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Ameren Illinois Company

Electric & Gas Residential, Commercial, and Industrial Energy Efficiency Portfolio - PY9 Summary Evaluation Report

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Opinion Dynamics

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1. Executive Summary

This report presents the evaluation results from the ninth program year (PY9) of the Ameren Illinois Company (AIC) portfolio of commercial and industrial (C&I) and residential energy efficiency programs,[1] which ran from June 1, 2016 through May 31, 2017. In this document, the evaluation team provides the integrated portfolio results for PY9, as well as the detailed findings for each program as appendices.

During PY9, AIC offered eight programs for residential customers and three programs for C&I customers. The portfolio of residential and C&I programs included the following:

- Residential
  - Behavior Modification[2]
  - Appliance Recycling (ARP)
  - Heating and Cooling (HVAC)
  - Multifamily In-Unit[3]
  - Home Efficiency Standard (HES)
  - Home Efficiency Income Qualified (HEIQ)
  - ENERGY STAR® New Homes (ES New Homes)
  - School Kits
- Commercial and Industrial (C&I)
  - Standard
  - Custom
  - Retro-Commissioning (RCx)

The subsequent sections of this report present high-level findings from the evaluation of the PY9 programs. We also provide context around AIC's portfolio savings goals and resources, as well as an overview of the evaluation approaches employed.

[1] For simplicity, this report refers to the period of study as PY9. However, the June 2016 to May 2017 program year is composed of Electric Program Year Nine (EPY9) and Gas Program Year Six (GPY6).
[2] AIC offers the gas portion of the Behavioral Modification Program while the Illinois Power Agency (IPA) offers the electric portion of the program. This report contains information pertaining to evaluation of gas impacts of the Behavioral Modification program, covered under Section 8-104.
[3] In addition to the AIC Multifamily Program, the IPA offers a Multifamily Program focused on common areas and major measures.

1.1 Overall Portfolio Results

At the portfolio level, the AIC programs exceeded their goals for PY9, achieving total net savings of 197,694 MWh and 5,868,915 therms.[4] As Table 1 illustrates, the net realization rates for the entire portfolio are 113% for MWh and 119% for therms. Table 2 and Table 3 present ex ante gross, ex post gross, and ex post net savings for each program. For additional detail regarding PY9 savings, including lifetime savings, program costs, and participation, see Appendix A.

Table 1. AIC PY9 Portfolio Ex Post Net Impacts Compared to Compliance Goals

Program	PY9 Compliance Goal[a]		Ex Post Net Impacts		Realization Rate[b]	
	MWh	Therms	MWh	Therms	MWh	Therms
Residential Portfolio						
Residential Lighting (PY7 Carryover)	4,513	0	6,386	0	1.41	N/A
Behavioral Modification[c]	0	1,887,500	0	1,838,167	N/A	0.97
Appliance Recycling	3,169	0	1,099	0	0.35	-
HVAC	4,832	0	3,960	83,550	0.82	-
Multifamily	5,151	98,838	4,444	162,233	0.86	1.64
HES	2,389	427,530	30	8,371	0.01	0.02
HEIQ	4,420	322,597	3,414	446,506	0.77	1.38
ES New Homes	760	32,271	133	22,455	0.17	0.70
School Kits	273	33,605	741	16,411	2.72	0.49
Residential Total	25,506	2,802,342	20,207	2,577,693	0.79	0.92
Commercial and Industrial Portfolio						
Standard	82,880	744,554	97,497	1,980,678	1.18	2.66
Custom	32,111	1,271,811	70,803	1,078,717	2.20	0.85
Retro-Commissioning	16,372	129,528	9,187	231,827	0.56	1.79
Large C&I	17,480	0	0	0	N/A	N/A
Commercial Total	148,843	2,145,893	177,487	3,291,222	1.19	1.53
Portfolio Total						
Portfolio Total	**174,349**	**4,948,235**	**197,694**	**5,868,915**	**1.13**	**1.19**

[a] Source: AIC Compliance Filing Exhibit A, Docket 13-0498 (Filed November 29, 2016).
[Accessed: https://www.icc.illinois.gov/downloads/public/edocket/438399.pdf]

[b] The realization rate = ex post net impacts ÷ planned impacts.

[c] Note that this encompasses only the AIC portion of the program, covering gas only.

[d] Note that the total may not equal the sum of the values in the column due to rounding.

[4] AIC is not required to meet program-specific goals.

Table 2. AIC PY9 Portfolio MWh Savings Results

Program	Ex Ante Gross	Gross Realization Rate[a]	Ex Post Gross	NTGR[b]	Ex Post Net
Residential Portfolio					
Residential Lighting (PY7 Carryover)	N/A	N/A	13,587	0.47	6,386
Appliance Recycling	1,963	1.04	2,047	0.54	1,099
HVAC	5,089	0.99	5,070	0.78	3,960
Multifamily	4,476	1.03	4,601	0.97	4444
HES	43	0.92	39	0.77	30
HEIQ	2,815	1.21	3,414	1.00	3,414
ES New Homes	183	0.73	133	1.00	133
School Kits	907	0.72	681.00	0.97	741
Residential Total	*15,476*	*1.03*	*29,572*	*0.68*	*20,207*
Commercial Portfolio					
Standard	124,499	1.00	124,727	0.78	97,497
Custom	107,139	0.88	94,738	0.75	70,803
RCx	10,740	0.94	10,096	0.91	9,187
Commercial Total	*242,378*	*0.95*	*229,561*	*0.77*	*177,487*
Portfolio Total					
AIC Portfolio Total	**257,854**	**0.95**	**259,133**	**0.76**	**197,694**

[a] The ratio of ex post gross energy savings to ex ante gross energy savings. Residential and portfolio total calculations exclude residential lighting carryover, for which ex ante savings are not available.

[b] Please note that these NTGRs are program-level, and may differ from SAG-approved values applied at the end-use level.

Table 3. AIC PY9 Portfolio Therm Savings Results

Program	Ex Ante Gross	Gross Realization Rate[a]	Ex Post Gross	NTGR[b]	Ex Post Net
Residential Portfolio					
Behavioral Modification	1,838,167	1.00	1,838,167	1.00	1,838,167
HVAC	102,771	0.90	92,833	0.90	83,550
Multifamily	174,043	1.09	189,395	0.86	162,233
HES	11,920	0.92	10,997	0.76	8,371
HEIQ	470,762	0.95	446,506	1.00	446,506
ES New Homes	13,423	1.66	22,321	1.01	22,455
School Kits	22,434	0.67	15,784	1.04	16,411
Residential Total	2,633,520	0.99	2,616,003	0.99	2,577,693
Commercial Portfolio					
Standard	3,265,042	1.00	3,264,361	0.61	1,980,678
Custom	1,233,635	1.06	1,313,061	0.82	1,078,717
RCx	252,564	1.01	254,755	0.91	231,827
Commercial Total	*4,751,241*	*1.02*	*4,832,177*	0.68	*3,291,222*
Portfolio Total					
AIC Portfolio Total	**7,384,761**	**1.01**	**7,448,180**	**0.79**	**5,868,915**

[a] The ratio of ex post gross energy savings to ex ante gross energy savings.

[b] Please note that these NTGRs are program-level, and may differ from SAG-approved values applied at the end-use level.

2. Overview of the AIC Portfolio

The AIC portfolio had energy savings goals of approximately 174 GWh and 4.9 million therms for PY9. AIC has adjustable energy savings goals that are updated in light of changes to the IL-TRM and NTGRs applicable to each program. The final adjustable energy savings goals are presented in AIC's adjustable goals tracker and replicated in Table 4 below. Note that while goals are presented at the program level for comparison purposes, goals are effective at the portfolio level, meaning AIC has the ability to shift resources across all programs to meet them as it sees fit.

Table 4. AIC PY9 Portfolio Compliance Goals by Program

Program	MWh	Therms
Residential Portfolio		
Residential Lighting	4,513	-
Behavioral Modification		1,887,500
Appliance Recycling	3,169	-
HVAC	4,832	-
Multifamily	5,151	98,838
HES	2,389	427,530
HEIQ	4,420	322,597
ES New Homes	760	32,271
School Kits	273	33,605
Residential Total	25,506	2,802,342
Commercial Portfolio		
Standard	82,880	744,554
Custom	32,111	1,271,811
RCx	16,372	129,528
Large C&I	17,480	-
Commercial Total	148,843	2,145,893
AIC Portfolio Total	**174,349**	**4,948,235**

Source: AIC Compliance Filing Exhibit A, Docket 13-0498 (Filed November 29, 2016).
[Accessed: https://www.icc.illinois.gov/downloads/public/edocket/438399.pdf]

AIC's planned costs for the PY9 portfolio totaled $45,659,342 for electric programs and $11,764,912 for gas programs. Table 5 provides the planned costs by program.

Table 5. AIC PY9 Portfolio Planned Costs by Program

Program	PY9 Electric Budget	PY9 Gas Budget
Residential Portfolio		
Appliance Recycling	$1,313,788	$0
Behavioral Modification	$0	$984,375
ES New Homes	$655,381	$361,921
HES	$4,004,447	$2,211,350
HVAC	$2,844,928	$0
HEIQ	$8,375,886	$1,303,887
Multifamily	$1,061,851	$312,752
School Kits	$115,375	$120,175
Residential Total	**$18,371,656**	**$5,294,459**
Commercial Portfolio		
Standard	$11,661,911	$2,636,097
Custom	$5,379,948	$1,989,674
RCx	$1,869,563	$127,004
Large C&I	$1,710,000	$0
Commercial Total	**$20,621,422**	**$4,752,776**
Portfolio Costs		
AIC Portfolio Admin Costs	$1,963,352	$505,891
AIC EM&V Costs	$1,369,780	$352,947
AIC Education Costs	$981,676	$252,946
AIC Marketing Costs	$981,676	$252,946
Emerging Technologies	$1,369,780	$352,947
AIC Portfolio Total	**$45,659,342**	**$11,764,912**

Note: Totals may not sum due to rounding

Source: AIC Compliance Filing Exhibit C, Docket 13-0498 (Filed December 6, 2016). [Accessed: https://www.icc.illinois.gov/downloads/public/edocket/438825.pdf]

3. Evaluation Approach

The PY9 evaluation plan served as the foundation for the evaluation activities conducted. The evaluation approach included both program- and non-program-specific activities, including efforts to support the Illinois Statewide Technical Reference Manual for Energy Efficiency (IL-TRM) process. The team implemented all aspects of the evaluation plan for PY8. Table 6 provides a summary of the evaluation activities performed by the team. Detailed information about the data collection activities and analyses performed for each program is included in Appendix C.

Table 6. PY9 Evaluation Activities and Type of Assessment

Evaluation Activity	Residential								Commercial		
	Behavioral Modification	ARP	HVAC	Multifamily	HES	HEIQ	ES New Homes	School Kits	Standard	Custom	RCx
Program Material & Data Review	✓All programs										
Program Manager and Implementer Interviews	✓ All programs										
Market Actor Interviews[a]			✓	✓						✓	✓
Participant Survey			✓					✓	✓	✓	
Non-Participant Survey											
Predictive & Multilevel Modeling	✓										
Expert Interviews											
Literature Review						✓					
Incremental Cost Analysis											
Ex Post Gross Impact Analysis											
Application of the IL-TRM		✓	✓	✓	✓	✓		✓	✓		
M&V Site Visits										✓	✓
Consumption Analysis	✓										
REM/Rate Simulation							✓				
Ex Post Net Impact Analysis											
Application of SAG Approved NTGR		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Retrospective Application of Researched NTGR[b]										✓	
Performed NTGR Research for Prospective Use								✓	✓		✓

[a] Program allies, retailers, or other market actors.

[b] Applied offering-specific researched NTGR for Competitive Large Incentive Project (CLIP) Custom projects.

4. Program-Level Results

4.1 Residential Behavioral Modification

AIC developed the Residential Behavioral Modification Program to reduce its residential customers' energy consumption. Launched in August 2010, the program seeks to:

- Reduce energy consumption by encouraging energy-efficient behaviors,
- Boost customer engagement and education by helping customers understand energy efficiency and how to save energy in their homes, and
- Educate customers about no-cost and low-cost energy-saving measures and behaviors.

The Behavioral Modification Program began in PY3 and, until the end of PY7, AIC oversaw a single dual-fuel program, as well as reviewed and approved any program materials or changes that were made during the program year. Since PY8, AIC has administered the program for gas customers, while the electric portion of the program has been offered through the IPA procurement process. Thus, this report presents PY9 AIC therm savings for the Behavior Modification Program.

In PY9, the program offered three forms of treatment: (1) a hard-copy printed home energy report (HER) mailed four times a year to the customer's billing address; (2) an electronic HER (eHER) sent once per billing cycle to all customers with email addresses (generally once a month); and (3) an online portal, which customers can log onto to view the same report and access additional information.

The Behavioral Modification Program reached just about a third of AIC's approximately 1 million residential customers in PY9. A total of 308,906 participants received reports in PY9 (including both dual-fuel and gas-only customers). Oracle added a new cohort of just over 46,000 dual-fuel customers in September 2016 (Expansion Cohort 7). As a result, the number of income-qualified customers who received HERs with the Home Energy Program Income-Qualified (HEPIQ) marketing module, increased demonstrating AIC staff commitment to expand services for income qualified customers.

Program Impacts

In PY9, the program achieved adjusted net savings of 1,838,167 therms (see Table 7). Adjusted net savings remove the energy savings that resulted from customer participation in other AIC programs.

Table 7. PY9 Behavioral Modification Program Net Gas Impacts

Cohort	Number of Customers Treated in PY9[a]	Unadjusted Net Savings (% per household)	Unadjusted Net Savings (therms per household)	Unadjusted Net Program Savings (therms)[b]	PY9 Savings Uplift (therms)	Legacy Savings Uplift (therms)	Adjusted Net Program Savings (therms)
Original Cohort	33,406	0.92%	7.01	226,995	0	6,316	220,679
Expansion Cohort 1	50,266	1.32%	11.38	553,165	0	13,381	539,783
Expansion Cohort 2	73,636	0.71%	4.18	296,150	21,675	3,161	271,314
Expansion Cohort 3	12,015	2.16%	14.93	173,368	0	0	173,368
Expansion Cohort 4	20,329	0.86%	5.78	112,101	0	11,793	100,308
Expansion Cohort 5	45,359	0.86%	6.65	280,698	0	242	280,456
Expansion Cohort 6	27,716	0.50%	2.33	59,293	0	795	58,497
Expansion Cohort 7	46,179	0.84%	5.94	203,528	9,767	0	193,761
Total[c]	**308,906**		**6.17**	**1,905,299**	**31,442**	**35,689**	**1,838,167**

[a] The number of customers in PY9 refers to the number of customers to which AIC/IPA intended to provide HERs and who had an experiment start date
[b] Pro-rated for participants whose accounts closed during PY9
[c] Totals may not be exact due to rounding

Key Findings and Recommendations

The evaluation team provides the following key findings and recommendations for the program:

- **Key Finding #1: The program reduced energy consumption.** Billing analyses results indicate a net reduction of 1,838,167 therms. Program participants achieved 5.95 therms savings per household per year. We calculated these values by dividing the total adjusted net program therm savings for the evaluated period by the total number of gas program participants.
  - **Recommendation:** Depending on the selected cohorts for future program years, AIC can use the average savings estimates for therms over the evaluated period to inform future participant selection. Theoretically, AIC could multiply these averages by the selected future participant type and produce estimates of the next program year's anticipated electricity and gas savings. These projections of savings provide information about the types of participants to select to include in future program years.
- **Key Finding #2: All cohorts show equivalency in terms of average daily consumption in the pre-participation period.** In addition, we demonstrated equivalency between the treatment and control groups of Expansion Cohort 7 using household, demographic, and psychographic data.
  - **Recommendation**: We recommend that the vendor continue to monitor the equivalency of the treatment and control groups of each cohort to ensure they remain so.
- **Key Finding #3: For the second year in a row, technical issues resulted in reductions to report frequency for many customers.** There were widespread issues with missing monthly billing reads in October 2016 that reduced the frequency of reports for approximately 31,000 customers. Because these billing reads were missing, these customers were mistakenly moved to program opt-out status. In addition, when Oracle converted to its Agile EE platform, the staff discovered 7,600 treatment

customers had not been receiving reports since 2012 or 2013, depending upon the customer. Both issues were addressed and the customers were included back in the program.

- **Recommendation:** Investigate the reoccurring missing reads issue as it affects program delivery and evaluation. The missing billing reads occurred in the fall just as it had in PY8. AIC should perform systematic checks to ensure that the billing data provided to Oracle goes through a thorough quality assurance/quality control (QA/QC) process to prevent this issue from occurring again.

- **Key Finding #4: Oracle's use of exclusion criteria that allow for the inclusion of customers with only 90 days of pre-period billing information may contribute to high program attrition rates, as well as volatility in estimating energy savings associated with the program.** As documented in the AIC PY9 Behavior Modification Evaluation Report, later cohorts with lower required pre-period billing information have higher attrition rates, and results across statistical models vary and in some cases become negative. Fewer pre-period billing records lead to fewer customers that can be incorporated within a statistical model, leading to more uncertainty in savings estimates. This is particularly notable in modeled gas savings from Expansion Cohort 6, where results from our statistical models are divergent from each other as well as from Oracle's model.

  - **Recommendation:** We recommend expanding the number of required pre-participation billing months for any new cohorts to a minimum of nine months.

4.2 Residential Appliance Recycling

As with previous program years, Ameren Illinois Company (AIC) offered customers a $50 incentive to pick up and recycle (free of charge) refrigerators and freezers directly from AIC electric customer's homes in PY9. Leidos Engineering managed the program and helped to oversee its discontinuation. Appliance Recycling Centers of America (ARCA), a subcontractor to Leidos Engineering, implemented the program, which included scheduling, pick-up, recycling the appliances, and customer service. Given AIC's plans to shut down the program during PY9, the program manager focused on successfully exiting the program.

The evaluation team conducted process and impact assessments of the PY9 ARP. The process evaluation included a review of program-tracking data and materials, and interviews with implementation staff to gauge program performance. The impact evaluation involved applying deemed values from the Illinois Statewide Technical Reference Manual for Energy Efficiency Version 5 (IL-TRM V5) to calculate gross impacts. To calculate net impacts, the evaluation team applied the Illinois Stakeholder Advisory Group (SAG)-approved, measure-level net-to-gross ratios (NTGR) for freezers and refrigerators. Key findings from the PY9 evaluation are presented below.

Program Impacts

Table 8 summarizes net electricity and demand savings from the PY9 ARP. The evaluation team calculated ex post gross savings by applying IL-TRM V5 algorithms to verified measure quantities from the program-tracking database. The program achieved ex ante gross savings of 1,963 MWh and ex post gross savings of 2,047 MWh, which resulted in a 104% gross realization rate. We then applied the SAG-approved PY9 NTGR for the program (based on PY6 participant survey responses): the NTGR of 62% for freezers and the NTGR of 52% for refrigerators. The gross savings-weighted average NTGR was 54%.

Table 8. PY9 Net ARP Impacts

Savings Type	Ex Ante Gross	Realization Rate	Ex Post Gross	NTGR	Ex Post Net[a]
Energy Savings (MWh)					
Total MWh	1,963	104%	2,047	54%	1,099
Demand Savings (MW)					
Total MW	0.24	104%	0.25	54%	0.134

[a] The evaluation team determined ex post net savings by applying NTGR, verified participation, and verified per-unit savings.

AIC offered the ARP only through the first three months of PY9, recycling 2,234 units and achieving net energy savings of 1,099 MWh.

AIC discontinued the ARP partway through PY9 because increased efficiency in the appliance stock resulted in decreased energy savings and avoided costs were lower than in the previous plan. Once the decision was made to discontinue the program, AIC revised the program's energy savings and participation goals for PY9 to reflect the shorter time frame and developed an exit strategy. The implementation plan stated the revised net energy savings goal as 1,072 MWh and 2,218 appliances recycled.[5] The program reached 103% of the revised PY9 goal of 1,072 MWh through recycling 2,234 units.

Conclusions and Recommendations

AIC plans to relaunch ARP, and customers will be able to participate again starting January 1, 2018. Upon further review of the program, AIC decided to relaunch the program because customers are highly satisfied with it; and despite lower per-unit savings, the program helps AIC meet its energy savings goals because it achieves high participation.

The evaluation team provides the following conclusions and recommendations:

- **Key Finding #1:** Program managers from both AIC and Leidos reported that the program closed down successfully due to a combination of increased communication between implementation staff, effective program marketing to customers, and the commitment to picking up appliances for all scheduled appointments.
- **Key Finding #2:** AIC plans to relaunch the program and customers will be able to participate again starting January 1, 2018. In 2018, AIC is not planning for any major changes to program design from past years. However, AIC has not completed the request for proposal process for an implementation contractor and, pending final selection, may make changes to future program implementation.
  - **Recommendation**: The program may have a new implementation subcontractor responsible for scheduling, collecting appliances, and processing customer incentives. As a result, it is important to set clear key performance indicators for the subcontractor so that AIC will be able to determine, in a timely manner, if there have been any negative changes to program delivery such as customer wait time for pick up and escalated customer complaints. In addition, it will be important to manage customer expectations as some customers may be frustrated by the discontinuation and then continuation of the program. To mitigate this AIC should focus marketing messaging on AIC's commitment to meeting customer needs.

[5] Ameren Illinois. *Program Year Nine Implementation Plan Sec. 8-103/8-104*. Revised Submission Date November 4, 2016.

4.3 Residential Heating and Cooling

The Residential Heating and Cooling Program (HVAC) program offered customers incentives through registered program allies for purchases of brushless/electronically commutated motors (ECMs), air-source heat pumps (ASHPs), programmable thermostats, and smart thermostats, with pool pump incentives added at the end of the program year.

Registered program allies performed all equipment installations except for thermostats, which were offered as a self-install option. AIC offered incentives that varied based on equipment types and baseline efficiency levels. The incentives for all equipment installed by a program ally were deducted from the contractor installation invoice at the time of sale. AIC worked with Leidos as the HVAC program administrator. CLEAResult continued to work as an implementation subcontractor under Leidos' management.

The evaluation of the PY9 HVAC program involved both process and impact assessments as well as a metering study to inform future versions of the Illinois Statewide Technical Reference Manual (IL-TRM). Key findings from the PY9 evaluation are presented below.

Program Impacts

Table 9 summarizes the net electricity and demand savings from the PY9 HVAC program. The evaluation team followed the IL-TRM Version 5.0 protocol (Version 6.0 for pool pumps, as the protocol was not available in Version 5.0) and used equipment information from the program tracking data to calculate unique savings values for every measure reported. The program reported ex ante gross savings of 5,089 MWh and achieved ex post gross savings of 5,070 MWh, which resulted in a 99.2% gross realization rate for energy. The program also achieved ex post demand savings of 1.023 MW and 92,833 therms (compared with reported ex ante demand savings of 1.053 MW and therms savings of 102,771) resulting in gross realization rates of 97.2% and 90.3% for demand and natural gas, respectively. We then applied the measure-specific net-to-gross ratios (NTGRs), agreed upon by the Illinois Stakeholder Advisory Group (SAG), to the ex post gross impacts to get the ex post net impacts. The program achieved ex post net savings of 3,960 MWh, 83,550 therms, and 0.802 MW.

Table 9. PY9 Net HVAC Program Impacts

	Ex Ante Gross	Gross Realization Rate	Ex Post Gross	NTGR[a]	Ex Post Net
Energy Savings (MWh)					
Total MWh	5,089	99.2%	5,070	0.781	3,960
Demand Savings (MW)					
Total MW	1.053	97.2%	1.023	0.784	0.802
Therm Savings					
Total Therms	102,771	90.3%	92,833	0.900	83,550

[a] The energy and demand NTG values differ because of the specific measure mix and variation in measure-level savings within the program (e.g., the ECM measure does not contribute significant demand savings).

Overall program and measure-level realization rates for energy and demand were very close to 100%, and the measure level realization rates for therms ranged from 90.2% to 90.8%.

In terms of meeting energy savings targets, the HVAC program achieved 3,960 net MWh of energy savings, representing just over its 3,954 MWh target (100.2%), and 83,550 net therms savings, representing 535% of

its 15,603 therms target. Participation showed that a total of 5,083 measures were installed through the program, representing a 28% decrease over the PY8 total (7,016).

Key Findings and Recommendations

PY9 HVAC program participation was lower than expected. A bonus incentive was introduced for ASHP measures in January 2017 to encourage participation, and smart thermostat measures were added to the program in February 2017. These changes helped boost participation in these categories. However, ECM participation fell short of PY8 levels. The PY9 program also included the addition of a pool pump incentive in the last two months of the program year.

Overall, the program saw a smooth transition between PY8 and PY9, despite the arrival of new project managers at Leidos and CLEAResult. Program staff reported that consistent program processes and strong communication between all partners contributed to the smooth transition. Although most aspects of the program remained consistent with previous years, the program did add a technical review team to streamline the application review process and added additional fields for program allies to fill out on application forms.

Overall, the evaluation team determined that AIC, Leidos, and CLEAResult effectively implemented the HVAC program by making effective program changes, managing the budget, reacting to low participation (by adding bonus incentives and new measures as needed), and maintaining internal communication. The program also met MWh savings goals, and it exceeded therms goals, despite limited offerings.

The evaluation team offers the following key findings and recommendations for AIC's consideration. All key findings are based on PY9 evaluation activities, however Key Findings #3-6 were also presented in the PY8 evaluation report, which was published after the PY9 program had already launched.

- **Key Finding #1:** Program staff and contractors noted that there was not always a lot of lead-time before program changes (particularly those that took place mid-year) such as the addition of the smart thermostat and pool pump incentives. Additionally, many contractors (6 of 14) indicated that they would like to see improved communication from AIC as a key way to improve the relationship between AIC and program allies. Several contractors also indicated that they would like presenters at program ally events to be more capable of answering their questions and concerns. Although program staff worked to provide as much time before program changes as possible (and gave grace time to allow for processing of existing projects before dropping the replace-on-burnout [RB] air source heat pump [ASHP] measure), contractors indicated that timely communication continues to be an area with room for improvement.
  - **Recommendation:** Improve communication with contractors by increasing outreach on possible upcoming program changes, and provide educational opportunities throughout the year to teach program allies how to sell the program.
  - **Recommendation:** Ensure that staff who run program ally events can answer technical questions, or train them where to direct complex questions on topics not covered at the training or event.
- **Key Finding #2:** Contractors' main criticism of the HVAC program focused on insufficient program measure offerings, with eight of fourteen less than satisfied with this aspect of the program. Contractors are most dissatisfied with this program aspect and reported additional measures would encourage customers to be more efficient.
  - **Recommendation:** Although AIC must consider issues of cost-effectiveness and getting the most energy savings per incentive dollar spent, engaged and satisfied contractors can support AIC's

overall program efforts. Cadmus suggests AIC consider how it can provide limited support for dropped measures or add new measures to the program to keep it interesting for contractors. For instance, consider providing small incentives to the contractors for selling high efficiency equipment, rather than rebates to consumers.

- **Key Finding #3:** The evaluation team identified multiple incidences of missing or incorrect information in the tracking database.
  - **Recommendation:** Add an additional step in the data entry process to compare the rebate forms to the AHRI database as an accuracy check. Also, ensure sufficient quality control in reviewing information entered into the tracking database to ensure consistent and accurate data is recorded. For smart thermostats, also collect the existing thermostat type (manual or programmable).
- **Key Finding #4:** The evaluation team found that while a measure in the IL-TRM V5.0 outlines savings for furnace blower motors, it does not account for the installation of an ECM along with a new ASHP. The evaluation team believes that savings from ECMs may overlap with savings from the installation of a new ASHP. The overlap occurs because the presence of an ECM is already accounted for in the efficiency ratings (SEER, EER, HSPF) of the new ASHP.
  - **Recommendation:** Provide ECM incentives only to those installations where a new ASHP has not been installed.
  - **Recommendation:** Consider further research to assess incremental ECM savings for use when being installed with a new ASHP.
- **Key Finding #5:** The evaluation team identified a number of DMSHPs entered in the PY9 program tracking database. While this type of ASHP is not excluded based on the program requirements, it does require a different savings algorithm than is used for a traditional ASHP.
  - **Recommendation:** Ex ante savings estimates for DMSHPs should not use the ASHP approach from the IL-TRM V5.0, but rather the DMSHP algorithm from chapter 5.3.12 (in IL-TRM V5.0 or IL-TRM V6.0).
- **Key Finding #6:** The program tracking database is ambiguous about whether new ASHPs are installed into an existing system, with a gas furnace for backup heat, or as a separate standalone system in which the ASHP is the only heating unit. In cold climates, the backup system will turn on to provide heating when the ASHP is unable to meet the heating load of the home.
  - **Recommendation:** Add a flag to the tracking data that indicates whether ASHPs are installed in systems with fossil fuel backup heating equipment (such as a gas furnace or boiler).

4.4 Residential Multifamily In-Unit

The AIC Multifamily Program offers financial incentives and technical services that enable multifamily housing property owners and property managers[6] to achieve energy savings (electric and gas) and lower operating costs via energy efficient upgrades. The program's incentives are priced to offset the entire cost of the upgrade, essentially making the upgrades free to the property owner. Most measures are provided with a full

[6] We use the term "property manager" to refer to both property managers and property owners.

direct-install service,[7] and administrators implement the program using a hybrid approach that leverages both the staff from the program's implementation vendor, CLEAResult, and program allies, which are local and regional insulation and air sealing contractors.

As a result of PY9 installations, the AIC Multifamily Program was expected to contribute 4% of the overall PY9 portfolio's electric savings (6,461 MWh) and 3% of the overall portfolio's gas savings (156,503 therms). These goals represented a decrease relative to PY8. In addition, this program was part of the Illinois Power Agency (IPA)/8-103 expansion, and we provide results from the evaluation of the stand-alone IPA Multifamily Program in a separate report. Hereafter, except where noted, "Ameren Illinois Multifamily Program" refers to both the IPA and Ameren Illinois Company (AIC) Multifamily Programs and "AIC Multifamily Program" refers exclusively to the AIC Program. Program specifics are discussed in more detail later in the PY9 AIC and IPA Multifamily Program Evaluation reports.

PY9 evaluation activities for the AIC Multifamily Program include interviews with program allies, a program benchmarking review, and an impact evaluation. We also reviewed program materials and program-tracking data, and interviewed program administrators and implementation staff. Given the recent passage of the Illinois Future Energy Jobs Bill (SB 2814), many of our PY9 evaluation activities include reflections on the program's historical performance, as well as suggestions for best practices to implement for future program years. Below, we present the key findings of the PY9 AIC Multifamily Program evaluation.

Program Impacts

Overall, the ex post net savings from the PY9 AIC Multifamily Program were 4,444 MWh, 0.79 MW, and 162,233 therms (Table 10). The evaluation team verified all program measures through a review of the program-tracking database and application of the Illinois Statewide Technical Reference Manual for Energy Efficiency Version 5.0[8] (IL-TRM V5.0). Based on this review, the program achieved a 103% realization rate for gross electric savings and a 109% realization rate for gross gas savings. Differences between ex ante gross and ex post gross savings calculations are due to variances in savings assumptions for specific measures.

Table 10. PY9 Gross and Net Multifamily Program Impacts

	Ex Ante Gross	Gross Realization Rate	Ex Post Gross	NTGR[a]	Ex Post Net
Energy Savings (MWh)					
Total MWh	4,476	103%	4,601	0.97	4,444
Demand Savings (MW)					
Total MW[b]	n/a	n/a	0.82	0.96	0.79
Gas Savings (Therms)					
Total Therms [c]	174,043	109%	189,395	0.86	162,233

[a] The net-to-gross ratios (NTGRs) are estimated at a measure level but are shown in aggregate for the program here.
[b] Ex ante program tracking data provided to the evaluation team did not report PY9 demand savings.
[c] Ex ante gross therms include waste heat penalties for lighting whereas ex post excludes waste heat penalties

[7] The exception is programmable thermostats, which the implementer leaves for the property maintenance staff to install.
[8] Illinois Statewide Technical Reference Manual for Energy Efficiency Version 5.0. Effective June 2016.

The AIC Multifamily Program fell short of electric savings goals in PY9, achieving 69% of the 6,461 net MWh electric goal and 98% of the 164,940 net therm gas savings goal. According to program staff, electric savings were more difficult to achieve in PY9 for two reasons. First, participating properties tended to be smaller complexes; compared to years when the program served very large complexes, serving the PY9 customers required more driving time per unit upgraded and resulted in fewer units served. Second, several property managers turned down the CFLs offered by the program because they wanted to upgrade directly to LEDs. Because AIC was already planning to switch to LEDs in PY10, the implementer was able to work around property managers' uninterest in CFLs by offering a limited number of LEDs ahead of schedule to select properties at the end of PY9.

Key Findings and Recommendations

Findings from our PY9 process research identified similar broad areas of program success and possible improvement, which may be helpful to AIC as it looks towards some design and funding changes upcoming in PY10. Key findings come from in-depth interviews with program allies (n=5) and a program benchmarking review that compares the Ameren Illinois Multifamily Program to similar offerings in other parts of the country.

Specifically, Ameren Illinois had significantly expanded its offerings over the last nine years, leveraging expanded budgets to achieve increased savings among properties that were unlikely to install energy efficient upgrades without the program. As a testament to this successful growth, all allies are satisfied with their PY9 experiences and recall that their air sealing and insulation business in the AIC service territory has expanded over their tenure with the program. Program allies noted that it is becoming more difficult to efficiently serve remaining cost-effective savings opportunities, but suggested ways to overcome this emerging challenge, such as expanding funding for market segments that they see as still having savings opportunities (e.g., low-income multifamily buildings, small towns, and smaller complexes), modifying program guidelines, and/or adding additional measures. The benchmarking and best practices review does suggest that the program is already applying most of the best practices for multifamily programs serving dual-fuel customers; however, possible ways to improve the program include expanding current efforts to coordinate program providers, partner with similar organizations to expand reach, and communicate all energy and non-energy upgrade benefits to property managers. Ameren Illinois may also have an opportunity to act on other best practices in coming years, like standardizing data tracking over the program lifespan to better enable cross-year comparisons, and working longer-term to identify opportunities for timing upgrades with larger building renovation projects. Overall, comparing Ameren Illinois' day-to-day practices with best practices recommended by industry groups suggest that Ameren Illinois' program is well-positioned to overcome traditional and emerging market barriers in its service territory.

- **Key Finding #1:** Program tracking data for PY9 were generally clean and complete. However, there were some small issues with the ex ante savings assumptions. For example, for common area lighting measures, the implementer applied IL-TRM V5.0 algorithms and inputs for residential dwellings, whereas the evaluation team applied the commercial and industrial algorithms and inputs[9]. Additionally, ex ante savings calculations for faucet aerators were based on single family assumptions rather than multifamily assumptions.
    - **Recommendation:** It is important to ensure that the program-tracking platform accurately calculates and claims savings that are representative of actual installation parameters and which reflect the most appropriate assumptions from the IL-TRM V5.0. More specifically, common area lighting measures should reference the commercial and industrial IL-TRM V5.0, while all remaining

[9] The implementation team used assumptions from the IL-TRM V5.0 Volume 3 (residential measures). The evaluation team determined that the IL-TRM V5.0 Volume 2 (commercial measures) would be more appropriate for common area lighting measures.

measures should apply residential multifamily assumptions from the IL-TRM V5.0. By doing a complete quality assurance/quality control (QA/QC) review of all measures, the implementers can minimize data entry errors, however small, and ensure that all algorithms and the assumptions programmed in the program-tracking database reflect best practice.

- **Key Finding #2:** While the Ameren Illinois Multifamily Program relies on program allies to deliver its major measures program offering, a program best practice identified in the program benchmarking exercise, some allies are facing challenges in serving the program as a result of midyear program funding disruptions (PY9 and in past years) and an increasingly-saturated marketplace.
  - **Recommendation:** AIC should work closely with program allies and program implementers in the transition period (if possible) and early in PY2018 to help the allies and implementers plan for and navigate changes. Clear and timely communication is an opportunity to enable the program allies to plan for any adaptations needed so they can rely on the program as a dependable part of their business and serve customers in an efficient and effective manner.
- **Key Finding #3:** Most program allies feel that they have already worked through many of the easier-to-serve properties in AIC's service territory and view the remaining buildings as more scattered throughout the territory and less cost-effective to serve. The program benchmarking process identified best practices for addressing saturated markets including expanding offerings for comprehensive upgrades and promoting them through escalating incentives and financing options.
  - **Recommendation:** Consider expanding program offerings or guidelines to open-up new cost-effective savings opportunities for program allies. Also consider whether new incentive structures, such as financing options, could help balance the program's budgetary constraints with the need to continue addressing property owners' split incentives.
- **Key Finding #4:** Engaging with organizations that are also involved in multifamily energy efficiency is a best practice for ratepayer-funded programs seeking to expand their reach. AIC staff continue to attend annual landlord association meetings in the Peoria, IL area, and have identified leads from these venues. In addition, program allies have had success marketing the program by actively recruiting property managers at rental property professional association meetings.
  - **Recommendation:** AIC should continue to build on efforts to market the Multifamily Program via existing networks of multifamily organizations by placing advertisements in housing trade association publications or developing new partnerships with organizations that can provide AIC with a single point of access to a wide variety and number of properties, such as regional housing companies and financial institutions.

4.5 Residential Home Efficiency Standard

The Home Efficiency Standard (HES) Program is a home energy diagnostic and retrofit program that offers residential customers a home audit, an audit report and recommendations for retrofits, directly installed measures, and incentives for building shell retrofits. In particular, program participants may receive energy-efficient lighting, faucet aerators, showerheads, insulation, and air sealing. CLEAResult implements the HES Program with oversight from Leidos, which manages implementation of AIC's energy efficiency portfolio.

Given that AIC decided to discontinue the HES Program after PY8 due to an estimated Total Resource Cost (TRC) less than 1.0, PY9 program implementation activities were limited to closing-out any remaining projects begun in the prior program year. Ultimately, the HES Program was implemented for only two months in early

PY9, from May 20, 2016 to July 31, 2016. The evaluation team completed an impact evaluation of the projects completed during this time and conducted only a few process-related evaluation tasks to confirm that the closeout process went as planned.

Program Impacts

AIC expected the HES Program to achieve 81 MWh and 17,923 therms, which represents 0.1% of the overall PY9 filed planned electric savings and 0.3% of overall residential filed planned therm savings, respectively. Per the PY9 implementation plan, AIC estimated completing 123 retrofits in PY9.

The program fell short of its participation estimate, reaching 70 customers in PY9. This represents 36 audits and 34 home retrofit projects, which is 57% of the estimated program retrofits for PY9. AIC program staff noted that some of the outstanding projects were not completed since they only had the first two months of the program year to complete projects.

Overall, the program provided ex post net savings of 30.25 MWh, 0.01 MW, and 8,371 therms in PY9. The program achieved gross realization rates of 92% for MWh savings, 91% for MW savings, and 92% for therms savings. Table 11 summarizes the impacts for the HES Program in PY9.

Table 11. PY9 HES Program Net Impacts

	Ex Ante Gross	Realization Rate	Ex Post Gross	NTGR[a]	Ex Post Net
Energy Savings (MWh)					
Total MWh	42.50	92%	39.11	0.77	30.25
Demand Savings (MW)					
Total MW	0.02	91%	0.02	0.75	0.01
Therms Savings					
Total Therms	11,920	92%	10,997	0.76	8,371

[a] To obtain net program savings, we applied the SAG-approved PY9 NTGRs to ex post gross savings by measure and summed the results. We divided the ex post net program impacts by ex post gross program impacts to arrive at the program-level NTGRs.

Key Findings

The key goal for the program was to work closely with trade allies to complete any outstanding projects. According to program staff, the closeout process went smoothly, within budget, and without any lingering issues.

4.6 Residential Home Efficiency Income Qualified

The Home Efficiency Income Qualified (HEIQ) Program is a home energy diagnostic and whole-house retrofit program that began as a pilot in PY3 and is in its sixth year of implementation as of PY9. The target market for the program is AIC customers with homes heated by a fuel source (electricity or natural gas) provided by AIC and with a household income between 0% and 300% of federal poverty guidelines for household size. CLEAResult implements the program and reports to Leidos, who manages all of AIC's commercial and residential programs. Participants can join the program in one of two ways: by applying directly for a home audit through the program or by applying to the program through a program ally.

The expected savings from the HEIQ Program is 3% of the overall PY9 portfolio of electric savings and 9% of PY9 portfolio therm savings (including both residential and commercial).[10] Per the program implementation plan, AIC estimated that it would perform 1,794 audits and complete 1,350 retrofits in PY9, resulting in savings of 3,731 MWh, 1.81 MW, and 689,797 therms.

For PY9, the evaluation team conducted a process and impact evaluation of the HEIQ Program, which included interviews with program staff, participation analysis, and a literature review of best practices for low-income program design and marketing strategies.

Program Impacts

The HEIQ Program had electric and gas program budgets of $10,382,518 and $3,409,632[11], respectively. The program fell significantly short of its participation and savings goals in PY9, which AIC staff attributed to a slow start as the program implemented several program design changes. In PY9, the program reached 1,443 participants, including 622 audits (35% of goal) and 821 retrofits (61% of goal). The program achieved ex post net savings of 3,414 MWh, 1.18 MW, and 446,506 therms in PY9.

Table 12. PY9 HEIQ Program Net Impacts

	Ex Ante Gross	Realization Rate	Ex Post Gross	Net-to-Gross Ratio (NTGR)	Ex Post Net
Energy Savings (MWh)					
Total MWh	2,815	121%	3,414	1.00	3,414
Demand Savings (MW)					
Total MW	0.97	121%	1.18	1.00	1.18
Therm Savings					
Total Therms	470,762	95%	446,506	1.00	446,506

Key Findings and Recommendations

- **Key Finding #1:** As of the end of PY9, there are many low-income communities in AIC's service territory that are largely untouched by AIC and IPA residential programs. This represents a large opportunity for future program delivery. We identified the top-20 communities in terms of the number of high-priority households.[12]
  - **Recommendation:** We recognize that AIC may have other considerations than historical participation and eligibility when targeting communities. The evaluation team recommends that the program implementation team use the list of top-20 communities as a starting point to select communities or broader areas that they would like to target for future HEIQ participation. Once AIC approves them, our team can analyze the targeted areas at the street level to avoid multifamily locations and ineligible neighborhoods. This effort will essentially provide more refined targets at the most granular address-level.
- **Key Findings #2**: Neighborhood sweeps are an effective strategy for ensuring certain communities are well-covered by programs. Further, neighborhood sweep approaches often leverage community

[10] Note that the percentage of expected savings here and throughout the document is calculated based on AIC Plan 3 Compliance Filing from Docket 13-0498, dated January 28, 2014.
[11] Source: Ameren Illinois Program Year Nine Implementation Plan Sec. 8-103/8-104, July 8, 2016.
[12] The top 20 communities include Springfield, Decatur, Bloomington, Centralia, East Saint Louis, Danville, Galesburg, Carbondale, Mount Vernon, Granite City, Belleville, Jacksonville, Ottawa, Alton, Salem, Marseilles, Olney, Quincy, Peru, and Monmouth.

leaders who could help identify low-income parts of the neighborhood and attend kick-off events. These steps can help raise awareness of the program, lend credibility to the program representatives visiting homes, and help schedule some visits in advance of the sweeps.

- **Recommendation:** Once AIC determines which communities they would like to target (see the recommendation under Key Finding #1), we recommend that AIC employs a neighborhood sweep approach in those communities. Neighborhood sweeps typically occur over the course of a few weeks and can cover around 500 homes. Fewer but more extensive sweeps could be undertaken if budget is available.

- **Recommendation:** Should AIC employ neighborhood sweeps, we recommend that AIC identify community leaders (e.g., mayors, councilmembers, pastors, etc.,) to help raise awareness and enhance the credibility of the program. Community leaders can also be helpful in the planning stage to identify specific areas of most need. We also recommend holding kick-off events at community centers (e.g., schools, city halls, churches) with the community leaders present to lend credibility to the program.

- **Key Findings #3:** There is an opportunity to provide some additional educational collateral in tandem with the audit. Notably, it may not be possible to calculate or claim additional savings from education measures. However, educational components have the potential to improve customers' perceived value of the program and satisfaction with AIC. Additional education may also be helpful in convincing customers to invest in deeper retrofits. During the PY8 evaluation, some Program Allies reported that certain measures are harder to sell than others, specifically the air sealing and insulation. Their recommendation was to provide more education on these measures prior to the audit.

  - **Recommendation:** AIC could consider adding educational collateral to their audits beyond the audit report. One option is to provide a list of energy-saving tips after the audit. Given this would be for low-income customers, the collateral should focus on low/no cost tips for saving energy (e.g., turning off the lights or changing thermometer setpoints). Another option is to provide an education pamphlet (e-mail or mail) prior to the audits that explains what to expect during the audit and the equipment and systems that could be changed.

- **Key Finding #4:** Ex ante savings incorporates cooling degree days (CDD) and heating degree days (HDD) for conditioned basements or crawl space with the idea that this area is enclosed within the thermal barrier due to the installation of proper air sealing measures. The evaluation team applied CDD and HDD for unconditioned basements and crawl spaces, as the area is not purposely conditioned, but indirectly conditioned due to duct leakage. Applying CDD and HDD using conditioned space assumptions creates overlap in savings for rim joist, crawl space, and basement wall insulation with air sealing and duct sealing measures.

  - **Recommendation:** When calculating savings for rim joist, crawl space, and basement wall insulation, the evaluation team recommends recording the basement condition for each project and applying the associated CDDs and HDDs from the IL-TRM. If this information is unknown or cannot be collected, we recommend applying unconditioned assumptions, which is consistent with the approach in previous program evaluations.

4.7 Residential ENERGY STAR® New Homes

Implemented by CLEAResult and administered by Leidos Engineering in PY9, the ENERGY STAR® New Homes (ES New Homes) 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 discontinued the ES New Homes Program after determining that the program was no longer cost-effective. In PY9, the ES 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 ES New Homes energy savings, depending on the code version applied to the home.

Program Impacts

Table 13 summarizes electric and gas savings from the PY9 ES New Homes Program. The evaluation 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 13. PY9 ES New Homes Program Net Savings

	Ex Ante Gross	Realization Rate[a]	Ex Post Gross	NTGR[b]	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

[a] Realization rate = ex post gross savings ÷ ex ante gross savings
[b] 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 due to 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 ES New Homes Program's discontinuation after PY9, the evaluation team offers the following program conclusion and recommendation to assist AIC should the program be revised and restored in future years.

- **Key Finding #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:** 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.

4.8 School Kits

Through the Residential Energy Efficiency School Kits (School Kits) Program, Ameren Illinois Company (AIC) distributes kits (containing energy-efficient items) during on-site presentations to fifth- through eighth-grade students. Since PY8, Leidos Engineering has provided oversight on behalf of AIC. Leidos subcontracts with CLEAResult to implement the program and Energy Federation Incorporated (EFI) to compile and deliver kits to schools. AIC seeks to increase sales and awareness of ENERGY STAR®-qualified lighting products through the program, along with other AIC energy efficiency offerings. The School Kits Program provided energy efficiency kits to 7,499 students in PY9 (June 1, 2016 to May 31, 2017).

As shown in Table 14, each kit contained two 13-watt CFLs, two faucet aerators, one showerhead and one hot water temperature card thermometer, along with instructional materials explaining how to properly set water heater temperatures. School Kits Program materials also encouraged student participants to complete an activity worksheet with the assistance of their parent or guardian, who then submit a program-administered, web-based student participant survey, to verify the installation of energy-efficient items.

Table 14. PY9 School Kits Products

Product	Quantity Per Kit
13-watt CFL	2
1.0 Gallons Per Minute (GPM) Bath Faucet Aerator	1

Product	Quantity Per Kit
2.0 GPM Kitchen Faucet Aerator	1
1.75 GPM High-Efficiency Showerhead	1
Hot Water Temperature Card Thermometer	1
Instructional Materials	N/A

The implementation plan specified the following two general program objectives:

- Increase awareness of energy efficiency and conservation
- Increase energy efficiency for targeted students and their families through simple home energy efficiency tools and measures

More specifically, the filed PY9 energy goals, which are based on distributing 5,000 kits, are 366 net MWh and 48,298 net therms. AIC estimated program savings based on the default assumptions in the Illinois Statewide Technical Reference Manual (IL-TRM) V5.0. However, the program implementer determined that the budget supported a 7,500-kit goal in PY7 and PY8, and staff agreed to maintain the increased goal in PY9. The program implementer assumed energy savings of 60.13 annual net kWh and 6.07 annual net therms per kit, for a combined 7,500-kit net savings goal of 451 MWh and 45,509 therms. AIC and the program implementer did not set demand reduction goals.

Program Impacts

Table 15 summarizes the PY9 School Kits Program's net energy and demand savings of 741 MWh, 0.126 MW, and 16,411 therms. Although the program implementer exceeded the program's filed MWh goal, it fell short of the filed therms savings goal. Total MWh savings were higher and therm savings were lower due to differences resulting from estimated compared to actual electric water heating saturation rates. While AIC and the program implementer used the IL-TRM V5.0 default water heater fuel saturation rates of 16% electric and 84% natural gas, the evaluation team applied ex ante and ex post fuel saturations of 55% electric and 45% natural gas based on the PY9 program implementer participant survey results. To determine gross savings and net realization rates, the evaluation team applied deemed per-unit gross savings inputs set forth in the IL-TRM V5.0, in combination with the following:

- PY9 School Kits Program non-CFL measure installation rates and water heater fuel saturations (derived from the implementer-administered web-based student participant survey results) for program measures
- Application of the Stakeholder Advisory Group's (SAG's) approved net-to-gross ratio (NTGR) for this program
- Additionally, for PY9,[13] the evaluation team included net savings for delayed CFL installations attributed to the PY7 and PY8 School Kits Programs.

As a result, the program achieved the gross and net savings shown in Table 15. Realization rates less than 100% are mainly due to ex ante installation rates being higher than ex post installation rates for all measures other than CFLs.

[13] Delayed 13-watt installations by PY7 and PY8 School Kits Program participants, estimated as installed during the PY9 program year (in accordance with IL-TRM V3.0 (PY7) and IL-TRM V4.0 (PY8)), were credited to the final PY9 School Kits Program net impacts.

Table 15. PY9 Net School Kits Program Impacts

Savings Type	Ex Ante Gross[a]	Realization Rate	Ex Post Gross	NTGR	Initial PY9 Ex Post Net	PY7 Ex Post CFL Net Savings Realized in PY9	PY8 Ex Post CFL Net Savings Realized in PY9	PY9 Ex Post Net
Energy Savings (MWh)								
Total MWh	907	72%	681	0.97	657	46	39	741
Demand Savings (MW)								
Total MW	0.183	64%	0.121	1.00	0.120	0.005	0.001	0.126
Energy Savings (therms)								
Total Therms	22,434	67%	15,784	1.04	16,411	0	0	16,411

[a] Ex ante savings are based on IL-TRM V5 with actual water heater saturations (55% electric)

Key Findings and Recommendations

The PY9 School Kits Program delivered 7,499 kits to students, one short of its 7,500-kit goal. Of the 71 participating schools, the implementer successfully recruited 32 new schools in PY9, the program's fourth year. Most teachers completing the implementer's teacher survey expressed interest in participating in the program in the future. AIC, Leidos, and CLEAResult program staff coordinated planning and implementation efforts, frequently communicating throughout the program year. During the evaluation team's process review, utility and implementation staff reported that they were highly satisfied with PY9 program performance. Stakeholders also reported that operations ran smoothly, without significant issues.

Based on this research, the evaluation team provides the following key findings and recommendations:

- **Key Finding #1:** The implementer-administered, web-based student participant survey response rate decreased from 33% in PY8 to 23% in PY9. This remains lower than the 55% response rate for PY6, though consistent with the 23% in PY7. Student response rates typically depend on teachers' encouragement levels and associated completion requirements. As student survey data directly informs program impacts (e.g., installation rates and water heater saturations), it is important to encourage increased response rates to capture more accurate savings calculations.
  - **Recommendation:** Consider revising incentives for student survey completions. Instead of providing incentives to teachers or schools with the best response rates, provide incentives to individual teachers whose classroom (i.e., students) meet a minimum response rate. For teachers who have participated in the past, consider offering incentives for improved response rates. A tiered incentive—$20 for returning any surveys, $50 for returning 50% of a classroom's surveys, and $100 for returning 80% of a classroom's surveys—may also increase response rates. The tiered incentive as described would increase the incentive budget from $500 to $1820, based on the PY9 results; however, presuming even higher response rates, we recommend an even higher incentive budget.
  - **Recommendation:** Program staff could revise delivery tactics to increase response rates (e.g., e-mailing teachers directly to remind them to complete the student survey activity or encouraging teachers to consider using the activity worksheet and installations as homework assignments).

- **Key Finding #2:** As recommended in the PY8 evaluation report, the program implementer worked with the evaluation team to update the parent[14] letter and the parent postcards to obtain permission to collect additional information useful in assessing program free-ridership. AIC and the implementer also coordinated a second edit to the postcard, which included a chance for households to win a gift card for responding to request for contact information, and web link to the free-ridership survey to encourage parents to take the survey on their own. However, household response rates remained low, and AIC, Leidos, CLEAResult, and the evaluation team revised the process in time for the launch of the transition period program offering. This time, the evaluation team eliminated the parent postcard, only providing a web link to the survey in the parent letter, and adjusted the gift card drawing to be awarded to teachers whose classrooms have the strongest response rates.

    - **Recommendation:** Monitor the process for obtaining household survey responses to ensure the evaluation team reaches its quota (n=70) for desired confidence and precision levels. If the response rate remains low, consider reinstating the postcard into the kit to increase visibility, or consider adjusting the program's activity sheet and student participant online survey to collect the additional NTGR information.

Key Finding #3: Realization rates less than 100% for non-CFL measures are due to ex ante installation rates being higher than ex post installation rates. The non-CFL ex-ante savings calculations produced by the implementer used installation rates derived from the PY7 participant survey and reported in the PY7 School Kits report. The evaluation team used results from the PY9 implementer-administered, web-based student participant survey to estimate installation rates for non-CFL items.

- **Recommendation:** Calculate future ex ante savings using the PY9 ex post installation rates presented in the PY9 School Kits Program Evaluation report.

4.9 Commercial and Industrial Standard

In PY9 (June 1, 2016 through May 31, 2017) AIC expected savings from the C&I Standard program to account for 48% of overall portfolio electric savings and 15% of overall portfolio therm savings (including both residential and commercial programs)[15]. The Standard Program offers AIC business customers fixed incentives for the installation of specific energy efficiency measures. The core portion of the Standard Program (herein after referred to as the Core Program) covers energy efficient lighting, variable frequency drives (VFDs), HVAC equipment, refrigeration/grocery equipment, commercial kitchen equipment, steam traps, and other measures. Leidos is the main program implementer.

Additionally, the Standard Program includes the Ameren Illinois Business Customer Online Store (Online Store) offering that is available to all electric business customers. The Online Store, maintained by Energy Federation, Inc. (EFI), offers a variety of energy-saving lighting products, including LED lighting, LED exit signs, and occupancy sensors. The program also continued its Green Nozzle initiative in PY9, which is a small offering that provides free efficient water nozzles to all natural gas customers and to customers in the food service sector who have electric water heating. Finally, in PY9, the program continued its Instant Incentives offering, which was first introduced as a midstream lighting pilot program in PY7. The Instant Incentives component provides incentives to customers purchasing lighting at lighting distributor locations to help increase the market share of efficient lighting products.

[14] For the remainder of this report, "parent" will refer to either "parent" or "guardian."
[15] Based on the PY9 Implementation Plan

Our evaluation of the Standard Program included impact and process assessments of specific components. We reviewed program materials and program-tracking data, interviewed program administrators and implementation staff, and conducted additional research. Our quantitative research included surveys of customers who purchased equipment through the Core Program and who purchased lighting through the Instant Incentives offering. We also collected and analyzed data to support updated net-to-gross ratios (NTGRs) for prospective application to the Instant Incentives offering.

Program Impacts

Table 16 shows that electric and gas gross realization rates for all program components are either at or above 100% or very close to it. As outlined in the evaluation plan, the evaluation team applied Illinois Stakeholder Advisory Group (SAG)-approved NTGRs to the program's ex post gross savings to develop estimates of ex post net savings. Table 16 also provides the PY9 Standard Program ex ante and ex post gross and net impacts. The PY9 Standard Program achieved 97,497 MWh and 14.65 MW in net electric savings and 1,980,678 therms in net gas savings. This level of savings enabled the program to exceed its PY9 internal electric goals and greatly exceed its internal gas goals.

Table 16. Standard Program Impact Summary

Savings Category	Ex Ante Gross	Realization Rate	Ex Post Gross	NTGR	Ex Post Net
Energy Savings (MWh)					
Core Program	87,141	99.5%	86,696	0.78	67,571
Instant Incentives	32,023	102.1%	32,690	0.78	25,490
Online Store	5,306	100.0%	5,306	0.83	4,404
Green Nozzle	29	121.1%	35	0.92	32
Laminar Flow Restrictor[a]	—	N/A	—	N/A	—
Total MWh Savings	**124,499**	**100.2%**	**124,727**	**0.78**	**97,497**
Demand Savings (MW)					
Core Program	11.63	98.9%	11.50	0.78	9.02
Instant Incentives	6.72	102.6%	6.89	0.78	5.38
Online Store	0.31	100.0%	0.31	0.83	0.26
Green Nozzle	—	N/A	—	N/A	—
Laminar Flow Restrictor[a]	—	N/A	—	N/A	—
Total MW Savings	**18.66**	**100.2%**	**18.71**	**0.78**	**14.65**
Gas Savings (Therms)					
Core Program	3,256,970	100.0%	3,256,319	0.61	1,974,286
Instant Incentives	—	N/A	—	N/A	—
Online Store	—	N/A	—	N/A	—
Green Nozzle	4,510	99.3%	4,481	0.89	3,988
Laminar Flow Restrictor[a]	3,562	100.0%	3,562	0.68	2,404
Total Therm Savings	**3,265,042**	**100.0%**	**3,264,361**	**0.61**	**1,980,678**

Note: Savings for the Instant Incentives offering include carryover from PY7 and PY8 projects.

a Referred to as program offering "SA - Sink Aerator" in the PY9 C&I Standard database. We refer to this program offering as "Laminar Flow Restrictor" throughout this report.

Key Findings and Recommendations

- **Key Finding #1:** Our impact evaluation found electric and gas gross realization rates of, or just under, 100% for all program components, indicating that the program is tracking its savings and projects carefully. However, we continue to find minor discrepancies in the database that do not reflect the latest TRM updates.
  - **Recommendation:** We recommend incorporating all Illinois Statewide Technical Reference Manual Version 5.0 (IL-TRM V5.0) updates and applying the correct measure assumptions consistently across all measures to ensure AIC continues achieving high realization rates moving forward.
- **Key Finding #2:** The implementer indicated that one participant requested laminar flow restrictors (LFRs) with a higher flow rate compared to the flow rate of other LFRs installed within the program. The algorithm within the IL-TRM V5.0 includes throttling factors for flow rates measured during the direct install. Incorporating the throttling rates for this one LFR project results in flow rates (2.20 gpm * 0.95 throttle rate = 2.09 gpm) less than the baseline flow rate (2.46 gpm * 0.83 throttle rate = 2.04), thus resulting in negative therm savings.
  - **Recommendation:** We recommend the implementer require a larger flow rate reduction such that savings yield positive results.
- **Key Finding #3:** An examination of the participant tracking database for the Core Program shows that first-time participants outnumbered participants who had previously engaged with the program. In the case of the Instant Incentives offering, 48% of the survey participants who used the program in PY9 did so for the first time as well. We inquired with first-time Core Program and Instant Incentives participants to ask why they had not participated before PY9. Forty percent of Core Program participants reported that they did not know about the program and another 38% reported that they did not need to do any upgrades prior to PY9. Of the Instant Incentives participants, 75% were unaware of the program prior to PY9, while 12% reported that they had not been interested in energy efficiency until now.
  - **Recommendation:** While the Core Standard Program is quite mature, there are still a number of AIC business customers who were not aware of the program or were not interested in participating until this past program year. AIC's marketing plan utilizes several approaches to reach its business customers, and we recommend that it continue to use multiple avenues as a way of getting the attention of customers who are unaware of the program. Additionally, AIC could consider launching a marketing campaign that offers a bonus to first-time participants to entice them to participate. This might gain the attention of customers who felt they could not afford to make upgrades or who might be on the cusp of considering energy efficient projects.
- **Key Finding #4:** The popularity of the Instant Incentives offering increased as it completed its second full year as part of the Core Standard program. Participation increased from 273 customers in PY8 to over 1,600 customers in PY9, and net ex post savings grew from 3,888 MWh in PY8 to 25,359 MWh in PY9. Over 95% of respondents reported that they were extremely satisfied with the program overall, as well as with the lighting equipment purchased.
  - **Recommendation:** Based on the increasing popularity of Instant Incentives, AIC should continue with this offering as part of its Core Standard Program. Growth in participation and energy savings, along with high levels of participant satisfaction, support the continued offering of this component of the Standard Program.

- **Key Finding #5:** Customers who participated in the Instant Incentives offering reported the most common way they learned about the offering is through distributors and retailers. This is not surprising since distributors are a main way customers purchase energy efficient lighting through this program component. To ensure lighting distributors are familiar with this offering, AIC provides Instant Incentives training opportunities to lighting distributors through webinars as part of its marketing plan.

  - **Recommendation**: AIC should continue to provide training opportunities and marketing strategies aimed towards lighting distributors and retailers to grow the Instant Incentives offering, as it experienced a positive reception by AIC business customers. Since this offering is still relatively new, we recommend expanding the distribution of relevant marketing materials to inform additional customers and program allies of this opportunity

4.10 Commercial and Industrial Custom

In PY9 (June 1, 2016–May 31, 2017), AIC expected the Custom Program to account for 49% of the overall portfolio electric savings and 15% of portfolio therm savings.[16] The Custom Program is comprised of four distinct offerings, which account for 100% of the program savings: the core Custom offering; the Competitive Large Incentive Project (CLIP) offering; the New Construction Lighting offering; and the Strategic Energy Management (SEM) offering.[17] The Custom Program also provides several special program offerings (Staffing Grants, Feasibility Studies, and the Metering and Monitoring Pilot) to engage customers and discover energy savings opportunities, but the program does not claim direct savings for these offerings.

To support the process evaluation, we interviewed Staffing Grant recipients, CLIP incentive recipients, participants in the SEM offering, and program staff. We also reviewed program implementation and marketing materials. Gross impact evaluation research efforts included desk reviews and on-site visits to verify custom equipment performance. Net impact analysis included application of Illinois Stakeholder Advisory Group (SAG)-approved NTGRs and interviews with recipients of CLIP incentives and Staffing Grants.

Program Impacts

Overall, the Custom Program performed well in PY9. As shown in Table 17 below, the program achieved 94,738 MWh in ex post gross electric energy savings and 1,313,061 therms in ex post gross gas savings[18] equating to gross realization rates of 88% for electric energy and 106% for gas energy in PY9.

Table 17 also provides the PY9 Custom Program ex post net impacts. As outlined in the evaluation plan, the evaluation team typically estimated net savings by applying Illinois Stakeholder Advisory Group (SAG)-approved net-to-gross ratios (NTGRs) to program ex post gross savings. The Custom Program achieved 70,803 MWh in ex post net electric energy savings, falling just short of its PY9 electric target, while delivering 1,078,717 therms in ex post net gas savings and exceeding the PY9 gas savings target.[19]

[16] Based on the PY9 Implementation Plan.
[17] While AIC processes small-scale new construction projects through the Standard Program, lighting and large-scale heating, ventilation, and air conditioning (HVAC) projects are processed through the Custom Program. New construction lighting projects falling under the New Construction Lighting offering and large-scale HVAC projects in new construction are included in the Custom incentive offering.
[18] Ex post refers to the estimated impacts found by the evaluation team.
[19] Note that while AIC sets savings targets for each program year, programs ultimately aim to achieve a single goal for the 3-year Plan 3 period.

Table 17. Custom Program Impact Summary

Savings	Ex Ante Gross	Realization Rate	Ex Post Gross	NTGR[a]	Ex Post Net
Energy Savings (MWh)					
Total MWh	107,139	0.88	94,738	0.75	70,803
Demand Savings (MW)					
Total MW	13.3	0.87	11.6	0.75	8.7
Gas Savings (Therms)					
Total Therms	1,233,635	1.06	1,313,061	0.82	1,078,717

Note: Values may not multiply cleanly due to rounding.
[a] Blended NTGR based on SAG-approved NTGR for all Custom Program projects except those completed through the CLIP offering, for which an offering-specific NTGR was applied retrospectively to projects based on PY9 research.

The program realized somewhat lower MWh and MW savings in PY9 compared to PY8, and somewhat higher therm savings. This is not surprising, since a certain level of year-to-year variation can be expected due to the large, unique projects that are characteristic of a custom C&I program.

Key Findings and Recommendations

Our research found that PY9 was another successful year for the Custom Program, in terms of achieved savings, participant satisfaction, and program implementation. The program is quite mature, and as a result, we primarily focused our recommendations on the program's newer initiatives; in particular, the SEM offering, which produced savings for the first time in PY9. Below we highlight key findings and recommendations from our research.

- **Key Finding #1:** SEM interviewees most frequently identified the discovery of new energy-saving opportunities as a benefit of participating in the program. A participant suggested further expanding opportunities for learning about new ideas for energy efficiency projects by facilitating interactions between SEM participants so that participants can learn ideas from each other. This recommendation may be especially useful as the SEM participants in PY9 were from the same two industries, which presents opportunities for collaboration and learning.
  - **Recommendation:** Consider facilitating communications between AIC commercial customers through the SEM program. Creating partnerships between SEM participants in the same sector or scheduling meetings and facility tours for SEM participants with similar needs could expand the potential for identification of new savings opportunities and ongoing learning.
- **Key Finding #2:** The SEM program is offered at no cost to customers. During our research with SEM participants, several participants reported that their participation in the SEM program helped demonstrate the benefits of investing in energy efficiency to their upper management, helping to convince their upper management to invest in energy efficient capital projects they otherwise would not have.
  - **Recommendation:** Continue using the SEM program as the program of choice to introduce AIC commercial customers to energy efficiency programs. The SEM program is a powerful recruiting tool to leverage in situations where potential participants are apprehensive about participating in energy efficiency programs due to concern about capital costs.
- **Key Finding #3:** One of the three SEM projects did not have sufficient details to reproduce the ex ante calculations. The other two projects had some details, but detailed calculations were only available for

every measure for one project. Additionally, measure descriptions made it difficult to replicate energy savings based on the provided information.

- **Recommendation:** Measure savings should include a supporting calculation and measure description. The calculation would show the mathematical steps taken to develop the savings estimate. The description would provide the background of the key parameters used in the calculations. Often this can be accomplished with a few sentences for each measure.

- **Key Finding #4:** Production data and other important operational metrics from industrial and manufacturing program participants have generally not been provided for SEM projects. Energy usage at manufacturing facilities is driven significantly by production-related factors. These may include pounds or widgets produced per day, amount of input material processed, or number of trucks loaded for warehouses.

  - **Recommendation:** Working with customers to obtain detailed operational metrics would significantly improve the programs ability to track and normalize expected savings. Additional data would also aid the savings validation completed during evaluation. Operational metrics should be at the daily or hourly level of granularity if possible to best integrate with available interval data. These data would allow AIC to establish detailed savings validation and assist in evaluation. Finally, meaningful operational metrics can be used along with interval data to speed up the feedback process for AIC and participants instead of waiting for 12 monthly data points to be available. The evaluation team will provide detailed feedback on desirable data and project checkpoints in the upcoming evaluation cycle.

- **Key Finding #5:** Several Staffing Grant interviewees reported facing challenges related to aligning their internal timeline needs with Staffing Grant program scheduling. These challenges included difficulty meeting program deadlines, the inability to reallocate Staffing Grant funds to complete other priority projects that were not pre-approved, and a mismatch between the participant's fiscal budgeting year and AIC's fiscal year.

  - **Recommendation:** Consider introducing more flexibility into the Staffing Grant program deadlines and project requirements so that the program can better meet participant schedule needs.

4.11 Commercial and Industrial Retro-Commissioning

The Retro-Commissioning (RCx) Program is one of three in AIC's C&I portfolio, which also includes the Custom and the Standard programs. The Retro-Commissioning Program helps AIC business customers evaluate their existing mechanical equipment, energy management, industrial refrigeration, and industrial compressed air systems to identify no-cost and low-cost efficiency measures to optimize energy systems. Customers contract with preapproved Retro-Commissioning Service Providers (RSPs) to perform an energy survey, resulting in a written report detailing the savings opportunities. Following verified implementation of measures with a payback of less than 12 months, AIC pays an incentive that covers 70%–80% of the energy survey cost, based on the project type. A further implementation incentive is paid to the customer based on the energy saved, and a bonus is paid to the RSP based on timely measure implementation and energy saved.

For PY9, the program had a net electric savings target of 9,076 MWh and a net gas savings target of 275,039 therms. The program achieved 9,187 MWh in ex post net electric savings and 231,827 therms in ex post net gas savings, meeting its electric target but falling somewhat short of its gas target.

A secondary goal of the Retro-Commissioning Program is the identification of retrofit and capital improvement projects that can be channeled to the Standard and Custom incentive programs offered by AIC. AIC offers an additional bonus to customers who complete a Custom project within a year of having completed a retro-commissioning study.

The PY9 evaluation includes gross impact results, a limited process assessment, and prospective net-to-gross (NTG) research. Our quantitative impact research included engineering reviews of a census of PY9 retro-commissioning projects plus on-site inspection and verification of measures for a sample of projects.

The process evaluation involved reviewing program materials and program-tracking data, interviewing program managers, and a participant survey including high-level process questions.

Below we present the key findings of the PY9 evaluation.

Program Impacts

Table 18 summarizes reported and verified program participation. A total of 21 projects yielding savings were completed in the PY9 program, a small increase from a total of 19 in PY8. Two projects saved both electricity and gas at a given site—both at healthcare facilities. Two other projects were gas-only. All other projects completed in PY9 were industrial customers saving only electricity.

Beyond the 21 projects yielding savings, six customers took steps to begin participation in the program with initial assessments to determine retro-commissioning feasibility; AIC paid the RSP a small incentive, referred to as a "stipend," for this task. Since stipend costs occurred in PY9, they will be included in program cost-benefit analysis, although there are no savings associated with these sites in PY9. The customers may choose to implement study-recommended measures in future program years. Finally, the program began one compressed air project at a facility that later suffered tornado damage that rendered the compressed air system inoperable; the program did not claim savings for this project.

Table 18. PY9 Retro-Commissioning Program Participation Summary

Program Component	Unique Projects[a]	Ex Ante Gross Electric Savings		Ex Ante Gross Gas Savings	
		MWh	%	Therms	%
Compressed Air	16	7,992	74%	0	—
Industrial Refrigeration	1	1,184	11%	0	—
Large Facility	4	1,634	15%	252,564	100%
Healthcare	*4*	*1,634*	*15%*	*252,564*	*100%*
Commercial	*0*	*0*	—	*0*	—
Grocery	0	0	—	0	—
Total	**21**	**10,741**	**—**	**252,564**	**—**

[a] This project count reflects projects with associated savings. As discussed above, seven projects listed in the AIC database as paid have no associated savings and are not incorporated in this table.

The evaluation team performed an engineering desk review of all 21 projects as well as on-site visits for eight projects to obtain gross realization rates for the program savings. The evaluation team modified the program ex ante gross savings for several reasons, although ultimately the gross realization rates were relatively high (94% for MWh savings, 92% for MW savings, and 101% for therm savings).

The evaluation team applied net-to-gross ratios (NTGRs) approved by the Illinois Stakeholder Advisory Group (SAG) to the gross savings estimates to calculate program net impacts. Table 19 summarizes PY9 gross and net impacts.

Table 19. PY9 Retro-Commissioning Program Gross and Net Impacts

	Ex Ante Gross	Realization Rate	Ex Post Gross	NTGR	Ex Post Net
Energy Savings (MWh)					
Total MWh	10,740	0.94	10,096	0.91	9,187
Demand Savings (MW)					
Total MW	1.04	0.92	0.95	0.91	0.87
Energy Savings (Therms)					
Total Therms	252,564	1.01	254,755	0.91	231,827

Key Findings and Recommendations

Based on our research, the evaluation team makes the following impact recommendations for the program:

- **Improve documentation of baseline conditions**. This recommendation applies mostly to commercial and healthcare building retro-commissioning. Over the past several years, documentation has improved, but several projects had gaps in baseline documentation. Calculation inputs should include notes for whether inputs are measured, based on design conditions, or assumed by the RSPs. Require more pre-implementation documentation of as-found conditions to confirm the baselines used in calculations, such as: screenshots of a week of operating data or a control schedule.

- **Use TRM or other standard defaults for assumed parameters.** Several projects include unreasonable assumptions for some operating parameters such as motor loading and efficiency. Encourage better accuracy with measured values or design inputs. When this information is not available, use TRM-sourced defaults and lastly conservative program-level assumptions.

- **Ensure demand savings reflect summer peak hour operation.** Several winter-saving measures claimed demand savings in error. Many optimizing control resets do not save during peak-load hours, but only make off-peak operation more efficient.

- **Continue to improve documentation of post-installation inspections.** Though inspection documentation is much improved from prior years, some gaps still exist. Document more measures with data or representational verification (photos, graphs, etc.). Clearly annotate which measures the verification is supposed to show. Some measures are hard to represent in this manner and some small measures may not merit large effort. A savings magnitude threshold (gross kWh or % of project savings) might be used to prioritize effort.

  - Frequently, the only verification for compressed air leak repairs is a hand-annotated list of leaks. If additional post-installation trend data are available for compressed air projects, they should be included in verification documentation.

  - Collect trend data from Building Automation Systems that demonstrate implementation.

  - Implement a stronger review regimen through the implementation contractor. Positively confirm operating hours, plant pressures, production pressures, and compressor part-load performance.

- **Continue to improve compressed air savings calculations.** Ensure use of marginal rather than average efficiency – especially for multi-compressor plants, avoid assuming year-round operation without any down-time, and accurately account for plant air pressure in savings estimates. Attention to these details will result in higher realization rates for the program.

- **Encourage implementation of more savings and measures in addition to leak repair.** For example, require implementation of bundled measures that meet a payback threshold — 12 months, for example — in order to receive the study subsidy incentive. All savings from PY9 sampled compressed air projects derive from leak repairs or pressure reduction. No other low-cost measures were implemented through the program. While the savings from leak repairs is significant and cost-effective, the RSPs should spend more effort investigating and encouraging implementation of other short-payback measures, including, for example, no-loss drains, elimination of inappropriate uses, storage, better staging of multiple compressors, and cycling driers. Compressed air retro-commissioning is more than leak repair.

Appendix A. PY9 Detailed Ex Post Savings Results

The following table provides detailed ex post savings results by program. We also provide an embedded Excel version following the table.

AIC PY9 Programs	Ex Ante Gross			Realization Rate	Verified Ex Post Gross			Deemed/ Used	Verified Ex Post Net					Actual	Evaluation Estimate (Where Available)	Participation		WAML
	First Year Annual Energy Savings	First Year Peak Demand Savings	Lifetime Savings	Energy Savings (Ex Ante Gross/Ex Post Gross)	First Year Annual Energy Savings	First Year Peak Demand Savings	Lifetime Savings	NTGR	First Year Annual Savings	First Year Peak Demand Savings	Lifetime Savings	First Year Cost per First Year Annual Savings	First Year Cost per Lifetime Savings	Program Costs	Net-to-Gross Ratio	# Units	Units Definition	Years
	MWh/Therms	MW	MWh/Therms	%	MWh/Therms	MW	MWh/Therms	%	MWh/Therms	MW	MWh/Therms	$/MWh or $/Therms	$/MWh or $/Therms	$	%			
Residential Programs																		
Residential Lighting (PY7)	N/A	N/A	N/A	N/A	13,587	1.67	N/A	47%	6,386	0.79	N/A	N/A	N/A	N/A	No research	N.A.	N.A.	N/A
Behavior Modification (Gas)	1,838,167	-	N/A	N/A	N/A	-	N/A	N/A	1,838,167	-	1,838,167	$ 0.58	$ 1	$ 1,071,351	N/A	308,905	Customers treated	1.0
ARP (Electric)	1,963	0.24	15,704	104%	2,047	0.25	16,376	54%	1,099	0.13	8,792	$ 311.53	$ 39	$ 342,369	No research	2,234	Participants	8.0
HVAC (Electric)	5,089	1.05	5,089	100%	5,070	1.02	5,070	78%	3,960	0.80	3,960	$ 603.02	$ 603	$ 2,387,954	No research	4,889	Participants	1.0
Multifamily (Electric)	4,476	N/A	34,053	103%	4,601	0.82	35,004	97%	4,444	0.79	33,810	$ 545.54	$ 72	$ 2,424,367	No research	669	Projects	7.6
Multifamily (Gas)	102,771	-	1,608,773	90%	92,833	-	1,453,204	90%	83,550	-	1,307,888	$ 8.49	$ 1	$ 709,571	No research	669	Projects	15.7
HES (Electric)	43	0.02	653	71%	30	0.02	465	100%	30	0.01	465	$ 9,599.61	$ 624	$ 290,388	No research	70	Participants	15.4
HES (Gas)	174,043	-	3,736,992	109%	189,395	-	4,066,625	86%	162,233	-	3,483,412	$ 0.50	$ 0	$ 81,179	No research	70	Participants	21.5
HEIQ (Electric)	2,815	0.97	32,553	121%	3,414	1.18	39,480	100%	3,414	1.18	39,480	$ 2,396.23	$ 207	$ 8,180,721	No research	1,443	Participants	11.6
HEIQ (Gas)	11,920	-	162,462	92%	10,997	-	149,882	76%	8,371	-	114,092	$ 336.74	$ 25	$ 2,818,813	No research	1,443	Participants	13.6
ES New Homes (Electric)	183	0.06	5,307	73%	133	0.05	3,857	100%	133	0.05	3,857	$ 1,377.47	$ 47	$ 183,204	No research	119	Homes	29.0
ES New Homes (Gas)	470,762	-	13,652,098	95%	446,506	-	12,948,674	100%	446,506	-	12,948,674	$ 0.17	$ 0	$ 77,965	No research	119	Homes	29.0
School Kits (Electric)	907	0.18	907	82%	741	0.12	741	100%	741	0.13	741	$ 167.45	$ 167	$ 124,078	No research	7,499	Kits	1.0
School Kits (Gas)	13,423	-	13,423	166%	22,321	-	22,321	101%	22,455	-	22,455	$ 6.17	$ 6	$ 138,560	No research	7,499	Kits	1.0
Business Programs																		
Standard (Electric)	124,499	18.66	1,348,447	100%	124,727	18.71	1,350,916	78%	97,497	14.65	1,055,988	$ 0.01	$ 15	$15,722,451	Instant Incentives: 0.916	6,128	Projects	10.8
Standard (Gas)	3,265,042	-	13,249,745	100%	3,264,361	-	13,246,981	61%	1,980,678	-	8,037,715	$ 1.39	$ 0	$ 1,422,129	No research	66	Projects	4.1
Custom (Electric)	107,139	13.30	1,314,000	88%	94,738	11.60	1,161,909	75%	70,803	8.70	868,359	$ 0.01	$ 9	$ 7,807,263	No research	128	Projects	12.3
Custom (Gas)	1,233,635	-	16,037,255	265%	3,264,361	-	42,436,693	61%	1,980,678	-	25,748,814	$ 1.19	$ 0	$ 1,663,887	No research	25	Projects	13.0
RCx (Electric)	10,740	1.04	53,700	94%	10,096	0.95	50,480	91%	9,187	0.87	45,935	$ 0.01	$ 16	$ 757,052	NTGR: 0.89	19	Projects	5.0
RCx (Gas)	252,564	-	1,262,820	520%	1,313,061	-	6,565,305	82%	1,078,717	-	5,393,585	$ 2.62	$ 0	$ 411,835	NTGR: 0.89	4	Projects	5.0

PY9 Detailed Ex Post Savings Results

Appendix B. PY9 High Impact Measure List

The following embedded Excel file provides detailed ex post gross savings results by IL-TRM measure category.

PY9 High Impact Measure List

Appendix C. PY9 Program Evaluation Reports

These reports are provided under separate covers and are available publicly at www.ilsag.info.

For more information, please contact:

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