Opinion Dynamics

Boston | Headquarters

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

1000 Winter St
Waltham, MA 02451

Ameren Illinois Company 2019 Residential Program Impact Evaluation Report

Final
April 30, 2020

Opinion Dynamics

Table of Contents

Opinion Dynamics

Table of Tables

Table of Figures

Table of Equations

1. Executive Summary

This report presents impact evaluation results from Ameren Illinois Company's (AIC) 2019 Residential Program. The Residential Program is part of AIC's overall portfolio of residential and non-residential energy efficiency programs implemented during the 2019 calendar year. The overarching objective of the 2019 impact evaluation is to determine the gross and net electric energy, electric demand, and natural gas impacts associated with the Program.

1.1 Background

This is the second calendar year of AIC's four-year 2018 Plan, which was developed based on guidance provided through Illinois Senate Bill 2814 (the Future Energy Jobs Act [FEJA]). Passage of FEJA has led to a number of significant changes in energy efficiency program delivery in Illinois, including the following:

- **Discontinuation of energy efficiency programs funded through the Illinois Power Agency (IPA):** Energy efficiency programs adopted through the IPA procurement plan process and previously available to AIC customers, including several residential programs, ended on May 31, 2017.
- **Discontinuation of energy efficiency programs offered through the Illinois Department of Commerce and Economic Opportunity (DCEO):** Before the Transition Period (June 1, 2017, to December 31, 2017), public housing facilities were ineligible for AIC energy efficiency programs and instead were served by programs offered through the DCEO. As of June 1, 2017, these customers became eligible for AIC programs and the Transition Period allowed AIC to begin to integrate these customers into its programs and beginning in 2018, public housing facilities served by AIC are fully eligible for the AIC Residential Program in the same manner as other AIC customers.
- **Shift to Cumulative Persisting Annual Savings (CPAS):** Beginning in 2018, electric energy savings goals for Illinois utilities are primarily defined based on persisting savings as a percentage of sales. As such, annual evaluations of AIC's electric programs, including this one, present both annual, as well as persisting savings over the life of delivered measures. As a result, AIC and its implementer have also sought to deliver programs that achieve savings that persist for a longer period of time.
- **Applicable Annual Incremental Goal (AAIG):** On a year to year basis, AIC must meet an AAIG. The AAIG is defined as the difference between the cumulative persisting electric savings goal for the year being evaluated and the cumulative persisting electric savings goal for the previous year. The utility must achieve sufficient savings through its programs to replace savings from measures at the end of their measure life before progress can be counted towards the AAIG.
- **Calculation of Weighted Average Measure Life (WAML):** FEJA replaces the existing funding mechanism for electric energy efficiency in Illinois by allowing AIC to create a regulatory asset and amortize and recover the total expenditures of that regulatory asset "over a period that is equal to the weighted average of the measure lives implemented for that year that are reflected in the regulatory asset."[1] Therefore, we present WAML for AIC's electric Residential Program in this report in accordance with the guidelines for calculation presented in the Illinois Stakeholder Advisory Group's (SAG) WAML Report.[2]
- **Savings Conversion.** FEJA allows electric utilities that jointly offer an energy efficiency measure or program with a gas utility to fund said measures or programs if the gas utility discontinues doing so

[1] Weighted Average Measure Life Report. Illinois Energy Efficiency Stakeholder Advisory Group. February 20, 2018.
[2] Ibid.

and to recover the cost of doing so. In this case, the electric utility is allowed to "convert" non-electric energy savings achieved through said measures or programs to electric savings for the purposes of goal attainment. The total amount of savings allowed to be converted is capped at a maximum of 10% of the utility's AAIG. AIC met the above criteria in 2019 and chose to convert savings from the Income Qualified Initiative of the Residential Program. Further detail on the savings conversion is provided in the forthcoming 2019 AIC Integrated Impact Evaluation Report.

The Residential Program is made up of eight initiatives (some further broken down into channels), which the evaluation team assessed as part of the 2019 evaluation:

- Retail Products
- Income Qualified
  - Community Action Agency (CAA)
  - Single Family
  - Multifamily
  - Smart Savers
- Public Housing
- Behavioral Modification
- Heating and Cooling (HVAC)
- Appliance Recycling
- Multifamily
- Direct Distribution of Efficient Products (Direct Distribution)
  - School Kits
  - Appliance Recycling Kits
  - Community Kits

The initiatives are designed to achieve energy savings from residential customers in accordance with AIC's plan filing, and provide energy efficiency services and assistance to customers through a wide range of channels. The Retail Products Initiative, which provides point-of-sale and instant discounts to customers purchasing energy efficient products, is the largest component of the Program from an electric energy savings perspective. The Income Qualified Initiative, which provides whole-home retrofit services and energy efficiency measures through a range of channels, is the largest component of the Program from a natural gas savings perspective as well as from a program spending perspective.

AIC had an overarching goal of serving customers that live in multifamily units in 2019. CMC Energy (CMC) serves multifamily properties through the Income Qualified, Public Housing, and Multifamily (market-rate) initiatives respectively. CMC recruits multifamily property managers to participate and channels them into the appropriate initiative offering based on tenant income guidelines and the property's Public Housing Authority status. Overall, the delivery models and measure offerings for these initiatives are similar with some variation between initiatives. We describe the Income Qualified, Public Housing, and Multifamily Initiatives in more detail in Section 3 of this report.

1.2 Program Savings

Within the following sections, the evaluation team presents annual savings (annualized 2019 energy savings), and CPAS. As discussed in greater detail within the forthcoming 2019 AIC Integrated Impact Evaluation Report, AIC's performance against its Applicable Annual Incremental Goal (AAIG)[3] is determined based on both types of program savings.

1.2.1 Annual Savings

The 2019 Residential Program achieved 128,644 MWh, 20.35 MW, and 1,742,952 therms in verified net savings. These savings include a non-participant spillover (NPSO) adder on net savings for non-income qualified initiatives of 3.1% for electricity and 4.4% for gas.[4],[5] These savings are also reported after accounting for the FEJA-allowed "conversion" of natural gas savings to electric energy savings for the purpose of goal attainment.

Table 1, Table 2, and Table 3 present ex ante gross, verified gross, and verified net electric energy, electric demand, and gas savings by initiative for the 2019 Residential Program.

[3] AAIG is defined as the difference between the cumulative persisting goal for the year being evaluated and the cumulative persisting goal for the previous year. Further explanation is provided in the 2019 AIC Integrated Impact Evaluation Report.
[4] Ameren Illinois Company Energy Efficiency Portfolio 2019 Net-to-Gross Ratios. Accessed at:
https://s3.amazonaws.com/ilsag/AIC_2019_NTGR_Recommendations_Summary_FINAL_2018-09-25.pdf
[5] Income qualified programs include the Income Qualified and Public Housing Initiatives, as well as the Appliance Recycling Kits and Community Kits channels of the Direct Distribution Initiative.

Table 1. 2019 Residential Program Electric Energy Annual Savings Summary

Initiative/Effort	Ex Ante Gross MWh	Gross Realization Rate	Verified Gross MWh	Net-to-Gross Ratio (NTGR)	Verified Net MWh
Retail Products	109,992	104%	114,127	0.716	81,770
Income Qualified - CAA	955	85%	815	1.000	815
Income Qualified - Single Family	8,746	107%	9,332	1.000	9,332
Income Qualified - Multifamily	1,562	104%	1,630	1.000	1,630
Income Qualified - Smart Savers	3,059	92%	2,824	1.000	2,824
Public Housing	1,164	100%	1,162	1.000	1,162
Behavioral Modification	3,617	29%	1,061	N/A	1,061
HVAC	7,478	122%	9,130	0.755	6,890
Appliance Recycling	4,714	109%	5,147	0.541	2,786
Multifamily	1,335	107%	1,424	0.921	1,311
Direct Distribution - School Kits	2,007	100%	2,014	0.930	1,874
Direct Distribution - Appliance Recycling Kits	126	95%	120	1.000	120
Direct Distribution - Community Kits	980	100%	980	1.000	980
Residential Program Subtotal	*145,736*	*103%*	*149,767*	*0.752*	*112,555*
Residential NPSO Adder (3.1% for non-IQ initiatives)					2,966
Income Qualified – Single Family (gas conversion)					13,121
Residential Program Total					**128,644**

Table 2. 2019 Residential Program Electric Demand Annual Savings Summary

Initiative/Effort	Ex Ante Gross MW	Gross Realization Rate[a]	Verified Gross MW	NTGR	Verified Net MW
Retail Products	14.60	106%	15.48	0.725	11.29
Income Qualified - CAA	0.24	89%	0.22	1.000	0.22
Income Qualified - Single Family	2.84	107%	3.04	1.000	3.04
Income Qualified - Multifamily	0.19	124%	0.24	1.000	0.24
Income Qualified - Smart Savers	0.62	107%	0.66	1.000	0.66
Public Housing	0.17	108%	0.19	1.000	0.19
Behavioral Modification	N/A	N/A	0.18	N/A	0.18
HVAC	3.84	111%	4.27	0.741	3.16
Appliance Recycling	0.58	109%	0.63	0.540	0.34
Multifamily	0.15	135%	0.21	0.935	0.19
Direct Distribution - School Kits	0.28	100%	0.28	0.943	0.27
Direct Distribution - Appliance Recycling Kits	0.02	96%	0.02	1.000	0.02
Direct Distribution - Community Kits	0.13	113%	0.14	1.000	0.14
Residential Program Subtotal	*23.67*	*107%*	*25.56*	*0.778*	*19.94*
Residential NPSO Adder (3.1%)					0.48
Residential Program Total					**20.42**

[a] Because the implementer did not provide ex ante demand savings, we do not include the Behavioral Modification Initiative in calculations of gross realization rate for demand.

Table 3. 2019 Residential Program Gas Annual Savings Summary

Initiative/Effort	Ex Ante Gross Therms	Gross Realization Rate	Verified Gross Therms	NTGR	Verified Net Therms
Retail Products	739,243	95%	700,639	1.000	700,595
Income Qualified - CAA	89,141	102%	90,739	1.000	90,739
Income Qualified - Single Family	815,506	103%	837,672	1.000	837,672
Income Qualified - Multifamily	25,361	102%	25,743	1.000	25,743
Income Qualified - Smart Savers	300,262	95%	285,545	1.000	285,545
Public Housing	31,662	102%	32,181	1.000	32,181
Behavioral Modification	35,694	0%	0	N/A	0
HVAC	69,492	100%	69,775	1.000	69,775
Appliance Recycling	0	N/A	0	N/A	0
Multifamily	27,626	100%	27,650	0.998	27,604
Direct Distribution - School Kits	25,825	101%	25,965	1.000	25,965
Direct Distribution - Appliance Recycling Kits	5,724	100%	5,726	1.000	5,726
Direct Distribution - Community Kits	50,698	104%	52,959	1.000	52,959
Residential Program Subtotal	*2,216,235*	*97%*	*2,154,595*	*1.000*	*2,154,505*
Residential NPSO Adder (4.4%)					36,253
Income Qualified (gas conversion)					-447,806
Residential Program Total					**1,742,952**

1.2.2 Cumulative Persisting Annual Savings

Table 4 summarizes CPAS and WAML for the 2019 Residential Program at the initiative level. For additional detail related to CPAS and measure life, please see the individual initiative chapters in Section 3, the overall CPAS spreadsheet provided with this report, and Appendix C, which presents CPAS for each year of program operation.

Table 4. 2019 Residential Program CPAS and WAML

Initiative	WAML	First-Year Verified Gross Savings (MWh)	NTGR	CPAS – Verified Net Savings (MWh)							Lifetime Savings (MWh)[a]
				2018	2019	2020	2021	...	2030	...	
Retail Products	9.1	114,127	0.716		81,770	81,770	49,955	...	24	...	419,631
Income Qualified - CAA	14.9	815	1.000		815	815	555	...	415	...	10,188
Income Qualified - Single Family	14.7	9,332	1.000		9,332	9,332	7,809	...	3,718	...	102,091
Income Qualified - Multifamily	10.7	1,630	1.000		1,630	1,630	1,460	...	127	...	15,304
Income Qualified - Smart Savers	11.0	2,824	1.000		2,824	2,824	2,824	...	0	...	31,067
Income Qualified - Single Family (gas conversion)	18.5	13,121	1.000		13,121	13,121	13,121	...	6,997	...	188,627
Public Housing	10.4	1,162	1.000		1,162	1,162	768	...	92	...	8,605
Behavior Modification	5.0	1,061	N/A		1,061	783	484	...	0	...	2,700
HVAC	16.5	9,130	0.755		6,890	6,890	6,890	...	3,954	...	83,825
Appliance Recycling	6.5	5,146	0.541		2,786	2,786	2,786	...	0	...	20,894
Multifamily	10.3	1,424	0.921		1,311	1,311	1,141	...	3	...	12,015
DD - School Kits	8.8	2,014	0.931		1,874	1,874	1,340	...	0	...	12,586
DD - Appliance Recycling Kits	8.9	120	1.000		120	120	85	...	0	...	793
DD - Community Kits	9.1	980	1.000		980	980	642	...	0	...	6,241
Non-Participant Spillover (3.1% Adder)	9.5	4,120	N/A		2,966	3,068	2,025	...	140	...	18,000
2019 CPAS		**167,006**	**0.770**		**128,644**	**128,468**	**91,886**	**...**	**15,570**	**...**	**932,565**
Expiring 2019 CPAS					**0**	**176**	**36,582**	**...**	**14,302**	**...**	
Expired 2019 CPAS					**0**	**176**	**36,758**	**...**	**113,074**	**...**	
WAML	**10.6**										

[a] Lifetime savings are inclusive of all savings for the entire life of all measures. During 2019, the longest-lived measures installed through the Residential Program had a measure life of 25 years. Therefore, some CPAS exist through 2038.

2. Evaluation Approach

The following section of the report describes the evaluation approach taken for the 2019 Residential Program impact evaluation. As part of the evaluation process, the evaluation team applied versions of the Illinois Energy Efficiency Policy Manual and the Illinois Technical Reference Manual (IL-TRM) applicable to the 2018 program year (generally Version 1.1[6] and Version 7.0, respectively) wherever relevant.[7] Appendix A of this report provides more detailed initiative-specific methodology where appropriate.

2.1 Research Objectives and Evaluation Activities

The overarching research objectives for the impact evaluation of AIC's 2019 Residential Program are as follows:

- What were the estimated gross energy and demand impacts from the Program?
- What were the estimated net energy and demand impacts from the Program?

The evaluation team met these objectives by conducting the impact evaluation activities outlined in Table 5. As shown, for most initiatives, the impact evaluation primarily consisted of applying savings algorithms from the Illinois Technical Reference Manual (IL-TRM) V7.0 to final initiative tracking databases to estimate verified gross savings. For Behavioral Modification, the team employed consumption analysis to estimate impacts. In addition, we reviewed initiative materials and interviewed all initiative managers.

Table 5. 2019 Residential Program Impact Evaluation Activities

Initiative	Gross Impacts		Net Impacts	
	IL-TRM Application Review	Engineering Desk Reviews	Consumption Analysis	Application of SAG-Approved NTGRs
Retail Products	✓			✓
Income Qualified	✓			✓
Public Housing	✓			✓
Behavior Modification	✓		✓	
HVAC	✓			✓
Appliance Recycling	✓			✓
Multifamily	✓			✓
Direct Distribution	✓			✓
Smart Savers	✓			[a]

[a] Smart Savers delivers only advanced thermostats. By SAG agreement, savings achieved by these measures are considered to be net and, therefore, not subject to adjustment for net effects.

The following sections provide further detail on the verified gross and net impact evaluation activities.

[6] Broadly speaking, Version 1.1 of the Policy Manual was in effect during these evaluations. However, the evaluation report voluntarily applies policies from Sections 11.2, 11.3, and 11.4 of Policy Manual 2.0. Despite these policies not being formally in effect for the program year being evaluated, they were applied given informal agreement to do so and their absence from Version 1.1.

[7] In future years, the evaluation team will apply updated versions of these manuals to the evaluation of this program as required by law, ICC orders and changes to the manuals themselves.

2.2 Verified Gross Impact Analysis Approach

2.2.1 Application of IL-TRM V7.0

To determine verified gross impacts associated with the measures delivered through the Residential Program, we reviewed the content of the initiative tracking database to identify database errors and duplicate records, and to ensure that the implementer correctly applied savings algorithms and assumptions stated in the IL-TRM V7.0 and the IL-TRM V7.0 errata document. In particular, we applied the algorithms and assumptions provided in the IL-TRM V7.0, while using project-specific data from the initiative tracking databases as inputs where appropriate. As part of this process, we also verified measure installations through analysis of initiative tracking databases, as well as through the review of supporting project documentation.

We resolved any discrepancies found in the databases and provide details related to any gross savings adjustments in the initiative-specific sections of this report.

In accordance with Illinois policy, the evaluation team omitted heating penalties from savings reported in the body of this report. Appendix B presents detail on heating penalties for cost-effectiveness purposes.

2.3 Verified Net Impact Analysis Approach

To determine verified net savings for the 2019 Residential Program, we primarily applied SAG-approved net-to-gross ratios (NTGRs) to verified gross savings. There are two exceptions to this approach.

- One exception to this approach is the Behavioral Modification Initiative, which is implemented as a randomized controlled trial (RCT) and is evaluated using a consumption analysis approach that directly estimates net savings. Further details around the methods employed for the evaluation of this initiative are presented in Appendix A.
- In addition, the evaluation team did not apply a NTGR to savings achieved from the installation of advanced thermostats. By SAG agreement, savings achieved by these measures are considered to be net and, therefore, not subject to adjustment with an NTGR.

2.4 Sources and Mitigation of Error

The evaluation team took steps to mitigate potential sources of error throughout the planning and implementation of the 2019 evaluation. In particular, we took the following actions to address potential sources of non-survey related error.[8]

- **Analysis Error:** For prescriptive gross impact calculations, we applied IL-TRM V7.0 calculations to the participant data in the tracking database to calculate gross impacts. To minimize data analysis error, a separate team member reviewed all calculations to verify their accuracy. For net impact calculations, we applied SAG-approved NTGRs to estimated gross impacts to derive net impacts where appropriate. To minimize analytical errors, all calculations were reviewed by a separate team member to verify their accuracy.

[8] There is no sampling error or measurement error associated with any Residential Program evaluation activity because we did not conduct any sampling-based evaluation activities for the 2019 impact evaluation.

For the Behavioral Modification Initiative, we also addressed the following types of error:

- **Model Specification Error**: The most difficult type of modeling error, in terms of bias and the ability to mitigate it, is specification error. In this type of error, variables that predict model outcomes are included when they should not be or left out when they should be included, possibly producing biased estimates. The team addressed this type of error by using a fixed-effects model, which adjusts for constant differences from one household to the next using customer-specific intercepts. Over time, treatment and control groups in a randomized experiment can drift apart due to attrition, causing an imbalance between the groups that must be addressed in the model specification. When there is an imbalance in consumption, weather, or other factors between treatment and control groups, model specification error can become much more pronounced. For this reason, the team also included models that control for weather conditions to account for differences in temperatures experienced by treatment and control populations.
- **Measurement Errors**: Measurement error can come from variables such as weather data, which are commonly included in the billing analysis models. If an inefficient base temperature is chosen for calculating degree-days or if an incorrect climate zone weather station is chosen, the model results could be subject to measurement error. We addressed this type of error by very carefully choosing the closest weather station for each customer in the model. Specifying an incorrect time period (either pre-treatment or post-treatment) can also lead to measurement error. To the extent that the data received from the implementer are correct, this should not be a problem; however, little can be done if there is an error in the source data.
- **Multi-collinearity**: This type of modeling error can both bias the model results and produce very large variances in the results. The team dealt with this type of error by using model diagnostics such as variance inflation factor (VIF), though the relatively simple models (i.e. ones with few independent variables) used in the impact analysis have essentially no chance of problems with multi-collinearity.
- **Heteroskedasticity**: This type of modeling error can result in imprecise model results due to variance changing across customers with different levels of consumption. The team addressed this type of error by using robust standard errors. Most statistical packages offer a robust standard error option and make conservative assumptions in calculating the errors, which has the effect of making significance tests conservative as well.
- **Serial Correlation**: This type of modeling error can result in imprecise model results (due to multiple observations being highly correlated within the customer). The team addressed this type of error by clustering the errors by customer and using robust error estimation.

3. Initiative-Level Results

Within the following sections, we present the results of the impact evaluation of the 2019 Residential Program initiatives. Each sub-section presents a summary of the initiative's design, participation, and associated electric and natural gas impacts. Additional details on the impact analysis methodology used for these evaluations are presented in Appendix A.

3.1 Retail Products

3.1.1 Initiative Description

The AIC Retail Products Initiative builds on AIC's prior Residential Lighting Program, which for nine years, aimed to transform the residential lighting market in AIC territory by increasing customers' awareness and use of ENERGY STAR® (ES) lighting. The 2019 Retail Products Initiative, implemented by CLEAResult, continues to partner with retailers and manufacturers to sell a variety of LED lighting products and also incorporates rebates for advanced thermostats, advanced power strips, variable-speed pool pumps, and as of late 2019, several energy-efficient appliances, including clothes washers, clothes dryers, refrigerators, and freezers. These discounts encourage customers who are reluctant to pay full price for energy-efficient versions of these products to forego cheaper, less efficient alternatives. As the Initiative continues in future years, AIC will consider adding other products to the offering.

Summary of Key Implementation Changes in 2019

For the 2019 program year, the Retail Products Initiative adapted its measure offerings and incentives as follows:

- Incorporated downstream rebates for clothes washers, clothes dryers, refrigerators, and freezers in December 2019
- Discontinued rebates on variable-speed pool pumps mid-year
- Continued to discount advanced thermostats at $100, increasing to $125 during prime sales period in coordination with manufacturer discounts

3.1.2 Participation Summary

LED lighting remained the primary enduse for the Retail Products Initiative in 2019, accounting for 97% of all units sold through the initiative. Standard LEDs remained the most commonly sold lighting product but played a less dominant role than in prior years, accounting for 63% of all products sold (a decrease from 82% in 2018). The incentives for standrad products were eleiminated mid-year 2019 as part of the Retail Products portfolio restructuring to account for savings beyond 2021. Reflector LEDs represented 20%, and other specialty LEDs accounted for 14% of all products sold. Advanced power strips and thermostats represented 3% of all products sold and more than 99% of non-lighting sales. The remaining measures, each only available for a portion of the year, collectively accounted for 1% of sales. Table 6 presents participation in the Retail Products Initiative during 2019.

Table 6. 2019 Retail Products Initiative Lighting Sales Summary

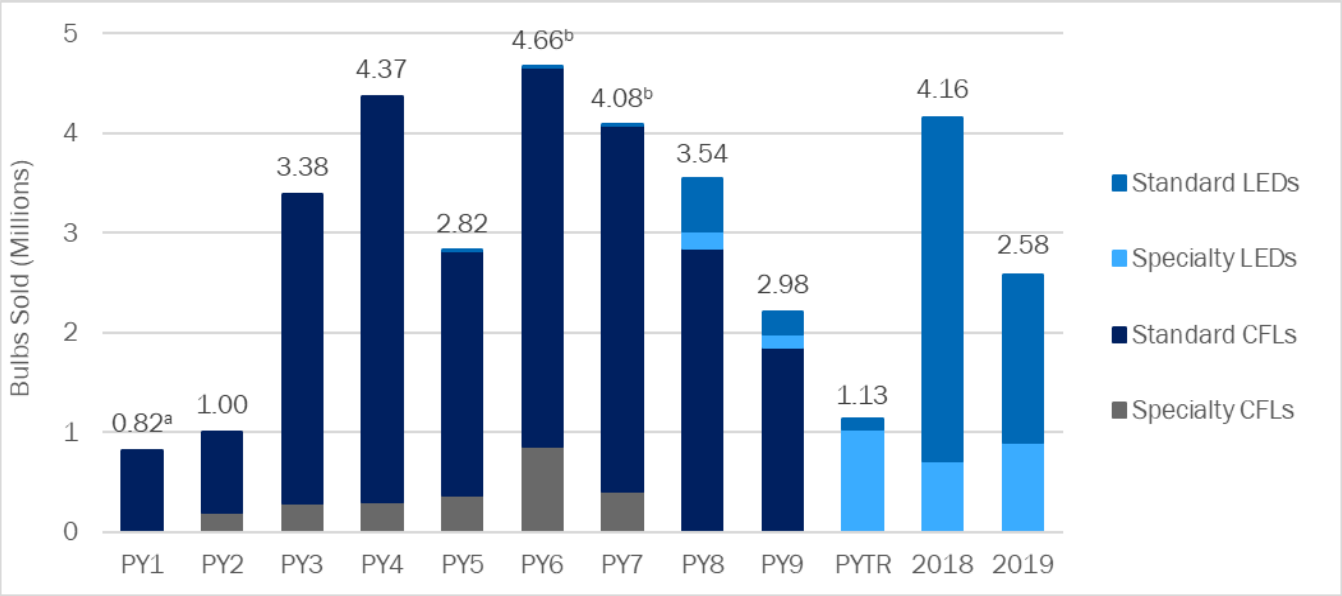
Bulb Type	Bulb Shape	Bulb Quantity	Share of Sales
Standard LEDs	A-line	1,683,305	63%
Specialty LEDs (Reflector)	BR/R	463,233	17%
	PAR/MR	70,751	3%
Specialty LEDs (Other)	Decorative	288,550	11%
	Globe	67,808	3%
	3-way	9,743	<1%
Advanced power strips		55,275	2%
Advanced thermostats		16,044	1%
Variable-speed pool pumps		8	<1%
Clothes washers		177	<1%
Clothes dryers		79	<1%
Refrigerators		82	<1%
Freezers		6	<1%
Total		**2,655,061**	**100%**

Historic Product Sales

The Retail Products Initiative discounted 2,583,390 LED light bulbs during 2019, adding to a decade of AIC-driven efficient lighting sales. While the Initiative discounted roughly one-third fewer bulbs in 2019 compared to 2018, the absolute number and share of specialty LEDs increased. In 2019, 900,085 specialty bulbs were discounted, accounting for 35% of LED sales, which is more than twice the 17% share represented by specialty bulbs in 2018. Since 2009, AIC has offered discounts on 34.8 million energy-efficient lighting products.

Figure 1 shows efficient lighting sales from PY1 through 2019.

Figure 1. Retail Products Initiative Historical Lighting Sales (PY1-2019)

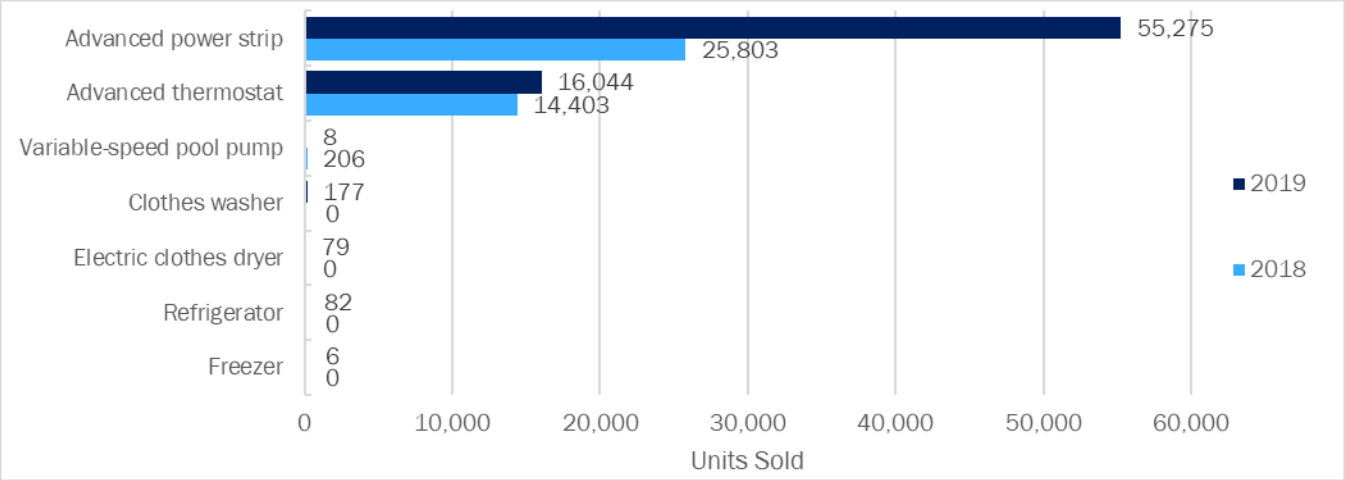


[a] We do not have a record of the number of CFLs sold by shape for PY1.

[b] LEDs were sold, but the quantity is too small for the bar to be clearly visible.

The Retail Products Initiative included seven non-lighting measures in 2019. Still, only advanced power strips and advanced thermostats were rebated throughout the entire year and together accounted for more than 99% of non-lighting units sold. In addition to incorporating the four new appliance types in late 2019, the Initiative sold more than twice as many advanced power strips and slightly more advanced thermostats than in the previous year. Variable-speed pool pumps were eliminated from the program in 2019. Eight units were rebated from applications received in 2019 for products purchased at the end of the 2018 pool season for use in 2019. Figure 2 illustrates non-lighting program sales in 2019, relative to 2018.

Figure 2. Retail Products Initiative Non-Lighting Sales in 2018 and 2019



Sales by Delivery Channel

Nearly all LEDs (more than 99%) and the vast majority of advanced power strips (94%) were discounted at the point of sale. The remainder were sold through the online marketplace. The online marketplace was a more popular delivery channel for advanced thermostats, accounting for 43% of thermostat sales. Another 30% of thermostat participants submitted a rebate application after purchase, and the remaining 28% applied for a rebate in advance of purchase and redeemed at point-of-sale using the Instant Rebate offering. Downstream rebates accounted for all sales of clothes washers, clothes dryers, refrigerators, and freezers, and nearly all participants submitted their applications online. Table 7 provides a breakdown of the share of units sold by product category and rebate channel.

Table 7. 2019 Retail Products Initiative Sales by Delivery Channel

Measure	Point of Sale	Online Store	Application-Based Rebate		
			Paper	Online	Instant Rebate
LED lighting (n=2,583,390)	>99%	<1%	N/A	N/A	N/A
Advanced power strips (n=55,275)	94%	6%	N/A	N/A	N/A
Advanced thermostats (n=16,044)	N/A	43%	3%	26%	28%
Variable-speed pool pumps (n=8)	N/A	N/A	50%	50%	N/A
Clothes washers (n=177)	N/A	N/A	0%	100%	N/A
Clothes dryers (n=79)	N/A	N/A	0%	100%	N/A
Refrigerators (n=82)	N/A	N/A	1%	99%	N/A

Measure	Point of Sale	Online Store	Application-Based Rebate		
			Paper	Online	Instant Rebate
Freezers (n=6)	N/A	N/A	0%	100%	N/A

Lighting Retail Channel Coverage

Throughout 2019, AIC offered discounted LED products across 55 retailers at 763 storefronts. Big box, DIY, discount, and club stores sold the vast majority of discounted LEDs (91% of all LED sales). While the big box and DIY stores were similarly large contributors to LED sales in prior years, discount stores replaced club retailers as the third-largest contributor to program sales. Table 8 provides a breakdown of lighting sales and total store locations by retail channel.

Table 8. 2019 Retail Products Initiative Sales by Delivery Channel

Retail Channel	Store Locations	Bulb Quantity	Share of Sales
Big box	77	927,789	36%
DIY	72	757,991	29%
Discount	397	353,182	14%
Club	9	310,960	12%
Hardware	80	160,891	6%
Pharmacy	81	38,247	1%
Grocery	41	27,891	1%
Online	1	3,414	<1%
Other	5	3,025	<1%
Total	**763**	**2,583,390**	**100%**

3.1.3 Initiative Annual Savings Summary

Table 9 presents Retail Products Initiative annual savings achieved in 2019. The 2019 Retail Products Initiative achieved 81,770 MWh, 11.29 MW, and 700,595 therms in verified net savings.

Table 9. 2019 Retail Products Initiative Annual Savings

	Electric Energy Savings (MWh)	Electric Demand Savings (MW)	Gas Savings (Therms)
Ex Ante Gross Savings	109,992	14.60	739,243
Gross Realization Rate	104%	106%	95%
Verified Gross Savings	114,127	15.48	700,639
NTGR	0.716	0.729	1.000
Verified Net Savings	81,770	11.29	700,595

Note: Totals may not sum due to rounding.

3.1.4 Initiative Savings Detail

The Retail Products Initiative achieved 114,127 MWh in gross energy savings and 81,770 MWh in net energy savings, as shown in Table 10. Lighting products accounted for the vast majority of energy savings (89% of gross and 86% of net). Advanced thermostats and power strips each made up between 5% and 8% of gross

and net energy savings. Ex ante energy savings included as part of the Initiative's tracking data was slightly less than verified gross estimates for measures driving the vast majority of energy savings, as evidenced by the overall gross realization rate of 103%. Implementer staff applied conservative ex ante savings estimates for appliances newly introduced in late 2019 (clothes washers, clothes dryers, refrigerators, and freezers), resulting in realization rates ranging from 139% to 233%.

Table 10. 2019 Retail Products Initiative Electric Energy Savings by Measure

Measure Category	Ex Ante Gross Savings (MWh)	Gross Realization Rate	Verified Gross Savings (MWh)	NTGR	Verified Net Savings (MWh)
Lighting (first-year)	98,154	95%	92,780	0.69	64,018
Lighting (carryover)	N/A	N/A	9,157	0.70	6,376
Advanced power strips	5,693	100%	5,693	0.86	4,896
Advanced thermostat	6,110	105%	6,444	N/A	6,444
Pool pump	15	102%	16	0.80	12
Clothes washer	8	233%	20	0.63	12
Electric clothes dryer	8	139%	12	0.67	8
Refrigerator	3	168%	5	0.65	3
Freezer	0	168%	0	0.63	0
Total	**109,992**	**103%**	**114,127**	**0.72**	**81,770**

The Retail Products Initiative achieved 15.48 MW in gross peak demand savings and 11.29 MW in net energy savings, as shown in Table 11. As with energy savings, lighting products accounted for the vast majority of energy savings (85% of gross and 81% of net). Advanced thermostats amounted to another 10% of gross and 14% of net demand savings. Ex ante demand savings included as part of the Initiative's tracking data nearly matched verified gross estimates for first-year lighting, advanced power strips, and pool pumps. Implementer staff applied conservative ex ante savings estimates for advanced thermostats and appliances newly introduced in late 2019 (clothes washers, clothes dryers, refrigerators, and freezers), resulting in realization rates ranging from 135% to 234%.

Table 11. 2019 Retail Products Initiative Electric Demand Savings by Measure

Measure Category	Ex Ante Gross Savings (MW)	Gross Realization Rate	Verified Gross Savings (MW)	NTGR	Verified Net Savings (MW)
Lighting (first-year)	12.76	95%	12.12	0.69	8.36
Lighting (carryover)	N/A	N/A	1.11	0.67	0.77
Advanced power strips	0.64	100%	0.64	0.86	0.55
Advanced thermostat	1.18	135%	1.59	1.00	1.59
Pool pump	0.01	101%	0.01	0.80	0.01
Clothes washer	0.00	234%	0.00	0.63	0.00
Electric clothes dryer	0.00	139%	0.00	0.67	0.00
Refrigerator	0.00	168%	0.00	0.65	0.00
Freezer	0.00	168%	0.00	0.63	0.00
Total	**14.60**	**106%**	**15.48**	**0.73**	**11.29**

The Retail Products Initiative achieved 700,639 therms in gross gas savings and 700,521 therms in net gas savings, as shown in Table 12. Advanced thermostats amounted to virtually 100% of gas savings, while a

fraction of a percent was attributable to clothes washers. Ex ante energy savings included as part of the Initiative's tracking data slightly overestimated gas savings, resulting in an overall gross realization rate of 95%.

Table 12. 2019 Retail Products Initiative Gas Savings by Measure

Research Category	Ex Ante Gross Savings (Therms)	Gross Realization Rate	Verified Gross Savings (Therms)	NTGR	Verified Net Savings (Therms)
Advanced thermostat	739,047	95%	700,521	1.00	700,521
Clothes washer	196	60%	118	0.63	74
Total	**739,243**	**95%**	**700,639**	**1.00**	**700,595**

We compared ex ante and verified savings for each measure and found the following explanations for differences between ex ante and verified savings (i.e., explanations for gross realization rates not equal to 100%):

- Lighting: The gross realization rate for lighting sold during 2019 was 95% for energy and demand savings. Verified energy savings fell within 10% of ex ante estimates for 63% of bulbs sold and within 15% for 97% of bulbs sold, findings which are nearly identical for demand savings.
  - Ex ante savings applied a first-year commercial in-service rate of 95%. Verified savings applied a rate of 82.5%. This difference effectively applies only to the small portion of bulbs purchased for commercial application, and results in slightly lower verified savings estimates.
  - Ex ante savings applied leakage rates of 0.07% for standard LEDs and 2.0% for specialty LEDs Verified savings applied a rate of 13.1% for all LEDs. The higher leakage rate produces lower verified savings estimates.
  - Ex ante savings assumed 97% of all LEDs were purchased for residential application and 3% for commercial use. Verified savings apply these same values for specialty LEDs, but use 95% and 5% for respective residential and commercial application of standard products. The slightly higher commercial share for standard products results in slightly higher first-year savings due to their higher first-year in-service rate, hours of use, and coincidence factor.
- Advanced thermostats: The gross realization rate for advanced thermostats was 105% for energy savings, 135% for demand savings, and 95% for gas savings.
  - For both energy and demand savings, ex ante and verified estimates matched in 12% of cases. The majority of differences were attributable to the use of single-family assumptions for ex ante calculations, which produce slightly higher savings than the 'unknown' assumptions used for verified estimates. After accounting for the use of single-family assumptions, just 27% of differences were left unexplained, of which the vast majority (79%) claimed energy savings from just one of multiple valid sources (i.e., claimed only furnace fan savings, only electric heating, or only cooling).
  - For gas savings, ex ante and verified savings initially matched in 20% of cases, and 96% of discrepancies were explained by the use of single-family assumptions for ex ante calculations.
  - The small number of remaining differences between ex ante and verified savings were mostly attributable to differences in how repeat participants were identified for exclusion from savings calculations. Verified savings excluded repeat participants based on cross-references of electric and gas account numbers.

- Clothes washers: The gross realization rate for clothes washers was 233% for energy and demand savings, and 60% for gas savings. For three records, no ex ante savings were claimed. Verified savings did not exclude these cases.
  - Ex ante savings reflected net per-unit savings based on deemed values provided by the IL-TRM V7.0 for either ENERGY STAR or CEE Tier 2 clothes washers and a NTGR of 0.62. 82% of cases used ENERGY STAR assumptions, resulting in ex ante savings of 45.76 kWh, 0.0066 kW, and 0.806 therms. 18% of cases used CEE Tier 2 assumptions, resulting in ex ante savings of 60.64 kWh, 0.0087 kW, and 2.604 therms.
  - Verified gross savings used product-specific capacities recorded in the tracking data and ENERGY STAR values for other inputs, resulting in values rangin from 46.76 to 161.14 kWh, 0.0067 to 0.0232 kW, and 0.305 to 0.762 therms. Verified net savings use a NTGR of 0.63.
- Electric clothes dryers: The gross realization rate for clothes dryers was 139% for energy and demand savings.
  - Ex ante savings applied net per-unit savings based on deemed values provided by the IL-TRM V7.0 and a NTGR of 0.66, resulting in per-unit savings of 105.89 kW and 0.0142 kW for 65% of cases. In the other 35% of cases, values were 1% higher at 106.91 kWh and .0144 kW.
  - Verified per-unit electric savings used product-specific load capacities from tracking data which produced savings ranging from 138.60 to 167.08 kWh and from 0.0186 to 0.0224 kW. Verified net savings used a NTGR of 0.67.
- Refrigerators: The gross realization rate for refrigerators was 168% for energy and demand savings.
  - Ex ante savings applied net per-unit savings based on deemed values provided by product manufacturers and a NTGR of 0.61, resulting in per-unit savings ranging from 20.13 to 74.42 kWh and 0.0030 to 0.0112 kW.
  - Verified per-unit electric savings used actual volumes and freezer type provided in tracking data to inform assumptions as specified by the IL-TRM V7.0, producing estimates ranging from 40.67 to 71.83 kWh and from 0.0061 to 0.0108 kW. Verified net savings used a NTGR of 0.65.
- Freezers: The gross realization rate for freezers was 168% for energy and demand savings.
  - Ex ante savings applied net per-unit savings based on deemed values provided by product manufacturers and a NTGR of 0.58, resulting in per-unit savings ranging from 26.10 to 31.90 kWh and 0.0042 to 0.0051 kW.
  - Verified per-unit electric savings used actual volumes and freezer type provided in tracking data to inform assumptions as specified by the IL-TRM V7.0, producing estimates ranging from 43.78 to 52.85 kWh and from 0.0071 to 0.0085 kW. Verified net savings used a NTGR of 0.63.

3.1.5 Cumulative Persisting Annual Savings

Table 13 presents CPAS and WAML for the 2019 Retail Products Initiative. The measure-specific and total verified gross savings for the Initiative are summarized, and CPAS in each year of the 2018-2021 Plan are presented. The WAML for the Initiative is 9.1 years.

Table 13. 2019 Retail Products Initiative CPAS and WAML

Measure	Measure Life	First-Year Verified Gross Savings (MWh)	NTGR	CPAS - Verified Net Savings (MWh)							Lifetime Savings (MWh)
				2018	2019	2020	2021	...	2030	...	
2019 Standard LED - Residential	10.0	45,771	0.690		31,582	31,582	8,433	...	0	...	130,630
2019 Standard LED - Commercial	4.2	8,193	0.690		5,653	5,653	1,510	...	0	...	14,628
2019 Reflector LED - Residential	10.0	24,151	0.690		16,664	16,664	16,664	...	0	...	92,124
2019 Reflector LED - Commercial	4.2	2,707	0.690		1,868	1,868	1,868	...	0	...	7,845
2019 Specialty LED - Residential	10.0	10,753	0.690		7,419	7,419	7,419	...	0	...	41,309
2019 Specialty LED - Commercial	4.2	1,205	0.690		832	832	832	...	0	...	3,493
2018 Standard LED - Residential	10.0	5,121	0.700		3,585	3,585	948	...	0	...	14,757
2018 Standard LED - Commercial	4.2	243	0.700		170	170	45	...	0	...	439
2018 Reflector LED - Residential	10.0	569	0.700		398	398	398	...	0	...	2,207
2018 Reflector LED - Commercial	4.2	32	0.700		23	23	23	...	0	...	95
2018 Specialty LED - Residential	10.0	199	0.700		139	139	139	...	0	...	769
2018 Specialty LED - Commercial	4.2	11	0.700		8	8	8	...	0	...	33
PYTR Standard LED - Residential	10.0	506	0.580		293	293	78	...	0	...	1,213
PYTR Standard LED - Commercial	4.2	68	0.580		39	39	10	...	0	...	101
PYTR Reflector LED - Residential	10.0	83	0.600		50	50	50	...	0	...	276
PYTR Reflector LED - Commercial	4.2	7	0.600		4	4	4	...	0	...	19
PYTR Specialty LED - Residential	10.0	38	0.580		22	22	22	...	0	...	122
PYTR Specialty LED - Commercial	4.2	3	0.580		2	2	2	...	0	...	8
PY9 Standard LED - Residential	10.0	371	0.580		215	215	56	...	0	...	882
PY9 Standard LED - Commercial	4.2	50	0.580		29	29	8	...	0	...	74
PY9 Reflector LED - Residential	10.0	67	0.600		40	40	40	...	0	...	223

Measure	Measure Life	First-Year Verified Gross Savings (MWh)	NTGR	CPAS - Verified Net Savings (MWh)						Lifetime Savings (MWh)
				2018	2019	2020	2021	...	2030	...	
PY9 Reflector LED - Commercial	4.2	6	0.600		4	4	4	...	0	...	15
PY9 Specialty LED - Residential	10.0	26	0.580		15	15	15	...	0	...	85
PY9 Specialty LED - Commercial	4.2	2	0.580		1	1	1	...	0	...	6
PY9 Standard CFL - Residential	2.0	873	0.630		550	550	0	...	0	...	1,100
PY9 Standard CFL - Commercial	2.0	128	0.630		80	80	0	...	0	...	161
PY9 IPA Rural Kits Standard CFL	2.0	109	0.578		63	63	0	...	0	...	126
PY9 IPA MICK Standard CFL	2.0	57	1.000		57	57	0	...	0	...	114
PY9 IPA CFL Distribution Standard CFL	2.0	587	1.000		587	587	0	...	0	...	1,174
Advanced Power Strip	7.0	5,693	0.860		4,896	4,896	4,896	...	0	...	34,274
Advanced Thermostat	11.0	6,444	1.000		6,444	6,444	6,444	...	0	...	70,881
Variable-Speed Pool Pump	7.0	16	0.800		12	12	12	...	0	...	87
Clothes Washer	14.0	20	0.630		12	12	12	...	12	...	173
Electric Clothes Dryer	16.0	12	0.670		8	8	8	...	8	...	125
Refrigerator	17.0	5	0.650		3	3	3	...	3	...	57
Freezer	22.0	0	0.630		0	0	0	...	0	...	4
Total		**114,127**	**0.716**		**81,770**	**81,770**	**49,955**	**...**	**24**	**...**	**419,631**
Expiring 2019 CPAS					**0**	**0**	**31,815**	**...**	**6,444**	**...**	
Expired 2019 CPAS					**0**	**0**	**31,815**	**...**	**81,747**	**...**	
WAML	**9.1**										

3.2 Income Qualified

3.2.1 Initiative Description

The Income Qualified (IQ) Initiative is a multi-channel AIC initiative implemented to reach income qualified customers. The target markets for the Initiative are (1) single family customers with household incomes up to 300% of federal poverty guidelines for household size and (2) multifamily properties with the majority of tenants receiving state, federal, or other income-qualified assistance.

Throughout this report, we will refer to the IQ Initiative as being implemented through four channels:

- **Single Family:** This is a single-family home energy diagnostic and whole-house retrofit offering delivered through AIC implementation partners.
- **CAA:** This is a single-family home energy diagnostic and whole-house retrofit offering delivered by Community Action Agencies (CAAs).
- **Multifamily:** This channel delivers energy efficiency to income qualified multifamily properties.
- **Smart Savers:** This channel delivers advanced thermostats directly to income qualified customers.

Single Family, CAA, and Multifamily Channels

The Single Family, CAA, and Multifamily channels of the IQ Initiative provide Building Performance Institute (BPI) energy audits that identify building envelope and HVAC retrofit opportunities and provide health and safety inspections. During the audit, implementation staff also install energy-efficient "direct install" (DI) measures such as LEDs, showerheads, faucet aerators, advanced power strips, and pipe insulation. Following the audit, customers may also receive building envelope measures (i.e., air sealing and insulation) and high-efficiency HVAC measures (i.e., smart thermostats, central air conditioners, boilers, and air source heat pumps).

The Initiative provides all audit services and DI measures at no cost to the customer. Low-income single family customers and multifamily properties pay no out-of-pocket costs for shell and HVAC retrofits. Moderate-income[9] single family participants may pay out of pocket costs for HVAC-related mechanical repairs exceeding $1,000 and building envelope retrofits exceeding $2,000.

Leidos oversees the implementation of the Single Family, CAA, and Multifamily channels of the IQ INitiative in coordination with several implementation partners across three channels. Walker-Miller and AIC Program Allies serve low to moderate-income single family customers who do not participate in the Illinois Home Weatherization Assistance Program (IHWAP). CAAs, with support from AIC partner Resource Innovations, serve low-income single family customers that also participate in IHWAP. CMC Energy and three[10] specific AIC program allies serve IQ multifamily properties. All AIC program allies providing initiative services must be "core" allies, meaning they are BPI-certified. Table 14 below briefly describes each implementation partner's role.

[9] AIC defines low income customers as those with household incomes less than 200% of federal poverty guidelines and moderate income customers as those with household incomes between 200% and 300% of federal poverty guidelines.
[10] Assured Energy does all building envelope retrofits. AAA Northgate or Rebel Inc. do all HVAC retrofits.

Table 14. 2019 IQ Initiative - Key Implementation Partners and Roles

Partner	Multifamily Channel	Single Family Channel (without IHWAP)	CAA Channel (with IHWAP)
Leidos	Overall marketing and implementation lead, customer eligibility review, QC field inspections, technical reviews of scopes of work, and incentive application review		
CMC Energy	Marketing, audits, and DI	None	None
Walker-Miller	None	Marketing, audits and DI, QC field inspections of program ally projects[a]	None
Resource Innovations	None	None	Marketing, CAA oversight and support, and incentive application review;
CAAs	None	None	Marketing, waitlist management, eligibility review, audits and DI, building envelope/HVAC retrofits, and QC field inspections
Program Allies	Marketing and building envelope/HVAC retrofits	Marketing, audits and DI, and building envelope/HVAC retrofits[a]	None[b]

[a] For the single family non-CAA channel, either Walker Miller or a Program Ally may complete the energy audit with DI, depending on who identified the lead. Program Allies complete all building envelope and HVAC retrofits.

[b] CAAs either complete projects on their own or bid out project work to certified contractors.

Smart Savers Channel

The Income Qualified - Smart Savers Initiative (Smart Savers Initiative) launched in August 2018 as a pilot market development effort to provide advanced thermostats at no-cost to hard-to-reach customers. AIC first identified four geographic areas to target and expanded the offering to 11 communities in 2019. Customers in the targeted areas received e-mail invitations to apply online or by phone for a free advanced thermostat to install in their homes. Participating customers were given the option of requesting a thermostat to install themselves or a contractor to install the device.

Summary of Key Implementation Changes in 2019

Single Family, CAA, and Multifamily Channels

- There were a few key changes in 2019 that significantly impacted Single Family and CAA channel implementation, coordination, and communication processes. However, there were no substantial changes to multifamily channel implementation.
- After achieving participation goals, the Single Family channel began offering a scaled-down audit, called the Instant Savers Assessment. This new, scaled-down offering reduced costs for the audit and helped preserve the implementation budget while enabling AIC to continue to meet customer demand for services. The Instant Savers Audit provides the same DI measures and health and safety inspections as the original audit but does not perform blower door or combustion testing and did not provide a proposed building envelope and HVAC retrofit scope of work. While the assessment does not provide a scope of work, it does identify the home's HVAC and building envelope opportunities and potential issues that may prevent the project from moving forward. Walker-Miller then puts customers on a waitlist for building envelope and HVAC retrofits in 2020 if such opportunities exist. Leidos and AIC commented that removing these tests was a logical way to lower the cost of audit implementation

per customer as these tests would need to be performed again just prior to receiving building envelope and HVAC retrofits in 2020.

- Resource Innovations made changes to CAA project forecasting support and invoice payment processes. In 2018, CAAs provided volume forecasts only on an annual basis although AIC reports on progress monthly. Resource Innovations now meets with each CAA quarterly to review forecasts, confirm monthly targets, and re-allocate funding as needed. Resource Innovations, Leidos, and AIC all agree that this has significantly improved forecasting accuracy. As for incentive payment to CAAs, incentives were originally processed in bulk monthly, causing some CAAs to wait four weeks or more. In 2019, Resource Innovations now processes incentives as they come, and CAAs receive incentives no more than three weeks after project completion.
- Leidos' Home Energy Specialist (HES) call center now monitors the status of Single Family channel audits completed by Program Allies. HES staff follow-up with program allies to confirm that audits are scheduled and completed.
- Leidos changed the standard pricing process in 2019. Leidos now brings together implementation staff and top-performing single family and multifamily Program Allies (i.e., Allies that provide most project volume) for an annual review process.
- Walker-Miller added a new internal QA/QC process for audits. A field supervisor now shadows a sample of field staff audits, although there is no specific goal for the percentage of audits the supervisor shadows. The supervisor aims for equal coverage across Walker-Miller field staff.

Smart Savers Channel

For the 2019 program year, the Smart Savers channel adapted its measure offerings and incentives as follows:

- Expanded from 4 communities in 2018 to 11 in 2019
- Engaged only single-family customers in 2019
- All 2019 participants submitted applications online

3.2.2 Participation Summary

Single Family, CAA, and Multifamily Channels

AIC and implementation staff across the board commented that the Initiative has been very successful across all channels. According to staff, increased communication between AIC and implementation staff, increased engagement with CAAs, and positive word of mouth about the Initiative have all contributed to the heightened success of each channel in 2019.

Overall, the Initiative far exceeded its participation goals for single family channels (CAA and Single Family) but fell short of its participation goals for multifamily. That said, the Initiative exceeded its savings targets overall, and for each channel (see Section 3.7.3 and 3.7.4).

Table 15 presents Initiative participation during 2019 for single family customers. The Initiative served over 4,500 homes by providing home audits, DI measures, and building envelope or HVAC retrofits. Walker-Miller and Program Allies (the Single Family channel) served most single family homes (92%, N=4,537), while CAAs served the remaining 8%. Overall, the single family portion of the Initiative far exceeded its goals, which were to serve 2,720 households, including 2,420 Single Family and 300 CAA projects.

Table 15. 2019 IQ Initiative Participation Summary – Single Family Channels

Participation	Channel Type		Total
	Single Family	CAA	
Number of single family homes served	**4,157**	**380**	**4,537**
Full Participation: DI + Building envelope or HVAC measures	2,038	358	2,396
DI measures only	1,612	4	1,616
Building shell or HVAC measures only	507	18	525

Source: Initiative tracking data. We determined unique homes based on electric or gas account numbers.

Notes: This table excludes 90 unique account numbers: 26 with only kit measures (see Table 61 for information on kits) and 64 with only "Other" measures (based on the "product family" field in the tracking data). "Other" measures have no ex-ante savings estimates and include Admin Cost, Program Support, Health and Safety, Authorized Measure, and Program Support.

Table 16 presents IQ Initiative participation during 2019 for multifamily properties. The Initiative served 49 properties and 1,108 units. More than half of the properties (57%, N=49) only received DI measures, while the remaining 43% included HVAC measures (i.e., ductless minisplit heat pumps and smart thermostats). No properties received building envelope measures, although air sealing and attic insulation were eligible Initiative measures. The multifamily portion of the Initiative fell short of its participation goal of serving 1,590 units and completing 90 HVAC and building envelope projects (i.e., at 90 unique properties).

Table 16. 2019 IQ Participation Summary – Multifamily

Participation	Total
Number of multifamily properties served	**49**
DI measures only	28
Full Participation: DI + HVAC measures	14
HVAC measures only	7
Number of units served	**1,108**

Source: Initiative tracking data. There were 53 unique project IDs across 49 properties (as defined by account number). and unique tenants based on a combination of address and unit ID number.

Smart Savers Channel

All of the 6,048 advanced thermostats distributed by the Smart Savers Initiative in 2019 were installed in single-family homes, reflecting a shift from 2018 when 29% were installed in multifamily units. All 2019 participants enrolled online, and 40% had their new thermostat installed by a service professional. Table 17 presents participation in the Smart Savers Initiative during 2019.

Table 17. 2019 Smart Savers Initiative Participation Summary

Installation Method	Units	Share of Sales
Direct Install	2,404	40%
Self-Install	3,644	60%
Total	**6,048**	**100%**

3.2.3 Initiative Annual Savings Summary

Table 18 presents overall Income Qualified Initiative annual savings achieved in 2019. The 2019 Income Qualified Initiative achieved 14,602 MWh, 4.16 MW, and 1,239,699 therms in verified net savings. Total savings by channel are presented in Section 3.2.4.

Table 18. 2019 Income Qualified Initiative Annual Savings

	Electric Energy Savings (MWh)	Electric Demand Savings (MW)	Gas Savings (Therms)
Ex Ante Gross Savings	14,323	3.90	1,230,271
Gross Realization Rate	102%	107%	101%
Verified Gross Savings	14,602	4.16	1,239,699
NTGR	1.000	1.000	1.000
Verified Net Savings	14,602	4.16	1,239,699

3.2.4 Initiative Savings Detail

The Income Qualified Initiative distributed 32 different types of measures across the four channels, as shown in Table 19, Table 20, and Table 21. Overall, the Initiative achieved strong gross realization rates; 102% for electric savings, 107% for demand savings, and 101% for gas savings.

Table 19. 2019 Income Qualified Electric Energy Savings by Measure

Measure Category	Ex Ante Gross Savings (MWh)	Gross Realization Rate	Verified Gross Savings (MWh)	NTGR	Verified Net Savings (MWh)
CAA					
Lighting	370	95%	352	1.000	352
Air Sealing	216	87%	188	1.000	188
Insulation	266	65%	174	1.000	174
Bathroom Exhaust Fan	46	95%	44	1.000	44
Showerhead	23	102%	23	1.000	23
Advanced Thermostat	21	101%	21	1.000	21
Faucet Aerator	5	106%	6	1.000	6
Full Kit - Standard LED	3	95%	3	1.000	3
Full Kit - Advanced Power Strip	2	100%	2	1.000	2
Full Kit - Showerhead	1	97%	1	1.000	1
Full Kit - Faucet Aerator	1	105%	1	1.000	1
Full Kit - Water Temperature Card	0.04	92%	0.04	1.000	0.04
Subtotal	*955*	*85%*	*815*	*1.000*	*815*
Single Family					
Lighting	2,686	100%	2,686	1.000	2,686
Central Air Conditioner (CAC)	1,167	161%	1,883	1.000	1,883
Insulation	1,290	81%	1,039	1.000	1,039
Air Source Heat Pump (ASHP)	781	109%	848	1.000	848

Measure Category	Ex Ante Gross Savings (MWh)	Gross Realization Rate	Verified Gross Savings (MWh)	NTGR	Verified Net Savings (MWh)
Air Sealing	796	87%	695	1.000	695
BPM Motor	665	100%	664	1.000	664
Advanced Thermostat	430	133%	573	1.000	573
Bathroom Exhaust Fan	405	99%	400	1.000	400
Advanced Power Strip	364	100%	364	1.000	364
Duct Sealing	68	130%	88	1.000	88
Showerhead	42	100%	42	1.000	42
Faucet Aerator	38	99%	38	1.000	38
Hot Water Pipe Insulation	6	100%	6	1.000	6
Electric Kit - Standard LED	6	95%	5	1.000	5
Electric Kit - Advanced Power Strip	2	100%	2	1.000	2
Subtotal	*8,746*	*107%*	*9,332*	*1.000*	*9,332*
Multifamily					
Advanced Thermostat	744	112%	835	1.000	835
Lighting	420	98%	413	1.000	413
Ductless Heat Pump	126	100%	126	1.000	126
Advanced Power Strip	97	100%	97	1.000	97
Faucet Aerator	118	82%	97	1.000	97
Showerhead	50	110%	55	1.000	55
Hot Water Pipe Insulation	7	100%	7	1.000	7
Subtotal	*1,562*	*104%*	*1,630*	*1.000*	*1,630*
Smart Savers					
Advanced Thermostat	3,059	92%	2,824	1.000	2,824
Subtotal	*3,059*	*92%*	*2,824*	*1.000*	*2,824*
Total	**14,323**	**102%**	**14,602**	**1.000**	**14,602**

Table 20. 2019 Income Qualified Initiative Electric Demand Savings by Measure

Measure Category	Ex Ante Gross Savings (MW)	Gross Realization Rate	Verified Gross Savings (MW)	NTGR	Verified Net Savings (MW)
CAA					
Air Sealing	0.083	104%	0.087	1.000	0.087
Insulation	0.091	69%	0.063	1.000	0.063
Lighting	0.045	96%	0.043	1.000	0.043
Faucet Aerator	0.007	94%	0.007	1.000	0.007
Advanced Thermostat	0.007	100%	0.007	1.000	0.007
Bathroom Exhaust Fan	0.005	95%	0.005	1.000	0.005
Showerhead	0.002	112%	0.003	1.000	0.003

Measure Category	Ex Ante Gross Savings (MW)	Gross Realization Rate	Verified Gross Savings (MW)	NTGR	Verified Net Savings (MW)
Full Kit - Standard LED	0.0004	100%	0.0004	1.000	0.0004
Full Kit - Faucet Aerator	0.0002	142%	0.0003	1.000	0.0003
Full Kit - Advanced Power Strip	0.0002	100%	0.0002	1.000	0.0002
Full Kit - Showerhead	0.0001	114%	0.0001	1.000	0.0001
Full Kit - Water Temperature Card	0.000003	138%	0.000004	1.000	0.000004
Subtotal	*0.242*	*89%*	*0.215*	*1.000*	*0.215*
Single Family					
Central Air Conditioner (CAC)	1.195	118%	1.410	1.000	1.410
Insulation	0.513	82%	0.421	1.000	0.421
Air Sealing	0.350	100%	0.350	1.000	0.350
Lighting	0.340	100%	0.340	1.000	0.340
Advanced Thermostat	0.104	161%	0.168	1.000	0.168
Air Source Heat Pump (ASHP)	0.118	109%	0.129	1.000	0.129
BPM Motor	0.094	97%	0.091	1.000	0.091
Bathroom Exhaust Fan	0.046	99%	0.046	1.000	0.046
Advanced Power Strip	0.041	100%	0.041	1.000	0.041
Duct Sealing	0.024	104%	0.025	1.000	0.025
Faucet Aerator	0.011	136%	0.015	1.000	0.015
Showerhead	0.004	128%	0.005	1.000	0.005
Hot Water Pipe Insulation	0.001	100%	0.001	1.000	0.001
Electric Kit - Standard LED	0.001	102%	0.001	1.000	0.001
Electric Kit - Advanced Power Strip	0.0002	100%	0.0002	1.000	0.0002
Subtotal	*2.841*	*107%*	*3.041*	*1.000*	*3.041*
Multifamily					
Advanced Thermostat	0.080	163%	0.130	1.000	0.130
Lighting	0.056	97%	0.054	1.000	0.054
Faucet Aerator	0.028	104%	0.029	1.000	0.029
Advanced Power Strip	0.011	100%	0.011	1.000	0.011
Ductless Heat Pump	0.014	60%	0.009	1.000	0.009
Showerhead	0.005	146%	0.007	1.000	0.007
Hot Water Pipe Insulation	0.001	100%	0.001	1.000	0.001
Subtotal	*0.195*	*124%*	*0.241*	*1.00*	*0.241*
Smart Savers					
Advanced Thermostat	0.617	107%	0.659	1.000	0.659
Subtotal	*0.617*	*107%*	*0.659*	*1.000*	*0.659*
Total	**3.90**	**107%**	**4.16**	**1.000**	**4.16**

Table 21. 2019 Income Qualified Initiative Gas Savings by Measure

Research Category	Ex Ante Gross Savings (Therms)	Gross Realization Rate	Verified Gross Savings (Therms)	NTGR	Verified Net Savings (Therms)
CAA					
Insulation	56,165	82%	46,031	1.000	46,031
Air Sealing	25,341	144%	36,428	1.000	36,428
Advanced Thermostat	4,554	108%	4,928	1.000	4,928
Showerhead	1,055	102%	1,081	1.000	1,081
Gas Kit - Showerhead	578	112%	645	1.000	645
Gas Kit - Faucet Aerator	483	121%	583	1.000	583
Faucet Aerator	252	102%	258	1.000	258
Gas Kit - Shower Timer	237	97%	230	1.000	230
Gas Kit - Thermostatic Valve	116	176%	204	1.000	204
Full Kit - Showerhead	173	94%	163	1.000	163
Full Kit - Faucet Aerator	145	101%	147	1.000	147
Gas Kit - Water Temperature Card	30	108%	32	1.000	32
Full Kit - Water Temperature Card	9	91%	8	1.000	8
Hot Water Pipe Insulation	2	100%	2	1.000	2
Subtotal	*89,141*	*102%*	*90,739*	*1.000*	*90,739*
Single Family					
Furnace	259,101	109%	282,072	1.000	282,072
Insulation	285,412	83%	236,300	1.000	236,300
Air Sealing	101,198	134%	135,257	1.000	135,257
Advanced Thermostat	122,626	95%	115,949	1.000	115,949
Duct Sealing	25,020	184%	45,973	1.000	45,973
Showerhead	7,703	100%	7,728	1.000	7,728
Faucet Aerator	7,259	99%	7,205	1.000	7,205
Boiler	5,389	100%	5,394	1.000	5,394
Hot Water Pipe Insulation	1,798	100%	1,795	1.000	1,795
Subtotal	*815,506*	*103%*	*837,672*	*1.000*	*837,672*
Multifamily					
Advanced Thermostat	20,486	100%	20,486	1.00	20,486
Faucet Aerator	2,868	94%	2,704	1.00	2,704
Showerhead	1,977	128%	2,524	1.00	2,524
Hot Water Pipe Insulation	30	100%	30	1.00	30
Subtotal	*25,361*	*102%*	*25,743*	*1.00*	*25,743*
Smart Savers					
Advanced Thermostat	300,262	95%	285,545	1.000	285,545
Subtotal	*300,262*	*95%*	*285,545*	*1.000*	*285,545*

Research Category	Ex Ante Gross Savings (Therms)	Gross Realization Rate	Verified Gross Savings (Therms)	NTGR	Verified Net Savings (Therms)
Total	1,230,271	101%	1,239,699	1.000	1,239,699

Below we discuss the reasons for differences between ex ante and verified savings for each measure with a realization rate that is less than 100%.[11] We organized the list below from largest to smallest contribution to ex-ante savings.

- Lighting: The gross realization rates for lighting were 99% for kWh and 99% for kW savings.
  - LED common area: Ex ante estimates applied a lifetime in-service rate (ISR) of 98%. The verified analysis applied the corrected ISR of 100% based on receiving documentation provided by Leidos, resulting in higher kWh and kW verified savings.
  - Standard LEDs: Ex ante estimates applied hours of use (HOU) and coincidence factor (CF) assumptions for unknown installed location (e.g., interior, exterior) wherethe database indicates these are interior bulbs. The verified analysis applied assumptions for interior bulbs, resulting in lower kWh and kW verified savings.
  - In-unit multifamily LEDs: Ex ante estimates applied single family assumptions to LEDs received through the multifamily channel. The verified analysis applied multifamily assumptions, resulting in lower kWh and kW verified savings.
- Furnaces: The gross realization rate for furnaces was 109% for therms savings.
  - Ex ante estimates did not derate the existing furnace efficiency per IL-TRM guidelines. The verified analysis derated the existing efficiency, resulting in higher verified therms savings.
  - Ex ante estimates applied existing furnace Annual Fuel Utilization Efficiency (AFUE) values that did not align with the AFUE values in the tracking database. The verified analysis applied the AFUE values in the tracking database, resulting in higher verified therms savings.
  - Ex ante estimates applied the time of sale (TOS) existing furnace AFUE value of 80% to projects that are early retirement. The verified analysis applied actual efficiencies from the tracking database or otherwise applied the default values for early retirement from the IL-TRM, resulting in higher verified therms savings.
- Insulation: The gross realization rate for insulation was 78% for kWh, 80% for kW, and 83% for therms savings.
  - Attic insulation: Ex ante estimates did not apply an adjustment for furnace fan savings for 43 projects. The verified analysis applied the adjustment for these projects, resulting in higher verified kWh and kW savings.
  - Attic insulation: The existing AFUE in the tracking database was much low (e.g., a 15% AFUE furnace) than the normal range for 58 cases, suggesting a potential data entry error. The verified analysis set a minimum of 50% AFUE, resulting in lower verified therms savings.
  - Crawlspace, rim joist, and floor insulation: Ex ante estimates used cooling degree days (CDDs) and heating degree days (HDDs) assumption appropriate for conditioned space when space

[11] Note, the realization rates we present in this list are the realization rates for measures across all Initiative channels and differ from the channel-specific realization rates. Please see Table 19, Table 20, and Table 21 for channel-specific realization rates.

conditioning status was unknown. The verified analysis used unconditioned space assumptions, resulting in lower verified kWh, kW, and therms savings.

- Advanced thermostats (Single Family, CAA, and Multifamily): The gross realization rates for advanced thermostats were 120% for kWh savings, 160% for kW savings, and 96% for therms savings.
  - Ex ante estimates did not claim cooling savings when the tracking database indicated central air conditioning as the primary cooling type. The verified analysis included cooling savings for these cases, resulting in higher verified kWh and kW savings.
  - Ex ante estimates applied a cooling reduction of 6.3%, where the IL-TRM specifies 8%. The verified analysis applied 8%, resulting in higher verified kWh and kW savings.
  - Ex ante estimates have a discrepancy between heating climate zone and gas heating consumption. The verified analysis corrected for this issue, resulting in lower verified therms savings overall.
- Central air conditioner (CAC): The gross realization rates for CAC were 161% for kWh savings and 118% for kW savings. The only discrepancies between ex ante and verified savings were with early retirement CACs.
  - Ex ante estimates did not derate the existing CAC efficiency per IL-TRM guidelines. The verified analysis derated the existing efficiency, resulting in higher verified kWh and kW savings.
  - Ex ante estimates applied existing energy efficiency ratio (EER) = 7.5 to all early retirement cases, which is the default from the IL-TRM when EER is unknown. The verified analysis converted the actual Seasonal Energy Efficiency Ratio (SEER) values in the database to EER and used those values, resulting in lower verified kW savings.
- Air sealing: The gross realization rates for air sealing were 87% for kWh savings, 101% for kW savings, and 136% for therms savings.
  - Ex ante estimates did not apply the cooling savings adjustment factor for demand savings. The verified analysis applied this factor, resulting in higher verified kW savings.
  - Ex ante applied a gas heating savings adjustment of 72% instead of 100% when calculating therms for cases with no attic insulation installed through the Initiative. The TRM indicates to apply 100% when no attic insulation is installed. The verified analysis applied 100% to cases with no attic insulation installed through the Initiative, resulting in higher verified therms savings.
  - Ex ante estimates applied leakage assumptions (N_heat and N_cool) for climate zone 3 (Springfield) when the climate zone is 2 (Chicago), resulting in higher verified kWh, kW, and therms savings.
  - Ex ante estimates applied a heating season adjustment for kWh fan savings of 100% while the TRM specifies 107% when attic insulation is installed through the Initiative. The verified analysis applied 107%, resulting in higher verified kWh savings.
  - Ex ante estimates applied a cooling savings adjustment factor of 121% in all cases, when estimates should have applied an adjustment factor of 100% in cases where no attic insulation was installed. The verified analysis applied 100% in cases where no attic insulation was installed, resulting in lower verified kWh savings. Note that this decrease in verified kWh savings was greater than the increases noted above, resulting in lower kWh verified savings overall.
- Full community kit: The gross realization rates for full community kits were 100% for kWh savings, 113% for kW savings, and 101% for therms savings.

- Ex ante estimates applied assumptions for unknown home type when calculating savings for kits provided through the CAA channel. This offering targets single family homes and, as such, the verified analysis applied single family assumptions, resulting in lower verified kWh and therms savings, and higher verified kW savings.
- Ex ante estimates did not include wastewater kWh savings in demand calculations in accordance with the IL-TRM. The verified analysis included wastewater savings, resulting in higher demand savings.
- For bathroom faucet aerators when housing type was unknown, ex-ante estimates assumed housing shares of 79% single family and 21% multifamily to estimate total faucets per household (FPH), resulting in 2.55 FPH. The verified analysis used the total FPH for unknown home type (3.42 faucets) and subtracted one faucet for kitchen to arrive at 2.42 FPH for unknown home type. These adjustments resulted in higher verified kWh, kW, and therms savings.
- For faucet aerators and showerheads, the IL-TRM does not provide a default value for energy per gallon (EPG_{gas}) or HOU for unknown housing type. The ex ante estimates assumed housing shares of 79% single family and 21% multifamily for these variables. The verified analysis used shares of 69% single family and 31% multifamily based on footnote 660 in the TRM under EPG_{gas} and HOU, resulting in lower verified kWh, kW, and therms savings. Note that because this reduction was not greater than the increases noted above, the overall realization rates remained above 100%.

- Gas community kit: The gross realization rate for gas community kits was 121% for therms savings.
  - Ex ante estimates applied an 84% gas water heating weight to showerheads and thermostatic shower valves, even when the home water heating type was gas. The verified analysis used 100% gas water heating for these cases, resulting in higher therms savings.
  - Ex ante estimates applied assumptions for unknown home type when calculating savings for kits the Initiative provided through the CAA channel. This offering targets single family homes and, as such, the verified analysis applied single family assumptions, resulting in lower verified therms savings.
  - For bathroom aerators when housing type was unknown, ex-ante estimates assumed housing shares of 79% single family and 21% multifamily to estimate total FPH. The verified analysis used the total FPH for unknown home type (3.42 faucets) and subtracted one faucet for kitchen to arrive at 2.42 FPH for unknown home type. These adjustments resulted in higher verified therms savings.
  - For bathroom aerators, showerheads, and shower timers, the IL-TRM does not provide a default value for EPG_{gas} or HOU for unknown housing type. The ex ante estimates assumed housing shares of 79% single family and 21% multifamily for these variables. The verified analysis used shares of 69% single family and 31% multifamily based on footnote 660 in the TRM under EPG_{gas} and HOU, resulting in lower verified therms savings. Note that because this reduction was not greater than the increases noted above, the overall realization rates remained above 100%.
- Electric community kit: The gross realization rates for electric community kits were 99% for kWh savings and 100% for kW savings.
  - Ex ante estimates applied assumptions for unknown home type when calculating LED savings for kits the Initiative provided through the CAA and non-CAA channels. These channels target single family homes, therefore the verified analysis applied assumptions for single family homes instead, resulting in lower verified kWh and higher kW savings. Note, the increase in verified kW savings was not enough to result in a realization rate different from 100% when rounding.

- CEFS kit: The gross realization rates for CEFS kits were 97% for kWh savings, 100% for kW savings, and 84% for therms savings.
  - Ex ante estimates did not apply the 80% adjustment for air sealing savings to outlet gaskets. The verified analysis applied this adjustment, resulting in lower verified kWh and therms savings.
- Air source heat pump early replacement (ASHP ER): The gross realization rates for ASHP ER were 109% for kWh savings and 109% for kW savings.
  - Ex ante estimates did not derate the existing system efficiency per IL-TRM guidelines. The verified analysis derated the existing efficiency, resulting in higher verified kWh and kW savings.
  - Ex ante estimates applied existing EER = 7.5 to all early retirement cases, which is the default from the IL TRM when EER is unknown. The verified analysis converted the actual SEER values in the database to EER and used those values, resulting in higher kW savings.
- Brushless permanent magnet (BPM) motor: The gross realization rates for BPM motors were 100% for kWh savings and 97% for kW savings.
  - There were misalignments between ex ante savings estimates and the tracking data in terms of system category, cooling capacity, and heating capacity. The verified analysis corrected for these issues, resulting in lower verified kWh and kW savings. Note, the decrease in verified kWh savings was not enough to result in a realization rate different from 100% when rounding.
- Bathroom fan: The gross realization rates for bathroom fans were 98% for kWh savings and 98% for kW savings.
  - Ex ante estimates applied HOU for continuous operation in all cases. The IL-TRM indicates to assume continuous operation only for homes that are tightly sealed. Verified savings used continuous fan runtime defaults from the IL-TRM for participants who received air sealing through the Initiative, otherwise we assumed standard hours of use, resulting in lower verified kWh and kW savings.
  - Ex ante estimates applied a deemed value of 216.9 to all projects, which is the deemed default from the IL TRM for a continuous, most-efficient ENERGY STAR bathroom fan. The verified analysis applied actual efficiencies provided in the tracking data and otherwise used the ILTRM defaults when efficiencies were unknown, resulting in lower verified kWh and kW savings.
- Ductless heat pump: The gross realization rates for ductless heat pumps were 100% for kWh savings and 60% for kW savings.
  - Ex ante estimates applied a CF of 72% for whole-home cooling. Given these measures replace window air conditioners, we assume they operate as localized and used a CF of 43% in accordance with the IL TRM, resulting in lower verified kW savings.
- Faucet aerators: The gross realization rates for aerators were 87% for kWh savings, 111% for kW savings, and 98% for therms savings.
  - Ex ante estimates claimed kWh savings when water heating type was gas for four projects. The verified analysis corrected for this issue, resulting in lower verified kWh savings.
  - Ex ante estimates did not include wastewater kWh in the demand algorithms. The verified analysis included it, resulting in higher verified kW savings.
  - Ex ante applied single family assumptions to aerators received through the multifamily channel. The verified analysis applied multifamily assumptions to these aerators, resulting in lower verified

kWh, kW, and therms savings. Note that because this reduction was not greater than the increases noted above, the overall realization rates remained above 100%.

- Showerheads: The gross realization rates for showerheads were 103% for kWh savings, 133% for kW savings, and 106% for therms savings.
  - Ex ante estimates applied single family assumptions to showerheads received through the multifamily channel. The verified analysis applied multifamily assumptions, resulting in higher verified kWh and therms savings.
  - Ex ante did not claim demand savings for most projects. All projects should receive wastewater demand savings in accordance with the IL-TRM. The verified analysis includes wastewater demand savings for these measures, resulting in higher verified kW savings.

3.2.5 Cumulative Persisting Annual Savings

Table 22 presents CPAS and WAML for the 2019 Income Qualified Initiative. The total verified gross savings for the Initiative are summarized by channel, and CPAS in each year of the 2018-2021 Plan are presented.[12] The WAML for the Initiative is 13.5 years. CPAS and WAML for each channel at a measure level are summarized in Table 23 through Table 26.

In 2019, AIC converted natural gas savings produced by a subset of Single Family channel measures to CPAS for the purposes of goal attainment; those savings are presented separately in Table 27.

Table 22. 2019 Income Qualified Initiative CPAS and WAML

Channel	WAML	First-Year Verified Gross Savings (MWh)	NTGR	CPAS - Verified Net Savings (MWh)							Lifetime Savings (MWh)
				2018	2019	2020	2021	...	2030	...	
CAA	14.9	815	1.000		815	815	555	...	415	...	10,188
Single Family	14.7	9,332	1.000		9,332	9,332	7,809	...	3,819	...	102,091
Multifamily	10.7	1,630	1.000		1,630	1,630	1,460	...	127	...	15,304
Smart Savers	11.0	2,824	1.000		2,824	2,824	2,824		0		31,067
2019 CPAS		**14,602**	**1.000**		**14,602**	**14,602**	**12,647**	...	**4,361**	...	**158,650**
Expiring 2019 CPAS					**0**	**0**	**1,954**	...	**4,253**	...	
Expired 2019 CPAS					**0**	**0**	**1,954**	...	**10,241**	...	
WAML	**13.5**										

[12] For further detail, including achieved CPAS in years not presented in this table, please see the summary CPAS spreadsheet attached to this report.

Table 23. 2019 Income Qualified Initiative CPAS and WAML – CAA

Measure	Measure Life	First-Year Verified Gross Savings (MWh)	NTGR	CPAS - Verified Net Savings (MWh)							Lifetime Savings (MWh)
				2018	2019	2020	2021	...	2030	...	
Standard LED	10.0	352	1.00		352	352	94	...	-	...	1,460
Air Sealing	20.0	188	1.00		188	188	188	...	193	...	3,816
Attic Insulation	20.0	95	1.00		95	95	95	...	98	...	1,938
Bathroom Exhaust Fan	19.0	44	1.00		44	44	44	...	44	...	832
Showerhead	10.0	23	1.00		23	23	23	...	-	...	232
Wall Insulation	20.0	27	1.00		27	27	27	...	28	...	542
Crawl Space Insulation	20.0	29	1.00		29	29	29	...	29	...	589
Advanced Thermostat	11.0	21	1.00		21	21	21	...	-	...	235
Floor Insulation	20.0	19	1.00		19	19	19	...	19	...	378
Faucet Aerator	10.0	6	1.00		6	6	6	...	-	...	55
Rim Joist Insulation	20.0	3	1.00		3	3	3	...	3	...	65
Full Community Kit - LED Standard	10.0	3	1.00		3	3	1	...	-	...	13
Full Community Kit - Advanced Power Strip	7.0	2	1.00		2	2	2	...	-	...	15
Full Community Kit - Showerhead	10.0	1	1.00		1	1	1	...	-	...	9
Full Community Kit - Faucet Aerator	10.0	1	1.00		1	1	1	...	-	...	9
Full Community Kit - Water Temperature Card	2.0	0.04	1.00		0.04	0.04	-	...	-	...	0.1
2019 CPAS		**815**	**1.00**		**815**	**815**	**555**	**...**	**415**	**...**	**10,188**
Expired 2019 CPAS					**0**	**0**	**260**	**...**	**21**	**...**	
Expiring 2019 CPAS					**0**	**0**	**260**	**...**	**400**	**...**	
WAML	**14.9**										

Table 24. 2019 Income Qualified Initiative CPAS and WAML – Single Family

Measure	Measure Life	First-Year Verified Gross Savings (MWh)	NTGR	CPAS - Verified Net Savings (MWh)							Lifetime Savings (MWh)
				2018	2019	2020	2021	...	2030	...	
Standard LED	10.0	1,896	1.00		1,896	1,896	533	...	-	...	8,052
Central AC (ER)	18.0	1,878	1.00		1,878	1,878	1,878	...	388	...	15,932
ASHP (ER) - Replaces Electric Resistance	16.0	730	1.00		730	730	730	...	730	...	11,679
Air Sealing	20.0	695	1.00		695	695	695	...	607	...	13,023
Attic Insulation	20.0	675	1.00		675	675	675	...	582	...	12,570
BPM	15.0	664	1.00		664	664	664	...	664	...	9,966
Advanced Thermostat	11.0	573	1.00		573	573	573	...	-	...	6,300
Bathroom Exhaust Fan	19.0	400	1.00		400	400	400	...	400	...	7,592
Specialty LED	10.0	395	1.00		395	395	395	...	-	...	2,163
Advanced Power Strip - Tier 1	7.0	364	1.00		364	364	364	...	-	...	2,550
Standard LED - Exterior	6.1	224	1.00		224	224	67	...	-	...	720
Crawl Space Insulation	20.0	202	1.00		202	202	202	...	187	...	3,887
Wall Insulation	20.0	130	1.00		130	130	130	...	113	...	2,427
ASHP (ER) - Replaces ASHP	16.0	114	1.00		114	114	114	...	14	...	825
Reflector LED	10.0	101	1.00		101	101	101	...	-	...	583
Duct Sealing	20.0	88	1.00		88	88	88	...	88	...	1,768
Reflector LED - Exterior	6.1	59	1.00		59	59	59	...	-	...	303
Showerhead	10.0	42	1.00		42	42	42	...	-	...	417
Faucet Aerator	10.0	38	1.00		38	38	38	...	-	...	382
Rim Joist Insulation	20.0	32	1.00		32	32	32	...	31	...	631
Specialty LED - Exterior	6.1	12	1.00		12	12	12	...	-	...	61
Hot Water Pipe Insulation	15.0	6	1.00		6	6	6	...	6	...	92
Electric Community Kit - LED Standard	10.0	5	1.00		5	5	1	...	-	...	22
Central AC (TOS)	18.0	5	1.00		5	5	5	...	5	...	81
ASHP (TOS)	16.0	3	1.00		3	3	3	...	3	...	56
Electric Community Kit - Advanced Power Strip	7.0	2	1.00		2	2	2	...	-	...	13

Measure	Measure Life	First-Year Verified Gross Savings (MWh)	NTGR	CPAS - Verified Net Savings (MWh)							Lifetime Savings (MWh)
				2018	2019	2020	2021	...	2030	...	
2019 CPAS		9,332	1.00		9,332	9,332	7,809	...	3,819	...	102,091
Expired 2019 CPAS					-	-	1,524	...	573	...	
Expiring 2019 CPAS					-	-	1,524	...	5,514	...	
WAML	14.7										

Table 25. 2019 Income Qualified Initiative CPAS and WAML – Multifamily

Measure	Measure Life	First-Year Verified Gross Savings (MWh)	NTGR	CPAS - Verified Net Savings (MWh)							Lifetime Savings (MWh)
				2018	2019	2020	2021	...	2030	...	
Advanced Thermostat	11.0	835	1.00		835	835	835	...	-	...	9,187
Standard LED	10.0	233	1.00		233	233	64	...	-	...	980
Ductless Heat Pump (ER)	15.0	126	1.00		126	126	126	...	120	...	1,834
Advanced Power Strip - Tier 1	7.0	97	1.00		97	97	97	...	-	...	678
Faucet Aerator	10.0	97	1.00		97	97	97	...	-	...	967
Specialty LED	10.0	90	1.00		90	90	90	...	-	...	496
Showerhead	10.0	55	1.00		55	55	55	...	-	...	552
Reflector LED	10.0	11	1.00		11	11	11	...	-	...	63
Hot Water Pipe Insulation	15.0	7	1.00		7	7	7	...	7	...	107
Reflector LED - Common Area	8.4	2	1.00		2	2	2	...	-	...	13
Specialty LED - Common Area	8.4	1	1.00		1	1	1	...	-	...	6
Reflector LED - Exterior	6.1	1	1.00		1	1	1	...	-	...	4
Standard LED - Exterior	6.1	1	1.00		1	1	0.3	...	-	...	4
2019 CPAS		**1,558**	**1.00**		**1,558**	**1,558**	**1,388**	**...**	**127**	**...**	**14,890**
Expired 2019 CPAS					**0**	**0**	**170**	**...**	**835**	**...**	
Expiring 2019 CPAS					**0**	**0**	**170**	**...**	**1,431**	**...**	
WAML	**10.8**										

Table 26. 2019 Income Qualified Initiative CPAS and WAML – Smart Savers

Measure	Measure Life	First-Year Verified Gross Savings (MWh)	NTGR	CPAS - Verified Net Savings (MWh)							Lifetime Savings (MWh)
				2018	2019	2020	2021	...	2030	...	
Advanced Thermostat	11.0	2,824	N/A		2,824	2,824	2,824	...	0	...	31,067
2019 CPAS		**2,824**	**N/A**		**2,824**	**2,824**	**2,824**	**...**	**0**	**...**	**31,067**
Expired 2019 CPAS					**0**	**0**	**0**	**...**	**2,824**	**...**	
Expiring 2019 CPAS					**0**	**0**	**0**	**...**	**2,824**	**...**	
WAML	**11.0**										

Table 27. 2019 Income Qualified CPAS and WAML – Single Family (Gas Conversion)

Measure	Measure Life	First-Year Verified Gross Savings (MWh)	NTGR	CPAS - Verified Net Savings (MWh)							Lifetime Savings (MWh)
				2018	2019	2020	2021	...	2030	...	
Advanced Thermostat	11	1,916	1.000		1,916	1,916	1,916	...	0	...	19,158
Air Sealing	20	2,299	1.000		2,299	2,299	2,299	...	2,173	...	42,548
Boiler	25	5	1.000		5	5	5	...	5	...	116
Boiler ER	25	67	1.000		67	67	67	...	29	...	1,031
Duct Sealing	20	273	1.000		273	273	273	...	273	...	5,186
Faucet Aerator	10	148	1.000		148	148	148	...	0	...	1,328
Furnace	20	131	1.000		131	131	131	...	131	...	2,482
Furnace ER	20	4,240	1.000		4,240	4,240	4,240	...	597	...	33,798
Insulation	20	3,853	1.000		3,853	3,853	3,853	...	3,746	...	76,101
Pipe Insulation	15	43	1.000		43	43	43	...	43	...	605
Showerhead	10	146	1.000		146	146	146	...	0	...	1,315
2019 CPAS		**13,121**	**1.000**		**13,121**	**13,121**	**13,121**	**...**	**6,997**	**...**	**188,627**
Expiring 2019 CPAS					**0**	**0**	**0**	**...**	**1,916**	**...**	
Expired 2019 CPAS					**0**	**0**	**0**	**...**	**6,124**	**...**	
WAML	**18.5**										

3.2.6 Conclusions and Recommendations

Based on the results of this evaluation, the evaluation team offer the following key findings and recommendations for the Income Qualified Initiative moving forward:

- Key Finding #1: The ex ante estimates did not derate existing efficiencies for several HVAC measures (furnaces, CACs, and ASHPs) in accordance with the IL-TRM. This resulted in higher verified savings compared to ex ante estimates.
  - Recommendation: We recommend that the implementation team derate furnace, CAC, and ASHP existing efficiencies in accordance with the IL TRM.
- Key Finding #2: The ex ante estimates did not use actual SEER/EER ratings when they were available in the tracking data for CAC and ASHP early retirement savings. Instead, ex ante estimates used the default value from the TRM all cases. This resulted in lower verified savings compared to ex ante.
  - Recommendation: We recommend that the implementation team use the actual existing efficiencies in the tracking data when estimating early replacement CAC and ASHP savings. In cases where the existing efficiency is unknown, the default TRM value is appropriate.
- Key Finding #3: Kit ex ante estimates used incorrect housing type assumptions. For example, ex ante used unknown housing type assumptions for full community kits provided through the CAA channel. The verified analysis corrected for these issues, which had varying impacts on verified savings (i.e., in some cases making them higher and, in some cases, making them lower compared to ex ante).
  - Recommendation: We recommend that the implementation team align housing type assumptions for kits with their channel type: single family assumption for CAA and non-CAA channels, multifamily housing type assumptions for the Multifamily channel, and unknown housing type assumptions for the Community Kits channel.
- Key Finding #4: Ex ante estimates did not include wastewater kWh savings in demand savings calculations for faucet aerators and showerheads, resulting in higher demand savings compared to ex ante.
  - Recommendation: We recommend that the implementation team include wastewater kWh savings in demand savings calculation for faucet aerators and showerheads.
- Key Finding #5: Ex ante savings apply cooling degree days (CDD) and heating degree days (HDD) for conditioned space for crawl space, rim joist, and floor insulation with the idea that these areas are enclosed within the thermal barrier due to the installation of proper air sealing measures. The evaluation team applied CDD and HDD for unconditioned space, as the area is not purposely conditioned, but indirectly conditioned due to duct leakage.
  - Recommendation: We recommend the implementation team collect this information and include it in the program tracking database in future program years to allow us to appropriately apply CDDs and HDDs.

3.3 Public Housing

3.3.1 Initiative Description

The AIC Public Housing Initiative offers home energy diagnostic services and whole-house retrofits to multifamily properties owned by government entities (i.e., federal, state, and municipal housing authorities). The Initiative serves properties within AIC territory with an average household income at or below 300% of federal poverty guidelines that are owned or managed by Public Housing Authorities (PHAs).

Leidos and CMC Energy (CMC) work collaboratively to recruit customers to the Initiative and deliver upgrades. Leidos fields Initiative inquiries from interested customers through their call center, and they complete technical reviews on completed applications to ensure that participants qualify for the Initiative and are in good standing as PHAs.

CMC supports Leidos with customer recruitment through their dedicated outreach representative who contacts eligible PHAs to inform them about the Initiative's offerings. CMC also leads the day-to-day implementation of the Initiative, which includes assisting PHA staff with initiative enrollment, conducting audits, installing in-unit measures, and following up with participating property managers to confirm installed measures are performing as planned.

Customers are eligible to receive in-unit direct install and building envelope measures through the Initiative. The process for the delivery of these measures is as follows:

- In-unit Measures: An energy advisor from CMC contacts the PHA to schedule an audit and develop a scope of work. CMC then submits the project information to Leidos for approval. Upon receiving project approval, CMC proceeds with installing in-unit direct install measures including standard and specialty LEDs, low-flow faucet aerators and showerheads, advanced thermostats, and advanced power strips in tenant units at no cost to the PHA.
- Building Envelope Measures: Participants can decide to install envelope measures, including air sealing and insulation, either independently or in addition to direct install measures. CMC, Leidos, and program allies all help with generating leads for building envelope upgrade installations. Interested PHAs must submit an additional application, and an energy advisor from Leidos performs a pre-inspection to ensure that the property is eligible to receive building envelope measures. Program allies complete the upgrades upon approval of the pre-inspection. Leidos verifies measure installation by performing onsite inspections on 5% of completed projects.

Summary of Key Implementation Changes in 2019

AIC made a few changes to the Public Housing Initiative during the 2019 program year:

- The Public Housing Initiative stopped offering standard LED lightbulbs in September 2019 in preparation for expected changes to IL-TRM baselines based on the Federal Energy Independence and Securities Act (EISA) standards that were expected to take effect in 2020. The new standards were expected to increase baseline assumptions for lighting efficiency, which would have substantially reduced the CPAS savings for standard lighting measures. The Public Housing Initiative continues to offer specialty LED bulbs.
- CMC hired a specific marketing and outreach staff member for 2019 to recruit properties to participate in the Income Qualified Initiative. Initiative staff reported this staff member also helped to generate leads and increase enrollment in the Public Housing Initiative.

- AIC created a new goal in 2019 to distribute 1,200 advanced thermostats through the Public Housing Initiative.

3.3.2 Participation Summary

Table 28 presents Public Housing Initiative participation during 2019. The Public Housing Initiative served 90 total properties[13] in 2019 that received direct install measures, envelope upgrades, or both. In 2019, AIC served 31% of the properties that participated in the Initiative in 2018 (91 vs. 292), and achieved 59% of the total 2018 verified net electric savings in 2019 (987 MWh vs. 1,675 MWh). These results indicate that the implementation team likely served larger properties and delivered more measures to each property in 2019.

Table 28. 2019 Public Housing Initiative Participation Summary

Participation	Count
Unique Properties	90
Unique Projects	151
Measure Count[a]	21,301

[a] The units for attic insulation and air sealing are the number of discrete installations.

Table 29 presents the quantity and frequency of measures delivered to PHA properties. The most commonly installed measures were LEDs[14] (62% of properties), faucet aerators (49% of properties), and showerheads (48% of properties). The Public Housing Initiative distributed 152 advanced thermostats in 2019, which is significantly less than the internal initiative goal of distributing 1,200 advanced thermostats. Initiative staff reported PHA property managers were reluctant to accept advanced thermostats because they were concerned this measure would be complicated for tenants to operate. As such, PHA property managers feared that the thermostats would require PHA staff to provide more ongoing technical assistance. In addition, PHA property managers were concerned about possible tenant theft of the devices.

Table 29. 2019 Public Housing Frequency and Quantity of Measures Delivered

Measure Type	Count of Unique Properties Receiving Measures	Quantity of Measures Distributed
LED[a]	56	14,819
Faucet Aerator	44	3,387
Showerhead	43	1,455
Advanced Power Strip - Tier 1	29	1,334
Advanced Thermostat	3	152
Air Sealing	28	76
Attic Insulation	30	78
Total	**N/A**	**21,301**

[a] The LED measure type includes standard and specialty LEDs

[13] Unique properties are defined by geographic location, so multiple buildings in the same location comprise one property.
[14] As AIC offered LEDs through September 2019, LED measure counts include standard and specialty LEDs.

3.3.3 Initiative Annual Savings Summary

Table 30 presents Public Housing Initiative annual savings achieved in 2019. The 2019 Public Housing Initiative achieved 1,162 MWh, 0.19 MW, and 32,181 therms in verified net savings. The Initiative exceeded its internal initiative electric savings target of 814 MWh and fell slightly short of its internal initiative gas savings target of 33,321 therms. Initiative staff reported that hiring an additional outreach staff member dedicated to recruiting multifamily properties helped the Public Housing Initiative achieve savings goals in 2019.

Table 30. 2019 Public Housing Initiative Annual Savings

	Electric Energy Savings (MWh)	Electric Demand Savings (MW)	Gas Savings (Therms)
Ex Ante Gross Savings	1,164	0.17	31,662
Gross Realization Rate	100%	108%	102%
Verified Gross Savings	1,162	0.19	32,181
NTGR	1.000	1.000	1.000
Verified Net Savings	1,162	0.19	32,181

3.3.4 Initiative Savings Detail

The Public Housing Initiative distributed 12 measure types, as shown in Table 31. Measures included standard and specialty type LED bulbs for interior and exterior use, faucet aerators for bathrooms and kitchens, showerheads, advanced power strips, advanced thermostats, air sealing, and attic insulation. LEDs contributed to about 60% to the total verified energy savings and almost 50% of the verified demand savings.

Table 31. 2019 Public Housing Initiative Electric Energy Savings by Measure

Measure Category	Ex Ante Gross Savings (MWh)	Gross Realization Rate	Verified Gross Savings (MWh)	NTGR	Verified Net Savings (MWh)
LED - In-Unit (A-Type)	535	100%	535	1.000	535
LED - Common Area (A-Type)	139	102%	142	1.000	142
Kitchen Faucet Aerator	115	101%	116	1.000	116
Showerhead	105	100%	105	1.000	105
Advanced Power Strip - Tier 1	95	100%	95	1.000	95
Attic Insulation	75	88%	66	1.000	66
Advanced Thermostats	42	116%	49	1.000	49
Air Sealing	31	87%	27	1.000	27
Bathroom Faucet Aerator	22	101%	23	1.000	23
LED - Exterior (A-Type)	3	102%	3	1.000	3
LED - Common Area (Reflector)	1	102%	1	1.000	1
LED - In-Unit (Globe)	<1	100%	<1	1.000	<1
Total	**1,164**	**100%**	**1,162**	**1.000**	**1,162**

Table 32. 2019 Public Housing Initiative Electric Demand Savings by Measure

Measure Category	Ex Ante Gross Savings (MW)	Gross Realization Rate	Verified Gross Savings (MW)	NTGR	Verified Net Savings (MW)
LED - In-Unit (A-Type)	0.06	100%	0.06	1.000	0.06
Kitchen Faucet Aerator	0.03	116%	0.03	1.000	0.03
LED - Common Area (A-Type)	0.02	102%	0.02	1.000	0.02
Bathroom Faucet Aerator	0.02	116%	0.02	1.000	0.02
Advanced Thermostats	0.01	127%	0.02	1.000	0.02
Showerhead	0.01	115%	0.01	1.000	0.01
Advanced Power Strip - Tier 1	0.01	100%	0.01	1.000	0.01
Attic Insulation	0.01	99%	0.01	1.000	0.01
LED - In-Unit (Globe)	<0.01	100%	<0.01	1.000	<0.01
LED - Common Area (Reflector)	<0.01	102%	<0.01	1.000	<0.01
Air Sealing	<0.01	127%	<0.01	1.000	<0.01
Total	**0.17**	**108%**	**0.19**	**1.000**	**0.19**

Table 33. 2019 Public Housing Initiative Gas Savings by Measure

Measure Category	Ex Ante Gross Savings (Therms)	Gross Realization Rate	Verified Gross Savings (Therms)	NTGR	Verified Net Savings (Therms)
Showerhead	11,856	101%	11,917	1.000	11,917
Kitchen Faucet Aerator	9,548	105%	10,046	1.000	10,046
Advanced Thermostats	4,376	100%	4,376	1.000	4,376
Attic Insulation	3,608	99%	3,563	1.000	3,563
Bathroom Faucet Aerator	1,451	99%	1,440	1.000	1,440
Air Sealing	823	102%	839	1.000	839
Total	**31,662**	**102%**	**32,181**	**1.000**	**32,181**

The realization rates for electric energy and natural gas savings are 100% and 102% respectively, which indicates ex ante and verified savings values are closely aligned. The 108% realization rate for the demand savings is driven by common area LEDs, kitchen faucet aerators, showerheads, and advanced thermostats, which all had realization rates greater than 100%.

The following list describes the primary reasons for differences between ex ante and verified savings calculations for each measure category:

- **Advanced Thermostats:**
  - **Cooling Reduction:** The implementation team applied a cooling reduction of 6.3% to all advanced thermostat measures instead of the 8.0% cooling reduction specified in the IL-TRM V7.0. This change increased verified electric savings and demand savings.
- **Air Sealing:** Various errors in the implementation team's application of IL-TRM V7.0 algorithms and parameters resulted in overstated electric energy savings and understated electric demand and gas savings. These include:

- For measures recorded in the tracking database as installed in Chicago and Belleville, the implementation team applied various parameters--including the leakage conversion factors (N_heat and N_cool), CDD and HDD, and FLH_cool--for Springfield. The implementation team also applied assumptions for Springfield for some measures installed in Belleville with blank heating zone fields, whereas the evaluation team used cooling zone to look up the value in IL-TRM V7.0.
- For installations with natural gas furnace heating systems, the implementation team applied an air sealing cooling adjustment factor (ADJ_AirSealingCool) of 107% instead of 121% and an air sealing heating adjustment factor (ADJ_AirSealingHeatFan) of 107% instead of 100% for energy savings. The implementation team omitted the adjustment factors in the demand savings calculations.
- For installations with electric resistance heating systems, the implementation team applied an air sealing cooling adjustment factor of 100% instead of 121% and an air sealing heating adjustment factor of 100% instead of 107%.

- **Faucet Aerators:**
  - **Wastewater Savings:** The implementation team excluded wastewater demand savings for all projects and wastewater energy savings for four projects, understating the demand and energy savings.
  - **EPG values:** For kitchen aerators, the implementation team incorrectly applied IL-TRM V7.0 EPG value (0.0046) for "unknown" installed location for participants with gas water heating, when the value should have been 0.0048. For bathroom aerators, the implementation team rounded the IL-TRM V7.0 EPG value to 0.004 instead of using the actual value 0.00397 provided in the IL-TRM V7.0.
- **Showerheads:**
  - **Wastewater savings:** The implementation team excluded wastewater demand savings for all projects and wastewater energy savings for two projects, understating the demand and energy savings.
  - **EPG values:** The implementation team applied a rounded EPG value of 0.0058 instead of the actual value as it appears in the IL-TRM V7.0 (0.00583).
- **Attic Insulation:**
  - **Attic Insulation R11 to R49 (Gas):** The implementation team did not include the attic cooling adjustment factor (ADJ_AtticCool) of 121% as specified in the IL-TRM V7.0. This impacted 37 projects totaling 54,454 square feet of installed attic insulation.
  - **R-values**: For one project, the implementation team applied R-11 for the existing R-value where the initiative tracking database indicated R-19.
  - **HDD:** The implementation team used the HDD value for Springfield when the climate location in the database indicates Belleville. This impacted 18 projects totaling 45,195 square feet of installed attic insulation.
- **LEDs:**
  - **ISRs:** For common area and exterior lighting, the implementation team applied an ISR of 98%, while the evaluation team applied a 100% ISR using the sign-off sheet delivery method specified in the IL-TRM V7.0.

3.3.5 Cumulative Persisting Annual Savings

Table 34 presents CPAS and WAML for the 2019 Public Housing Initiative. The measure-specific and total verified gross savings for the Initiative are summarized, and CPAS in each year of the 2018-2021 Plan are presented.[15] The WAML for the Initiative is 10.4 years.

Table 34. 2019 Public Housing Initiative CPAS and WAML

Measure	Measure Life	First-Year Verified Gross Savings (MWh)	NTGR	CPAS - Verified Net Savings (MWh)							Lifetime Savings (MWh)
				2018	2019	2020	2021	...	2030	...	
Standard LED - In Unit	10.0	535	1.000		535	535	146	...	-	...	2,241
Standard LED - Common Area	8.4	142	1.000		142	142	139	...	-	...	846
Kitchen Faucet Aerator	10.0	116	1.000		116	116	116	...	-	...	1,158
Showerhead	10.0	105	1.000		105	105	105	...	-	...	1,055
Advanced Power Strip - Tier 1	7.0	95	1.000		95	95	95	...	-	...	664
Attic Insulation	20.0	66	1.000		66	66	66	...	65	...	1,323
Advanced Thermostat	11.0	49	1.000		49	49	49	...	-	...	537
Air Sealing	20.0	27	1.000		27	27	27	...	26	...	533
Bathroom Faucet Aerator	10.0	23	1.000		23	23	23	...	-	...	226
Standard LED - Exterior	11.6	3	1.000		3	3	1	...	1	...	17
Reflector LED - Common Area	8.4	1	1.000		1	1	1	...	-	...	4
Specialty LED - In Unit	10.0	<1	1.000		<1	<1	<1	...	-	...	2
2019 CPAS		**1,162**	**1.000**		**1,162**	**1,162**	**768**	**...**	**92**	**...**	**8,605**
Expiring 2019 CPAS					**0**	**0**	**394**	**...**	**49**	**...**	
Expired 2019 CPAS					**0**	**0**	**394**	**...**	**1,070**	**...**	
WAML	**10.4**										

[15] For further detail, including achieved CPAS in years not presented in this table, please see the summary CPAS spreadsheet attached to this report.

3.3.6 Conclusions and Recommendations

Based on the results of this evaluation, the evaluation team offers the following key findings and recommendations for the Public Housing Initiative moving forward:

- Key Finding #1: Although the overall gross energy and demand realization rates were close to 100%, there were multiple occurrences where the implementation team incorrectly applied the TRM algorithms and/or inputs (these discrepancies are detailed in Section 3.3.4).
  - Recommendation: Carefully review chosen ex ante savings parameters against the IL-TRM to more accurately and consistently calculate savings and to avoid significant realization rate discrepancies in future years.
- Key Finding #2: The implementation team applied the WHFe for high rise multifamily buildings (for LEDs in common areas of the buildings). This approach may be understating the savings for installations in mid-rise multifamily buildings.
  - Recommendation: The implementation team should track whether the properties served through the initiative are high rise or mid-rise buildings.
- Key Finding #3: The implementation team did not include wastewater energy savings and demand savings calculations for faucet aerators and showerheads.
  - Recommendation: The implementation team should update calculations to include wastewater savings.

3.4 Behavioral Modification

3.4.1 Initiative Description

In 2019, AIC administered the Behavior Modification Initiative to two cohorts of dual fuel (electric and gas) customers, with implementation support from Uplight (formerly known as Tendril) and oversight from Leidos. The Initiative's primary method for encouraging energy-efficient behaviors is a Home Energy Report (HER). The initiative offered the following treatment to participants in 2019: hard-copy HERs mailed to participating customers, and electronic HERs (eHERs) sent to participating customers with e-mail addresses on file; and monthly high usage alerts (HUAs) sent to treatment customers with e-mails who were at risk of experiencing a spike in energy usage in a given month. Each HER includes the following information:

- A summary of the customer's energy use and the charges from the previous month's energy use;
- A comparison of the customer's current and past energy usage over the past year;
- A comparison of the customer's energy usage to that of households with similar characteristics;
- A chart that forecasts which energy use categories will contribute the most to their energy use in the next month (heating, cooling, electronics, lighting, etc.);
- Promotion of applicable AIC initiatives and rebates; and
- Tips for reducing energy consumption tailored to the customer's home energy profile (e.g., type of home, square footage, and number of occupants).

The Initiative also provides access to an online Home Energy Portal that encourages customers to participate in weekly energy challenges and serves as a platform for customers to view their HERs. Table 35 presents the

number of HERs and eHERs that the two cohorts, Legacy Wave 4 and Tendril Wave 1, received in 2019 as well as the delivery schedule. While the original intent of the program was to treat customers for the entirety of 2019, the program was terminated in August.

Table 35. Frequency of HERs and eHERs Sent to Behavioral Modification Initiative Treatment Group

Cohort	Fuel Type	Number of HERs and eHERs	Timing of HERs
Legacy Wave 4	Dual	5	Jan, Feb, June, July, Aug
Tendril Wave 1	Dual	5	Jan, Feb, June, July, Aug

Summary of Key Implementation Changes in 2019

AIC launched the Behavior Modification Initiative in August 2010 and added new cohorts on a rolling basis until the Initiative reached roughly one-third of AIC's one million residential customers by 2017. In 2018, Uplight selected the legacy cohort known as Expansion Cohort 1 to continue receiving HER treatment and the other eight legacy cohorts that received HERs in prior years (the Original Cohort and Expansion Cohort 2 through Expansion Cohort 8) did not receive HERs.

In 2019, Uplight stopped treatment of Expansion Cohort 1 and formed two new waves: Legacy Wave 4 and Tendril Wave 1 (which was composed primarily of customers new to the Behavioral Modification Initiative, but also included ~4,000 control-group customers from Legacy Wave 6). After treating these two new waves for eight months of the program year, treatment was discontinued.

Each of the changes are described below.

- **Treatment Customers**. Uplight created two waves of customers for the 2019 program year: 1) a combination wave of new HER customers and customers that were in the control group in Legacy Cohort 6, and 2) a wave of customers that were listed as "not in treatment or control" for Legacy Cohort 4. These waves are designated "Tendril Wave 1" and "Legacy Wave 4," respectively.

  Opinion Dynamics was involved in the process to randomize for Tendril Wave 1. Uplight sent Opinion Dynamics a pool of about 47,000 customers, from which we randomly selected 70% for treatment and 30% for control. Opinion Dynamics was not involved in the selection or randomization of Legacy Cohort 4 for the 2019 program year.

- **Free-Form Text.** One of the main changes to the reports in 2019 was the addition of free form text space to highlight other programs. Free form text can include links and program descriptions and helps guide customers to participate in other AIC offerings that will help them save energy.

- **Mid-Year Treatment Stoppage.** The 2019 HER program was suspended in August 2019 as part of AIC's strategy to increase savings persistence across the portfolio. In interviews with Uplight and AIC in June 2019, neither partner anticipated this suspension.

Uplight rolled out new program features in 2018, such as the online portal, high usage alerts, and energy challenges, which were continued in the 2019 Behavioral Modification Initiative. Uplight reporting indicates that these features are being increasingly used by AIC customers. The use of the online portal increased from 57 users in May 2018, when it opened, to more than 800 in June 2019. Likewise, Uplight sent high usage alerts (HUAs) to 19 customers in May 2018 but was reaching out to 5,651 in June 2019. Statistics for June 2019 show that Uplight e-mailed energy challenges to close to 700 customers four times, almost half of which were opened.

3.4.2 Participation Summary

The Behavioral Modification Initiative included about 7% of AIC's approximately 1 million residential customers in 2019. Table 36 presents Behavior Modification participation during 2019. Both cohorts consist of dual-fuel customers, who use both electricity and gas provided by AIC. As noted above, the treatment duration in 2019 (eight months) was shorter than originally planned due to the program termination in August.

Table 36. 2019 Behavioral Modification Participation (includes Control Group)

Cohort Name	Fuel Type	Customer Counts		2019 Program Start Date	Approximate Time in Initiative
		Gas	Electric		
Legacy Cohort 4	Dual	23,784	23,914	January 2019	Eight months
Tendril Wave 1	Dual	47,263	47,263	January 2019	Eight months

3.4.3 Initiative Annual Savings Summary

The evaluation team undertook a variety of efforts to develop interim net impact results for the Behavioral Modification Initiative. These include a comparison of the equivalency between treatment and control groups and impact modeling. We provide high-level savings results below, with additional details in Appendix A of this report.

The 2019 Behavior Modification Initiative achieved 1,061 MWh and 0 therms in verified net savings. The realization rate was 97% for electric and 0% for gas (Table 37).

Table 37. 2019 Behavior Modification Initiative Annual Savings

	Electric Energy Savings (MWh)	Electric Demand Savings (MW)	Gas Savings (Therms)
Net Energy Savings Claimed by Uplight	3,617	N/A	35,694
Unadjusted Net Initiative Savings	1,061	0.18	0
Uplift Adjustment	0	N/A	N/A
Final Net Impacts after Accounting for Uplight	1,061	0.18	0
Net Realization Rate	97%	N/A	0%

There are several potential drivers of these results:

- Low realization rates due to differing interpretation of statistical validity:
  - As discussed in more detail below, the evaluation team found that all models were statistically insignificant for Tendril Wave 1 Gas and Legacy Wave 4 Gas and Electric. This means that we are unable to reject the null hypothesis that savings are zero and cannot report any verified savings for Tendril Wave 1 Gas and Legacy Wave 4 Gas and Electric.
  - Because Uplight claimed savings for all four groups, but only Tendril Wave 1 Electric produced verified savings, we report a low realization rate for electric savings and no savings (0% realization rate) for gas savings.
- Lower savings than anticipated:
  - The lower than anticipated savings may be a function of the early termination of the HER program. Treating customers via home energy reports for less than a full year may not be sufficient for customers to make capital improvements or habituate behavioral energy management practices.

3.4.4 Initiative Savings Detail

Detailed Initiative Savings

The evaluation team fit several statistical models to estimate the unadjusted net impacts of the Initiative. We ultimately selected the lagged dependent variable (LDV) model after evaluating a series of model diagnostics.

Table 38 shows the unadjusted net kWh, kW, and therm savings for the two waves treated in 2019. The only program for which the evaluation team found statistically significant savings at the 90% confidence level is Tendril Wave 1 Electric. Tendril Wave 1 Gas, Legacy Wave 4 Electric, and Legacy Wave 4 Gas all had savings estimates that were statistically insignificant. A statistically insignificant result means we are unable to reject the null hypothesis that savings were zero. Consistent with evaluation best practices, the evaluation team is, therefore, reporting zero savings for Tendril Wave 1 Gas, Legacy Wave 4 Electric, and Legacy Wave 4 Gas.

Table 38. 2019 Unadjusted Per-Household Net Savings

Wave	Fuel	Number of Customers Treated in 2019[a]	Unadjusted Net Savings (% per household)	Unadjusted Net Savings (per household)[b]	Unadjusted Net Initiative Savings[c]
Tendril Wave 1	kWh	32,933	0.25%	32.22	1,060,963
	MW	32,933	0.25%	0.01	0.184
	Therms	32,933	No statistically significant savings		
Legacy Cohort 4	kWh	17,957	No statistically significant savings		
	MW	17,957	No statistically significant savings		
	Therms	17,855	No statistically significant savings		
Total	**kWh**	**32,933**	**0.25%**	**32.22**	**1,060,963**
	MW	**32,933**	**0.25%**	**0.01**	**0.184**
	Therms	**0**	**No statistically significant savings**		

[a] Refers to the number of customers AIC selected to provide HERs.

[b] Reflect the per household per day savings for all of 2019.

[c] Pro-rated for participants whose accounts closed during 2019.

Uplift from Other AIC Initiatives

The savings analysis for the Behavioral Modification Initiative considers energy savings that resulted from energy-efficient actions taken through other AIC residential energy efficiency initiatives. While we would expect a base rate of participation in these initiatives from both the treatment and control groups, it is possible that the Behavioral Modification Initiative resulted in an increase, or "uplift," in participation in other AIC residential energy efficiency initiatives among the members of the treatment group by promoting these initiatives to treated customers.

Because no statistically significant savings were observed for Legacy Cohort 4 or Tendril Wave 1 Gas, the evaluation team tested only Tendril Wave 1 Electric for uplift. Furthermore, because Tendril Wave 1 Electric was a heretofore untreated cohort, no legacy uplift is possible and annual uplift is the only item for consideration. Our analysis shows that no significant annual uplift occurred for Tendril Wave 1 Electric, and therefore verified net initiative savings are equal to those presented in Table 38. For further detail on uplift, please see Appendix A.

3.4.5 Cumulative Persisting Annual Savings

Table 39 presents CPAS and WAML for the 2019 Behavior Modification Initiative. The measure-specific and total verified gross savings for the Initiative are summarized, and CPAS in each year of the 2019-2022 Plan are presented.[16] The WAML for the Initiative is 5 years.

Table 39. 2019 Behavior Modification Initiative CPAS and WAML

Measure	Measure Life	First-Year Verified Gross Savings (MWh)	CPAS - Verified Net Savings (MWh)							Lifetime Savings (MWh)
			2018	2019	2020	2021	...	2030	...	
Home Energy Reports	5.0	1,061		1,061	783	484	...	0	...	2,700
2019 CPAS		**1,061**		**1,061**	**783**	**484**	**...**	**0**	**...**	**2,700**
Expiring 2019 CPAS				**0**	**278**	**299**	**...**	**0**	**...**	
Expired 2019 CPAS				**0**	**278**	**577**	**...**	**1,061**	**...**	
WAML	**5.0**									

[16] For further detail, including achieved CPAS in years not presented in this table, please see the summary CPAS spreadsheet attached to this report.

3.5 HVAC

3.5.1 Initiative Description

Since June 2009, AIC has offered HVAC incentives to its customers to encourage the purchase of higher-efficiency heating and cooling equipment. During the 2019 program year, the HVAC Initiative offered incentives for advanced thermostats, air-source heat pumps (ASHPs), ductless heat pumps, central air conditioners (CACs), high-efficiency Brushless Permanent Magnet (BPM) blower motors, and heat pump water heaters (HPWHs).

Through the HVAC Initiative, AIC provides incentives to customers through registered trade allies as direct discounts on the equipment and installation costs. The incentive appears as a line item deduction on the contractors' installation invoices. The initiative offers standard incentives for replacing failed equipment (replace-on-burnout [RB] or time of sale [TOS]) with new equipment of SEER 16.0 or higher (ASHPs must also be rated a minimum of 9.0 HSPF) and offers a higher incentive to customers for CAC and ASHP measures when the customer replaces working, but inefficient older equipment. To be considered an early replacement (ER) project, a unit that is being replaced had to be verifiably operable with a seasonal energy efficiency ratio (SEER) rating of 10.0 or less.

Summary of Key Implementation Changes in 2019

The HVAC Initiative made the following changes to its offerings and delivery in 2019:

- Reduced the advanced thermostat incentive from $269 to $100 in April 2019 due to budgetary considerations
- Removed programmable thermostat and high-efficiency pool pumps from initiative offerings
- Implemented an online portal for program allies to submit applications at the end of 2019
- Developed case studies of AIC HVAC Initiative participants and promoted these case studies on the AIC website

The key challenge that program staff experienced in 2019 was the low uptake of HPWHs. Program staff attributed this to a lack of customer awareness of HPWH technology as well as a limited number of trained program allies who can perform HPWH installations.

3.5.2 Participation Summary

BPM blower motors installed as part of a new gas furnace remained the primary measure for the HVAC Initiative in 2019, accounting for 43% of initiative measures. ASHPs dominated the heat pump product category, accounting for 88% of heat pumps installed through the initiative. Despite the lower incentive for advanced thermostats in 2019, the initiative did not experience a decrease in advanced thermostat participation compared to 2018. The number of advanced thermostats installed in 2019 increased by 34% compared to 2018, from 917 to 1,393. Heat pump water heaters had the lowest participation (0.02% of measures installed) due to the challenges noted previously. Table 40 presents participation in the HVAC Initiative in 2019.

Table 40. 2019 HVAC Initiative Participation Summary

Measure Category	Participant [a]	Project Count	Measure Count
ASHP	300	306	306
ASHP ER[b]	130	132	132
CAC	1,927	1,970	1,970
CAC ER	1,712	1,738	1,738
BPM	4,153	4,234	4,235
Heat Pump Water Heater	2	2	2
Advanced Thermostat	1,343	1,380	1,393
Ductless Heat Pump	52	57	57
Ductless Heat Pump ER[b]	3	3	3
Initiative Total	**5,433**	**9,822**	**9,836**

[a] Total participant count reflects the number of unique participants in the program, while participant count by measure category reflects the count of unique participants in that measure category.

[b] One ASHP ER measure was reclassified by the verification team as a Ductless Heat Pump ER measure after a review of the measure's AHRI ID. Total counts reflect the verified analysis.

3.5.3 Initiative Annual Savings Summary

Table 41 presents the HVAC Initiative annual savings achieved in 2019. Overall, the HVAC Initiative achieved 6,890 MWh, 3.16 MW, and 69,775 therms in verified annual net savings.

Table 41. 2019 HVAC Annual Savings

	Electric Energy Savings (MWh)	Electric Demand Savings (MW)	Gas Savings (Therms)
Ex Ante Gross Savings	7,478	3.84	69,492
Gross Realization Rate	122%	111%	100%
Verified Gross Savings	9,130	4.27	69,775
NTGR	0.755	0.741	1.000
Verified Net Savings	6,890	3.16	69,775

Note: Any apparent variances in calculations are due to rounding.

3.5.4 Initiative Savings Detail

In 2019, the HVAC Initiative distributed nine different measures to residential customers, as shown in Table 42. CAC ER (31%), BPM (30%), ASHP ER (14%), and CAC (12%) measures collectively contributed a majority (87%) of ex ante electric energy savings (Table 42). The advanced thermostat, ASHP, ductless heat pump, and HPWH measures together contributed the remaining 13% of ex ante electric energy savings.

Table 42. 2019 HVAC Initiative Electric Energy Savings by Measure

Measure Category	Ex Ante Gross Savings (MWh)	Gross Realization Rate	Verified Gross Savings (MWh)	NTGR	Verified Net Savings (MWh)
ASHP	288	99%	284	0.641	182
ASHP ER	1,062	111%	1,177	0.761	896
CAC	930	100%	929	0.641	596
CAC ER	2,299	163%	3,743	0.761	2,848

Measure Category	Ex Ante Gross Savings (MWh)	Gross Realization Rate	Verified Gross Savings (MWh)	NTGR	Verified Net Savings (MWh)
BPM	2,231	100%	2,237	0.761	1,703
Heat Pump Water Heater	4	108%	5	0.760	3
Advanced Thermostat	407	120%	489	N/A	489
Ductless Heat Pump	241	100%	242	0.641	155
Ductless Heat Pump ER	16	147%	23	0.761	17
Total	**7,478**	**122%**	**9,130**	**0.755**	**6,890**

Note: Totals may not sum due to rounding.

Table 43 presents the HVAC Initiative annual electric demand savings achieved in 2019 by measure. CAC ER measures were the highest contributor to ex ante electric demand savings (62%), followed by the CAC (22%), BPM (6%), and ASHP ER (5%) measures. The ASHP, advanced thermostat, DMSHP, DMSHP ER, and HPWH measures contributed the remaining 5% of ex ante electric demand savings.

Table 43. 2019 HVAC Initiative Electric Demand Savings by Measure

Measure Category	Ex Ante Gross Savings (MW)	Gross Realization Rate	Verified Gross Savings (MW)	NTGR	Verified Net Savings (MW)
ASHP	0.08	96%	0.08	0.641	0.05
ASHP ER	0.18	116%	0.21	0.761	0.16
CAC	0.84	100%	0.85	0.641	0.54
CAC ER	2.38	115%	2.74	0.761	2.09
BPM	0.25	105%	0.26	0.761	0.20
Heat Pump Water Heater	0.00	108%	0.00	0.760	0.00
Advanced Thermostat	0.09	135%	0.12	N/A	0.12
Ductless Heat Pump	0.01	91%	0.01	0.641	0.00
Ductless Heat Pump ER	0.00	125%	0.00	0.761	0.00
Total	**3.84**	**111%**	**4.27**	**0.741**	**3.16**

Note: Totals may not sum due to rounding.

Only the advanced thermostat measure contributed gas savings to the HVAC Initiative, achieving 69,775 therms in verified net savings (Table 44).

Table 44. 2019 HVAC Initiative Gas Savings by Measure

Measure Category	Ex Ante Gross Savings (Therms)	Gross Realization Rate	Verified Gross Savings (Therms)	NTGR	Verified Net Savings (Therms)
Advanced Thermostat	69,492	100%	69,775	N/A	69,775
Total	**69,492**	**100%**	**69,775**	**N/A**	**69,775**

Overall, the 2019 HVAC Initiative achieved 122%, 111%, and 100% gross realization rates for electric energy, electric demand, and gas, respectively. We describe the key drivers of differences between ex ante and verified savings below.

- **ASHP ER:** The gross electric energy and electric demand realization rates for ASHP ERs were 114% and 116%, respectively.

- The verified analysis derated actual existing efficiencies by 1% per year based on the age of the existing equipment, as required by the IL-TRM v7.0 when using rated efficiencies. The derated efficiency levels were lower than the rated efficiencies used in ex ante, contributing to higher verified electric energy savings.
- Ex ante calculations assume an existing efficiency of 7.5 EER for all measures. While the IL-TRM V7.0 deems a default value of 7.5 EER, it instructs the use of actual EER ratings when possible. The verified analysis calculates existing EER from actual tracked existing SEER values, when available. This drives all discrepancies between ex ante and verified electric demand savings.
- For some ER measures, ex ante applied full load hour (FLH) values inconsistent with the Climate Zone recorded in the tracking database.

- **CAC ER**: The gross electric energy and electric demand realization rates for CAC ERs were 163% and 115%, respectively.
  - The verified analysis derated actual existing efficiencies by 1% per year based on the age of the existing equipment, as required by the IL-TRM V7.0 when using rated efficiencies. The derated efficiency levels were lower than the rated efficiencies used in the ex ante estimates, contributing to higher verified electric energy savings. This drives all discrepancies in electric energy savings.
  - Ex ante calculations assume an existing efficiency of 7.5 EER for all measures. While the IL-TRM V7.0 deems a default value of 7.5 EER, it instructs the use of actual EER ratings when possible. The verified analysis calculates existing EER from actual tracked existing SEER values, when available. This drives all discrepancies between ex ante and verified electric demand savings.
- **BPM**: The gross electric energy and electric demand realization rates for BPMs were 100% and 105%, respectively.
  - The cooling system classification is the key driver of discrepancies between ex ante and verified demand savings. For example, in cases where the Cooling Equipment field is empty in the tracking database, ex ante assumes "no cooling system" while verified calculations assume the "cooling system unknown."
- **Heat Pump Water Heater**: The gross electric energy and electric demand realization rates for heat pump water heaters were 108%.
  - Ex ante savings applied the IL-TRM V7.0 algorithm to calculate baseline efficiency (UEF_{base}). This approach fails to take into account the V7.0 Errata, which updated the algorithm for this parameter.
  - Ex ante savings incorrectly converted SEER to COP using the relationship between EER and COP. The verified analysis converted tracked SEER values to EER before calculating COP.
- **Advanced Thermostat**: The gross electric energy, electric demand, and gas realization rates for advanced thermostats were 120%, 135%, and 100%, respectively.
  - In almost all records, ex ante savings applied a cooling reduction of 6.3% to all advanced thermostat measures. The verified savings applied a cooling reduction of 8.0% as deemed in the IL-TRM V7.0, resulting in increased verified electric energy and demand savings.
- **DMSHP**: The gross electric energy and electric demand realization rates for DMSHPs were 100% and 91%, respectively.
  - Ex ante savings assumed whole-house cooling for all measures. The verified analysis classified systems as having limited or whole-house cooling, based on the cooling equipment types included

in the tracking database. The classification of homes with limited cooling reduced savings, accounting for all discrepancies between ex ante and verified electric demand savings.

- **DMSHP ER**: The gross electric energy and electric demand realization rates for DMSHP ER were 147% and 125%, respectively.
  - The increase in savings is due to the reclassification of one ASHP ER measure that had a ductless heat pump AHRI ID as a DMSHP ER measure.

3.5.5 Cumulative Persisting Annual Savings

Table 45 presents CPAS and WAML for the 2019 HVAC Initiative. The measure-specific and total verified gross savings for the Initiative are summarized, and CPAS in each year of the 2018-2021 Plan are presented.17 The WAML for the Initiative is 16.5 years.

ASHP ER, CAC ER, and DMSHP ER measures receive early replacement savings for the remaining useful life (RUL) of the existing equipment—six years, or 18 years when replacing electric resistance. During the RUL of the existing equipment, savings are calculated based on the size and efficiency of the existing heating and cooling equipment. After this period, the baseline changes to a federal standard baseline and per-unit savings are the same as the equivalent replace-on-burnout/time of sale measure for the remaining duration of the equipment's existing useful life (EUL).

Table 45. 2019 HVAC Initiative CPAS and WAML

Measure	Measure Life	First-Year Verified Gross Savings (MWh)	NTGR	CPAS - Verified Net Savings (MWh)							Lifetime Savings (MWh)
				2018	2019	2020	2021	...	2030	...	
ASHP	16.0	284	0.641		182	182	182	...	182	...	2,911
ASHP ER (Replaces ASHP)	16.0	315	0.761		240	240	240	...	54	...	1,977
ASHP ER (Replaces Resistance)	16.0	862	0.761		656	656	656	...	656	...	10,493
CAC	18.0	929	0.641		596	596	596	...	596	...	10,723
CAC ER	18.0	3,743	0.761		2,848	2,848	2,848	...	591	...	24,185
BPM	15.0	2,237	0.761		1,703	1,703	1,703	...	1,703	...	25,548
Heat Pump Water Heater	15.0	5	0.760		3	3	3	...	3	...	52
Advanced Thermostat	11.0	489	N/A		489	489	489	...	0	...	5,384
Ductless Heat Pump	15.0	242	0.641		155	155	155	...	155	...	2,327
Ductless Heat Pump ER (Replaces ASHP)	15.0	8	0.761		6	6	6	...	2	...	50
Ductless Heat Pump ER (Replaces Resistance)	15.0	15	0.761		12	12	12	...	12	...	175
2019 CPAS		**9,130**	**0.755**		**6,890**	**6,890**	**6,890**	**...**	**3,954**	**...**	**83,825**
Expiring 2019 CPAS					**0**	**0**	**0**	**...**	**0**	**...**	
Expired 2019 CPAS					**0**	**0**	**0**	**...**	**2,937**	**...**	
WAML	**16.5**										

[17] For further detail, including achieved CPAS in years not presented in this table, please see the summary CPAS spreadsheet attached to this report.

3.5.6 Conclusions and Recommendations

Based on the results of this evaluation, the evaluation team offers the following key findings and recommendations for the HVAC Initiative moving forward:

- Key Finding #1: Missing data in the tracking database make it difficult to verify or determine appropriate assumptions to use in the savings calculations. For example, the baseline heating equipment field for DMSHPs is blank for 27 records (47% of DMSHP measures), and no unknown default is provided in the IL-TRM V7.0. Ex ante savings calculations assume electric resistance heating in these cases, which the evaluation team could not verify. Similarly, missing data about existing cooling systems make it difficult to determine whether there is no cooling, or the cooling system is unknown.
  - Recommendation: Ensure all tracking data required for savings estimation are consistently collected and transferred to the Initiative tracking database. Do not allow "blank" data fields; if needed, include an "unknown" input value.
- Key Finding #2: Ex ante electric energy and demand savings for ASHP ER and CAC ER measures are consistently lower than verified savings, which de-rate existing efficiencies by 1% per year in alignment with the IL-TRM V7.0.
  - Recommendation: De-rate existing efficiencies from the tracking database by 1% per year, as based on the age of the existing equipment. De-rating efficiency accounts for the degradation of the performance of the existing equipment over time.
- Key Finding #3: The IL-TRM V7.0 errata separated the remaining life of existing equipment for DMSHP ER measures based on the type of existing heating equipment, deeming a lifetime of 18 years for electric resistance and six years for all other existing equipment types. The HVAC Initiative tracking database currently only has one product code to account for all DMSHP ER measures.
  - Recommendation: Establish separate product codes to track DMSHP ER measures by equipment replacement type, as is currently practiced with ASHP ER measures.

3.6 Appliance Recycling

3.6.1 Initiative Description

The Appliance Recycling Initiative (ARI) encourages residential customers to retire working, primary and secondary, inefficient refrigerators, and freezers. AIC offers a $50 incentive to pick up and recycle (free of charge) working, full size (between ten and 27 cubic feet) refrigerators and freezers directly from the homes of AIC electric customers. The goal of this activity is to eliminate the removed appliances' electricity consumption from the grid. Leidos managed the Initiative, providing reporting, quality control, and customer support. Solutions for Energy Efficient Logistics (SEEL), a subcontractor to Leidos, scheduled pickups and collected appliances, recycled units in an environmentally sound manner, and processed customer incentives.

Summary of Key Implementation Changes in 2019

The program design was largely unchanged from previous years. However, in 2019, customers were asked to confirm their appointments 48 hours in advance of pickup to reduce the number of canceled appointments. Additionally, the Direct Distribution Initiative began delivering energy efficiency kits through this initiative, as discussed in the Direct Distribution Initiative chapter of this report.

3.6.2 Participation Summary

Table 46 presents ARI participation during 2019. Overall, the ARI had 5,067 participants who recycled 5,422 units. Of appliances recycled, refrigerators represented the bulk of the Initiative, with 4,196 refrigerators recycled compared to 1,226 freezers.

Table 46. 2019 Appliance Recycling Initiative Participation Summary

Participation	Quantity
Participants	5,067
Refrigerators	4,196
Freezers	1,226

Note: Some participants recycled more than one unit, and as a result, the sum of refrigerators and freezers is greater than the total number of participants.

3.6.3 Initiative Annual Savings Summary

Table 47 presents ARI annual savings achieved in 2019. Overall, the 2019 ARI achieved 2,786 MWh and 0.34 MW in verified net savings.

Table 47. 2019 Appliance Recycling Initiative Annual Savings

	Electric Energy Savings (MWh)	Electric Demand Savings (MW)
Ex Ante Gross Savings	4,714	0.58
Gross Realization Rate	109%	109%
Verified Gross Savings	5,147	0.63
NTGR	0.541	0.540
Verified Net Savings	2,786	0.34

3.6.4 Initiative Savings Detail

The ARI recycled 4,196 refrigerators and 1,226 freezers as shown in Table 48. Refrigerators represented the majority of both recycled units and total Initiative savings (Table 48 and Table 49 below).

Table 48. 2019 Appliance Recycling Initiative Electric Energy Savings by Measure

Measure Category	Ex Ante Gross Savings (MWh)	Gross Realization Rate	Verified Gross Savings (MWh)	NTGR	Verified Net Savings (MWh)
Refrigerator	3,646	111%	4,051	0.52	2,107
Freezer	1,068	103%	1,095	0.62	679
Total	**4,714**	**109%**	**5,147**	**0.54**	**2,786**

Table 49. 2019 Appliance Recycling Initiative Electric Demand Savings by Measure

Measure Category	Ex Ante Gross Savings (MW)	Gross Realization Rate	Verified Gross Savings (MW)	NTGR	Verified Net Savings (MW)
Refrigerator	0.45	111%	0.50	0.52	0.26
Freezer	0.13	103%	0.13	0.62	0.08
Total	**0.58**	**109%**	**0.63**	**0.54**	**0.34**

The two primary reasons for realization rates different than 100% are the evaluation team's more granular approach to HDD and CDD based on NOAA data, and slightly different categorization as to which units are considered "primary." Additionally, in 2019 the average age of recycled refrigerators and freezers increased by over four years compared with 2018 values. While this change did not have a significant impact on the realization rates, it is not consistent with prior year's findings or the evaluation team's observations of other utilities (see Table 50 below).

Table 50. 2019 Appliance Recycling Initiative Age Comparison

Utility	Appliance	2018 Average Age	2019 Average Age	Difference in Age (Years)
AIC	Refrigerator	24.2	28.9	+4.8
	Freezer	29.2	32.3	+3.1
Midwest Utility	Refrigerator	21.9	21.9	0.0
	Freezer	24.7	26.1	+1.4
Eastern Utility	Refrigerator	22.8	21.2	-1.6
	Freezer	27.7	26.4	-1.3

3.6.5 Cumulative Persisting Annual Savings

Table 51 presents CPAS and WAML for the 2019 ARI. The measure-specific and total verified gross savings for the Initiative are summarized, and CPAS in each year of the 2018-2021 Plan are presented.[18] The WAML for the Initiative is 6.5 years.

Table 51. 2019 Appliance Recycling Initiative CPAS and WAML

Measure	Measure Life	First-Year Verified Gross Savings (MWh)	NTGR	CPAS - Verified Net Savings (MWh)							Lifetime Savings (MWh)
				2018	2019	2020	2021	...	2030	...	
Refrigerator	6.5	4,051	0.520		2,107	2,107	2,107	...	0	...	15,800
Freezer	6.5	1,095	0.620		679	679	679	...	0	...	5,094
2019 CPAS		**5,147**	**0.541**		**2,786**	**2,786**	**2,786**	**...**	**0**	**...**	**20,894**
Expiring 2019 CPAS					**0**	**0**	**0**	**...**	**0**	**...**	
Expired 2019 CPAS					**0**	**0**	**0**	**...**	**2,786**	**...**	
WAML	**6.5**										

[18] For further detail, including achieved CPAS in years not presented in this table, please see the summary CPAS spreadsheet attached to this report.

3.6.6 Conclusions and Recommendations

Based on the results of this evaluation, the evaluation team offers the following key finding for the Appliance Recycling Initiative:

- Key Finding #1: The average refrigerator and freezer age in 2019 was over four years older than the 2018 appliance age. The average age is also significantly higher than the average age observed for selected other utility appliance recycling programs. This might indicate programmatic changes, such as effective targeting of older units.

3.7 Multifamily

3.7.1 Initiative Description

The AIC Multifamily Initiative offers incentives and services that enable energy savings and lower operating costs in market-rate multifamily housing, defined as buildings with three or more units managed by a private entity. The initiative implementer, CMC Energy (CMC), conducts all outreach and recruitment, performs assessments to identify installation opportunities, and provides direct installation of energy-saving measures for building common areas and tenant units. Measures are provided free-of-charge. The types of measures that property managers and tenants are eligible to receive through the Initiative are as follows:

- **In-unit:** Initiative offerings for tenant units include standard and specialty LED light bulbs, low-flow showerheads, faucet aerators, advanced thermostats, pipe wrap, and tier-1 advanced power strips. The implementer is responsible for installing LEDs, low-flow showerheads, faucet aerators, and pipe wrap in tenant units while delivery methods for the advanced thermostats vary by property. In most cases, property management staff install the thermostats under CMC supervision. However, CMC occasionally leaves thermostats behind for property management staff to install. Before projects are completed, CMC staff verify the installation of all thermostats that were left behind by visiting the units.

  Similarly, delivery methods for the advanced power strips also vary by property as CMC staff either provide tenants with in-person tutorials about how to use their advanced power strips, or they leave the power strips behind for tenants to install (some complexes do not want initiative staff unplugging tenant TVs or other equipment when the tenant is not present).

- **Common Areas:** The Initiative provides light bulbs and occasional water-saving faucet aerators in common areas. More specifically, the implementer offers properties medium screw-based standard and specialty LED replacements for incandescent or halogen lamps in interior and exterior settings. They will also place faucet aerators in common areas with sinks. The implementer conducts all common area lighting upgrades indoors.

Leidos also provides implementation services to support the Multifamily Initiative, including developing marketing materials, providing initiative oversight, and conducting outreach to housing organizations and community groups. CMC conducts QA/QC inspections on direct install measures and is responsible for managing project submissions, inventory, and initiative tracking data.

Summary of Key Implementation Changes in 2019

AIC made changes to the Multifamily Initiative participation and savings goals and customer recruitment process during the 2019 program year:

- In September 2019, the Multifamily Initiative stopped offering standard LED lightbulbs in preparation for expected changes to IL-TRM baselines based on the Federal Energy Independence and Securities Act (EISA) standards that were expected to take effect in 2020. The new standards were expected to increase baseline assumptions for lighting efficiency, which would have substantially reduced the CPAS savings for standard lighting measures. The Multifamily Initiative continues to offer specialty LED bulbs.
- The Multifamily Initiative implementer, CMC, hired a specific marketing and outreach staff member for 2019 to recruit properties to participate in the Income Qualified Initiative in 2019. Initiative staff reported this staff member also helped to generate leads and increase enrollment in the Multifamily Initiative.

- AIC substantially reduced Multifamily Initiative energy and gas savings and participation goals for the 2019 program year given the saturation of the target market and a corporate decision to focus on serving Income Qualified and Public Housing Association customers that had not previously been served through AIC Initiatives.
- AIC created a new goal for the Multifamily Initiative in 2019 to distribute 1,500 advanced thermostats.

3.7.2 Participation Summary

Table 52 summarizes Multifamily Initiative participation in 2019. The Multifamily Initiative delivered 10,536 measures to 34 property managers, 42 unique properties, and unique 916 tenant units, which is slightly lower than the internal initiative target of 1,200 tenant units.[19]

Table 52. 2019 Multifamily Initiative Participation Summary

Participation	Count
Unique Property Managers	34
Unique Properties[a]	42
Unique Tenant Units	916
Measure Count	10,536

[a] Unique properties are defined by geographic location, so multiple buildings in the same location comprise one property.

Table 53 presents the quantity and frequency of measures delivered to property managers. Property managers most frequently received LEDs, advanced thermostats, and advanced power strips. These three measures also comprised the greatest quantity of measures delivered to property managers. The Initiative distributed 1,456 advanced thermostats in 2019, nearly reaching the internal initiative target to distribute 1,500 advanced thermostats. Advanced thermostats are still a somewhat new initiative offering as AIC first began offering this measure through the Multifamily Initiative mid-way through the 2018 program year. Multifamily Initiative staff reported that the advanced thermostat offering helped drive customer participation in the Initiative because property managers view the thermostats as a marketing tool to attract new tenants.

[19] Estimates of property and tenant unit counts were developed through Opinion Dynamics' analysis of tracking data, including categorization of different addresses together, and may differ from internal implementation estimates. In particular, the evaluation team received two datasets from the implementer: a tenant-level dataset and a property-level dataset. The evaluation team calculated counts of unique participants and measures using the property-level dataset and calculated counts of unique tenant units using the tenant-level dataset. These two databases are not linked, and the initiative implementer reports that counts of tenant units are subject to greater incidence of human error.

Table 53. 2019 Multifamily Frequency and Quantity of Measures Delivered

Measure Type	Count of Unique Property Managers Receiving Measure	Count of Unique Properties Receiving Measure	Quantity of Measures Distributed
LED	24	30	7,520
Advanced Thermostat	20	24	1,456
Advanced Power Strip - Tier 1	19	23	783
Pipe Insulation	2	4	450
Faucet Aerator	17	20	234
Showerhead	13	13	93
Total	**34**	**42**	**10,536**

Note: Quantities of pipe insulation are measured in linear feet, and all other quantities are measured in units of equipment.

3.7.3 Initiative Annual Savings Summary

Table 54 presents the Multifamily Initiative annual savings achieved in 2019. The Multifamily Initiative exceeded its internal initiative electric savings target of 1,170 MWh and fell slightly short of the internal initiative gas savings target of 28,950 therms. Property managers showed a strong interest in advanced thermostats in 2019, and this measure helped the Initiative meet savings goals as advanced thermostats comprised 60% of electric savings and 97% of gas savings in 2019.

Table 54. 2019 Multifamily Initiative Annual Savings

	Electric Energy Savings (MWh)	Electric Demand Savings (MW)	Gas Savings (Therms)
Ex Ante Gross Savings	1,335	0.15	27,626
Gross Realization Rate	107%	135%	100%
Verified Gross Savings	1,424	0.21	27,650
NTGR	0.921	0.935	0.998
Verified Net Savings	1,311	0.19	27,604

3.7.4 Initiative Savings Detail

In 2019, the Multifamily Initiative distributed 15 measure categories to property managers, including standard and specialty LEDs bulbs for interior and exterior use, water heater pipe insulation, faucet aerators for bathrooms and kitchens, showerheads, advanced power strips, and advanced thermostats (Table 55). About 90% of the total initiative verified savings came from LEDs and advanced thermostats.

Table 55. 2019 Multifamily Initiative Electric Energy Savings by Measure

Measure Category	Ex Ante Gross Savings (MWh)	Gross Realization Rate	Verified Gross Savings (MWh)	NTGR	Verified Net Savings (MWh)
Advanced Thermostat	795	111%	880	1.000	880
LED - Common Area (A-Type)	155	102%	158	0.773	122
LED - In-Unit (A-Type)	148	100%	148	0.773	114
Advanced Power Strip - Tier 1	56	100%	56	0.794	44
LED - In-Unit (Candelabra)	43	100%	43	0.773	33
LED - Exterior (A-Type)	23	104%	24	0.773	18
Showerhead	20	100%	20	1.004	20

Measure Category	Ex Ante Gross Savings (MWh)	Gross Realization Rate	Verified Gross Savings (MWh)	NTGR	Verified Net Savings (MWh)
LED - In-Unit (Globe)	32	100%	32	0.773	25
Kitchen Faucet Aerator	19	101%	19	1.004	19
LED - Common Area (Candelabra)	20	102%	20	0.773	16
LED - Common Area (Reflector)	14	102%	14	0.773	11
LED - In-Unit (Reflector)	7	100%	7	0.773	6
LED - Common Area (Globe)	2	102%	2	0.773	2
Bathroom Faucet Aerator	1	105%	1	1.004	1
Pipe Insulation	0.04	100%	0.04	0.794	0.04
Total	**1,335**	**107%**	**1,424**	**0.921**	**1,311**

Table 56. 2019 Multifamily Initiative Electric Demand Savings by Measure

Measure Category	Ex Ante Gross Savings (MW)	Gross Realization Rate	Verified Gross Savings (MW)	NTGR	Verified Net Savings (MW)
Advanced Thermostat	0.086	161%	0.139	1.000	0.139
LED - Common Area (A-Type)	0.019	102%	0.020	0.773	0.015
LED - In-Unit (A-Type)	0.018	100%	0.018	0.773	0.014
Kitchen Faucet Aerator	0.005	108%	0.005	1.004	0.005
Advanced Power Strip - Tier 1	0.006	100%	0.006	0.794	0.005
LED - In-Unit (Candelabra)	0.006	100%	0.006	0.773	0.005
Pipe Insulation	0.000	100%	0.000	0.794	0.000
LED - In-Unit (Globe)	0.005	100%	0.005	0.773	0.004
LED - Common Area (Globe)	<0.001	102%	<0.001	0.773	<0.001
LED - Common Area (Candelabra)	0.002	102%	0.003	0.773	0.002
LED - In-Unit (Reflector)	0.001	100%	0.001	0.773	0.001
LED - Common Area (Reflector)	0.002	102%	0.002	0.773	0.001
Bathroom Faucet Aerator	0.001	111%	0.001	1.004	0.001
Showerhead	0.003	105%	0.003	1.004	0.003
LED - Exterior (A-Type)	0.000	N/A	0.000	0.773	0.000
Total	**0.154**	**135%**	**0.208**	**0.935**	**0.195**

Table 57. 2019 Multifamily Initiative Gas Savings by Measure

Research Category	Ex Ante Gross Savings (Therms)	Gross Realization Rate	Verified Gross Savings (Therms)	NTGR	Verified Net Savings (Therms)
Advanced Thermostat	26,795	100%	26,795	1.00	26,795
Kitchen Faucet Aerator	464	105%	488	1.00	490
Pipe Insulation	234	100%	234	0.79	186
Showerhead	90	101%	91	1.00	91
Bathroom Faucet Aerator	43	99%	43	1.00	43
Total	**27,626**	**100%**	**27,650**	**1.00**	**27,604**

The electric energy and demand realization rates are driven by differences between ex ante and verified savings calculations. Advanced thermostats and LEDs account for more than 90% of the ex ante savings (60% and 33% respectively). As such, differences in savings calculations for these measures influence the overall energy and demand realization rates.

The overall gas realization rate is 100%, driven by the 100% realization rate for advanced thermostats, which make up 97% of the overall gas savings. Although three gas measures (bathroom and kitchen faucet aerators and showerheads) had differences between ex ante and verified gross savings, these measures make up only 3% of the overall gas savings, and the savings discrepancies are negligible compared to the overall gas savings.

We describe the primary reasons for differences between the ex ante and verified savings calculations below. Note that while certain inputs may increase savings, others decrease savings. The combination of all inputs brings about the overall realization rate for a specific measure. The following differences between ex ante and verified savings calculations contribute to the overall resulting energy and gas realization rates:

- **Advanced Thermostats:**
  - **Cooling Reduction:** Most of the difference in energy savings can be explained by the deemed cooling reduction factor chosen for analysis. The implementation team applied a cooling reduction of 6.3%, and the evaluation team applied a cooling reduction of 8.0% as specified in the IL-TRM V7.0. This change increased verified electric energy and demand savings.
  - **Cooling Savings:** For 168 thermostats installed in gas-heated homes with central AC cooling, the ex ante savings did not include cooling savings. The evaluation team included cooling savings, which increased the overall verified savings. Similarly, for 211 thermostats in gas-heated homes with no information about the cooling type (i.e., tracking database field is blank), the ex ante savings did not include cooling savings. The evaluation team included fractional cooling savings based on the "unknown" cooling factor in the IL-TRM V7.0.
- **LEDs:**
  - **Waste Heat Factor**: There is a 3% difference in ex ante and verified demand savings realization rates because the implementation team incorrectly applied the waste heat energy factor (WHFe) instead of the waste heat factor for demand (WHFd) in the demand calculation.
  - **Exterior Lighting**: For exterior installations in multifamily buildings, the implementation team applied assumptions from the Residential TRM, whereas the evaluation team applied assumptions from the Commercial TRM.
  - **ISRs:** For common area lighting, the implementation team applied an ISR of 98%, but the evaluation team applied a 100% ISR using the sign-off sheet delivery method specified in the IL-TRM V7.0. For interior lighting demand savings, the implementation team either excluded an ISR or used an ISR of 100%.
- **Faucet Aerators:** The evaluation team made several adjustments to the verified gross savings calculations that resulted in energy and demand realization rates greater than 100%.
  - **Wastewater Savings:** Ex ante demand savings did not include wastewater savings, understating the demand savings.
  - **EPG Values:** For Kitchen aerators, the implementation team incorrectly applied IL-TRM V7.0 EPG value of 0.0046 for the "unknown" installed location for participants with gas water heating when

the value should have been 0.0048. For bathroom aerators, the implementation team rounded the IL-TRM V7.0 EPG value to 0.0040 instead of using the actual value of 0.00397.

- **Showerheads:** The evaluation team made two adjustments to the verified gross savings calculations that increased savings, resulting in energy and demand realization rates of 100% and 105%, respectively.
  - **Wastewater Savings:** The implementation team did not include wastewater savings in the energy or demand savings calculations, which understated the energy and demand savings.
  - **EPG Values:** The implementation team applied a rounded EPG value of 0.0058 instead of the value provided in the IL-TRM V7.0 (0.00583).

3.7.5 Cumulative Persisting Annual Savings

Table 58 presents CPAS and WAML for the 2019 Multifamily Initiative. The measure-specific and total verified gross savings for the Initiative are summarized, and CPAS in each year of the 2018-2021 Plan are presented.[20] The WAML for the Initiative is 10.3 years.

Table 58. 2019 Multifamily Initiative CPAS and WAML

Measure	Measure Life	First-Year Verified Gross Savings (MWh)	NTGR	CPAS - Verified Net Savings (MWh)						Lifetime Savings (MWh)
				2018	2019	2020	2021	...	2030	...	
Standard LED - In Unit	10.0	148	0.773		114	114	32	...	0	...	485
Pipe Insulation	15.0	0	0.794		0.03	0.03	0.03	...	0.03	...	1
Specialty LED - In Unit	10.0	75	0.773		58	58	58	...	0	...	318
Reflector LED - In Unit	10.0	7	0.773		6	6	6	...	0	...	33
Specialty LED - Common Area	8.4	23	0.773		18	18	18	...	0	...	93
Standard LED - Common Area	8.4	158	0.773		122	122	48	...	0	...	550
Reflector LED - Common Area	8.4	14	0.773		11	11	11	...	0	...	60
Standard LED - Exterior	11.6	24	0.773		18	18	5	...	3	...	85
Advanced Power Strip - Tier 1	7.0	56	0.794		44	44	44	...	0	...	309
Bathroom Faucet Aerator	10.0	1	1.004		1	1	1	...	0	...	12
Kitchen Faucet Aerator	10.0	19	1.004		19	19	19	...	0	...	193
Showerhead	10.0	20	1.004		20	20	20	...	0	...	203
Advanced Thermostat	11.0	880	1.000		880	880	880	...	0	...	9,675
2019 CPAS		**1,424**	**0.921**		**1,311**	**1,311**	**1,141**	**...**	**3**	**...**	**12,015**
Expiring 2019 CPAS					**0**	**0**	**170**	**...**	**881**	**...**	
Expired 2019 CPAS					**0**	**0**	**170**	**...**	**1,308**	**...**	
WAML	**10.3**										

[20] For further detail, including achieved CPAS in years not presented in this table, please see the summary CPAS spreadsheet attached to this report.

3.7.6 Conclusions and Recommendations

The gross realization rates for the 2019 Multifamily Initiative are 107% for electric energy savings and 100% for gas savings, which indicates that ex ante and verified savings values are closely aligned. The discrepancy analysis described above details the reasons for the small differences between the ex ante and verified gross electric energy and gas savings.

The gross demand realization rate of 135% indicates that the ex ante calculations underestimated demand savings. This underestimation is primarily due to savings adjustments for advanced thermostats and bathroom faucet aerators, which have realization rates of 161% and 111%, respectively.

The evaluation team offers the following key findings and recommendations for the Multifamily Initiative:

- Key Finding #1: The implementation team applied a cooling reduction of 6.3% when calculating the energy savings for advanced thermostats.
  - Recommendation: Revise the cooling reduction value to 8% as indicated in the IL-TRM V7.0.
- Key Finding #2: The implementation team consistently applied the WHFe for high rise multifamily buildings throughout their analysis. This approach may understating savings if any properties treated are mid-rise multifamily buildings.
  - Recommendation: The implementation team should track whether the properties served through the Initiative are high rise or mid-rise buildings per IL-TRM definitions of property type.
- Key Finding #3: The implementation team did not include wastewater energy savings and demand savings calculations for faucet aerators and showerheads.
  - Recommendation: Update calculations to include wastewater savings.

3.8 Direct Distribution

3.8.1 Initiative Description

The Direct Distribution of Efficient Products Initiative (Direct Distribution Initiative) provided energy savings kits through three delivery channels: School Kits, Appliance Recycling Kits, and Community Kits.

School Kits

The School Kits channel provided energy savings kits and in-class energy education presentations to fifth-grade students throughout Ameren Illinois' service territory. The School Kits channel was designed and implemented by the National Energy Foundation (NEF) with many of the same program elements as previous years. Kits were purchased by Bradley Co. and assembled and delivered to participating schools by SOURCEone.

Each kit contained the following energy-efficient products:

- Four LED light bulbs
- Advanced power strip
- High-performance showerhead
- Kitchen sink aerator
- Bathroom sink aerator
- Hot water temperature card thermometer

In 2019, the School Kits channel delivered 7,514 kits to participating schools that were recruited by NEF from within Ameren Illinois' dual-fuel territory. As with prior years, a large number of schools that participated previously registered for presentations in 2019. To meet the Initiative's 30% low to moderate-income (LMI) goal, NEF identified, tracked, and prioritized the enrollment of schools and geographic areas that qualified as LMI. In total, 58% of all schools served qualified as LMI.

All in-school presentations were scheduled and completed within a three to four-week period each semester (spring and fall). The presentation familiarized students with the kit materials and provided instruction on how to install the energy-saving measures with their families. Students received a color-changing pencil for installing the kit contents and completing a Home Energy Worksheet (HEW) documenting the upgrades made to their homes. Teachers whose classrooms achieved an 80% HEW response rate received a $50 gift card. In total, 62% of all student participants returned HEWs. Through the HEW, parents were encouraged to provide an e-mail address to which a follow-up web-based survey was distributed. Thirty-three parents from 16 schools completed the follow-up survey.

Appliance Recycling Kits

The Appliance Recycling Kits channel offered free, energy-saving kits to customers who 1) recycled an appliance through the Appliance Recycling Initiative and resided within 34 regions identified as having significant populations of low-income customers. The kits were provided through SEEL staff (an Appliance Recycling implementation contractor) immediately following appliance pickup.

Each kit contained the following energy-efficient products:

- Four LED light bulbs
- Advanced power strip
- High-performance showerhead
- Kitchen sink aerator
- Bathroom sink aerator
- Hot water temperature card thermometer

In 2019, 524 customers received a kit through the Appliance Recycling Kits channel. Installation information for each measure was included in the kit as well as targeted marketing materials for other AIC Residential Program offerings, such as the Heating and Cooling Initiative.

Community Kits

The Community Kits channel distributes energy efficiency kits to income qualified customers at community events or following home visits conducted as part of the Income Qualified Initiative. Four distinct types of kit were offered through Community Kits in 2019: a "full" kit, an electric-focused kit, a gas-focused kit, and a "CEFS Kit" with a handful of new measures. In addition to these kits, a handful of stand-alone measures (LEDs and advanced power strips) were also reported as being delivered through this channel in 2019.

Summary of Key Implementation Changes in 2019

In 2019, many changes were made to the design and delivery of the School Kits Initiative due to a change in the implementer. Beginning in spring 2019, NEF developed a complete suite of new materials for the Initiative, including teacher and parent materials, in-school presentation materials, and program outreach and marketing materials. The following changes were also implemented throughout 2019:

- **In-school presentations were provided to fifth-grade students only.** In previous years, the program was offered to students in fifth through eighth grade. NEF worked with Ameren Illinois to accommodate previously scheduled presentations to other grade levels in the spring; however, beginning in fall of 2019, the presentation was delivered only to fifth-grade students.
- **In-school presentation delivery was concentrated to a three to four-week window.** In previous years, the in-school presentations were spread over several months. In the 2019 spring and fall semesters, NEF scheduled all presentations within a concentrated period of time.
- **In-school presentations were delivered by teams of two educators.** NEF employed four energy efficiency educators to provide in-school presentations. Each presentation was delivered by two of the four educators; in previous years, presentations were attended by only one representative of the Initiative.
- **Participating schools are recruited via e-mail, phone calls, and direct mail.** The Initiative no longer recruited schools at local conferences or engaged in event-based marketing. Instead, NEF employed a variety of outreach strategies that included an e-mail campaign, postcard promotion, and use of NEF's Educational Service Representatives and call center.
- **Incentives offered to both students and teachers changed**. In previous years, students were offered a $5 gift card for HEW completion, and teachers with the highest HEW response rates were eligible to win a $250 gift card. In 2019, students received a color-changing pencil for HEW completion, and all teachers with a HEW response rate of 80% were rewarded with a $50 gift card.

- **NEF employed a dedicated customer service representative.** This individual assisted interested schools and teachers with enrollment, scheduling, and other needs via e-mail and a custom toll-free number.
- **The Small Business Direct Install Initiative was cross-promoted in each of the schools.** While one energy educator set up materials for the presentation, a second educator provided school administrators with details on the Small Business Direct Install Initiative and discussed how the school might qualify.
- **The 2018 mini-kits pilot was discontinued**. A number of factors contributed to the cancellation of the mini-kits pilot: it was not part of the implementer's proposed Initiative design; savings for the kit items were not as robust as traditional school kit measures; and the design (targeting third and fourth-grade students) disallowed certain schools from participating year over year.
- **Appliance Recycling Kits were introduced.** In 2019, the Direct Distribution of Efficient Products Initiative expanded to include Appliance Recycling Kits.

3.8.2 Participation Summary

According to the implementer's tracking database, 83 schools in 50 different service cities received energy savings kits during 2019, and the number of kits distributed to each of the participating schools ranged from 10 to 366. Table 59 presents the number of School Kits measures distributed during 2019.

Table 59. 2019 School Kits Participation Summary

Measure	Number of Measures Distributed
9W LED	30,056
1.0 GPM Bath Faucet Aerator	7,514
1.5 GPM Kitchen Faucet Aerator	7,514
1.5 GPM High Efficiency Showerhead	7,514
Hot Water Temperature Card Thermometer	7,514
Advanced Power Strip	7,514
Program Total	**67,626**

Table 60 presents the number of Appliance Recycling Kits measures distributed during 2019.

Table 60. 2019 Appliance Recycling Kits Participation Summary

Measure	Number of Measures Distributed
9W LED	2,096
1.0 GPM Bath Faucet Aerator	524
1.5 GPM Kitchen Faucet Aerator	524
1.5 GPM High Efficiency Showerhead	524
Hot Water Temperature Card Thermometer	524
Advanced Power Strip	524
Program Total	**4,716**

Table 61 describes the types and number of kits of energy-efficient products that the Community Kits channel distributed to customers in 2019. Nearly 5,700 kits were provided in 2019, which is about half of the planned goal of distributing 10,700 kits. The Community Kits channel does not track home type for kits distributed at

events, making it unclear how many single family versus multifamily customers received kits. The tracking data also does not provide delivery method in all cases, but most kits were delivered (at least 85%, N=5,692) during community events. Otherwise, kits were left behind or mailed after home visits conducted as part of the Income Qualified Initiative.

Table 61. 2019 Community Kits Participation Summary

Kit Type	Kit Contents	Number of Kits by Home Type		Total Kits Distributed
		Single Family	Unknown: Delivered at Events	
Community Kits	**"Full" kit provided to gas and electric AIC customers:** (4) 9W LEDs, (1) advanced power strip tier 1 (1) low-flow showerhead, (1) kitchen faucet aerator, (1) bathroom faucet aerator, and (1) water temperature card	30	3,900	3,930
	"Gas" kit provided to gas-only AIC customers: (1) low-flow showerhead, (1) kitchen faucet aerator, (1) bathroom faucet aerator, (1) water temperature card, (1) thermostatic shower valve, and (1) 5-minute shower timer	100	543	643
	"Electric" kit provided to electric-only AIC customers: (8) 9W LEDs and (1) advanced power strip tier 1	26	90	116
LED 4-pack	(4) 9W LEDs and (1) advanced power strip tier 1	669	16	685
LED 1-pack	(1) 9W LED	0	214	214
CEFS Kit	(2) 9W LEDs, (1) advanced power strip tier 1, (1) LED nightlight, (20) outlet gaskets, (1) furnace filter alarm	56	0	56
Advanced Thermostat Kit	(1) advanced thermostat	0	32	32
Advanced Power Strip 1-pack	(1) advanced power strip tier 1	0	16	16
Total Kits Distributed		**811**	**4,811**	**5,692**

Source: Initiative tracking data.

3.8.3 Initiative Annual Savings Summary

Table 62 presents Direct Distribution Initiative annual savings achieved in 2019. The 2019 Direct Distribution Initiative achieved 2,974 MWh, 0.426 MW, and 84,651 therms in verified net savings.

Table 62. 2019 Direct Distribution Initiative Annual Savings - Overall

	Electric Energy Savings (MWh)	Electric Demand Savings (MW)	Gas Savings (Therms)
Ex Ante Gross Savings	3,114	0.425	82,247
Gross Realization Rate	100%	104%	103%
Verified Gross Savings	3,114	0.443	84,651
NTGR	0.955	0.963	1.000
Verified Net Savings	2,974	0.426	84,651

3.8.4 Initiative Savings Detail

Table 63, Table 64, and Table 65 present 2019 School Kits savings for each kit measure.[21] The evaluation team credited School Kits with savings from CFL and LED bulbs distributed during PY9, Transition Period and 2018 program years, and installed during the 2019 program year, as shown in Table 69. Because the Transition Period accounted for only 7 of the 12 months of a year, we claimed 5/12 of Future Year 3 13W CFL installations from PY9 (18 MWh and 0.002 MW in verified gross savings), Future Year 3 9W LED installations from the Transition Period (21 MWh and 0.002 MW in verified gross savings), and Future Year 2 delayed 9W LED installations by 2018 participants (81 MWh and 0.008 MW in verified gross savings).

Table 63. 2019 School Kits Electric Energy Savings by Measure

Measure Category	Ex Ante Gross Savings (MWh)	Gross Realization Rate	Verified Gross Savings (MWh)	NTGR	Verified Net Savings (MWh)
9W LED	747	100%	747	0.84	627
1.0 GPM Bath Faucet Aerator	29	100%	29	1.00	29
1.5 GPM Kitchen Faucet Aerator	252	100%	252	1.00	252
1.5 GPM High Efficiency Showerhead	281	100%	281	1.00	281
Hot Water Temperature Card Thermometer	48	106%	51	1.00	51
Advanced Power Strip	534	100%	534	1.00	534
School Kits Subtotal	1,891	100%	1,894	0.94	1,775
Carryover from 2018 [Year 2 PY2018] - 9W LEDs	81	100%	81	0.83	67
Carryover from 2017 [Year 3 Transition Period] - 9W LEDs	18	115%	21	0.83	17
Carryover from 2017 [Year 3 PY9] - 13W CFLs	17	106%	18	0.83	15
School Kits Total Including Carryover Savings	**2,007**	**100%**	**2,014**	**0.93**	**1,874**

Note: Totals may not sum due to rounding.

[21] Five-twelfths of delayed 13W CFL installations by PY9 participants in year 3, delayed 13W CFL installations by Transition Period participants in year 3, and delayed 9W LED installations by 2018 participants in year 2, estimated as installed during 2019 (in accordance with IL-TRM V7.0), were credited to the final 2019 Direct Distribution School Kit Initiative ex ante gross, verified gross and verified net impacts.

Table 64. 2019 School Kits Electric Demand Savings by Measure

Measure Category	Ex Ante Gross Savings (MW)	Gross Realization Rate	Verified Gross Savings (MW)	NTGR	Verified Net Savings (MW)
9W LED	0.090	100%	0.090	0.84	0.076
1.0 GPM Bath Faucet Aerator	0.036	100%	0.036	1.00	0.036
1.5 GPM Kitchen Faucet Aerator	0.051	100%	0.051	1.00	0.051
1.5 GPM High Efficiency Showerhead	0.028	100%	0.028	1.00	0.028
Hot Water Temperature Card Thermometer	0.005	106%	0.006	1.00	0.006
Advanced Power Strip	0.060	100%	0.060	1.00	0.060
School Kits Subtotal	0.271	100%	0.272	0.95	0.257
Carryover from 2018 [Year 2 PY2018] - 9W LEDs	0.007	116%	0.008	0.83	0.007
Carryover from 2017 [Year 3 Transition Period] - 9W LEDs	0.002	117%	0.002	0.83	0.002
Carryover from 2017 [Year 3 PY9] - 13W CFLs	0.002	106%	0.002	0.83	0.002
School Kits Total Including Carryover Savings	**0.282**	**101%**	**0.283**	**0.94**	**0.267**

Note: Totals may not sum due to rounding.

Table 65. 2019 School Kits Gas Savings by Measure

Research Category	Ex Ante Gross Savings (Therms)	Gross Realization Rate	Verified Gross Savings (Therms)	NTGR	Verified Net Savings (Therms)
1.0 GPM Bath Faucet Aerator	1,195	100%	1,194	1.00	1,194
1.5 GPM Kitchen Faucet Aerator	10,490	100%	10,502	1.00	10,502
1.5 GPM High Efficiency Showerhead	11,917	100%	11,922	1.00	11,922
Hot Water Temperature Card Thermometer	2,223	106%	2,347	1.00	2,347
School Kits Total	**25,825**	**101%**	**25,965**	**1.00**	**25,965**

Note: Totals may not sum due to rounding.

Table 66, Table 67, and Table 68 present 2019 Appliance Recycling Kits savings for each kit measure.

Table 66. 2019 Appliance Recycling Kits Electric Energy Savings by Measure

Measure Category	Ex Ante Gross Savings (MWh)	Gross Realization Rate	Verified Gross Savings (MWh)	NTGR	Verified Net Savings (MWh)
9W LED	57	89%	51	1.000	51
1.0 GPM Bath Faucet Aerator	2	100%	2	1.000	2
1.5 GPM Kitchen Faucet Aerator	13	100%	13	1.000	13
1.5 GPM High Efficiency Showerhead	17	100%	17	1.000	17
Hot Water Temperature Card Thermometer	1	100%	1	1.000	1
Advanced Power Strip	37	100%	37	1.000	37
Appliance Recycling Kits Total	**126**	**95%**	**120**	**1.00**	**120**

Note: Totals may not sum due to rounding.

Table 67. 2019 Appliance Recycling Kits Electric Demand Savings by Measure

Measure Category	Ex Ante Gross Savings (MW)	Gross Realization Rate	Verified Gross Savings (MW)	NTGR	Verified Net Savings (MW)
9W LED	0.007	89%	0.006	1.000	0.006
1.0 GPM Bath Faucet Aerator	0.002	100%	0.002	1.000	0.002
1.5 GPM Kitchen Faucet Aerator	0.002	100%	0.002	1.000	0.002
1.5 GPM High Efficiency Showerhead	0.001	100%	0.001	1.000	0.001
Hot Water Temperature Card Thermometer	0.0001	100%	0.0001	1.000	0.0001
Advanced Power Strip	0.004	100%	0.004	1.000	0.004
Appliance Recycling Kits Total	**0.016**	**96%**	**0.016**	1.000	**0.016**

Note: Totals may not sum due to rounding.

Table 68. 2019 Appliance Recycling Kits Gas Savings by Measure

Research Category	Ex Ante Gross Savings (Therms)	Gross Realization Rate	Verified Gross Savings (Therms)	NTGR	Verified Net Savings (Therms)
1.0 GPM Bath Faucet Aerator	279	100%	279	1.000	279
1.5 GPM Kitchen Faucet Aerator	2,254	100%	2,257	1.000	2,257
1.5 GPM High Efficiency Showerhead	3,031	100%	3,032	1.000	3,032
Hot Water Temperature Card Thermometer	160	99%	159	1.000	159
Appliance Recycling Kits Total	**5,724**	**100%**	**5,726**	**1.000**	**5,726**

Note: Totals may not sum due to rounding.

The IL-TRM V7.0 assumes that kit recipients install 60% of the LEDs during the year that they are distributed. Up to 84% of all remaining LEDs are eventually installed during the following two years. Therefore, in addition to gross savings achieved from measure installations during 2019, the evaluation team calculated gross savings for future LED installations, per the IL-TRM V7.0. Table 69 and Table 70 show savings from bulbs provided to School Kit participants and Appliance Recycling participants and installed in 2019 as well as bulbs that will be installed and claimed in future program years.

Table 69. 2019 School Kits Verified Gross Impacts of Lighting Measures by Assumed Installation Year

Measure	Energy (MWh)			Demand (MW)		
	2019	2020	2021	2019	2020	2021
9W LED	747	97	27	0.090	0.012	0.003

Table 70. 2019 Appliance Recycling Kits Verified Gross Impacts of Lighting Measures by Assumed Installation Year

Measure	Energy (MWh)			Demand (MW)		
	2019	2020	2021	2019	2020	2021
9W LED	51	7	2	0.006	0.001	0.0002

Table 71, Table 72, and Table 73 present 2019 Community Kits savings by measure.

Table 71. 2019 Community Kits Electric Energy Savings by Measure

Measure Category	Ex Ante Gross Savings (MWh)	Gross Realization Rate	Verified Gross Savings (MWh)	NTGR	Verified Net Savings (MWh)
Lighting	10	99%	10	1.000	10
Advanced Power Strip	1	100%	1	1.000	1
Full Kit - Standard LED	426	100%	426	1.000	426
Full Kit - Advanced Power Strip	277	100%	277	1.000	277
Full Kit - Showerhead	123	100%	123	1.000	123
Full Kit - Faucet Aerator	108	101%	109	1.000	109
Full Kit - Water Temperature Card	5	92%	5	1.000	5
CEFS Kit - Standard LED	2	100%	2	1.000	2
CEFS Kit - LED Night Light	1	100%	1	1.000	1
CEFS Kit - Outlet Gasket	1	80%	0.4	1.000	0.4
CEFS Kit - Furnace Filter Alarm	1	100%	1	1.000	1
Electric Kit - Standard LED	20	100%	20	1.000	20
Electric Kit - Advanced Power Strip	6	100%	6	1.000	6
Community Kits Total	**980**	**100%**	**980**	**1.000**	**980**

Table 72. 2019 Community Kits Electric Demand Savings by Measure

Measure Category	Ex Ante Gross Savings (MW)	Gross Realization Rate	Verified Gross Savings (MW)	NTGR	Verified Net Savings (MW)
Lighting	0.001	99%	0.001	1.000	0.001
Advanced Power Strip	0.000	100%	0.000	1.000	0.000
Full Kit - Standard LED	0.051	102%	0.052	1.000	0.052
Full Kit - Advanced Power Strip	0.031	100%	0.031	1.000	0.031
Full Kit - Showerhead	0.011	124%	0.014	1.000	0.014
Full Kit - Faucet Aerator	0.028	145%	0.041	1.000	0.041
Full Kit - Water Temperature Card	0.000	138%	0.001	1.000	0.001
CEFS Kit - Standard LED	0.000	100%	0.000	1.000	0.000
CEFS Kit - LED Night Light	0.000	N/A	0.000	1.000	0.000
CEFS Kit - Furnace Filter Alarm	0.000	100%	0.000	1.000	0.000

Measure Category	Ex Ante Gross Savings (MW)	Gross Realization Rate	Verified Gross Savings (MW)	NTGR	Verified Net Savings (MW)
Electric Kit - Standard LED	0.002	100%	0.002	1.000	0.002
Electric Kit - Advanced Power Strip	0.001	100%	0.001	1.000	0.001
Community Kits Total	**0.127**	**113%**	**0.144**	**1.000**	**0.144**

Table 73. 2019 Community Kits Gas Savings by Measure

Measure Category	Ex Ante Gross Savings (MWh)	Gross Realization Rate	Verified Gross Savings (MWh)	NTGR	Verified Net Savings (MWh)
Full Kit - Showerhead	22,542	102%	22,924	1.000	22,924
Full Kit - Faucet Aerator	18,837	102%	19,128	1.000	19,128
Full Kit - Water Temperature Card	1,170	91%	1,063	1.000	1,063
Gas Kit - Thermostatic Valve	630	190%	1,199	1.000	1,199
Gas Kit - Shower Timer	1,287	96%	1,240	1.000	1,240
Gas Kit - Showerhead	3,139	121%	3,800	1.000	3,800
Gas Kit - Faucet Aerator	2,623	121%	3,170	1.000	3,170
Gas Kit - Water Temperature Card	163	108%	176	1.000	176
CEFS Kit - Outlet Gasket	230	79%	183	1.000	183
CEFS Kit - Furnace Filter Alarm	77	100%	77.3	1.000	77.3
Community Kits Total	**50,698**	**104%**	**52,959**	**1.000**	**52,959**

School Kits Realization Rate Details

- **LEDs:** Since the evaluation team used the same savings assumptions as the implementer for the 9W LEDs, the verified gross per-unit energy and demand savings match the ex ante per-unit savings (24.8 kWh and 0.003 kW) for 100% realization rates.
- **Bath Faucet Aerators (electric and gas):** Since the evaluation team used the same savings assumptions as the implementer for the bath faucet aerators, the verified gross per-unit energy, demand, and gas savings match the ex ante per-unit savings (3.88 kWh, 0.005 kW, and 0.16 therms) for 100% realization rates.
- **Kitchen Faucet Aerators (electric and gas):** Since the evaluation team used the same savings assumptions as the implementer for the kitchen faucet aerators, the verified gross per-unit energy, demand, and gas savings match the ex ante per-unit savings (33.49 kWh, 0.007 kW, and 1.40 therms) for 100% realization rates.
- **Showerheads (electric and gas):** Since the evaluation team used the same savings assumptions as the implementer for the showerheads, the verified gross per-unit energy, demand savings match the ex ante per-unit savings (37.43 kWh, 0.004 kW, and 1.59 therms) for 100% realization rates.
- **Hot Water Temperature Card (electric and gas):** The gross realization rate of 106% for energy, demand, and gas savings is due to differences in ISR assumptions. Ex ante savings assumed a 16% ISR from the PY9 School Kits evaluation, while the verified calculations relied upon the 2018 implementer-administered participant survey results of 17% ISR, in accordance with IL-TRM V7.0.
- **Advanced Power Strips (electric):** Since the evaluation team used the same savings assumptions as the implementer for the advanced power strips, the verified gross per-unit energy and demand savings match the ex ante per-unit savings (71.07 kWh and 0.008 kW) for 100% realization rates.

Appliance Recycling Kits Realization Rate Details

- **LEDs:** The gross realization rate of 89% occurs due to differences in ISR assumptions. Ex ante savings calculations for 9W LEDs used an ISR value of 66% that is prescribed in IL-TRM V7.0 for LEDs that are distributed through a 'Direct Mail Kit' opt-in program. The evaluation team used an ISR value of 59% prescribed in IL-TRM V7.0 for LEDs that are part of an 'LED Distribution' of free bulbs provided without request.
- **Bath Faucet Aerators (electric and gas):** Since the evaluation team used the same savings assumptions as the implementer for the bath faucet aerators, the verified gross per-unit energy, demand, and gas savings match the ex ante per-unit savings (3.19 kWh, 0.003 kW, and 0.53 therms) for 100% realization rates.
- **Kitchen Faucet Aerators (electric and gas):** Since the evaluation team used the same savings assumptions as the implementer for the kitchen faucet aerators, the verified gross per-unit energy, demand, and gas savings match the ex ante per-unit savings (24.49 kWh, 0.004 kW, and 4.30 therms) for 100% realization rates.
- **Showerheads (electric and gas):** Since the evaluation team used the same savings assumptions as the implementer for the showerheads the verified gross per-unit energy, demand and gas savings match the ex ante per-unit savings (31.55 kWh, 0.003 kW, and 5.78 therms) for 100% realization rates.
- **Hot Water Temperature Card (electric):** Since the evaluation team used the same savings assumptions as the implementer, the verified gross per-unit energy and demand savings match the ex ante per-unit savings (1.3 kWh, 0.001 kW) for 100% realization rates.
- **Hot Water Temperature Card (gas):** The gross realization rate of 99% occurs due to slight differences in parameter values used in the ex ante and verified gross savings calculations. Ex ante calculations used single-family and multifamily deemed savings assumptions from IL-TRM V7.0 in conjunction with the 79% single family and 21% multifamily customer population distribution from the 2013 Market Potential Assessment to calculate a weighted average per-unit savings value of 0.305 therms. The evaluation team used single-family and multifamily recovery efficiency of gas water heaters assumptions from IL-TRM V7.0 in conjunction with the 79% single family and 21% multifamily customer population distribution from the 2013 Market Potential Assessment to calculate a weighted average recovery efficiency of gas water heater value of 0.757 that was used in the verified gross per-unit savings (0.303 therms) calculation.
- **Advanced Power Strips (electric):** Since the evaluation team used the same savings assumptions as the implementer, the verified gross per-unit energy and demand savings match the ex ante per-unit savings (71.1 kWh, 0.008 kW) for 100% realization rates.

3.8.5 Cumulative Persisting Annual Savings

Table 74 presents CPAS and WAML by channel for the 2019 Direct Distribution Initiative. The measure-specific and total verified gross savings for the Initiative are summarized, and CPAS in each year of the 2018-2021 Plan are presented.[22] The WAML for the Initiative is 8.9 years. CPAS and WAML for each channel at a measure level are summarized in Table 75 through Table 80.

Table 74. 2019 Direct Distribution Initiative CPAS and WAML

Channel	Measure Life	First-Year Verified Gross Savings (MWh)	NTGR	CPAS - Verified Net Savings (MWh)							Lifetime Savings (MWh)
				2018	2019	2020	2021	...	2030	...	
School Kits	8.8	2,014	0.931		1,874	1,874	1,340	...	0	...	12,586
Appliance Recycling Kits	8.9	120	1.000		120	120	85	...	0	...	793
Community Kits	9.1	980	1.000		980	980	642	...	0	...	6,241
2019 CPAS		**3,114**	**0.955**		**2,974**	**2,974**	**2,067**	**...**	**0**	**...**	**19,620**
Expiring 2019 CPAS					**0**	**0**	**907**	**...**	**0**	**...**	
Expired 2019 CPAS					**0**	**0**	**907**	**...**	**2,974**	**...**	
WAML	**8.9**										

[22] For further detail, including achieved CPAS in years not presented in this table, please see the summary CPAS spreadsheet attached to this report.

Table 75. 2019 School Kits CPAS and WAML

Channel	Measure Life	First-Year Verified Gross Savings (MWh)	NTGR	CPAS - Verified Net Savings (MWh)							Lifetime Savings (MWh)
				2018	2019	2020	2021	...	2030	...	
9W LED (2019 - Year 1)	10.0	747	0.840		627	627	203	...	0	...	2,879
9W LEDs (Carryover from 2018 [Year 2 2018])	10.0	81	0.830		67	67	35	...	0	...	417
9W LEDs (Carryover from 2017 [Year 3 Transition Period)	10.0	21	0.830		17	17	6	...	0	...	79
13W CFLs (Carryover from 2017 [Year 3 PY9])	2.0	18	0.830		15	15		...	0	...	31
1.0 GPM Bath Faucet Aerator	9.0	29	1.000		29	29	29	...	0	...	263
1.5 GPM Kitchen Faucet Aerator	9.0	252	1.000		252	252	252	...	0	...	2,265
1.5 GPM High Efficiency Showerhead	10.0	281	1.000		281	281	281	...	0	...	2,812
Hot Water Temperature Card Thermometer	2.0	51	1.000		51	51		...	0	...	102
Advanced Power Strips	7.0	534	1.000		534	534	534	...	0	...	3,738
2019 CPAS		**2,014**	**0.931**		**1,874**	**1,874**	**1,340**	**...**	**0**	**...**	**12,586**
Expiring 2019 CPAS					**0**	**0**	**534**	**...**	**0**	**...**	
Expired 2019 CPAS					**0**	**0**	**534**	**...**	**1,874**	**...**	
WAML	**8.9**										

Table 76. 2019 Appliance Recycling Kits CPAS and WAML

Channel	Measure Life	First-Year Verified Gross Savings (MWh)	NTGR	CPAS - Verified Net Savings (MWh)							Lifetime Savings (MWh)
				2018	2019	2020	2021	...	2030	...	
9W LED (2019 - Year 1)	10.0	51	1.000		51	51	17	...	0	...	235
1.0 GPM Bath Faucet Aerator	9.0	2	1.000		2	2	2	...	0	...	15
1.5 GPM Kitchen Faucet Aerator	9.0	13	1.000		13	13	13	...	0	...	115
1.5 GPM High Efficiency Showerhead	10.0	17	1.000		17	17	17	...	0	...	165
Hot Water Temperature Card Thermometer	2.0	1	1.000		1	1	0	...	0	...	1
Advanced Power Strips	7.0	37	1.000		37	37	37	...	0	...	261
2019 CPAS		**120**	**1.000**		**120**	**120**	**85**	**...**	**0**	**...**	**793**
Expiring 2019 CPAS					**0**	**0**	**35**	**...**	**0**	**...**	
Expired 2019 CPAS					**0**	**161**	**196**	**...**	**281**	**...**	
WAML	**8.9**										

Table 77. 2019 Community Kits CPAS and WAML

Channel	Measure Life	First-Year Verified Gross Savings (MWh)	NTGR	CPAS - Verified Net Savings (MWh)							Lifetime Savings (MWh)
				2018	2019	2020	2021	...	2030	...	
Standard LED	10.0	10	1.00		10	10	3	...	0	...	40
Advanced Power Strip - Tier 1	7.0	1	1.00		1	1	1	...	0	...	8
Full Community Kit - LED Standard	10.0	426	1.00		426	426	116	...	0	...	1,777
Full Community Kit - Advanced Power Strip	7.0	277	1.00		277	277	277	...	0	...	1,940
Full Community Kit - Showerhead	10.0	123	1.00		123	123	123	...	0	...	1,230
Full Community Kit - Faucet Aerator	10.0	109	1.00		109	109	109	...	0	...	1,086
Full Community Kit - Water Temperature Card	2.0	5	1.00		5	5	0	...	0	...	9
Electric Community Kit - LED Standard	10.0	20	1.00		20	20	5	...	0	...	82

Channel	Measure Life	First-Year Verified Gross Savings (MWh)	NTGR	CPAS - Verified Net Savings (MWh)							Lifetime Savings (MWh)
				2018	2019	2020	2021	...	2030	...	
Electric Community Kit - Advanced Power Strip	7.0	6	1.00		6	6	6	...	0	...	45
CEFS Kit - LED Standard	10.0	2	1.00		2	2	0.5	...	0	...	7
CEFS Kit - LED Night Light	8.0	1	1.00		1	1	1	...	0	...	5
CEFS Kit - Outlet Gasket	20.0	0.4	1.00		0.4	0.4	0.4	...	0.4	...	9
CEFS Kit - Furnace Filter Alarm	3.0	1	1.00		1	1	1	...	0	...	2
2019 CPAS		**980**	**1.00**		**980**	**980**	**642**	**...**	**0.4**	**...**	**6,241**
Expiring 2019 CPAS					**0**	**0**	**338**	**...**	**0**	**...**	
Expired 2019 CPAS					**0**	**0**	**338**	**...**	**980**	**...**	
WAML	**9.1**										

Appendix A. Detailed Impact Analysis Methodology

This appendix presents details of the impact analysis methods used for the 2019 Residential Program.

Retail Products

Gross Impact Methodology

This appendix contains detail on the savings assumptions used to estimate verified gross electric energy, electric demand, and gas savings from lighting, advanced power strips, advanced thermostats, and variable-speed pool pumps for the Retail Products Initiative in 2019. Table 78 lists the measures in the Public Housing Initiative, their corresponding IL-TRM entry, and whether or not errata applied to the measure in the 2019 evaluation.

Table 78. Retail Products Initiative Measures Evaluated

Measure	TRM Entry	Errata Applied?
Commercial ENERGY STAR Compact Fluorescent Lamp (CFL)	4.5.1	No errata present for this measure
LED Bulbs and Fixtures	4.5.4	No; errata exist for this measure in general but are not relevant to the measure as implemented through the Retail Products Initiative
ENERGY STAR Clothes Washers	5.1.2	No; an errata exists for this measure but is not relevant to AIC, which implements no programs in Cook County
ENERGY STAR Freezer	5.1.5	No errata present for this measure
ENERGY STAR and CEE Tier 2 Refrigerator	5.1.6	No errata present for this measure
ENERGY STAR Clothes Dryer	5.1.10	No errata present for this measure
Advanced Power Strip - Tier 1	5.2.1	No errata present for this measure
Advanced Thermostats	5.3.16	No errata present for this measure
Compact Fluorescent Lamp (CFL)	5.5.1	No errata present for this measure
LED Specialty Lamps	5.5.6	No errata present for this measure
LED Screw Based Omnidirectional Bulbs	5.5.8	No errata present for this measure
High Efficiency Pool Pumps	5.7.1	No errata present for this measure

Lighting Savings Assumptions

The evaluation team calculated verified gross electric and demand savings for 2019 Retail Products Initiative lighting products using the Initiative tracking database and applying algorithms and savings assumptions based on the IL-TRM V7.0. The evaluation team used the following equations from the IL-TRM V7.0 to estimate electric energy, electric demand, and gas savings for LED lighting:

Equation 1. Lighting Energy and Demand Savings Equations

$$kWh = \left[Qty \times LA \times \%Res \times \left[\frac{(Watt_{base} - Watt_{ee})}{1000} \times ISR_{res} \times HOU_{res} \times WHFe_{res}\right]\right] + \left[Qty \times LA \times \%Com \times \left[\frac{(Watt_{base} - Watt_{ee})}{1000} \times ISR_{com} \times HOU_{com} \times WHFe_{com}\right]\right]$$

$$kW = \left[Qty \times LA \times \%Res \times \left[\frac{(Watt_{base} - Watt_{ee})}{1000} \times ISR_{res} \times CF_{res} \times WHFd_{res}\right]\right] + \left[Qty \times LA \times \%Com \times \left[\frac{(Watt_{base} - Watt_{ee})}{1000} \times ISR_{com} \times CF_{com} \times WHFd_{com}\right]\right]$$

Where:

Qty	=Quantity of bulbs from initiative tracking data
LA	=Leakage adjustment (1 – leakage rate)
%Res	=Portion of bulbs purchased for residential application
%Com	=Portion of bulbs purchased for commercial application
Watt_base	=EISA-compliant baseline wattage
Watt_ee	=Actual wattage of installed energy-efficient bulb
ISR	=In-service rate
HOU	=Hours of use
WHFe	=Waste heat factor for energy savings
WHFd	=Waste heat factor for demand savings
CF	=Coincidence factor
res	=Residential values
com	=Commercial values

Lighting Leakage and Residential Versus Commercial Installation

The nature of an upstream lighting offering prevents implementers from directly verifying that each bulb sold goes to an Ameren Illinois customer and is installed in a residential setting. The IL-TRM V7.0, therefore, stipulates a 13.1% leakage rate for Ameren Illinois upstream lighting programs to account for bulbs sold to non-AIC customers. Of the remaining 86.9% of bulbs, the IL-TRM V7.0 stipulates that 95% of standard LEDs and 97% of specialty LEDs go to residential applications. In comparison, the remaining 5% of standard and 3% of specialty products are purchased for commercial applications.

Lighting Baseline Wattage and EISA Compliance

The baseline wattages in the IL-TRM V7.0 vary depending on the bulb type. Baseline wattages for standard LEDs are based on the lumen output and account for EISA efficiency standards, where appropriate. Table 79 lists the baseline wattages as they were applied to calculate 2019 verified savings for standard LEDs.

Table 79. Baseline Wattages for Standard LEDs

Lumen Range	Base Wattage
250–309	25
310–749	29
750–1,049	43

Lumen Range	Base Wattage
1,050–1,489	53
1,490–2,600	72
2,601–3,300	150
3,301–5,279	200
5,280–6,209	300

The baseline wattages for directional LEDs vary depending on the directional bulb type and lumen range and account for the Department of Energy (DOE) energy efficiency standards for incandescent reflector lamps and any appropriate exemptions to the standards. Table 80 lists the baseline wattages as they were applied to calculate 2019 verified savings for specialty reflector LEDs.

Table 80. Baseline Wattages for Reflector LEDs

Bulb Type	Lumen Range	Base Wattage
R, ER, BR with medium screw bases w/ diameter >2.25" (*see exceptions below)	420-472	40
	473–524	45
	525–714	50
	715–937	65
	938–1,259	75
	1,260–1,399	90
	1,400–1,739	100
	1,740–2,174	120
	2,175–2,624	150
	2,625–2,999	175
	3,000–4,500	200
*R, BR, and ER with medium screw bases w/ diameter <=2.25"	400–449	40
	450–499	45
	500–649	50
	650–1,199	65
*ER30, BR30, BR40, or ER40	400–449	40
	450–499	45
	500–649	50
BR30, BR40, or ER40	650-1419	65
*R20	400-449	40
	450-719	45
*All reflector lamps below lumen ranges specified above	200-299	20
	300-399	30

For PAR and MR directional products, we used bulb diameter (D), center beam candle power (CBCP), and beam angle (BA) to calculate baseline wattage using the following equation.

Equation 2. Baseline Wattage for PAR and MR Reflector LEDs

$$375.1 - 4.355(D) - \sqrt{227{,}800 - 937.9(D) - 0.9903(D^2) - 1479(BA) - 12.02(D * BA) + 14.69(BA^2) - 16{,}720 * \ln(CBCP)}$$

Table 81 lists the baseline wattages as they were applied to calculate 2019 verified savings for specialty non-reflector LEDs such as 3-way, globe, and candelabra bulbs.

Table 81. Baseline Wattages for Specialty Non-Reflector LEDs

3-Way	250–449	25
	450–799	40
	800–1,099	60
	1,100–1,599	75
	1,600–1,999	100
	2,000–2,549	125
	2,550–2,999	150
Globe (medium and intermediate bases less than 750 lumens)	90–179	10
	180–249	15
	250–349	25
	350–749	40
Decorative (Shapes B, BA, C, CA, DC, F, G, medium and intermediate bases less than 750 lumens)	70–89	10
	90–149	15
	150–299	25
	300–749	40
Globe (candelabra bases less than 1050 lumens)	90–179	10
	180–249	15
	250–349	25
	350–499	40
	500–1,049	60
Decorative (Shapes B, BA, C, CA, DC, F, G, candelabra bases less than 1050 lumens)	70–89	10
	90–149	15
	150–299	25
	300–499	40
	500–1,049	60

Lighting In-Service Rate and Carryover Savings

Per the IL-TRM V7.0, the first-year in-service rate (ISR) varies by bulb type and installation location, and 98% of all bulbs are projected to be installed within three years of purchase while the remaining 2% are never installed. Using this trajectory, savings are claimed in the year that bulbs are installed. Therefore, the 2019 Retail Products Initiative claims savings from first-year installations of 2019 bulb sales as well as carryover savings from bulbs sold in previous years but not installed until 2019. Likewise, savings associated with bulbs purchased in 2019 but not installed until the second or third year after purchase will be claimed as carryover savings the year they get installed. Table 82 below provides an installation trajectory by bulb type and installation location.

Table 82. Illinois Statewide TRM Version 7.0 LED Lighting ISR Trajectory

Install Location	Bulb Type	First Year	Second Year	Third Year	Cumulative
Residential	Standard	78.4%	10.6%	9%	98%
	Specialty	84.0%	7.6%	6.4%	98%
Commercial	All	82.5%	8.4%	7.1%	98%

2019 lighting impacts include carryover savings from products purchased in previous program years but not installed until 2019. Up until June 1, 2017, AIC programs ran from June 1 through May 31, instead of on a calendar year as they do now. To align carryover savings from bulbs sold prior to June 1, 2017, we adjust third-year savings from PY9 proportionally based on the number of months the program year overlapped with the 2017 calendar year. PY9 spanned five months of 2017, so 5/12th of third-year installations are assumed installed in 2019. The Transition Period fell entirely in 2017, so 100% of third-year installations are claimed as carryover in 2019. In 2018, the Initiative operated on a calendar year, so 100% of second-year installations are claimed as carryover in 2019.

When calculating carryover savings, installation trajectory and NTGR are based on values used for the evaluation associated with the year of purchase. Other gross savings assumptions are assigned in line with the TRM leveraged for evaluation of the year bulbs are installed. Table 83 provides carryover energy and demand savings claimed by the 2019 Retail Products Initiative for bulbs sold in 2017 and 2018 but not installed until 2019. This includes third-year savings from three IPA programs (Rural Kits, Moderate Income Kits, and CFL Distribution) operated in PY9, which are presented separately.

Table 83. 2019 Retail Products Initiative Carryover Savings from Sales in PY9, PYTR, and 2018

Source	Verified Gross Savings (MWh)	Verified Gross Savings (MW)	NTGR	Verified Net Savings (MWh)	Verified Net Savings (MW)
PY9 / third-year installs	1,522	0.181	0.614	934	0.111
PY9 IPA / third-year installs	753	0.074	0.939	707	0.070
PYTR / third-year installs	705	0.091	0.583	411	0.053
2018 / second-year installs	6,176	0.769	0.700	4,323	0.538
Total	**9,156**	**1.114**	**N/A**	**6,375**	**0.772**

Lighting Hours of Use

The IL-TRM V7.0 provides different residential HOU assumptions for different bulb types depending on where they get installed. Table 84 provides the applied HOU assumptions.

Table 84. Illinois Statewide TRM Version 7.0 Lighting HOU Assumptions

Install Location	Bulb Type	Hours of Use
Residential	Standard	1,159
	Specialty	1,020
Commercial	All	3,612

Lighting Waste Heat Factor

The IL-TRM V7.0 provides different waste heat factor values for energy and demand savings and depending on installation location. Table 85 outlines waste heat factor assumptions by savings type and installation location.

Table 85. Illinois Statewide TRM Version 7.0 Lighting WHF Assumptions

Install Location	Bulb Type	Waste Heat Factor (Energy)	Waste Heat Factor (Demand)
Residential	Standard	1.051	1.093
	Specialty	1.046	1.083
Commercial	All	1.09	1.36

Lighting Coincidence Factor

The IL-TRM V7.0 provides peak coincidence factors (CFs) based on installation location and bulb type. Table 86 provides the applied CF assumptions.

Table 86. Illinois Statewide TRM Version 7.0 Lighting CF Assumptions

Install Location	Bulb Type	Coincidence Factor
Residential	Standard	0.135
	Specialty	0.117
Commercial	All	0.580

Advanced Power Strip Savings Assumptions

The evaluation team calculated verified gross electric and demand savings for 2019 Retail Products Initiative advanced power strips using the initiative tracking database and applying the following algorithms and savings assumptions based on the IL-TRM V7.0.

Equation 3. Advanced Power Strip Energy and Demand Savings Equations

$$\Delta kWh = Qty \times kWh_{per} \times ISR$$

$$\Delta kW = \Delta kWh/HOU \times CF$$

Where:

Qty =Quantity of advanced power strips from initiative tracking data
kWh_per =Per-unit deemed energy savings=56.5 (5-plug); 103.0 (7-plug)
ISR =In-service rate = 100%
HOU =Hours of use = 7,129
CF =Coincidence factor = 0.80

Advanced Thermostat Savings Assumptions

The evaluation team calculated verified gross electric and demand savings for 2019 Retail Products Initiative advanced thermostats using the initiative tracking database and applying algorithms and savings assumptions based on the IL-TRM V7.0.

The evaluation team used the following equations from the IL-TRM V7.0 to estimate electric energy, electric demand, and gas savings for advanced thermostats:

Equation 4. Advanced Thermostat Energy and Demand Savings Equation

$$kWh = kWh_{Cool} + kWh_{Heat}$$

$$\Delta kWh_{Heat} = Qty \times \%Elec_{Heat} \times ElecUse_{Heat} \times Reduct_{Heat} \times HF \times ISR + (Qty \times \Delta Therms \times Furnace_e \times 29.3)$$

$$\Delta kWh_{Cool} = Qty \times \text{Ctrl}_{Cool} \times \left((FLH_{Cool} \times Capacity_{Cool} \times 1/SEER)/1000\right) \times Reduct_{Cool} \times ISR$$

$$\Delta kW = Qty \times \%AC \times (1 \div EER)/1000 \times Capacity_{Cool} \times Reduct_{Cool} \times CF \times ISR$$

$$\Delta Therms = Qty \times Gas_{Heat} \times GasUse_{Heat} \times HF \times Reduct_{Heat} \times ISR$$

Where:

Qty =Quantity of homes with advanced thermostats from tracking data
%Elec_heat =Portion of heating assumed to be electric = 100% if electric space heating fuel, 0% if gas space heating fuel, 3% if unknown
ElecUse_heat =Estimated annual household heating consumption for electrically heated homes applied by heating type and climate zone (see Table 87)

Table 87. Electric Heating Consumption by Climate Zone

Climate Zone	Electric Resistance (kWh)	Heat Pump (kWh)
1 (Rockford)	21,748	12,793
2 (Chicago)	20,778	12,222
3 (Springfield)	17,794	10,467
4 (Belleville)	13,726	8,074
5 (Marion)	13,970	8,218
Average	21,749	11,617

Reduct_heat =Reduction in heating energy consumption = 7.0% if unknown previous thermostat
HF =Household factor to adjust heating consumption for multifamily = 96.5% if unknown
ISR =Percentage of thermostats installed and effectively programmed = 100%
Ctrl_cool =Portion of cooling controlled by thermostat = 100% if central cooling or heat pump, 82.5% if unknown

FLH_cool =Full load cooling hours applied by home type and climate zone (assume 90% SF and 10% MF if home type unknown; see Table 88)

Table 88. Full Load Cooling Hours by Climate Zone

Climate Zone	FLH (Single-Family)	FLH (Multifamily)	FLH (Blended)
1 (Rockford)	512	467	507.5
2 (Chicago)	570	506	563.8
3 (Springfield)	730	663	723.3
4 (Belleville)	1,035	940	1025.5
5 (Marion)	903	820	894.7
Weighted Average	629	564	N/A

Capacity_cool =Cooling capacity of air conditioner by home type = 31,864 BTU/hour if home type unknown
SEER =Cooling equipment seasonal energy efficiency ratio = 9.3 if unknown
Reduct_cool =Reduction in cooling energy consumption due to installing an advanced thermostat = 8.0%
EER =Cooling efficiency of central air conditioner or heat pump = 7.5 if unknown
CF =Summer system peak coincidence factor = 0.34
%GasHeat =100% if gas space heating fuel, 0% if electric space heating fuel, 97% if unknown
GasUse_heat =Estimated annual household heating consumption for gas-heated homes applied by climate zone (see Table 89)

Table 89. Gas Heating Consumption by Climate Zone

Climate Zone	Therms
1 (Rockford)	1,052
2 (Chicago)	1,005
3 (Springfield)	861
4 (Belleville)	664
5 (Marion)	676
Average	955

Furnace_e =Furnace fan energy consumption as a percentage of annual fuel consumption = 3.14%

Advanced thermostat tracking data included detailed information on heating fuel and heating and cooling systems for most participants. Climate zones were assigned based on customer zip code from the initiative tracking data. Per the IL-TRM V7.0, additional savings cannot be claimed for a second advanced thermostat installed in a single location.

Variable-Speed Pool Pump Savings Assumptions

The evaluation team calculated verified gross electric and demand savings for 2019 Retail Products Initiative variable-speed pool pumps using the initiative tracking database and applying algorithms and savings assumptions based on the IL-TRM V7.0.

The evaluation team used the following equations from the IL-TRM V7.0 to estimate electric energy and electric demand savings for variable-speed pool pumps:

Equation 5. Variable Speed Pool Pump Energy and Demand Savings Equations

$$\Delta kWh = \text{Qty} \times \frac{\left[\left(\frac{(HOU_{base} \times GPM_{base} \times 60)}{EF_{base}}\right) - \left(\frac{HOU_{vsH} \times GPM_{vsH} \times 60}{EF_{vsH}}\right) + \left(\frac{HOU_{vsL} \times GPM_{vsL} \times 60}{EF_{vsL}}\right)\right]}{1000 \times Days}$$

$$\Delta kW = \left[\left(\frac{kWh\_day_{base}}{Days}\right)/HOU_{base}) - \left(\frac{kWh\_day_{vsH} + kWh\_day_{vsL}}{Days}\right)/(HOU_{vsH} + HOU_{vsL})\right] \times CF$$

Where:

Qty	=Quantity of variable-speed pool pumps from tracking data
HOU	=Daily runtime/daily hours of use = 11.4 for single-speed in-ground, 2 for variable-speed in-ground at high speed, 16 for variable-speed in-ground at low speed
GPM	=Gallons per minute = 64.4 for single-speed in-ground; 50 for variable-speed in-ground at high speed; 30.6 for variable-speed in-ground at low speed
EF	=Energy factor = 2.1 for single-speed, 3.8 for variable-speed at high speed, 7.3 for variable-speed at low speed
Days	=Days per year that swimming pool is operational = 125
CF	=Coincidence factor = 0.831
kWh_day	=daily energy consumption
base	=Single-speed pump
vsH	=Variable-speed pump at high speed
vsL	=Variable-speed pump at low speed

Clothes Washer Savings Assumptions

Equation 6. Clothes Washer Energy and Demand Savings Equations

$$\Delta kWh = \left[Capacity \times \frac{1}{IMEF_{base}} \times Ncycles \times \left(\%CW_{base} + (\%DHW_{base} \times \%Elec_{DHW})\right) + \left(\%Dryer_{base} \times \%Elec_{Dryer}\right)\right] - \left[Capacity \times \frac{1}{IMEF_{ee}} \times Ncycles \times \left(\%CW_{ee} + (\%DHW_{ee} \times \%Elec_{DHW})\right) + \left(\%Dryer_{ee} \times \%Elec_{Dryer}\right)\right]$$

$$\Delta kW = \Delta kWh/Hours \times CF$$

$$\Delta Therms = \left[\left(Capacity \times \frac{1}{IMEF_{base}} \times Ncycles \times \left((\%DHW_{base} \times \%Gas_{DHW} \times R\_eff) + \left(\%Dryer_{base} \times \%Gas_{Dryer}\right)\right)\right) - \left(Capacity \times \frac{1}{IMEF_{ee}} \times Ncycles \times \left((\%DHW_{ee} \times \%Gas_{DHW} \times R_{eff}) + \left(\%Dryer_{ee} \times \%Gas_{Dryer}\right)\right)\right) \times kWh\_therm\right]$$

Where:

Qty	=Quantity of variable-speed pool pumps from tracking data
Capacity	=Clothes washer capacity from tracking data (cubic feet)
IMEF	=Integrated Modified Energy Factor = 1.75 for baseline, 2.23 for ENERGY STAR
Ncycles	=Number of annual cycles = 264
%CW	=% of energy consumption from clothes washer = 8.1% for baseline, 5.8% for ENERGY STAR

%DHW =% of energy consumption from water heating = 26.5% for baseline, 31.2% for ENERGY STAR
%Dryer =% of energy consumption from dryer = 65.4% for baseline, 63.0% for ENERGY STAR
%Elec_DHW =% of water heaters with electric heaters = 32% for unknown
%Elec_Dryer =% of dryers with electric heaters = 100% for electric dryers, 62% for unknown
Hours =Annual hours = 264
CF =Summer CF = 0.038
R_eff =Recovery efficiency factor = 1.26
%Gas_DHW =62%
%Gas_dryer =0%
kWh_therm =kWh to therms conversion factor = 0.03412

Electric Clothes Dryer Savings Assumptions

Equation 7. Electric Clothes Dryer Energy and Demand Savings Equations

$$\Delta kWh = \left(\frac{Load}{CEF_{base}} - \frac{Load}{CEF_{ee}}\right) \times Ncycles \times \%Elec$$

$$\Delta kW = \Delta kWh/HOU \times CF$$

Where:
Qty =Quantity of variable-speed pool pumps from tracking data
Load =Drum capacity (standard=8.45, compact=3)
CEF =Combined Energy Factor = 3.11 lbs/kWh for baseline standard vented electric, 3.93 lbs/kWh for ENERGY STAR standard vented electric
Ncycles =283 if actual is unknown
%Elec =Portion of usage assumed to be electric = 100%
HOU =Annual hours = 283
CF =Summer peak coincidence factor = 3.8%

Refrigerator Savings Assumptions

$$\Delta kWh = Qty \times UEC_{base} - UEC_{ee}$$

$$\Delta kW = (\Delta kWh/Hours) \times TAF \times LSAF$$

Where:
Qty =Quantity of variable-speed pool pumps from tracking data
AV =Adjusted volume = (Refrigerator volume*(14.75/21.51))+(Freezer volume*(6.76/21.51)*1.63)
UEC_base =Federal baseline unit energy consumption (see Table 90)
UEC_ee =ENERGY STAR unit energy consumption (see Table 90)

Table 90. Refrigerator Energy Usage Specifications

Product Category	Assumptions after September 2014	
	Federal Baseline UEC in kWh/year	ENERGY STAR UEC in kWh/year
Refrigerators and Refrigerator-freezers with manual defrost	6.79AV + 193.6	6.11 * AV + 174.2
Refrigerator-Freezer--partial automatic defrost	7.99AV + 225.0	7.19 * AV + 202.5

Product Category	Assumptions after September 2014	
	Federal Baseline UEC in kWh/year	ENERGY STAR UEC in kWh/year
Refrigerator-Freezers--automatic defrost with top-mounted freezer without through-the-door ice service and all-refrigerators--automatic defrost	8.07AV + 233.7	7.26 * AV + 210.3
Refrigerator-Freezers--automatic defrost with side-mounted freezer without through-the-door ice service	8.51AV + 297.8	7.66 * AV + 268.0
Refrigerator-Freezers--automatic defrost with bottom-mounted freezer without through-the-door ice service	8.85AV + 317.0	7.97 * AV + 285.3
Refrigerator-freezer—automatic defrost with bottom-mounted freezer with through-the-door ice service	9.25AV + 475.4	8.33 * AV + 436.3
Refrigerator-Freezers--automatic defrost with top-mounted freezer with through-the-door ice service	8.40AV + 385.4	7.56 * AV + 355.3
Refrigerator-Freezers--automatic defrost with side-mounted freezer with through-the-door ice service	8.54AV + 432.8	7.69 * AV + 397.9

TAF =Temperature adjustment factor = 1.25
LSAF =Load Shape adjustment factor = 1.057
Hours =Annual hours of use = 8,766

Freezer Savings Assumptions

$$\Delta kWh = Qty \times UEC_{base} - EUC_{ee}$$

$$\Delta kW = (\Delta kWh/Hours) \times CF$$

Where:

Qty =Quantity of variable-speed pool pumps from tracking data
AV =Adjusted volume = 1.73 * actual volume (cubic ft)
UES_base =Federal Baseline unit energy consumption = 8.62*AV+228.3 for upright freezers with automatic defrost
UEC_ee =ENERGY STAR unit energy consumption = 7.76*AV+205.5 for upright freezers with automatic defrost
Hours =Full load hours per year = 5,890
CF =Summer peak coincidence factor

Measure Lives and Cumulative Persisting Annual Savings

The evaluation team assigned the following effective useful life assumptions recommended by the Illinois TRM Version 7.0 to calculate CPAS savings.

Table 91. IL-TRM V7.0-Recommended Effective Useful Life

Measure	EUL (Years)
LED lighting (residential application)	10
LED lighting (commercial application)	4.2[a]
Advanced power strips	7
Advanced thermostats	11
Variable-speed pool pumps	7
Clothes washer	14
Electric clothes dryer	16
Refrigerator	17
Freezer	22

[a] Calculated in accordance with commercial TRM guidelines; assumes 15,000 hour useful life of product and unknown commercial HOU of 3,612.

Net Impact Methodology

The evaluation team applied SAG-approved 2019 NTGRs to verified gross savings to calculate verified net savings. Table 92 outlines the SAG-approved NTGR values applied to verified gross savings to calculate verified net savings.

Table 92. SAG-Approved Retail Products NTGRs

Measure	Electric NTGR	Gas NTGR
LED lighting	0.700	N/A
Advanced thermostats	N/A	N/A
Advanced power strips (discount channel)	1.000	N/A
Advanced power strips (online marketplace)	0.860	N/A
Variable-speed pool pumps	0.800	N/A
Clothes washer	0.630	0.630
Electric clothes dryer	0.670	N/A
Refrigerator	0.650	N/A
Freezer	0.630	N/A

Income Qualified

Gross Impact Methodology

The evaluation team calculated verified savings for the Income Qualified Initiative by applying savings algorithms from the IL-TRM V7.0. The team leveraged initiative tracking data such as primary heating and cooling type, the delivery mechanism (e.g., direct install, leave behind), LED wattage, LED lamp type, project location (e.g., for weather-dependent variables), installed measure location (e.g., for faucet aerators), air

sealing and attic insulation parameters (e.g., R values) to inform savings assumptions. For variables outside these parameters, the evaluation team typically relied on defaults from the IL-TRM V7.0, except in the following circumstances:

- One notable exception is the in-service rate applied for hot water temperature cards. The IL-TRM V7.0 instructs evaluators to use in-service rates determined through evaluation. The evaluation team applied a 10% in-service rate previously determined as part of the PY9 IPA Rural Kits evaluation.[23]
- The IL-TRM V7.0 does not provide guidance on mobile homes. The evaluation team used a memo provided to AIC on June 8, 2018, regarding mobile home savings calculations. We used this memo when determining verified savings for mobile home applications.[24]

Table 93 lists the measures in the Income Qualified Initiative, their corresponding IL-TRM entry, and whether or not errata applied to the measure in the 2019 evaluation.

Table 93. Income Qualified Initiative Measures Evaluated

Measure	TRM Entry	Errata Applied?
LED Bulbs and Fixtures	4.5.4	No; errata exist for this measure in general but are not relevant to the measure as implemented through the IQ Initiative
Advanced Power Strip – Tier 1	5.2.1	No errata present for this measure
Air Source Heat Pump	5.3.1	No errata present for this measure
Ductless Heat Pumps	5.3.12	Yes
Advanced Thermostats	5.3.16	No errata present for this measure
Central Air Conditioning	5.3.3	No errata present for this measure
Duct Insulation and Sealing	5.3.4	No errata present for this measure
Furnace Blower Motor	5.3.5	No errata present for this measure
Gas High Efficiency Boiler	5.3.6	No errata present for this measure
Gas High Efficiency Furnace	5.3.7	No errata present for this measure
High Efficiency Bathroom Exhaust Fan	5.3.9	No errata present for this measure
Domestic Hot Water Pipe Insulation	5.4.1	No errata present for this measure
Low Flow Faucet Aerators	5.4.4	No; errata exists for these measures but is not relevant to AIC, which implements no programs in Cook County
Low Flow Showerheads	5.4.5	
Water Heater Temperature Setback	5.4.6	No errata present for this measure
Thermostatic Restrictor Shower Valve	5.4.8	No; errata exists for these measures but is not relevant to AIC, which implements no programs in Cook County
Shower Timer	5.4.9	
LED Nightlights	5.5.11	No errata present for this measure
LED Screw Based Omnidirectional Bulbs	5.5.8	No errata present for this measure
Air Sealing	5.6.1	No errata present for this measure
Floor Insulation Above Crawlspace	5.6.3	No errata present for this measure
Wall Insulation	5.6.4	No errata present for this measure
Ceiling/Attic Insulation	5.6.5	No errata present for this measure
Rim/Band Joist Insulation	5.6.6	No errata present for this measure

[23] Accessed at: https://s3.amazonaws.com/ilsag/AIC-IPA_PY9_Rural_Kits_Report_FINAL_2017-10-13.pdf
[24] Memo from Opinion Dynamics to AIC. "Mobile Home Savings Calculations Using the IL-TRM". June 8, 2018.

Measure Lives and Cumulative Persisting Annual Savings

The evaluation team applied measure lives and baseline shifts from the IL-TRM V7.0 to calculate CPAS.

Net Impact Methodology

The SAG-approved NTGRs for the Income Qualified Initiative are 1.00 for all measures. Therefore, gross savings are equivalent to net savings.

Public Housing

Gross Impact Methodology

The evaluation team calculated verified savings for the Public Housing Initiative by applying savings algorithms from the IL-TRM V7.0. The team leveraged initiative tracking data such as primary heating and cooling type, the delivery mechanism (e.g., direct install, leave behind), LED wattage, LED lamp type, project location (e.g., for weather-dependent variables), installed measure location (e.g., for faucet aerators), air sealing and attic insulation parameters (e.g., R values) to inform savings assumptions. For variables outside these parameters, the evaluation team relied on defaults from the IL-TRM V7.0. Table 94 lists the measures in the Public Housing Initiative, their corresponding IL-TRM entry, and whether or not errata applied to the measure in the 2019 evaluation.

Table 94. Public Housing Initiative Measures Evaluated

Measure	TRM Entry	Errata Applied?
Specialty LED - Common Area	4.5.4	Errata exist for this measure in general but are not relevant to the measure as implemented through the Multifamily Initiative
Standard LED - Common Area		
Reflector LED - Common Area		
Standard LED - Exterior		
Advanced Power Strip - Tier 1	5.2.1	No errata present for this measure
Advanced Thermostat	5.3.16	No errata present for this measure
Standard LED - In Unit	5.5.8	No errata present for this measure
Specialty LED - In Unit	5.5.6	No errata present for this measure
Reflector LED - In Unit		
Bathroom Faucet Aerator	5.4.4	Errata exist for these measures but are not relevant to AIC, which implements no programs in Cook County
Kitchen Faucet Aerator		
Showerhead	5.4.5	
Air Sealing	5.6.1	No errata present for this measure
Attic Insulation	5.6.5	No errata present for this measure

Measure Lives and Cumulative Persisting Annual Savings

The evaluation team applied measure lives from the IL-TRM V7.0 to calculate CPAS.

Net Impact Methodology

The SAG-approved NTGRs for the Public Housing Initiative are 1.00 for all measures. Therefore, gross savings are equivalent to net savings.

Behavior Modification

Equivalency Analysis Results

The evaluation team performed an equivalency analysis to ensure that the treatment and control groups were equivalent in terms of energy consumption Legacy Cohort 4 and Tendril Wave 1, and the results are presented in Table 95. We compared average daily consumption (ADC) of electricity and gas between treatment and control groups during their pre-participation period to assess whether these groups were equivalent after accounting for attrition. Based on our analysis, we found that the two groups were equivalent. In the year prior to receiving reports for the Initiative (January to December 2019), ADC for the Legacy Cohort 4 was 50 kWh/day and two therms/day for households in both the control group and treatment group. Similarly, from January to December 2019, the ADC for Tendril Wave 1 was 37 kWh/day and two therms/day for households in both the control group and treatment group.

Table 95. Pre-Participation Average Daily Consumption, kWh and Therms

Wave	Fuel Type	Treatment (Pre-Participation) Consumption	Control (Pre-Participation) Consumption
Legacy Cohort 4	kWh	50.41	50.47
	Therms	2.16	2.2
Tendril Wave 1	kWh	36.85	37.07
	Therms	2.03	2.02

Figure 3 and Figure 4 present the pre-participation period electric and gas consumption respectively for both treatment and control groups and exhibits equivalency for Legacy Cohort 4. Figure 5 and Figure 6 present the pre-period ADC for electric and gas consumption for Tendril Wave 1 for both treatment and control groups, which also demonstrate equivalency.

Figure 3. Legacy Cohort 4 Pre-Participation Period Electric Consumption, Treatment vs. Control

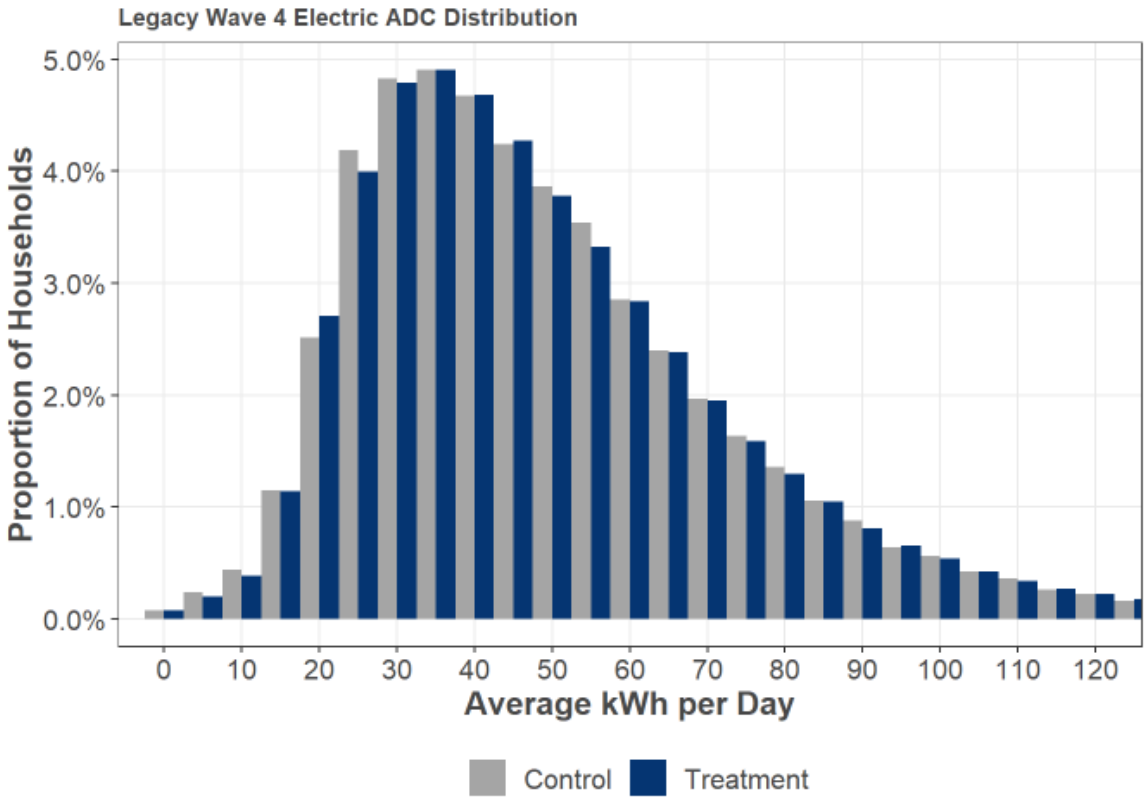


Figure 4. Legacy Cohort 4 Pre-Participation Period Gas Consumption, Treatment vs. Control

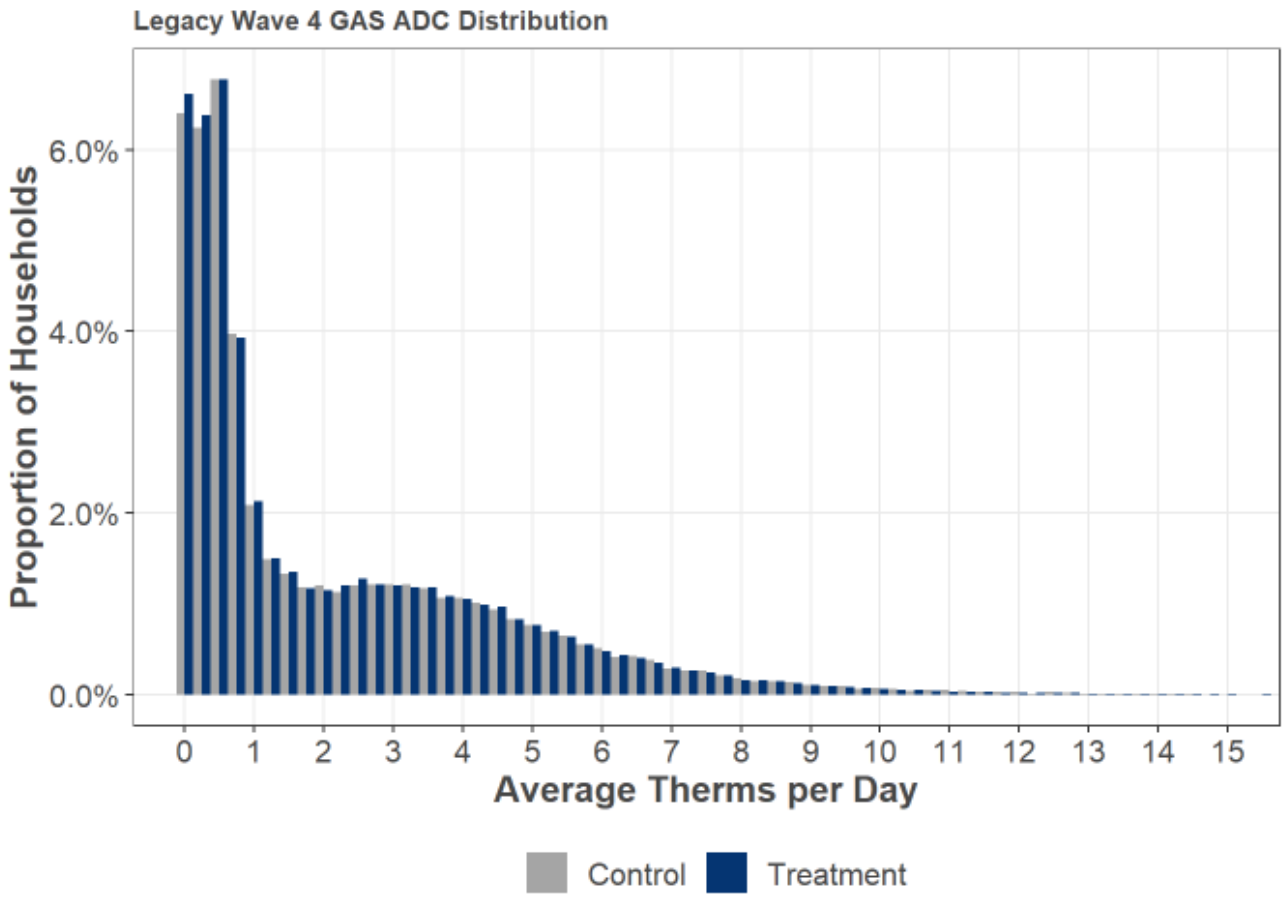


Figure 5. Tendril Wave 1 Pre-Participation Period Electric Consumption, Treatment vs. Control

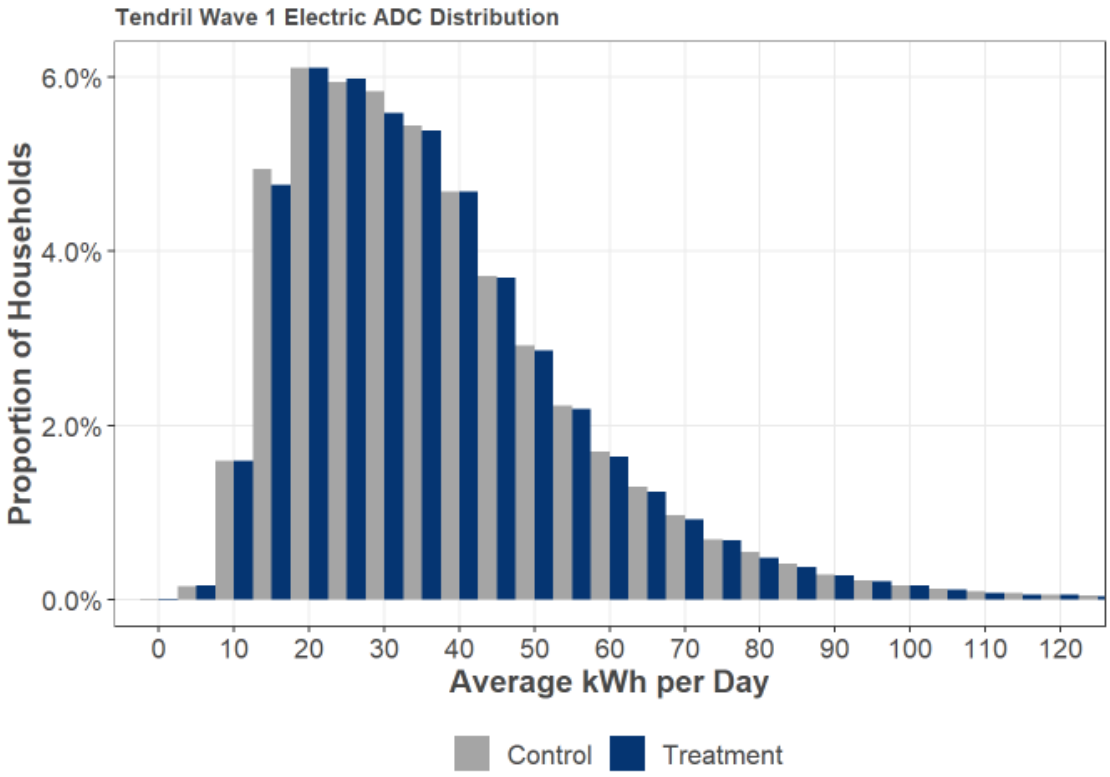
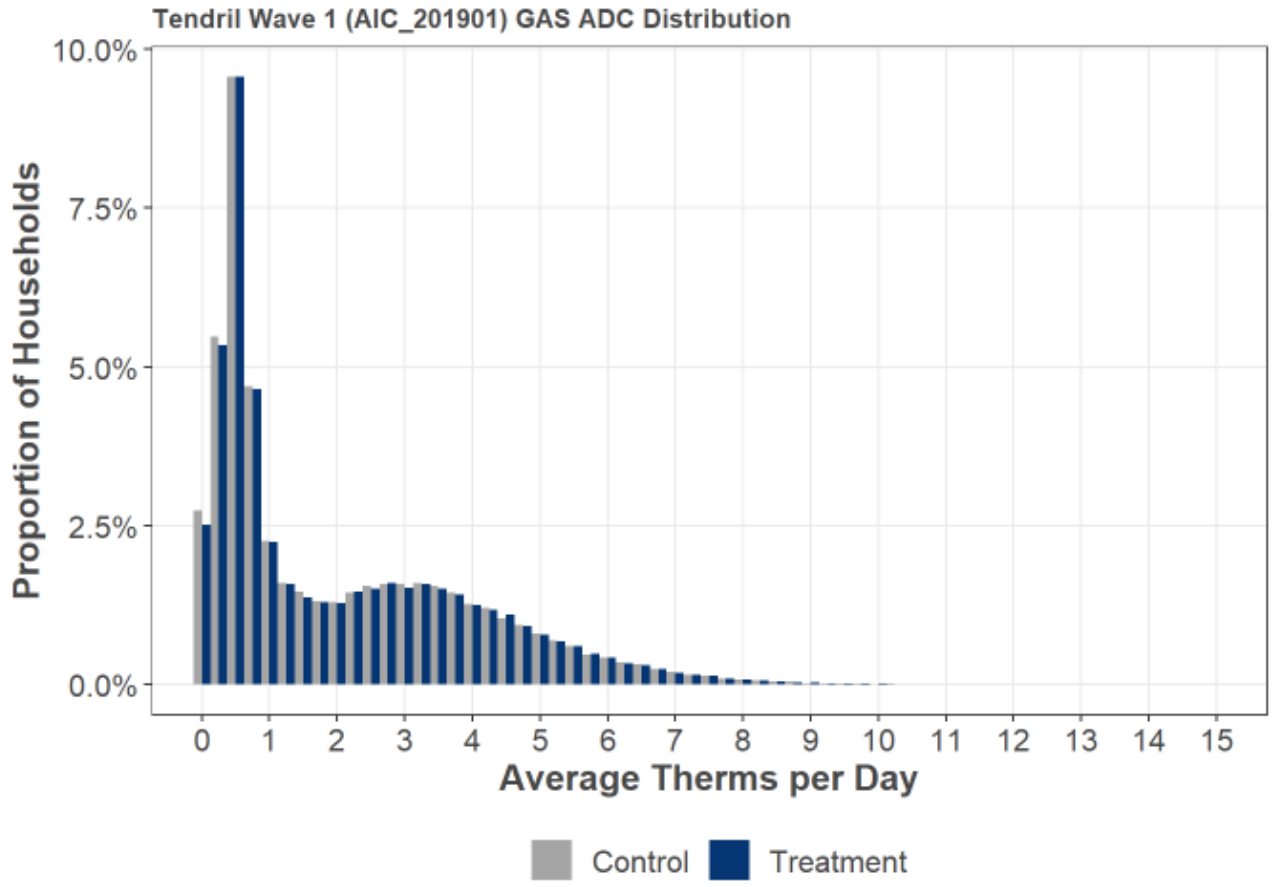


Figure 6. Tendril Wave 1 Pre-Participation Period Gas Consumption, Treatment vs. Control



Data Cleaning Results

This section shows the results of the data cleaning effort for the billing analysis (see Table 96). Results include all customers who were ever assigned to a treatment or control group with available billing data. The primary driver leading to the removal of customers for the analysis is customers that have insufficient post-period billing data. This group of customers was 10% of the initial population.

Table 96. Data Cleaning Results for Treatment and Control Groups, Gas and Electric

Wave	Fuel Type	Metric[a]	Unique Customers		Observations[b]	
			Treatment	Control	Treatment	Control
Legacy Cohort 4	Electric	Initial #	17,957	5,957	399,171	132,948
		Final #	15,868	5,304	375,378	125,600
		% Remaining	88.37%	89.04%	94.04%	94.47%
	Gas	Initial #	17,855	5,929	396,286	131,862
		Final #	15,760	5,270	372,648	124,720
		% Remaining	88.27%	88.89%	94.04%	94.58%

Wave	Fuel Type	Metric[a]	Unique Customers		Observations[b]	
			Treatment	Control	Treatment	Control
Tendril Wave 1	Electric	Initial #	32,933	14,330	712,534	309,922
		Final #	28,597	12,398	640,637	277,816
		% Remaining	86.83%	86.52%	89.91%	89.64%
	Gas	Initial #	32,933	14,330	711,715	309,194
		Final #	28,647	12,442	641,487	278,673
		% Remaining	86.99%	86.82%	90.13%	90.13%

[a] The initial number of customers the evaluation team began with includes customers that moved out or opted out before the experiment start date.

[b] Note that the number of observations (i.e., bills) the evaluation team began with includes those from the pre-period and 2018 post-period.

Modeling Initiative Impacts

Energy Savings

The impact analysis relied on a statistical analysis of monthly electric and gas billing data for all AIC customers who received a HER (the treatment group) and a randomly selected group of customers who did not receive a HER (the control group). The evaluation team used an intent to treat (ITT) approach in 2019.

As part of the impact analysis, we selected three different types of models:

- A lagged dependent variable (LDV) model (Equation 8) that incorporates the post-participation period only.
- A weather adjusted model (Equation 9), which allows direct year-to-year savings comparison.
- A simple base model (Equation 10), which is run as a base case specification to help calibrate the magnitude of results.

We provide impact estimates for the Initiative using the first model. Our model specifications are as follows:

Model 1: Lagged Dependent Variable (LDV) Model

The evaluation team used an LDV model to estimate the electric and gas savings experienced by the Initiative's treatment group for 2019. This model differs from Model 2 and Model 3, which are linear fixed effects regression (LFER) models in that only usage from the post-participation period is used in estimating the model. Information from the pre-participation period is used only to calculate pre-usage variables that are incorporated into the LDV model. Following last year's evaluation, we used three levels of pre-participation period usage for each customer: overall pre-participation period average daily consumption (ADC), summer pre-participation period ADC, and winter pre-participation period ADC. The LDV model uses the control group in the same way as the LFER model, in that the treatment effect is corrected for control group ADC so that the coefficient of the treatment variable is the average ITT effect. We employed the following estimating equation:

Equation 8. Post-Participation Period Only Model Estimating Equation

$$ADC_{it} = \alpha_i + \beta_1 Treatment_i + \beta_2 PreUsage_i + \beta_3 PreWinter_i + \beta_4 PreSummer_i + \beta_5 MonthYear_t + \beta_6 PreUsage_i \cdot MonthYear_t + \beta_7 PreWinter_i \cdot MonthYear_t + \beta_8 PreSummer_i \cdot MonthYear_t + \varepsilon_{it}$$

Where:

ADC_{it} = Average daily consumption (kWh or therms) for household *i* at time *t*

α_i = Household-specific intercept

β_1 = Coefficient for the change in consumption for the treatment group

β_2 = Coefficient for the average daily usage across household *i* available pretreatment meter reads

β_3 = Coefficient for the average daily usage over the months of December through March across household *i* available pretreatment meter reads

β_4 = Coefficient for the average daily usage over the months of June through September across household *i* available pretreatment meter reads

β_5 = Vector of coefficients for month-year dummies

β_6 = Vector of coefficients for month-year dummies by average daily pretreatment usage

β_7 = Vector of coefficients for month-year dummies by average daily winter pretreatment usage

β_8 = Vector of coefficients for month-year dummies by average daily summer pretreatment usage

$Treatment_i$ = Variable to represent treatment and control groups (0 = control group, 1 = treatment group)

$PreUsage_i$ = Average daily usage for household *i* over the entire pre-participation period

$PreWinter_i$ = Average daily usage for household *i* over the pre-participation months of December through March

$PreSummer_i$ = Average daily usage for household *i* over the pre-participation months of June through September

$MonthYear_t$ = Vector of month-year dummies

ε_{it} = Error

Model 2: Weather-Adjusted Model

This model incorporates weather terms within a simple LFER model. This improves the precision in the modeled results by accounting for possible differences in weather experienced by the study population. We controlled for the weather by accounting for HDD and CDD, using a base of 65°F for HDD and 75°F for CDD. This model also helps account for differences between treatment and control group usages that correlate with the weather.

Equation 9. Weather-Adjusted Model Estimating Equation

$$ADC_{it} = \alpha_i + \beta_1 Post_t + \beta_2 Treatment_i \cdot Post_t + \beta_3 HDD_{it} + \beta_4 CDD_{it} + \varepsilon_{it}$$

Where:

$ADC_{it}, \alpha_i, Treatment_i$ and ε_{it} are defined as above in Model 1

β_1 = Coefficient for the change in consumption between pre- and post-participation periods

β_2 = Coefficient for the change in consumption for the treatment group in the post-participation period compared to the pre-participation period and to the control group; this is the basis for the net savings estimate

β_3 = Coefficient for HDD

β_4 = Coefficient for CDD

$Post_t$ = Variable to represent the pre- and post-participation periods (0 = pre-participation period, 1 = post participation period[25])

HDD_{it} = Sum of HDD (base 65°F)

CDD_{it} = Sum of CDD (base 75°F)

Model 3: Base Model

The base model is a simple fixed-effects linear regression, as shown in Equation 10.

Equation 10. Base Model Estimating Equation

$$ADC_{it} = \alpha_i + \beta_1 Post_t + \beta_2 Treatment_i \cdot Post_t + \varepsilon_{it}$$

Where:

$ADC_{it}, \alpha_i, Treatment_i$ and ε_{it} are defined as above in Model 1

β_1, β_2 *and* $Post_t$ is defined as above in Model 2

Results Using Alternative Model Specifications

Three model specifications were used to estimate the electric and gas savings from the 2019 Behavioral Modification Initiative. The evaluation team presents the unadjusted per household savings for each of the models below. Based on model diagnostics,[26] the evaluation team considered the LDV model results to best represent the savings from the Initiative. The LDV results in Table 97 replicate those presented in the body of the report in Table 38.

As reported above, the only model that was statistically significant was the LDV model for Tendril Wave 1 Electric. No other fuel, model, or wave combination produced models with statistically significant treatment effect coefficients.

[25] We defined the pre-period as the 12 months before the customer's first report. The month in which a customer receives his or her first report is neither pre-period nor post-period. The post period is the time period after the experiment start date (May 2018).
[26] Model diagnostics included comparing the R^2, adjusted R^2, and standard errors across the three models for each fuel type.

Table 97. 2019 Unadjusted Per-Household Net Savings – LDV Model

Wave	Fuel Type	Model	Unadjusted Net Savings (% per household)	Unadjusted Net Savings (per household)
Tendril Wave 1	kWh	LDV	0.25%	32.22
		Weather Adjusted	Not statistically significant	
		Base	Not statistically significant	
	Therms	LDV	Not statistically significant	
		Weather Adjusted	Not statistically significant	
		Base	Not statistically significant	
Legacy Cohort 4	kWh	LDV	Not statistically significant	
		Weather Adjusted	Not statistically significant	
		Base	Not statistically significant	
	Therms	LDV	Not statistically significant	
		Weather Adjusted	Not statistically significant	
		Base	Not statistically significant	

The confidence intervals for all models are shown in Table 98 below. The only model in which the estimate did not include zero within a 90% confidence interval was the LDV model for Tendril Wave 1 Electric.

Table 98. Model Confidence Intervals

Model	Wave	Units	Baseline	Savings	Robust SE Savings	90% Lower Confidence Interval	90% Higher Confidence Interval
LDV	Tendril Wave 1	kWh	35.17	-0.09	0.03	0.00	-0.12
	Tendril Wave 1	therm	2.02	0.00	0.00	0.00	0.00
	Legacy Wave 4	kWh	47.77	-0.03	0.06	0.00	-0.08
	Legacy Wave 4	therm	2.12	0.00	0.00	0.00	0.00
Weather Adjusted FELM	Tendril Wave 1	kWh	34.97	-0.05	0.06	0.00	-0.14
	Tendril Wave 1	therm	1.86	0.00	0.00	0.00	-0.01
	Legacy Wave 4	kWh	47.86	-0.06	0.12	0.00	-0.25
	Legacy Wave 4	therm	2.14	0.01	0.01	0.00	-0.01
Base Model FELM	Tendril Wave 1	kWh	34.98	-0.06	0.07	0.00	-0.17
	Tendril Wave 1	therm	1.86	0.00	0.01	0.00	-0.02
	Legacy Wave 4	kWh	47.85	-0.05	0.13	0.00	-0.26
	Legacy Wave 4	therm	2.14	0.01	0.02	0.00	-0.02

Because the model results for Tendril Wave 1 Gas and Legacy Wave 4 Electric and Gas were not statistically significant, we are unable to reject the null hypothesis that savings were zero and are reporting zero savings for those programs.

Billing Analysis Model Coefficients

Below we provide the billing analysis model coefficients for both electric and gas results for the model specifications. For the LDV model, the coefficient describing the treatment effects is “treat.” For the Weather-Adjusted and Base models, the coefficient describing the treatment effects is “Post x Treatment.” (The

coefficients describing the treatment effect are shown in bold in the tables below.) For the treatment effect to be meaningful, the coefficient of interest must be significant at the 90% confidence level (e.g., $P \leq 0.1$).

Table 99. LDV Model Billing Analysis Model Coefficients – Electric

Variable	Coefficient	Standard Error	P-Value
Tendril Wave 1			
treat	**-0.09**	**0.03**	**0.00**
pre_adc	0.99	0.03	0.00
pre_adc_summ	-0.32	0.01	0.00
pre_adc_win	0.27	0.01	0.00
Legacy Wave 4			
treat	**-0.03**	**0.06**	**0.66**
pre_adc	0.92	0.06	0.00
pre_adc_summ	-0.34	0.03	0.00
pre_adc_win	0.33	0.02	0.00

Table 100. LDV Model Billing Analysis Model Coefficients – Gas

Variable	Coefficient	Standard Error	P-Value
Tendril Wave 1			
treat	**0.00**	**0.00**	**0.39**
pre_adc	1.00	0.03	0.00
pre_adc_summ	-0.44	0.02	0.00
pre_adc_win	0.33	0.01	0.00
Legacy Wave 4			
treat	**0.00**	**0.00**	**0.99**
pre_adc	1.04	0.05	0.00
pre_adc_summ	-0.44	0.03	0.00
pre_adc_win	0.32	0.02	0.00

Table 101. Weather-Adjusted Model Billing Analysis Model Coefficients – Electric

Variable	Coefficient	Standard Error	P-Value
Tendril Wave 1			
Post	-0.01	0.05	0.75
HDD	0.25	0.00	0.00
CDD	0.01	0.00	0.00
Post x Treatment	**-0.05**	**0.06**	**0.34**
Legacy Wave 4			
Post	-0.28	0.10	0.01
HDD	0.30	0.00	0.00
CDD	0.02	0.00	0.00
Post x Treatment	**-0.06**	**0.12**	**0.63**

Table 102. Weather-Adjusted Model Billing Analysis Model Coefficients – Gas

Variable	Coefficient	Standard Error	P-Value
Tendril Wave 1			
Post	-0.01	0.00	0.00
HDD	0.01	0.00	0.00
CDD	0.00	0.00	0.00
Post x Treatment	**0.00**	**0.00**	**0.81**
Legacy Wave 4			
Post	0.03	0.01	0.00
HDD	0.01	0.00	0.00
CDD	0.00	0.00	0.00
Post x Treatment	**0.01**	**0.01**	**0.58**

Table 103. Original Model Billing Analysis Model Coefficients – Electric

Variable	Coefficient	Standard Error	P-Value
Tendril Wave 1			
Post	-2.01	0.06	0.00
Post x Treatment	**-0.06**	**0.07**	**0.39**
Legacy Wave 4			
Post	-2.88	0.11	0.00
Post x Treatment	**-0.05**	**0.13**	**0.72**

Table 104. Original Model Billing Analysis Model Coefficients – Gas

Variable	Coefficient	Standard Error	P-Value
Tendril Wave 1			
Post	-0.32	0.01	0.00
Post x Treatment	**0.00**	**0.01**	**0.88**
Legacy Wave 4			
Post	-0.07	0.01	0.00
Post x Treatment	**0.01**	**0.02**	**0.51**

Demand Reductions

We calculated demand impacts based on the IL-TRM V7.0,[27] which applies a peak adjustment factor to modeled energy savings results. The demand reductions leveraged 2019 electric savings and are adjusted to account for persistence from previous years.

[27] Volume 4, page 11.

Participation Uplift and Joint Savings Analysis

2019 Uplift

To determine whether the Behavioral Modification Initiative treatment generated participation uplift in 2019 (e.g., an increase in participation in other energy efficiency initiatives in 2019 as a result of the Behavioral Modification Initiative), we calculated whether more treatment than control group members participated in other AIC residential energy efficiency initiatives after receiving HERs compared to participation before receiving HERs. We cross-referenced the Behavioral Modification Initiative database—both treatment and control groups —with the databases of other residential energy efficiency initiatives in 2019. We include five residential initiatives in our analysis for 2019:

- Appliance Recycling
- HVAC
- Income Qualified
- Retail Products
- Smart Savers

The participation uplift analysis calculates the number of customers who participated in both the Behavioral Modification Initiative **and** other energy efficiency initiatives in 2019. To ensure the participation uplift is attributable solely to the Behavioral Modification Initiative, we calculate participation uplift using a post-only difference estimator and tested the result for statistical significance. To do so, we identify the total number of treatment and control group customers who participated in an AIC energy efficiency initiative in 2019. Any positive difference between the treatment and control population that is statistically significant is the net participation due to the Behavioral Modification Initiative.

Table 105 presents the result of our annual participation uplift analysis for initiatives that were active during 2019. We did not observe a statistically significant effect for participants in any 2019 AIC initiative. Note that we tested only Tendril Wave 1 Electric for annual uplift as statistically significant Behavioral Modification Initiative savings were not found for any other cohort.

Table 105. 2019 Participation Uplift Rate by Initiative

Initiative Name	Tendril Wave 1 Electric Uplift
Appliance Recycling	<0.01%
Income Qualified	<0.01%
HVAC	<0.01%
Retail Products	<0.01%
Smart Savers	<0.01%

Note: No reported uplift figures are statistically significant at 90% confidence.

Legacy Uplift

The Behavioral Modification Initiative consumption analysis captures savings within the model for each year of a given measure's estimated useful life. To ensure that AIC does not inappropriately attribute savings to the Behavioral Modification Initiative that are associated with other initiatives and to accurately reflect the evaluation paradigm in Illinois, we also net out the savings from equipment rebated through other energy

efficiency initiative in past years for each year of the estimated useful life of the measure. Because Tendril Wave 1 Electric is a new, heretofore untreated cohort, no legacy uplift exists.

Measure Lives and Cumulative Persisting Annual Savings

Continued implementation of HER programs in Illinois and across the country has demonstrated persistence of savings beyond the first year, leading Illinois to adopt a measure decay framework in IL-TRM V6.0, which was continued in V7.0. This framework assumes that savings persist over five years but decay in each year. The TRM prescribes the use of the persistence factors presented in Table 106 over the five-year life to estimate lifetime electric energy savings for the program.

Table 106. HER Electric Savings Persistence Factors

Year	Electric Persistence Factor
Year 1 (program year under evaluation)	100%
Year 2	80%
Year 3	54%
Year 4	31%
Year 5	15%

Source: IL-TRM V7.0, Measure 6.1.1.

In addition to applying persistence rate factors, lifetime savings need to account for customer attrition over time due to move-outs and account closures.[28] Based on the observations evaluating the Behavioral Modification Initiative, as well as other energy efficiency programs in Illinois and across the country, the evaluation team concludes that multiple factors can drive attrition:

- Macroeconomic factors – economic downturns or upturns can drive customer mobility in a given year resulting in account closures
- Sociodemographic characteristics – household income levels, homeownership status, and home type are among key characteristics likely to drive differences in the attrition rate within each customer segment
- Length of customer participation in the initiative – attrition is generally higher in the first year upon program launch and decreases over time

To best balance these competing priorities in the prospective retention rate estimate, the evaluation team chose to develop a prospective retention rate for the initiative by developing a weighted average rate across the cohorts in the initiative from PY5 through the Transition Period. Using customers across these cohorts allowed us to capture the various customer segments (e.g., high users, low users, etc.) that can have differing attrition due to move out or other reasons in the estimate. Using a five-year period allowed for a balance between capturing the general decrease in attrition over time, which is important to consider for existing participants, and possible economic changes affecting customer transiency, which is important from a forward-looking perspective.

[28] It is possible that some savings resulting from HER program interventions persist after customers move out as either (a) energy efficient improvements to the residence that continue to deliver savings or (b) habituated energy conservation behaviors that customers continue to exercise at their new residence (as long as that residence is within a utility's service territory). As of this time, no definitive data exists to estimate the extent to which either of these two scenarios occurs. IL-TRM V7.0 therefore assumes no persisting savings upon customer move-out, though it encourages additional research on the matter.

To calculate the retention rate using this approach, we specified a simple linear regression, shown in Equation 11, to calculate a change in retention after each month of initiative treatment.

Equation 11. Prospective Retention Rate Regression Model

$$Retention\ Rate_{it} = \alpha_i + \beta_1 Months\ Treated_{it}$$

Where:

$Retention\ Rate_{it}$	is the retention rate for cohort *i* in program year *t*
α_i	is the model intercept
β_1	is the model coefficient of interest
$Months\ Treated_{it}$	is the number of treated months for cohort *i* in program year *t*

The model intercept (α_i) represents the average weighted retention rate at the start of each cohort, and the regression coefficient represents the increase in the retention rate for each additional treatment month. We then calculated the overall participant weighted treatment months from the last five years and included it in the regression output to calculate the overall weighted average retention rate. The weighted average retention rate is 92.3%. We used this rate as a multiplier when estimating lifetime savings from the Behavior Modification Initiative.

HVAC

Gross Impact Methodology

The evaluation team used 2019 HVAC Initiative tracking data and algorithms in the IL-TRM V7.0 and V7.0 errata to determine verified gross savings for the HVAC Initiative. Detailed information in the tracking database included data on quantity, unit type, size, efficiency, and measure installation locations. These served as inputs to savings algorithms in the IL-TRM V7.0 and V7.0 errata. The evaluation team reported ex ante savings by summarizing data from the tracking database. The team calculated verified savings for every installed measure using data from the tracking database when available and defaulting to deemed parameter values in the IL-TRM V7.0 and V7.0 errata when tracked data was unavailable. Table 107 lists the measures in the HVAC Initiative, their corresponding IL-TRM entry, and whether or not errata applied to the measure in the 2019 evaluation.

Table 107. HVAC Initiative Measures Evaluated

Measure	TRM Entry	Errata Applied?
ASHP	5.3.1	No errata present for this measure
ASHP ER		
CAC	5.3.3	No errata present for this measure
CAC ER		
BPM	5.3.5	No errata present for this measure
Heat Pump Water Heater	5.4.3	Yes
Advanced Thermostat	5.3.16	No errata present for this measure
Ductless Heat Pump	5.3.12	Yes

Measure	TRM Entry	Errata Applied?
Ductless Heat Pump ER		

Measure Lives and Cumulative Persisting Annual Savings

The evaluation applied the measure lives deemed in the IL-TRM V7.0 and V7.0 errata to determine CPAS for the HVAC Initiative.

Net Impact Methodology

The evaluation team applied SAG-approved 2019 NTGRs to verified gross savings to calculate verified net savings. Table 108 outlines the SAG-approved NTGR values applied to verified gross savings to calculate verified net savings.

Table 108. SAG-Approved HVAC Initiative NTGRs

Measure	Electric NTGR	Gas NTGR
ASHP	0.641	N/A
ASHP ER	0.761	N/A
CAC	0.641	N/A
CAC ER	0.761	N/A
BPM	0.761	0.761
Heat Pump Water Heater	0.760	0.760
Advanced Thermostat	N/A	N/A
Ductless Heat Pump	0.641	0.641
Ductless Heat Pump ER	0.761	0.761

Appliance Recycling

Gross Impact Methodology

The IL-TRM V7.0 algorithm provides coefficients to calculate the energy consumption of recycled appliances based on a collaborative metering study conducted for Commonwealth Edison Company and two Michigan utilities (Consumers Energy and DTE Energy) (Measure 5.1.8, which does not have errata). Holding all other variables constant, the coefficient of each independent variable indicates the influence of that variable on annual consumption as follows:

- A positive coefficient indicates an upward influence on consumption
- A negative coefficient indicates a downward influence on consumption

With the exception of the intercept, the coefficient value indicates the marginal impact of a one-point increase in the independent variable on the unit energy consumption (UEC). For instance, a single cubic-foot increase in refrigerator size results in a 27.15 kWh increase in average annual consumption. For dummy variables, the coefficient value represents the difference in consumption if a given condition holds true. For example, the 161.86 coefficient for the dummy variable “Primary Usage Type” indicates the customer used the refrigerator as a primary unit; all else equal, this means a primary refrigerator annually consumed 161.86 kWh more than a secondary unit. Table 109 lists the IL-TRM V7.0 coefficients for refrigerators.

Table 109. UEC Refrigerator Regression Algorithm

Intercept	83.32
Independent Variables	**Estimate Coefficient**
Age (years)	3.68
Pre-1990 (= 1 if manufactured pre-1990)	485.04
Size (cubic feet)	27.15
Dummy: Side-by-Side (= 1 if side-by-side)	406.78
Dummy: Primary Usage Type (in absence of the Initiative) (= 1 if primary unit)	161.86
Interaction: Located in Unconditioned Space x CDD/365.25	15.37
Interaction: Located in Unconditioned Space x HDD/365.25	-11.07

Table 110 lists the regression coefficients for freezers from the IL-TRM V7.0.

Table 110. UEC Freezer Regression Algorithm

Intercept	132.12
Independent Variables	**Estimate Coefficient**
Age (years)	12.13
Pre-1990 (= 1 if manufactured pre-1990)	156.18
Size (cubic feet)	31.84
Chest Freezer Configuration (= 1 if chest freezer)	-19.71
Interaction: Located in Unconditioned Space x CDD/365.25	9.78
Interaction: Located in Unconditioned Space x HDD/365.25	-12.76

Extrapolation

Using the 2019 tracking database, the evaluation team determined the corresponding characteristics (i.e., independent variables) for participating appliances that were then entered into the IL-TRM V7.0 algorithm. Table 111 summarizes Initiative averages or proportions for each independent variable.

Table 111. 2019 Appliance Recycling Initiative Mean Explanatory Variables

Appliance	Independent Variables	Participant 2019 Population Mean Value	Participant Population Mean Value (PY 2018)
Refrigerator	Age (years)	28.87	23.59
	Pre-1990 (= 1 if manufactured pre-1990)	0.61	0.30
	Size (cubic feet)	19.67	19.52
	Dummy: Side-by-Side (= 1 if side-by-side)	0.24	0.27
	Dummy: Primary Usage Type (in the absence of the Initiative) (= 1 if primary unit)	0.23	0.67
	Interaction: Located in Unconditioned Space x CDD/365.25	1.07	0.95
	Interaction: Located in Unconditioned Space x HDD/365.25	5.62	5.20

Appliance	Independent Variables	Participant 2019 Population Mean Value	Participant Population Mean Value (PY 2018)
Freezer	Age (years)	32.32	27.97
	Pre-1990 (= 1 if manufactured pre-1990)	0.70	0.46
	Size (cubic feet)	15.88	17.34
	Chest Freezer Configuration (= 1 if chest freezer)	0.45	0.44
	Interaction: Located in Unconditioned Space x CDD/365.25	1.40	2.38
	Interaction: Located in Unconditioned Space x HDD/365.25	7.34	13.22

To determine annual and average-annual per-unit energy consumption using the IL-TRM V7.0 algorithm and 2019 AIC tracking data, the evaluation team applied average participant refrigerator and freezer characteristics to the regression model coefficients. This approach ensured we based the resulting UEC on specific units recycled through AIC's initiative in 2019, rather than on a point estimate based on a secondary data source. Table 112 shows the annual UEC for refrigerators and freezers AIC recycled in 2019 and per-unit demand savings.

Table 112. 2019 ARI Unit Energy Savings (without part-use)

Measure	Unit Energy Savings (kWh)	Unit Demand Savings (kW)
Refrigerator	1,110	0.14
Freezer	1,051	0.12

The evaluation team calculated demand savings by applying the following formula from the IL-TRM V7.0 for refrigerators and freezers:

The evaluation team calculated demand savings by applying the following formula from the IL-TRM V7 for refrigerators and freezers:

$$Unit\ Demand\ Savings = \Delta kW\ = \frac{kWh}{8760} * Coincidence\ Factor$$

Where:

Coincidence factor = 1.081 for refrigerators and 1.028 for freezers.

Part-Use

The part-use factor accounts for appliances not plugged in year-round prior to participation. For 2019, the evaluation team applied a part-use factor of 0.87 for refrigerators and 0.85 for freezers, estimated using 2018 survey responses, as specified in the IL-TRM V7.0.

We applied part-use factors to the modeled annual consumption value listed in Table 113 to calculate average per-unit gross energy savings for 2019. As shown in Table 113, the verified per-unit values for refrigerators and freezers were 966 kWh and 893 kWh, respectively.

Table 113. 2019 Evaluated Gross Energy Savings (Per-Unit)

Recycling Measure	Ex Ante (kWh)	Verified (kWh)	Percent Difference
Refrigerator	869	966	11%
Freezer	871	893	3%

Table 113 also compares ex ante and verified gross savings. The ex ante savings are estimates generated by Leidos using the IL-TRM V7.0 algorithm. The discrepancy between ex ante and verified savings is because Leidos used the initiative tracking data to determine which units were primary and which were secondary. In contrast, the evaluation team used the 2018 participant surveys to determine the proportion of primary units. It appeared the tracking data recorded location at the time of pickup rather than location during the previous year of operation. Using the 2018 survey responses is consistent with past evaluation methodology and specifically asks how appliances were used for the entire year prior to being recycled.

Table 114. 2018 Participant Survey Appliance Location During Previous Year of Operation

Primary/Secondary	Reported Location	Percent of Units (n=146)
Primary	Kitchen	23%
Secondary	Garage	37%
	Porch/patio	4%
	Basement	29%
	Other	10%

Overall, there was only a minor discrepancy in per-unit savings for freezers, with verified gross freezer savings 3% higher than ex ante savings. However, there was a relatively moderate discrepancy for refrigerators with verified gross refrigerator savings 11% higher than ex ante savings. The initiative realization rate, overall, was 109%.

Measure Lives and Cumulative Persisting Annual Savings

In order to calculate cumulative persisting annual savings for both refrigerators and freezers, the measure life values were determined by the Illinois TRM V7.0, section 5.1.8.

Net Impact Methodology

The evaluation team applied SAG-approved 2019 NTGRs to verified gross savings to calculate verified net savings. Table 117 outlines the SAG-approved NTGR values applied to verified gross savings to calculate verified net savings.

Table 115. SAG-Approved Appliance Recycling NTGRs

Measure	Electric NTGR
Refrigerator	0.520
Freezer	0.620

Multifamily

Gross Impact Methodology

The evaluation team calculated verified savings for the Multifamily Initiative by applying savings algorithms from the IL-TRM V7.0. The team leveraged initiative tracking data such as primary heating and cooling type, the delivery mechanism (e.g., direct install, leave behind), LED wattage, LED lamp type, project location (e.g., for weather-dependent variables), and installed measure location (e.g., for faucet aerators) to inform savings assumptions. For variables outside these parameters, the evaluation team relied on defaults from the IL-TRM V7.0. Table 116 lists the measures in the Multifamily Initiative, their corresponding IL-TRM entry, and whether or not errata applied to the measure in the 2019 evaluation.

Table 116. Multifamily Initiative Measures Evaluated

Measure	TRM Entry	Errata Applied?
Standard LED - In Unit	5.5.8	No errata present for this measure
Specialty LED - In Unit	5.5.6	No errata present for this measure
Reflector LED - In Unit		
Specialty LED - Common Area	4.5.4	Errata exist for this measure in general but are not relevant to the measure as implemented through the Multifamily Initiative
Standard LED - Common Area		
Reflector LED - Common Area		
Standard LED - Exterior		
Pipe Insulation	5.4.1	No errata present for this measure
Advanced Power Strip - Tier 1	5.2.1	No errata present for this measure
Bathroom Faucet Aerator	5.4.4	Errata exist for these measures but are not relevant to AIC, which implements no programs in Cook County
Kitchen Faucet Aerator		
Showerhead	5.4.5	
Advanced Thermostat	5.3.16	No errata present for this measure

Measure Lives and Cumulative Persisting Annual Savings

The evaluation team applied measure lives from the IL-TRM V7.0 to calculate CPAS.

Net Impact Methodology

The evaluation team applied 2019 SAG-approved NTGRs to verified gross savings to calculate verified net savings. Table 117 outlines the SAG-approved NTGR values the evaluation team used to calculate verified net savings.

Table 117. SAG-Approved Multifamily Initiative NTGRs

Measure	Electric NTGR	Gas NTGR
Standard LED - In Unit	0.7734	N/A
Specialty LED - In Unit		
Specialty LED - Common Area		
Standard LED - Common Area		
Standard LED - Exterior		

Measure	Electric NTGR	Gas NTGR
Pipe Insulation	0.794	1.000
Advanced Power Strip - Tier 1	0.794	N/A
Bathroom Faucet Aerator	1.000	1.000
Kitchen Faucet Aerator	1.000	1.000
Showerhead	1.000	1.000
Advanced Thermostat	1.000	1.000

Direct Distribution of Efficient Products

Gross Impact Methodology

To estimate gross savings values for Direct Distribution Initiative measures, the evaluation team used the tracking database to verify the reported distribution of kits and to apply the IL-TRM V7.0 deemed per-unit gross savings inputs. Table 120 lists the measures in the Direct Distribution Initiative, their corresponding IL-TRM entry, and whether or not errata applied to the measure in the 2019 evaluation.

Table 118. Direct Distribution Initiative Measures Evaluated

Measure	TRM Entry	Errata Applied?
Advanced Power Strip – Tier 1	5.2.1	No errata present for this measure
Ground Source Heat Pump	5.3.8	No errata present for this measure
Low Flow Faucet Aerators	5.4.4	No; an errata exists for this measure but is not relevant to AIC, which implements no programs in Cook County
Low Flow Showerheads	5.4.5	
Water Heater Temperature Setback	5.4.6	No errata present for this measure

The evaluation team used home-type information from the 2013 AIC Energy Efficiency Market Potential Assessment[29] to estimate single- and multifamily weighted averages for certain verified gross per-unit savings parameters, in conjunction with parameter values prescribed for single- and multifamily participants in the IL-TRM V7.0.[30] To estimate energy savings associated with the initiative, the evaluation team applied electric water heater saturation rates based on the implementer-administered, web-based student participant survey data to verified installations of energy kit measures.

To determine gross savings and net realization rates, the evaluation team applied deemed per-unit gross savings inputs set forth in the IL-TRM V7.0, in combination with non-LED measure installation rates and water heater fuel saturations derived from the implementer-administered, web-based student participant survey results for initiative measures.

[29] Ameren Illinois Company. *Energy Efficiency Market Potential Assessment*. Report Number 1404. Volume 2: Market Research. June 10, 2013. Available online: http://ilsagfiles.org/SAG_files/Potential_Studies/Ameren/Appendix%204_AIC%20DSM%20Potential%20Study%202013%20Volume%202%20Market%20Research.docx.

[30] Note that 79% of customers live in single family homes and 21% live in multifamily homes. The IL-TRM V7.0 reports the average number of people per household in single family homes as 2.56 and the average number of people in multifamily homes as 2.10. The evaluation team used this information to create a weighted average of 2.46 people per household. Mathematically, this is expressed as ((79% * 2.56) + (21% * 2.10)) = 2.46.

LEDs

The evaluation team used the following equations from the IL-TRM V7.0 to estimate energy and demand savings for LEDs.

Equation 12. ENERGY STAR LED Energy Savings Algorithm

$$\Delta kWh = \left(\frac{Watts_{base} - Watts_{EE}}{1{,}000}\right) \times ISR \times (1 - Leakage) \times Hours \times WHFe$$

Equation 13. ENERGY STAR LED Demand Savings Algorithm

$$\Delta kW = \left(\frac{Watts_{base} - Watts_{EE}}{1{,}000}\right) \times ISR \times WHFd \times CF$$

Table 119 lists the assumptions the evaluation team used to estimate verified savings for the 9-watt LED measure.

Table 119. Verified Assumptions for ENERGY STAR LED

Parameter	Value	Units	Notes/Reference
$Watts_{base}$	43	watts	Base watts incandescent equivalent (IL-TRM V6.0)
$Watts_{EE}$	9	watts	Actual wattage of LED installed
1,000	1,000	W/kW	Conversion factor
ISR	60%	N/A	Installation rate (IL-TRM V7.0; School Kits) – School Kits
ISR	59%	N/A	Installation rate (IL-TRM V7.0; LED Distribution) – Appliance Recycling Kits
Leakage	0%	N/A	The evaluation team assumed a 0% leakage rate since the implementer doesn't collect utility information and the Direct Distribution Initiative targets AIC customers.
Hours	1,159	Hours	IL-TRM V7.0 – Unknown installation location
WHFe	1.051	N/A	Waste heat factor (WHF) for energy (IL-TRM V7.0; Unknown location)
WHFd	1.093	N/A	WHF for demand (IL-TRM V7.0; Unknown location)
CF	13.5%	N/A	Summer peak coincidence factor (IL-TRM V7.0; Unknown location).

[a] EnerNOC Utility Solutions Consulting. *Ameren Illinois Energy Efficiency Market Potential Assessment. Report Number 1404. Volume 2: Market Research.* June 10, 2013. Available online: http://ilsagfiles.org/SAG_files/Potential_Studies/Ameren/Appendix%204_AIC%20DSM%20Potential%20Study%202013%20Volume%202%20Market%20Research.docx

Bathroom and Kitchen Faucet Aerators

The evaluation team used the following equations from the IL-TRM V7.0 to estimate energy and demand savings for faucet aerators.

Equation 14. Faucet Aerator Electric Energy Savings Algorithm

$$\Delta kWh = \%ElectricDHW \left(\frac{(GPM_{base} * L_{base} - GPM_{low} * L_{low}) * Household * 365.25 * DF)}{FPH}\right) \times EPG\_electric \times ISR$$

Equation 15. Faucet Aerator Water Supply and Wastewater Treatment Electric Energy Savings Algorithm

$$\Delta kWh\_water = \left(\frac{\Delta Water}{1{,}000{,}000}\right) \times E\_water\_total$$

Equation 16. Faucet Aerator Electric Demand Savings Algorithm

$$\Delta kW = \left(\frac{\Delta kWh}{Hours}\right) \times CF$$

Equation 17. Faucet Aerator Gas Savings Algorithm

$$\Delta Therms = \%FossilDHW \times ISR \left(\frac{(GPM_{base} * L_{base} - GPM_{low} * L_{low}) * Household * 365.25 * DF)}{FPH}\right) \times EPG\_gas$$

Table 120 provides assumptions used to estimate verified savings for bathroom faucet aerators.

Table 120. Verified Assumptions for Bathroom Faucet Aerators

Parameter	Value	Units	Notes/Reference
%ElectricDHW – School Kit	49%	N/A	The implementer and the evaluation team used the 2018 implementer-administered web-based student participant survey data to estimate electric and gas water heater saturation rates. 49% of Initiative measures were installed in residences with electric water heating and 51% installed in homes with gas water heating.
%FossilDHW – School Kit	51%	N/A	
%ElectricDHW – AR Kit	16%	N/A	'Unknown' fuel source prescribed values (IL-TRM V7.0)
%FossilDHW – AR kit	84%	N/A	
GPM_{base}	1.53	gal/min	Base case flow (IL-TRM V7.0)
GPM_{low}	0.94	gal/min	Low case flow (IL-TRM V7.0)
L_{base}	1.6	min/day	Base case use length (IL-TRM V7.0)
L_{low}	1.6	min/day	Low case use length (IL-TRM V7.0)
Household	2.42	# of people	Average number of people per household (IL-TRM V7.0; Household type unknown)
365.25	365.25	Average days in a year	Days in a year, on average (IL-TRM V7.0)
DF	90%	Percent	Drain factor (IL-TRM V7.0) – 'Bath'
FPH	Single Family: 2.83 Multifamily: 1.50	Faucets per household	Bath faucets per household (IL-TRM V7.0). The evaluation team used the 79% single family/21% multifamily customer population distribution to calculate a weighted average for bathroom faucets per household value of 2.55.
EPG_electric	0.0795	kWh/gal	Energy per gallon of hot water supplied by electricity (IL-TRM V7.0) – Bath
EPG_gas	Single Family: 0.00341 Multifamily: 0.00397	Therm/gal	Energy per gallon of hot water supplied by gas (IL-TRM V7.0) Bath. The evaluation team used the 79% single family/21% multifamily customer population distribution to calculate a weighted average energy per gallon of hot water supplied by natural gas value of 0.00353.
ISR – School Kit	30%	N/A	'Distributed School Efficiency Kit Bathroom Aerator' prescribed value (IL-TRM V7.0)
ISR – AR Kit	61%	N/A	'Efficiency Kit Bathroom Aerator' prescribed value (IL-TRM V7.0)

Hours	Single Family: 14 Multifamily: 22	Hours/Year	Annual electric water heating recovery hours for faucet use per faucet (IL-TRM V7.0 "Bathroom"). The evaluation team used the 79% single family/21% multifamily customer population distribution to calculate a weighted average recovery hours per faucet value of 15.7.
CF	0.022	N/A	Coincidence Factor for electric load reduction (IL-TRM V7.0)
E_{water} Total	5,010	kWh/Million Gallons	IL Total Water Energy Factor (IL-TRM V7.0)
ΔWater – School Kit	88	Gallons	((GPM_base * L_base - GPM_low * L_low) * Household * 365.25 *DF / FPH) * $ISR_{School\ Kit}$
ΔWater – AR Kit	180	Gallons	((GPM_base * L_base - GPM_low * L_low) * Household * 365.25 *DF / FPH) * $ISR_{AR\ Kit}$

Table 121 provides assumptions used to estimate verified savings for kitchen faucet aerators.

Table 121. Verified Assumptions for Kitchen Faucet Aerators

Parameter	Value	Units	Notes/Reference
%ElectricDHW	49%	N/A	The implementer and the evaluation team used the 2018 implementer-administered web-based student participant survey data to estimate electric and gas water heater saturation rates. 49% of Initiative measures were installed in residences with electric water heating and 51% installed in homes with gas water heating.
%FossilDHW	51%	N/A	
%ElectricDHW – AR Kit	16%	N/A	'Unknown' fuel source prescribed values (IL-TRM V7.0)
%FossilDHW – AR kit	84%	N/A	
GPM_{base}	1.63	gal/min	Base case flow (IL-TRM V7.0)
GPM_{low}	0.94	gal/min	Low case flow (IL-TRM V7.0)
L_{base}	4.5	min/day	Base case use length (IL-TRM V7.0)
L_{low}	4.5	min/day	Low case use length (IL-TRM V7.0)
Household	2.42	# of people	Average number of people per household (IL-TRM V7.0; Household type unknown)
365.25	365.25	Average days in a year	Days in a year, on average (IL-TRM V7.0)
DF	75%	Percent	Drain factor (IL-TRM V7.0) – 'Kitchen'
FPH	1.0	Kitchen faucets per household	Kitchen faucets per household (IL-TRM V7.0).
EPG_electric	0.0969	kWh/gal	Energy per gallon of hot water supplied by electricity (IL-TRM V7.0) – 'Kitchen'
EPG_gas	Single Family: 0.00415 Multifamily: 0.00484	Therm/gal	Energy per gallon of hot water supplied by natural gas (IL-TRM V7.0 "Kitchen"). The evaluation team used the 79% single family/21% multifamily customer population distribution to calculate a weighted average energy per gallon of hot water supplied by natural gas value of 0.00429.
ISR – School Kit	31%	N/A	'Distributed School Efficiency Kit Kitchen Aerator' prescribed value (IL-TRM V7.0)
ISR – AR Kit	58%	N/A	'Efficiency Kit Kitchen Aerator' prescribed value (IL-TRM V7.0)

Hours	Single Family: 102 Multifamily: 84	Hours/Year	Annual electric water heating recovery hours for faucet use per faucet (IL-TRM V7.0 "Kitchen"). The evaluation team used the 79% single family/21% multifamily customer population distribution to calculate a weighted average recovery hours per faucet value of 98.
CF	0.022	N/A	Coincidence factor for electric load reduction (IL-TRM V7.0)
E_{water} Total	5,010	kWh/Million Gallons	IL Total Water Energy Factor (IL-TRM V7.0)
ΔWater – School Kit	638	Gallons	= ((GPM_base * L_base - GPM_low * L_low) * Household * 365.25 *DF / FPH) * ISR $_{School\ Kit}$
ΔWater – AR Kit	1,194	Gallons	= ((GPM_base * L_base - GPM_low * L_low) * Household * 365.25 *DF / FPH) * ISR $_{AR\ Kit}$

Showerheads

The evaluation team used the following equations from the IL-TRM V7.0 to estimate energy and demand savings for showerheads.

Equation 18. Showerhead Electric Energy Savings Algorithm

$$\Delta kWh = \%ElectricDHW \left(\frac{(GPM_{base} * L_{base} - GPM_{low} * L_{low}) * Household * SPCD * 365.25)}{SPH}\right) \times EPG\_electric \times ISR$$

Equation 19. Faucet Aerator Water Supply and Wastewater Treatment Electric Energy Savings Algorithm

$$\Delta kWh\_water = \left(\frac{\Delta Water}{1{,}000{,}000}\right) \times E\_water\_total$$

Equation 20. Showerhead Electric Demand Savings Algorithm

$$\Delta kW = \left(\frac{\Delta kWh}{Hours}\right) \times CF$$

Equation 21. Showerhead Gas Energy Savings Algorithm

$$\Delta Therms = \%FossilDHW \left(\frac{(GPM_{base} * L_{base} - GPM_{low} * L_{low}) * Household * SPCD * 365.25}{SPH}\right) \times EPG\_gas \times ISR$$

Table 122 provides assumptions used to estimate verified savings for showerheads.

Table 122. Verified Assumptions for Showerheads

Parameter	Value	Units	Notes/Reference
%ElectricDHW – School Kit	49%	N/A	The implementer and the evaluation team used the 2018 implementer-administered web-based student participant survey data to estimate electric and gas water heater saturation rates. 49% of Initiative measures were installed in residences with electric water heating and 51% installed in homes with gas water heating.
%FossilDHW – School Kit	51%	N/A	
%ElectricDHW – AR Kit	16%	N/A	'Unknown' fuel source prescribed values (IL-TRM V7.0)

Parameter	Value	Units	Notes/Reference
%FossilDHW – AR Kit	84%	N/A	
GPM_{base}	2.35	gal/min	Base case flow (IL-TRM V7.0)
GPM_{low}	1.50	gal/min	Actual case flow
L_{base}	7.8	min/day	Base case use length (IL-TRM V7.0)
L_{low}	7.8	min/day	Low case use length (IL-TRM V7.0)
Household	2.42	# of people	Average number of people per household (IL-TRM V7.0; Household type unknown)
SPCD	0.6	Showers per capita per day	Showers per capita per day (IL-TRM V7.0)
365.25	365.25	Average days in a year	Days in a year, on average (IL-TRM V7.0)
SPH	1.64	Showerheads per household	Showerheads per household (IL-TRM V7.0; Household type unknown)
EPG_electric	0.117	kWh/gal	Energy per gallon of hot water supplied by electricity (IL-TRM V7.0)
EPG_gas	Single Family: 0.00501 Multifamily: 0.00583	Therm/gal	Energy per gallon of hot water supplied by natural gas (IL-TRM V7.0). The evaluation team used the 79% single family/21% multifamily customer population distribution to calculate a weighted average energy per gallon of hot water supplied by natural gas value of 0.00518.
ISR – School Kit	28%	N/A	'Distributed School Efficiency Kit Showerhead' - prescribed value (IL-TRM V7.0)
ISR – AR Kit	62%	N/A	'Efficiency Kits--One showerhead kit' prescribed value (IL-TRM V7.0)
Hours	Single Family: 266 Multifamily: 218	Hours/Year	Annual electric water heating recovery hours for showerhead use (IL-TRM V7.0 "EE Kits"). The evaluation team used the 79% single family/21% multifamily customer population distribution to calculate a weighted average recovery hours per faucet value of 256.
CF	0.0278	N/A	Coincidence Factor for electric load reduction (IL-TRM V7.0)
E_{water} Total	5,010	kWh/Million Gallons	IL Total Water Energy Factor (IL-TRM V7.0)
ΔWater – School Kit	600	Gallons	= ((GPM_base * L_base - GPM_low * L_low) * Household * SPCD * 365.25 / SPH) * $ISR_{School\ Kit}$
ΔWater – AR Kit	1,329	Gallons	= ((GPM_base * L_base - GPM_low * L_low) * Household * SPCD * 365.25 / SPH) * $ISR_{AR\ Kit}$

Hot Water Temperature Card Thermometer

The evaluation team used the following equations from the IL-TRM V7.0 to estimate energy and demand savings for hot water temperature card thermometers.

Equation 22. Hot Water Temperature Card Thermometer Electric Energy Savings Algorithm

$$\Delta kWh = \left(\frac{\left(UA * \left(T_{pre} - T_{post}\right) * Hours * ISR\right)}{3{,}412 * RE\_electric}\right)$$

Equation 23. Hot Water Temperature Card Thermometer Electric Demand Savings Algorithm

$$\Delta kW = \left(\frac{\Delta kWh}{Hours}\right) \times CF$$

Equation 24. Hot Water Temperature Card Thermometer Gas Energy Savings Algorithm

$$\Delta Therms = \left(\frac{(UA * (T_{pre} - T_{post}) * Hours * ISR)}{100{,}000 * RE\_gas}\right)$$

Table 123 provides assumptions used to estimate verified savings for hot water temperature card thermometers.

Table 123. Verified Assumptions for Hot Water Temperature Card Thermometers

Parameter	Value	Units	Notes/Reference
%ElectricDHW – School Kit	49%	N/A	The implementer and the evaluation team the 2018 implementer-administered web-based student participant survey data to estimate electric and gas water heater saturation rates. 49% of Initiative measures were installed in residences with electric water heating and 51% installed in homes with gas water heating.
%FossilDHW – School Kit	51%	N/A	
%ElectricDHW – AR Kit	16%	N/A	'Unknown' fuel source prescribed values (IL-TRM V7.0)
%FossilDHW – AR Kit	84%	N/A	
U	0.083	Btu/Hr-°F-ft^2	Overall heat transfer coefficient of tank (IL-TRM V7.0)
A	24.99	Square Feet	Surface area of storage tank (IL-TRM V7.0)
T_{pre}	135	Degrees °F	Deemed hot water set point prior to adjustment (IL-TRM V7.0)
T_{post}	120	Degrees °F	Deemed new hot water set point (IL-TRM V7.0)
Hours	8,766	Hours	Number of hours in a year
3,412	3,412	N/A	Conversion from Btu to kWh (IL-TRM V7.0)
RE_electric	0.98	kWh/gal	Recovery efficiency of electric hot water heater (IL-TRM V7.0)
RE_gas	Single Family: 0.78 Multifamily: 0.67	Therm/gal	Recovery efficiency of gas water heater (IL-TRM V7.0). The evaluation team used single family/multifamily values in conjunction with the 79% single family/21% multifamily customer population distribution from the 2013 *Market Potential Assessment* to calculate a weighted average recovery efficient of gas water heater value of 0.757.
ISR – School Kit	17%	N/A	Evaluation team applied the 17% ISR calculated from the 2019 implementer-administered web-based student participant survey data, in accordance with IL-TRM V7.0.
ISR – AR Kit	10%	N/A	'Efficiency Kits – One showerhead kit' prescribed value (IL-TRM V7.0)
CF	1	N/A	Coincidence factor for electric load reduction (IL-TRM V7.0)

Advanced Power Strip

The evaluation team used the following equations from the IL-TRM V7.0 to estimate energy and demand savings for advanced power strips.

Equation 25. Advanced Power Strip Electric Energy Savings Algorithm

$$\Delta kWh = kWh \times ISR$$

Equation 26. Advanced Power Strip Electric Demand Savings Algorithm

$$\Delta kW = \left(\frac{\Delta kWh}{Hours \times CF}\right)$$

Table 124 list the assumptions the evaluation team used to estimate verified savings for advanced power strips.

Table 124. Verified Assumptions for Advanced Power Strips

Parameter	Value	Units	Notes/Reference
kWh	103	kWh	IL-TRM V7.0 – 7-plug Tier 1 APS
ISR – School Kit	69%	N/A	Installation rate (IL-TRM V7.0)
ISR – AR Kit	69%	N/A	Installation rate (IL-TRM V7.0)
Hours	7,129	Hours	IL-TRM V7.0 – Annual number of hours during which the controlled standby loads are turned off by the advanced power strip
CF	0.8	N/A	Summer peak coincidence factor (IL-TRM V7.0).

Measure Lives and Cumulative Persisting Annual Savings

In order to calculate cumulative persisting annual savings for kit measures, the measure life values were determined by the Illinois TRM v7.0.

Net Impact Methodology

The evaluation team applied SAG-approved 2019 NTGRs to verified gross savings to calculate verified net savings. Table 125 outlines the SAG-approved NTGR values applied to verified gross savings to calculate verified net savings.

Table 125. SAG-Approved Direct Distribution NTGRs

Measure	Electric NTGR	Gas NTGR
9W LED – School Kit	0.840	N/A
9W LED – Appliance Recycling Kit	1.000	N/A
1.0 GPM Bath Faucet Aerator	1.000	1.000
1.5 GPM Kitchen Faucet Aerator	1.000	1.000
1.5 GPM High-Efficiency Showerhead	1.000	1.000
Hot Water Temperature Card Thermometer	1.000	1.000
Advanced Power Strip	1.000	N/A

Appendix B. Cost-Effectiveness Inputs

In this appendix, we provide additional inputs for the cost-effectiveness testing of AIC's Residential Program. Two specific types of additional inputs are provided; summaries of interactive effects that are not counted toward goal attainment and summaries of secondary electric savings from water supply and wastewater treatment.

Interactive Effects

By agreement with SAG, AIC is not penalized for interactive effects resulting from the installation of efficient prescriptive measures that create an increase in energy usage when considering savings for goal attainment. Therefore, we exclude those effects in all savings reported throughout the body of this report. However, these effects must be evaluated and considered as part of cost-effectiveness testing and are therefore presented in this appendix.

Within the following sections, the evaluation team focuses specifically on the following interactive effects.

- **Lighting Heating Penalties.** The inclusion of waste heat factors for lighting is based on the concept that heating loads are increased to supplement the reduction in heat that was once provided by the existing, less-efficient lamp type. The team applied the IL-TRM waste heat factors to lamps based on heating fuel types provided in the tracking database to arrive at gross heating penalties. For the cases where tracking data did not provide the heating type, the team assumed natural gas heating per the IL-TRM.
- **Furnace Blower Motor Heating Penalties.** High-efficiency fan motors operate at cooler temperatures than traditional furnace blower motors. The amount of heat that is released decreases due to cooler operating conditions. Heating equipment must make up for this loss of heat during the heating season, resulting in an increase in HVAC heating loads. The team applied IL-TRM algorithms to calculate the associated heating penalty.
- **Heat Pump Water Heater Penalties.** When heat pump water heaters are installed in conditioned space, they move heat from the ambient air into water stored in a tank. During the heating season, this can result in an increase in HVAC heating loads. The team applied IL-TRM algorithms to calculate the associated heating penalty.

All heating penalties were calculated using algorithms from the IL-TRM V7.0 (with applicable errata applied).

Secondary Electric Savings for Water Supply and Wastewater Treatment

Some measures delivered through the Residential Program produce water savings as well as energy savings. For applicable measures, IL-TRM V7.0 includes an algorithm to calculate the secondary electric impacts of these water savings; decreased electricity usage for water supply and wastewater treatment as result of water savings stemming from the energy efficient measures. As directly instructed in the IL-TRM, these savings may be included in savings when considered for goal attainment, but must be removed from savings for the purpose of cost-effectiveness calculations. Therefore, we present these savings separately in this appendix to provide transparency on the reduced savings that will be used when conducting testing for cost-effectiveness. All secondary electric savings were calculated using algorithms from the IL-TRM V7.0. Errata for secondary electric savings do not apply to AIC.

Retail Products

Interactive Effects

Table 129 presents interactive effects not reported in the body of the report for the Retail Products Initiative by sector.

Table 126. 2019 Retail Products Initiative Interactive Effects by Sector

Measure	Therms
LED Lighting (Residential Application)	-1,574,680
LED Lighting (Commercial Application)	-244,335
Total Interactive Effects	**-1,819,015**

Secondary Electric Savings for Water Supply and Wastewater Treatment

We calculated secondary electric savings from water supply and wastewater treatment for measures installed through the Retail Products Initiative during 2019. These savings are included in the body of the report and for goal attainment purposes in line with guidance provided in IL-TRM V7.0.

Table 130 presents secondary electric savings claimed through the Retail Products Initiative that will be excluded from cost-effectiveness calculations.

Table 127. 2019 Retail Products Initiative Secondary Electric Savings

	kWh
ENERGY STAR Clothes Washer Secondary Electric Savings	1,412
Total Secondary Electric Savings	**1,412**

Total Impacts for Cost-Effectiveness

Table 131 presents final total 2019 Retail Products Initiative verified gross impacts to be used for cost-effectiveness, adjusted for interactive effects and secondary electric savings.

Table 128. 2019 Retail Products Initiative Verified Gross Impacts for Cost-Effectiveness

	MWh	Therms
Verified Gross Impacts for Goal Attainment	81,063	700,595
Interactive Effects	N/A	-1,819,015
Secondary Electric Savings	-1	N/A
Final Verified Gross Impacts for Cost-Effectiveness	**81,062**	**-1,118,420**

Income Qualified

Interactive Effects

Table 132 presents interactive effects not reported in the body of the report for the Income Qualified Initiative by enduse and channel.

Table 129. 2019 Income Qualified Initiative Interactive Effects by Enduse

Penalty	kWh	Therms
CAA		
Lighting Heating Penalty	-11,606	-6,998
Furnace Blower Motor Heating Penalty	0	0
Subtotal	*-11,606*	*-6,998*
Single Family		
Lighting Heating Penalty	-62,879	-50,723
Furnace Blower Motor Heating Penalty	0	-56
Subtotal	*-62,879*	*-50,779*
Multifamily		
Lighting Heating Penalty	-155,819	-1,821
Furnace Blower Motor Heating Penalty	0	0
Subtotal	*-155,819*	*-1,821*
Smart Savers		
Lighting Heating Penalty	0	0
Furnace Blower Motor Heating Penalty	0	0
Subtotal	*0*	*0*
Total	**-230,304**	**-59,599**

Secondary Electric Savings for Water Supply and Wastewater Treatment

We calculated secondary electric savings from water supply and wastewater treatment for measures installed through the Income Qualified Initiative during 2019. These savings are included in the body of the report and for goal attainment purposes in line with guidance provided in IL-TRM V7.0.

Table 133 presents secondary electric savings claimed through the Income Qualified Initiative that will be excluded from cost-effectiveness calculations by measure.

Table 130. 2019 Income Qualified Initiative Secondary Electric Savings

Measure	kWh
CAA	
Faucet Aerators	898
Showerheads	2,181
Subtotal	*3,079*
Single Family	
Faucet Aerators	10,406

Measure	kWh
Showerheads	9,122
Subtotal	*19,529*
Multifamily	
Faucet Aerators	7,511
Showerheads	4,347
Subtotal	*11,858*
Smart Savers	
Faucet Aerators	0
Showerheads	0
Subtotal	*0*
Total	**34,465**

Total Impacts for Cost-Effectiveness

Table 134 presents final total 2019 Income Qualified Initiative verified gross impacts to be used for cost-effectiveness, adjusted for interactive effects and secondary electric savings.

Table 131. 2019 Income Qualified Initiative Verified Gross Impacts for Cost-Effectiveness

	kWh	Therms
CAA		
Verified Gross Impacts for Goal Attainment	814,942	90,739
Interactive Effects	-11,606	-6,998
Secondary Electric Savings	-3,079	0
Subtotal	*800,258*	*83,740*
Single Family		
Verified Gross Impacts for Goal Attainment	9,332,499	837,672
Interactive Effects	-62,879	-50,779
Secondary Electric Savings	-19,529	0
Subtotal	*9,250,091*	*786,893*
Multifamily		
Verified Gross Impacts for Goal Attainment	1,629,973	25,743
Interactive Effects	-155,819	-1,821
Secondary Electric Savings	-11,858	0
Subtotal	*1,462,296*	*23,922*
Smart Savers		
Verified Gross Impacts for Goal Attainment	2,824,243	285,545
Interactive Effects	0	0
Secondary Electric Savings	0	0
Subtotal	*2,824,243*	*285,545*
Total	**14,336,887**	**1,180,100**

Public Housing

Interactive Effects

Table 135 presents interactive effects not reported in the body of the report for the Public Housing Initiative by measure.

Table 132. 2019 Public Housing Initiative Interactive Effects by Measure

Measure	MWh	Therms
Standard LED - In Unit	-69	-254,513
Specialty LED - In Unit	-0.14	-73
Standard LED - Common Area	-59	-651
Reflector LED - Common Area	-	-17
Total Interactive Effects	**-128**	**-255,254**

Secondary Electric Savings for Water Supply and Wastewater Treatment

We calculated secondary electric savings from water supply and wastewater treatment for measures installed through the Public Housing Initiative during 2019. These savings are included in the body of the report and for goal attainment purposes in line with guidance provided in IL-TRM V7.0.

Table 136 presents secondary electric savings claimed through the Public Housing Initiative that will be excluded from cost-effectiveness calculations.

Table 133. 2019 Public Housing Initiative Secondary Electric Savings

Measure	kWh
Faucet Aerators	18,626
Showerheads	14,150
Total	**32,777**

Total Impacts for Cost-Effectiveness

Table 138 presents final total 2019 Public Housing Initiative verified gross impacts to be used for cost-effectiveness, adjusted for interactive effects and secondary electric savings.

Table 134. 2019 Public Housing Initiative Verified Gross Impacts for Cost-Effectiveness

	MWh	Therms
Verified Gross Impacts for Goal Attainment	1,161	32,181
Interactive Effects	-128	-255,254
Secondary Electric Savings	-33	N/A
Final Verified Gross Impacts for Cost-Effectiveness	**1,001**	**-223,073**

Behavior Modification

Home energy reports do not produce quantifiable interactive effects or secondary electric savings, and therefore savings presented in the body of the report will be used for cost-effectiveness testing.

HVAC

Interactive Effects

Table 138 presents interactive effects not reported in the body of the report for the HVAC Initiative by measure.

Table 135. 2019 HVAC Initiative Gross Impacts with Heating Penalties

	MWh	Therms
Furnace Blower Motor Heating Penalty	N/A	-207
Heat Pump Water Heater Heating Penalty	N/A	-24
Total	**N/A**	**-231**

Secondary Electric Savings for Water Supply and Wastewater Treatment

No measures delivered through the HVAC Initiative in 2019 produce quantifiable water savings.

Total Impacts for Cost-Effectiveness

Table 139 presents final total 2019 HVAC Initiative verified gross impacts to be used for cost-effectiveness, adjusted for interactive effects.

Table 136. 2019 HVAC Initiative Verified Gross Impacts for Cost-Effectiveness

	MWh	Therms
Verified Gross Impacts for Goal Attainment	9,107	69,775
Interactive Effects	N/A	-231
Final Verified Gross Impacts for Cost-Effectiveness	**9,107**	**69,544**

Appliance Recycling

No measures delivered through the Appliance Recycling Initiative in 2019 produce interactive effects or secondary electric savings, and therefore savings presented in the body of the report will be used for cost-effectiveness testing.

Multifamily

Interactive Effects

Table 140 presents interactive effects not reported in the body of the report for the Multifamily Initiative by measure.

Table 137. 2019 Multifamily Initiative Interactive Effects by Measure

Measure	MWh	Therms
Standard LED - In Unit	-47	-31,519
Specialty LED - In Unit	-27	-16,604
Specialty LED - Common Area	-19	N/A

Measure	MWh	Therms
Standard LED - Common Area	-81	-81
Total Interactive Effects	**-174**	**-48,204**

Secondary Electric Savings for Water Supply and Wastewater Treatment

We calculated secondary electric savings from water supply and wastewater treatment for measures installed through the Multifamily Initiative during 2019. These savings are included in the body of the report and for goal attainment purposes in line with guidance provided in IL-TRM V7.0.

Table 141 presents secondary electric savings claimed through the Multifamily Initiative that will be excluded from cost-effectiveness calculations.

Table 138. 2019 Multifamily Initiative Secondary Electric Savings

Measure	kWh
Faucet Aerators	1,574
Showerhead	904
Total	**2,452**

Total Impacts for Cost-Effectiveness

Table 142 presents final total 2019 Multifamily Initiative verified gross impacts to be used for cost-effectiveness, adjusted for interactive effects and secondary electric savings.

Table 139. 2019 Multifamily Initiative Verified Gross Impacts for Cost-Effectiveness

	MWh	Therms
Verified Gross Impacts for Goal Attainment	1,378	27,650
Interactive Effects	-174	-48,204
Secondary Electric Savings	-2	N/A
Final Verified Gross Impacts for Cost-Effectiveness	**1,202**	**-20,473**

Direct Distribution

Interactive Effects

Table 143 presents interactive effects not reported in the body of the report for the Direct Distribution Initiative by channel.

Table 140. 2019 Direct Distribution Initiative Interactive Effects by Channel

Channel	kWh	Therms
School Kits	0	-14,548
Appliance Recycling Kits	0	-998
Community Kits	-139,663	-8,567
Total Interactive Effects	**-139,663**	**-24,113**

Secondary Electric Savings for Water Supply and Wastewater Treatment

We calculated secondary electric savings from water supply and wastewater treatment for measures installed through the Direct Distribution Initiative during 2019. These savings are included in the body of the report and for goal attainment purposes in line with guidance provided in IL-TRM V7.0.

Table 144 presents secondary electric savings claimed through the Direct Distribution Initiative by channel that will be excluded from cost-effectiveness calculations.

Table 141. 2019 Direct Distribution Initiative Secondary Electric Savings

Measure	kWh
School Kits	49,947
Appliance Recycling Kits	7,095
Community Kits	52,998
Total	**110,041**

Total Impacts for Cost-Effectiveness

Table 142 presents final total 2019 Direct Distribution Initiative verified gross impacts to be used for cost-effectiveness, adjusted for interactive effects and secondary electric savings.

Table 142. 2019 Direct Distribution Initiative Verified Gross Impacts for Cost-Effectiveness

	kWh	Therms
School Kits		
Verified Gross Impacts for Goal Attainment	2,013,788	25,965
Interactive Effects	0	-14,548
Secondary Electric Savings	-49,947	0
Subtotal	*1,963,841*	*11,417*
Appliance Recycling Kits		
Verified Gross Impacts for Goal Attainment	120,172	5,726
Interactive Effects	0	-998
Secondary Electric Savings	-7,095	0
Subtotal	*113,077*	*4,728*
Community Kits		
Verified Gross Impacts for Goal Attainment	980,222	52,959
Interactive Effects	-139,663	-8,567
Secondary Electric Savings	-52,998	0
Subtotal	*787,561*	*44,392*
Total	**2,864,478**	**60,538**

Appendix C. Cumulative Persisting Annual Savings

This appendix presents detailed CPAS for the Residential Program and its subcomponents. Due to many years of CPAS, tables are challenging to read; please reference the separately provided CPAS spreadsheet for additional detail as needed.

Table 146 provides CPAS for the 2019 Residential Program through 2047 at the initiative level. Lifetime savings for the 2019 Residential Program are 913,580 MWh.

Table 143. 2019 Residential Program CPAS and WAML

Initiative	Initiative-Level WAML	First-Year Verified Gross MWh	NTGR	CPAS - Verified Net MWh														
				2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Retail Products	9.1	114,127	0.716		81,770	81,770	49,955	49,955	46,504	23,567	23,567	18,659	18,659	18,659	6,467	24	24	24
IQ	13.8	12,393	1.000		12,393	12,393	10,100	10,100	10,100	9,681	8,020	7,263	7,262	7,262	5,720	4,291	4,291	4,291
IQ (gas conversion)	18.4	12,840	1.000		12,840	12,840	12,840	12,840	12,840	12,840	9,197	9,197	9,159	8,865	6,656	6,656	6,656	6,656
Public Housing	10.4	1,161	0.000		1,161	1,161	768	768	768	672	672	577	551	534	141	92	93	93
Behavior Modification	5.0	1,061	N/A		1,061	783	484	257	115	0	0	0	0	0	0	0	0	0
HVAC	16.5	9,130	0.755		6,890	6,890	6,890	6,890	6,890	6,890	4,443	4,443	4,443	4,443	4,443	3,954	3,954	3,954
Appliance Recycling	6.5	5,146	0.541		2,786	2,786	2,786	2,786	2,786	2,786	2,786	1,393	0	0	0	0	0	0
Multifamily	10.3	1,378	0.926		1,275	1,275	1,105	1,105	1,105	1,054	1,054	1,010	980	961	885	3	0	0
Direct Distribution	8.7	2,160	0.933		2,016	2,016	1,408	1,408	1,408	1,408	1,408	837	837	542	0	0	0	0
Smart Savers	11.0	2,824	1.000		2,824	2,824	2,824	2,824	2,824	2,824	2,824	2,824	2,824	2,824	2,824	0	0	0
NPSO	9.5	4,123	N/A		2,970	2,961	1,942	1,934	1,823	1,107	1,031	817	772	763	366	123	123	123
2019 Portfolio CPAS		**166,342**	**0.769**		**127,987**	**127,701**	**91,103**	**90,868**	**87,163**	**62,830**	**55,002**	**47,019**	**45,487**	**44,851**	**27,502**	**15,142**	**15,140**	**15,140**
Expiring 2019 Portfolio CPAS					**0**	**286**	**36,597**	**235**	**3,705**	**24,333**	**7,828**	**7,983**	**1,531**	**636**	**17,350**	**12,360**	**2**	**0**
Expired 2019 Portfolio CPAS					**0**	**286**	**36,884**	**37,119**	**40,824**	**65,157**	**72,985**	**80,968**	**82,499**	**83,136**	**100,485**	**112,845**	**112,847**	**112,847**

Initiative	Initiative-Level WAML	First-Year Verified Gross MWh	NTGR	CPAS - Verified Net MWh														
				2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047
Retail Products	9.1	114,127	0.716	11	11	4	0	0	0	0	0	0	0	0	0	0	0	0
IQ	13.8	12,393	1.000	4,291	3,493	2,746	2,746	2,353	1,910	0	0	0	0	0	0	0	0	0
IQ (gas conversion)	18.4	12,840	1.000	6,612	6,612	6,612	6,612	6,612	631	34	34	34	34	29	0	0	0	0
Public Housing	10.4	1,161	0.000	93	93	93	93	93	93	0	0	0	0	0	0	0	0	0
Behavior Modification	5.0	1,061	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HVAC	16.5	9,130	0.755	3,954	2,078	1,187	1,187	0	0	0	0	0	0	0	0	0	0	0
Appliance Recycling	6.5	5,146	0.541	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Multifamily	10.3	1,378	0.926	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Direct Distribution	8.7	2,160	0.933	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Smart Savers	11.0	2,824	1.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NPSO	9.5	4,123	N/A	123	65	37	37	0	0	0	0	0	0	0	0	0	0	0
2019 Portfolio CPAS		**166,342**	**0.769**	**15,084**	**12,353**	**10,678**	**10,675**	**9,058**	**2,633**	**34**	**34**	**34**	**34**	**29**	**0**	**0**	**0**	**0**
Expiring 2019 Portfolio CPAS				**56**	**2,731**	**1,675**	**3**	**1,617**	**6,425**	**2,599**	**0**	**0**	**0**	**5**	**29**	**0**	**0**	**0**
Expired 2019 Portfolio CPAS				**112,903**	**115,634**	**117,308**	**117,312**	**118,929**	**125,354**	**127,953**	**127,953**	**127,953**	**127,953**	**127,958**	**127,987**	**127,987**	**127,987**	**127,987**
WAML	**10.3**																	

Retail Products

Table 147 provides CPAS for the 2019 Retail Products Initiative through 2047. Lifetime savings for the Initiative are 419,631 MWh.

Table 144. 2019 Retail Products Initiative CPAS and WAML

Measure Category	Measure Life	First-Year Verified Gross MWh	NTGR	CPAS (Verified Net MWh)														
				2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
2019 Standard LED - Residential	10.0	45,771	0.690		31,582	31,582	8,433	8,433	8,433	8,433	8,433	8,433	8,433	8,433	0	0	0	0
2019 Standard LED - Commercial	4.2	8,193	0.690		5,653	5,653	1,510	1,510	302	0	0	0	0	0	0	0	0	0
2019 Reflector LED - Residential	10.0	24,151	0.690		16,664	16,664	16,664	16,664	16,664	1,761	1,761	1,761	1,761	1,761	0	0	0	0
2019 Reflector LED - Commercial	4.2	2,707	0.690		1,868	1,868	1,868	1,868	374	0	0	0	0	0	0	0	0	0
2019 Specialty LED - Residential	10.0	10,753	0.690		7,419	7,419	7,419	7,419	7,419	842	842	842	842	842	0	0	0	0
2019 Specialty LED - Commercial	4.2	1,205	0.690		832	832	832	832	166	0	0	0	0	0	0	0	0	0
2018 Standard LED - Residential	10.0	5,121	0.700		3,585	3,585	948	948	948	948	948	948	948	948	0	0	0	0
2018 Standard LED - Commercial	4.2	243	0.700		170	170	45	45	9	0	0	0	0	0	0	0	0	0
2018 Reflector LED - Residential	10.0	569	0.700		398	398	398	398	398	43	43	43	43	43	0	0	0	0
2018 Reflector LED - Commercial	4.2	32	0.700		23	23	23	23	5	0	0	0	0	0	0	0	0	0
2018 Specialty LED - Residential	10.0	199	0.700		139	139	139	139	139	15	15	15	15	15	0	0	0	0
2018 Specialty LED - Commercial	4.2	11	0.700		8	8	8	8	2	0	0	0	0	0	0	0	0	0
PYTR Standard LED - Residential	10.0	506	0.580		293	293	78	78	78	78	78	78	78	78	0	0	0	0
PYTR Standard LED - Commercial	4.2	68	0.580		39	39	10	10	2	0	0	0	0	0	0	0	0	0
PYTR Reflector LED - Residential	10.0	83	0.600		50	50	50	50	50	5	5	5	5	5	0	0	0	0
PYTR Reflector LED - Commercial	4.2	7	0.600		4	4	4	4	1	0	0	0	0	0	0	0	0	0
PYTR Specialty LED - Residential	10.0	38	0.580		22	22	22	22	22	2	2	2	2	2	0	0	0	0
PYTR Specialty LED - Commercial	4.2	3	0.580		2	2	2	2	0	0	0	0	0	0	0	0	0	0
PY9 Standard LED - Residential	10.0	371	0.580		215	215	56	56	56	56	56	56	56	56	0	0	0	0
PY9 Standard LED - Commercial	4.2	50	0.580		29	29	8	8	2	0	0	0	0	0	0	0	0	0
PY9 Reflector LED - Residential	10.0	67	0.600		40	40	40	40	40	5	5	5	5	5	0	0	0	0
PY9 Reflector LED - Commercial	4.2	6	0.600		4	4	4	4	1	0	0	0	0	0	0	0	0	0
PY9 Specialty LED - Residential	10.0	26	0.580		15	15	15	15	15	2	2	2	2	2	0	0	0	0
PY9 Specialty LED - Commercial	4.2	2	0.580		1	1	1	1	0	0	0	0	0	0	0	0	0	0
PY9 Standard CFL - Residential	2.0	873	0.630		550	550	0	0	0	0	0	0	0	0	0	0	0	0
PY9 Standard CFL - Commercial	2.0	128	0.630		80	80	0	0	0	0	0	0	0	0	0	0	0	0
PY9 IPA Rural Kits Standard CFL	2.0	109	0.578		63	63	0	0	0	0	0	0	0	0	0	0	0	0
PY9 IPA MICK Standard CFL	2.0	57	1.000		57	57	0	0	0	0	0	0	0	0	0	0	0	0
PY9 IPA CFL Distribution Standard CFL	2.0	587	1.000		587	587	0	0	0	0	0	0	0	0	0	0	0	0
Advanced Power Strip	7.0	5,693	0.860		4,896	4,896	4,896	4,896	4,896	4,896	4,896	0	0	0	0	0	0	0
Advanced Thermostat	11.0	6,444	N/A		6,444	6,444	6,444	6,444	6,444	6,444	6,444	6,444	6,444	6,444	6,444	0	0	0
Variable-Speed Pool Pump	7.0	16	0.800		12	12	12	12	12	12	12	0	0	0	0	0	0	0
Clothes Washer	14.0	20	0.630		12	12	12	12	12	12	12	12	12	12	12	12	12	12
Electric Clothes Dryer	16.0	12	0.670		8	8	8	8	8	8	8	8	8	8	8	8	8	8
Refrigerator	17.0	5	0.650		3	3	3	3	3	3	3	3	3	3	3	3	3	3
Freezer	22.0	0	0.630		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total		**114,127**	**0.716**		**81,770**	**81,770**	**49,955**	**49,955**	**46,504**	**23,567**	**23,567**	**18,659**	**18,659**	**18,659**	**6,467**	**24**	**24**	**24**
Expiring 2019 CPAS					**0**	**0**	**31,815**	**0**	**3,451**	**22,936**	**0**	**4,909**	**0**	**0**	**12,191**	**6,444**	**0**	**0**
Expired 2019 CPAS					**0**	**0**	**31,815**	**31,815**	**35,267**	**58,203**	**58,203**	**63,112**	**63,112**	**63,112**	**75,303**	**81,747**	**81,747**	**81,747**

Cumulative Persisting Annual Savings

Measure Category	Measure Life	First-Year Verified Gross MWh	NTGR	CPAS (Verified Net MWh)														
				2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047
2019 Standard LED - Residential	10.0	45,771	0.690	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2019 Standard LED - Commercial	4.2	8,193	0.690	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2019 Reflector LED - Residential	10.0	24,151	0.690	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2019 Reflector LED - Commercial	4.2	2,707	0.690	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2019 Specialty LED - Residential	10.0	10,753	0.690	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2019 Specialty LED - Commercial	4.2	1,205	0.690	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018 Standard LED - Residential	10.0	5,121	0.700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018 Standard LED - Commercial	4.2	243	0.700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018 Reflector LED - Residential	10.0	569	0.700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018 Reflector LED - Commercial	4.2	32	0.700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018 Specialty LED - Residential	10.0	199	0.700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018 Specialty LED - Commercial	4.2	11	0.700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PYTR Standard LED - Residential	10.0	506	0.580	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PYTR Standard LED - Commercial	4.2	68	0.580	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PYTR Reflector LED - Residential	10.0	83	0.600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PYTR Reflector LED - Commercial	4.2	7	0.600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PYTR Specialty LED - Residential	10.0	38	0.580	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PYTR Specialty LED - Commercial	4.2	3	0.580	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PY9 Standard LED - Residential	10.0	371	0.580	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PY9 Standard LED - Commercial	4.2	50	0.580	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PY9 Reflector LED - Residential	10.0	67	0.600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PY9 Reflector LED - Commercial	4.2	6	0.600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PY9 Specialty LED - Residential	10.0	26	0.580	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PY9 Specialty LED - Commercial	4.2	2	0.580	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PY9 Standard CFL - Residential	2.0	873	0.630	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PY9 Standard CFL - Commercial	2.0	128	0.630	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PY9 IPA Rural Kits Standard CFL	2.0	109	0.578	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PY9 IPA MICK Standard CFL	2.0	57	1.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PY9 IPA CFL Distribution Standard CFL	2.0	587	1.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Advanced Power Strip	7.0	5,693	0.860	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Advanced Thermostat	11.0	6,444	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Variable-Speed Pool Pump	7.0	16	0.800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clothes Washer	14.0	20	0.630	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Electric Clothes Dryer	16.0	12	0.670	8	8	0	0	0	0	0	0	0	0	0	0	0	0	0
Refrigerator	17.0	5	0.650	3	3	3	0	0	0	0	0	0	0	0	0	0	0	0
Freezer	22.0	0	0.630	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total		**114,127**	**0.716**	**11**	**11**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Expiring 2019 CPAS				**12**	**0**	**8**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Expired 2019 CPAS				**81,759**	**81,759**	**81,767**	**81,770**	**81,770**	**81,770**	**81,770**	**81,770**	**81,770**	**81,770**	**81,770**	**81,770**	**81,770**	**81,770**	**81,770**
WAML	**9.1**																	

Income Qualified

Table 148 provides initial electric CPAS for the 2019 Income Qualified Initiative through 2047 by channel. Lifetime savings for the Initiative are 158,650 MWh.

Table 145. 2019 Income Qualified Initiative CPAS and WAML

Channel	Measure Life	First-Year Verified Gross MWh	NTGR	CPAS (Verified Net MWh)														
				2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
CAA	14.9	815	1.000		815	815	555	555	555	555	555	553	553	553	436	415	415	415
Single Family	14.7	9,332	1.000		9,332	9,332	7,809	7,809	7,809	7,305	5,646	5,272	5,272	5,272	4,392	3,819	3,819	3,819
Multifamily	10.7	1,630	1.000		1,630	1,630	1,460	1,460	1,460	1,303	1,296	1,199	1,199	1,198	962	127	127	127
Smart Savers	11.0	2,824	1.000		2,824	2,824	2,824	2,824	2,824	2,824	2,824	2,824	2,824	2,824	2,824	0	0	0
Total		**14,602**	**1.000**		**14,602**	**14,602**	**12,647**	**12,647**	**12,647**	**11,987**	**10,321**	**9,848**	**9,848**	**9,847**	**8,614**	**4,361**	**4,361**	**4,361**
Expiring 2019 CPAS					**0**	**0**	**1,954**	**0**	**0**	**661**	**1,666**	**473**	**0**	**0**	**1,233**	**4,253**	**0**	**0**
Expired 2019 CPAS					**0**	**0**	**1,954**	**1,954**	**1,954**	**2,615**	**4,281**	**4,754**	**4,754**	**4,754**	**5,988**	**10,241**	**10,241**	**10,241**

Channel	Measure Life	First-Year Verified Gross MWh	NTGR	CPAS (Verified Net MWh)														
				2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047
CAA	14.9	815	1.000	415	415	415	415	415	371	0	0	0	0	0	0	0	0	0
Single Family	14.7	9,332	1.000	3,819	3,148	2,401	2,401	2,008	1,608	0	0	0	0	0	0	0	0	0
Multifamily	10.7	1,630	1.000	127	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Smart Savers	11.0	2,824	1.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total		**14,602**	**1.000**	**4,361**	**3,563**	**2,816**	**2,816**	**2,423**	**1,979**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Expiring 2019 CPAS				**0**	**797**	**747**	**0**	**393**	**443**	**1,979**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Expired 2019 CPAS				**10,241**	**11,039**	**11,786**	**11,786**	**12,179**	**12,622**	**14,602**	**14,602**	**14,602**	**14,602**	**14,602**	**14,602**	**14,602**	**14,602**	**14,602**
WAML	**13.5**																	

Table 149 provides CPAS converted from therms for the 2019 Income Qualified Initiative through 2047 by measure. Lifetime savings for the 2019 Income Qualified Initiative conversion are 188,627 MWh.

Table 146. 2019 Income Qualified Initiative Gas Conversion CPAS and WAML

Measure	Measure Life	First-Year Verified Gross MWh	NTGR	CPAS (Verified Net MWh)														
				2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Advanced Thermostat	11.0	1,916	N/A		1,916	1,916	1,916	1,916	1,916	1,916	1,916	1,916	1,916	1,916	1,916	0	0	0
Air Sealing	20.0	2,299	1.000		2,299	2,299	2,299	2,299	2,299	2,299	2,299	2,299	2,299	2,299	2,173	2,173	2,173	2,173
Boiler	25.0	5	1.000		5	5	5	5	5	5	5	5	5	5	5	5	5	5
Boiler ER	25.0	67	1.000		67	67	67	67	67	67	67	67	29	29	29	29	29	29
Duct Sealing	20.0	273	1.000		273	273	273	273	273	273	273	273	273	273	273	273	273	273
Faucet Aerator	10.0	148	1.000		148	148	148	148	148	148	148	148	148	148	0	0	0	0
Furnace	20.0	131	1.000		131	131	131	131	131	131	131	131	131	131	131	131	131	131
Furnace ER	20.0	4,240	1.000		4,240	4,240	4,240	4,240	4,240	4,240	597	597	597	597	597	597	597	597
Insulation	20.0	3,853	1.000		3,853	3,853	3,853	3,853	3,853	3,853	3,853	3,853	3,853	3,853	3,746	3,746	3,746	3,746
Pipe Insulation	15.0	43	1.000		43	43	43	43	43	43	43	43	43	43	43	43	43	43
Showerhead	10.0	146	1.000		146	146	146	146	146	146	146	146	146	146	0	0	0	0
Total		**13,121**	**1.000**		**13,121**	**13,121**	**13,121**	**13,121**	**13,121**	**13,121**	**9,477**	**9,477**	**9,439**	**9,439**	**8,912**	**6,997**	**6,997**	**6,997**
Expiring 2019 CPAS					**0**	**0**	**0**	**0**	**0**	**0**	**3,643**	**0**	**38**	**0**	**527**	**1,916**	**0**	**0**
Expired 2019 CPAS					**0**	**0**	**0**	**0**	**0**	**0**	**3,643**	**3,643**	**3,682**	**3,682**	**4,208**	**6,124**	**6,124**	**6,124**

Measure Category	Measure Life	First-Year Verified Gross MWh	NTGR	CPAS (Verified Net MWh)														
				2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047
Advanced Thermostat	11.0	1,916	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Air Sealing	20.0	2,299	1.000	2,173	2,173	2,173	2,173	2,173	2,299	0	0	0	0	0	0	0	0	0
Boiler	25.0	5	1.000	5	5	5	5	5	5	5	5	5	5	5	0	0	0	0
Boiler ER	25.0	67	1.000	29	29	29	29	29	29	29	29	29	29	29	0	0	0	0
Duct Sealing	20.0	273	1.000	273	273	273	273	273	273	0	0	0	0	0	0	0	0	0
Faucet Aerator	10.0	148	1.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Furnace	20.0	131	1.000	131	131	131	131	131	131	0	0	0	0	0	0	0	0	0
Furnace ER	20.0	4,240	1.000	597	597	597	597	597	597	0	0	0	0	0	0	0	0	0
Insulation	20.0	3,853	1.000	3,746	3,746	3,746	3,746	3,746	3,853	0	0	0	0	0	0	0	0	0
Pipe Insulation	15.0	43	1.000	43	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Showerhead	10.0	146	1.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total		**13,121**	**1.000**	**6,997**	**6,953**	**6,953**	**6,953**	**6,953**	**7,187**	**34**	**34**	**34**	**34**	**34**	**0**	**0**	**0**	**0**
Expiring 2019 CPAS				**0**	**43**	**0**	**0**	**0**	**-233**	**7,153**	**0**	**0**	**0**	**0**	**34**	**0**	**0**	**0**
Expired 2019 CPAS				**6,124**	**6,167**	**6,167**	**6,167**	**6,167**	**5,934**	**13,087**	**13,087**	**13,087**	**13,087**	**13,087**	**13,121**	**13,121**	**13,121**	**13,121**
WAML	**18.5**																	

Public Housing

Table 150 provides CPAS for the 2019 Public Housing Initiative through 2047 by measure. Lifetime savings for the Initiative are 8,605 MWh.

Table 147. 2019 Public Housing Initiative CPAS and WAML

Measure	Measure Life	First-Year Verified Gross MWh	NTGR	CPAS (Verified Net MWh)														
				2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Standard LED - In Unit	10.0	535	1.000		535	535	146	146	146	146	146	146	146	146	0	0	0	0
Standard LED - Common Area	8.4	142	1.000		142	142	139	139	139	43	43	43	17	0	0	0	0	0
Kitchen Faucet Aerator	10.0	116	1.000		116	116	116	116	116	116	116	116	116	116	0	0	0	0
Showerhead	10.0	105	1.000		105	105	105	105	105	105	105	105	105	105	0	0	0	0
Advanced Power Strip - Tier 1	7.0	95	1.000		95	95	95	95	95	95	95	0	0	0	0	0	0	0
Attic Insulation	20.0	66	1.000		66	66	66	66	66	66	66	66	66	66	65	65	66	66
Advanced Thermostat	11.0	49	1.000		49	49	49	49	49	49	49	49	49	49	49	0	0	0
Air Sealing	20.0	27	1.000		27	27	27	27	27	27	27	27	27	27	26	26	26	26
Bathroom Faucet Aerator	10.0	23	1.000		23	23	23	23	23	23	23	23	23	23	0	0	0	0
Standard LED - Exterior	11.6	3	1.000		3	3	1	1	1	1	1	1	1	1	1	1	0	0
Reflector LED - Common Area	8.4	1	1.000		1	1	1	1	1	0	0	0	0	0	0	0	0	0
Specialty LED - In Unit	10.0	0	1.000		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total		**1,162**	**1.000**		**1,162**	**1,162**	**768**	**768**	**768**	**672**	**672**	**577**	**551**	**534**	**141**	**92**	**93**	**93**
Expiring 2019 CPAS					**0**	**0**	**394**	**0**	**0**	**97**	**0**	**95**	**26**	**17**	**393**	**49**	**-1**	**0**
Expired 2019 CPAS					**0**	**0**	**394**	**394**	**394**	**490**	**490**	**585**	**611**	**628**	**1,021**	**1,070**	**1,069**	**1,069**

Measure Category	Measure Life	First-Year Verified Gross MWh	NTGR	CPAS (Verified Net MWh)														
				2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047
Standard LED - Common Area	8.4	142	1.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Standard LED - Exterior	11.6	3	1.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Specialty LED - In unit	10.0	0	1.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reflector LED - Common Area	8.4	1	1.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Standard LED - In unit	10.0	535	1.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Air Sealing	20.0	27	1.000	26	26	26	26	26	26	0	0	0	0	0	0	0	0	0
Advanced Power Strip - Tier 1	7.0	95	1.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Advanced Thermostat	11.0	49	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Attic Insulation	20.0	66	1.000	66	66	66	66	66	66	0	0	0	0	0	0	0	0	0
Bathroom Faucet Aerator	10.0	23	1.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kitchen Faucet Aerator	10.0	116	1.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Showerhead	10.0	105	1.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total		**1,161**	**0.080**	**93**	**93**	**93**	**93**	**93**	**93**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Expiring 2019 CPAS				**0**	**0**	**0**	**0**	**0**	**0**	**93**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Expired 2019 CPAS				**1,069**	**1,069**	**1,069**	**1,069**	**1,069**	**1,069**	**1,162**	**1,162**	**1,162**	**1,162**	**1,162**	**1,162**	**1,162**	**1,162**	**1,162**
WAML	**10.4**																	

Behavioral Modification

Table 151 provides CPAS for the 2019 Behavioral Modification Initiative through 2032 by measure. Lifetime savings for the Initiative are 2,700 MWh.

Table 148. 2019 Behavioral Modification Initiative CPAS and WAML

Measure Category	Measure Life	First-Year Verified Gross MWh	NTGR	CPAS (Verified Net MWh)														
				2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Home Energy Reports	5.0	1,061	N/A		1,061	783	484	257	115	0	0	0	0	0	0	0	0	0
Total		**1,061**	**N/A**		**1,061**	**783**	**484**	**257**	**115**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Expiring 2019 CPAS					**0**	**278**	**299**	**228**	**142**	**115**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Expired 2019 CPAS					**0**	**278**	**577**	**804**	**946**	**1,061**	**1,061**	**1,061**	**1,061**	**1,061**	**1,061**	**1,061**	**1,061**	**1,061**
WAML	**5.0**																	

HVAC

Table 151 provides CPAS for the 2019 HVAC Initiative through 2047 by measure. Lifetime savings for the Initiative are 83,825 MWh.

Table 149. 2019 HVAC Initiative CPAS and WAML

Measure Category	Measure Life	First-Year Verified Gross MWh	NTGR	CPAS (Verified Net MWh)														
				2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
ASHP Standard	16.0	284	0.641		182	182	182	182	182	182	182	182	182	182	182	182	182	182
ASHP ER (Replaces ASHP)	16.0	315	0.761		240	240	240	240	240	240	54	54	54	54	54	54	54	54
ASHP ER (Replaces Resistance)	16.0	862	0.761		656	656	656	656	656	656	656	656	656	656	656	656	656	656
DHP	15.0	242	0.641		155	155	155	155	155	155	155	155	155	155	155	155	155	155
DHP ER (Replaces ASHP)	15.0	8	0.761		6	6	6	6	6	6	2	2	2	2	2	2	2	2
DHP ER (Replaces Resistance)	15.0	15	0.761		12	12	12	12	12	12	12	12	12	12	12	12	12	12
CAC Standard	18.0	929	0.641		596	596	596	596	596	596	596	596	596	596	596	596	596	596
CAC ER	18.0	3,743	0.761		2,848	2,848	2,848	2,848	2,848	2,848	591	591	591	591	591	591	591	591
Heat Pump Water Heater	15.0	5	0.760		3	3	3	3	3	3	3	3	3	3	3	3	3	3
BPM	15.0	2,237	0.761		1,703	1,703	1,703	1,703	1,703	1,703	1,703	1,703	1,703	1,703	1,703	1,703	1,703	1,703
Advanced Thermostat	11.0	489	N/A		489	489	489	489	489	489	489	489	489	489	489	0	0	0
Total		**9,130**	**0.755**		**6,890**	**6,890**	**6,890**	**6,890**	**6,890**	**6,890**	**4,443**	**4,443**	**4,443**	**4,443**	**4,443**	**3,954**	**3,954**	**3,954**
Expiring 2019 CPAS					**0**	**0**	**0**	**0**	**0**	**0**	**2,447**	**0**	**0**	**0**	**0**	**489**	**0**	**0**
Expired 2019 CPAS					**0**	**0**	**0**	**0**	**0**	**0**	**2,447**	**2,447**	**2,447**	**2,447**	**2,447**	**2,937**	**2,937**	**2,937**

Measure Category	Measure Life	First-Year Verified Gross MWh	NTGR	CPAS (Verified Net MWh)														
				2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047
ASHP Standard	16.0	284	0.641	182	182	0	0	0	0	0	0	0	0	0	0	0	0	0
ASHP ER (Replaces ASHP)	16.0	315	0.761	54	54	0	0	0	0	0	0	0	0	0	0	0	0	0
ASHP ER (Replaces Resistance)	16.0	862	0.761	656	656	0	0	0	0	0	0	0	0	0	0	0	0	0
DHP	15.0	242	0.641	155	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DHP ER (Replaces ASHP)	15.0	8	0.761	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DHP ER (Replaces Resistance)	15.0	15	0.761	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CAC Standard	18.0	929	0.641	596	596	596	596	0	0	0	0	0	0	0	0	0	0	0
CAC ER	18.0	3,743	0.761	591	591	591	591	0	0	0	0	0	0	0	0	0	0	0
Heat Pump Water Heater	15.0	5	0.760	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BPM	15.0	2,237	0.761	1,703	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Advanced Thermostat	11.0	489	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total		**9,130**	**0.228**	**3,954**	**2,078**	**1,187**	**1,187**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Expiring 2019 CPAS				**0**	**1,875**	**892**	**0**	**1,187**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Expired 2019 CPAS				**2,937**	**4,812**	**5,704**	**5,704**	**6,890**	**6,890**	**6,890**	**6,890**	**6,890**	**6,890**	**6,890**	**6,890**	**6,890**	**6,890**	**6,890**
WAML	**16.5**																	

Appliance Recycling

Table 153 provides CPAS for the 2019 Appliance Recycling Initiative through 2032 by measure. Lifetime savings for the Initiative are 20,894 MWh.

Table 150. 2019 Appliance Recycling Initiative CPAS and WAML

Measure	Measure Life	First-Year Verified Gross MWh	NTGR	CPAS (Verified Net MWh)														
				2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Refrigerator Recycling	6.5	4,051	0.520		2,107	2,107	2,107	2,107	2,107	2,107	2,107	1,053	0	0	0	0	0	0
Freezer Recycling	6.5	1,095	0.620		679	679	679	679	679	679	679	340	0	0	0	0	0	0
Total		**5,146**	**0.541**		**2,786**	**2,786**	**2,786**	**2,786**	**2,786**	**2,786**	**2,786**	**1,393**	**0**	**0**	**0**	**0**	**0**	**0**
Expiring 2019 CPAS					**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1,393**	**1,393**	**0**	**0**	**0**	**0**	**0**
Expired 2019 CPAS					**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1,393**	**2,786**	**2,786**	**2,786**	**2,786**	**2,786**	**2,786**
WAML	**6.5**																	

Multifamily

Table 154 provides CPAS for the 2019 Multifamily Initiative through 2032 by measure. Lifetime savings for the Initiative are 12,015 MWh.

Table 151. 2019 Multifamily Initiative CPAS and WAML

Measure	Measure Life	First-Year Verified Gross MWh	NTGR	CPAS (Verified Net MWh)														
				2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Standard LED - In Unit	10.0	148	0.773		114	114	32	32	32	32	32	32	32	32	0	0	0	0
Pipe Insulation	15.0	0	0.794		0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034
Specialty LED - In Unit	10.0	75	0.773		58	58	58	58	58	6	6	6	6	6	0	0	0	0
Reflector LED - In Unit	10.0	7	0.773		6	6	6	6	6	1	1	1	1	1	0	0	0	0
Specialty LED - Common Area	8.4	23	0.773		18	18	18	18	18	1	1	1	1	0	0	0	0	0
Standard LED - Common Area	8.4	158	0.773		122	122	48	48	48	48	48	48	19	0	0	0	0	0
Reflector LED - Common Area	8.4	14	0.773		11	11	11	11	11	2	2	2	1	0	0	0	0	0
Standard LED - Exterior	11.6	24	0.773		18	18	5	5	5	5	5	5	5	5	5	3	0	0
Advanced Power Strip - Tier 1	7.0	56	0.794		44	44	44	44	44	44	44	0	0	0	0	0	0	0
Bathroom Faucet Aerator	10.0	1	1.004		1	1	1	1	1	1	1	1	1	1	0	0	0	0
Kitchen Faucet Aerator	10.0	19	1.004		19	19	19	19	19	19	19	19	19	19	0	0	0	0
Showerhead	10.0	20	1.004		20	20	20	20	20	20	20	20	20	20	0	0	0	0
Advanced Thermostat	11.0	880	1.000		880	880	880	880	880	880	880	880	880	880	880	0	0	0
Total		**1,424**	**0.921**		**1,311**	**1,311**	**1,141**	**1,141**	**1,141**	**1,059**	**1,059**	**1,015**	**984**	**964**	**885**	**3**	**0**	**0**
Expiring 2019 CPAS					**0**	**0**	**170**	**0**	**0**	**82**	**0**	**44**	**30**	**20**	**79**	**881**	**3**	**0**
Expired 2019 CPAS					**0**	**0**	**170**	**170**	**170**	**252**	**252**	**297**	**327**	**347**	**427**	**1,308**	**1,311**	**1,311**
WAML	**10.3**																	

Direct Distribution

Table 155 provides CPAS for the 2019 Direct Distribution Initiative through 2032 by channel. Lifetime savings for the Initiative are 19,620 MWh.

Table 152. 2019 Direct Distribution Initiative CPAS and WAML

Channel	Measure Life	First-Year Verified Gross MWh	NTGR	CPAS (Verified Net MWh)														
				2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
School Kits	8.8	2,014	0.931		1,874	1,874	1,340	1,340	1,340	1,340	1,340	806	806	525	0	0	0	0
Appliance Recycling Kits	8.9	120	1.000		120	120	85	85	85	85	85	48	48	33	0	0	0	0
Community Kits	9.1	980	1.000		980	980	642	641	641	641	641	357	356	356	0	0	0	0
Total		**3,114**	**0.955**		**2,974**	**2,974**	**2,067**	**2,066**	**2,066**	**2,066**	**2,066**	**1,210**	**1,210**	**914**	**0**	**0**	**0**	**0**
Expiring 2019 CPAS					**0**	**0**	**907**	**1**	**0**	**0**	**0**	**856**	**1**	**295**	**914**	**0**	**0**	**0**
Expired 2019 CPAS					**0**	**0**	**907**	**908**	**908**	**908**	**908**	**1,764**	**1,765**	**2,060**	**2,974**	**2,974**	**2,974**	**2,974**
WAML	**8.9**																	

For more information, please contact:

Hannah Howard
Managing Director / V.P.

510-214-0183 tel
510-444-5222 fax
hhoward@opiniondynamics.com

1000 Winter Street
Waltham, MA 02451