IMPACT AND PROCESS EVALUATION OF 2011 (PY4) AMEREN ILLINOIS COMPANY RESIDENTIAL MULTIFAMILY PROGRAM

FINAL

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1. EXECUTIVE SUMMARY

Ameren Illinois Company (AIC) offers the Multifamily Program to owners and managers of residential properties with three or more units in its service territory. The program comprises three different components:

- The In-Unit Energy Efficiency Component, which offers free compact fluorescent light bulbs (CFLs), faucet aerators, and low-flow showerheads for in-unit installation, along with an informational brochure for residents.
- The Common Area Lighting Component, which provides rebates for lighting fixture upgrades, CFLs to replace incandescent bulbs, occupancy sensors, and exit sign replacements.
- The Major Measures Component, which offers incentives for air sealing, attic and wall insulation, HVAC measures, and programmable thermostats.

The Multifamily Program launched in November 2008, and is implemented by Conservation Services Group (CSG). This evaluation reviews the program's performance in Program Year 4 (PY4), which began in June 2011 and ended in May 2012. The expected savings from this program were 3% of the overall portfolio of electric savings and 2% of portfolio therm savings (including both residential and commercial).

To support the evaluation, we conducted in-depth interviews with program staff, a database review and analysis, and obtained gross and net impacts. The evaluation for PY4 is limited given budget constraints, as well as the small amount of total portfolio energy savings associated with the Multifamily Program. We plan to increase the level of rigor in PY5, which may include more closely examining the program's realization rates and updating the net-to-gross (NTG) ratio for the Major Measures Component.

Impact Results

We verified Multifamily Program participation in PY4 by reviewing the implementer's tracking database. Table 1 provides participation by program component using both the number of projects completed and multifamily customers. As shown in Table 1, there were 601 projects serving 184 customers in PY4.

Table 1. Summary of PY4 Program Participation by Component

Program Component	Number of Projects	Number of Customers
In-Unit Component	178	100
Common Area Lighting Component	12	11
Major Measures Component	411	73
Total	601	184

The evaluation team also verified program participation at the measure level. Realization rates of 100% were found for the In-Unit and Common Area Lighting components, while the Major

Measures Component had a realization rate of 103%.

As shown in Table 2, in total the program saved 7,385 MWh and 293,274 therms. The program exceeded goals (5,675 MWh and 74,457 therms) by 30% and 294%, respectively. This accomplishment is primarily due to higher than expected participation in the Major Measures component in PY4. Ex ante savings are those that were ultimately claimed by the Program at the end of PY4. Finally, ex post are those savings estimated by the evaluation team through a review of the program tracking database and application of fixed deemed savings values.

Table 2. PY4 Multifamily Program Net Impacts

Program Component	Ex Ante Net Impacts			Ex Post Net Impacts		
	MW	MWh	Therms	MW	MWh	Therms
In-Unit Component	0.2	3,436	40,658	0.4	3,608	44,164
Common Area Lighting Component	0.0	264	–	0.0	269	–
Major Measures Component	0.1	2,848	230,834	1.2	3,508	249,110
Total	0.3	6,548	271,492	1.5	7,385	293,274
Net Realization Rate				*5.00*	*1.13*	*1.08*

Aside from the higher than anticipated results of the Major Measures Component, other differences in Planned, Ex Ante and Ex Post savings values include the following:

- The implementer used lower per unit savings values than what was deemed for faucet aerators (both electrically heated and gas heated domestic water). This is because these values were revised after the start of PY4, and CSG's contract did not allow for the updated values to be applied retroactively in tracking its goals.

- Participation was lower than planned for the In-Unit and Common Area Lighting Components. CSG hypothesizes that the economy may have still had an effect on some property managers, hindering them from making additional building investments through the Common Area Lighting Component. Staff resources were stretched due to the unexpectedly high volume of Major Measures projects, which may have resulted in lower participation for the In-Unit Component.

- A lower NTG ratio was used for some Common Area Lighting projects than the deemed NTG value of 0.80.

- The implementer applied NTG ratios for the Major Measures Component from the AIC PY2 Home Energy Performance Report instead of updated NTG ratios from the PY3 Home Energy Performance Report. The NTG ratio for air sealing increased from 0.63 to 0.93, resulting in higher Ex-Post Net savings totals.

- The implementer claimed 675.2 kWh for programmable thermostats in electrically heated buildings, while the deemed savings values for PY4 are 2,720 kWh for buildings with electric resistance heat and 67 therms and 680 kWh for buildings with gas heat and central air conditioners. If programmable thermostats become a larger part of program savings, this may be an area of future research for the evaluation team.

Process Results

The evaluation team reviewed program materials and conducted in-depth interviews with the AIC Multifamily Program Manager and the CSG Multifamily Program Manager in June and July of 2012 (n=2). The in-depth interviews explored several areas, including the following: program goals and objectives, program design and implementation, marketing and outreach, program tracking, involvement of trade allies, changes in PY4, and expected changes in PY5.

One key change from PY3 was the addition of the Major Measures component, which includes incentives for air sealing, attic and wall insulation, HVAC measures, and programmable thermostats. This component experienced high participation rates, and drove much of the program savings for PY4.

Key Recommendations

Key recommendations for the program include the following:

- **While there are eight participating trade allies, the program is primarily dependent on one trade ally for the Major Measures Component.** This creates a certain amount of risk if this trade ally were no longer able to work with the program. AIC and CSG may want to develop a strategy to engage and enlist new trade allies to participate in the program, or alternatively, reach out to other currently participating trade allies to determine how the program could assist them in bringing in more projects. Training may be necessary so that potential trade allies have the necessary skills to install insulation and air sealing in multifamily buildings.

- **Total project costs for Major Measures projects should be collected, tracked, and monitored.** This information would allow the evaluation team to pursue future research questions such as: How much of the project cost does the incentive amount cover? Would property owners be willing to initiate a project with a lower incentive?

- **Participation across program components was low, with only seven unique customers participating in multiple program components in PY4.** While cross participation may be higher across program years (perhaps an area of future research), CSG could consider strategies to market across the program components, such as returning to past customers and making them aware of other program offerings.

- **If programmable thermostats are offered at no cost through the program, AIC and CSG should ensure that adequate tenant education is offered,** as this is an area where other utility programs have struggled. Tenant dissatisfaction could result if they do not know how to set the thermostat and change settings if necessary, resulting in unrealized energy savings. Several options may be considered to educate tenants, including:

  - Providing each tenant unit with a one-page handout that gives the customer basic instructions for the most common settings and preferred temperature settings for optimal energy efficiency

  - Using the customer call center to answer tenant questions on how to set their thermostat or make changes. As an added step, a sticker with the customer call center phone number could be affixed to the thermostat itself.

  - Training property managers and owners on thermostat settings so they can answer

tenants' questions

- Setting up temporary displays in common areas with educational and instructional materials
- Depending on the area being served, information may need to be provided in multiple languages

2. INTRODUCTION

This report presents results from the PY4 evaluation of the AIC Residential Multifamily Program. The Multifamily Program launched in November 2008, and is implemented by CSG. This evaluation reviews the program's performance in Program Year 4 (PY4), which began in June 2011 and ended in May 2012. To support the evaluation, we conducted research including a review of program materials and program tracking data, and interviews with program managers and implementation staff.

Program Description

AIC offers the Multifamily Program to owners or managers of residential properties with three or more units in its service territory. The program comprises three different components, including the following:

- The In-Unit Energy Efficiency Component, which offers free CFLs, faucet aerators, and low-flow showerheads for in-unit installation, along with an informational brochure for residents.
- The Common Area Lighting Component, which provides incentives for lighting fixture upgrades, CFLs to replace incandescent bulbs, occupancy sensors, and exit sign replacements.
- The Major Measures Component, which offers incentives for air sealing, attic and wall insulation, HVAC measures, and programmable thermostats.

3. EVALUATION METHODS

3.1 DATA SOURCES AND ANALYTICAL METHODS

The assessment of the fourth year of the Multifamily Program included both process and impact analyses. The table below summarizes the activities performed by the evaluation team in support of the PY4 evaluation.

Table 3. Summary of Evaluation Methods

Task	PY4 Impact	PY4 Process	Forward Looking	Details
Program Staff In-Depth Interviews		√		Telephone interviews with Ameren and CSG program managers (n=2).
Database Review and Analysis	√			Review database for errors and quality. Obtain verified participation values.
Obtain Gross and Net Impacts	√			Apply deemed savings values and deemed net-to-gross ratios from previous years to verified participation numbers.

The PY4 evaluation does not include any forward-looking tasks that feed into establishing or updating deemed savings values or net-to-gross ratios. However, tasks are planned in PY5 and PY6 to update these values as needed, and include on-site audits, property manager surveys, and secondary research.

3.1.1 PROCESS ANALYSIS

The evaluation team reviewed program materials and performed in-depth interviews with both AIC and CSG program managers in June and July of 2012 (n=2). Topics included program goals and objectives, marketing and outreach, trade allies, design changes that were made for PY4, and how recommendations from previous evaluations were addressed. Discussions also included upcoming program changes in PY5.

3.1.2 IMPACT ANALYSIS

The impact analysis for PY4 is limited given budget constraints and the small amount of total portfolio energy savings assumed to come from the Multifamily Program. Work completed in previous evaluations was used to determine gross and net impacts. We plan to increase the level of rigor in PY5, more closely examining the program's realization rates and updating some net-to-gross ratios.

Gross Impacts

The evaluation team reviewed the program's tracking database for errors and data quality to determine gross impacts. Then, we determined the verified participant number for each measure. For the In-Unit Component, we applied deemed savings values from PY1, PY2, and PY3 to the number of verified measures. Table 4 below shows the deemed savings values for the in-unit direct installation measures. As all estimates of savings are based on a census of the program database

and deemed savings values or algorithms, no confidence intervals are presented.

Table 4. Multifamily In-Unit Deemed Savings Values

Measure	Deemed Savings		Source
	KWh	Therms	
15 watt CFL	38.4	-	Cadmus 8/1/2011 memo
20 watt CFL	47.0	-	
23 watt CFL	65.8	-	
Faucet Aerator – Electric DHW	71.1	-	Cadmus 9/12/2011 memo
Faucet Aerator – Gas DHW	-	3.2	
Showerhead 2.0 GPM – Electric DHW	398.4	-	
Showerhead 2.0 GPM – Gas DHW	-	17.7	

The measures installed within the Common Area Lighting component had deemed values for occupancy sensors and input values for all other measures. We applied the following algorithm to calculate gross impacts for the Common Area Lighting component:

Annual kWh Savings = (kWexisting – kWnew) x Annual Operating Hours x Quantity Installed

The program database includes input values for each common area measure installed, and savings numbers were recalculated using the above algorithm. This algorithm applies to all common area measures except for occupancy sensors, which receive a deemed savings value of 210 kWh per unit installed[1].

We also applied deemed savings values to calculate gross savings for Major Measures. Air sealing savings values are on a cubic feet per minute at 50 pascals (CFM 50) basis. First, we calculated the difference in pre and post CFM values using application information provided in the multifamily database. We then applied the deemed savings value to this difference for each project. For attic and wall insulation, we applied deemed savings values to the number of square feet indicated for a particular property in the application.

[1] Reviewed by Cadmus in 2010.

Table 5. Multifamily Major Measures Deemed Savings Values

Measure	Deemed Savings		Units	Source
	KWh	Therms		
Air Sealing – Electric Resistance Heat	2.23		CFM50	Converted Cadmus Savings/SF to CFM50 per 8/1/2011 memo
Air Sealing – Electric Heat Pump	0.85			
Air Sealing – Electric CAC only	0.05			
Air Sealing – Gas Heat		0.19		
Attic Insulation (R-11 to R-38) – Electric Resistance Heat	1.23		Square Feet	Converted Cadmus Savings/SF to CFM50 per 8/1/2011 memo
Attic Insulation (R-11 to R-38) – Electric Heat Pump	0.52			
Attic Insulation (R-11 to R-38) – Electric CAC only	0.22			
Attic Insulation (R-11 to R-38) – Gas Heat		0.09		
Attic Insulation (R-19 to R-49) – Electric Resistance Heat	0.62			
Attic Insulation (R-19 to R-49) – Electric Heat Pump	0.26			
Attic Insulation (R-19 to R-49) – Electric CAC only	0.11			
Attic Insulation (R-19 to R-49) – Gas Heat		0.04		
Wall Insulation – Electric Resistance Heat	2.51			
Wall Insulation – Electric Heat Pump	0.97			
Wall Insulation – Electric CAC Only	0.17			
Wall Insulation – Gas Heat		0.18		
Programmable Thermostat – Electric Heat	2,720		Thermostat	Cadmus 8/1/11 memo
Programmable Thermostat – Electric CAC Only	680		Thermostat	Cadmus 8/1/11 memo
Programmable Thermostat – Gas Heat		67	Thermostat	Cadmus 3/8/11 Home Energy Performance memo

Peak Demand savings for In-Unit and Common Area Lighting measures were calculated according to algorithms and inputs provided in the State of Illinois Energy Efficiency Technical Reference Manual (TRM).[2]

The following algorithms were applied to calculate low-flow showerhead and faucet aerator demand savings for the In-Unit Component:

[2] The State of Illinois Energy Efficiency Technical Reference Manual became effective on June 1, 2012.

*Annual kW savings = (Annual kWh savings / Hours of Use) * Coincidence Factor (CF)*[3]

Additionally, the algorithm below was used to calculate demand savings for In-Unit CFLs:

Annual kW savings = ((WattsBase – WattsEE)/1000) x In-service Rate x Waste Heat Factor for Demand (WHFd) x CF[4]

For Common Area Lighting, the following algorithm from the TRM was applied to calculate annual demand savings:

*Annual kW savings = ((WattsBase - WattsEE) / 1000) * In-service Rate * WHFd * CF*[5]

The TRM also included demand savings algorithms for single-family and multifamily shell measures. However, the algorithm called for certain input values that the evaluation team did not have access to, such as age or Seasonal Energy Efficiency Ratio (SEER) value of the cooling system. For this reason, the evaluation team calculated Major Measure demand savings by multiplying electric energy savings by the appropriate end-use coincidence factor used in the PY2 report of the Home Performance Program for shell measures. The coincidence factors were calculated from hourly end-use load shapes, which were developed from engineering models for the Midwestern region of the United States and then calibrated to long-term weather conditions in AIC's service territory.

Demand savings for programmable thermostats in the TRM were assumed to be zero due to inconclusive evaluation results thus far. Therefore, we did not calculate demand savings for this measure. However, the TRM notes that EPA's ENERGY STAR® program is developing a new specification for this product category, and if evaluation results demonstrate more consistent cooling savings, this assumption will be revisited.

[3] The evaluation team used the following input values from the TRM: Hours of Use = 162 for faucet aerators and 354 for showerheads, CF = 2.2% for faucet aerators and 2.78% for showerheads. Deemed savings values were used for annual kWh savings.

[4] The evaluation team used the following input values from the TRM: In-service Rate for CFL Direct Install Programs = 0.969, WHFd = 1.07, CF = 9.5%. For baseline wattage, assumed that a 60 watt bulb was replaced by a 15 watt CFL, a 75 watt bulb was replaced by a 20 watt CFL, and a 100 watt bulb was replaced by a 23 watt CFL.

[5] The evaluation team used the following input values from the TRM: In-service Rate = 1.0, WHFd = 1.07, CF = 100% for LED exit signs and 75% for other Common Area Lighting. For baseline and energy efficient wattage, we used values from the implementer's database.

Net Impacts

We calculated net impacts in PY4 using NTG ratios established in PY2 and PY3.

Net-to-Gross Ratio

An NTG ratio of 1.0 is applied for the In-Unit component, as these measures are provided free-of-charge. An NTG ratio of 0.8 is used for common area measures, which was estimated by The Cadmus Group through a survey of building owners and managers in PY2.

We applied the following NTG ratios for the Major Measures component. Due to budget limitations in PY4, we apply NTG ratios established for the Home Energy Performance program in PY3 to building shell measures under the Major Measures component.

Table 6. Major Measures Component Net-to-Gross Values and Sources

Measure	Net-to-Gross Ratio	Source
Air Sealing	1.00	AIC PY3 Home Energy Performance Report
Attic Insulation	0.93	
Wall Insulation	0.93	
Programmable Thermostat	0.87	

4. RESULTS AND FINDINGS

4.1 PROGRAM INSIGHTS

In PY4, the Multifamily Program achieved estimated gross savings of 7,609 MWh and 299,191 therms and net savings of 7,385 MWh and 293,274 therms. Program goals were exceeded by 30% and 294%, respectively. This success is primarily due to the addition of the Major Measures Component in PY4, which offers incentives for building shell measures and programmable thermostats.

4.2 PROCESS FINDINGS

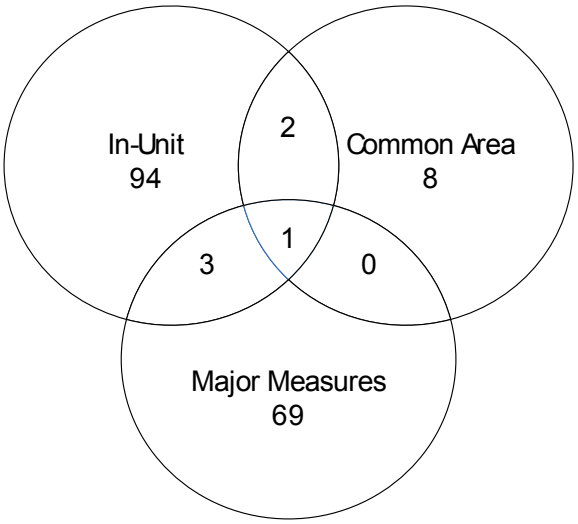
Our team reviewed program materials and performed in-depth interviews with both Ameren and CSG program managers in June and July of 2012 (n=2). Topics included program goals and objectives, marketing and outreach, participating trade allies, program design changes, and how recommendations from previous evaluations were addressed. Upcoming program changes in PY5 were also discussed.

In PY4, a significant change was the addition of the Major Measures component. This program component offers incentives for air sealing, attic insulation, wall insulation, and programmable thermostats. Program participation far exceeded expectations, resulting in the program exceeding its MWh goal by 30% and its therm goal by 294%. This is primarily the result of one trade ally, which completed 91% of all Major Measure projects. A discussion of trade ally involvement is included in the section below. Additionally, CSG noted that the incentives offered for air sealing and insulation typically covered the majority of project costs. This, combined with a motivated trade ally, likely drove much of the activity under this program in PY4.

The program also offered incentives for natural gas furnaces and boilers under the Major Measures Component, but none of these measures were installed through the program. The implementer indicates that this may be because multifamily furnaces and boilers are typically replaced on failure, and it is not cost-effective to the property manager/owner to replace heating and cooling equipment early. In PY5, heating equipment will not be offered, and customers will be referred to other Ameren programs as needed.

The evaluation team identified the number of unique multifamily customers participating in the program in a review of the program's database. We also explored cross-participation in multiple multifamily components during the year by looking for the same customer name in the other components of the program databases. Figure 1 shows that cross participation was low, with only six customers participating in multiple multifamily components during PY4. In future years, it may be useful to explore cross-participation by customer and by building site since the beginning of the program, as many property owners and managers may participate across program years as equipment needs arise or as they become more familiar with the program's offerings. Additionally, many customers operate multifamily buildings in multiple locations.

Figure 1. Summary of Multifamily Program Cross-Participation



The implementation team is considering several program changes for PY5. Additional measures may be offered at no cost, including programmable thermostats, exit signs, and occupancy sensors. Pre-approval of projects will be required for the Major Measures component because the PY4 Program experienced very high participation, making it difficult at times to manage the level of production and quality assurance and control activities. Full-scale quality assurance efforts will also be deployed mid-year in PY5 for the Major Measures component. A few more staff will be added to assist in quality assurance efforts which will allow account managers more time to concentrate on higher-level tasks, such as contractor engagement.

As part of the process review, the evaluation team also assessed the program database for geographic spread of where multifamily project sites are located. The majority of buildings are located in central and southern Illinois. Over 60% of project sites were in six cities, including Champaign, Peoria, Urbana, Belleville, Decatur, and Carbondale. The remaining building sites are spread out over 90 other cities across the state.

Table 7. Geographic Distribution of Multifamily Project Sites by Program Component

City	In-Unit	Major Measures	Common Area Lighting	Total	Percent of Total
Champaign	23	110	3	136	22.6%
Peoria	15	59	1	75	12.5%
Urbana	9	57	0	66	11.0%
Decatur	8	55	0	63	10.5%
Carbondale	21	0	0	21	3.5%
Belleville	15	0	1	16	2.7%
Remaining Cities[a]	87	130	7	224	37.2%
Total Project Sites	178	411	12	601	100%

[a] Includes cities with fewer than 2.0% of total building sites.

4.2.1 MARKETING AND OUTREACH

Program marketing and outreach in PY4 was similar to PY3. Most outreach consisted of calls by account managers to property owners or managers, and walk-through audits or on-site visits to discuss program offerings and identify potential audit recommendations.

For the Major Measures component, considerable outreach to multifamily properties was performed by one trade ally. In PY4, four to five of this trade ally's sales representatives were deployed throughout central Illinois, resulting in much higher than expected program production.

Table 8. Major Measures Component Trade Allies

Trade Ally	Number of Major Measure Projects	Percentage of Projects
Trade Ally 1	374	91.0%
Trade Ally 2	13	3.2%
Trade Ally 3	10	2.4%
Trade Ally 4	6	1.5%
Participant Installed[6]	3	0.7%
Trade Ally 5	2	0.5%
Trade Ally 6	1	0.2%
Trade Ally 7	1	0.2%
Trade Ally 8	1	0.2%
Total	**411**	**100.0%**

[6] These three projects only installed programmable thermostats.

In contrast, trade allies are typically not employed by building managers for the In-Unit or Common Area Lighting Components. CSG states that electrical contractors were engaged by CSG at its beginning, but now these contractors are not very active. Instead, lighting upgrades are typically performed by building maintenance staff. CSG notes that this is primarily because if a project consists of just changing bulbs or fixtures and no rewiring is involved, an electrician is not required by state law.

4.3 IMPACT RESULTS

The following sections provide participant and measure verification rates and gross and net impacts for the Multifamily Program in PY4.

4.3.1 PARTICIPANT VERIFICATION/INSTALLATION RATE

The evaluation team verified participants and installation rates in PY4 by performing a review of the program's tracking database to check for errors and data quality. The number of participating customers by program component and number of projects by program component appears in the table below. As shown, a customer may participate in multiple projects during the year.

Table 9. Summary of Program Participation

Component	Number of Projects	Number of Customers by Component
In-Unit Component	178	100
Common Area Lighting	12	11
Major Measures Component	411	73
Total	**601**	**184**

Table 10 shows participation by measure type within the three program components. The In-Unit and Common Area Lighting Components had realization rates of 100%, while the Major Measures Component had a realization rate of 103%.

Table 10. Summary of Installed Measures

Measure	Number of Measures Reported	Number of Verified Measures	Verification Rate[a]
In-Unit Component			
15 watt CFL	43,651	43,651	100.0%
20 watt CFL	3,574	3,574	100.0%
23 watt CFL	152	152	100.0%
Faucet Aerator – Electric DHW	5039	5,039	100.0%
Faucet Aerator – Gas DHW	2191	2,191	100.0%
Showerhead 2.0 GPM – Electric DHW	3502	3,502	100.0%
Showerhead 2.0 GPM – Gas DHW	2099	2,099	100.0%
In-Unit Subtotal	***60,208***	***60,208***	***100.0%***

Measure	Number of Measures Reported	Number of Verified Measures	Verification Rate[a]
Common Area Lighting Component			
4-foot T8 (32w lamp with electronic ballast)	260	260	100.0%
Integral CFL (>13 watt screw-in)	859	859	100.0%
LED exit sign	111	111	100.0%
Modular CFL (<=18 watts, pin based electronic ballast fixture)	52	52	100.0%
Occupancy Sensor	18	18	100.0%
Common Area Lighting Subtotal	***1300***	***1300***	***100.0%***
Major Measures Component			
Air Sealing – Electric Heat		157	
Air Sealing – Heat Pump	199	36	97.0%
Air Sealing – Electric CAC only	133	132	99.3%
Air Sealing – Gas Heat	203	204	100.5%
Attic Insulation (R-11 to R-38) – Electric Heat		150	
Attic Insulation (R-11 to R-38) – Heat Pump	192	35	96.4%
Attic Insulation (R-11 to R-38) – Electric CAC only	133	132	99.3%
Attic Insulation (R-11 to R-38) – Gas Heat	213	213	100.0%
Attic Insulation (R-19 to R-49) – Electric Heat	7	7	100.0%
Attic Insulation (R-19 to R-49) – Gas Heat	0	1	100.0%
Wall Insulation – Electric Heat		1	
Wall Insulation – Heat Pump	4	1	50.0%
Wall Insulation – Electric CAC Only	1	1	100.0%
Wall Insulation – Gas Heat	3	4	133.3%
Programmable Thermostat – Electric Heat	214	214	100.0%
Programmable Thermostat – Electric CAC Only	0	55	100.0%
Programmable Thermostat – Gas Heat	55	55	100.0%
Major Measures Subtotal	***1357***	***1398***	***103.0%***
Total	**62,865**	**62,906**	**100.1%**

[a] The verification rate represents the percentage of measures verified (measures verified / measures reported).

4.3.2 GROSS IMPACTS

The evaluation team applied deemed savings values to the verified number of measures to determine verified gross savings values. As shown in Table 11, overall the program saved 7,609 MWh and 299,191 therms.

Table 11. Gross Impacts by Component

Component	Ex Ante Gross Impacts			Ex Post Gross Impacts[a]		
	MW	MWh	Therms	MW	MWh	Therms
In-Unit Component	0.2	3,436	40,658	0.4	3,608	44,164
Common Area Lighting Component	0.0	336	–	0.0	336	–
Major Measures Component	0.1	3,203	253,675	1.2	3,666	255,028
Total	0.3	6,975	294,333	1.6	7,609	299,191

[a] Ex post gross impacts are based on the application of deemed fixed savings values to verified participation numbers.

Demand savings are also provided in the impact analysis, although the program did not have any demand goals. In some cases, ex ante demand values varied significantly from ex post demand values, as the program did not track demand savings for every measure and values tracked did not always match values calculated using the TRM or, in the case of Major Measures, PY2 coincidence factors.

The following tables detail gross impacts by measure for the In-Unit Component, the Common Area Lighting Component, and the Major Measures Component. The evaluation team calculated In-Unit Component electric savings of 3,607,648 kWh, while CSG tracked gross savings of 3,435,818, as shown in Table 12 below. This difference can be explained by the per unit savings values used for faucet aerators. The implementer used 37 kWh per faucet aerator to calculate electric savings, while the deemed value for PY4 is 71.1 kWh.

Table 12. In-Unit Electric Component Gross Impacts

Measure	Faucet Aerator	Showerhead 2.0 GPM	15 watt CFL	20 watt CFL	23 watt CFL	Total
Reported Participation	5,039	3,502	43,651	3,574	152	55,918
Verified Participation	5,039	3,502	43,651	3,574	152	55,918
Reported kWh per Unit	37.0	398.4	38.4	47.0	65.8	-
Reported kW per Unit	0.0160	0.0480	0.0000	0.0000	0.0000	-
Deemed KWh per Unit	71.1	398.4	38.4	47.0	65.8	-
Deemed kW per Unit	0.0097	0.0313	0.0032	0.0039	0.0054	-
Ex Ante Gross kWh	**186,443**	**1,395,197**	**1,676,198**	**167,978**	**10,002**	**3,435,818**
Ex Ante Gross KW	**80.6**	**168.1**	**0.0**	**0.0**	**0.0**	**248.7**
Ex Post Gross kWh	**358,273**	**1,395,197**	**1,676,198**	**167,978**	**10,002**	**3,607,648**
Ex Post Gross KW	**48.7**	**109.6**	**193.5**	**19.4**	**1.2**	**372.2**

Note: Ex post gross impacts are based on the application of deemed fixed savings values to verified participation

numbers.

Gas savings for the In-Unit Component totaled 44,164 therms. This is higher than the CSG-tracked savings of 40,164 therms. The difference can be explained by the per unit savings values used for faucet aerators. CSG used 1.6 therms per aerator, while the deemed value for PY4 is 3.2 therms per aerator.

Table 13. In-Unit Gas Component Gross Impacts

Measure	Faucet Aerator	Showerhead 2.0 GPM	Total
Reported Participation	2,191	2,099	4,290
Verified Participation	2,191	2,099	4,290
Reported Therms per Unit	1.60	17.70	
Deemed Therms per Unit	3.20	17.70	
Ex Ante Gross Therms	**3,506**	**37,152**	**40,658**
Ex Post Gross Therms	**7,011**	**37,152**	**44,164**

Note: Ex post gross impacts are based on the application of deemed fixed savings values to verified participation numbers.

The evaluation team calculated savings of 335,967 kWh for the Common Area Lighting Component, which is equal to tracked program savings.

Table 14. Common Area Lighting Component Gross Impacts

Measure	4-foot T8 (32w lamp with electronic ballast)	LED exit sign	Integral CFL (>13 watt screw-in)	Modular CFL (<=18 watts, pin based electronic ballast fixture)	Occupancy Sensor	Total
Reported Participation	260	111	859	52	18	1,300
Verified Participation	260	111	859	52	18	1,300
Ex Ante Gross kWh	**33,685**	**20,735**	**267,062**	**10,705**	**3,780**	**335,967**
Ex Ante Gross kW	**0.00**	**0.00**	**0.00**	**0.00**	**0.54**	**0.54**
Ex Post Gross kWh	**33,685**	**20,735**	**267,062**	**10,705**	**3,780**	**335,967**
Ex Post Gross kW	**0.21**	**0.16**	**0.48**	**0.04**	**0.0**	**0.89**

Note: Ex post gross impacts are based on the application of deemed fixed savings values to verified participation numbers.

The program tracking database reported gross savings of 3.2 million kWh for the Major Measures Component, while the evaluation team calculated a savings of 3.7 million kWh. This is primarily due to differing per unit savings values for programmable thermostats. CSG claimed 675.2 kWh for programmable thermostats in electrically heated buildings, while the deemed savings values for PY4 are 2,720 kWh for buildings with electric resistance heat and 680 kWh for buildings with gas heat and central air conditioners. If programmable thermostats become a larger part of the

program in future years, this may be an area of future evaluation research.

Ex ante and ex post demand savings varied considerably, as shown in Table 15. In most cases, the deemed value calculated using coincidence factors from prior program years was much higher than the value used in the program database. As noted previously, the program did not have demand goals.

Table 15. Major Measures Electric Component Gross Impacts

Measure[a]	Reported Participation[b]	Verified Participation	Reported kWh per Unit	Deemed KWh per Unit	Reported kW per Unit	Deemed kW per Unit	Ex Ante Gross		Ex Post Gross	
							kWh	KW	kWh	KW
Air Sealing – Electric Heat		157	2.23	2.23	0.00004	0.0013	1,931,399	31.0	1,931,399	779.5
Air Sealing - Heat Pump	199	36	0.85	0.85	0.00004	0.0005	178,744	7.6	178,744	72.1
Air Sealing – Electric CAC only	133	132	0.05	0.05	0.00004	0.0000	29,794	22.0	29,795	12.0
Attic Insulation (R-11 to R-38) – Electric Heat		150	1.24	1.23	0.00001	0.0005	734,927	6.7	694,117	280.1
Attic Insulation (R-11 to R-38) – Heat Pump	192	35	0.52	0.52	0.00001	0.0002	97,937	2.2	94,132	38.0
Attic Insulation (R-11 to R-38) – Electric CAC only	133	132	0.22	0.22	0.00001	0.0001	82,815	4.5	83,288	33.6
Attic Insulation (R-19 to R-49) – Electric Heat	7	7	0.62	0.62	0.00001	0.0003	0	0.0	33,338	13.5
Wall Insulation – Electric Heat		1	2.51	2.51	0.00002	0.0010	2,058	0.0	652.6	0.3
Wall Insulation – Heat Pump	4	1	0.97	0.97	0.00002	0.0004	485	0.0	485	0.2
Wall Insulation – Electric CAC Only	1	1	0.17	0.17	0.00002	0.0001	300	0.0	299.9	0.1
Programmable Thermostat – Electric Heat	214	214	675.2	2,720	0.00000	0.0000	144,493	0.0	582,080	0.0
Programmable Thermostat – Electric CAC Only	0	55	0	680	0.00000	0.0000	0	0.0	37,400	0.0
Total	883	921					3,202,951	74.1	3,665,730	1,229.4

Note: Ex post gross impacts are based on the application of deemed fixed savings values to verified participation numbers.

[a] For air sealing, savings are on a per cubic feet per minute at 50 pascals (CFM 50) basis. Insulation savings are on a per square foot basis.

[b] Installed measures as reported by the program implementer in the following file: "MF Data Request_PY4_Tables.xlsx".

Other differences between ex ante and ex post gross savings include slight differences in per unit savings claimed in the tracking database and deemed savings values. For example, for attic insulation, the tracking database uses a per unit value of 1.24 kWh for buildings heated with electric resistance, while the deemed savings value is 1.23 kWh per unit. In other areas, participation rates found in the database were different from reported values.

The Major Measures Component also saved a total of 255,028 therms in PY4, which is higher than the CSG reported value of 253,675 therms, as shown in Table 16. This is due to differences in per unit savings claimed for programmable thermostats and reported versus verified participation values.

Table 16. Major Measures Gas Component Gross Impacts

Measure	Reported Participation	Verified Participation	Reported Therms per Unit	Deemed Therms per Unit	Ex Ante Gross Therms	Ex Post Gross Therms
Air Sealing – Gas Heat	203	204	0.19	0.19	189,838	189,844
Attic Insulation (R-11 to R-38) – Gas Heat	213	213	0.09	0.09	59,447	59,586
Attic Insulation (R-19 to R-49) – Gas Heat	0	1	0.04	0.04	0	441
Wall Insulation – Gas Heat	3	4	0.18	0.18	1,148	1,472
Programmable Thermostat – Gas Heat	55	55	58.96	67	3,243	3,685
Total	**474**	**477**			**253,675**	**255,028**

Note: Ex post gross impacts are based on the application of deemed fixed savings values to verified participation numbers.

4.3.3 NET IMPACTS

The program overall achieved net impacts of 7,385 MWh and 293274 therms, as shown below in Table 17. The ex ante net savings of 6,548 MWh and 271,492 therms.

Table 17. Multifamily Net Impacts by Program Component

Component	Ex Ante Net Impacts			Ex Post Net Impacts		
	MW	MWh	Therms	MW	MWh	Therms
In-Unit Component	0.2	3,436	40,658	0.4	3,608	44,164
Common Area Lighting Component	0.0	264	0.0	0.0	269	0.0
Major Measures Component	0.1	2,848	230,834	1.2	3,508	249,110
Total	0.3	6,548	271,492	1.6	7,126	293,274

The evaluation team calculated net impacts of 3,607,648 kWh for the In-Unit Component, with a realization rate of 105%.

Table 18. Multifamily In-Unit Electric Component Net Impacts

Measure	Faucet Aerator	Showerhead 2.0 GPM	15 watt CFL	20 watt CFL	23 watt CFL	Total
Ex Ante Gross kWh	186,443	1,395,197	1,676,198	167,978	10,002	3,435,818
Ex Ante Gross kW	80.6	168.1	0.0	0.0	0.0	248.7
Ex Post Gross kWh	358,273	1,395,197	1,676,198	167,978	10,002	3,607,648
Ex Post Gross kW	48.7	109.6	193.5	19.4	1.2	372.2
Ex Ante NTG	1.0	1.0	1.0	1.0	1.0	
Ex Post NTG	1.0	1.0	1.0	1.0	1.0	
Ex Ante Net kWh	**186,443**	**1,395,197**	**1,676,198**	**167,978**	**10,002**	**3,435,818**
Ex Ante Net kW	**80.6**	**168.1**	**0.0**	**0.0**	**0.0**	**248.7**
Ex Post Net kWh	**358,273**	**1,395,197**	**1,676,198**	**167,978**	**10,002**	**3,607,648**
Ex Post Net kW	**48.7**	**109.6**	**193.5**	**19.4**	**1.2**	**372.2**
Realization Rate kWh	**192%**	**100%**	**100%**	**100%**	**100%**	**105%**
Realization Rate kW	**60%**	**65%**	-	-	-	**150%**

Note: Realization Rate = Ex Post Net Value / Ex Ante Net Value

The In-Unit Component also achieved a realization rate of 109% for gas measures, resulting in net therm savings of 44,164.

Table 19. Multifamily In-Unit Gas Component Net Impacts

Measure	Faucet Aerator	Showerhead 2.0 GPM	Total
Ex Ante Gross therms	3,506	37,152	40,658
Ex Post Gross therms	7,011	37,152	44,164
Ex Ante NTG	1.0	1.0	1.0
Ex Post NTG	1.0	1.0	1.0
Ex Ante Net therms	**3,506**	**37,152**	**40,658**
Ex Post Net therms	**7,011**	**37,152**	**44,164**
Realization Rate	**200%**	**100%**	**109%**

Note: Realization Rate = Ex Post Net Value / Ex Ante Net Value

For the Common Area Lighting Component, the evaluation team calculated a realization rate of 102%, with net kWh savings of 268,773. We found that different net-to-gross ratios were used for some projects in the tracking database than the deemed net-to-gross ratios.

Table 20. Multifamily Common Area Lighting Component Net Impacts

Measure	4-foot T8 (32w lamp with electronic ballast)	LED exit sign	Integral CFL (>13 watt screw-in)	Modular CFL (<=18 watts, pin based electronic ballast fixture)	Occupancy Sensor	Total
Ex Ante Gross kWh	33,685	20,735	267,062	10,705	3,780	335,967
Ex Ante Gross kW	0.0	0.0	0.0	0.0	0.5	0.5
Ex Post Gross kWh	33,685	20,735	267,062	10,705	3,780	335,967
Ex Post Gross kW	0.2	0.2	0.5	0.0	0.0	0.9
Ex Ante NTG	0.8	0.79	0.78	0.76	0.8	
Ex Post NTG	0.8	0.8	0.8	0.8	0.8	
Ex Ante Net kWh	**26,840**	**16,437**	**209,215**	**8,136**	**3,024**	**263,651**
Ex Ante Net kW	**0.0**	**0.0**	**0.0**	**0.0**	**0.4**	**0.4**
Ex Post Net kWh	**26,948**	**16,588**	**213,649**	**8,564**	**3,024**	**268,773**
Ex Post Net kW	**4.3**	**0.1**	**34.2**	**1.4**	**0.5**	**40.5**
Realization Rate kWh	**100%**	**101%**	**102%**	**105%**	**100%**	**102%**
Realization Rate kW	-	-	-	-	-	**165.1%**

Note: Realization Rate = Ex Post Net Value / Ex Ante Net Value

As shown in Table 21, the Major Measures Component saw a net impact of 3.5 million kWh and a realization rate of 123%. Ex ante and ex post demand savings are quite different. As noted previously, the evaluation team calculated demand savings for multifamily shell measures by multiplying energy savings by coincidence factors established in PY2 for HEP shell measures.

Table 21. Multifamily Major Measures Electric Component Net Impacts

Measure	Ex Ante Gross		Ex Post Gross		Ex Ante NTG	Ex Post NTG	Ex Ante Net		Ex Post Net		Net Realization Rate	
	kWh	kW	kWh	kW			kWh	kW	kWh	kW	kWh	kW
Air Sealing – Electric Heat	1,931,399	31.0	1,931,399	779.5	1.00	1.00	1,931,399	31.0	1,921,742	775.6	100%	2,504%
Air Sealing - Heat Pump	178,744	7.6	178,744	72.1	1.00	1.00	178,744	7.6	177,850	71.8	100%	941%
Air Sealing – Electric CAC only	29,794	22.0	29,795	12.0	1.00	1.00	29,794	22.0	29,646	12.0	100%	54%
Attic Insulation (R-11 to R-38) – Electric Heat	734,927	6.7	694,117	280.1	0.63	0.93	462,708	4.2	643,447	259.7	139%	6,150%
Attic Insulation (R-11 to R-38) – Heat Pump	97,937	2.2	94,132	38.0	0.63	0.93	61,917	1.4	87,260	35.2	141%	2,536%
Attic Insulation (R-11 to R-38) – Electric CAC only	82,815	4.5	83,288	33.6	0.67	0.93	55,594	3.0	77,208	31.2	139%	1,028%
Attic Insulation (R-19 to R-49) – Electric Heat	0	0.0	33,338	13.5	0.63	0.93	0	0.0	30,904	12.5	-	-
Wall Insulation – Electric Heat	2,058	0.0	653	0.3	0.63	0.93	1,297	0.0	605	0.2	47%	969%
Wall Insulation – Heat Pump	485	0.0	485	0.2	0.63	0.93	305	0.0	450	0.2	147%	-
Wall Insulation – Electric CAC Only	300	0.0	300	0.1	0.63	0.93	189	0.0	278	0.1	147%	631%
Programmable Thermostat – Electric Heat	144,493	0.0	582,080	0.0	0.87	0.87	125,709	0.0	506,410	0.0	403%	-
Programmable Thermostat – Electric CAC Only	0	0.0	37,400	0.0	0.87	0.87	0	0.0	32,538	0.0	-	-
Total	**3,202,951**	**74.1**	**3,665,730**	**1,229.4**	**-**	**-**	**2,847,654**	**69.3**	**3,508,338**	**1,198**	**123%**	**1,728%**

Note: Realization Rate = Ex Post Net Value / Ex Ante Net Value

The Major Measures Component also attained net gas savings of 249,110therms. Table 22 below shows net impacts by measure.

Table 22. Multifamily Major Measures Gas Component Net Impacts

Measure	Ex Ante Gross therms	Ex Post Gross therms	Ex Ante Net to Gross Ratio	Ex Post Net to Gross Ratio	Ex Ante Net therms	Ex Post Net therms	Net Realization Rate
Air Sealing – Gas Heat	189,838	189,844	1.00	1.00	189,838	188,895	100%
Attic Insulation (R-11 to R-38) – Gas Heat	59,447	59,586	0.63	0.93	37,451	55,236	147%
Attic Insulation (R-19 to R-49) – Gas Heat	0	441	0.63	0.93	0	409	100%
Wall Insulation – Gas Heat	1,148	1,472	0.63	0.93	723	1,364	189%
Programmable Thermostat – Gas Heat	3,243	3,685	0.87	0.87	2,822	3,206	114%
Total	**253,675**	**255,028**			**230,834**	**249,110**	**108%**

Note: Realization Rate = Ex Post Net Value / Ex Ante Net Value

4.4 INPUTS FOR FUTURE PROGRAM PLANNING

In the PY5 evaluation period, we will reassess the evaluation priorities for the Multifamily Program with AIC. Because the Major Measures Component played a very prominent role in program savings in PY4, it may be appropriate to target more evaluation efforts in PY5 and PY6 towards this area. Below listed are evaluation activities that could be performed:

- Field verification of measure persistence through site visits to a sample of participating buildings. Measures persistence is a significant input to determining lifecycle gross impacts associated with Multifamily Programs. Our experience evaluating similar programs indicates that measures installed in tenant-occupied spaces are often removed, particularly when the installations occur in building "sweeps," at times when tenants may not be in the unit.

- Surveys of property managers/owners participating in the Major Measures component to update the NTG for these measures. Currently, NTG values from the Home Energy Program are being used for air sealing and insulation installed through the Multifamily Program. As there are several differences between single family and multifamily participants, different values may be more appropriate. These surveys could also explore process-related questions and program satisfaction.

- Surveys of participating and non-participating trade allies for the Common Area Lighting and Major Measures components. This will allow us to collect information on program process for each component, trade ally customer engagement, and explore additional ways

for the program to potentially work with trade allies.

- Secondary research of similar multifamily programs across the country to compare and contrast program design and implementation strategies. This secondary research may include a look at the market size and opportunity size for the Multifamily Program in AIC territory to see how much further growth AIC can expect. We will focus this research on developing recommendations for further program improvements that may increase the program's savings potential in future years.

A. APPENDIX – IMPLEMENTATION MODEL

The evaluation team created an implementation model for the Multifamily Program evaluated in PY4. An implementation model is a graphic presentation of the intervention – what occurs and who undertakes the functional activities of the program. The model is displayed using a multi-level Visio document that has various functions in its rows, and key stakeholders and populations in the columns. We determined the functions, stakeholders, and processes through a review of the available program documentation and further refined them based on interviews with program staff. This model does not attempt to assess the effects of the program.

The model is organized by function and the stakeholders involved.

- **Functions**: These represent the discrete functions inherent to the program. These functions include program administration and design, marketing and outreach, education, service delivery and evaluation. Service delivery encompasses activities that are directed towards intervention recipients and, for these models, is a catchall for any activity not included in the other functions. These functional areas may vary across programs.

- **Stakeholders**: These include the various providers who are involved in program delivery or receive program services. Stakeholders include tenants, property managers or owners, market actors, the implementer, and the utility.

We also identified several key points within each of the program functions. These include:

- **Program Administration and Design**: As the program implementer, Conservation Services Group (CSG) designs the different program components, sets the incentive structure, and establishes budgets and goals within the program. AIC manages CSG's contract and reviews and approves the areas mentioned above. In addition, CSG reports energy savings progress and program activities to AIC on a monthly basis.

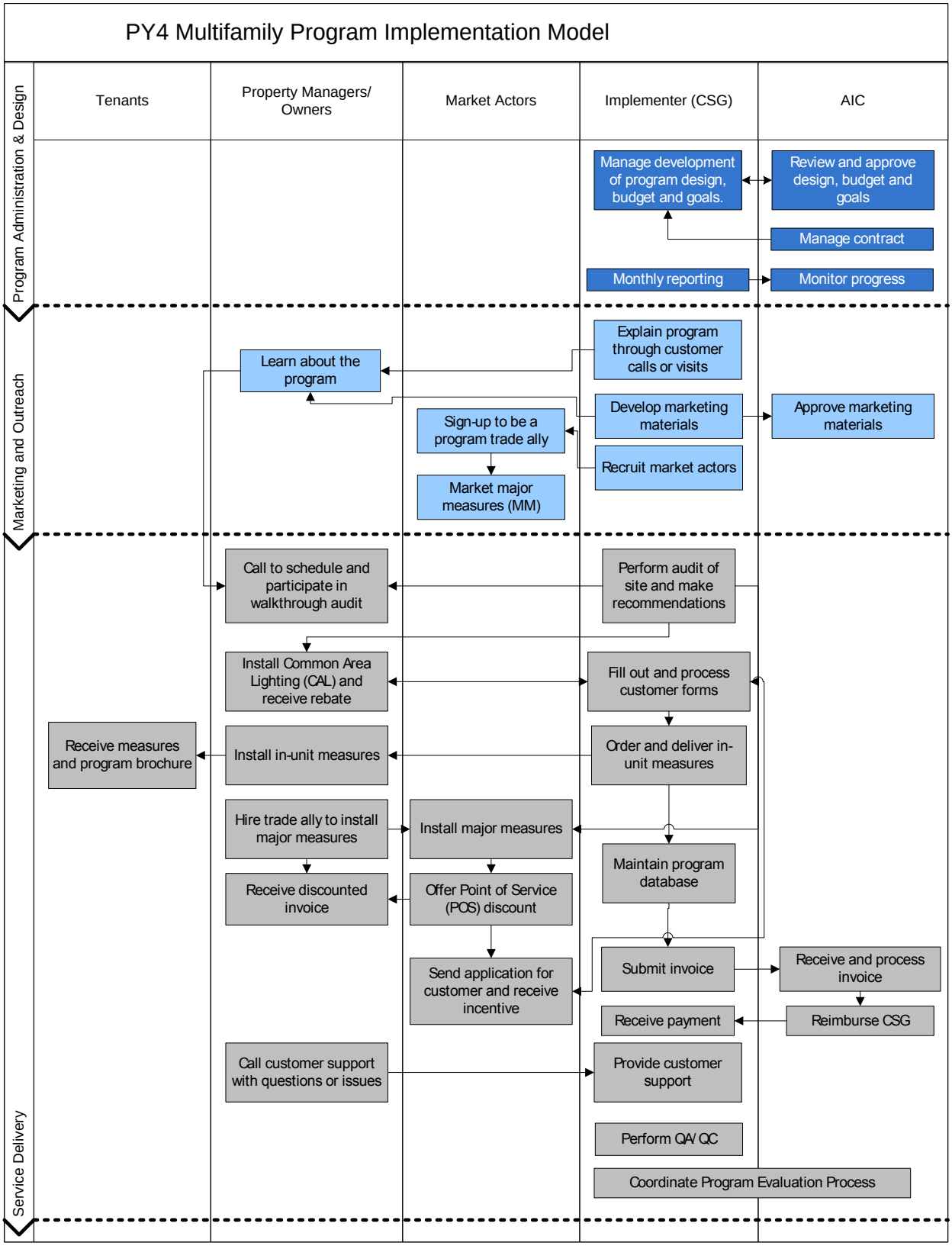
- **Marketing and Outreach**: Property managers or owners learn about the program through direct contact with CSG representatives or market actors who participate in the program. CSG develops marketing materials and recruits market actors, while AIC approves marketing materials.

- **Education**: CSG provides a walk-through audit or conducts a site visit of the property for interested property managers. Property managers participate in the walk-through audit, and CSG makes recommendations based on the energy efficiency needs of the property.

- **Service Delivery**: For the In-Unit Component, CSG will fill out and process customer forms and deliver materials for the property manager to install for tenant units. Based on recommendations, a property manager will install Common Area Lighting measures and work with CSG to fill out an application and receive a rebate. Under the Major Measures Component, a market actor installs recommended measures and offers a point of sale discount. The market actor submits an incentive application. AIC reimburses CSG for program costs, and CSG maintains the database and provides customer support.

- **Evaluation**: CSG performs quality assurance and control tasks for each program component, and participates in evaluation activities. AIC also supports evaluation efforts.

Below we provide the Multifamily Program implementation model.


PY4 Multifamily Program Implementation Model
Tenants
Property Managers/ Owners
Market Actors
Implementer (CSG)
AIC
Program Administration & Design
Marketing and Outreach
Service Delivery
Manage development of program design, budget and goals.
Review and approve design, budget and goals
Manage contract
Monthly reporting
Monitor progress
Explain program through customer calls or visits
Learn about the program
Develop marketing materials
Approve marketing materials
Sign-up to be a program trade ally
Recruit market actors
Market major measures (MM)
Call to schedule and participate in walkthrough audit
Perform audit of site and make recommendations
Install Common Area Lighting (CAL) and receive rebate
Fill out and process customer forms
Receive measures and program brochure
Install in-unit measures
Order and deliver in-unit measures
Hire trade ally to install major measures
Install major measures
Maintain program database
Receive discounted invoice
Offer Point of Service (POS) discount
Send application for customer and receive incentive
Submit invoice
Receive and process invoice
Receive payment
Reimburse CSG
Call customer support with questions or issues
Provide customer support
Perform QA/ QC
Coordinate Program Evaluation Process