AIC marketing materials and key points for sales discussions.
- **Conclusion 3:** Program builders preferred the simplicity of the non-certified incentive option and generally achieved comparable or better HERS index than those building ENERGY STAR homes. AIC would not sacrifice savings by emphasizing this program option. Additionally, nearly three-quarters of single-family program participation occurred in the non-certified, HERS-only category. An opportunity exists, however, to encourage all builders to achieve a better HERS index and more program savings.
  - **Recommendation 4:** Consider implementing an enforceable maximum HERS (such as 70 or 65) and a sliding incentive scale. For example, offer builders a $50 additional incentive for every HERS point they achieve below a specified level. One southwestern U.S. utility successfully employed this model for its new homes program and consequently achieved greater savings from the program.
- **Conclusion 4:** The program's historical use of desk review quality assurance has worked well, but, as the program grows and gains staff capacity, problems may become more difficult to detect.

- **Recommendation 5:** Consider conducting on-site verification of a small portion of program homes (such as 10%) to maintain a high level of quality control as the program grows. For builders with multiple program homes, program staff could conduct on-site inspections for the first two or three homes submitted by a new builder, and then randomly test other homes once program staff have established the builder complies with program requirements.

4.5 Future Planning Inputs

As part of the PY6 evaluation, the team performed research to support the development of an updated free-ridership for the ENERGY STAR New Homes Program. Resulting free-ridership values are based on self-report data from interviewed participating builders. While question wording may differ slightly, the free-ridership estimation approach is conceptually consistent with that used by ComEd's evaluation team. As of this report, ComEd's evaluation team plans to gather additional measure-level data from builders. This additional step was beyond the scope and budget for the AIC evaluation.

As a result of our free-ridership analysis, we recommend using the values in Table 19 for future planning. Appendix B provides details on the analysis.

Table 19. NTGR

Fuel	Free-Ridership (FR)	Spillover (SO)	NTGR (1 – FR + SO)
Electricity	58.2%	0.2%	42.1%
Gas	0.6%	1.2%	100.6%

A. Appendix – Data Collection Instruments

Ameren Illinois_NH Building Inspector_

Ameren Illinois_NH NonPartBuilder Surv

Ameren Illinois_NH Builder Survey_ 6 11

B. Appendix – PY6 NTGR Research

Net-to-Gross Ratio Analysis

The New Homes program evaluation required adopting a different approach for assessing free-ridership and spillover than that used for other AIC residential programs, as the builder—rather than the homeowner—makes the decisions. As a result, the evaluation team developed the NTGR for future planning based on interviews with participating builders. More specifically, we interviewed 11 participating builders, 7 of whom could complete questions allowing for the assessment of the NTGR. We disqualified 4 of the 11 participating builders from the NTGR questions because the evaluation team learned while conducting the interviews that the builders had not built any homes in the program in PY6. This occurred because PY6 year-end data was not yet available at the time of interviews. The evaluation team made further unsuccessful attempts to contact additional builders.

As the program included multiple measures and not specific equipment, survey questions addressed the builders' sales of program homes (both ENERGY STAR-certified and not certified) and the program's influence on their building practices for participating and non-participating homes. The evaluation team used a multiple-question approach to assess free-ridership for each participant.

The following key questions from the participating builder interview guide (included as Appendix A) addressed NTGR. It is important to note that not all free-ridership questions generate a score; those that do not provide anecdotal evidence that aids the evaluation team in finalizing the score. Additionally, the wording of the questions depended on whether the builder followed the ENERGY STAR path or the HERS-only path. As these interviews were conducted by the program evaluation lead, the questions were adjusted during the interview based on the types of homes built and to follow answers to previous questions.

> 5. In an average year, about how many homes do you build?
>
> 6. Over the last year, about what percent of these homes were built in Ameren Illinois territory?
>
> 7. And of the homes you built in the past year in Ameren territory, what percentage received incentives or rebates from the Ameren Illinois ENERGY STAR New Homes program?
>
> 14a [If builder did ENERGY STAR path] Overall, how much influence did the program, including the rebates, have on your decision to build ENERGY STAR homes?
>
> 14b. [If builder did HERS-only path] Overall, how much influence did the program, including the rebates, have on your decision to build homes that achieved a certain HERS index?
>
> 15a. [If builder did ENERGY STAR path] If Ameren Illinois did not offer the ENERGY STAR New Homes program, would you build the same number of homes to the ENERGY STAR standard, fewer homes, or more homes meeting the standard?
>
> 15b. [If builder did HERS-only path] If Ameren Illinois did not offer the ENERGY STAR New Homes program, would you build the same number of homes to the same HERS index, fewer homes, or more homes meeting the HERS index?
>
> 16a. [If builder did ENERGY STAR path and said "fewer" to 15a] If Ameren Illinois did not offer the ENERGY STAR New Homes program would you still have built any homes that qualified as ENERGY STAR?

16b. [If builder did HERS-only path and said "fewer" to 15b] If Ameren Illinois did not offer the ENERGY STAR New Homes program would you still have built any homes that achieved the same HERS index?

17. If the program didn't exist, would you still would have built energy-efficient homes? If so, how would the homes you built have been different from program homes, if at all?

Free-Ridership Findings

Table 20 lists the questions and the scoring algorithm used to develop the free-ridership scores. The unadjusted scores in

Table 20 represent the scores allocated based on three questions that were testing for the program influence:

- The importance of the program in the decision, using a 4-point scale
- Whether the builder would have built the same number or fewer homes to the standard without the program
- Whether homes built without the program would have met the same standard

If the builder rated the program "very important" in their decision to build homes to program standards, the builder would have built fewer homes to the standard, and homes they would have built without the program would be lower efficiency; the free-ridership score was 0%. At the other end of the spectrum, if the builder rated the program "not too important or not at all important" in the decision to build homes to program standards, the builder would have built the same number of homes to the standards, and homes built without the program would still meet program standards; the free-ridership score was 100%. As shown in

Table 20, free-ridership scores of between 25% and 75% occur when response combinations do not clearly indicate free-ridership or non-free-ridership. The evaluation team assigned the score of 25%, 50%, or 75% based on the degree to which the response combination indicates free-ridership, as illustrated in the table, as some respondents were not clearly 100% or 0% free-riders. The evaluation team used the 25%, 50%, and 75% as partial free-ridership scores to account for the ambiguous responses. We did not use a more precise scoring method (such as using a 0–10 scale for program importance), as it indicates a level of precision inconsistent with uncertainty of the responses. Further, the evaluation team considered other information gathered through open-ended questions during the interview, and in some cases adjusted the final score to be consistent with the overall response to the interview. These adjustments are described in Table 21.

Table 20. ENERGY STAR New Homes Program Free-Ridership Scoring

How important is the program, including rebates, in your decision to build ENERGY STAR homes/homes with a HERS below 70?	If Ameren Illinois did not offer the program, would you build the same number of homes, fewer homes, or more homes to the ENERGY STAR standard/HERS below 70?	If the program didn't exist, would you still have built energy-efficient homes? How would the homes you built have been different from program homes?	Builder's ID Number	Unadjusted Free-Ridership Score
Very important	Fewer	Lower efficiency, at or below 2012 IL energy code	3,4,5,6	0%
Very important	Same	Lower efficiency, at or below 2012 IL energy code		25%
Very important	Same	ENERGY STAR or other energy-efficiency certification	2	50%
Somewhat important	Fewer	Lower efficiency, at or below 2012 IL energy code	7	25%
Somewhat important	Same	Lower efficiency, at or below 2012 IL energy code		50%
Somewhat important	Same	ENERGY STAR or other energy-efficiency certification	1	75%
Not too important or not at all important*	Fewer	Lower efficiency, at or below 2012 IL energy code		50%
Not too important or not at all important	Same	Lower efficiency, at or below 2012 IL energy code		75%
Not too important or not at all important	Same	ENERGY STAR or other energy-efficiency certification		100%

* "Not too important" and "Not at all important" both indicate a lack of program importance in the decision process and therefore are combined for scoring purposes (no builders rated the program with this response).

To calculate free ridership, the evaluation team weighted each surveyed builder's free-ridership score by the percentage of total ex post energy savings in the sample that the builder represented (derived from the number of program homes and ex post savings of each of that builder's homes) following this equation:

$$Participation\ Weighted\ Free\text{-}Ridership = \frac{\sum[Respondent\ Score] * [Respondent\ Ex\ Post\ Savings]}{[Energy\ Savings\ All\ Respondents]}$$

Even using the multi-question approach to scoring free-ridership, the evaluation team found inconsistent responses and, through survey probing, assessed the likelihood of a participant being a free-rider. We applied a two-step process for assessing free-ridership. Step 1 considered the basic responses to each question and assigned a free-ridership score. Step 2 considered the verbatim language and responses to probes through the interview process and, in some cases, adjusted the score. For example, two of the seven builders interviewed specialized in low- and mixed-income multifamily properties, and noted that they specifically sought out the AIC program as they already built ENERGY STAR homes and needed additional funding sources (Builders 1 and 7). Builder 7's initial score was not consistent with this comment and therefore we adjusted the score to be the same as Builder 1. Three evaluators provided input on whether or not a score warranted an adjustment after reviewing inconsistencies in responses. We adjusted scores from builders who indicated elsewhere in the questionnaire that they were building energy-efficient homes before joining the program and/or specifically sought out the program as a funding source. Table 21 shows the initial free-ridership score assigned to each builder's responses and the corresponding free-ridership savings. Table 21 also shows the team's rationale for each builder score.

Table 21. Free-Ridership by Builder

Builder	Free-Ridership Score	Adjusted Free-Ridership	Reason for Adjustment/Comment	Ex Post PY6 Electric Free-Ridership	Ex Post PY6 Gas Free-Ridership
1	75%	–	–	38,059	–
2	50%	–	–	–	47.3
3	0%	–	–	–	–
4	0%	–	–	–	–
5	0%	–	Builder said he likes using a HERS rater now and does not want to change his methods. No adjustment made because program introduced him to using a rater.	–	–
6	0%	–	Builder said he would continue building practices similar to ENERGY STAR standard, with most of the same techniques they use in the program, but would cut back on insulation, house wrap, and energy blanket in basement to reduce costs.	–	–
7	25%	75%	While he may build fewer total homes without the program, builder already was building ENERGY STAR to receive other multifamily grant funding, and specifically sought out the program to offset costs for homes already planned.	95,580	–
Total				**133,639**	**47.3**

Table 22 shows free-ridership rates for each fuel type. We calculated the free-ridership rate as the free-ridership savings from interviewed builders divided by the total interviewed builder's homes savings

Table 22. Free-Ridership Rates

Fuel	Total Savings Interviewees	Free-Rider Savings	Free-Rider Rate
Electricity (kWh)	229,736	133,639	58.2%
Gas (Therms)	7,763	47	0.6%

Spillover Analysis and Findings

The evaluation team also utilized the participating builder interviews to gather information about participating builder practices influenced by, but not incented by, the program. Only one builder had attributable spillover through this analysis. The process required asking builders the following two questions about how their newly constructed homes, built outside the program, but within AIC's service territory, varied from those within the program:

- In the homes you built that did not receive an incentive from the program, did you apply the same energy-efficiency measures or practices you used in homes that did qualify for the program?

- Are there any changes in your construction practice in non-program homes that have resulted from your participation in the AIC ENERGY STAR New Homes Program?

Four of the seven builders we interviewed built both program and non-program homes (including outside AIC territory). Two of these built non-program homes within AIC territory. When asked if they applied the same measures or practices in their non-program homes due to the program, one builder said "yes." We counted this builder's PY6 constructed non-program home as spillover.

This builder constructed eight program homes and one non-program home in AIC territory. We estimated spillover for the one home based on the energy savings for that home relative to a baseline home. We divided those savings by the total savings from program homes built by all interviewed builders resulting in spillover shown in Table 23. The spillover amount is an estimate of the energy savings of the home built to program standard yet not included in the program. The estimate is based on the ex post savings of this builder. The spillover rate is the proportion of spillover savings to the total savings of the homes built by interviewed builders.

Table 23. Weighted Spillover

Fuel	Total Savings Interviewees	Spillover Amount	Spillover Rate
Electricity (kWh)	229,736	546	0.2%
Gas (therms)	7,763	95	1.2%

While not factored into the spillover calculation, the evaluation team also used the following question to ask builders if they went beyond requirements for the ENERGY STAR rating:

- In the homes you built for the Ameren program, are there any energy-efficiency measures or building practices you used that went beyond the requirements?

Three of seven total builders indicated that they sometimes built homes that exceeded program requirements. For these three respondents, only one built some homes to the ENERGY STAR standard. Builders noted the following practices sometimes exceeded requirements:

- "Sometimes you have to go above and beyond because of the code. We've done a few properties with geothermal and energy recovery ventilation systems."
- "I use a little different method than how I used to build, mostly in wall insulation and framing techniques that we've adapted."
- "Some houses we build with solid blown in insulation, which gets way above where we need to be and the customer wanted it."

Since savings are based on actual REM/Rate model analysis compared to baseline homes, we included any savings on program homes from going above and beyond minimum requirements in the program savings estimates.

NTGR

Based on the free-ridership and spillover results, the evaluation team calculated the program NTGR as:

$$NTGR = 1 - free\text{-}ridership\ ratio + spillover$$

Energy unit-specific results are shown in Table 24. The electric NTGR is lower than the current 80% deemed planning estimate; however, the gas results are higher. We benchmarked these results against other available New Homes programs. Interestingly, there are few data points on New Homes programs, and data we found are highly variable. The 2013 NTGR from a similar program of similar tenure in Wisconsin was 65%. By contrast, the NTGR for the 2013 Ameren Missouri ConstructionSavers program, which was only a year old at the time of evaluation, was 28.3%.

Table 24. NTGR

Fuel	Free-Ridership (FR)	Spillover (SO)	NTGR (1 – FR + SO)
Electricity	58.2%	0.2%	42.1%
Gas	0.6%	1.2%	100.6%

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