

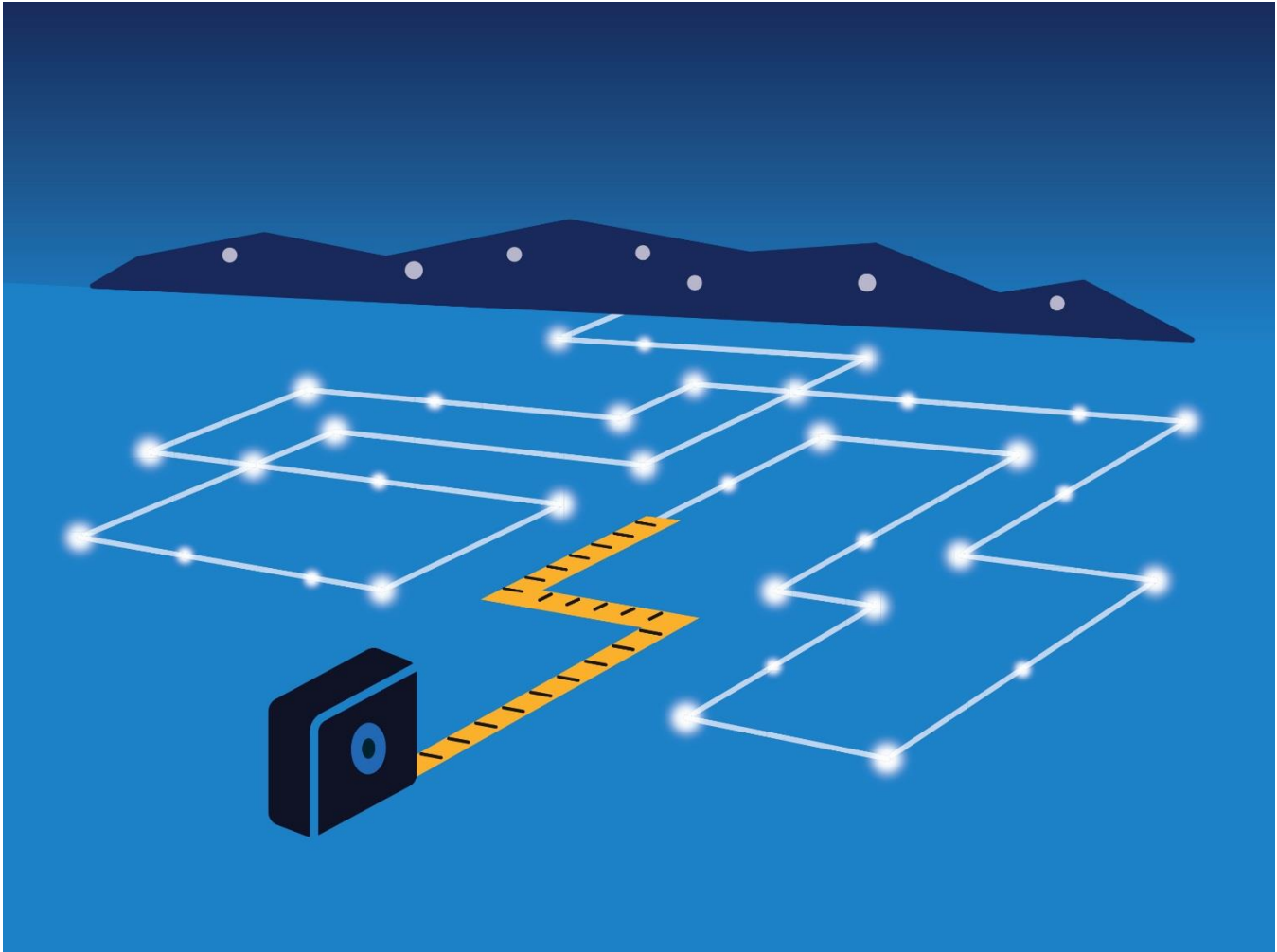


Opinion **Dynamics**

Boston | Headquarters

617 492 1400 tel
617 497 7944 fax
800 966 1254 toll free

1000 Winter St
Waltham, MA 02451



Impact and Process Evaluation of 2016 (PY9) Ameren Illinois Company ENERGY STAR® New Homes Program

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CADMUS

NAVIGANT



MichaelsEnergy

Contributors

Jane Colby
Principal, Cadmus

Jeremy Eckstein
Senior Analyst, Cadmus

Shannon Donohue
Associate, Cadmus

Sara Wist
Associate, Cadmus

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1. Executive Summary

This report summarizes the evaluation activities and associated findings for the ENERGY STAR® New Homes Program during its ninth year of operation (PY9). During PY9, Leidos Engineering administered the program and CLEAResult implemented it. The program offered builders financial incentives for constructing single-family homes and duplexes that achieved a Home Energy Rating System (HERS) index of 65 or lower (i.e., a lower HERS index indicates a more efficient home). Participating builders hired HERS raters to verify savings achieved through energy-efficient practices and equipment.

During the seventh program year (PY7), Ameren Illinois Company (AIC) discontinued incentives for newly constructed multifamily properties (i.e., three units or more). Then, at the conclusion of PY8 (June 1, 2016), they ended the ENERGY STAR New Homes Program after determining that the program was no longer cost-effective. In PY9, the ENERGY STAR New Homes Program operated only to process projects that entered the program pipeline in PY8, prior to the program’s close.

To assess PY9 performance, the evaluation team conducted in-depth interviews with program managers, reviewed building simulation models (REM/Rate) that predict energy savings by comparing specific home characteristics with baseline homes, and analyzed the program-tracking database.

In January 2016, the State of Illinois implemented the 2015 Illinois Energy Conservation Code (IECC), effectively raising the program’s baseline. Homes processed during PY9 had to meet the 2012 IECC code baseline or the 2015 IECC code baseline. Accordingly, the evaluation team used two baselines to evaluate ENERGY STAR New Homes energy savings, depending on the code version applied to the home.

Program Impacts

Table 1 summarizes electric and gas savings from the PY9 ENERGY STAR New Homes Program. The team calculated ex post gross savings by verifying building simulation models for 119 of the 125 participating homes. The program’s ex ante gross savings were 183 MWh and 13,423 therms and achieved ex post gross savings of 133 MWh and 22,321 therms. As in previous years, when compared to planning assumptions, gas measures achieved more savings than electricity measures. While ex post gross electric and demand impacts fell short of ex ante planning estimates, with realization rates of 73% and 77%, respectively, the gas realization rate was 166%.

Table 1. PY9 ENERGY STAR New Homes Program Net Savings

	Ex Ante Gross	Realization Rate*	Ex Post Gross	NTGR**	Ex Post Net
Energy Savings (MWh)					
Total MWh	183	73%	133	1.003	133
Demand Savings (MW)					
Total MW	0.06	77%	0.05	1.003	0.05
Therms Savings					
Total Therms	13,423	166%	22,321	1.006	22,455

* Realization rate = ex post gross savings ÷ ex ante gross savings.

** Net-to-gross ratio.

AIC derived ex ante per-home gross savings from prototype energy models. The modeling approach assumed proportional gas and electric savings, and assigned a unit energy savings to each home based on the fuels provided by AIC, as well as the home’s efficiency level. Due to the inherent design of the HERS rating system,

gas and electric savings are treated equally in the HERS score. This allows a builder to decide what measures to install and which fuels are saved. As in years past we found that gas realization rates outperformed electric realization rates as builders installed more gas savings measures than AIC assumed in its prototype models

Key Findings and Recommendations

AIC cancelled the program after PY8 for cost-effectiveness reasons, however it paid incentives for homes that were already in the pipeline for PY9. Based on the evaluation team's experience, other new homes programs face similar challenges. New homes programs must find a balance between ever-increasing building codes and standards that raise energy efficiency baselines and find cost-effective opportunities to encourage efficiency above the baseline. Without incentives, additional energy savings can be expensive and difficult for builders to recover through a new home's sale price.

Despite the ENERGY STAR New Homes Program's discontinuation after PY9, the team offers the following program conclusion and recommendation to assist AIC should the program be revised and restored in future years.

- **Conclusion #1:** Participation grew over the life of the program, demonstrating a demand for energy-efficient new homes. Past evaluations indicated that the program's flexible requirements allowed builders to trade off gas measures for electric measures and achieve program required HERS scores. While the HERS index does not account for the relative value of avoided gas vs. electric savings, the cost effectiveness of gas or electric measures in new homes can vary significantly. A new home's cost-effectiveness depends more on the specific measures installed and the source of fuel rather than the HERS score.

- **Recommendation #1:** Due to past engagement of homebuilders in the new homes program, the program had considerable momentum with builders and could consider targeting specific cost-effective prescriptive measures, rather than HERS scores. As defined in the Illinois Statewide Technical Reference Manual (TRM) V5.0, possible prescriptive measures include geothermal heat pumps, high efficiency gas water heaters, high-efficiency lighting, innovative heating and cooling systems (e.g., mini-split or variable refrigerant flow heat pumps), and heat recovery ventilation systems.

2. Evaluation Approach

Due to the program’s discontinuation, the PY9 assessment of the ENERGY STAR® New Homes Program generally focused on program impacts. To gain insights into how AIC transitioned the program, the evaluation team conducted interviews with the program manager and the program implementer for a limited process evaluation.

2.1 Research Objectives

The PY9 ENERGY STAR New Homes Program evaluation primarily sought to estimate ex post gross and net energy and demand savings associated with the program. The team designed the evaluation to answer the following questions.¹

2.1.1 Impact Questions

- How many homes were built to program standards in PY9?
- What was the appropriate baseline for estimating program savings?

2.1.2 Process Questions

- What changes occurred in PY9? What impacts resulted from these changes?

2.2 Evaluation Tasks

Table 2 summarizes PY9 evaluation activities conducted for the ENERGY STAR New Homes Program.

Table 2. PY8 ENERGY STAR New Homes Evaluation Methods

Activity	PY9 Process	PY9 Impact	Details
Program Staff Interviews	✓		One interview with the AIC portfolio manager and one interview with Leidos, AIC’s program administrator, to discuss the program’s transition activities and review program results.
REM/Rate File Review/ Simulations		✓	Reviewing REM/Rate project files and running simulations to verify savings for each as-built home against an appropriate PY9 baseline for each jurisdiction.

¹ The evaluation plan included the following objectives that were discontinued when the program was terminated and evaluation activities were dropped (participant and nonparticipant builders and code official interviews):

- Does the program continue to result in savings from market transformation and spillover?
- What codes are enforced in different areas?
- How well did the program’s processes work, and what opportunities exist for improvements?

2.2.1 Program Staff In-Depth Interviews

The evaluation team conducted two interviews with program staff: one with AIC's residential portfolio manager and one with AIC's program administrator. These interviews explored questions regarding the program's design, implementation, and communication, and the reasons for its discontinuation.

2.2.2 Review of Program Data

The team reviewed the program-tracking database to assess if the program tracked sufficient data to determine whether the homes met program standards.

2.2.3 REM/Rate File Review

In PY9, the team developed a Microsoft Access tool to gather information automatically from the REM/Rate files. The tool enabled the team to review nearly a census of REM/Rate files submitted to the program, rather than a sample. The team requested all REM/Rate files submitted to the program for PY9 and received 123 files (out of 125 included in the program database). The team could not model four REM/Rate files due to version control issues with the REM/Rate software. The 119 files that Cadmus was able to model matched participants in the program-tracking database (per project ID).

The team modeled the homes using this tool to determine energy impacts of homes above the prevailing energy code. For each home, the team determined the prevailing energy code based on the date on which the program implementer reserved the incentive. On December 11, 2015, Illinois adopted the 2015 Illinois Energy Conservation Code (IECC), with Illinois Amendments taking effect on January 1, 2016. The team modeled homes with a reservation date on or before December 31, 2015, using the older IECC 2012 code as the baseline. The team modeled homes with a reservation date on or after January 1, 2016, using the newest IECC 2015, with Illinois Amendments serving as the baseline.

2.2.4 Impact Analysis

Gross Impacts

The team first reviewed the program-tracking database for errors, including duplicate entries. The team then compiled details from each home in the sampled REM/Rate files and compared these results to home characteristics and Home Energy Rating System (HERS) index information in the tracking database to ensure consistency. The team performed energy simulations for each home against prevailing code and federal standards using the User Defined Reference Home (UDRH) feature in REM/Rate for each of the 123 homes for which Cadmus received REM/Rate files, including the four that were found to have issues.

The team developed a set of baseline home characteristics representing the minimum energy code and federal appliance requirements. Given those characteristics, REM/Rate could automatically run two energy simulations for each home. The first simulation represented the home's energy usage as recorded by the HERS Rater ("As Built"); the second represented the home's energy usage, employing characteristics from the current energy code requirements ("Reference Home"). This analysis produced gross realization rates, which the team applied to the six homes in the tracking database that did not have files or where modeling could not be conducted.

Table 3 summarizes how we applied the available data to generate PY 9 savings estimate.

Table 3. Summary of Impact Analysis Data Utilization

Number of Homes in PY9	Number of REM/Rate Files Received	Number of REM/Rate Successfully Modeled	Number of Homes to Which Realization Rates Applied
125	123	119	6

Net Impacts

The team applied net-to-gross ratios (NTGRs), approved by the Stakeholder Advisory Group (SAG) to PY9 program savings. Table 4 summarizes NTGRs used in the net impact analysis.

Table 4. SAG-Approved PY9 NTGRs

Measure Description	Electric NTGR	Gas NTGR
Single-family only	1.003	1.006

2.3 Sources and Mitigation of Error

Table 5 summarizes possible error sources associated with data collection conducted for the ENERGY STAR New Homes Program. Detailed discussions follow for each item.

Table 5. Possible Error Sources

Research Task	Survey Error		Non-Survey Error
	Sampling Error	Non-Sampling Error	
Gross Impact Calculations (REM/Rate file review)	N/A	N/A	Data processing error
Net Impact Calculations	N/A	N/A	Data processing error

Throughout the PY9 evaluation’s planning and implementation process, the evaluation team adopted a number of steps to mitigate potential error sources. To minimize data processing errors, different team members reviewed all calculations to verify their accuracy.

Non-Survey Error

- **Data Processing Errors**
 - **Gross Impact Calculations:** To minimize data processing errors, the team had a team member review all calculations to verify computation accuracy; the member did not perform the original calculations.
 - **Net Impact Calculations:** To estimate the program’s net impacts, the team applied deemed NTGRs to the gross impact calculations.

3. Detailed Evaluation Findings

3.1 Program Description

In PY9, the AIC ENERGY STAR New Homes Program offered financial incentives for builders that constructed single-family homes and duplexes with an HERS index of 65 or less. Homes meeting ENERGY STAR 3.0 standards and achieving a HERS index of 65 or lower became eligible to receive additional incentives. Homebuilders constructing single-family homes and duplexes using an AIC-provided heating fuel qualified to participate in the program. Builders hired a HERS rater to verify savings achieved by energy-efficient practices and equipment, and, as needed, to provide technical assistance about energy-efficient practices. Typically, HERS raters completed program applications for the builder and interacted with the program implementer on the project's status.

Additionally, through a tiered incentive structure, the program defrayed costs of hiring HERS raters and contributed to covering expenses and reducing time required to install higher-efficiency measures. At PY8's conclusion, AIC discontinued the ENERGY STAR New Homes Program as it was no longer cost-effective. PY9 activity focused on closing the program and processing homes that remained in the program pipeline at the close of PY8.

Table 6 details incentives and associated tiers offered through the program during PY9. ENERGY STAR-certified homes received higher incentives because, in addition to achieving the ENERGY STAR HERS Index target, they had to complete five mandatory requirements, including the following:

- Rater design review checklist
- Rater field checklist
- HVAC design report
- HVAC commissioning checklist
- Water Management System builder requirements

By completing these five steps in addition to achieving ENERGY STAR's HERS index target and ENERGY STAR certification, homeowners were assured their new homes would have undergone a process of independent third-party inspections and testing to guarantee a high energy performance level and to meet the Environmental Protection Agency's energy efficiency requirements.

Table 6. PY9 ENERGY STAR New Homes Program Incentive Structure

Tier	Heat Provider	PY9	
		HERS Rated	ENERGY STAR Rated
Tier I Base Incentive (HERS Rating 56-65)	AIC Gas Heat	\$500	\$600
	AIC Electric Service other Gas Provider	\$500	\$600
	AIC Gas Heat and Electric Service	\$800	\$1,000
	AIC Electric Heat	\$800	\$1,000
Tier II (HERS Rating 46-55)	AIC Gas Heat	\$1,000	\$1,200
	AIC Electric Service other Gas Provider	\$1,000	\$1,200
	AIC Gas Heat and Electric Service	\$1,600	\$2,000
	AIC Electric Heat	\$1,600	\$2,000
Tier III (HERS Rating 0-45)	AIC Gas Heat	\$1,500	\$1,800
	AIC Electric Service other Gas Provider	\$1,500	\$1,800
	AIC Gas Heat and Electric Service	\$2,400	\$3,000
	AIC Electric Heat	\$2,400	\$3,000

3.2 Process Findings

3.2.1 Program Performance

In PY9, the ENERGY STAR New Homes Program transitioned to an end while honoring commitments AIC made to builders in PY8. As expected, program participation dropped significantly while AIC processed only the homes scheduled for completion in the first quarter of PY9.

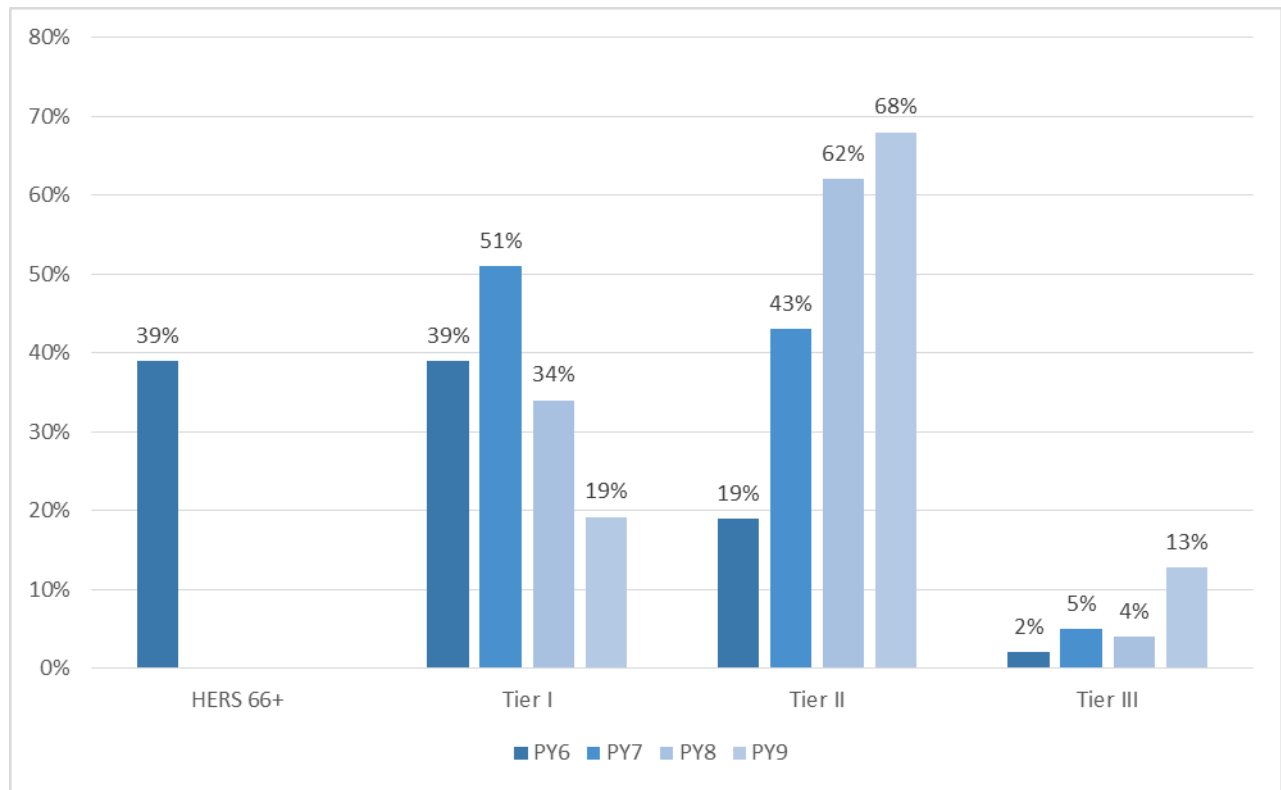
Table 7. Historical Program Participation

Program Year	Home Type	Goal	Actual	Percentage Achieved
		(Number of Homes)	(Number of Homes)	
PY7	Single-family & multifamily	420	547	130%
PY8	Single-family only	462	577	125%
PY9	Single-family only	N/A	125	N/A

Note: AIC did not set a formal goal for program participation in PY9.

While the ENERGY STAR New Homes Program primarily focused on ending program activity (marketing, outreach and training activities did not take place in PY9), participating homes continued to become more efficient than in previous years, as shown in Figure 1. The figure demonstrates that since PY6, the percentage of homes rated in Tier II and Tier III increased, while the percentage of homes rated in Tier I decreased.

Figure 1. HERS Indices of Historical Program Homes*

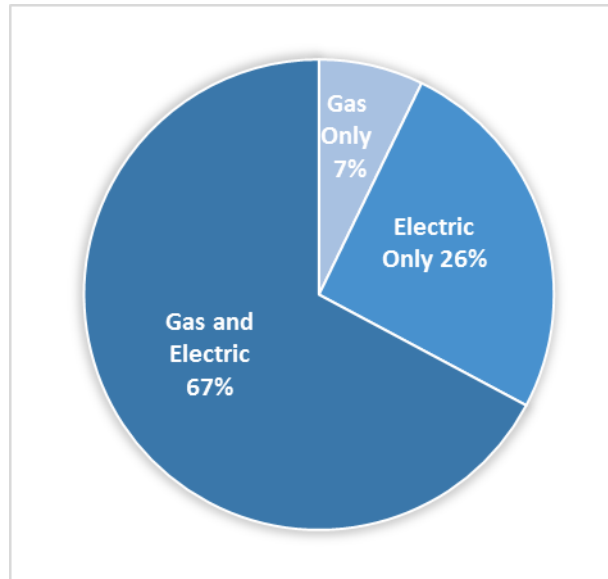


*PY6, n=302; PY7, n=547; PY8, n=577; PY9, n=125

Note: In PY7, PY8, and PY9 homes with a HERS score greater than 65 were not eligible for program incentives.

As shown in Figure 2, AIC served as the gas and electric provider for the majority of program homes (67%). Approximately one-quarter of the homes only received AIC electric service (e.g., no gas service, gas service from another utility), and a small percentage only received AIC gas service and electric service from another utility.

Figure 2. PY9 Program Homes AIC Services (n=125)



3.2.2 Program Status

At the end of PY8, AIC determined that it would no longer implement the ENERGY STAR New Homes program as it was no longer cost-effective. In PY9, AIC sought to effectively close the program within the program year’s first quarter while still honoring the commitments that AIC made to builders in PY8. Accordingly, AIC, Leidos, and CLEARResult worked with builders and HERS raters to identify projects that could be processed within PY9’s first quarter. The team identified 125 homes that entered the project pipeline in PY8 and could be processed by the deadline.

3.2.3 Program Communication

Leidos and CLEARResult communicated the program’s closure to builders and HERS raters by e-mail prior to the annual program kick-off meeting, and then elaborated on the process for closing the program during that three-day meeting. CLEARResult account managers worked directly with builders to identify projects that could be completed in PY9 to qualify for an incentive.

3.3 Impact Assessment

The evaluation team verified participating homes and ex ante savings estimates by reviewing energy analysis models from 119 participating homes², included in the tracking database. By running the models against the effective energy code during the home’s construction, the team verified energy and demand savings for each

² Of the 125 homes submitted to the program, the team could correctly analyze 119 files, due to software difficulties with four files and two missing files. Given the very low rate of missing data and errors, the team did not further attempt to verify the remaining six homes.

home. The team then compared verified energy savings against each home’s deemed energy savings to determine gross realization rates.

3.3.1 Gross Impacts

Baseline Characterization

Typically for new construction programs and as outlined in the Illinois TRM,³ building codes and federal standards serve as the baseline condition. In recent years, Illinois adopted the newest IECC codes after publication. As shown in Table 9, Illinois adopted the newest code, IECC 2015, as of January 1, 2016.

Table 8. Residential Code History in Illinois

2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
IECC 2006		IECC 2009*			IECC 2012*			IECC 2015*		

*Includes Illinois Amendments

In PY9, the IECC 2015 energy code update affected 54% of program homes. The evaluation team applied the IECC 2012 baseline to homes reserved before December 31, 2016 and applied the IECC 2015 to homes reserved after January 1, 2016. Baseline conditions also differed by climate zone. As shown in Table 9, 38% of homes were built in the southern part of Illinois as part of climate zone 4A, and 61% of homes were built in northern Illinois as part of climate zone 5A.

Table 9. Baselines Applied to Homes Modeled

Baseline	Number of Homes Modeled	Percent of Homes Modeled*
IECC 2012 Climate Zone 4A	23	19%
IECC 2012 Climate Zone 5A	31	26%
IECC 2015 Climate Zone 4A	23	19%
IECC 2015 Climate Zone 5A	42	35%
Total	119	100%

*Percentages do not sum to 100% due to rounding

The IECC 2012 and IECC 2015 baselines served for calculating energy savings from REM/Rate models utilizing the REM/Rate software’s UDRH feature. For each of the 119 homes, the features detailed in Table 10 were modified by REM/Rate to create a baseline model for each participant home. The baseline home equaled the same size and shape as the participant home, but used the minimum requirements from IECC 2012 and IECC 2015 as well as current federal standards.

³ The Residential New Construction program outlined its baseline definition in Illinois TRM V3.0 Section 2.5. Illinois TRM V5.0 did not include an outline for the baseline definition of an ENERGY STAR New Homes Program; so the guidance provided in TRM V3.0 served in its place

Table 10. Baseline Home Characteristics

Component	IECC 2012 Zone 4	IECC 2012 Zone 5	IECC 2015 Zone 4	IECC 2015 Zone 5
Thermostat	Heating 72F Cooling 75F Programmable Thermostat	Heating 72F Cooling 75F Programmable Thermostat	Heating 72F Cooling 75F Programmable Thermostat	Heating 72F Cooling 75F Programmable Thermostat
Ceiling*	U-0.026	U-0.026	U-0.026	U-0.026
Walls	U-0.057	U-0.057	U-0.060	U-0.060
Floors	U-0.033	U-0.033	U-0.047	U-0.033
Slab	R-10, 2ft	R-10, 2ft	R-10, 2ft	R-10, 2ft
Windows	U-0.35	U-0.32	U-0.35	U-0.32
Infiltration	5ACH50	5ACH50	5ACH50	5ACH50
Duct Leakage	4CFM/100CFA	4CFM/100CFA	4CFM/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	R-8 Attic Supply, R-6 Otherwise
Heat Pump	8.2 HSPF 14 SEER	8.2 HSPF 14 SEER	8.2 HSPF 14 SEER	8.2 HSPF 14 SEER
Furnace	80 AFUE	80 AFUE	80 AFUE	80 AFUE
Boiler	82 AFUE	82 AFUE	82 AFUE	82 AFUE
AC	13 SEER	13 SEER	13 SEER	13 SEER
Lighting	75% CFL	75% CFL	75% CFL	75% CFL
Appliances	RESNET Default	RESNET Default	RESNET Default	RESNET Default
Gas Water Heat	0.59 EF	0.59 EF	0.59 EF	0.59 EF
Electric Water Heat	0.91 EF	0.91 EF	0.91 EF	0.91 EF

Modeling Results

Of 125 homes in the PY9 program population, the REM/Rate analysis included 119 homes, representing 95% of the program population.

The evaluation team requested all REM/Rate files submitted to the program for PY9 and received 123 files (of 125 in the program database). The team could not model four of the 123 REM/Rate files due to version control issues with REM/Rate software. The team matched outputs from the REM/Rate analysis to the tracking database, finding corresponding matches for 119 REM/Rate outputs in the tracking data.

Across the sample, energy modeling indicated that average electric savings were 27% lower than ex ante deemed kWh savings. The program's variance in ex ante and ex post energy savings most likely resulted from the difference in program assumptions regarding home size and installed energy features; these varied significantly across the sample. As shown in Table 11, realization rates declined in homes for which the team applied IECC 2015 baselines. While some variation could result from the new baseline, IECC 2015 did not appear significantly more stringent than IECC 2012.⁴ Due to small population sizes in each category, much of the variance resulted from individual home characteristics.

⁴ The U.S. Department of Energy's analysis of energy impacts from IECC 2015 through IECC 2012 showed a 1% decrease in energy consumption from the new code. Designed to be an easier-to-use energy code, IECC 2015 sought increased code compliance for

Table 11. kWh Savings by Code Version Baseline

Baseline	Consumption as Built (kWh)	Consumption Reference Homes (kWh)	Savings (kWh)	Verified Homes	Savings per Home (kWh)	Deemed Savings (kWh)	% of Deemed Savings Realized
IECC 2012 4A	189,208	207,040	17,832	15	1,189	18,360	97%
IECC 2012 5A	302,880	350,341	47,461	31	1,531	60,840	78%
IECC 2015 4A	257,385	278,554	21,169	22	962	28,975	73%
IECC 2015 5A	390,928	432,335	41,407	42	986	66,775	62%
Total	1,140,401	1,268,270	127,869	110	1,162	174,950	73%

Across the sample, REM/Rate analysis showed electric demand savings were 23% lower than ex ante kW savings. Table 12 shows demand savings realization rates for each code baseline. Similar to kWh savings, demand savings were less than planned, a result similar to the 79% PY8 demand realization rate.

Table 12. kW Savings by Code Version Baseline

	Consumption as Built (kW)	Consumption Reference Homes (kW)	Savings (kW)	Verified Homes	Savings per Home (kW)	Deemed Savings (kW)	% of Deemed Savings Realized
IECC 2012 4A	49	55	6	15	0.4	7	90%
IECC 2012 5A	83	97	14	31	0.4	19	70%
IECC 2015 4A	67	75	8	22	0.3	9	81%
IECC 2015 5A	114	131	18	42	0.4	23	77%
Total	313	359	45	110	0.4	59	77%

Across the sample, the REM/Rate analysis showed gas savings 67% higher than ex ante gas savings, a result similar to that observed in past program years. As in the past, AIC derived ex ante per-home gross savings from prototype energy models. The modeling approach assumed proportional gas and electric savings, and assigned a unit energy savings to each home based on the fuels provided by AIC, as well as the home's efficiency level. Due to the inherent design of the HERS rating system, gas and electric savings are treated equally in the HERS score. This allows a builder to decide what measures to install and which fuels are saved. Program homes commonly featured energy-efficient water heating and gas furnaces, both of which significantly drive gas savings. Table 13 shows the gas savings realization rates for each code baseline.

Table 13. Therms Savings by Code Version Baseline

	Total Consumption - As IS	Total Consumption - Reference	Savings	Verified homes	Savings per home	Deemed Savings	% of Deemed Savings Realized
IECC 2012 4A	13,270	17,717	4,447	22	202	3,020	147%
IECC 2012 5A	17,403	23,196	5,792	20	290	3,146	184%
IECC 2015 4A	13,386	15,727	2,341	20	117	2,268	103%
IECC 2015 5A	23,445	32,541	9,097	28	325	4,522	201%
Total	67,504	89,181	21,677	90	241	12,956	167%

homebuilders. 2015 IECC Determination of Energy Savings: Preliminary Technical Analysis. Mendon, Taylor, Rao & Xei. U.S. Department of Energy. 2014.

The team also analyzed savings by each incentive level (i.e., the tier associated with the home’s HERS score, whether the home received AIC electric service only, AIC gas service only, or both AIC electric and gas service, and whether the home was ENERGY STAR certified). Table 14 and Table 15 show ex ante and ex post savings for homes where the team could verify models and associated realization rates.

Table 14. kWh Savings by Incentive Tier

Rating Type	Fuel Type	Tier	Verified homes	Consumption as Is (kWh)	Consumption Reference (kWh)	Verified Gross Savings kWh	Ex Ante kWh	Realization Rate kWh
ENERGY STAR	Electric Only	Tier I	4	27,394	34,316	6,922	5,850	118%
		Tier II	12	141,592	168,567	26,975	36,125	75%
		Tier III	5	50,746	59,110	8,364	14,190	59%
	Gas and Electric	Tier I	1	4,746	6,156	1,410	675	209%
		Tier II	7	56,973	62,825	5,852	8,925	66%
		Tier III	3	24,289	27,304	3,015	5,805	52%
HERS	Electric Only	Tier I	0	-	-	-	-	-
		Tier II	6	55,648	59,968	4,320	7,650	56%
		Tier III	2	42,733	60,188	17,455	12,900	135%
	Gas and Electric	Tier I	14	165,589	168,303	2,714	9,450	29%
		Tier II	53	540,375	588,081	47,706	67,575	71%
		Tier III	3	30,314	33,449	3,135	5,805	54%
Totals			110	1,140,401	1,268,270	127,869	174,950	73%

Table 15. kW Savings by Incentive Tier

Rating Type	Fuel Type	Tier	Verified homes	Consumption as Is (kW)	Consumption Reference (kW)	Verified Gross Savings kW	Ex Ante kW	Realization Rate kW
ENERGY STAR	Electric Only	Tier I	4	6	7	1	2	65%
		Tier II	12	27	32	5	9	52%
		Tier III	5	12	15	3	4	68%
	Gas and Electric	Tier I	1	2	2	0	0	186%
		Tier II	7	19	23	4	4	103%
		Tier III	3	7	9	2	2	92%
HERS	Electric Only	Tier I	0	-	-	-	-	-
		Tier II	6	18	20	2	2	103%
		Tier III	2	8	11	3	3	94%
	Gas and Electric	Tier I	14	45	49	4	3	135%
		Tier II	53	159	178	20	28	69%
		Tier III	3	10	12	2	2	120%
Totals			110	313	359	45	59	77%

Table 16. Therms Savings by Incentive Tier

Rating Type	Fuel Type	Tier	Verified Homes	Consumption as Is (therms)	Consumption Reference (therms)	Verified Gross Savings (therms)	Ex Ante (therms)	Realization Rate (therms)
ENERGY STAR	Gas and Electric	Tier I	1	513	661	148	81	183%
		Tier II	7	6,363	9,261	2,898	1,071	271%
		Tier III	3	2,412	3,286	873	697	125%
	Gas Only	Tier I	0	-	-	-	-	-
		Tier II	0	-	-	-	-	-
		Tier III	0	-	-	-	-	-
HERS	Gas and Electric	Tier I	14	8,879	10,410	1,531	1,134	135%
		Tier II	53	40,957	53,854	12,897	8,109	159%
		Tier III	3	2,709	4,168	1,458	697	209%
	Gas Only	Tier I	4	2,425	2,989	564	324	174%
		Tier II	4	2,606	3,692	1,087	612	178%
		Tier III	1	640	859	220	232	95%
Totals			90	67,504	89,181	21,677	12,956	167%

As noted, REM/Rate models for 119 of the 125 homes found in the PY9 tracking data did not contain software issues. For the six homes that could not be modeled, the team applied realization rates from each incentive tier for which they could model savings. Table 17 shows extrapolated savings for those homes.

Table 17. Savings for Homes Extrapolated

Rating Type	Fuel Type	Tier	Non-Verified Models	Ex Ante (kWh)	Ex Ante (kW)	Ex Ante (therms)	Realization Rate (kWh)	Realization Rate (kW)	Realization Rate (therms)	Gross Savings (kWh)	Gross Savings (kW)	Gross Savings (therms)
ENERGY STAR	Electric Only	Tier II	2	2,550	0.74	-	75%	52%		1,904	0.38	-
	Electric Only	Tier III	1	1,935	0.56	-	59%	68%		1,141	0.39	-
	Gas and Electric	Tier III	1	1,935	0.56	232	52%	92%	125%	1,005	0.52	291
HERS	Gas and Electric	Tier I	1	675	0.20	81	29%	135%	135%	194	0.27	109
	Gas and Electric	Tier II	1	1,275	0.54	153	71%	69%	159%	900	0.37	243
Totals			6	8,370	2.61	466				5,144	1.93	644

Table 18 shows total gross energy and demand savings impacts for new homes in PY9. The ex ante gross savings represent total reported program savings, per the tracking data. The ex post gross savings were modeled energy savings plus tracking data savings, multiplied by the modeled realization rates (per Table 17). The team determined the program-level realization rates by dividing ex post gross savings by ex ante savings.

Table 18. AIC ENERGY STAR New Homes Gross Savings

	Ex Ante Gross	Realization Rate	Ex Post Gross
Energy Savings (MWh)			
Total MWh	183	73%	133
Demand Savings (MW)			
Total MW	0.06	77%	0.05
Therms Savings			
Total Therms	13,423	166%	22,321

3.3.2 Net Impacts

The team applied SAG-approved NTGR values to the PY9 ENERGY STAR New Homes program. Table 19 shows PY9 net energy and demand savings.

Table 19. AIC New Homes Program Net Savings

	Ex Post Gross	NTGR	Ex Post Net
Energy Savings (MWh)			
Total MWh	133	1.003	133
Demand Savings (MW)			
Total MW	0.05	1.003	0.05
Therms Savings			
Total Therms	22,321	1.006	22,455

4. Conclusions and Recommendations

AIC cancelled the program after PY8 for cost-effectiveness reasons, however it paid incentives for homes that were already in the pipeline for PY9. Based on the evaluation team's experience, other new homes programs face similar challenges. New homes programs must find a balance between ever-increasing building codes and standards that raise energy efficiency baselines and find cost-effective opportunities to encourage efficiency above the baseline. Without incentives, additional energy savings can be expensive and difficult for builders to recover through a new home's sale price.

Despite the ENERGY STAR New Homes Program's discontinuation after PY9, the team offers the following program conclusion and recommendation to assist AIC should the program be revised and restored in future years.

- **Conclusion #1:** Participation grew over the life of the program, demonstrating a demand for energy-efficient new homes. Past evaluations indicated that the program's flexible requirements allowed builders to trade off gas measures for electric measures and achieve program required HERS scores. While the HERS index does not account for the relative value of avoided gas vs. electric savings, the cost effectiveness of gas or electric measures in new homes can vary significantly. A new home's cost-effectiveness depends more on the specific measures installed and the source of fuel rather than the HERS score.
- **Recommendation #1:** Due to past engagement of homebuilders in the new homes program, the program had considerable momentum with builders and could consider targeting specific cost-effective prescriptive measures, rather than HERS scores. As defined in the Illinois Statewide Technical Reference Manual (TRM) V5.0, possible prescriptive measures include geothermal heat pumps, high efficiency gas water heaters, high-efficiency lighting, innovative heating and cooling systems (e.g., mini-split or variable refrigerant flow heat pumps), and heat recovery ventilation systems.

Appendix A. Data Collection Instruments

For more information, please contact:

Hannah Arnold
Managing Director

510 444 5050 tel
510 444 5222 fax
harnold@opiniondynamics.com

1 Kaiser Plaza, Suite 445
Oakland, CA 94612



Boston | Headquarters

617 492 1400 tel
617 497 7944 fax
800 966 1254 toll free

1000 Winter St
Waltham, MA 02451

San Francisco Bay

510 444 5050 tel
510 444 5222 fax

1 Kaiser Plaza, Suite 445
Oakland, CA 94612