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Ameren Illinois Company 2019 Business Program Impact Evaluation Report

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Opinion Dynamics

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1. Executive Summary

This report presents impact evaluation results from Ameren Illinois Company's (AIC) 2019 Business Program. The Business Program is part of AIC's overall portfolio of residential and non-residential energy efficiency programs implemented during 2019. The overarching impact evaluation objective for the 2019 Business Program was to determine 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 (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 offered through the Illinois Power Agency (IPA):** Energy efficiency programs adopted through the IPA procurement plan process and previously available to AIC customers, including numerous small business programs, ended on May 31, 2017.
- **Discontinuation of energy efficiency programs offered through the Illinois Department of Commerce and Economic Opportunity (DCEO):** Prior to the Transition Period (June 1, 2017, to December 31, 2017), public sector nonresidential customers (e.g., schools, government buildings) and 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. Beginning in 2018, public sector AIC customers are fully eligible for the AIC Business Program in the same manner as other AIC customers.
- **Change in eligibility for the largest AIC customers:** As part of FEJA, customers with electric demand of over 10 MW became ineligible for AIC programs as of June 1, 2017. These customers historically provided a majority or near-majority of Business Program electric energy savings, so their exclusion from AIC programs moving forward has had significant effects on the Program and required the Program to generally pursue larger numbers of smaller projects than its past focus. This change particularly affected the Custom Initiative, which historically has derived 50% or more of its energy savings from 10 MW 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 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 not just savings in the short-term, but that persist for an extended period.
- **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 energy efficiency programs in this report in accordance

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

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 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 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 Custom Initiative of the Business Program.

The Business Program is the largest component of AIC's portfolio, and is made up of five key subcomponents, referred to as "initiatives":

- Standard
- Custom
- Retro-Commissioning
- Streetlighting
- Building Operator Certification (BOC)

The initiatives are designed to achieve energy savings from non-residential customers in accordance with AIC's plan filing. The Standard Initiative makes up the bulk of the Business Program in terms of energy savings; it primarily provides prescriptive rebates, energy audits, and direct installation of energy efficient measures to customers. The Custom and Retro-Commissioning Initiatives provide information, technical support, and financial assistance for energy efficiency projects of a more custom nature, while the Streetlighting Initiative seeks to increase adoption of energy efficient streetlights throughout AIC territory. BOC provides education and training to customers to encourage more energy efficient operation of facilities, and can lead to energy efficient actions being taken by customers without further AIC support.

The Opinion Dynamics team ("the evaluation team") conducted impact evaluations of all five initiatives in 2019.

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.

[2] Ibid.
[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.

1.2.1 Annual Savings

The 2019 Business Program achieved 206,629 MWh, 33.25 MW, and 2,445,203 therms in verified net savings. These savings are 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 Business Program. The Program had strong performance in 2019, maintaining high gross realization rates for electric energy (99%), electric demand (99%), and natural gas (91%).

Table 1. 2019 Business 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
Standard	200,778	99%	199,497	0.866	172,771
Custom	27,130	102%	27,583	0.822	22,673
Retro-Commissioning	5,322	88%	4,680	0.890	4,165
Streetlighting	4,014	100%	4,014	1.000	4,014
Business Program Subtotal	*237,244*	*99%*	*235,774*	*0.864*	*203,623*
Custom (gas conversion)					2,684
BOC					322
Business Program Total					**206,629**

Table 2. 2019 Business Program Electric Demand Annual Savings Summary

Initiative/Effort	Ex Ante Gross MW	Gross Realization Rate	Verified Gross MW	NTGR	Verified Net MW
Standard	33.89	101%	34.11	0.869	29.64
Custom	4.32	92%	3.96	0.822	3.25
Retro-Commissioning	0.60	54%	0.33	0.890	0.29
Streetlighting	0.00	N/A	0.00	N/A	0.00
Business Program Subtotal	*38.81*	*99%*	*38.40*	*0.864*	*33.18*
BOC					0.06
Business Program Total					**33.25**

Table 3. 2019 Business Program Gas Annual Savings Summary

Initiative/Effort	Ex Ante Gross Therms	Gross Realization Rate	Verified Gross Therms	NTGR	Verified Net Therms
Standard	2,285,498	101%	2,316,720	0.600	1,390,792
Custom	1,487,000	76%	1,131,829	0.939	1,062,788
Retro-Commissioning	83,622	88%	73,197	0.890	65,145
Streetlighting	0	N/A	0	N/A	0
Business Program Subtotal	*3,856,120*	*91%*	*3,521,746*	*0.715*	*2,518,725*
Custom (gas conversion)					(91,598)
BOC					18,076
Business Program Total					**2,445,203**

1.2.2 Cumulative Persisting Annual Savings

Table 4 summarizes CPAS and WAML for the 2019 Business 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. The overall WAML for the 2019 Business Program is 13.3 years.

Table 4. 2019 Business 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	...	
Standard	13.3	199,497	0.866		172,771	172,741	171,413	...	122,623	...	2,158,753
Custom	14.8	27,583	0.822		22,673	22,673	22,618	...	19,644	...	335,275
Custom (gas conversion)	14.4	2,858	0.939		2,684	2,684	2,684	...	2,684	...	38,609
Retro-Commissioning	5.3	4,680	0.000		4,165	4,159	3,946	...	0	...	22,183
Streetlighting	12.0	4,014	1.000		4,014	4,014	4,014	...	3,324	...	42,647
BOC	14.9	322	N/A		322	322	322	...	303	...	4,648
2019 CPAS		**238,954**	**0.865**		**206,629**	**206,592**	**204,997**	**...**	**148,578**	**...**	**2,602,116**
Expiring 2019 CPAS					**0**	**37**	**1,596**	**...**	**30,826**	**...**	
Expired 2019 CPAS					**0**	**37**	**1,632**	**...**	**58,051**	**...**	
WAML	**13.3**										

[a] Lifetime savings are inclusive of all savings for the entire life of all measures. During 2019, the longest-lived measures installed through the Business Program had a measure life of 26.9 years. Therefore, some CPAS exist through 2045.

2. Evaluation Approach

The following section of the report describes the evaluation approach taken for the 2019 Business 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 2019 program year (generally Version 1.1[4] and Version 7.0, respectively) wherever relevant.[5] Appendix A of this report provides more detailed initiative-specific methodology where appropriate.

The 2019 Business Program impact evaluation approach included initiative-specific activities with the primary goal of estimating gross and net energy and demand impacts. For the Standard and Streetlighting initiatives, the impact evaluation primarily consisted of applying savings algorithms from the IL-TRM V7.0 to final initiative tracking databases to estimate verified gross savings. For the Custom and Retro-Commissioning initiatives, the team primarily employed a combination of engineering desk reviews and on-site verification to estimate verified gross savings. This report also presents the first AIC-specific evaluation of the BOC offering, which used custom impact analysis to determine impacts from projects completed by BOC participants.

2.1 Research Objectives and Evaluation Activities

The overarching research questions for the impact evaluation of AIC's 2019 Business 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. In addition, we reviewed initiative materials and interviewed all initiative managers.

Table 5. 2019 Business Program Impact Evaluation Activities

Initiative	Gross Impacts			Net Impacts	
	IL-TRM Application Review	Engineering Desk Reviews	On-Site M&V	Consumption Analysis	Application of SAG-Approved NTGRs
Standard	✓	✓			✓
Custom		✓	✓	✓	✓
Retro-Commissioning		✓	✓		✓
Streetlighting	✓				✓
Building Operator Certification	✓	✓	✓		

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

[4] 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.

[5] 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 majority of measures delivered through the Standard Initiative, 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 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. Further, 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.

2.2.2 Application of Custom Impact Methods

The Custom, Retro-Commissioning, and BOC initiatives are not suitable for gross impact analysis using the IL-TRM. These initiatives require custom energy savings calculations to determine some or all gross impacts.[6] In addition, for a small number of measures provided through the Standard Initiative during 2019, we conducted engineering desk reviews to determine savings if the measure was not currently included in the IL-TRM. Further details around the custom impact methods applied for these initiatives are presented in Appendix A.

2.3 Verified Net Impact Analysis Approach

To determine verified net savings for the 2019 Business Program, we applied SAG-approved net-to-gross ratios (NTGRs) to verified gross savings. Details on SAG-approved NTGRs applied are presented in Appendix A.

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 error:

- Analysis Error:
  - **Prescriptive Gross Impact Calculations:** 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.
  - **Custom Gross Impact Calculations:** We determined custom gross impacts using desk reviews and data collected during on-site M&V. To minimize data analysis errors, the evaluation team had all

[6] Note that in most cases, we applied IL-TRM assumptions and measure characterizations for evaluation of Building Operator Certification in accordance with evaluation best practice.

calculations reviewed by a separate team member to verify that calculations were performed accurately.

- **Net Impact Calculations:** For net impact calculations, we applied SAG-approved NTGRs to estimated gross impacts to derive net impacts. To minimize analytical errors, all calculations were reviewed by a separate team member to verify their accuracy.

- **Sampling Error:**
  - **Custom Impact Sample:** The evaluation team completed an impact review for 54 of 156 Custom projects achieving savings in 2019, drawing three waves of stratified samples separately for projects claiming electric and gas savings. For gross impact results, at the 90% confidence level, we achieved a relative precision of 14.4% for electric energy savings, 5.6% for electric demand savings, and 8.4% for gas savings.
  - **Retro-Commissioning Impact Sample:** The evaluation team completed desk reviews for a census (20) of Retro-Commissioning projects, completed a census of on-site visits for Large Facilities and Retro-Commissioning Lite projects, and drew a stratified sample of four Compressed Air projects for on-site M&V. For gross impact results for Compressed Air, at the 90% confidence level, we achieved a relative precision of 2.1% for electric energy savings and 0% (no adjustments made, and therefore no error) for electric demand savings. All gas projects received desk reviews and on-site M&V, and therefore there is no sampling error around gas impacts.
- **Non-Sampling Error:**
  - **Measurement Error:** To minimize data collection error during site visits, the evaluation team used trained engineers and technicians familiar with the equipment covered by the Custom, Retro-Commissioning, and BOC initiatives and the methods used to calculate the gross impacts.

3. Initiative-Level Results

Within the following sections, we present the results of the impact evaluation of the 2019 Business Program initiatives. Each sub-section presents a summary of the initiative's design, participation, and associated electric and natural gas impacts.

3.1 Standard

3.1.1 Initiative Description

Implemented by Leidos, the Standard Initiative offers AIC non-residential customers fixed incentives for the installation of specific energy efficiency measures. Incentives are delivered through several distinct offerings which are described below:

- **Core:** The Core offering covers lighting, variable speed drives (VSDs), HVAC equipment, refrigeration/grocery store equipment, commercial kitchen equipment, steam traps, leak survey and repair, and other measures.
- **Instant Incentives:** Instant Incentives is a midstream offering that offers discounts at the point of sale and covers a variety of standard, specialty, and linear LEDs.
- **Online Store:** Through the Initiative, AIC operates the Online Store that offers all-electric business customers a variety of energy-saving products, such as LEDs, occupancy sensors, advanced thermostats, and advanced power strips.
- **Small Business Direct Install:** Small Business Direct Install (SBDI) became an offering through the Initiative beginning in 2018. SBDI relies on AIC Business Program allies to provide small businesses with a free energy assessment and a simplified process for installing rebated measures.
- **Small Business Energy Performance:** Small Business Energy Performance (SBEP) began as a pilot in 2019. SBEP currently involves the completion of pilot projects in small nonresidential facilities.
- **Green Nozzles:** The Initiative also includes the Green Nozzles offering, which offers free low-flow pre-rinse nozzles to all AIC all-gas business customers, as well as customers in the foodservice sector who use electric water heating.

Summary of Key Implementation Changes in 2019

During 2019, the Standard Initiative implemented the following design and implementation changes relative to 2018:

- The SBDI offering focused almost exclusively on lighting measures. Last year, the offering included non-lighting measures, but allies were not very receptive to making non-lighting measures available.
- For a limited time, AIC provided an installation incentive in addition to the discount on equipment purchased through the Instant Incentives offering.
- Customers received free shipping on purchases through the Online Store, and AIC also provided 19% off of orders for most of 2019.
- In addition to these changes, AIC offered public sector customers higher incentives through the SBDI and Instant Incentives offerings, thereby leading to an increase in public sector participation in 2019. The increased incentives were discontinued in the first half of 2019.

3.1.2 Participation Summary

Table 6 presents participation and ex ante gross savings estimates. We present these data separated by public and private sectors to provide context as to the primary drivers of initiative participation (Table 6). Altogether, the Initiative reported a total of 199,205 MWh, 33.61 MW, and 2,285,499 therms in ex ante gross savings.

Table 6. 2019 Standard Initiative Participation Summary

Offering	Total Projects	Ex Ante Gross Savings		
		MWh	MW	Therms
Private Sector				
Core Offering	1,339	63,092	10.28	2,038,511
Instant Incentives[a,b]	1,283	24,688	5.23	0
Online Store	939	1,209	0.41	34,858
Green Nozzles	8	5	0.00	1,199
SBDI	2,574	60,581	8.95	0
SBEP	2	9	0.00	1,067
Private Sector Subtotal	*6,145*	*149,583*	*24.87*	*2,075,635*
Public Sector				
Core Offering	355	18,100	2.83	197,545
Instant Incentives[a,b]	211	11,995	2.56	0
Online Store	98	91	0.05	1,907
Green Nozzles	27	50	0.00	10,412
SBDI	659	19,387	3.30	0
SBEP	0	0	0.00	0
Public Sector Subtotal	1,350	49,622	8.74	209,864
Total	**7,495**	**199,205**	**33.61**	**2,285,499**

[a] Reported ex ante savings for Instant Incentives in Table 6 represents savings from 2019 sales only and does not include carryover savings. Detailed savings tables later in this section include carryover, and therefore totals may not align.

[b] The count of projects for Instant Incentives is the number of unique participants.

3.1.3 Initiative Annual Savings Summary

Table 7 presents Standard Initiative verified annual savings achieved in 2019. The 2019 Standard Initiative achieved 172,771 MWh, 29.64 MW, and 1,390,792 therms in verified net savings.

Table 7. 2019 Standard Initiative Annual Savings

	Electric Energy Savings (MWh)	Electric Demand Savings (MW)	Gas Savings (Therms)
Ex Ante Gross Savings	200,778	33.89	2,285,498
Gross Realization Rate	99%	101%	101%
Verified Gross Savings	199,497	34.11	2,316,720
NTGR	0.866	0.869	0.600
Verified Net Savings	172,771	29.64	1,390,792

The gross realization rates for electric energy, electric demand, and gas energy savings are all close to 100%, indicating that the verified gross savings are close to the savings reported by the Initiative. The NTGRs of 0.865

for electric energy, 0.868 for electric demand, and 0.600 for therm savings indicate the fraction of verified gross savings that are attributed to Initiative activities.

3.1.4 Initiative Savings Detail

The Standard Initiative incentivized a variety of measures through each of its offerings, as shown in Table 8 through Table 10. The tables present electric energy, electric demand, and gas savings by offering and are followed by a discussion of key drivers of discrepancies between the reported (ex ante) and verified gross savings.

Table 8 shows electric energy savings claimed and verified for each offering in 2019. Lighting remains a primary driver of Standard Initiative savings, accounting for over 90% of Initiative electric savings in 2019.

Table 8. 2019 Standard Initiative Electric Energy Savings by Measure

Offering/Measure Category	Ex Ante Gross Savings (MWh)	Gross Realization Rate	Verified Gross Savings (MWh)	NTGR	Verified Net Savings (MWh)
Core Offering					
Lighting	64,759	100%	64,780	0.778	50,399
HVAC	7,841	102%	8,011	0.557	4,462
Specialty Equipment	1,094	100%	1,099	0.849	933
VSDs	6,516	100%	6,516	0.833	5,427
Steam Traps	0	N/A	0	N/A	0
Leak Survey and Repair	981	90%	888	0.702	623
Core Offering Total	**81,191**	**100%**	**81,293**	**0.761**	**61,844**
Instant Incentives[a]					
Linear LED	32,626	96%	31,473	0.893	28,111
Specialty LED	4,719	100%	4,702	0.886	4,166
Standard LED	912	96%	876	0.855	749
Instant Incentives Total	**38,256**	**97%**	**37,050**	**0.891**	**33,026**
Online Store					
Lighting	914	94%	855	0.831	711
Advanced Thermostats	384	101%	389	0.831	323
Advanced Power Strips	2	100%	2	0.831	1
Online Store Total	**1,299**	**96%**	**1,246**	**0.831**	**1,035**
SBDI					
Lighting	79,945	100%	79,818	0.962	76,785
Non-Lighting	23	100%	23	0.833	19
SBDI Total	**79,968**	**100%**	**79,841**	**0.962**	**76,804**
SBEP Total	**9**	**85%**	**8**	**0.800**	**6**
Green Nozzles Total	**55**	**109%**	**60**	**0.920**	**55**
Standard Initiative Total	**200,778**	**99%**	**199,497**	**0.866**	**172,771**

Note: Totals may not sum, and calculations may not appear correct due to rounding.
[a] Includes carryover savings from PY9, Transition Period, and 2018 programs.

Table 9 shows electric demand savings claimed and verified for each offering in 2019.

Table 9. 2019 Standard Initiative Electric Demand Savings by Measure

Offering/Measure Category	Ex Ante Gross Savings (MW)	Gross Realization Rate	Verified Gross Savings (MW)	NTGR	Verified Net Savings (MW)
Core Offering					
Lighting	10.53	100%	10.56	0.778	8.21
HVAC	1.02	99%	1.01	0.557	0.56
Specialty Equipment	0.09	97%	0.09	0.849	0.07
VSDs	1.36	100%	1.36	0.833	1.14
Steam Traps	0.00	N/A	0.00	N/A	0.00
Leak Survey and Repair	0.11	90%	0.10	0.702	0.07
Core Offering Total	**13.12**	**100%**	**13.12**	**0.767**	**10.06**
Instant Incentives[a]					
Linear LED	6.94	97%	6.74	0.893	6.02
Specialty LED	0.94	100%	0.94	0.886	0.84
Standard LED	0.18	100%	0.17	0.855	0.15
Instant Incentives Total	**8.06**	**98%**	**7.86**	**0.891**	**7.01**
Online Store					
Lighting	0.26	94%	0.24	0.831	0.20
Advanced Thermostats	0.19	102%	0.20	0.831	0.16
Advanced Power Strips	0.00	N/A	0.00	N/A	0.00
Online Store Total	**0.45**	**97%**	**0.44**	**0.831**	**0.37**
SBDI					
Lighting	12.26	104%	12.69	0.962	12.21
Non-Lighting	0.00	N/A	0.00	N/A	0.00
SBDI Total	**12.26**	**104%**	**12.69**	**0.962**	**12.21**
SBEP Total	**0.00**	**225%**	**0.00**	**0.800**	**0.00**
Green Nozzles Total	**0.00**	**N/A**	**0.00**	**N/A**	**0.00**
Standard Initiative Total	**33.89**	**101%**	**34.11**	**0.869**	**29.64**

Note: Totals may not sum, and calculations may not appear correct due to rounding.
[a] Includes carryover savings from PY9, Transition Period, and 2018 programs.

Table 10 shows the gas savings claimed and verified for each offering in 2019. As in recent years, steam trap repair and replacement was a primary driver of Initiative gas savings, accounting for over 80% of Initiative savings.

Table 10. 2019 Standard Initiative Gas Savings by Measure

Offering/Measure Category	Ex Ante Gross Savings (Therms)	Gross Realization Rate	Verified Gross Savings (Therms)	NTGR	Verified Net Savings (Therms)
Core Offering					
Lighting	0	N/A	0	N/A	0
HVAC	329,008	99%	327,052	0.494	161,564
Specialty Equipment	17,444	127%	22,189	0.675	14,978
VSDs	0	N/A	0	N/A	0
Steam Traps	1,889,604	100%	1,889,604	0.608	1,148,879
Leak Survey and Repair	0	N/A	0	N/A	0
Core Offering Total	**2,236,055**	**100%**	**2,238,845**	**0.592**	**1,325,421**
Instant Incentives[a]					
Linear LED	0	N/A	0	N/A	0
Specialty LED	0	N/A	0	N/A	0
Standard LED	0	N/A	0	N/A	0
Instant Incentives Total	**0**	**N/A**	**0**	**N/A**	**0**
Online Store					
Lighting	0	N/A	0	N/A	0
Advanced Thermostats	36,765	178%	65,367	0.831	54,320
Advanced Power Strips	0	N/A	0	N/A	0
Online Store Total	**36,765**	**178%**	**65,367**	**0.831**	**54,320**
SBDI					
Lighting	0	N/A	0	N/A	0
Non-Lighting	0	N/A	0	N/A	0
SBDI Total	**0**	**N/A**	**0**	**N/A**	**0**
SBEP Total	**1,067**	**84%**	**896**	**0.800**	**717**
Green Nozzles Total	**11,612**	**100%**	**11,612**	**0.890**	**10,334**
Standard Initiative Total	**2,285,498**	**101%**	**2,316,720**	**0.600**	**1,390,792**

Note: Totals may not sum and calculations may not appear correctly due to rounding.
[a] Includes carryover savings from PY9, Transition Period, and 2018 programs.

Summary of Savings Discrepancies

Overall, the Standard Initiative achieved gross realization rates of 99%, 101%, and 101% for MWh, MW, and therms savings, respectively. Primary contributors to deviations in realization rates at the offering level are outlined and discussed below.

Core Offering

- Standard Lighting for Business (SLB): The gross realization rate for SLB is 100% for both energy and demand savings.
  - The verified and claimed savings are increased slightly by an incorrect “Exterior” application for some LED measures. For these measures, the evaluation team applied the building type with an "Interior" application based on initiative tracking data. This had a minimal impact on lighting realization rates.
  - Verified savings are also slightly increased by an error in the program tracked fixture wattage assignment for fluorescent exit sign replacements. Program implementers assume an efficient wattage of 9W replacing a 14W dual-sided CFL exit sign. The evaluation team applied the IL-TRM v7.0 "unknown" assumption for efficient and baseline conditions, which is a 4W double-sided LED replacing a 14W double-sided CFL exit sign. This had a minimal impact on lighting realization rates.
- Heating, Ventilation, and Air Conditioning (HVAC): The gross realization rate for HVAC is 102% for electric energy savings and 99% for both demand savings and gas savings.
  - Advanced Thermostat - For gas heating systems, program implementers incorrectly applied the Heating Reduction Factor to fan runtime savings. For electric heating systems, an assumed constant 15,678 kWh heating consumption (~avg of unknown HP and ER); verified used initiative tracking data location and IL-TRM V7.0 tables to determine electric and gas heating consumption.
  - The reduced kW savings is due primarily to a baseline discrepancy for Unitary Air Conditioning measures. For Unitary AC units smaller than 65kbtuh, program implementers applied a SEER 13 based on 2012 IECC Minimum Efficiency Requirements (baseline effective 1/1/2013). Conversely, the evaluation applied SEER 14 based on the Code of Federal Regulations (baseline effective 1/1/2019) and as guided by the IL-TRM V7.0.
  - For High-Efficiency Furnace measures, ex ante calculation applied coincidence factors and annual operating hours from the HVAC Section 4.4 overarching table of building-specific parameters. Conversely, verified calculations applied the measure-specific coincidence factors and operating hours of equipment from section 4.4.11.
- Specialty Equipment (SE): The gross realization rate is 97% for electric demand savings and 127% for gas savings.
  - The reduction in kW savings is due to a difference in coincidence factors between claimed and verified savings for ENERGY STAR Electric Convection Ovens. When measure-specific building type data were unavailable, verified applied conservative coincidence factors (equal to Fast Food Limited Menu 0.32 CF).
  - The increase in therms savings is due to an ENERGY STAR Dishwasher project that under-estimated savings using an unknown mix of assumptions on heating fuel source for the tank and booster. The evaluation team applied the initiative tracking data and cross-referenced information in the implementers tracking database to confirm those assumptions.

- A small increase in kWh savings also occurred due to the implementation team's exclusion of secondary kWh impacts from water supply and wastewater treatment from ex ante calculations.

- Leak Survey and Repair (LSR): The gross realization rate is 90% for both electric energy and demand savings.
  - Ex ante applies a kW/CFM reduction factor specific to the fan motor control type; the evaluation team cannot verify the control type and therefore applies the "unknown" kW/CFM reduction factor, leading to reduced energy and demand savings.

Instant Incentives (II)

- Instant Incentives: The gross realization rate for Instant Incentives measures is 97% for electric energy savings and 98% for electric demand savings.
  - Savings discrepancies are sourced entirely from carryover measures; we observe a 100% realization rate for all Instant Incentives measures rebated in 2019.

Online Store (OS)

- Advanced Thermostat: The gross realization rate for Advanced Thermostats is 101% for energy savings, 102% for demand savings, and 178% for gas savings.
  - Ex ante assumed 100% electric heating and claimed no gas savings; for installations with unknown space heating fuels, the evaluation team assumes a 3% electric and 97% gas mix as guided by the IL-TRM v7.0.

- Lighting: The gross realization rate for Lighting is 94% for electric energy and demand savings.
  - Because the verified analysis could not confirm existing wattages through the Online Store delivery and initiative tracking data, the evaluation team assumed baseline wattages based on the incentivized lamp efficient wattage. The evaluation team applied baseline wattage assumptions following federal standards, such as Energy Independence and Security Act (EISA). Discrepancies occur in 15% of lighting measures and account for nearly all of the difference between claimed and verified savings for Online Store lighting measures.

Small Business Direct Install (SBDI)

- The gross realization rate for the SBDI offering is 100% for electric energy and 104% for electric demand savings.
  - Space Conditioning - Program implementers used a mixture of building type and space conditioning assumptions to determine coincidence factors and waste heat factors for lighting measures. In most cases, the evaluation team confirmed the claimed assumptions. When initiative tracking data indicated a space was not conditioned, the evaluation team applied a coincidence factor and waste heat factor of 1.0, in contrast to the implementation team applying assumptions based on a conditioned space.
  - Building/System Type – For lighting measures, building classification plays a prominent role in determining key factors used in lighting algorithms. Initiative tracking data does not track the HVAC system type needed to identify the appropriate building type for larger buildings. For example, the "Office High Rise" building type should also indicate if the HVAC system has a variable air volume economizer, constant air volume with/without an economizer, or operates fan coil units. When initiative tracking data did not specify the HVAC system type, the evaluation team applied a

generalized and conservative estimate of assumptions from the group of building types, including offices, hospitals, and multifamily.

Small Business Energy Performance (SBEP)

- The SBEP pilot was new in 2019 and treated commercial buildings that are residential in terms of construction (e.g., homes that have been converted into businesses). As a result, the implementation team considered these projects to be custom, but estimated savings using Residential TRM algorithms. The evaluation team supports the methodology being used by the implementation team and recommends it for continued use wherever possible; using Residential TRM algorithms is appropriate for the building stock being treated and provides a high level of transparency. Nevertheless, we noted a number of discrepancies that should be addressed in future years and revised savings accordingly.

  As with all custom projects, savings claims would strongly benefit from a brief explanation of the existing condition and the upgrade being made. Additional information about the facilities (e.g., what the existing heating/cooling systems were, rather than just their efficiencies) will support the claim.

  We summarize key discrepancies observed below.

  - Air sealing and attic insulation adjustment factors were incorrectly specified in a number of cases.
  - Project locations did not match zones chosen for N_cool, N_heat, HDD, and EFLH in a number of cases.
  - Rim joist insulation calculations assumed conditioned space for CDD and HDD parameters. The evaluation team consistently uses unconditioned space when evaluating rim joist insulation across the portfolio and has indicated as such to the implementation team in several past residential evaluations; future discussion of the correct choice of parameter is worthwhile to ensure alignment in future years.

Green Nozzles (GN)

- An increase in kWh savings occurred due to the implementation team's exclusion of secondary kWh impacts from water supply and wastewater treatment from ex ante calculations.

3.1.5 Cumulative Persisting Annual Savings

Table 11 presents CPAS and WAML for the 2019 Standard 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.[7] The WAML for the Initiative is 13.3 years.

Table 11. 2019 Standard CPAS and WAML

Offering	Measure Life	First-Year Verified Gross Savings (MWh)	NTGR	CPAS - Verified Net Savings (MWh)							Lifetime Savings (MWh)
				2018	2019	2020	2021	...	2030	...	
Lighting	12.1	64,780	0.778		50,399	50,384	49,893	...	27,888	...	589,676
HVAC	12.1	8,011	0.557		4,462	4,462	4,462	...	3,456	...	63,172
Specialty Equipment	11.0	1,099	0.849		933	933	933	...	649	...	11,444
VSDs	15.0	6,516	0.833		5,427	5,427	5,427	...	5,427	...	81,411
Leak Survey and Repair	5.0	888	0.702		623	623	623	...	0	...	3,117
Green Nozzles	5.0	60	0.920		55	55	55	...	0	...	276
Instant Incentives[a]	14.2	37,050	0.891		33,026	33,026	33,025	...	29,877	...	468,308
Online Store	9.0	1,246	0.831		1,035	1,035	898	...	38	...	8,155
SBDI	14.0	79,841	0.962		76,804	76,788	76,091	...	55,282	...	933,106
SBEP	18.5	7	0.800		6	6	6	...	4	...	86
2019 CPAS		**199,497**	**0.866**		**172,771**	**172,741**	**171,413**	**...**	**122,623**	**...**	**2,158,753**
Expiring 2019 CPAS					**0**	**30**	**1,328**	**...**	**28,823**	**...**	
Expired 2019 CPAS					**0**	**30**	**1,358**	**...**	**50,148**	**...**	
WAML	**13.3**										

[a] Instant Incentives includes carryover savings from PY9, Transition Period, and 2018.

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

3.1.6 Conclusions and Recommendations

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

- Key Finding #1: Our impact evaluation found electric and gas gross realization rates close to 100% for almost all Initiative components, indicating that the Initiative is tracking its savings and projects accurately. Still, we continue to find minor discrepancies in the database that do not reflect the latest TRM updates.
  - Recommendation: Continue to incorporate all IL-TRM updates and apply the correct measure assumptions consistently across all measures to ensure AIC continues achieving high realization rates.
- Key Finding #2: Initiative tracking data for lighting measures include key parameters required to define EISA backstop baseline variables, including the number of lamps per fixture, the wattage per lamp, and the lumens per lamp for the base and efficient units. However, these fields are not fully populated across all initiative offerings.
  - Recommendation: Continue incorporating these key variables for standard and specialty lighting measures not exempt from the EISA backstop provision across the entire Standard Core initiative tracking data, including within the Instant Incentive, Small Business Direct Install, and Online Store offerings.
- Key Finding #3: The overall approach to calculating savings for the SBEP pilot is well thought out. However, some parameters chosen for estimation of savings were incorrectly specified, and some information valuable for evaluation of projects did not appear present.
  - Recommendation: Continue to use Residential TRM where appropriate to estimate savings for SBEP projects. Carefully validate all parameters moving forward. Provide high-level narrative explanations of projects, if possible, to help clarify the upgrades being made.

3.2 Custom

3.2.1 Initiative Description

The Custom Initiative offers incentives to AIC Business customers for energy efficiency projects involving equipment not covered through the Standard Initiative. The Custom Initiative allows customers to propose additional measures and tailor projects to the specific needs of their facilities. It also provides an avenue for piloting new measures before incorporating them into the Standard Initiative.

Business customers often represent the highest potential for energy savings, but these savings frequently result from highly specialized equipment designed for particular industries or types of facilities. The Custom Initiative allows customers to propose additional measures and tailor projects to their facility and equipment needs.

The Custom Initiative is delivered to customers through several different offerings. Two core offerings provide all the savings claimed through the Initiative:

- The Custom Incentives (or “Core Custom”) offering provides incentives for electric and gas measures not incented through other AIC offerings. Some examples of common Custom measures include

compressed air, Energy Management Systems (EMS), and industrial process measures, including heat recovery, process heat, and improvements to steam systems.

- The New Construction Lighting offering offers additional incentives for lighting measures in new construction projects.

Additionally, AIC offers a number of smaller "incubator" offerings through the Custom Initiative, including Metering and Monitoring, Strategic Energy Management, Feasibility Studies, and Staffing Grants. These offerings typically serve the purpose of engaging AIC's business customers more deeply with energy efficiency and do not typically lead to savings claims.

Summary of Key Implementation Changes in 2019

AIC made a number of changes to the Custom Initiative during the 2019 program year:

- AIC raised incentive levels for the public sector and small business (DS-2) Custom electric projects but maintained the incentive level set in July 2018 for projects completed by private sector customers in 2019. These incentive increases for the public sector, and DS-2 customers were designed to attract them to Custom offerings as these customers did not participate as much in 2018. Participation rates for public sector customers may be relatively lower since they tend to face greater resource constraints and additional project approval hurdles compared to their private sector counterparts. AIC initiative staff reported the increased incentive levels helped to encourage enrollment from customers who may not have otherwise participated. The 2019 Custom Initiative incentives are as follows:
  - AIC maintained incentives at $0.12/kWh for electric measures used in private sector Custom projects, which was the highest level reached in 2018.
  - AIC increased electric incentives for public sector and DS-2 customers to $0.18/kWh.
  - AIC reduced Custom gas incentives from $1.20/therm to $1.00/therm in 2019 for private sector customers. For public sector customers, the Custom gas incentives were increased from $1.20/therm to $2/therm.
  - The incentive for New Construction Lighting Custom projects increased in 2019. Additionally, the per-project cap incentive was increased by $50,000.
  - AIC changed the Custom project eligibility requirements to allow Custom incentives to cover 80% of total project costs in 2019.
  - AIC offered a tiered early completion bonus of 15% for projects completed in the 1st quarter of 2019, 10% for projects completed in the 2nd quarter, and 5% for projects completed in the 3rd quarter.
- AIC and its program implementer emphasized the use of its online Custom project application instead of paper applications.
- AIC initiative and implementation staff reported that the exclusion of 10 MW customers from AIC Business Program eligibility continues to have some ongoing impacts on Custom Initiative operations in 2019.
  - With the exclusion of 10 MW customers, Custom Initiative participants tend to have fewer resources to complete projects. As a result, Custom projects tend to be smaller than before the exclusion applied.

- AIC staff is working on educating smaller customers in specific sectors, such as industrial manufacturing and health care/hospitals, about the Custom Initiative to encourage participation.

3.2.2 Participation Summary

Table 12 presents a summary of the Custom Initiative projects completed and unique customers by each Custom Initiative offering.

Table 12. 2019 Custom Initiative Participation Summary

Offering	Total Projects/ Grants/Participants	Unique Customers[a]	Ex Ante Gross Savings		
			MWh	MW	Therms
Custom Incentive	122[b]	87	21,547	2.78	1,487,000
New Construction Lighting	35	34	5,583	1.54	–
Staffing Grant	34	0	–	–	–
Metering & Monitoring	4	2	–	–	–
Strategic Energy Management	17	17	–	–	–
Feasibility Study	3	2	–	–	–
Building Energy Assessment	4	3			
Total	**219**	**145**	**27,130**	**4.32**	**1,487,000**

[a] Column does not sum to total because some unique customers participated in more than one Custom offering.

[b] Counts presented later in this report reflect 121 completed Custom Incentive projects with savings. One Custom Incentive project partially paid out for 2019 did not claim savings in 2019; AIC expects the project to complete and claim savings in 2020.

Public sector customers became eligible for AIC Initiatives during the Transition Period. Table 13 shows that public sector customers contributed significantly to the Custom Initiative overall project mix; public sector customers were responsible for 27% of the total Initiative projects completed in 2019.

Table 13. 2019 Custom Initiative Participation Summary by Sector

Offering	Total Projects/ Grants/ Participants	
	Public Sector	Private Sector
Custom Incentive	30	92
New Construction Lighting	6	29
Staffing Grant	15	19
Metering & Monitoring	0	4
Strategic Energy Management	5	12
Feasibility Study	0	3
Building Energy Assessment	4	0
Total	**60**	**159**

Analysis of initiative tracking data shows businesses completed the highest percentage of Custom projects (30%) from the manufacturing and industrial sector (Table 14). Similar to 2018, Education customers continue to represent a growing customer segment as public schools became eligible for the Custom Initiative during the Transition Period, and education customers completed the second-largest share of projects in 2019. Projects in the retail and medical sectors also represented larger shares of participants.

Table 14. 2019 Custom Initiative Projects by Organization Type

Organization Type	Share of Total Projects/Grants/Participants (n=219)
Manufacturing/ Industrial	30%
Education	23%
Retail	14%
Medical	12%
Municipality	5%
Grocery	4%
Warehouse	2%
Office	4%
Lodging	<1%
Religious	1%
Other/Unknown	5%

3.2.3 Initiative Annual Savings Summary

Table 15 presents the Custom Initiative annual savings achieved in 2019. The 2019 Custom Initiative achieved 22,673 MWh, 3.25 MW, and 1,062,788 therms in verified net savings.

Table 15. 2019 Custom Initiative Annual Savings

	Electric Energy Savings (MWh)	Electric Demand Savings (MW)	Gas Savings (Therms)
Ex Ante Gross Savings	27,130	4.32	1,487,000
Gross Realization Rate	102%	92%	76%
Verified Gross Savings	27,583	3.96	1,131,829
NTGR[a]	0.822	0.822	0.939
Verified Net Savings	22,673	3.25	1,062,788

3.2.4 Initiative Savings Detail

For the Custom Initiative, we verified initiative participation and gross impacts through desk reviews and on-site M&V of a sample of projects, as described in Appendix A. Site-specific M&V was conducted in three distinct waves with samples independently developed for each wave by fuel type (electric or gas). We used a combined ratio estimator to develop a realization rate for each wave by savings type (presented later in this chapter).[8]

Site-Specific Results

Table 16 presents the results of the gross savings analysis for the 54 Custom Initiative projects we reviewed in 2018. Realization rates for individual projects ranged from 0% to 642% for electric energy and 14% to 176% for gas. Additional detail for a selected set of project reviews are provided in Appendix D of this report.

[8] Cochran, William G. Sampling Techniques. 1977. New York: John Wiley & Sons.

Table 16. 2019 Custom Initiative Gross Impact Results for Sampled Projects

Project ID	Sample			Ex Ante Gross Savings			Gross Realization Rate			Verified Gross Savings		
	Wave	Fuel	Stratum	MWh	MW	Therms	MWh	MW	Therms	MWh	MW	Therms
900004	1	Electric	3	260	0.032	–	100%	100%	–	260	0.032	–
1000068	1	Electric	3	343	0.063	–	129%	100%	–	441	0.063	–
1800123	1	Gas	3	–	–	73,735	–	–	85%	–	–	62,464
1800139	1	Gas	1	–	–	3,794	–	–	98%	–	–	3,721
1800391	1	Gas	2	–	–	14,508	–	–	97%	–	–	14,051
1800506	1	Electric	3	1,118	0.337	–	87%	75%	–	975	0.252	–
1800589	1	Both	3	1,203	0.027	80,893	89%	162%	105%	1,068	0.044	85,221
1800623	1	Gas	3	–	–	26,085	–	–	176%	–	–	46,000
1800738	1	Both	3	214	0.042	24,509	38%	38%	14%	82	0.016	3,380
1801098	1	Electric	3	251	0.029	–	77%	112%	–	193	0.032	–
1801342	1	Electric	3	321	0.037	–	222%	222%	–	711	0.081	–
1801385	1	Electric	1	49	0.010	–	142%	100%	–	70	0.010	–
1801399	1	Electric	3	299	0.056	–	42%	43%	–	125	0.024	–
1801470	1	Gas	3	–	–	42,825	–	–	114%	–	–	49,001
1801519	1	Electric	3	447	0.051	–	91%	167%	–	409	0.085	–
1801554	1	Electric	3	435	0.062	–	0%	0%	–	0	0.000	–
1801673	1	Electric	1	43	0.019	–	166%	108%	–	72	0.020	–
1802041	1	Electric	3	397	0.045	–	41%	41%	–	162	0.019	–
1802141	1	Electric	3	222	0.025	–	59%	54%	–	130	0.014	–
1802324	1	Electric	3	201	0.023	–	100%	190%	–	201	0.044	–
1900012	1	Gas	3	–	–	35,648	–	–	16%	–	–	5,677
1900080	2	Electric	3	657	0.297	–	355%	110%	–	2,331	0.328	–
1900094	1	Electric	3	344	0.039	–	31%	40%	–	106	0.016	–
1900099	3	Electric	3	776	0.380	–	362%	114%	–	2,806	0.433	–
1900111	1	Electric	3	277	0.032	–	81%	63%	–	225	0.020	–
1900122	1	Electric	2	57	0.006	–	33%	0%	–	19	0.000	–
1900133	2	Electric	3	930	0.000	–	60%	N/A	–	560	0.000	–
1900184	2	Electric	1	53	0.022	–	186%	124%	–	98	0.027	–
1900266	2	Gas	1	–	–	5,825	–	–	100%	–	–	5,825
1900325	1	Electric	2	83	0.037	–	98%	63%	–	82	0.023	–
1900345	2	Gas	2	–	–	212,520	–	–	18%	–	–	38,102
1900350	3	Gas	2	–	–	115,263	–	–	41%	–	–	47,830
1900351	3	Gas	2	–	–	257,544	–	–	100%	–	–	257,544
1900352	3	Gas	2	–	–	260,913	–	–	100%	–	–	260,913
1900404	2	Electric	1	9	0.010	–	642%	94%	–	55	0.010	–
1900419	3	Electric	3	590	0.067	–	75%	42%	–	443	0.029	–
1900449	2	Electric	2	213	0.045	–	62%	98%	–	131	0.044	–
1900451	2	Gas	2	–	–	10,661	–	–	107%	–	–	11,427

Project ID	Sample			Ex Ante Gross Savings			Gross Realization Rate			Verified Gross Savings		
	Wave	Fuel	Stratum	MWh	MW	Therms	MWh	MW	Therms	MWh	MW	Therms
1900455	3	Electric	3	1,359	0.199	–	85%	80%	–	1,156	0.159	–
1900485	2	Gas	2	–	–	10,196	–	–	105%	–	–	10,741
1900493	3	Both	2	279	0.000	67,256	100%	N/A	29%	279	0.000	19,685
1900516	2	Electric	3	452	0.052	–	103%	-5%	–	464	-0.003	–
1900538	2	Electric	3	1,483	0.181	–	23%	46%	–	335	0.082	–
1900546	2	Electric	1	50	0.002	–	3%	0%	–	1	0.000	–
1900714	2	Electric	2	185	0.005	–	5%	0%	–	10	0.000	–
1900743	2	Electric	1	75	0.023	–	43%	83%	–	32	0.019	–
1900759	2	Gas	2	–	–	16,572	–	–	140%	–	–	23,120
1901040	3	Both	2	1,013	0.046	60,415	125%	125%	166%	1,262	0.058	100,581
1901046	3	Electric	3	423	0.048	–	100%	157%	–	423	0.076	–
1901174	3	Electric	1	19	0.003	–	64%	64%	–	12	0.002	–
1901214	3	Electric	3	516	0.060	–	86%	86%	–	444	0.052	–
1901468	3	Electric	2	191	0.022	–	95%	100%	–	183	0.022	–
1901795	3	Gas	1	–	–	13,430	–	–	45%	–	–	6,101
1901796	3	Electric	1	82	0.009	–	69%	100%	–	57	0.009	–

Overall Results

We used a combined ratio estimation technique[9] to estimate gross realization rates for each wave by fuel type. Table 17 presents realization rates by wave and fuel type.

Table 17. 2019 Custom Initiative Realization Rates by Wave and Fuel Type

Wave	kWh	kW	Therms
1	90%	84%	90%
2	86%	85%	38%
3	119%	100%	82%

Applying these gross realization rates to the population of projects in each wave produced verified gross savings for the Initiative, presented in Table 18, Table 19, and Table 20.

Table 18. 2019 Custom Initiative Electric Energy Savings by Wave

Wave	Ex Ante Gross MWh	Gross Realization Rate	Verified Gross MWh	NTGR	Verified Net MWh
1	7,608	89.9%	6,839	0.822	5,622
2	7,516	85.9%	6,455	0.822	5,306
3	12,006	119.0%	14,288	0.822	11,745
Total	**27,130**	**101.7%**	**27,583**	**0.822**	**22,673**

[9] Cochran, William G. *Sampling Techniques.* 1977. New York: John Wiley & Sons.

Table 19. 2019 Custom Initiative Electric Demand Savings by Wave

Wave	Ex Ante Gross MW	Gross Realization Rate	Verified Gross MW	NTGR	Verified Net MW
1	1.14	84.3%	0.96	0.822	0.79
2	1.14	85.1%	0.97	0.822	0.79
3	2.04	99.6%	2.03	0.822	1.67
Total	**4.32**	**91.7%**	**3.96**	**0.822**	**3.25**

Table 20. 2019 Custom Initiative Gas Savings

Wave	Ex Ante Gross Therms	Gross Realization Rate	Verified Gross Therms	NTGR	Verified Net Therms
1	353,156	90.5%	319,441	0.939	299,955
2	261,584	37.7%	98,662	0.939	92,644
3	872,260	81.8%	713,726	0.939	670,189
Total	**1,487,000**	**76.1%**	**1,131,829**	**0.939**	**1,062,788**

3.2.5 Cumulative Persisting Annual Savings

The following tables present CPAS and WAML for the 2019 Custom Initiative. The total verified gross savings for the Initiative are summarized, and CPAS in each year of the 2018-2021 Plan are presented.[10] In 2019, AIC converted natural gas savings produced by five Custom Initiative projects to CPAS for the purposes of goal attainment; those savings are presented separately.

The evaluation team reviewed and adjusted measure lives provided by the implementation team for all sampled projects and calculated an adjustment to measure life based on that review that was then applied to all projects in the population. That adjustment was applied population-wide.[11] Further detail on this adjustment is provided in Appendix A.

Table 21 presents initial electric CPAS and WAML for the 2019 Custom Initiative.

Table 21. 2019 Custom Initiative Initial Electric 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	...	
Custom Incentives	15.4	21,661	0.822		17,806	17,806	17,750	...	17,160	...	274,277
New Construction Lighting	12.5	5,921	0.822		4,867	4,867	4,867	...	2,484	...	60,998
2019 CPAS		**27,583**	**0.822**		**22,673**	**22,673**	**22,618**	**...**	**19,644**	**...**	**335,275**
Expired 2019 CPAS					**0**	**0**	**55**	**...**	**2,973**	**...**	
Expiring 2019 CPAS					**0**	**0**	**55**	**...**	**3,029**	**...**	
WAML	**14.8**										

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

[11] The summary CPAS spreadsheet attached to this report also presents estimates of CPAS at the individual project level for all 156 projects in the 2019 Custom Initiative. However, please note that similar to savings adjustments made for the Custom Initiative and consistent with best evaluation practice, those adjustments are made population-wide rather than on a per-project basis, and therefore individual adjustments to measure life made through evaluation are not applied to specific projects.

Table 23 presents CPAS and WAML for gas savings converted to CPAS from the 2019 Custom Initiative.

Table 22. 2019 Custom Initiative Initial Electric 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	...	
Custom Gas Conversion	14.4	2,858	0.822		2,684	2,684	2,684	...	2,684	...	38,609
2019 CPAS		**2,858**	**0.822**		**2,684**	**2,684**	**2,684**	**...**	**2,684**	**...**	**38,609**
Expiring 2019 CPAS					**0**	**0**	**0**	**...**	**0**	**...**	
Expired 2019 CPAS					**0**	**0**	**0**	**...**	**0**	**...**	
WAML	**14.4**										

3.2.6 Conclusions and Recommendations

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

- Key Finding #1: We observed fewer very low realization rates on electric projects in 2019 as compared to the 2018 evaluation. In the 2018 evaluation, we recommended that the implementation team improve several items in the documentation of major custom projects to avoid evaluation risk. While fewer critical project challenges were observed in 2019, a number of projects did still exhibit significant deviations from ex ante estimates, and the evaluation team, therefore, reiterates the following recommendation:
  - Recommendation: The evaluation team expects that Custom Initiative project savings claims include a number of key components: 1) a full articulation of the baseline conditions chosen for a project (including reasoning to support why the chosen baseline is appropriate), 2) a clear explanation of what was (or will be) done to improve energy efficiency, and 3) a firm understanding of planned/actual post-implementation operating conditions. In the absence of one or more of these components, Custom Initiative projects are subject to significant evaluation risk.
- Key Finding #2: In many cases, the ex ante demand reductions that are reported are average demand reductions and do not appropriately account for the coincident peak demand period as defined in the IL-TRM V7.0.
  - Recommendation: Start moving toward reporting and evaluating coincident peak demand impacts. The industry as a whole needs to focus more on coincident peak demand as more renewables and other distributed generation come onto the grid. Moreover, new legislation or regulations regarding coincident peak demand reduction requirements could be introduced in Illinois at any time. Starting to move in the direction of reporting and evaluating coincident peak demand instead of average demand now will allow AIC to plan out coincidence and other needed studies over time instead of all at once when some new need is identified, or regulation is introduced, and ensure that demand savings claims are aligned between prescriptive and custom programs. This is an item for future discussion between the evaluation team and the implementation team.

3.3 Retro-Commissioning

3.3.1 Initiative Description

The Retro-Commissioning Initiative helps AIC business customers evaluate their existing mechanical equipment, energy management, and industrial compressed air systems to identify no-cost and low-cost efficiency measures to optimize existing energy-using systems.

Over time, deferred maintenance and changing operating directives and practices can lead to inefficient operation of building systems. Retro-commissioning is a process that examines current operations relative to the needs of equipment owners and those served by the equipment and determines opportunities for increasing equipment efficiency through maintenance, system tune-ups, scheduling, and optimization of operations. Most of the identified measures require little, if any, capital funds to implement. Secondary objectives of the Initiative include:

- Channeling participation into other AIC initiatives to implement cost-effective equipment replacements and retrofits.
- AIC offers an additional bonus to customers who complete a Custom project within a year of having completed a retro-commissioning study.
- Developing a network of Retro-Commissioning Service Providers (RSPs) that will continue to operate in the AIC service territory.
- Major market barriers to these energy efficiency opportunities are lack of awareness and the cost of the detailed engineering studies. Furthermore, even with a quality study in-hand, customer apathy can inhibit the implementation of recommendations despite being no-cost. To overcome these barriers, the Initiative subsidizes RSP studies and publicizes the benefits of retro-commissioning to foster a market for the services, with utility-certified RSPs providing the marketing outreach. AIC incentives pay for 70%–100% of the study cost, and implementation incentives are paid at a level of $0.02/kWh and between $0.30 - $0.40/therm depending on the offering (Table 23).

During 2019, the Retro-Commissioning Initiative had five subcomponents:

- **Compressed Air Retro-Commissioning.** The Compressed Air offering provides incentives to defray the cost of a retro-commissioning study of compressed air equipment, leading to the implementation of low-cost/no-cost energy efficiency measures for existing compressed air systems. Typical measures include leak repair, installation of zero-loss drains, and installation or tune-up of compressed air system controls.
- **Industrial Refrigeration Retro-Commissioning.** The Industrial Refrigeration offering provides incentives to defray the cost of a retro-commissioning study of industrial refrigeration equipment, leading to the implementation of low-cost/no-cost energy efficiency measures for existing industrial refrigeration systems. Typical measures include lowering condensing pressure, raising suction pressure, evaporator fan control, evaporator defrost settings, and compressor sequencing.
- **Large Facilities Retro-Commissioning.** The Large Facilities offering has historically targeted two separate types of facilities: healthcare facilities and large commercial facilities (primarily offices). Healthcare facilities represent a major opportunity for energy savings in AIC territory and historically have driven this offering. Typical measures include energy management system (EMS) settings adjustments to optimize the operation of HVAC systems. Since the passage of FEJA (SB2814), the Large Facilities offering also targets public sector facilities (e.g., schools), as do the other Retro-Commissioning offerings.

  Large Facilities retro-commissioning projects go through a screening phase that examines the feasibility of retro-commissioning at the facility. Sites with good savings potential are eligible to apply to the Initiative after AIC reviews the project. RSPs commit resources to this deliverable, which may or may not result in a viable retro-commissioning project. To defray the financial risk to the RSP and to encourage the RSPs to market the Initiative more aggressively, AIC pays a screening stipend of 5 to 10% of the retro-commissioning study cost to the RSP for complex projects. This stipend does not require a commitment to implement a project and does not necessarily mean that energy savings will be achieved in future years.
- **Retro-Commissioning Lite.** Beginning in 2018, the Retro-Commissioning Initiative began offering an option to smaller facilities that would not qualify for the Large Facilities offering. To date, there has been one Retro-Commissioning Lite project completed in AIC territory.
- **Grocery Store Retro-Commissioning.** Beginning in PY7 (2014-2015), the Retro-Commissioning Initiative began to offer retro-commissioning to grocery stores under a separate offering. This offering

is similar to the Large Facilities offering with relaxed facility size requirements and an increased focus on refrigeration systems. To date, this offering has not had any activity. In 2020, the Grocery Store Retro-Commissioning offering will be rolled into the Retro-Commissioning Lite offering.

Table 23. Retro-Commissioning Initiative Incentive Structure

Offering	Survey Incentive	Customer Implementation Incentive	Incentive Requirements
Compressed Air	80% of survey cost	▪ 2¢/kWh saved	▪ Payback period of 0–1 year ▪ Measure must be complete before incentive is paid
Industrial Refrigeration	70% of survey cost	▪ 2¢/kWh saved	▪ Payback period of 0–1 year ▪ Measure must be complete before incentive is paid
Large Facilities	70% of survey cost 5 - 10% of survey cost as "stipend" to RSP for complex projects	▪ 2¢/kWh ▪ 30¢/therm	▪ Payback period of 0–1 year ▪ Measure must be complete before incentive is paid ▪ Measures do not need to be complete for stipend to be paid
Grocery Store	90% of survey cost	▪ 2¢/kWh ▪ 40¢/therm	▪ Payback period of 0–1 year ▪ Measure must be complete before incentive is paid
Lite	100% of survey cost, capped at $15,000	▪ 2¢/kWh ▪ 30¢/therm	▪ Payback period of 0–1 year ▪ Measure must be complete before incentive is paid

Summary of Key Implementation Changes in 2019

The Retro-Commissioning Initiative did not go through any major implementation changes in 2019. Initiative design and incentives remained consistent with the 2018 Initiative. Notably, the Retro-Commissioning Lite offering did have its first participant in 2019.

3.3.2 Participation Summary

Table 24 summarizes Retro-Commissioning Initiative participation during 2019. During 2019, projects were completed in the Compressed Air, Large Facilities, and Retro-Commissioning Lite offerings. No projects were completed in the Grocery Store or Industrial Refrigeration offerings.

Table 24. 2019 Retro-Commissioning Participation Summary

Offering	Projects [a]	Ex Ante Gross Savings			
		MWh	%	Therms	%
Compressed Air	16	4,252	80%	0	–
Industrial Refrigeration	0	0	–	0	–
Large Facilities	3	961	18%	68,044	81%
Grocery	0	0	–	0	–
Lite	1	108	2%	15,578	19%
Total	**20**	**5,322**	–	**83,622**	–

[a] The project count reflects all projects with savings in 2019, which does not include four projects that only received a stipend.

The Retro-Commissioning Initiative has existed since the inception of the AIC portfolio in 2008. The Initiative has maintained consistent, but relatively low participation over its life. Notably, however, the exclusion of 10 MW customers from AIC's programs beginning in the Transition Period has significantly affected the overall savings achieved by the Initiative, which declined significantly after PY9 (2016-2017). Table 25 shows historic Retro-Commissioning participation for PY1 through 2019.

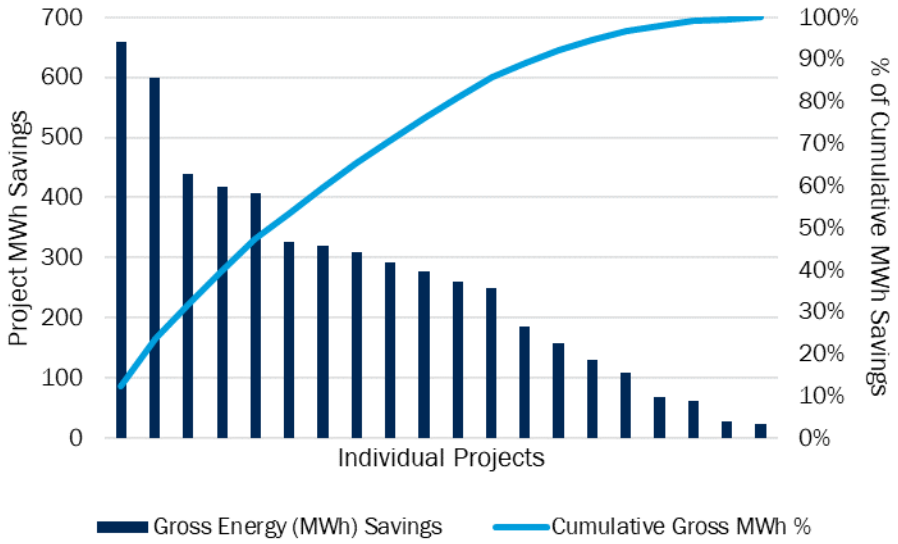
Table 25. Summary of Past Program Participation

Program Year	Projects [a]	Ex Ante Gross Savings	
		MWh	Therms
PY1 (2008-2009)	1	2,045	0
PY2 (2009-2010)	17	10,640	0
PY3 (2010-2011)	21	29,819	0
PY4 (2011-2012)	25	19,273	412,666
PY5 (2012-2013)	35	29,257	577,834
PY6 (2013-2014)	26	12,091	248,851
PY7 (2014-2015)	16	10,175	226,171
PY8 (2015-2016)	19	12,193	514,070
PY9 (2016-2017)	21	10,741	252,564
Transition Period	6	932	266,604
2018	12	5,992	190,552
2019	20	5,322	83,622

[a] This project count reflects projects with associated savings. A number of projects listed in the AIC database as paid have no associated savings — the vast majority of which are "stipend" projects.

Project data show that in 2019, initiative savings were less reliant on large projects than in past years. The Initiative completed more projects in 2019 than in 2018, and savings were more evenly distributed (Figure 1). Gas savings are dependent on only two Large Facilities projects and one Retro-Commissioning Lite project in 2019.

Figure 1. Annual Project and Cumulative Initiative Ex Ante Electric Savings



The evaluation team notes that in addition to the 20 completed projects in 2019, four stipends were paid, all in the Large Facility Retro-Commissioning offering.

3.3.3 Initiative Annual Savings Summary

In 2019 the Retro-Commissioning Initiative achieved verified net savings of 4,165 MWh, 0.290 MW, and 65,145 therms. Table 26 presents the Retro-Commissioning Initiative's annual savings achieved in 2019.

Table 26. 2019 Retro-Commissioning Initiative Annual Savings

	Energy Savings (MWh)	Demand Savings (MW)	Gas Savings (Therms)
Ex Ante Gross Savings	5,322	0.602	83,622
Gross Realization Rate	88%	54%	88%
Verified Gross Savings	4,680	0.326	73,197
NTGR	0.890	0.890	0.890
Verified Net Savings	4,165	0.290	65,145

3.3.4 Initiative Savings Detail

The Retro-Commissioning Initiative completed 20 projects through three of the five available Retro-Commissioning offerings in 2019. Table 27 presents each project, outlines the review type we completed, and presents ex ante and verified savings.

Table 27. 2019 Retro-Commissioning Initiative Project Results

Project ID	Project Type	Review Type	Ex Ante Gross Savings			Gross Realization Rate			Verified Gross Savings		
			MWh	MW	Therms	MWh	MW	Therms	MWh	MW	Therms
1800147	Compressed Air	Desk review only	291	0.034	0	56%	53%	N/A	162	0.018	0
1801273		Desk review only	158	0.018	0	94%	90%	N/A	148	0.017	0
1801464		Desk review only	27	0.012	0	104%	100%	N/A	28	0.012	0
1801577		Site visit	63	0.007	0	103%	98%	N/A	65	0.007	0
1801926		Desk review only	310	0.036	0	91%	100%	N/A	282	0.036	0
1801951		Desk review only	250	0.029	0	99%	95%	N/A	246	0.028	0
1802138		Desk review only	186	0.021	0	98%	94%	N/A	183	0.020	0
1900310		Desk review only	320	0.037	0	100%	96%	N/A	320	0.036	0
1900562		Desk review only	67	0.008	0	85%	96%	N/A	58	0.007	0
1900690		Site visit	326	0.037	0	89%	85%	N/A	289	0.032	0
1900903		Site visit	439	0.073	0	93%	50%	N/A	406	0.036	0
1900904		Desk review only	418	0.069	0	85%	41%	N/A	356	0.029	0
1900950		Desk review only	131	0.021	0	94%	64%	N/A	123	0.014	0
1901013		Site visit	407	0.046	0	88%	13%	N/A	359	0.006	0
1901092		Desk review only	259	0.041	0	67%	51%	N/A	174	0.021	0
1901093		Desk review only	600	0.068	0	80%	12%	N/A	483	0.008	0
1000346	Large Facilities	Desk review only	23	0.000	0	100%	N/A	N/A	23	0.000	0
1900005		Site visit	660	0.008	55,688	97%	0%	100%	642	0.000	55,688
1900333		Site visit	278	0.005	12,356	81%	0%	89%	224	0.000	10,978
1901122	Lite	Site visit	108	0.029	15,578	100%	0%	100%	108	0.000	15,578
Total			**5,322**	**0.602**	**83,622**	**88%**	**54%**	**98%**	**4,680**	**0.326**	**82,244**

3.3.5 Cumulative Persisting Annual Savings

Table 28 presents CPAS and WAML for the 2019 Retro-Commissioning Initiative. The measure-specific and total verified gross savings for the Retro-Commissioning Initiative are summarized, and CPAS in each year of the 2018-2021 Plan are presented.[12] The WAML for the Initiative is 5.3 years.

Table 28. 2019 Retro-Commissioning Initiative CPAS and WAML

Offering	Measure Life	First-Year Verified Gross Savings (MWh)	NTGR	CPAS - Verified Net Savings (MWh)							Lifetime Savings (MWh)
				2018	2019	2020	2021	...	2030	...	
Compressed Air Retro-Commissioning	4.7	3,682	0.890		3,277	3,270	3,058	...	0	...	15,520
Large Facilities Retro-Commissioning	7.5	890	0.890		792	792	792	...	0	...	5,941
Retro-Commissioning Lite	7.5	108	0.890		96	96	96	...	0	...	722
2019 CPAS		**4,680**	**0.890**		**4,165**	**4,159**	**3,946**	**...**	**0**	**...**	**22,183**
Expiring 2019 CPAS					**0**	**7**	**213**	**...**	**0**	**...**	
Expired 2019 CPAS					**0**	**7**	**219**	**...**	**4,165**	**...**	
WAML	**5.3**										

The evaluation team reviewed measure lives provided by the implementation team for 2019 Retro-Commissioning projects and determined that no adjustments were necessary.[13]

[12] For further detail, including achieved CPAS in years not presented in this table, please see the summary CPAS spreadsheet attached to this report.
[13] Unlike the Custom Initiative, for which only a sample of projects had measure lives reviewed, we reviewed measure lives for all 20 Retro-Commissioning Initiative projects.

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 Retro-Commissioning Initiative moving forward:

- Key Finding #1: One RSP has a consistent error of using average kW instead of marginal kW in their kWh calculations, which inflates both kW and kWh savings. This affects the not only the RCx program negatively, but also the Custom program.
  - The RSP has created an Excel Leak Savings calculator using the inflated savings rate for compressed air leak repair that they give to the customer. The calculator looks professional and customers assume the savings are correct and vetted by the program, since it is being used by an accepted RSP.
  - The studies by this RSP include both RCx measures and Custom measures. They calculate savings for capital projects, and then subtract off the inflated savings generated by the Leak Savings calculator. The effect is to understate the savings eligible for a custom rebate.
  - Recommendation: The program should review and vet both calculators from this provider, but especially the Leak calculator they are providing the customer.
- Key Finding #2: There is a significant difference between the two primary RSPs for the CARx program in both the quantity of leaks and the size of the leaks detected. The RSP referenced in Key Finding #1 had a significant amount of large and extra-large leaks, which increase savings. While no correction was made for this in the evaluation, it does raise the question of consistency within RSPs.
  - Ensure training is provided for RSP on leak detection equipment.
- Key Finding #3: RSPs need to improve the documentation for demonstrating implementation of measures. RSPs that are providing Compressed Air surveys do a good job of documenting leak repair, but fail to provide documentation on other recommendations such as pressure reduction or reducing hours of operation; Large Facility RSPs are improving their baseline documentation, but need to provide more post implementation documentation.
- Key Finding #4: Many RSPs for the program have developed standard calculators they are using for analysis of savings. In general, they are based on accepted engineering principles and provide sound results. However, RSPs consistently leave the baseline operating parameters and/or equipment specifications from previous projects in the calculators and/or have a calculation error that consistently cause overstatement of savings.
  - Recommendation: Consider providing a review and vetting of the RSPs calculators to correct calculation errors, standardize an inputs page and provide accepted inputs if data is not measured.

3.4 Streetlighting

3.4.1 Initiative Description

Made available to AIC customers for the first time in 2018, the Streetlighting Initiative incentivizes municipal customers to upgrade their streetlighting fixtures to LED technology. High-intensity discharge (HID) lighting is still the standard technology used for streetlighting in the United States. As such, the Initiative targets existing streetlighting and other outdoor lighting for upgrades from HID to LED technology.

The Initiative targets both municipal customers who own their streetlighting fixtures and municipal customers with AIC-owned streetlighting fixtures. In both cases, the Initiative provides incentives for customers to upgrade their lighting. AIC currently replaces streetlights it owns with LED technology upon burnout at no cost to customers. Early replacement of these streetlights is available to customers through the Initiative for a per-fixture fee. The Initiative incentivizes customers to request early replacement of these fixtures and provides an incentive to decrease the per-fixture cost to customers.

Summary of Key Implementation Changes in 2019

The second year of this program continued outwardly unchanged from 2018. The only notable difference is that achieved savings increased 145 percent year-over-year. This marked increase in achieved savings may be attributed in part to the program ramping up from its launch in 2018 and to the increased incentive rates offered for these measures.

3.4.2 Participation Summary

Table 29 summarizes Streetlighting participation during 2019, including subtotals for fixtures that are owned by the municipality versus those owned by AIC. The measure counts are based on the total quantity of LED fixtures installed.

Table 29. 2019 Streetlighting Initiative Participation Summary

Participation	Unique Participants	Project Count	Measure Count
Municipality-Owned Streetlighting	8	23	870
Utility-Owned Streetlighting	26	28	4,703
Total	**34**	**51**	**5,573**

The Streetlighting Initiative had significantly more participation in the 2019 program year compared to 2018 and generated 4,014 MWh in ex ante electric energy savings. Initiative staff reported that the tariff that requires AIC to replace utility-owned HID streetlights with LEDs on burnout creates a high barrier to participation in the Utility-Owned Streetlighting component of the Initiative. Although 2019 savings are significantly increased as compared to 2018, the alternative for participants to wait a brief period (a few years at most) to receive near-term free replacements is still a barrier to achieving the stated savings target.

3.4.3 Initiative Annual Savings Summary

Table 30 presents Streetlighting's annual savings achieved in 2019. The 2019 Streetlighting Initiative achieved 4,014 MWh in verified gross savings, with an associated gross realization rate of 100%. The SAG approved net-to-gross ratio for this measure is one (1.0), and therefore verified net savings are also 4,014 MWh.[14]

Table 30. 2019 Streetlighting Initiative Annual Savings

	Electric Energy Savings (MWh)	Electric Demand Savings (MW)	Gas Savings (Therms)
Ex Ante Gross Savings	4,014	0	0
Gross Realization Rate	100%	N/A	N/A
Verified Gross Savings	4,014	0	0
NTGR	1.000	N/A	N/A
Verified Net Savings	4,014	0	0

Streetlights are almost always off at the time of utility system peak demand. Therefore, the utility peak coincidence factor is zero, as defined in IL-TRM V7.0. In turn, the resulting electric demand savings are also zero.

3.4.4 Initiative Savings Detail

The Streetlighting Initiative distributed LED streetlighting measures in four categories, shown in Table 31. Utility-Owned Streetlighting projects achieved the majority (78%) of the 2019 savings.

Table 31. 2019 Streetlighting 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)
Municipality-Owned: ENERGY STAR or DLC Standard Tier	386	100%	386	1.00	386
Municipality-Owned: DLC Premium Tier	496	100%	496	1.00	496
Utility-Owned Streetlighting Replacing HPS	2,208	100%	2,208	1.00	2,208
Utility-Owned Streetlighting Replacing Mercury Vapor	924	100%	924	1.00	924
Total	**4,014**	**100%**	**4,014**	**1.00**	**4,014**

[14] Net-to-Gross-Ratio for this measure is documented by the SAG, here: www.ilsag.info/ntg_2019/

3.4.5 Cumulative Persisting Annual Savings

Table 32 presents CPAS and WAML for the 2019 Streetlighting Initiative. The measure-specific and total verified gross savings for the Initiative are summarized, and CPAS in each year of the 2019-2021 Plan are presented.[15] The WAML for the Initiative is 12.0 years.

A baseline shift occurs in 2023 for measures installed as early replacement of mercury vapor lamps. IL-TRM V7.0 stipulates that mercury vapor lamps have a four-year remaining useful life. Because Table 32 is an abbreviated version of the full CPAS table, this adjustment only appears in the column for 2030.

Table 32. 2019 Streetlighting 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	...	
BPL16 Municipality-Owned Streetlighting: DLC Standard Tier - Dusk to Dawn Operation	12.0	386	1.000		386	386	386	...	386	...	4,626
BPL23 Municipality-Owned Streetlighting: DLC Premium Tier - Dusk to Dawn Operation	12.0	496	1.000		496	496	496	...	496	...	5,950
BPL27 Utility-Owned Streetlighting - Dusk to Dawn Operation	12.0	2,208	1.000		2,208	2,208	2,208	...	2,208	...	26,498
BPL27 Utility-Owned Streetlighting - Replacing Mercury Vapor - Dusk to Dawn Operation	12.0	924	1.000		924	924	924	...	234[a]	...	5,573
2019 CPAS		**4,014**	**1.000**		**4,014**	**4,014**	**4,014**	**...**	**3,324**	**...**	**42,647**
Expiring 2019 CPAS					**0**	**0**	**0**	**...**	**0**	**...**	
Expired 2019 CPAS					**0**	**0**	**0**	**...**	**690**	**...**	
WAML	**12.0**										

[a] A baseline shift occurs in 2023 for measures installed as early replacement of mercury vapor lamps. IL-TRM V7.0 stipulates that mercury vapor lamps have a four-year remaining useful life (footnote 825 stipulates RUL is one third of the ECM measure life).

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

3.4.6 Conclusions and Recommendations

The overall performance of the program has improved substantially relative to the 2018 results. The 2019 realization rate is 100%, and both participation and total savings have increased.

The evaluation team also checked progress on the implementation of the previous year's recommendations. Based on our file reviews and database validation, the evaluation team found that the previous issue with fixture wattages that were incorrectly entered into the program database has been resolved.

- Key Finding #1: The 2019 Streetlighting Initiative has grown and improved relative to the previous year.
  - Recommendation: Continue to reach out to owners of roadway lighting in the AIC territory and ensure potential participants are aware of the opportunity to decrease energy and maintenance costs by installing LED streetlights.
- Key Finding #2: Replacement of utility-owned HPS streetlighting now makes up a substantial portion of the savings achieved by this program. As defined by IL-TRM V7.0, the assumed baseline for these measures is HPS for the life of the measure (12 years).

  We note that the existing HPS lamps being replaced have a limited remaining useful life. Furthermore, our current understanding of AIC's management of its streetlighting fixtures is that AIC will replace utility-owned HPS streetlights with LED fixtures upon burnout. Therefore, one interpretation of the counterfactual baseline for lifetime savings is that the baseline would become LED after burnout.

  However, the TRM deemed baseline is set at HPS for the life of the measure with no exceptions noted except for early retirement of a less efficient lamp. Therefore, the lifetime savings for utility-owned HPS fixtures are reported with the full 12-year EUL with no baseline shifts.
  - Recommendation: The Illinois TAC should consider updating the IL-TRM streetlighting measure to allow for the possibility of alternative baselines for unique program designs. The evaluation team has submitted a TRM tracker item with this request.
  - Recommendation: The evaluation team will further investigate AIC's streetlighting fixture management to understand if a specific update to measure characterization is required for future years of this Initiative.
  - Recommendation: AIC should consider the finding above and its implications for the Initiative more generally. For example, a second interpretation of the counterfactual scenario is that in the absence of AIC action, failing streetlights could continue to be replaced with HPS lamps, and that additional savings should also be claimed for "natural" AIC replacements of streetlighting with LED lamps. The two potential interpretations presented here are in no way intended to be exhaustive, and additional interpretations are likely to be possible.

3.5 Building Operator Certification

3.5.1 Initiative Description

AIC, in partnership with the Midwest Energy Efficiency Alliance (MEEA), offers the Building Operator Certification (BOC) Training to building operators in AIC territory. BOC is a nationally recognized training and certification program that was developed by the Northwest Energy Efficiency Council (NEEC) and focuses on energy-efficient building operations and preventative maintenance procedures. The BOC Training consists of two levels of training. The Level I course consists of seven one-day classes focused on building systems maintenance (Table 33)–with one course spanning two days. The Level II course consists of six one-day classes focused on equipment troubleshooting and maintenance—with one course spanning two days. Both courses consist of classroom training, project assignments to be completed at the participant's facility, and in-class tests at the end of each day. Course graduates must renew their credentials annually by accumulating points for maintaining employment; attending approved continuing education webinars; and, implementing projects at their facility. While participants do not need to be AIC customers to enroll in the course, AIC customers receive a discounted rate for early enrollment and a partial tuition reimbursement upon completion.

Table 33. List of BOC Training Topics

Topic	Level I	Level II
1001 - Energy Efficient Operation of Building HVAC Systems[a]	✓	
1002 - Measuring and Benchmarking Energy Performance	✓	
1003 - Efficient Lighting Fundamentals	✓	
1004 - HVAC Control Fundamentals	✓	
1005 - Indoor Environmental Quality	✓	
1006 - Common Opportunities for Low-Cost Operational Improvement	✓	
1007 - Facility Electrical Systems	✓	
2001 - Building Scoping for Operational Improvements[a]		✓
2002 - Optimizing HVAC Controls for Operational Improvements		✓
201 - Preventative Maintenance & Troubleshooting Principles		✓
202 - Advanced Electrical System Diagnostics		✓
214 – Building Commissioning		✓
216 – Enhanced Automation and Demand Reduction		✓

[a] These topics span two days.

In 2018, MEEA offered a Level I course in AIC territory from early October through the end of November and a Level II course from late October through December. In total, eight students completed the Level I course, and four completed the Level II course. Participants included facilities staff from universities, school districts, town governments, industrial facilities, and religious organizations (Table 34 below).

Summary of Evaluation Methodology

The evaluation team aligned the impact evaluation of the BOC Training with Kirkpatrick's Framework for evaluating adult learning interventions (see)-- the gold standard framework in adult training circles for

assessing training programs. Our approach involved following students throughout the training process and targeting specific research activities at different stages. Research activities included:

- **Baseline operations and maintenance and energy efficiency equipment survey:** Participants completed this survey as their first homework assignment in each of the two courses. The survey established baseline O&M conditions and collected information on the energy-related equipment in place prior to the training intervention.
- **Participant interviews:** Directly following the course, we interviewed participants to: (1) solicit feedback regarding their satisfaction with the course, (2) understand what they learned, (3) document any changes they made to their facilities during the training, (4) record any future plans for energy efficiency projects, and (5) identify the role the BOC Training played in these future plans. We provided a $50 incentive as a thank you for participating in the interviews.
- **Post-course savings survey:** We surveyed participants a year after they completed the BOC Training to understand the actions (if any) they took as a result of what they learned, including energy efficiency projects and modifications to building or equipment operations. We opted to wait a year to conduct this survey, given that enough time must elapse to see most impacts of training interventions. Participants need to identify potential energy efficiency improvements, have these improvements approved by their organization, implement these measures, and then have enough time pass in order to assess the resulting savings. Following the survey, we asked participants for the opportunity to schedule an onsite audit. We provided a $100 incentive as a thank you for participating in the survey.
- **Onsite audit:** Our engineers (1) verified the installation and operation of the measures indicated in the post-course savings survey, (2) ensured the measures were installed following the BOC Training, and (3) gathered additional information to support impact calculations We provided a $250-$500 incentive as a thank you for participating in the audit.[16]

Through these activities, we gathered information about the energy-saving actions that participants took, and how the BOC Training may have motivated participants to take these actions. As the BOC Training indirectly influences participants to implement energy efficiency projects, program administrators do not track detailed information to estimate ex ante energy and demand savings. As such, we estimated savings for those that participated in the data collection activities described above.[17] Five participants completed the post-course savings survey, and one agreed to an onsite audit (see Table 35).

Savings resulting from training programs are akin to spillover in that they are follow-on actions taken by participants as a result of information received from program administrators, and the IL-TRM instructs us to consider them as participant spillover.[18] This instruction informed both our methodology for determining program influence as well as the timing of this evaluation.

By their nature, follow-on actions such as these require time to be completed after the intervention (training) occurs. Because the 2018 BOC trainings occurred in Q4 of 2018 (ending in November and December, respectively), the evaluation team felt strongly that follow-on actions from the 2018 trainings would not be completed and able to be observed as part of the 2018 evaluation year. We therefore chose to evaluate follow-on savings resulting from the trainings during 2019 as part of the 2019 evaluations. Similarly, because these savings are evaluated in the manner of spillover, we do not apply a NTGR to evaluated savings – all savings claimed are already determined to have been influenced by BOC. A more detailed discussion of evaluation methodology is provided in Appendix A.

[16] The onsite audit incentive was originally set at $250 but due to lack of interest we raised it to $500 for participants with multiple facilities.
[17] To estimate savings, participants needed to complete the post-course savings survey for the evaluation team to estimate savings.
[18] IL-TRM V7.0 Attachment A: Illinois Statewide Net-to-Gross Methodologies, Page 24.

3.5.2 Participation Summary

Table 34 presents participation in the BOC Training during 2018 by certification level, organization, and segment. Overall, twelve AIC customers participated in training.

Table 34. 2018 BOC Training Participation Summary

Participant ID	BOC Level	Organization	Segment
20001	1	Livingston County Public Safety Complex	Government
20017	1	McLean County Unit School District # 5	School/University
20033	1	St. Paul Baptist Church	Church
20049	1	Excel Foundry & Machine	Process Industrial
20081	1	Illinois State University	School/University
20097	1	Illinois State University	School/University
20113	1	Illinois State University	School/University
20129	1	Bromley Hall (University of Illinois)	School/University
30001	2	Illinois Farm Bureau	Office
30002	2	Town of Normal	Government
30003	2	Lincoln College	School/University
30004	2	Illinois Farm Bureau	Office

Table 35 presents participation in the evaluation activities by each student.

Table 35. Summary of Student Participation in Evaluation Activities

Participant ID	Baseline Survey	Post-Course Interview	Post-Course Savings Survey	Onsite Audit
20001	✓	✓		
20017	✓	✓	✓	✓
20033	✓	✓	✓	
20049	✓	✓	✓	
20081	✓	[b]	[b]	
20097	✓	✓	✓	
20113	✓	[b]	[b]	
20129	✓	✓		
30001	✓	✓		
30002	✓	✓		
30003	✓	✓	✓	
30004	[a]	✓		

[a] Participant 30004 did not complete a baseline survey because their role is supplemental to the role of Participant 30001.

[b] Participants 20081, 20097, and 20113 held similar roles and worked together on the same building–each having different work shifts around the clock. These participants indicated that it would be duplicative for each of them to complete the data collection activities and thus we only completed the post-course interview and post-course savings survey with Participant 20097.

3.5.3 Initiative Annual Savings Summary

Overall, the BOC Training achieved 322 MWh, 0.064 MW, and 18,076 therms in verified net savings (Table 36).

Table 36. 2019 BOC Training Annual Savings

	Electric Energy Savings (MWh)	Electric Demand Savings (MW)	Gas Savings (Therms)
Verified Net Savings	322	0.064	18,076

3.5.4 Initiative Savings Detail

The BOC Training influenced four participants to implement lighting and HVAC measures. Since the training, surveyed participants completed nine total projects across lighting, domestic hot water heating and HVAC enduses. Projects ranged from common LED lighting upgrades to holistic building improvements, including HVAC optimization, variable frequency drives, and energy management system upgrades. Table 37 outlines the savings by participant and associated measures.

Table 37. 2019 BOC Training Electric Energy, Demand and Gas Savings by Participant

Participant ID	Projects Completed	Verified Net Savings			Description of Measures
		Energy Savings (MWh)	Demand Savings (MW)	Gas Savings (Therms)	
20017	2	227	0.035	16,219	LEDs, Lighting Controls, Boiler/hot water/steam system, Cooling tower optimization, Chiller/chilled water system, Economizer and ventilation controls
20033	2	3	0.000	844	HVAC equipment scheduling or space temperature, Water pump optimization, and Domestic hot water
20049	2	9	0.003	0	LEDs, Lighting Controls, Package/Split-System HVAC Changes
20097,20081, and 20113	0	0	0.000	0	No measures
30003	3	84	0.025	1,013	LEDs, Domestic hot water, HVAC equipment scheduling or space temperature
Total	**9**	**322**	**0.064**	**18,076**	

Note: Participants 20017 and 30003 made improvements at multiple sites.

Note: Participants 20097,20081, and 20113 were contacted as part of our research but did not report completing any energy efficiency projects.

Four participants completed projects producing electric energy savings, resulting in total of 322 MWh of net energy savings and 0.064 MW in net demand savings (see Table 38 and Table 39).

Table 38. 2019 BOC Training Electric Energy Savings by Measure

Enduse Measure Category	Verified Net Savings (MWh)
Lighting	128
Cooling tower optimization	109
Boiler/hot water/steam system	65

Enduse Measure Category	Verified Net Savings (MWh)
Chiller/chilled water system	9
HVAC equipment scheduling or space temperature	4
Economizer and ventilation controls	3
Water pump optimization	3
Package/Split-System HVAC Changes	1
Domestic hot water	0
Total	**322**

Table 39. 2019 BOC Training Electric Demand Savings by Measure

Enduse Measure Category	Verified Net Savings (MW)
Lighting	0.035
Cooling tower optimization	0.021
HVAC equipment scheduling or space temperature	0.006
Chiller/chilled water system	0.002
Water pump optimization	0.000
Package/Split-System HVAC Changes	0.000
Boiler/hot water/steam system	0.000
Economizer and ventilation controls	0.000
Domestic hot water	0.000
Total	**0.064**

Three BOC participants completed projects producing gas savings, contributing a total of 18,076 therms toward AIC energy efficiency goals (see Table 40).

Table 40. 2019 BOC Training Gas Savings by Measure

Enduse Measure Category	Verified Net Savings (Therms)
Boiler/hot water/steam system	16,219
HVAC equipment scheduling or space temperature	1,523
Domestic hot water	333
Total	**18,076**

BOC Training participants also enrolled in other AIC energy efficiency programs. Participants saved an additional 290 MWh of electricity through the Standard Initiative (see Table 41), largely through lighting projects. However, more than half (53%) of total verified electric energy savings are not attributable to other AIC initiatives and are therefore claimable by the BOC Training. All therm savings are attributable to the BOC Training because participants completed no natural gas-saving projects through AIC's other offerings. Overall, the BOC Training accounted for 75% of the participant's total electric and natural gas savings.[19]

[19] Converting BOC Training and Standard Initiative electric and therm savings into common MMBtu units equates to 2,907 MMBtu savings through the BOC Training and 991 MMBtu savings through the Standard Initiative.

Table 41. 2019 Cross Program Electric Energy and Demand Savings by Participant

Project ID	Verified Gross Savings (MWh) by Ameren Offering Participation				Share of Savings by Ameren Offering Participation			
	BOC	SLB	SBDI	HVAC	BOC	SLB	SBDI	HVAC
20017	227	22	90	71	55%	5%	22%	17%
20033	3	0	0	0	100%	0%	0%	0%
20049	9	108	0	0	8%	92%	0%	0%
20097	0	0	0	0	-	-	-	-
30003	84	0	0	0	100%	0%	0%	0%
Total	**322**	**130**	**90**	**71**	**53%**	**21%**	**15%**	**12%**

Note: SBDI is Small Business Direct Install, SLB is Standard Lighting for Business, HVAC is Heating, Air Conditioning, and Ventilation.

3.5.5 Cumulative Persisting Annual Savings

Table 42 presents CPAS and WAML for the 2019 BOC evaluation. The measure-specific and total verified gross savings for BOC savings are summarized, and CPAS in each year of the 2018-2021 Plan are presented.[20] The WAML for BOC savings is 14.9 years.

Table 42. 2019 BOC Training 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	...	
Lighting	14.2	128	N/A		128	128	128	...	119	...	1,845
Cooling tower optimization	15.0	109	N/A		109	109	109	...	109	...	1,633
Boiler/hot water/steam system	17.5	65	N/A		65	65	65	...	65	...	974
Chiller/chilled water system	15.0	9	N/A		9	9	9	...	9	...	142
HVAC equipment scheduling or space temperature	3.0	4	N/A		4	4	4	...	0	...	13
Economizer and ventilation controls	5.0	3	N/A		3	3	3	...	0	...	15
Water pump optimization	8.0	3	N/A		3	3	3	...	0	...	20
Package/split-system HVAC changes	8.0	1	N/A		1	1	1	...	0	...	5
2019 CPAS		**322**	**N/A**		**322**	**322**	**322**	**...**	**303**	**...**	**4,648**
Expired 2019 CPAS					**0**	**0**	**0**	**...**	**1**	**...**	
Expiring 2019 CPAS					**0**	**0**	**0**	**...**	**20**	**...**	
WAML	**14.9**										

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

3.5.6 Conclusions and Recommendations

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

- Key Finding #1: The BOC Training is indirectly leading to energy savings. More than half the energy savings quantified through the BOC Training evaluation were not claimed through other AIC initiatives, and respondents identified the BOC Training as an important influence in completing these projects.
  - Recommendation: To fully capture the savings generated through the BOC Training, the program team should consider ways to encourage participation in subsequent research activities so that all savings can be quantified. We understand the program team does not want to discourage participation by overburdening students; however, these research activities are critical to understanding the impact of the training. The program team should also consider continuing to follow up with BOC Training participants beyond the year following the training. Many of the participants represent public entities or larger organizations where the project approval and resource allocation process can be lengthy. As a result, larger projects may take longer than a year to approve and implement. Additionally, the BOC training can generate a "careers-worth" of energy savings. Continuing to follow up with responsive students can help capture future savings and potentially compensate for the savings lost through a lack of participation from other students.

Appendix A. Detailed Impact Analysis Methodology

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

Standard

Gross Impact Methodology

The evaluation team calculated verified gross savings for the Standard Initiative by applying savings algorithms from the commercial and industrial section (Volume 2) of the IL-TRM V7.0. The team leveraged initiative tracking data, including measure characteristics (e.g., lamp wattages, fuel usage efficiencies, and motor horsepower) and building characteristics (e.g., building type, climate zone, and floor area), to inform savings calculations. When necessary, we used default values and common baseline measure parameters (such as removed lamp wattage or fuel efficiencies) prescribed by the IL-TRM V7.0. Table 43 lists the measures in the Standard Initiative, their corresponding IL-TRM entry, and whether or not errata applied to the measure in the 2019 evaluation.

Table 43. Standard Initiative Measures Evaluated

Measure	TRM Entry	Errata Applied
Livestock Waterer	4.1.4	Yes
Commercial Solid and Glass Door Refrigerators & Freezers	4.2.2	No
Commercial Steam Cooker	4.2.3	No
ENERGY STAR Dishwasher	4.2.6	No; errata exists but is not applicable to AIC
ENERGY STAR Fryer	4.2.7	No
ENERGY STAR Hot Food Holding Cabinets	4.2.9	No
High Efficiency Pre-Rinse Spray Valve	4.2.11	No; errata exists but is not applicable to AIC
Pasta Cooker	4.2.17	No
ENERGY STAR Electric Convection Oven	4.2.19	No
Storage Water Heater	4.3.1	Yes
Air Conditioner Tune-up	4.4.1	No
Space Heating Boiler Tune-up	4.4.2	No
Process Boiler Tune-up	4.4.3	No
Boiler Lockout/Reset Controls	4.4.4	No
Electric Chiller	4.4.6	No
High Efficiency Boiler	4.4.10	No
High Efficiency Furnace	4.4.11	No
Infrared Heaters (all sizes), Low Intensity	4.4.12	No
Package Terminal Air Conditioner (PTAC) and Package Terminal Heat Pump (PTHP)	4.4.13	No
Single-Package and Split System Unitary Air Conditioners	4.4.15	No
Steam Trap Replacement or Repair	4.4.16	No
Variable Speed Drives for HVAC Pumps and Cooling Tower Fans	4.4.17	Yes

Measure	TRM Entry	Errata Applied
Small Commercial Programmable Thermostats	4.4.18	No
Demand Controlled Ventilation	4.4.19	No
Linkageless Boiler Controls for Space Heating	4.4.21	No
Variable Speed Drives for HVAC Supply and Return Fans	4.4.26	Yes
Unitary HVAC Condensing Furnace	4.4.37	No
High Temperature Heating and Ventilation (HTHV) Direct Fired Heater	4.4.39	No
Advanced Rooftop Controls (ARC)	4.4.41	No
Advanced Thermostats for Small Commercial	4.4.42	Yes
Fluorescent Delamping	4.5.2	No
High Performance and Reduced Wattage T8 Fixtures and Lamps	4.5.3	Yes
LED Bulbs and Fixtures	4.5.4	Yes
Commercial LED Exit Signs	4.5.5	No
Lighting Controls	4.5.10	No
T5 Fixtures and Lamps	4.5.12	Yes
Automatic Door Closer for Walk-In Coolers and Freezers	4.6.1	No
Beverage and Snack Machine Controls	4.6.2	No
Door Heater Controls for Cooler or Freezer	4.6.3	No
Evaporator Fan Control for Electrically Commutated Motors	4.6.6	No
Strip Curtain for Walk-in Coolers and Freezers	4.6.7	No
Night Covers for Open Refrigerated Display Cases	4.6.9	No
VSD Air Compressor	4.7.1	No
Compressed Air Low Pressure Drop Filters	4.7.2	No
Compressed Air No-Loss Condensate Drains	4.7.3	No
Advanced Power Strip - Tier 1 Commercial	4.8.7	No
High Frequency Battery Chargers	4.8.9	No

Non-TRM Measures

For leak survey and repair (LSR) and non-HVAC variable-speed drives (VSD) measures, the IL-TRM V7.0 Volume 2 does not provide an approach to calculate gross impacts. For these measures, the evaluation team used the approaches summarized below.

Leak Survey and Repair

The Leak Survey and Repair (LSR) offering targets compressed air system leaks. Because compressed air leak detection and air loss quantification are difficult to generalize, the IL-TRM has not adopted a standardized method for evaluating savings. The evaluation team employed a common method of using compressed air system characteristics, including kW/CFM reduction factors adopted from IL-TRM v7.0 section 4.7.3 Compressed Air No-Loss Condensate Drains and annual operating hours, in combination with field-collected data, including leak orifice diameter and ultrasonic noise measurement, to confirm leakage estimates.

The algorithms for calculating energy and demand savings are presented below:

Equation 1. LSR Electric Energy Savings

$$\text{Energy (kWh)} = Hours_{annual} \times \left[\sum (\#\text{ of Leaks} \times \text{CFM}_{\text{leak}})\right] \times \text{kW/CFM}$$

Equation 2. LSR Electric Demand Savings

$$\text{Demand (kW)} = \left[\sum (\#\text{ of Leaks} \times \text{CFM}_{\text{leak}})\right] \times \text{kW/CFM}$$

In the above equations, kW/CFM represents the system demand reductions per CFM of reduced air demand, dependent on fan motor control type (see Table 44), and CFM_{leak} represents the air leakage rate (in CFM per leak).

Air leakage rates are binned into six size categories under two intervention scenarios, repaired and reported but not repaired, summarized in Table 45. Under repaired intervention scenarios, leaks are assumed fully fixed, while under reported-but-not-repaired scenarios, it is assumed leaks will be repaired at a reduced rate than if repaired by the implementer.

Table 44. kW demand reductions by motor control type

Control Type [a]	kW / CFM
Reciprocating - On/off Control	0.184
Reciprocating - Load/Unload	0.136
Screw - Load/Unload	0.152
Screw - Inlet Modulation	0.055
Screw - Inlet Modulation w/ Unloading	0.055
Screw - Variable Displacement	0.153
Screw - VFD	0.178
Unknown	0.107

[a] Sourced from IL-TRM V7.0 section 4.7.3 Compressed Air No-Loss Condensate Drains

Table 45. CFM Leakage Rates by Size of Leak and Intervention Scenario

Leak Size Category	Leak Orifice Diameter (inches)	Intervention Scenario CFM Reduction (CFM_{leak})	
		Reported	Repaired
Small Leaks	1/64	0.25	0.41
Medium Leaks	1/32	1.00	1.62
Large Leaks	1/16	4.00	6.49
Extra Large Leaks	1/8	15.00	26.00
XXL Leaks	1/4	58.00	104.00
XXXL Leaks	3/8	130.00	234.00

Non-HVAC Variable-Speed Drives

Non-HVAC VSDs are offered through the VSD offering and include VSD installations on process fans and pumps. The evaluation team applied a mix of methods to evaluate verified savings, including the use of IL-

TRM V7.0 Section 4.4.26 algorithms and assumptions in coordination with the 2010 memorandum[21] that provides guidance on capping savings at a percentage of estimated base energy consumption. The following discussion details the evaluation team's methods for evaluating verified savings.

The evaluation team adopted the IL-TRM V7.0 Section 4.4.26 algorithms for calculating the base energy consumption of processes before the installation of VSDs. The algorithms for calculating verified energy and demand savings are provided below, with all input variable descriptions and values, if deemed, provided in Table 46:

Equation 3. VSD Electric Energy Savings

$$\text{Energy (kWh)} = kWh_{base} \times SL$$

$$kWh_{base} = \left[\left(0.746 \times HP \times \frac{LF}{\eta_{motor}}\right) \times RHRS_{Base} \times \sum_{0\%}^{100\%} (\%FF \times PLR_{Base})\right]$$

Equation 4. VSD Electric Demand Savings

$$\text{Demand (kW)} = \left[\left(0.746 \times HP \times \frac{LF}{\eta_{motor}}\right) \times PLR_{Base,FFpeak}\right] \times SL$$

Energy and demand savings are capped by the savings limit (SL) of 42% for pump applications and 67% for fan applications. To ensure that savings are capped, the evaluation team compares the verified energy and demand savings against the claimed savings. If the proportion of claimed savings to kWh_{base} is greater than the savings limit, then the savings limit is applied to the kWh_{base}. If the proportion is less than the claimed savings, then the claimed savings are accepted as the verified savings.

Table 46. Deemed Inputs for VSD Calculations

Algorithm Variable	Description	Value	Source
kWh_{base}	Base energy consumption of the existing motor prior to installation of the VSD	Calculated	IL-TRM V7.0
HP	Nominal horsepower of controlled motor	Actual value	Initiative tracking database
Motor LF	Motor load factor	75%	
Σ (%FF * PLR)	Flow Fraction and Part Load Ratio factor; assumes "No Control or Bypass Damper"	1	
η_{motor}	Installed nominal/nameplate motor efficiency, based on horsepower[a]	Calculated	Extracted from IL-TRM V7.0 Table of NEMA Motor Efficiencies
$RHRS_{base}$	Annual operating hours of base motor	Actual value	Initiative tracking database
SL (pump)	Savings limit for pump applications	42%	
SL (fan)	Savings limit for fan applications	67%	

[a] Default motor is a NEMA Premium Efficiency, ODP, 4-pole/1800 RPM fan motor.

[21] The memorandum titled "Recommendations for Verifying Savings for non-HVAC VFDs" was submitted in response to program administrator comments regarding the PY2 evaluation methods for non-HVAC VSDs.

The IL-TRM V8.0 Section 4.8.13 provides savings algorithms for VFDs installed on process fans. In 2020, the evaluation team will adopt the IL-TRM V8.0 to calculate verified savings for VFDs installed on process fans. The evaluation team will continue to apply the methods outlined above to calculate verified savings for VFDs installed on process pumps.

Measure Lives and Cumulative Persisting Annual Savings

For prescriptive measures, the evaluation team applied measure lives from the IL-TRM V7.0. The measure life of non-HVAC VSD measures is 15 years, in alignment with the IL-TRM V7.0 HVAC VSD measure lives. For Leak Survey and Repair measures, we applied a measure life of five years consistent with previous evaluations.

Net Impact Methodology

The evaluation team applied SAG-approved 2019 NTGRs to verified gross savings to calculate verified net savings. Table 47 outlines the SAG-approved NTGR values applied to verified gross savings to calculate verified net savings.

Table 47. SAG-Approved Standard Initiative NTGRs

Measure	Electric NTGR	Gas NTGR
Lighting	0.778	0.778[a]
HVAC	0.557	0.494
VSDs	0.833	N/A
Specialty Equipment	0.849	0.675
Leak Survey and Repair	0.702	N/A
Steam Traps	N/A	0.608
Green Nozzles	0.920	0.890
Laminar Flow Restrictor	0.849	0.675
Instant Incentives	0.916	0.916[a]
Online Store	0.831	0.831[a]

[a] The SAG-approved electric NTGRs for lighting measures are also applied to gas heating penalties associated with lighting measures for cost-effectiveness purposes.

Custom

Gross Impact Methodology

The evaluation team's gross impact analysis for the Custom Initiative used desk reviews and on-site M&V to determine verified gross impacts. Overall, the evaluation team reviewed a total of 54 Custom projects.

The evaluation team completed desk reviews (and in most cases, on-site M&V to provide increased accuracy) at a sample of 54 (core and NCL) projects to determine gross impact results. Desk reviews were used to compare the inputs provided in the application to the assumptions used in the analysis, verify consistency in savings estimates throughout the project file, and provide insight into the validity of the ex ante energy savings. The team accomplished this through the review of the submitted information and calculations for consistency, accuracy, and correct application of engineering principles.

Sampling Approach

We selected the sample of 2019 projects for evaluation in three waves, drawing each sample from the entire population of completed Custom projects. As part of this process, we selected projects independently by fuel type, by wave, to satisfy random sampling requirements.

We chose the sample of Custom projects using a stratified random sample design targeting 10% relative precision at the 90% level of confidence. For the stratification, we used the Dalenius-Hodges method to determine strata boundaries and the Neyman allocation to determine the optimal allocation of the available projects to the strata. In total, the sample drawn included 39 projects chosen for the electric sample and 17 projects chosen for the gas sample. The 56 reviews we conducted accounted for 47% of the total ex ante gross electric energy savings and 86% of ex ante gas savings. Table 48 and Table 49 present detail around the sample of electric and gas projects chosen for the 2018 evaluation.

Table 48. Custom Sampling Approach for Projects with Electric Savings

Wave	Sampling Stratum	Savings Range	Population of Projects		Completed Reviews	
			Count	Ex Ante MWh	Count	Ex Ante MWh
1	1	< 75 MWh	38	519	3	64
	2	> 75 MWh & < 305 MWh	20	3,418	5	793
	3	> 305 MWh & < 1,000 MWh	15	7,655	9	4,681
	Certainty	> 1,000	1	1,060	1	1,060
		Subtotal	*74*	*12,653*	*18*	*6,598*
2	1	< 150 MWh	12	834	3	145
	2	> 150 MWh & < 350 MWh	5	1,322	2	621
	3	> 350 MWh	3	1,918	3	1,918
		Subtotal	*20*	*4,074*	*8*	*2,683*
3	1	< 75 MWh	40	1,377	2	78
	2	> 75 MWh & < 350 MWh	38	6,048	3	535
	3	> 350 MWh	12	10,403	8	6,426
		Subtotal	*90*	*17,828*	*13*	*7,039*
	Total		**184**	**34,555**	**39**	**16,321**

Table 49. Custom Sampling Approach for Projects with Gas Savings

Wave	Sampling Stratum	Savings Range	Population of Projects		Completed Reviews	
			Count	Ex Ante Therms	Count	Ex Ante Therms
1	1	< 2,000 therms	2	3,012	1	1,160
	2	> 2,000 & < 18,000 therms	2	25,966	1	8,686
	3	> 18,000 therms	5	574,049	5	574,049
		Subtotal	*9*	*603,027*	*7*	*583,894*
2	1	< 70,000 therms	4	56,071	3	27,651
	Certainty	> 70,000 therms	1	70,262	1	70,262
		Subtotal	*5*	*126,332*	*4*	*97,912*
3	1	< 12,000 therms	12	67,062	1	11,065
	2	> 12,000 & <29,250 therms	6	108,246	1	13,539
	3	> 29,250 therms	4	578,032	4	578,032
		Subtotal	*22*	*753,340*	*6*	*602,636*
Total			**36**	**1,482,699**	**17**	**1,284,443**

To estimate the Initiative's verified savings, the evaluation team used the ratio adjustment method.[22] As described in Equation 5, we calculated the gross realization rate based on the desk reviews (and on-site M&V for the majority of projects) for a stratified random sample of projects. We then used the ratio of the verified gross savings to the ex ante gross savings (the realization rate) to adjust the ex ante gross savings for the population of all 2018 Custom projects with savings (N=197).

Equation 5. Ratio Adjustment Method

$$I_{EP} = \frac{I_{EPS}}{I_{EAS}} * I_{EA} \; I_{EP} = \frac{I_{EPS}}{I_{EAS}} * I_{EA}$$

where:

I_{EP} = the verified population energy and demand impacts
I_{EA} = the ex ante population energy and demand impacts
I_{EPS} = the verified sample energy and demand impacts
I_{EAS} = the ex ante sample energy and demand impacts

[22] Cochran, William G. *Sampling Techniques.* 1977. New York: John Wiley & Sons.

Precision Calculations

We calculated precision for our gross impact results by pooling the results from all waves of site visits.[23] To calculate relative precision, the team first determined the variance in the sample and then calculated the standard error and confidence interval. Equation 6 through Equation 9 were used.

Equation 6. Stratified Ratio Estimator

$$Stratified\ Ratio\ Estimator = \frac{\sum_{i=1}^{n} w_i\ y_i}{\sum_{i=1}^{n} w_i\ x_i}$$

Equation 7. Standard Error

$$Standard\ Error = \frac{1}{\hat{X}} \sqrt{\sum_{i=1}^{n} w_i\ (w_i - 1)\ e_i^2}$$

Equation 8. Confidence Interval

$$90\%\ Confidence\ Interval = \ 1.645 * Standard\ Error$$

Equation 9. Relative Precision

$$Relative\ Precision = \frac{Confidence\ Interval}{Stratified\ Ratio\ Estimator}$$

where:

w = case weights for each stratum h (N_h/n_h)
y = verified savings
x = ex ante savings
$e = y_i - b\ x_i$
$\hat{X} = \ w_i\ x_i$

Measure Lives and Cumulative Persisting Annual Savings

In accordance with methods presented and discussed in the IL-TRM V7.0 Attachment B,[24] the evaluation team reviewed the ex ante measure life assumptions provided by the implementation team for sampled Custom projects in 2019 and revised these assumptions where necessary. We then calculated an adjustment to ex ante measure lives like that of calculating a realization rate and applied that adjustment to all population ex ante measure lives. Table 50 provides a summary of the Custom Initiative project measure lives that were adjusted after evaluation. All other ex ante measure lives in our sample were determined to have been appropriately applied.

[23] The error bound of the total savings is estimated by calculating the square root of the sum of the squared error bounds of each wave or group of projects. These calculations are consistent with California Evaluation Framework.
[24] Illinois Statewide Technical Reference Manual V7.0 – Attachment B: Effective Useful Life for Custom Measure Guidelines.

Table 50. Custom Measure Life Adjustment due to Evaluation

Project Number	Enduse	Measure Life		Rationale for Adjustment
		Ex Ante	Verified	
1000068	Custom Lighting	14.0	7.1	Evaluation adjustments were made to project operating hours & affect calculated measure life
1801385	Custom Lighting	9.8	15.0	IL-TRM V7.0 Measure 4.5.7 - Lighting Power Density
1801519	Custom Electric HVAC - Equipment	13.0	23.0	IL-TRM V7.0 Measure 4.4.6 - Electric Chiller
1801554	Custom Compressed Air - Equipment	13.0	15.0	IL-TRM V7.0 Attachment B - Custom Compressed Air - Equipment
1801673	Custom Lighting	9.8	15.0	IL-TRM V7.0 Measure 4.5.7 - Lighting Power Density
1900133	Custom Electric HVAC - Equipment	23.0	13.0	IL-TRM V7.0 Attachment B - Custom Electric HVAC - Equipment
1900184	Custom Lighting	12.3	15.0	IL-TRM V7.0 Measure 4.5.7 - Lighting Power Density
1900325	Custom Compressed Air - Equipment	13.0	15.0	IL-TRM V7.0 Attachment B - Custom Compressed Air - Equipment
1900404	Custom Lighting	12.3	15.0	IL-TRM V7.0 Measure 4.5.7 - Lighting Power Density
1900419	Custom Electric HVAC - Equipment	23.0	15.0	IL-TRM V7.0 Attachment B - –Data Centers
1900538	Custom Electric HVAC - Equipment	15.0	23.0	IL-TRM V7.0 Measure 4.4.6 - Electric Chiller
1900546	Custom Electric HVAC - Controls	13.0	15.0	IL-TRM V7.0 Attachment B - Custom Electric HVAC - Controls

Net Impact Methodology

The evaluation team applied SAG-approved NTGRs for the Custom Initiative to verified gross savings to calculate verified net savings. Table 51 presents the SAG-approved NTGR values for the 2019 Custom Initiative.

Table 51. SAG-Approved Custom Initiative NTGRs

Measure	Electric NTGR	Gas NTGR
Core Custom	0.822	0.939
New Construction Lighting	0.822	0.939

Retro-Commissioning

The evaluation team examined Initiative impacts to estimate a realization rate of savings between ex ante and verified gross savings in two steps. Given the number of completed projects in 2019 (20), the evaluation team first conducted engineering desk reviews for a census of projects to revise Initiative ex ante savings values.

The engineering desk reviews consisted of a thorough examination of all available project documentation, including project reports, communications, equipment submittals, and calculations, and any other project-specific data that were available to our team. We also spoke to some site contacts to confirm measures and their continued operation and performance.

In addition, the evaluation team went on-site and inspected equipment and measure status for seven projects and collected supplemental data, as needed. On-site visits were made to two Large Facility Retro-Commissioning sites, including one educational facility and one medical facility, the only Retro-Commissioning Lite project completed in 2019, and four industrial sites for compressed air. The on-site visits represented a sample of electric savings for compressed air projects and a census of all other electric and all gas savings achieved by the Initiative in 2019. We selected the samples for electric and gas on-site verification as subsets of Initiative participants. Our sample was developed, targeting 90/10 precision around gross savings. Table 52 provides detail on ex ante savings covered by our impact review by review method.

Table 52. Retro-Commissioning Impact Evaluation Savings Covered

Review Type	# of Projects	Ex Ante Gross Savings	
		MWh	Therms
Desk review only	13	3,041	0
Desk review and site visit	7	2,281	83,622
Total	**20**	**5,322**	**83,622**

We conducted a desk review of all savings but completed sample-based on-site verification at only Compressed Air sites.[25] To extrapolate these results to the population, we compared the savings determined for each project through site visits to the savings determined for each project via desk reviews to calculate savings-weighted realization rates (site visit-determined gross savings divided by desk review-determined gross savings) by fuel type.

Measure Lives and Cumulative Persisting Annual Savings

In accordance with the methodology presented and discussed in the IL-TRM V7.0 Attachment B,[26] the evaluation team reviewed all ex ante measure life assumptions provided by the implementation team for all Retro-Commissioning projects in 2019. The implementation team selected the correct measure life assumptions in all cases in 2019, and therefore ex ante measure lives are used to calculate CPAS.

Net Impact Methodology

The evaluation team applied the SAG-approved NTGR by measure type, as summarized below.

Table 53 outlines the SAG-approved NTGR value applied to verified gross savings to calculate verified net savings. The Retro-Commissioning Initiative has a single electric and gas NTGR for all offerings under the initiative.

Table 53. SAG-Approved Retro-Commissioning Initiative NTGRs

Measure	Electric NTGR	Gas NTGR
Retro-Commissioning	0.890	0.890

[25] All Large Facilities Retro-Commissioning and Retro-Commissioning Lite projects were chosen for on-sites, and therefore no extrapolation to the population is conducted.
[26] Illinois Statewide Technical Reference Manual – Attachment B: Effective Useful Life for Custom Measure Guidelines.

Streetlighting

Gross Impact Methodology

The evaluation team verified gross impacts for the 2019 Streetlighting Initiative using a desk review. The gross impact analysis did not involve onsite visits or metering. The Streetlighting Initiative had only gross electric energy impacts in 2019; no peak demand or gas impacts were reported or evaluated in 2019. The desk review included the following activities:

- Crosschecking the values in the tracking database against the project files (such as the application, invoice, and specification sheets),
- Comparing the input assumptions against IL-TRM V7.0 (Measure 4.5.16),
- Recalculating the ex ante savings based on the inputs in the tracking database (algorithm check),
- Making adjustments to inputs based on findings in the desk review, and
- Calculating verified gross savings based on the updated inputs.

Equation 10 below is used to calculate gross electric energy impacts.

Equation 10. Gross Electric Energy Impact Calculation for LED Street Lights

$$kWh = (Quantity_{base} * Watts_{base} - Quantity_{EE} * Watts_{EE}) * Hours/1000$$

Table 54 below provides details on each input to the equation, including a description of the input, the value, and the source.

Table 54. Streetlighting Gross Electric Energy Inputs and Sources

Input	Description	Value	Source
$Quantity_{base}$	Number of baseline fixtures	Variable	Project files (application)
$Watts_{base}$	Wattage of baseline fixture	Variable	Project files (application), IL-TRM V7.0
$Quantity_{EE}$	Number of efficient fixtures	Variable	Project files (application, invoice)
$Watts_{EE}$	Wattage of efficient fixture	Variable	Project files (application, invoice, specification sheet)
Hours	Annual operating hours	4,303	IL-TRM V7.0 (LED Streetlights)
1,000	Conversion from watts to kilowatts	1,000	

Measure Lives and Cumulative Persisting Annual Savings

We applied the prescriptive IL-TRM 7.0 measure life of 12 years for LED streetlighting.

Net Impact Methodology

The evaluation team applied SAG-approved 2019 NTGRs to verified gross savings to calculate verified net savings. Table 55 outlines the SAG-approved NTGR values applied to verified gross savings to calculate verified net savings.

Table 55. SAG-Approved Streetlighting Initiative NTGRs

Measure	Electric NTGR	Gas NTGR
BPL16 Municipality-Owned Streetlighting: DLC Standard Tier - Dusk to Dawn Operation	1.000	n/a
BPL23 Municipality-Owned Streetlighting: DLC Premium Tier - Dusk to Dawn Operation	1.000	n/a
BPL27 Utility-Owned Streetlighting - Dusk to Dawn Operation	1.000	n/a
BPL27 Utility-Owned Streetlighting - Replacing Mercury Vapor - Dusk to Dawn Operation	1.000	n/a

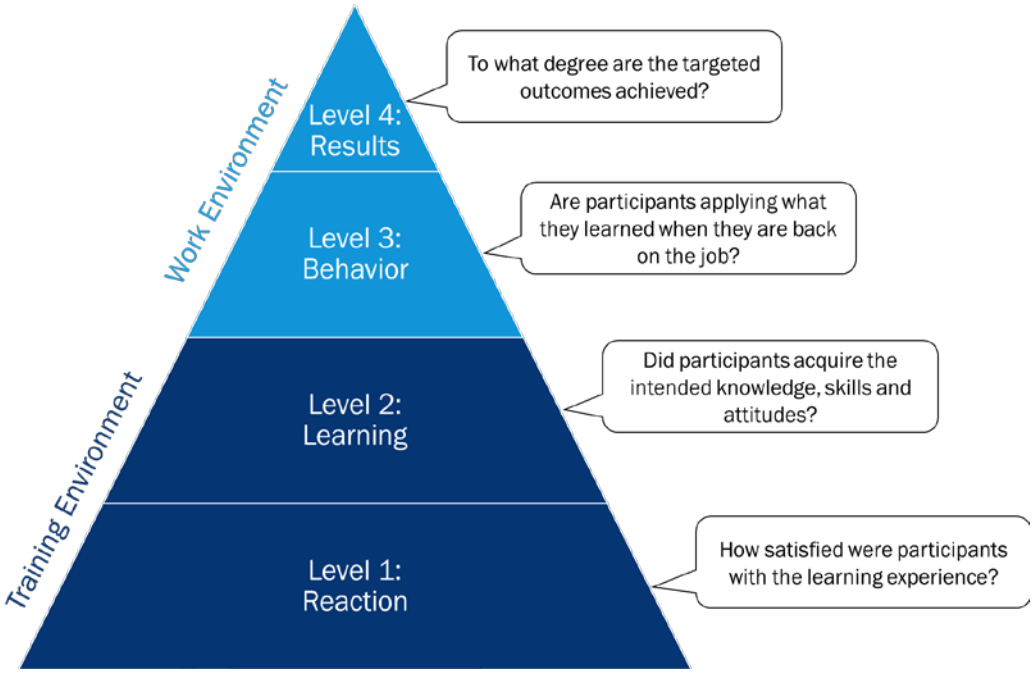
Building Operator Certification

Gross Impact Methodology

The evaluation team leveraged an innovative evaluation approach to calculate the 2019 gross impacts resulting from the 2018 BOC Training. We aligned the approach with Kirkpatrick's Framework for evaluating adult learning interventions—the gold standard for evaluating adult training interventions in the training industry. As illustrated in Figure 2, Kirkpatrick's Framework consists of four levels:

- Level 1 - Reaction: measures how participants feel about the learning experience. The value of Level 1 is that a good training experience improves knowledge transfer.
- Level 2 - Learning: measures the degree to which participants change attitudes, increase knowledge, or enhance skills as a result of the learning experience. The value of Level 2 is to demonstrate that learning occurs as a result of the training.
- Level 3 - Behavior: measures the degree to which participants apply what they have learned outside of the learning environment. This level seeks to demonstrate whether trainees take the information they learn and apply it.
- Level 4 - Results: the degree targeted outcomes are achieved system-wide. In this study, we measured the training's results in terms of energy savings. The value of measuring Level 4 is to inform the return on training investment realized from the training endeavor.

Figure 2. Kirkpatrick Model



To measure the four levels of learning, we conducted several research activities targeted at specific stages of the training process (see Table 56), including:

- **Baseline operations and maintenance and energy efficiency equipment survey:** Participants completed this survey as their first homework assignment. The survey established baseline O&M conditions and collected information on the energy-related equipment in place prior to the training intervention.
- **Participant interviews:** Directly following the course, we interviewed participants to (1) solicit feedback regarding their satisfaction with the course, (2) understand what they learned, (3) document any changes they made to their facilities during the training, (4) record any future plans for energy efficiency projects, and (5) identify the role the BOC Training played in these future plans.
- **Post-course savings survey:** We surveyed participants a year after they completed the BOC Training to understand the actions (if any) they took as a result of what they learned, including energy efficiency projects and modifications to building or equipment operations. Following the survey, we asked participants for the opportunity to schedule an onsite audit.
- **Engineering desk reviews:** Our engineers reviewed the data collected in the post-course savings survey, setup savings calculations, and identified additional data required to calculate impacts.
- **Onsite audit:** Our engineers (1) verified the installation and operation of the measures indicated in the post-course savings survey, (2) ensured the measures were installed following the BOC Training, and (3) gathered additional information to support impact calculations.

Table 56. Summary of Research Activities and the Associated Kirkpatrick Levels

Research Activity	Baseline	Level 1	Level 2	Level 3	Level 4
Baseline O&M and EE equipment survey	✓				
Participant Interviews		✓	✓	✓	
Post-course savings survey				✓	✓
Engineering desk reviews					✓
Onsite audit					✓

Overall, the evaluation team reviewed nine projects representing four participants for which we collected varying levels of information through the post-course survey. Originally, we expected to collect detailed information during the onsite audits to inform impact calculations; however, just one participant agreed to an audit (Table 35). In lieu of the audit, we attempted to follow up with participants to collect additional information via e-mail, but these efforts were unsuccessful. In cases where projects received incentives through other AIC initiatives, we pulled the information from that initiative's tracking database. We also filled in gaps with TRM baseline assumptions where possible.

Projects fell into one of three overarching categories: lighting, HVAC, and domestic hot water, summarized in Table 57. In general, the evaluation team utilized project information in conjunction with the IL-TRM v7.0 in developing energy savings. The following provides additional details about the evaluation team's methodology and assumptions by project category.

Table 57. List of Enduse Measure Categories and Relation to Overarching Categories

Enduse Measure Category	Lighting	HVAC	DHW
Lighting	✓		
Cooling tower optimization		✓	
Boiler/hot water/steam system		✓	
Chiller/chilled water system		✓	
HVAC equipment scheduling or space temperature		✓	
Economizer and ventilation controls		✓	
Water pump optimization		✓	
Package/Split-System HVAC Changes		✓	
Domestic hot water			✓

- **Lighting**: To estimate savings from lighting improvements, we collected information from participants to characterize the baseline and efficient lighting conditions for each lighting project. Similarly, to estimate savings from occupancy sensors, or other lighting control measures, we gathered data on the total wattage of the lights controlled by the sensors and applied the IL-TRM V7.0 assumptions for energy savings factors based on the installed lighting control type. Where we were unable to obtain information on baseline lighting conditions, we defaulted to assumptions from the IL-TRM V7.0.
- **HVAC**: For the majority of HVAC projects installed at participating sites, we employed a prescriptive evaluation approach according to recommendations captured in the IL-TRM V7.0. For these projects, we supplemented prescriptive algorithms with site-specific data gathered through the post-course savings survey. For two projects where participants installed high-efficiency motors on HVAC pumps, we estimated savings using a custom approach as the IL-TRM V7.0 does not guide these measures.

For the two high-efficiency motor improvements, the evaluation team applied affinity laws for pumps (see equations below), requiring assumptions on motor horsepower, load factor, and annual runtime hour assumptions because the evaluation team were not able to conduct a site audit. Motor projects with similar characteristics from the Standard Core HVAC offering provided estimate average motor horsepower and informed base and efficient case motor efficiency. Annual runtime hours came from section 4.4.17 Variable Speed Drives for HVAC Pumps, and Cooling Tower Fans of the IL-TRM V7.0, Assumptions for load factors, and motor efficiencies came from external sources. The 2021 Pennsylvania TRM suggests a default load factor of 0.79 for pumps citing a 2012 report from the Regional Technical Forum (RTF).[27] Considering the information provided through the post-course survey and comparing HVAC program participant motor characteristics, the evaluation team determined that motor efficiencies of 0.80 and 0.90 for the baseline and efficient motors were appropriate and conservative estimates.

$$\text{Energy (kWh)} = \left(0.746 \times HP \times \left(\frac{LF}{\eta_{base}} - \frac{LF}{\eta_{ee}}\right) \times Hours\right)$$

$$\text{Demand (kW)} = \left(0.746 \times HP \times \left(\frac{LF}{\eta_{base}} - \frac{LF}{\eta_{ee}}\right) \times CF\right)$$

- **DHW**: We applied the IL-TRM V7.0 to quantify energy, demand, and natural gas savings specific to the faucet aerator and hot water heater measures installed at two sites. For the hot water heater replacement project, general information on the project was available through the post-course survey. Still, we were unable to obtain information related to the hot water heater unit efficiency. As such, we applied an average efficiency from the Standard Core HVAC program tracking data for similar building and project types (n=5) as a proxy.

Measure Lives and Cumulative Persisting Annual Savings

The evaluation team applied prescriptive measure lives from the IL-TRM V7.0.

Attribution Analysis

Overall, participants reported that the BOC Training was one of several important factors that influenced energy efficiency improvements described in Table 37. As is typical for large commercial facilities, decision-makers plan building upgrades well in advance of execution and weigh a range of factors when considering whether to move forward with a major capital improvement. As such, surveyed participants indicated they likely would have moved forward with seven of the nine energy efficiency projects they completed had they not attended the BOC Training. On average, respondents rated the likelihood they would have completed the projects as a 7.7 out of 10, where 0= "definitely would not have taken the action" and 10= "definitely would have taken the action." Still, respondents reported that the BOC Training was very important when planning their energy-saving upgrades. On average, respondents rated the importance of the BOC Training as a 5.4 out of 10, where 0 equated to “very little importance and 10 equated to “a great deal of importance.” Further, respondents allocated an average of 53.5 out of 100 "points of influence"[28] to the BOC Training when considering all influencing factors in their decision to complete energy-savings projects. Expectedly, all the respondents reported that other non-program factors were influential in their decision-making process—i.e.,

[27] Regional Technical Forum. *Proposed Standard Savings Estimation Protocol for Ultra-Premium Efficiency Motors.* November 5, 2012. Appendix C, Table 6

[28] Respondents were given 100 points to reflect why they decided to take each energy saving action and asked to divide those points between 1) the influence of the program and 2) all other influencing factors.

respondents most commonly cited sustainability initiatives, financial benefits, and increasing occupant comfort as influential factors (Table 58).

Table 58. Influence of Non-BOC Factors on Decision to Implement Energy-Saving Projects

Factor	Post-Course Survey Respondents			
	Total	Influence Score [a]		
		0–3	4–6	7–10
Company commitment to going green	4	0	0	4
Reducing operating costs	4	0	1	3
Rate of return	4	1	0	3
Increased comfort	4	1	0	3
Employee, customer or student complaints	4	2	0	2
Other	2	0	1	1

[a] Respondents rated the influence of factors other than the BOC Training on a scale from 0 to 10, where 0 was "very little influence" and 10 was "a great deal of influence."

Non-Respondent Analysis

The evaluation team pursued the seven participants that completed the post-course survey, out of the 12 trainees that participated in 2018 (see Summary of Evaluation Methodology Section), for further research. To understand how those included in the impact analysis (i.e., "respondents") compared to the entire 2018 participant population, we assessed both groups on the following criteria:

- **Participant characteristics**: Respondents held similar positions and decision-making responsibilities as non-respondents. As Table 6 and Table 35 illustrate, we surveyed a greater share of participants that managed school or university facilities.
- **Facility characteristics**: On average, respondents managed more facilities than non-respondents. Respondent facilities were also typically larger and consumed more energy.
- **Pre-participation energy-saving actions**: Respondents tended to take more energy-saving actions prior to participating than the overall population (Table 59).

Table 59. Participant Energy-Saving Actions Completed Before the BOC Training

Upgrade Category	Respondents (n=5)	Population (n=11)[a]
Economizer and ventilation controls	5	11
Lighting	5	10
HVAC equipment scheduling or space temperature	5	10
Boiler/hot water/steam system	4	7
Chiller/chilled water system	4	7
Cooling tower optimization	3	6
Domestic hot water	3	6
Package/split-system HVAC	3	5
Fan optimization/air distribution	2	5
Water pump optimization	0	3
Other	2	2

[a] Note one participant did not complete the baseline operations and maintenance and energy efficiency equipment survey.

Appendix B. Cost-Effectiveness Inputs

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

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.

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 Business 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.

Standard

Interactive Effects

We calculated heating penalties associated with efficient lighting installed through the Standard Initiative during 2019. The initiative tracking database does not provide the heating fuel type; therefore, the evaluation team applied gas heat waste heat factors as specified in the IL-TRM V7.0 (when heating fuel is unknown).

Table 60 presents total verified gross impacts for the Standard Initiative for cost-effectiveness calculations. These values differ from those included in the main report due to the inclusion of heating penalties for lighting measures. Overall, the application of waste heat factors reduces total gross gas savings by 2,147,395 therms.

Table 60. 2019 Standard Initiative Verified Gross Impacts including Heating Penalties

	MWh	MW	Therms
Total Gross Savings without Heating Penalty	199,497	34.11	2,315,912
Core Standard Heating Penalty	—	—	-626,590
Instant Incentives Heating Penalty	—	—	-718,536
Online Store Heating Penalty	—	—	-14,721
Small Business Direct Install Heating Penalty	—	—	-787,548
Green Nozzle Heating Penalty	—	—	—
Total Gross Savings with Natural Gas Heating Penalty	**199,497**	**34.11**	**168,517**

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 Standard Initiative during 2019. These savings are included in the body of the report as well.

Table 61 presents total verified gross impacts for the Standard Initiative for cost-effectiveness calculations. These values differ from those included in the main report due to the exclusion of secondary electric savings. Overall, the removal of secondary .

Table 61. 2019 Standard Initiative Verified Gross Impacts Without Secondary Electric Savings

	MWh
Total Gross Savings with Secondary Electric Savings	199,497
Core Standard Secondary Electric Savings	4
Instant Incentives Secondary Electric Savings	—
Online Store Secondary Electric Savings	—
Small Business Direct Install Secondary Electric Savings	—
Green Nozzles Secondary Electric Savings	5
Total Gross Savings without Secondary Electric Savings	**199,488**

Custom

Interactive Effects

No measures delivered through the Custom Initiative in 2019 produce quantifiable interactive effects.

Secondary Electric Savings for Water Supply and Wastewater Treatment

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

Retro-Commissioning

Interactive Effects

No measures delivered through the Retro-Commissioning Initiative in 2019 produce quantifiable interactive effects.

Secondary Electric Savings for Water Supply and Wastewater Treatment

No measures delivered through the Retro-Commissioning Initiative in 2019 produce quantifiable water savings.

Streetlighting

Interactive Effects

Because all measures installed through the Streetlighting Initiative are located in unconditioned space, no measures delivered through the Streetlighting Initiative in 2019 produce quantifiable interactive effects.

Secondary Electric Savings for Water Supply and Wastewater Treatment

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

Building Operator Certification

Interactive Effects

We calculated heating penalties associated with efficient lighting installed as a result of BOC during 2019. Table 62 presents total verified net impacts for BOC for cost-effectiveness calculations. These values differ from those included in the main report due to the inclusion of heating penalties for lighting measures. Overall, the application of waste heat factors reduces total net gas savings by 2,546 therms.

Table 62. 2019 BOC Training Net Impacts including Heating Penalties

	MWh	MW	Therms
Total Gross Savings without Heating Penalty	322	0.064	18,076
BOC Training Heating Penalty	—	—	-2,546
Total Gross Savings with Natural Gas Heating Penalty	**322**	**0.064**	**15,530**

Secondary Electric Savings for Water Supply and Wastewater Treatment

No measures installed as a result of BOC in 2019 produce quantifiable water savings.

Appendix C. Cumulative Persisting Annual Savings

This appendix presents detailed CPAS for the Business 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 63 provides CPAS for the 2019 Business Program through 2047 at the initiative level. Lifetime savings for the 2019 Business Program are 2,602,116 MWh.

Table 63. 2019 Business 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
Standard	13.3	199,497	0.866		172,771	172,741	171,413	168,630	165,691	162,382	160,569	159,154	156,652	154,782	151,446	122,623	85,659	80,713
Custom	14.8	27,583	0.822		22,673	22,673	22,618	22,517	22,486	22,486	22,201	22,136	22,010	21,832	21,646	19,644	17,870	14,387
Custom (conversion)	14.4	2,858	0.939		2,684	2,684	2,684	2,684	2,684	2,684	2,684	2,684	2,684	2,684	2,684	2,684	2,586	2,416
Retro-Commissioning	5.3	4,680	0.890		4,165	4,159	3,946	3,909	3,784	888	888	444	0	0	0	0	0	0
Streetlighting	12.0	4,014	1.000		4,014	4,014	4,014	4,014	3,324	3,324	3,324	3,324	3,324	3,324	3,324	3,324	0	0
BOC	14.9	322	N/A		322	322	322	318	318	315	315	315	304	304	304	303	303	303
2019 Portfolio CPAS		**238,954**	**0.865**		**206,629**	**206,592**	**204,997**	**202,070**	**198,286**	**192,078**	**189,981**	**188,057**	**184,974**	**182,926**	**179,404**	**148,578**	**106,418**	**97,818**
Expiring 2019 Portfolio CPAS					**0**	**37**	**1,596**	**2,926**	**3,784**	**6,208**	**2,098**	**1,924**	**3,083**	**2,048**	**3,522**	**30,826**	**42,159**	**8,600**
Expired 2019 Portfolio CPAS					**0**	**37**	**1,632**	**4,559**	**8,343**	**14,550**	**16,648**	**18,572**	**21,655**	**23,703**	**27,225**	**58,051**	**100,211**	**108,811**

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
Standard	13.3	199,497	0.866	69,991	802	433	385	385	385	382	382	382	0	0	0	0	0	0
Custom	14.8	27,583	0.822	12,199	8,078	4,764	3,304	1,714	1,714	1,712	1,676	1,249	885	699	53	49	0	0
Custom (conversion)	14.4	2,858	0.939	1,401	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Retro-Commissioning	5.3	4,680	0.890	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Streetlighting	12.0	4,014	1.000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BOC	14.9	322	N/A	281	1	0	0	0	0	0	0	0	0	0	0	0	0	0
2019 Portfolio CPAS		**238,954**	**0.865**	**83,873**	**8,882**	**5,197**	**3,689**	**2,099**	**2,099**	**2,094**	**2,058**	**1,632**	**885**	**699**	**53**	**49**	**0**	**0**
Expiring 2019 Portfolio CPAS				**13,944**	**74,992**	**3,685**	**1,508**	**1,590**	**0**	**5**	**36**	**427**	**746**	**186**	**647**	**4**	**49**	**0**
Expired 2019 Portfolio CPAS				**122,755**	**197,747**	**201,432**	**202,940**	**204,530**	**204,530**	**204,535**	**204,570**	**204,997**	**205,743**	**205,929**	**206,576**	**206,580**	**206,629**	**206,629**
WAML	**13.3**																	

Standard

Table 64 provides CPAS for the 2019 Standard Initiative through 2047 at the enduse level. Lifetime savings for the 2019 Standard Initiative are 2,158,753 MWh.

Table 64. 2019 Standard Initiative CPAS and WAML

Enduse	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
Lighting	12.1	64,780	0.778		50,399	50,384	49,893	49,393	48,777	48,058	46,819	45,778	44,199	43,581	41,642	27,888	15,275	14,054
HVAC	12.1	8,011	0.557		4,462	4,462	4,462	4,262	4,262	4,262	4,262	4,262	3,878	3,878	3,695	3,456	3,456	3,456
Specialty Equipment	11.0	1,099	0.849		933	933	933	933	918	905	905	905	879	879	649	649	389	318
VSDs	15.0	6,516	0.833		5,427	5,427	5,427	5,427	5,427	5,427	5,427	5,427	5,427	5,427	5,427	5,427	5,427	5,427
Leak Survey and Repair	5.0	888	0.702		623	623	623	623	623	0	0	0	0	0	0	0	0	0
Green Nozzles	5.0	60	0.920		55	55	55	55	55	0	0	0	0	0	0	0	0	0
Instant Incentives	14.2	37,050	0.891		33,026	33,026	33,025	33,025	33,025	33,025	33,025	33,025	33,025	32,950	32,634	29,877	28,290	27,711
Online Store	9.0	1,246	0.831		1,035	1,035	898	898	862	791	725	610	406	377	362	38	38	35
SBDI	14.0	79,841	0.962		76,804	76,788	76,091	74,008	71,735	69,908	69,403	69,144	68,833	67,685	67,033	55,282	32,780	29,707
SBEP	18.5	7	0.800		6	6	6	6	6	6	4	4	4	4	4	4	4	4
Total		**199,497**	**0.866**		**172,771**	**172,741**	**171,413**	**168,630**	**165,691**	**162,382**	**160,569**	**159,154**	**156,652**	**154,782**	**151,446**	**122,623**	**85,659**	**80,713**
Expiring 2019 CPAS					**0**	**30**	**1,328**	**2,783**	**2,938**	**3,310**	**1,813**	**1,415**	**2,502**	**1,870**	**3,336**	**28,823**	**36,964**	**4,946**
Expired 2019 CPAS					**0**	**30**	**1,358**	**4,141**	**7,080**	**10,389**	**12,202**	**13,617**	**16,119**	**17,989**	**21,325**	**50,148**	**87,112**	**92,058**

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
Lighting	12.1	64,780	0.778	13,406	129	0	0	0	0	0	0	0	0	0	0	0	0	0
HVAC	12.1	8,011	0.557	3,456	478	430	382	382	382	382	382	382	0	0	0	0	0	0
Specialty Equipment	11.0	1,099	0.849	318	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VSDs	15.0	6,516	0.833	5,427	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Leak Survey and Repair	5.0	888	0.702	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Green Nozzles	5.0	60	0.920	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Instant Incentives	14.2	37,050	0.891	19,619	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Online Store	9.0	1,246	0.831	34	11	0	0	0	0	0	0	0	0	0	0	0	0	0
SBDI	14.0	79,841	0.962	27,726	181	0	0	0	0	0	0	0	0	0	0	0	0	0
SBEP	18.5	7	0.800	4	3	3	3	3	3	0	0	0	0	0	0	0	0	0
Total		**199,497**	**0.004**	**69,991**	**802**	**433**	**385**	**385**	**385**	**382**	**382**	**382**	**0**	**0**	**0**	**0**	**0**	**0**
Expiring 2019 CPAS				**10,721**	**69,189**	**369**	**48**	**1**	**0**	**3**	**0**	**0**	**382**	**0**	**0**	**0**	**0**	**0**
Expired 2019 CPAS				**102,779**	**171,969**	**172,338**	**172,385**	**172,386**	**172,386**	**172,389**	**172,389**	**172,389**	**172,771**	**172,771**	**172,771**	**172,771**	**172,771**	**172,771**
WAML	**13.3**																	

Custom

Table 65 provides initial electric CPAS for the 2019 Custom Initiative through 2047 at the subcomponent level. Lifetime savings for the 2019 Custom Initiative are 335,275 MWh.

Table 65. 2019 Custom Initiative CPAS and WAML

Offering	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
Custom Incentives	15.4	21,661	0.822		17,806	17,806	17,750	17,649	17,619	17,619	17,619	17,605	17,485	17,361	17,249	17,160	15,809	12,443
New Construction Lighting	12.5	5,921	0.822		4,867	4,867	4,867	4,867	4,867	4,867	4,582	4,531	4,525	4,471	4,397	2,484	2,061	1,944
Total		**27,583**	**0.822**		**22,673**	**22,673**	**22,618**	**22,517**	**22,486**	**22,486**	**22,201**	**22,136**	**22,010**	**21,832**	**21,646**	**19,644**	**17,870**	**14,387**
Expiring 2019 CPAS					**0**	**0**	**55**	**156**	**187**	**187**	**472**	**537**	**663**	**841**	**1,027**	**3,029**	**4,803**	**8,286**
Expired 2019 CPAS					**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Offering	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
Custom Incentives	15.4	21,661	0.822	10,689	7,255	4,444	3,157	1,714	1,714	1,712	1,676	1,249	885	699	53	49	0	0
New Construction Lighting	12.5	5,921	0.822	1,511	823	319	147	0	0	0	0	0	0	0	0	0	0	0
Total		**27,583**	**0.293**	**12,199**	**8,078**	**4,764**	**3,304**	**1,714**	**1,714**	**1,712**	**1,676**	**1,249**	**885**	**699**	**53**	**49**	**0**	**0**
Expiring 2019 CPAS				**10,473**	**14,595**	**17,909**	**19,369**	**20,959**	**20,959**	**20,961**	**20,997**	**21,423**	**21,788**	**21,973**	**22,620**	**22,624**	**22,673**	**0**
Expired 2019 CPAS				**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
WAML	**14.8**																	

Table 66 provides CPAS converted from therms for the 2019 Custom Initiative through 2047. Lifetime savings for the 2019 Custom Initiative conversion are 38,609 MWh.

Table 66. 2019 Custom Initiative Gas Conversion CPAS and WAML

Offering	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
Custom Gas Conversion	14.4	2,858	0.939		2,684	2,684	2,684	2,684	2,684	2,684	2,684	2,684	2,684	2,684	2,684	2,684	2,586	2,416
Total		**2,858**	**0.939**		**2,684**	**2,684**	**2,684**	**2,684**	**2,684**	**2,684**	**2,684**	**2,684**	**2,684**	**2,684**	**2,684**	**2,684**	**2,586**	**2,416**
Expiring 2019 CPAS					**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**98**	**171**
Expired 2019 CPAS					**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**98**	**268**

Offering	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
Custom Gas Conversion	14.4	2,858	0.939	1,401	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total		**2,858**	**0.939**	**1,401**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Expiring 2019 CPAS				**1,014**	**1,401**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Expired 2019 CPAS				**1,282**	**2,684**	**2,684**	**2,684**	**2,684**	**2,684**	**2,684**	**2,684**	**2,684**	**2,684**	**2,684**	**2,684**	**2,684**	**2,684**	**2,684**
WAML	**14.4**																	

Retro-Commissioning

Table 67 provides CPAS for the 2019 Retro-Commissioning Initiative through 2032 at the enduse level. Lifetime savings for the 2019 Retro-Commissioning Initiative are 22,183 MWh.

Table 67. 2019 Retro-Commissioning 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
Compressed Air Retro-Commissioning	4.7	3,682	0.890		3,277	3,270	3,058	3,020	2,895	0	0	0	0	0	0	0	0	0
Large Facility Retro-Commissioning	7.5	890	0.890		792	792	792	792	792	792	792	396	0	0	0	0	0	0
Retro-Commissioning Lite	7.5	108	0.890		96	96	96	96	96	96	96	48	0	0	0	0	0	0
Total		**4,680**	**0.890**		**4,165**	**4,159**	**3,946**	**3,909**	**3,784**	**888**	**888**	**444**	**0**	**0**	**0**	**0**	**0**	**0**
Expiring 2019 CPAS					**0**	**7**	**213**	**37**	**125**	**2,895**	**0**	**444**	**444**	**0**	**0**	**0**	**0**	**0**
Expired 2019 CPAS					**0**	**7**	**219**	**256**	**382**	**3,277**	**3,277**	**3,721**	**4,165**	**4,165**	**4,165**	**4,165**	**4,165**	**4,165**
WAML	**5.3**																	

Streetlighting

Table 64 provides CPAS for the 2019 Streetlighting Initiative through 2032 at the measure level. Lifetime savings for the 2019 Streetlighting Initiative are 42,647 MWh.

Table 68. 2019 Streetlighting 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
Municipality-Owned Streetlighting: DLC Standard	12.0	386	1.000		386	386	386	386	386	386	386	386	386	386	386	386	0	0
Municipality-Owned Streetlighting: DLC Premium	12.0	496	1.000		496	496	496	496	496	496	496	496	496	496	496	496	0	0
Utility-Owned Streetlighting	12.0	2,208	1.000		2,208	2,208	2,208	2,208	2,208	2,208	2,208	2,208	2,208	2,208	2,208	2,208	0	0
Utility-Owned Streetlighting - Replacing Mercury Vapor	12.0	924	1.000		924	924	924	924	234	234	234	234	234	234	234	234	0	0
Total		**4,014**	**1.000**		**4,014**	**4,014**	**4,014**	**4,014**	**3,324**	**3,324**	**3,324**	**3,324**	**3,324**	**3,324**	**3,324**	**3,324**	**0**	**0**
Expiring 2019 CPAS					**0**	**0**	**0**	**0**	**690**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3,324**	**0**
Expired 2019 CPAS					**0**	**0**	**0**	**0**	**690**	**690**	**690**	**690**	**690**	**690**	**690**	**690**	**4,014**	**4,014**
WAML	**12.0**																	

Building Operator Certification

Table 69 provides 2019 CPAS from BOC training through 2035 at the measure level. Lifetime savings from BOC are 4,648 MWh.

Table 69. 2019 CPAS and WAML from BOC Training

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	2033	2034	2035
Lighting	14.2	128	N/A		128	128	128	128	128	128	128	128	121	121	121	119	119	119	98	1	0
Cooling tower optimization	15.0	109	N/A		109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	0	0
Boiler/hot water/steam system	17.5	65	N/A		65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	0	0
Chiller/chilled water system	15.0	9	N/A		9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	0	0
HVAC scheduling	3.0	4	N/A		4	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Economizer and ventilation controls	5.0	3	N/A		3	3	3	3	3	0	0	0	0	0	0	0	0	0	0	0	0
Water pump optimization	8.0	3	N/A		3	3	3	3	3	3	3	3	0	0	0	0	0	0	0	0	0
Package/Split-System HVAC Changes	8.0	1	N/A		1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
2019 CPAS		**322**	**N/A**		**322**	**322**	**322**	**318**	**318**	**315**	**315**	**315**	**304**	**304**	**304**	**303**	**303**	**303**	**281**	**1**	**0**
Expiring 2019 CPAS					**0**	**0**	**0**	**4**	**0**	**3**	**0**	**0**	**10**	**0**	**0**	**1**	**0**	**0**	**22**	**280**	**1**
Expired 2019 CPAS					**0**	**0**	**0**	**4**	**4**	**7**	**7**	**7**	**18**	**18**	**18**	**20**	**20**	**20**	**41**	**321**	**322**
WAML	**14.9**																				

Appendix D. Custom Initiative Site Visit Reports

This appendix is provided under separate cover.

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