Opinion Dynamics

Boston | Headquarters

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

1000 Winter St
Waltham, MA 02451

Ameren Illinois Company 2020 Business Program Impact Evaluation Report

Final
April 28, 2021

Opinion Dynamics

Table of Contents

Opinion Dynamics

Table of Tables

Table of Figures

Table of Equations

1. Executive Summary

This report presents impact evaluation results from Ameren Illinois Company's (AIC) 2020 Business Program. The Business Program is part of AIC's overall portfolio of residential and non-residential energy efficiency programs implemented during 2020. The overarching objective of the 2020 Business Program impact evaluation is to determine gross and net electric energy, electric demand, and natural gas impacts associated with the Program.

1.1 Program Overview

The Business Program is the largest component of AIC's portfolio and is made up of a number of initiatives (further broken down into channels) that the evaluation team assessed as part of the 2020 evaluation:[1]

- Standard Initiative
  - Core (described further in Section 3.1.1)
  - Small Business Direct Install (SBDI)
  - Small Business Energy Performance (SBEP)
  - Instant Incentives (Midstream)
  - Midstream HVAC
  - Online Store
  - Green Nozzles
  - Sink Aerators
- Custom Initiative
  - Custom Incentives
  - New Construction Lighting
- Retro-Commissioning (RCx) Initiative
  - Compressed Air Retro-Commissioning
  - Large Facilities Retro-Commissioning
  - Virtual Commissioning™
- Streetlighting Initiative
  - Municipality-Owned Streetlighting (MOSL)
  - Utility-Owned Streetlighting (UOSL)
- Building Operator Certification (BOC)[2]

[1] In addition to the channels described here, the Program operates a number of channels that provide customer services but that do not directly produce energy savings (such as the Metering & Monitoring channel of the Custom Initiative) or that were operated in 2020 but that did not lead to any completed projects (such as the Retro-Commissioning Lite channel of the Retro-Commissioning Initiative).
[2] BOC is not technically an initiative but is listed here for simplicity. 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. We evaluate this offering to estimate energy savings that directly result from it, but AIC does not claim ex ante BOC savings.

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 efficiency measures to customers. The Custom and the RCx 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.

The Business Program is available to the majority of AIC's nonresidential customers, including both public and private sector customers. However, two notable customer groups are ineligible for the Business Program.

- **Large electric customers.** Non-residential electric customers with electric demand of over 10 MW became ineligible for AIC energy efficiency 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 has had significant effects on the Program and required the Program to generally pursue larger numbers of smaller projects to achieve its goals. This change particularly affected the Custom Initiative, which historically derived 50% or more of its energy savings from 10 MW customers.
- **Large gas customers.** AIC's largest non-residential natural gas customers also became ineligible for energy efficiency programs beginning in the 2020 program year. All customers with annual usage of either 4,000,000 therms or more across all AIC service points or 8,000,000 therms or more across all Illinois service points became ineligible for AIC programs as of January 1, 2020.

1.2 Policy Background

This is the third calendar year of AIC's four-year 2018 Plan, which was developed based on guidance provided through Illinois Senate Bill 2814 (the Future Energy Jobs Act [FEJA]). Based on this legislation, key concepts that affect program evaluation include:

- **Cumulative Persisting Annual Savings (CPAS):** Since 2018, electric energy savings goals for Illinois utilities have been primarily defined based on persisting savings as a percentage of sales. As such, annual evaluations of AIC's electric programs, including this one, present both annual and persisting savings over the life of delivered measures. As a result, AIC and its program implementer have also sought to deliver programs that achieve savings that persist for a longer period of time.
- **Applicable Annual Incremental Goal (AAIG):** AAIG is defined as the difference between the cumulative persisting electric savings goal for the year being evaluated and the cumulative persisting electric savings goal for the previous year. On a year-to-year basis, AIC must meet an AAIG. The utility must achieve sufficient savings through its programs to replace savings from measures at the end of their measure life before progress can be counted toward the AAIG.
- **Weighted Average Measure Life (WAML):** FEJA replaced 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."[3] Therefore, we present WAML for AIC's electric Business Program in this report in accordance with the guidelines for calculation presented in the Illinois Stakeholder Advisory Group's (SAG) WAML Report.[4]
- **Savings Conversion:** FEJA allows electric utilities to "convert" non-electric energy savings achieved to electric savings for the purposes of goal attainment in certain cases. The total amount of savings

[3] Illinois Energy Efficiency Stakeholder Advisory Group. *Weighted Average Measure Life Report.* 2018.
[4] Ibid.

allowed to be converted is capped at a maximum of 10% of the utility's AAIG. AIC met the criteria to convert savings in 2020 and chose to convert savings from the SBEP offering as part of the savings conversion.

1.3 Program Savings

In the following sections, the evaluation team presents annual savings (annualized 2020 energy savings) and CPAS. As discussed in greater detail in the *2020 AIC Integrated Impact Evaluation Report*, AIC's performance compared to its AAIG is determined based on both types of savings.

1.3.1 Annual Savings

The 2020 Business Program achieved 244,956 MWh, 35.23 MW, and 1,957,408 therms in verified net savings. 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 2020 Business Program.

Table 1. 2020 Business Program Electric Energy Annual Savings Summary

Initiative	Ex Ante Gross MWh	Gross Realization Rate	Verified Gross MWh	Net-to-Gross Ratio (NTGR)	Verified Net MWh
Standard	201,979	99%	200,341	0.884	177,037
Standard Carryover[a]	6,197	100%	6,197	0.845	5,234
Custom	32,018	97%	30,951	0.822	25,442
RCx	5,529	82%	4,522	0.898	4,062
Streetlighting	31,633	100%	31,633	0.990	31,306
Business Program Subtotal	*277,355*	*99%*	*273,643*	*0.888*	*243,081*
BOC					180
Standard (gas conversion)					1,695
Business Program Total					**244,956**

[a] Carryover savings are those achieved through installation of measures during 2020 that were distributed or rebated in prior Program years. For clarity, we break out carryover separately throughout this report.

Table 2. 2020 Business Program Electric Demand Annual Savings Summary

Initiative	Ex Ante Gross MW	Gross Realization Rate	Verified Gross MW	NTGR	Verified Net MW
Standard	34.59	101%	34.89	0.886	30.91
Standard Carryover	1.46	100%	1.46	0.849	1.24
Custom	4.93	70%	3.44	0.822	2.83
RCx	0.44	64%	0.28	0.890	0.25
Streetlighting	0.00	N/A	0.00	N/A	0.00
Business Program Subtotal	*41.42*	*97%*	*40.07*	*0.879*	*35.23*
BOC					0.00
Business Program Total					**35.23**

Table 3. 2020 Business Program Gas Annual Savings Summary

Initiative	Ex Ante Gross Therms	Gross Realization Rate	Verified Gross Therms	NTGR	Verified Net Therms
Standard	938,480	106%	993,317	0.546	542,690
Standard Carryover	0	N/A	0	N/A	0
Custom	1,302,727	116%	1,507,107	0.939	1,415,174
RCx	74,471	82%	61,170	0.890	54,441
Streetlighting	0	N/A	0	N/A	0
Business Program Subtotal	*2,315,678*	*111%*	*2,561,594*	*0.786*	*2,012,306*
BOC					2,960
Standard (gas conversion)					-57,857
Business Program Total					**1,957,408**

1.3.2 Cumulative Persisting Annual Savings

Table 4 summarizes CPAS and WAML for the 2020 Business Program at the initiative level. For additional detail related to CPAS and measure life, please see the individual initiative subsections in Section 3; the overall CPAS spreadsheet provided with this report; and Appendix C, which presents CPAS achieved in each future year. The overall WAML for the 2020 Business Program is 13.2 years.

Table 4. 2020 Business Program CPAS and WAML

Initiative	WAML	First-Year Verified Gross Savings (MWh)	NTGR	CPAS – Verified Net Savings (MWh)							Lifetime Savings (MWh)
				2018	2019	2020	2021	...	2030	...	
Standard	13.5	200,341	0.884			177,037	177,000	...	153,447	...	2,190,614
Standard Carryover	13.7	6,197	0.845			5,234	5,234	...	4,383	...	69,514
Custom	12.8	30,951	0.822			25,442	25,442	...	20,228	...	326,024
RCx	6.4	4,522	0.898			4,062	4,062	...	0	...	26,204
Streetlighting	12.0	31,633	0.990			31,306	31,306	...	29,494	...	361,175
BOC	8.9	180	N/A			180	180	...	13	...	1,597
Standard (gas conversion)	20.0	1,867	0.908			1,695	1,695	...	1,695	...	33,904
2020 CPAS		**275,690**	**0.889**			**244,956**	**244,919**	**...**	**209,261**	**...**	**3,009,032**
Expiring 2020 CPAS						**0**	**37**	**...**	**4,964**	**...**	
Expired 2020 CPAS						**0**	**37**	**...**	**35,695**	**...**	
WAML	**13.2**										

2. Evaluation Approach

The following section of the report describes the evaluation approach taken for the 2020 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 2020 program year (generally Version 1.1[5] and Version 8.0, respectively) wherever relevant.[6] Appendix A of this report provides more-detailed initiative-specific methodology where appropriate.

The 2020 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 V8.0 to the final initiative tracking databases to estimate verified gross savings. For the Custom and RCx initiatives, the team primarily employed a combination of engineering desk reviews, remote and on-site verification, and statistical analysis to estimate verified gross savings. This report also presents an 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 2020 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 listed in Table 5. In addition, we reviewed initiative materials and interviewed all initiative managers.

Table 5. 2020 Business Program Impact Evaluation Activities

Initiative	Gross Impacts				Net Impacts
	IL-TRM Application Review	Engineering Desk Reviews	On-Site Measurement and Verification (M&V)	Consumption Analysis	Application of SAG-Approved NTGRs
Standard	✓	✓			✓
Custom		✓	✓	✓	✓
RCx		✓		✓	✓
Streetlighting	✓				✓
BOC	✓	✓			

The following sections provide further detail on the approaches to estimating verified gross and net savings.

[5] Broadly speaking, Version 1.1 of the Policy Manual was in effect during this evaluation. However, a number of individual policies from Version 2.0 of the Policy Manual were also in effect during this evaluation; those individual policies (e.g., Section 11.1) were applied in this evaluation as well.

[6] In future years, the evaluation team will apply updated versions of these manuals to the evaluation of this Program as required by law, Illinois Commerce Commission orders, and changes to the manuals themselves.

2.2 Verified Gross Impact Analysis Approach

2.2.1 Application of IL-TRM V8.0

To determine verified gross impacts associated with the Streetlighting Initiative and 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 V8.0 and the IL-TRM V8.0 errata document. In particular, we applied the algorithms and assumptions provided in the IL-TRM V8.0, 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 gas penalties from savings reported in the body of this report. Appendix B presents details on gas penalties for cost-effectiveness purposes.

2.2.2 Carryover Savings

In addition to savings achieved by AIC's Business Program through measures delivered during the 2020 program year, AIC claims savings in 2020 from lighting measures distributed by the Business Program in prior years but not installed until 2020. The relevant initiatives include:

- 2018 and 2019 Standard Initiative (Instant Incentives offering)

Carryover savings are evaluated using the applicable NTGR from the year in which the product was sold, the applicable in-service rate (ISR) trajectory assumption based on the year in which the product was sold, and IL-TRM V8.0 and IL-TRM V8.0 errata assumptions for all other relevant impact parameters.

We reported previously on AIC's 2020 carryover savings as part of an earlier memo.[7] Carryover savings are not reported as part of individual initiative subsections in Section 3.

2.2.3 Application of Custom Impact Methods

The Custom and RCx initiatives, as well as a small number of Standard Initiative measures and savings achieved through BOC, 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.[8] Further details on the custom impact methods applied for these initiatives are presented in Appendix A.

Custom impact evaluation methods as applied to these programs often involve some degree of direct measurement of either energy savings or relevant impact parameters. As a result of the COVID-19 pandemic, which affected program implementation and operation for the majority of the 2020 program year, customer behavior and energy usage may have changed, potentially affecting custom project evaluation.[9] Per SAG

[7] Opinion Dynamics. "Ameren Illinois Company Lighting Carryover Savings Claimable in 2020." 2021. Accessed at: https://ilsag.s3.amazonaws.com/AIC-2020-Lighting-Carryover-Savings-Memo-FINAL-2021-02-20.pdf.
[8] Note that, where possible, we applied IL-TRM assumptions and measure characterizations for evaluation of these initiatives in accordance with evaluation best practice.
[9] Note that because relevant impact parameters for prescriptive measures were deemed in the IL-TRM V8.0 before the program year began, no such effect exists for prescriptive measures.

agreement, the evaluation team normalized 2020 energy savings estimated through custom evaluation methods to reflect a typical evaluation year,[10] obviating this concern around effects on annual and persisting savings.

2.3 Verified Net Impact Analysis Approach

To determine verified net savings for the 2020 Business Program, we applied SAG-approved NTGRs to verified gross savings. Details on SAG-approved NTGRs applied are presented in Appendix A.

The one exception is the BOC Initiative, for which we treated the savings as participant spillover per IL-TRM guidance.[11] As a result, we did not apply a SAG-approved NTGR to evaluated savings – all savings claimed were already determined to have been influenced by BOC.

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 2020 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 V8.0 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 remote and on-site M&V. To minimize data analysis errors, the evaluation team had all 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 Initiative Impact Sample:** The evaluation team completed an impact review for 54 of 154 Custom Initiative projects achieving savings in 2020, 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 11.7% for electric energy savings, 27.5% for electric demand savings, and 15.6% for gas savings. Further detail on our methodology for Custom Initiative sampling is provided in Appendix A.
  - **RCx Initiative Impact Sample:** The evaluation team completed desk reviews for a census (9) of RCx Initiative projects. There is therefore no sampling error around our impact results.

[10] Illinois Energy Efficiency Stakeholder Advisory Group. *Policy Resolution – 2020 Program Year.* 2020. Accessed at: https://ilsag.s3.amazonaws.com/SAG-Policy-Resolution_Normalization_Final_12-21-2020.pdf

[11] *2020 Illinois Statewide Technical Reference Manual for Energy Efficiency Version 9.0, Attachment A: Illinois Statewide Net-to-Gross Methodologies*. Table 2-1. 2020.

- **Non-Sampling Error:**
  - **Measurement Error:** To minimize data collection error during remote and on-site M&V, the evaluation team used trained engineers and technicians familiar with the equipment covered by the Custom and RCx initiatives and BOC and with the methods used to calculate the gross impacts.

For the Virtual Commissioning™ pilot specifically, we also addressed the following types of error:

- **Presence of Non-Routine Events:** "Non-routine events" refers to changes in facility energy consumption resulting from facility-related changes not related to the interventions recommended through the pilot. Non-routine events can make it difficult to accurately measure savings using meter-based approaches, including the approach used for the Virtual Commissioning™ pilot. Non-routine events were of particular concern in 2020, as facility schedules tended to be irregular and difficult to monitor due to COVID-19 restrictions and building shutdowns during protests. The team accounted for non-routine events in our modeling approach by removing data for the affected period and extending the baseline back in time accordingly, consistent with International Performance Measurement and Verification Protocol (IPMVP) Non-Routine Adjustment Option 1.[12]
- **Model Specification Error:** In this type of error, variables that predict model outcomes are included when they should not be or are left out when they should be included, possibly producing biased estimates. The team addressed this type of error by recommending that the program implementer consider additional model specifications in the future.
- **Measurement Error:** In the context of the Virtual Commissioning™ pilot, measurement error occurs when electric meters do not accurately record the true energy consumption of a facility. In practice, little can be done in an evaluation context to address this error. However, it is expected to be small.
- **Prediction Error:** Prediction error occurs when the model does not perfectly predict what future energy consumption will be. This issue is exacerbated for the Virtual Commissioning™ pilot in 2020 because the team had access to only three to five months of post-period data for each site, which introduces bias because the model was not able to train on a full range of temperature data after the intervention was initiated. This may increase the prediction error for temperatures that are outside the range of the training data. The team addressed this by carefully examining model fit diagnostics.
- **Multi-Collinearity:** This type of modeling error can both bias the model results and produce very large variance in the results. The team addressed this issue by carefully considering the model specification and data to ensure that there were no multi-collinearity issues.
- **Heteroskedasticity:** This type of modeling error can result in imprecise model results because the variance of the error term might be different across time. The team addressed this type of error by using Newey-West robust standard errors, which adjust for both autocorrelation and heteroskedasticity.
- **Serial Correlation:** This type of modeling error, also known as autocorrelation, can result in imprecise model results because the error term in one time period might be correlated with the error term in another time period. The team addressed this type of error by using Newey-West robust standard errors, which adjust for both autocorrelation and heteroskedasticity.

Finally, note that the calculations in some of the tables in this report cannot be exactly reproduced due to rounding.

[12] Webster, Lia. *IPMVP Application Guide on Non-Routine Events and Adjustments.* Efficiency Valuation Organization (EVO). 2020.

3. Initiative-Level Results

3.1 Standard Initiative

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 channels, which are described below:

- **Core:** The Standard Initiative offers traditional downstream rebates for lighting, variable speed drives (VSDs), HVAC equipment, refrigeration/grocery store equipment, commercial kitchen equipment, steam trap repair/replacement (STRR), leak survey and repair, and other measures. The Initiative separates these out into a series of distinct channels, detailed below, but we collectively refer to them as the "Core" channel for simplicity throughout this report.
  - Standard Lighting for Business (SLB)
  - Heating, Ventilating, and Air Conditioning (HVAC)
  - Specialty Equipment
  - Variable Speed Drives (VSD)
  - Steam Trap Repair/Replacement (STRR)
  - Leak Survey and Repair (LSR)
- **Instant Incentives:** Instant Incentives is a midstream offering that offers discounts at the point of sale that covered a variety of standard, specialty, and linear LEDs, as well as a small number of non-lighting measures in 2020.
- **Midstream HVAC (MHVAC):** AIC began offering midstream incentives for HVAC measures late in 2020 in anticipation of a focus on this channel in 2021.
- **Online Store:** Through the Initiative, AIC operates the Online Store, which offers business customers a variety of energy-saving products, such as LEDs, occupancy sensors, advanced thermostats, and advanced power strips.
- **SBDI:** 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.
- **SBEP:** SBEP began as a pilot in 2019. SBEP currently involves the completion of pilot projects in small non-residential facilities.
- **Green Nozzles:** The Initiative also includes the Green Nozzles offering, which offers free low-flow pre-rinse nozzles to all AIC business customers.
- **Sink Aerators:** The Initiative also provides incentives for faucet aerators, low-flow showerheads, and laminar flow restrictors.

Summary of Key Implementation Changes in 2020

During 2020, the Standard Initiative implemented the following significant design and implementation changes relative to 2019:

- The Initiative began to offer incentives through the MHVAC channel.
- The Initiative increased its focus on longer-lived measures to align with AIC's CPAS goals. To achieve this goal, incentives for some short-lived measures (such as, but not limited to, LED exit signs, compressed air leak repair, and HVAC tune-ups) were gradually removed throughout 2020.
- The SBEP channel was redesigned to focus on more-comprehensive building envelope improvement as compared to the 2019 pilot; in 2020, the channel focused on schools and completed 74 projects.
- To help customers weather the effect of the COVID-19 pandemic on their businesses, the implementation team made some targeted changes to the Initiative, including marketing to specific customer segments and increasing midstream incentives.

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. Altogether, the Initiative reported a total of 201,979 MWh, 34.59 MW, and 938,480 therms in ex ante gross savings.

Table 6. 2020 Standard Initiative Participation Summary

Offering	Total Projects	Ex Ante Gross Savings		
		MWh	MW	Therms
Private Sector				
SLB	625	37,538	6.86	0
HVAC	197	3,468	0.31	261,461
Specialty Equipment	83	1,097	0.15	12,029
VSDs	18	11,401	1.61	0
STRR	38	0	0.00	238,536
LSR	7	1,891	0.22	0
Green Nozzles	3	3	0.00	316
Sink Aerators	1	0	0.00	476
Online Store	339	446	0.10	33,698
Instant Incentives[a]	480	23,433	5.54	259
Equipment Install	10	0	0.00	0
MHVAC	1	1	0.00	0
SBDI	2,527	82,179	12.11	0
Private Sector Subtotal	*4,329*	*161,455*	*26.90*	*546,775*
Public Sector				
SLB	176	4,499	0.74	0
HVAC	70	2,025	0.19	191,993
Specialty Equipment	9	43	0.00	3,538
VSDs	17	3,685	0.85	0

Offering	Total Projects	Ex Ante Gross Savings		
		MWh	MW	Therms
STRR	13	0	0.00	39,134
Sink Aerators	3	0	0.00	886
Online Store	21	28	0.01	1,943
Instant Incentives[a]	198	11,694	2.77	0
Equipment Install	12	0	0.00	0
SBDI	463	18,240	3.03	0
SBEP	74	309	0.11	154,212
Public Sector Subtotal	*1,056*	*40,524*	*7.69*	*391,705*
Total	**5,385**	**201,979**	**34.59**	**938,480**

[a] Reported ex ante gross savings for Instant Incentives in Table 6 represent savings from 2020 sales only and do not include carryover savings.

3.1.3 Initiative Annual Savings Summary

Table 7 presents Standard Initiative annual savings achieved in 2020. The 2020 Standard Initiative achieved 177,037 MWh, 30.91 MW, and 542,690 therms in verified net savings. Note that the SAG-approved NTGRs were used to convert gross savings to net savings.

Table 7. 2020 Standard Initiative Annual Savings

	Electric Energy Savings (MWh)	Electric Demand Savings (MW)	Gas Savings (Therms)
Ex Ante Gross Savings	201,979	34.59	938,480
Gross Realization Rate	99%	100%	106%
Verified Gross Savings	200,341	34.89	993,317
NTGR	0.884	0.886	0.546
Verified Net Savings	177,037	30.91	542,690

3.1.4 Initiative Savings Detail

The Standard Initiative distributed a wide range of measures across five offerings, illustrated in Table 8 through Table 10.

The tables present the ex ante and verified electric energy, electric demand, and gas savings by offering and are followed by a discussion of key reasons for discrepancies between the claimed (ex ante) and verified gross savings. Unlike previous reporting years, all carryover savings from the Instant Incentives offering were excluded in ex ante and verified savings within this section of the report. As explained in Section 2.2.2, carryover savings were reported on separately and are presented separately within this report's summary tables.

In 2020, lighting measures again accounted for the overwhelming majority of verified net electric energy savings in the Standard Initiative, contributing 89%, slightly down from 91% in 2019. SBDI lighting measures contributed slightly more than 50% of total electric energy savings followed by Core (30%) and Instant Incentive (18%) lighting measures. The largest non-lighting contribution comes from the VSDs offering at 8%, followed by HVAC with 2% and LSR at 1% of total electric energy savings. The STRR offering provides an incremental

amount of electric energy savings to the Standard Initiative due to secondary electric energy savings associated with water and wastewater treatment, even though the offering targets gas savings.

Table 8. 2020 Standard Initiative Annual Electric Energy Savings by Measure

Measure Category	Ex Ante Gross Savings (MWh)	Gross Realization Rate	Verified Gross Savings (MWh)	NTGR	Verified Net Savings (MWh)
Core					
Lighting	42,037	100%	42,164	0.839	35,384
VSDs	15,086	100%	15,086	0.833	12,570
HVAC	5,492	79%	4,363	0.683	2,981
LSR	1,891	78%	1,483	0.849	1,259
Specialty Equipment	1,140	84%	958	0.849	813
STRR	0	N/A	1	0.608	1
Core Subtotal	*65,646*	*98%*	*64,055*	*0.828*	*53,008*
Instant Incentives					
Linear LEDs	30,346	101%	30,506	0.916	27,950
Specialty LEDs	4,779	100%	4,780	0.916	4,380
Advanced Thermostats	2	63%	1	0.800	1
Instant Incentives Subtotal	*35,127*	*100%*	*35,287*	*0.916*	*32,330*
Online Store					
Advanced Thermostats	309	60%	186	0.831	154
LED Bulbs	108	100%	108	0.831	90
Lighting Controls	51	100%	51	0.831	42
Advanced Power Strips	3	100%	3	0.831	3
LED Exit Signs	3	100%	3	0.831	2
Online Store Subtotal	*474*	*74%*	*350*	*0.831*	*291*
SBDI					
Lighting	100,406	100%	100,317	0.908	91,108
Non-Lighting	12	100%	12	0.908	11
SBDI Subtotal	*100,419*	*100%*	*100,330*	*0.908*	*91,119*
Other Channels					
SBEP Subtotal	309	*98%*	302	*0.908*	274
Green Nozzles Subtotal	*3*	*110%*	*3*	*0.920*	*3*
Sink Aerators Subtotal	*0*	*N/A*	*11*	*0.849*	*10*
MHVAC Subtotal	*1*	*223%*	*2*	*0.890*	*2*
Standard Initiative Total	**201,979**	**99%**	**200,341**	**0.884**	**177,037**

Similar to electric energy savings, lighting measures accounted for the overwhelming majority of net demand savings in the Initiative, contributing 91% to overall savings, slightly down from the 92% in 2019. Demand savings followed a similar distribution as electric energy savings, with SBDI contributing 46%, Instant Incentives 25%, and Core Lighting 21%. The largest non-lighting contribution again comes from VSDs at 6%, followed by HVAC at 1%.

Table 9. 2020 Standard Initiative Annual Electric Demand Savings by Measure

Measure Category	Ex Ante Gross Savings (MW)	Gross Realization Rate	Verified Gross Savings (MW)	NTGR	Verified Net Savings (MW)
Core					
Lighting	7.60	100%	7.60	0.839	6.38
VSDs	2.46	97%	2.38	0.833	1.98
HVAC	0.50	98%	0.49	0.683	0.34
LSR	0.22	79%	0.17	0.849	0.15
Specialty Equipment	0.15	82%	0.12	0.849	0.11
STRR	0.00	N/A	0.00	N/A	0.00
Core Subtotal	*10.93*	*99%*	*10.77*	*0.831*	*8.95*
Instant Incentives					
Linear LEDs	7.24	101%	7.28	0.916	6.67
Specialty LEDs	1.07	100%	1.07	0.916	0.98
Advanced Thermostats	<0.01	121%	<0.01	0.800	<0.01
Instant Incentives Subtotal	*8.31*	*100%*	*8.35*	*0.916*	*7.65*
Online Store					
Advanced Thermostats	0.05	110%	0.06	0.831	0.05
LED Bulbs	0.02	100%	0.02	0.831	0.02
Lighting Controls	0.03	100%	0.03	0.831	0.03
Advanced Power Strips	0.00	N/A	0.00	N/A	0.00
LED Exit Signs	<0.01	100%	<0.01	0.831	<0.01
Online Store Subtotal	*0.11*	*105%*	*0.11*	*0.831*	*0.09*
SBDI					
Lighting	15.14	103%	15.59	0.908	14.16
Non-Lighting	0	N/A	0	N/A	0
SBDI Subtotal	*15.14*	*103%*	*15.59*	*0.908*	*14.16*
Other Channels					
SBEP Subtotal	*0.11*	*63%*	*0.07*	*0.908*	*0.06*
Green Nozzles Subtotal	*0*	*N/A*	*0*	*N/A*	*0*
Sink Aerators Subtotal	*0*	*N/A*	*0*	*N/A*	*0*
MHVAC Subtotal	*<0.01*	*223%*	*<0.01*	*0.890*	*<0.01*
Standard Initiative Total	**34.59**	**101%**	**34.89**	**0.886**	**30.91**

Gas offerings experienced the largest change in distribution of savings from 2019. In 2019, the largest contributor was the STRR offering, accounting for 82% of net gas savings, followed by HVAC at 14%. In 2020, the STRR offering accounted for only 31% of net gas savings. This change is likely attributable to the exclusion of large gas customers from AIC's programs that began in 2020. Conversely, the HVAC offering experienced a large increase in net therms savings, accounting for 44% of gas savings for the 2020 program year. The SBEP offering contributed the third largest portion of net gas savings (18%) in its second year of being offered, followed by advanced thermostats (4%) through the Online Store, the specialty equipment offering (2%), and sink aerators (2%).

Table 10. 2020 Standard Initiative Annual Gas Savings by Measure

Measure Category	Ex Ante Gross Savings (Therms)	Gross Realization Rate	Verified Gross Savings (Therms)	NTGR	Verified Net Savings (Therms)
Core					
Lighting	0	N/A	0	N/A	0
VSDs	0	N/A	0	N/A	0
HVAC	453,454	122%	554,777	0.426	236,335
LSR	0	N/A	0	N/A	0
Specialty Equipment	15,566	100%	15,564	0.675	10,506
STRR	277,670	100%	277,670	0.608	168,823
Core Subtotal	*746,690*	*114%*	*848,011*	*0.490*	*415,664*
Instant Incentives					
Linear LEDs	0	N/A	0	N/A	0
Specialty LEDs	0	N/A	0	N/A	0
Advanced Thermostats	259	57%	149	0.800	119
Instant Incentives Subtotal	*259*	*57%*	*149*	*0.800*	*119*
Online Store					
Advanced Thermostats	35,641	69%	24,439	0.831	20,306
LED Bulbs	0	N/A	0	N/A	0
Lighting Controls	0	N/A	0	N/A	0
Advanced Power Strips	0	N/A	0	N/A	0
LED Exit Signs	0	N/A	0	N/A	0
Online Store Subtotal	*35,641*	*69%*	*24,439*	*0.831*	*20,306*
SBDI					
Lighting	0	N/A	0	N/A	0
Non-Lighting	0	N/A	0	N/A	0
SBDI Subtotal	*0*	*N/A*	*0*	*N/A*	*0*
Other Channels					
SBEP Subtotal	*154,212*	*70%*	*107,504*	*0.908*	*97,614*
Green Nozzles Subtotal	*316*	*100%*	*316*	*0.890*	*281*
Sink Aerators Subtotal	*1,363*	*947%*	*12,899*	*0.675*	*8,707*
MHVAC Subtotal	*0*	*N/A*	*0*	*N/A*	*0*
Standard Initiative Total	**938,480**	**106%**	**993,317**	**0.546**	**542,690**

Core

- SLB: The gross realization rate for SLB is 100% for both energy and demand savings.
  - Verified savings are slightly increased due to differences in space conditioning assumptions presented in the initiative tracking data and those applied in claimed savings calculations. The evaluation team applied the initiative tracking data, which noted spaces that are cooled and heated, and the fuel source for heating. This discrepancy minimally affects the SLB offering's performance, adjusting savings positively by 0.2%.
- HVAC: The gross realization rate for HVAC is 79% for electric energy savings, 98% for demand savings, and 122% for gas savings.
  - Claimed savings calculations for advanced thermostat measures assume that all installations are at sites with 100% electric heating and 100% air conditioning. The evaluation team applied the initiative tracking data to assign heating fuel and air conditioning assumptions. When heating fuel is unknown, or listed as dual fuel in the data, we applied a fuel mix of 3% electric and 97% gas. This resulted in a 7% decrease in verified electric energy savings and a slight decrease in gas savings for the HVAC offering.

    The implementation team multiplied claimed savings by the quantity of advanced thermostats installed at the project site. The IL-TRM V8.0 states that advanced thermostat measures are applicable only on systems with capacities less than five tons (60 kBTUh), because savings factors are sourced from residential studies. When assuming the capacity reported in the initiative tracking data is the capacity controlled by each installed thermostat, capacities exceed the five-ton limit in 60% of projects. As a result, the evaluation team applied the capacities reported in the initiative tracking system as the total controlled capacity of all thermostats installed at the project site, which better aligns with the IL-TRM V8.0 stipulation. This difference resulted in a decrease in electric energy savings and therm savings.

    The evaluation team also observed that gas savings are excluded for some projects, even where initiative tracking data points to the presence of natural gas heating at the site. This finding mostly offset the losses from discounting the measure quantity in verified savings.

    Additionally, within the advanced thermostats measure group, claimed savings calculations applied the Pennsylvania-New Jersey-Maryland (PJM) Interconnection coincidence factor (CF) of 23.9%.[13] The evaluation team applied the system summer peak CF of 45.7%. This difference resulted in a 7% increase in demand savings for the HVAC offering.
  - A prominent cause of decreased electric energy savings in the HVAC offering is the application of operating hours from the IL-TRM V7.0 in place of IL-TRM V8.0 for VSDs. The IL-TRM V8.0 updated operating hours associated with both VSD measures (Section 4.4.17, Variable Speed Drives for HVAC Pumps and Cooling Tower Fans, and Section 4.4.26, Variable Speed Drives for HVAC Supply and Return Fans). This misalignment with the applicable IL-TRM operating hours led to a decrease in electric energy savings of 11.6% (−566 MWh) and a 2% increase in demand savings for the HVAC offering.
  - The high-efficiency furnace measure group applied heating effective full load hours (EFLH) and CFs that are out of alignment with the IL-TRM V8.0 and initiative tracking data. The IL-TRM V8.0 Section 4.4.11, High Efficiency Furnace, provides EFLH and CF assumptions specific to high-efficiency furnaces, based on the building type. Program implementers applied the EFLH values from the IL-

[13] CFs are defined based on Illinois' two electrical control areas, PJM Interconnection, and the Midcontinent Independent System Operator (MISO). AIC is a part of MISO and therefore applies the system summer peak CF rather than the PJM CF.

TRM V8.0 Section 4.4, HVAC End Use, overarching tables, while also applying the CF associated with the "unknown" building type (42.4%) from the Section 4.4.11 tables. In contrast, the evaluation team utilized the building type field in the Initiative tracking data to derive the correct EFLH and CF from the Section 4.4.11 tables. Application of the appropriate EFLH values results in a 16.5% (96,904 therms) increase in gas savings for the HVAC offering. Application of the appropriate CFs did not result in a significant change in demand savings—the average actual CF reflected the TRM defined "unknown" assumption—but measure-level realization rates ranged from 25% to 206% for demand.

- Savings for Demand Controlled Ventilation (DCV) measures are based on the conditioned space managed by a DCV sensor (area per sensor) or the total space managed by the DCV system (area per project). Roughly 30% of the DCV projects implemented in 2020 divide the savings by the quantity of DCV sensors installed at the site, while the remaining portion of DCV projects do not. The evaluation team understands that the conditioned area provided in the Initiative tracking data is the total area for the system, and therefore does not divide the savings by the number of sensors. This difference resulted in a slight increase (1.7%) in electric energy and gas savings for the HVAC offering.

- Specialty Equipment: The gross realization rate is 84% for electric energy savings, 82% for demand savings, and 100% for gas savings.
  - A single project installing kitchen demand ventilation controls is the leading factor in the offering's lower realization rate. The IL-TRM V8.0 provides a deemed energy (4,966 kWh/horsepower [hp]) and demand (0.68 kW/hp) savings rate. The claimed savings calculations multiply the deemed savings by the project-specific horsepower twice, resulting in inflated savings estimates. This minor discrepancy accounts for the majority of savings discrepancy, decreasing the Specialty Equipment offering's total energy savings by 12.8% (−123 MWh) and 13.5% for demand savings.
  - The other prominent factor in the offering's performance is a calculation discrepancy in Evaporator Fan Control for Electrically Commutated Motors (ECM) measures. The evaluation team found that claimed savings for the 13 projects installing controls were all larger by a factor of 3 over the verified savings. The evaluation team cannot confirm the source of the discrepancy, but confirmed in the IL-TRM and the Initiative tracking data that this factor is applied incorrectly. This results in a 5.2% (−50 MWh) decrease in energy savings and a 4.6% decrease in demand savings.
- LSR: The gross realization rate is 78% for electric energy savings and 79% for demand savings.
  - A single project accounts for all the discrepancy in the LSR offering. The program implementer applied a system power reduction per reduced air demand factor (kW per cubic foot per minute [CFM]) of 0.55. This is a factor of 10 larger than what is provided in the IL-TRM V8.0 Section 4.7.3, Compressed Air No-Loss Condensate Drains, which was a source of savings assumptions for this offering.
- STRR: The gross realization rate is 100% for gas savings.
  - Verified savings include a small amount of kWh from secondary water supply and wastewater treatment. The implementation team did not include these impacts in ex ante calculations.

Instant Incentives

- Instant Incentives: The gross realization rate for Instant Incentives measures is 100% for electric energy savings, 100% for demand savings, and 57% for gas savings.

- The IL-TRM V8.0 requires that for commercial targeted lighting programs where installation location cannot be determined (e.g., upstream or midstream programs) evaluation should assume a portion (2%) of lamps are installed in residential facilities. For decorative and directional lamps, considered interchangeable between commercial and residential buildings, we found a minor savings discrepancy. We reviewed the assumptions utilized by the implementation team and cannot determine the source of the assumptions, such as hours of use (1,020 hours), ISR (81.5%), CF (11.7%), and waste heat factors (1.046 for energy and 1.083 for demand). We utilized the IL-TRM V8.0 specifications, resulting in a slight increase in savings for these measures. However, savings associated with residential installations account for less than 0.1% of Instant Incentives total savings.
- The 57% realization rate for gas savings is completely associated with two advanced thermostat measures. Discrepancies for this measure group are the same as those observed in Online Store, which are discussed below.

Online Store

- Online Store: The gross realization rate for Online Store measures is 74% for electric energy savings, 105% for demand savings, and 69% for gas savings.
  - Advanced Thermostats: The gross realization rate for Advanced Thermostats is 60% for energy savings, 110% for demand savings, and 69% for gas savings.
    - Program implementers make several assumptions that differ from the assumptions used in the evaluation, including heating and cooling EFLH, system capacities for heating and cooling, and the CF.

      Program implementers applied fixed effective full load heating (1,287) and cooling (1,403) hours associated with the "unknown" building type and Belleville climate zone from the IL-TRM V8.0 Section 4.4, HVAC End Use, EFLH tables. The evaluation team applied the Initiative tracking data climate zone city and building type in coordination with the EFLH tables to derive site-specific EFLH values.

      Program implementers assumed fixed 60 kBTUh cooling and 115 kBTUh heating HVAC system capacities. The IL-TRM V8.0 commercial volume does not provide default assumptions for heating and cooling capacities but does limit advanced thermostat measures to HVAC systems less than five tons (60 kBTUh). The evaluation team reverted to the IL-TRM V8.0 residential advanced thermostat measure, because Initiative tracking data does not include capacity information, and applied 33.6 kBTUh for cooling and heating systems, far below the ex ante assumptions.[14]

      The evaluation team also observed that gas savings were excluded for some projects, even where Initiative tracking data points to the presence of natural gas heating at the site.

      Lastly, program implementers applied the PJM-specific CF (23.9%) in contrast to the evaluation team's application of the system summer peak CF (45.7%).

      The overall result of these differences is a decrease of 35% in electric energy savings and a 46% decrease in gas savings for the Online Store offering, but a 5% increase in demand

[14] *2020 Illinois Statewide Technical Reference Manual for Energy Efficiency Version 8.0, Volume 3: Residential Measures*. Section 5.3.16, Advanced Thermostats. 2019.

savings due to a larger CF applied by the evaluation team. This measure accounts for more than 99% of Online Store savings discrepancies.

Small Business Direct Install

- The gross realization rate for the SBDI offering is 100% for electric energy and 103% for electric demand savings.
  - Program implementers used an inconsistent mixture of space conditioning assumptions to determine CFs, waste heat factors, and interactive factors for lighting measures. The evaluation team observed instances where exterior lighting measures applied interior conditioning assumptions, and other instances where electrically heated buildings applied gas interactive factors. This discrepancy slightly decreased electric energy savings for the SBDI offering.
  - Program implementers applied non-zero CFs for exterior lighting measures, including those listed under the building type "Exterior – Dusk to Dawn." Conversely, the evaluation team applied a CF of zero for all exterior lighting applications in accordance with the IL-TRM V8.0. The evaluation team applied Initiative tracking data to determine the appropriate assumptions, resulting in a decrease in demand savings.
  - Program implementers interchanged IL-TRM V8.0 lighting assumptions for Auto Dealership and Public Sector building types. The evaluation team confirmed the swapping of lighting assumptions through replication of ex ante savings and review of parameter assumptions in the Initiative tracking data system. This discrepancy resulted in a slight increase in electric energy savings, but a larger increase in demand savings leading to the 103% realization rate.
  - Lighting measure assumptions were derived from the building type, but in some cases, notably hospital and multifamily building types, the IL-TRM V8.0 requires additional information on the HVAC system and building size (e.g., high-rise or mid-rise), respectively. The program implementers assumed that hospital buildings use constant air volume systems without economizers and that multifamily buildings are high-rise. When Initiative tracking data does not specify HVAC system type or building size, the evaluation team applied generalized and conservative assumptions, leading to a slight decrease in SBDI offering savings.

Small Business Energy Performance

- The gross realization rate for the SBEP offering is 98% for electric energy savings, 63% for demand savings, and 70% for gas savings.
- In 2020, SBEP's second year, the program treated education buildings, including elementary through high school, with air sealing and weatherization measures. In 2019, the implementation team applied Residential TRM algorithms appropriate to the treated building stock, which the evaluation team agreed was appropriate and provided a high level of transparency. Since the building stock in 2020 does not fit within the Residential TRM and the Commercial TRM does not include air sealing or weatherization measures, the implementation team applied a new custom calculation, leveraging previously published work on air infiltration.[15] While the evaluation team supports the 2020 methodology used by the implementation team, we cannot verify the validity of some weather-

[15] The implementation team provided its source of savings document, with the following description in the header: "Standards and Guidelines Energy Conservation: Technical Information EC 128 (1980)." While the evaluation team could not confirm the source of the document, we determined it to be an acceptable approach to estimating air infiltration where wind loads are the prominent factor.

dependent factors supplied through the source of savings documentation. We note a number of discrepancies that should be addressed in future years and revised savings accordingly.

We summarize key discrepancies observed below.

- Program implementers applied fixed heating degree days (HDD) and cooling degree days (CDD) for each site. The evaluation team adjusted HDD and CDD values based on the climate zone of each site, determined through the IL-TRM.
- The implementation team applied a constant air density of 0.075 lb/ft^3, which is the air density at standard pressure (1 standard atmosphere) and temperature (32°F). The evaluation team calculated monthly average air densities using daily weather data pulled from "Climate Data Online."[16] Air densities tend to be higher in winter and lower in summer, affecting the distribution of heating- and cooling-specific savings.
- Program implementers did not apply a CF for demand calculations and assumed total operating hours of 2,872 hours. The evaluation team applied the same operating hours, but applied a CF of 65%, sourced from the IL-TRM V8.0 Section 4.5, Lighting End Use, tables, which provide a better proxy for occupancy in education buildings over summer hours than other potential sources.[17]
- Wind P factors and Building K factors were derived from the source of savings documentation and are deemed constants. The Wind P factor is the pressure differential built up by the wind. The Building K factor is associated with a building's shape and the ability for air to flow smoothly around the outer shell. Program implementers apply defined Wind P factors and Building K factors from the documentation appendices, which the evaluation team is unable to update with recent weather patterns.

Green Nozzles

- Green Nozzles: The gross realization rate for Green Nozzles is 110% for electric energy savings and 100% for gas savings.
  - The 10% 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.

Sink Aerators

- Sink Aerators: The gross realization rate for Sink Aerators is 947% for gas savings.
  - The evaluation team cannot identify the source of discrepancy for gas savings. Our review of Initiative tracking data did not reveal the source and, given the relative size of the offering in comparison to the Initiative, the evaluation team did not conduct further analysis.
  - A slight 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.

[16] National Oceanic and Atmospheric Administration (NOAA). "Climate Data Online." Accessed at: https://www.ncdc.noaa.gov/cdo-web.
[17] The evaluation team notes that this CF assumption requires further research and discussion with the implementation team in future years.

Midstream HVAC

- MHVAC: The gross realization rate for MHVAC is 223% for electric energy savings and demand savings. The MHVAC offering incented a single heat pump water heater in 2020.
  - The IL-TRM V8.0 provides algorithms for calculating the baseline uniform energy factor (UEF_{base}) for water heaters, based on fuel source, application, and tank size. The implementation team utilized the UEF_{base} calculation for the correct tank fuel source and application, but the incorrect tank size (>55 gallons), resulting in a UEF_{base} of 2.07 (unitless). We applied the UEF_{base} algorithm for a tank size less than 55 gallons, because the Initiative tracking data indicates an installed tank size of 50 gallons, resulting in a UEF_{base} of 0.92. The difference in UEF_{base} leads to a large increase in savings.
  - The implementation team derived a simple average consumption to usable water heater tank capacity ratio (consumption/cap) from the IL-TRM V8.0 Section 4.3.1, Water Heater, table, which provides consumption/cap assumptions based on building type. Given the midstream delivery approach for this measure, we applied the assumptions for the "Other Commercial" building type listed in the table, because derivation of an average value requires weighting based on the building mix in AIC territory. The difference in these assumptions—ex ante assumes 577 (unitless) compared to the verified assumption of 341—results in a decrease in savings, more than offset by the UEF_{base} discrepancy.

3.1.5 Cumulative Persisting Annual Savings

Table 11 presents CPAS and WAML for the 2020 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.[18] The WAML for the Initiative is 13.5 years.

In 2020, AIC converted some natural gas savings produced by SBEP channel projects to CPAS for the purposes of goal attainment; those savings are presented separately in Table 12.

Table 11. 2020 Standard Initiative CPAS and WAML

Channel	WAML	First-Year Verified Gross Savings (MWh)	NTGR	CPAS - Verified Net Savings (MWh)							Lifetime Savings (MWh)
				2018	2019	2020	2021	...	2030	...	
Lighting	12.4	42,164	0.839			35,384	35,384	...	30,646	...	417,278
HVAC	13.7	4,363	0.683			2,981	2,981	...	2,811	...	45,836
VSDs	15.0	15,086	0.833			12,570	12,570	...	12,570	...	188,549
Specialty Equipment	11.1	958	0.849			813	813	...	305	...	8,687
STRR[a]	6.0	1	0.608			1	1	...	0	...	5
LSR	5.0	1,483	0.849			1,259	1,259	...	0	...	6,297
Green Nozzles	5.0	3	0.920			3	3	...	0	...	15
Sink Aerators	10.0	11	0.849			10	10	...	0	...	96
MHVAC	15.0	2	0.890			2	2	...	2	...	29
Instant Incentives	14.6	35,287	0.916			32,330	32,330	...	31,031	...	463,480
Online Store	9.1	350	0.831			291	291	...	154	...	2,520
SBDI	13.6	100,329	0.908			91,119	91,082	...	75,653	...	1,052,342
SBEP	20.0	302	0.908			274	274	...	274	...	5,480
2020 CPAS		**200,341**	**0.884**			**177,037**	**177,000**	**...**	**153,447**	**...**	**2,190,614**
Expiring 2020 CPAS						**0**	**37**	**...**	**3,222**	**...**	
Expired 2020 CPAS						**0**	**37**	**...**	**23,591**	**...**	
WAML	**13.5**										

[a] Electric savings for STRR are from secondary electric energy savings for water supply and wastewater treatment.

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

Table 12. 2020 Standard Initiative - Gas Conversion CPAS and WAML

Channel	WAML	First-Year Verified Gross Savings (MWh)	NTGR	CPAS - Verified Net Savings (MWh)							Lifetime Savings (MWh)
				2018	2019	2020	2021	...	2030	...	
SBEP	20.0	1,867	0.908			1,695	1,695	...	1,695	...	33,904
2020 CPAS		**1.867**	**0.908**			**1,695**	**1,695**	**...**	**1,695**	**...**	**33,904**
Expiring 2020 CPAS						**0**	**0**	**...**	**0**	**...**	
Expired 2020 CPAS						**0**	**0**	**...**	**0**	**...**	
WAML	**20.0**										

3.1.6 Conclusions and Recommendations

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

- **Key Finding #1:** Advanced thermostat measures exhibited multiple savings discrepancies in both the Core (HVAC) and Online Store channels. Observed discrepancies are mostly misalignments with the IL-TRM V8.0 assumptions, including EFLH and CFs, but also include omission of gas heating savings for some projects.
  - Recommendation: We recommend reviewing and ensuring use of the IL-TRM V9.0 savings algorithms and assumptions for the upcoming 2021 program year. Alignment with the IL-TRM will ensure consistent and improved realization rates for a measure that is continuing to grow in share of Standard Initiative savings.
- **Key Finding #2:** Program implementers utilized previously published research to model air infiltration rates and to quantify energy savings for the SBEP channel. While the evaluation team accepts the approach used for 2020, several parameters included in the research are weather-sensitive and are potentially outdated because the underlying weather data from before 1980 pre-dates Typical Meteorological Year, Version 3 (TMY3) climate normals.
  - Recommendation: The evaluation team recommends updating key assumptions presented in the published research, notably the Building K factor and Wind P factor, with TMY3 data. Additionally, we recommend calculating monthly average air densities to reflect the timing of savings and subsequently the fuel source of savings. The evaluation team also recommends that the implementation team consider performing blower-door testing on a sample of buildings to verify CFM reductions per area of installed air sealing measures, especially if the SBEP channel is expected to become a larger piece of the Standard Initiative.
- **Key Finding #3:** The evaluation team observed multiple instances where ex ante savings assumptions were sourced from the IL-TRM V7.0 or were misaligned with the current IL-TRM V8.0, including mixing of building type assumptions for lighting, application of PJM-specific CFs, and the use of operating hours for HVAC VSD measures.
  - Recommendation: We recommend confirming that IL-TRM V9.0 algorithms and parameters are correctly implemented for all prescriptive measures in 2021.

3.2 Custom Initiative

3.2.1 Initiative Description

The Custom Initiative offers incentives to AIC Business Program customers for energy efficiency projects involving equipment not covered through other AIC initiatives. 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 prior to 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 to tailor projects to their facility and equipment needs.

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

- The Custom Incentives offering provides incentives for electric and gas measures not incented through other AIC offerings. Examples of common Custom Incentives 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 provides 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 to engage AIC's business customers more deeply with energy efficiency and do not typically yield claimed savings.

Summary of Key Implementation Changes in 2020

AIC made a number of changes to the Custom Initiative during the 2020 program year:

- AIC maintained a focus on getting more savings from the Custom Initiative by offering the Competitive Large Incentive Project (CLIP) incentives. There were two rounds of the CLIP offering in 2020; the first was due on January 31 and the second was due on June 30.
  - Though many of the projects that were set to be completed under the second CLIP offering are focused on 2021, AIC provided some extra incentives to get more of the projects finished in 2020.
  - AIC also began to move from the Staffing Grant offering that has been offered over the last few program years into this new CLIP offering.
- AIC increased the incentives for the Feasibility Study to 75% of the costs.
- AIC enlisted a group of engineers to serve as Process Energy Advisors (PEAs) to meet on-site with a customer.
  - The PEAs would aid a customer by helping customers fill out and submit applications. Occasionally, the PEA would also support a customer prior to the application stage by designing a project. The PEA would spend the week auditing the facility, working with the customer and their staff, and putting together a one-page measure proposal for the project. This would allow the customer to take the proposal to the upper management or capital review board and get the project approved.
- AIC launched several pilot programs, including a ground source heat pump pilot program and a network lighting controls pilot program.

3.2.2 Participation Summary

Table 13 presents a summary of the Custom Initiative projects completed and unique customers by each Custom Initiative offering.

Table 13. 2020 Custom Initiative Participation Summary

Offering	Total Projects/ Grants/Participants	Unique Customers [a]	Ex Ante Gross Savings [b]		
			MWh	MW	Therms
Custom Incentives	137	112	30,715	4.6	1,302,727
New Construction Lighting	29	29	1,303	0.4	–
Building Energy Assessment	84	84	–	–	–
Staffing Grant	14	0	–	–	–
Strategic Energy Management	8	8	–	–	–
Feasibility Study	8	8	–	–	–
Metering & Monitoring	7	3	–	–	–
Total	**287**	**233**	**32,017**	**4.9**	**1,302,727**

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

[b] Column may not sum to total because of rounding.

Public sector customers became eligible for AIC initiatives during the Transition Period. Table 14 shows that public sector customers contributed significantly to the Custom Initiative overall project mix. Public sector customers were responsible for 15% of the total Initiative projects completed in 2020.

Table 14. 2020 Custom Initiative Participation Summary by Sector

Offering	Total Projects/Grants/Participants	
	Private Sector	Public Sector
Custom Incentives	106	31
New Construction Lighting	25	4
Feasibility Study	6	2
Metering & Monitoring	7	0
Strategic Energy Management	8	0
Building Energy Assessment	81	3
Staffing Grant	11	3
Total	**244**	**43**

Analysis of Initiative tracking data shows the highest percentage of Custom Initiative projects with positive savings (25%) were completed by businesses from the manufacturing and industrial sectors (Table 15). With the addition of the new PEA support of process audits, many industrial manufacturing-type facilities were able to complete more projects in 2020. The next highest percentage of Custom Initiative projects (17%) were completed by businesses from the retail sectors. Lastly, similar to 2018 and 2019, education customers continue to represent a large customer segment, as public schools became eligible for the Custom Initiative during the Transition Period; education customers completed the third largest share of projects (14%) in 2020.

Table 15. 2020 Custom Initiative Projects by Organization Type

Organization Type	Share of Total Projects/Grants/Participants[a] (n=154)
Manufacturing/Industrial	25%
Retail	17%
Educational	14%
Medical	12%
Municipality	10%
Warehouse	7%
Office	5%
Grocery	5%
Other/Unknown	3%
Lodging	3%
Restaurant	1%
Multifamily	1%
Religious	1%

[a] These counts do not include Custom Initiative projects that did not produce savings.

3.2.3 Initiative Annual Savings Summary

Table 16 presents Custom Initiative annual savings achieved in 2020. The 2020 Custom Initiative achieved 25,442 MWh, 2.83 MW, and 1,415,174 therms in verified net savings. Note that the SAG-approved NTGRs were used to convert gross savings to net savings.

Table 16. 2020 Custom Initiative Annual Savings

	Electric Energy Savings (MWh)	Electric Demand Savings (MW)	Gas Savings (Therms)
Ex Ante Gross Savings	32,018	4.93	1,302,727
Gross Realization Rate	97%	70%	116%
Verified Gross Savings	30,951	3.44	1,507,107
NTGR	0.822	0.822	0.939
Verified Net Savings	25,442	2.83	1,415,174

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).

Site-Specific Results

Table 17 presents the results of the gross savings analysis for the 54 Custom Initiative projects we reviewed in 2020. Realization rates for individual projects ranged from 4% to 190% for electric energy and 0% to 243% for gas. Additional details for 15 project reviews are provided in Appendix D.

Table 17. 2020 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
1900257	1	Electric	3	660	0.077	–	79%	56%	–	518	0.043	–
1900500	1	Gas	3	–	–	28,179	–	–	100%	–	–	28,179
1900813	1	Electric	2	49	0.006	–	15%	15%	–	7	0.001	–
1901068	1	Electric	3	541	0.158	–	103%	85%	–	557	0.134	–
1901520	1	Electric	3	153	0.033	–	58%	93%	–	89	0.030	–
1901730	1	Electric	2	127	0.015	–	96%	126%	–	121	0.019	–
1902201	1	Electric	3	307	0.024	–	106%	141%	–	325	0.034	–
2000061	1	Electric	2	60	0.007	–	59%	0%	–	36	0.000	–
2000063	1	Gas	1	–	–	739	–	–	50%	–	–	370
2000077	1	Electric	3	441	0.068	–	100%	85%	–	443	0.058	–
2000083	1	Electric	1	31	0.007	–	100%	137%	–	31	0.009	–
2000110	1	Electric	1	29	0.006	–	106%	137%	–	31	0.009	–
2000132	1	Electric	3	578	0.067	–	71%	69%	–	412	0.047	–
2000192	1	Gas	2	–	–	4,901	–	–	66%	–	–	3,246
2000193	1	Electric	4	1,204	0.679	–	4%	1%	–	48	0.005	–
2000208	1	Gas	3	–	–	11,705	–	–	54%	–	–	6,349
2000227	1	Gas	3	–	–	20,578	–	–	100%	–	–	20,578
2000229	1	Electric	3	329	0.038	–	95%	123%	–	311	0.046	–
2000264	1	Electric	3	300	0.057	–	143%	81%	–	429	0.046	–
2000330	1	Electric	2	123	0.014	–	91%	61%	–	111	0.009	–
2000420	1	Electric	2	109	0.012	–	99%	99%	–	108	0.012	–
2000427	1	Gas	1	–	–	2,403	–	–	41%	–	–	975
2000429	1	Electric	1	6	0.006	–	40%	0%	–	2	0.000	–
2000483	1	Electric	1	16	0.002	–	5%	5%	–	1	0.000	–
2000818	1	Electric	3	134	0.015	–	74%	94%	–	99	0.014	–
1900489	2	Electric	3	137	0.016	–	64%	64%	–	87	0.010	–
1900593	2	Electric	3	402	0.067	–	100%	100%	–	402	0.067	–
1901411	2	Gas	4	–	–	390,428	–	–	91%	–	–	355,985

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
2000070	2	Electric	3	216	0.000	–	23%	N/A	–	49	0.006	–
2000078	2	Electric	3	473	0.054	–	116%	136%	–	550	0.073	–
2000079	2	Electric	2	76	0.008	–	143%	106%	–	109	0.008	–
2000080	2	Electric	1	7	0.001	–	85%	48%	–	6	0.001	–
2000114	2	Both	*	980	0.053	65,055	78%	201%	117%	764	0.107	76,182
2000156	2	Gas	1	–	–	6,657	–	–	243%	–	–	16,183
2000266	2	Electric	3	320	0.030	–	100%	0%	–	320	0.000	–
2000267	2	Both	*	319	0.037	23,001	83%	90%	0%	265	0.033	0
2000703	2	Gas	3	–	–	44,963	–	–	104%	–	–	46,728
2000710	2	Both	*	211	0.000	11,336	124%	N/A	195%	263	0.000	22,053
2000869	2	Electric	3	418	0.049	–	120%	144%	–	502	0.070	–
1800690	3	Gas	4	–	–	183,542	–	–	100%	–	–	183,542
1901698	3	Electric	3	1,978	0.443	–	106%	100%	–	2,094	0.443	–
1902094	3	Electric	1	116	0.013	–	190%	428%	–	221	0.057	–
2000005	3	Gas	3	–	–	54,263	–	–	91%	–	–	49,607
2000111	3	Electric	3	1,267	0.190	–	8%	5%	–	107	0.009	–
2000128	3	Electric	2	738	0.084	–	73%	16%	–	538	0.013	–
2000249	3	Electric	2	422	0.124	–	123%	40%	–	517	0.049	–
2000344	3	Gas	2	–	–	21,028	–	–	220%	–	–	46,292
2000572	3	Electric	3	949	0.183	–	78%	44%	–	743	0.080	–
2000941	3	Electric	1	215	0.025	–	176%	176%	–	378	0.043	–
2000998	3	Gas	1	–	–	1,462	–	–	116%	–	–	1,693
2001168	3	Electric	1	218	0.025	–	83%	85%	–	182	0.021	–
2001465	3	Electric	3	3,000	0.423	–	100%	0%	–	3,000	0.000	–
2100010	3	Electric	2	523	0.052	–	102%	69%	–	532	0.036	–
2100011	3	Electric	3	1,553	0.177	–	98%	100%	–	1,515	0.177	–

Unlike prescriptive measures, we cannot present a full summary of variances in savings across multiple Custom Initiative projects. For project-specific detail, please see Appendix D to this report, as well as the separate backup calculations and documentation provided by the evaluation team for review.

Nevertheless, we did make some observations around consistent differences in approach between the evaluation and implementation team that spanned multiple projects and provide them below for consideration.

- In general, compressed air energy savings calculations used a binned approach based on metered data. It is less accurate to bin the data than to use the metered data to calculate power demand at each metered data point and use that information to estimate the baseline energy consumption. Similarly, the same un-binned data can be used to estimate the proposed new system energy consumption more accurately.
- Treating compressors as binary on/off (full flow or zero flow) can cause savings estimates to be off significantly. This issue has historically occurred for a number of Custom Initiative projects. To help

increase the accuracy of savings estimates and mitigate evaluation risk, we recommend that compressor performance curves be used in the savings analyses, regardless of the compressor type. The Compressed Air Challenge[19] is a good source for typical compressor performance curves if none are available from the compressor manufacturers.

- For compressed air heat recovery measures, we strongly recommend verifying existing space conditions (prior to the project), including heating sources, heating equipment efficiency, and heating equipment set points. If the space was not previously heated, then the heat recovery measure provides comfort, but not energy savings.
- In general, it is best practice to account for part load efficiency of all equipment involved in a project as well as equipment sequencing (which affects loading). We saw several projects where ideal loading and/or maximum efficiencies were applied across the board resulting in overestimated energy savings.
- Some of the HVAC and HVAC controls projects used Carrier's HAP software to estimate energy savings. This software is very limited in its functionality and we do not recommend its use for projects with controls sequences any more complex than on/off. Additionally, it was not always clear in the documentation, models, or calculations which HVAC controls measures are included in the project savings. A simple summary of the controls measures being implemented for these projects and the associated setpoints would ensure that we are able to effectively evaluate the projects and have all of the necessary information to support savings claims.
- We consistently saw an incorrect WHF for energy applied to lighting projects for cannabis grow facilities with cooled spaces.
- We saw several projects where the savings were based off the savings from similar completed projects. While this is not an inherently incorrect approach, we strongly recommend that documentation and calculations showing how the reference project's savings were calculated be required by the program.
  - Specifically, it would be a best practice for trade allies to provide not only the calculations for the reference project, but to then clearly show how the reference project's savings were modified in order to estimate the savings from the new project (to normalize for weather, production, etc.). Simply providing a savings number from a reference project and then capping them or scaling them in some way that is not verifiable introduces evaluation risk. When this latter approach is taken, the project may not be evaluable without on-site metering (or at all).
  - Additionally, when trade allies use reference projects to estimate savings, it may be best practice to have the evaluation team do an early review of the project prior to its completion to help mitigate evaluation risk. We have been doing early reviews for large projects, but it would also be beneficial to do early reviews for projects with uncertain savings values even if they are not the biggest projects.
- We saw several projects that included the savings for other measures not included in the scope of the project (or, in one case the full savings attributed to Phase I of a three phase project). In one case, the measure generating these savings was known and we could "back them out" of the verified savings. In another case, the other measure (if there was one) was not described, but a reduced load was applied to the energy efficient (post) case for unknown reasons. We recommend screening the savings estimates for projects thoroughly to ensure that the savings from other projects are not included. The evaluation team can provide early reviews to projects in facilities where multiple measures are being

[19] http://www.compressedairchallenge.org.

implemented to ensure that only the savings for the measure(s) incented in the project are counted to reduce evaluation risk.

- As we observed in the 2019 Business Program evaluation report, we found that demand savings are most often calculated either by taking the difference between the equipment's pre- and post- demand, or by dividing energy savings by the hours of use. These methodologies do not account for the peak period as defined in the IL-TRM. As demand savings are likely to become more important in the coming years, we recommend that the program require trade allies to take into consideration the IL-TRM's definition of the peak period when calculating demand savings.

Overall Results

We used a combined ratio estimation technique[20] to estimate gross realization rates for each wave by fuel type. Realization rates by wave are presented in Table 18.

Table 18. 2020 Custom Initiative Realization Rates by Wave and Fuel Type

Wave	kWh	kW	Therms
1	72.8%	46.2%	84.8%
2	97.7%	114.8%	106.1%
3	103.4%	74.7%	128.7%

Applying these gross realization rates to the population of projects in each wave produced verified gross savings for the Initiative. Table 19, Table 20, and Table 21 present the annual ex ante and verified gross and net electric energy, electric demand, and gas savings for each wave.

Table 19. 2020 Custom Initiative Annual Electric Energy Savings by Wave

Wave	Ex Ante Gross MWh	Gross Realization Rate	Verified Gross MWh	NTGR	Verified Net MWh
1	6,269	72.8%	4,564	0.822	3,751
2	4,223	97.7%	4,127	0.822	3,393
3	21,526	103.4%	22,260	0.822	18,298
Total	**32,018**	**96.7%**	**30,951**	**0.822**	**25,442**

Table 20. 2020 Custom Initiative Annual Electric Demand Savings by Wave

Wave	Ex Ante Gross MW	Gross Realization Rate	Verified Gross MW	NTGR	Verified Net MW
1	1.49	46.2%	0.69	0.822	0.57
2	0.46	114.8%	0.53	0.822	0.43
3	2.98	74.7%	2.23	0.822	1.83
Total	**4.93**	**69.8%**	**3.44**	**0.822**	**2.83**

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

Table 21. 2020 Custom Initiative Annual Gas Savings by Wave

Wave	Ex Ante Gross Therms	Gross Realization Rate	Verified Gross Therms	NTGR	Verified Net Therms
1	75,497	84.8%	64,057	0.939	60,149
2	605,205	106.1%	642,227	0.939	603,051
3	622,025	128.7%	800,824	0.939	751,974
Total	**1,302,727**	**115.7%**	**1,507,554**	**0.939**	**1,415,593**

3.2.5 Cumulative Persisting Annual Savings

Table 22 presents CPAS and WAML for the 2020 Custom 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.[21] The WAML for the Initiative is 12.8 years.

The evaluation team reviewed and adjusted measure lives provided by the implementation team for all sampled projects and calculated adjustments to measure lives based on that review. These adjustments were then applied to the population to calculate CPAS.[22] Further detail on this adjustment is provided in Appendix A.

Table 22. 2020 Custom Initiative CPAS and WAML

Channel	Measure Life	First-Year Verified Gross Savings (MWh)	NTGR	CPAS - Verified Net Savings (MWh)							Lifetime Savings (MWh)
				2018	2019	2020	2021	...	2030	...	
Custom Incentives	12.8	29,884	0.822			24,565	24,565	...	19,602	...	315,654
New Construction Lighting	11.8	1,067	0.822			877	877	...	626	...	10,370
2020 CPAS		**30,951**	**0.822**			**25,442**	**25,442**	**...**	**20,228**	**...**	**326,024**
Expiring 2020 CPAS						**0**	**0**	**...**	**1,739**	**...**	
Expired 2020 CPAS						**0**	**0**	**...**	**5,214**	**...**	
WAML	**12.8**										

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

[22] The summary CPAS spreadsheet attached to this report also presents estimates of CPAS at the individual project level for all 154 projects in the 2020 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 using a ratio estimator on a per-wave basis rather than on a per-project basis, and therefore individual adjustments to measure life made through evaluation are not applied to specific projects.

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 a significant number of very low realization rates on electric projects in 2020. In the 2018 and 2019 evaluations, we recommended that the implementation team improve several items in the documentation of major custom projects to avoid evaluation risk. Given the number of projects and magnitude of the projects with significant deviations from ex ante estimates 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, 3) clearly documented and verifiable savings calculations, and 4) a clear description 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:** There were several projects that relied on the savings from other similar projects to calculate energy savings. This is not an inherently incorrect approach. However, if the calculations and assumptions used for the reference project are not provided and/or if the approach used to adjust the savings for the new project are not clear, evaluation risk increases. While it is possible that the project may be evaluable using on-site metering techniques, this is not feasible for all projects. When metering is not feasible, the realization rate is subject to the evaluator's engineering judgement and could range from 0% - 100%.
  - Recommendation: Documentation and calculations showing how a reference project's savings were calculated should be required by the program. Specifically, it would be a best practice for trade allies to provide not only the calculations for the reference project, but to then clearly show how the reference project's savings were modified in order to estimate the savings from the new project (to normalize for weather, production, etc.).
- **Key Finding #3:** This year we reviewed some of the larger Custom Initiative projects prior to their completion to ensure that the ex ante calculation was reasonable. When we later evaluated some of these projects as a part of this year's sample, we did not have to make very many (if any) adjustments to the ex ante savings values and the project evaluation was very efficient, which significantly benefits AIC, the implementation team, and the evaluation team.
  - Recommendation: Consider having the evaluation team do an early review not only of large projects, but also of projects that are more complex or have more uncertain ex ante calculations. We believe that over time, this approach will substantially alleviate many of the issues identified in Key Finding #1 and Key Finding #2.
- **Key Finding #4:** We continue to observe that, in most 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. The evaluation team, therefore, reiterates the following recommendation from prior years:
  - 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 Initiative

3.3.1 Initiative Description

The RCx 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
- 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/therm and $0.40/therm depending on the offering (Table 23).

During 2020, the RCx Initiative had five channels:

- **Compressed Air Retro-Commissioning:** The Compressed Air offering provided 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 included 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 provided 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 included 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. The typical source of savings is from EMS settings adjustments to optimize the operation of HVAC systems and other HVAC and lighting optimization activities. Since the passage of FEJA, the Large Facilities offering has also targeted public sector facilities (e.g., schools), as do the other RCx Initiative 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%–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 RCx 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 the AIC territory. Beginning in 2020, the Grocery Store Retro-Commissioning offering has been rolled into the Lite offering.
- **Virtual Commissioning™:** Beginning in mid-2020, the RCx Initiative began a pilot Virtual Commissioning™ offering. Due to substantial differences between the Virtual Commissioning™ offering and the remainder of the RCx Initiative, Virtual Commissioning™ is discussed separately in Section 3.4. All remaining information presented in this section discusses only the previous four RCx Initiative components.

Table 23. 2020 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 completed before incentive is paid
Industrial Refrigeration	70% of survey cost	▪ 2¢/kWh saved	▪ Payback period of 0–1 year ▪ Measure must be completed 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 completed before incentive is paid ▪ Measures do not need to be completed for stipend to be paid
Lite	100% of survey cost, capped at $15,000	▪ 2¢/kWh ▪ 30¢/therm	▪ Payback period of 0–1 year ▪ Measure must be completed before incentive is paid

Summary of Key Implementation Changes in 2020

In 2020, the Grocery Store Retro-Commissioning channel was rolled into the Lite offering. In June of 2020, the Compressed Air channel was discontinued due to an increased AIC focus on longer-lived measures. All Compressed Air projects completed in 2020 were completed earlier in the year.

3.3.2 Participation Summary

Table 24 summarizes RCx Initiative participation during 2020. During 2020, all Retro-Commissioning projects were completed through two channels, Compressed Air and Large Facilities.

Table 24. 2020 Retro-Commissioning Initiative Participation Summary

Channel	Projects	Ex Ante Gross Savings			
		MWh	%	Therms	%
Compressed Air	6	2,945	57%	0	0%
Industrial Refrigeration	0	0	0%	0	0%
Large Facilities	3	2,247	43%	74,471	100%
Lite	0	0	0%	0	0%
Total	**9**	**5,192**	–	**74,471**	–

The RCx 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 Program Year (PY) 9 (2016–2017). Table 25 shows historic RCx Initiative participation for PY1 through 2020.

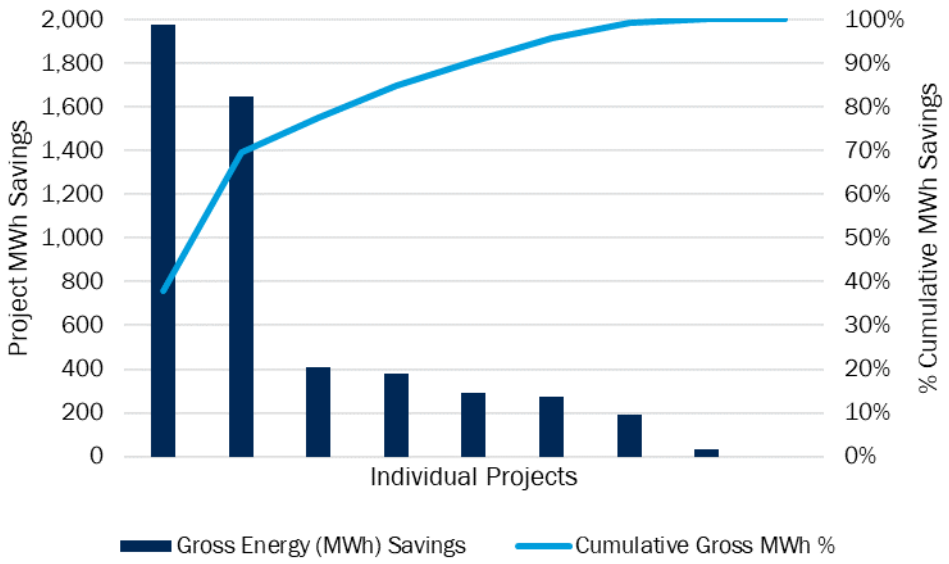
Table 25. Summary of Past Program Participation

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
2020	9	5,192	74,471

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

Project data show that in 2020, Initiative savings were fairly reliant on two large projects that accounted for about 70% of savings combined. This is different from the results observed in 2019, where savings were more spread out among projects. Figure 1 shows the annual and cumulative ex ante electric savings for these two large projects compared to the other seven.

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



3.3.3 Initiative Annual Savings Summary

In 2020, the RCx Initiative achieved verified net savings of 3,725 MWh, 0.25 MW, and 54,441 therms. Table 26 presents the RCx Initiative's annual savings achieved in 2020.[23] Note that the SAG-approved NTGRs were used to convert gross savings to net savings.

Table 26. 2020 Retro-Commissioning Initiative Annual Savings

	Energy Savings (MWh)	Demand Savings (MW)	Gas Savings (Therms)
Ex Ante Gross Savings	5,192	0.44	74,471
Gross Realization Rate	81%	64%	82%
Verified Gross Savings	4,186	0.28	61,170
NTGR	0.890	0.890	0.890
Verified Net Savings	3,725	0.25	54,441

[23] As previously discussed, please note that these savings do not include savings from the Virtual Commissioning™ pilot, presented separately in Section 3.4.

3.3.4 Initiative Savings Detail

The RCx Initiative completed nine projects through two of the four available RCx Initiative channels in 2020. Table 27 presents each project and presents ex ante and verified gross savings.

Table 27. 2020 Retro-Commissioning Initiative Project Results for Annual Gross Savings

Project ID	Project Type	Ex Ante Gross Savings			Gross Realization Rate			Verified Gross Savings		
		MWh	MW	Therms	MWh	MW	Therms	MWh	MW	Therms
1900886	Compressed Air	1,647	0.19	0	63%	63%	N/A	1,044	0.12	0
1901117		289	0.03	0	98%	99%	N/A	285	0.03	0
1901262		189	0.02	0	100%	100%	N/A	189	0.02	0
1901397		31	0.01	0	23%	29%	N/A	7	0.00	0
1901455		411	0.05	0	96%	98%	N/A	394	0.05	0
1901493		378	0.04	0	85%	100%	N/A	323	0.04	0
1000184	Large Facilities	0	0.00	66,871	N/A	N/A	82%	0	0	55,060
1901576		272	0.00	7,600	58%	N/A	80%	159	0	6,110
1901670		1,975	0.10	0	90%	18%	N/A	1,784	0.02	0
Total		**5,192**	**0.442**	**74,471**	**81%**	**64%**	**82%**	**4,186**	**0.283**	**61,170**

3.3.5 Cumulative Persisting Annual Savings

Table 28 presents CPAS and WAML for the 2020 RCx Initiative. The measure-specific and total verified gross savings for the RCx Initiative are summarized and CPAS in each year of the 2018–2021 Plan are presented.[24] The WAML for the Initiative is 6.4 years.

Table 28. 2020 Retro-Commissioning Initiative CPAS and WAML

Channel	WAML	First-Year Verified Gross Savings (MWh)	NTGR	CPAS (Verified Net MWh)							Lifetime Savings (MWh)
				2018	2019	2020	2021	...	2030	...	
Compressed Air Retro-Commissioning	4.4	2,242	0.890			1,995	1,995	...	0	...	8,871
Large Facilities Retro-Commissioning	8.6	1,944	0.890			1,730	1,730	...	0	...	14,876
2020 CPAS		**4,186**	**0.890**			**3,725**	**3,725**	**...**	**0**	**...**	**23,748**
Expiring 2020 CPAS						**0**	**0**	**...**	**0**	**...**	
Expired 2020 CPAS						**0**	**0**	**...**	**3,725**	**...**	
WAML	**6.4**										

The evaluation team reviewed measure lives provided by the implementation team for 2020 Retro-Commissioning Initiative projects and determined that there were minor adjustments necessary for measure lives assigned to two Large Facilities projects. Further detail is provided in Appendix A.

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

3.3.6 Conclusions and Recommendations

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

- **Key Finding #1:** RSPs for the Large Facilities Retro-Commissioning are doing a very good job of documenting baseline conditions. They are providing measured kW data, trend data from the Building Automation System (BAS), screen shots from the BAS, and pictures to document the baseline. They are also doing a good job of updating the baseline in their calculations, as they implement measures. For example, if an operating schedule was implemented, the baseline for the next measure included the new schedule.
- **Key Finding #2:** RSPs for the Large Facilities Retro-Commissioning vary in the quality and organization of their calculation spreadsheets. Most of the RSPs have well-organized spreadsheets that clearly label their operating assumptions and values. Though the calculations themselves are often complex and utilize a great deal of data, they are still easy to follow, verify savings, or modify as required. They use bin temperature data correctly in their calculations, accounting for time of day and day of week.
  - Only one RSP had calculations that were difficult to follow, with errors in assumptions and methodology that required complete recalculation of savings for some measures. While they used bin temperature data, they typically did not take into account time of day.
- **Key Finding #3:** All RSPs had corrections made in their calculation inputs for standard assumptions used when measured data were not available. These include load factors and typical equipment efficiency and cube law exponents. These corrections resulted in a decrease in verified savings.
  - Recommendation: The evaluation team has put together a list of standard inputs that should be used in calculations if measured data are not available.[25] Standardizing these inputs will ensure that the same inputs for these variables are used in calculations and will result in a reduction in the difference between ex ante and verified numbers.
- **Key Finding #4:** While RSPs are doing a good job of documenting baseline conditions with trend data and demonstrating the implementation of measures with pictures and screen shots from the BAS, RSPs need to provide more trend data that demonstrate the actual conditions after implementation.
  - Recommendation: Post-implementation data should have at least two weeks of seasonal trend data if possible. Measures with predominately cooling or heating savings should provide summer or winter trend data. These data should then be used in the original savings calculations as part of the RSP verification process.
  - RSPs should plan on obtaining trend verification by utilizing the trends that were set up for the baseline operations after implementation. Ideally, these trends would also be available during the evaluation process to determine if changes were made after implementation.
- **Key Finding #5:** The evaluation team did not conduct any on-site M&V activities as part of the 2020 evaluation. Due to the COVID-19 pandemic, we attempted to avoid these activities, and the specific nature of the completed projects ensured that we were able to maintain a high level of evaluation rigor without on-site M&V. We conducted phone outreach to the customers as needed, conducted virtual site visits where needed, and requested additional trend data as needed. We asked questions about the implementation of measures, including the extent to which COVID-19 affected implementation. While site visits are often preferred due to the complexity of operations, especially for the Large

[25] "Memo to AIC Re: 2019 Retro-Commissioning Impact Evaluation Report Recommendations." October 15, 2020.

Facilities Retro-Commissioning projects, the sites were cooperative and adaptive in this non-typical evaluation year, and our level of evaluation rigor remained high.

3.4 Virtual Commissioning™

AIC began partnering with Power TakeOff to offer a Virtual Commissioning™ pilot in 2020. AIC considers the Virtual Commissioning™ pilot to be a channel of the RCx Initiative (see Section 3.3). As a result, when summary tables in this report present savings at the Initiative level, Virtual Commissioning™ is rolled up with the remainder of the RCx Initiative. However, because the pilot is implemented separately and because required evaluation methods for the pilot differ substantially from the remainder of the RCx Initiative, we present our evaluation of the pilot in this separate section of the report.

3.4.1 Pilot Description

AIC and Power TakeOff launched the AIC Virtual Commissioning™ pilot in July 2020. Virtual Commissioning™ is a novel pilot approach that remotely targets the traditionally hard-to-reach customer segment of small and medium business customers to support low- and no-cost energy measures. The pilot's remote intervention capabilities were advantageous in 2020, as the pilot was able to operate effectively during the COVID-19 pandemic. Further, this approach leverages Advanced Metering Infrastructure (AMI) data to support targeted insights for hard-to-reach customers through the design, implementation, and evaluation phases of the pilot.

Power TakeOff uses their internal software to complete an initial analysis of AMI data from AIC's small and medium business customers to identify prospective participants. Power TakeOff then uses the outcomes of this analysis to remotely identify opportunities for low- and no-cost energy-saving improvements at the participants' facilities. These opportunities commonly include HVAC system modifications and lighting scheduling adjustments.

Power TakeOff energy advisors then contact potential participants to share the results of the analysis, confirm the energy-saving opportunities, and verify facility characteristics. After participants implement recommended changes, Power TakeOff develops individual facility-level regression models using the participant's pre- and post-participation energy consumption to estimate savings. The models must meet certain criteria for robustness in order for Power TakeOff to claim savings.[26] If a project both demonstrates continued savings for three months and meets the model robustness criteria, Power TakeOff can claim annualized savings for the project for the program year.

Power TakeOff also provides Leidos with small and medium business customer contact information and referrals to support lead generation for other AIC initiatives.

3.4.2 Participation Summary

Virtual Commissioning™ participation in 2020 reflected the offering's pilot status and the fact that it did not begin serving customers until July, as only 10 facilities across four customers had claimed savings.[27] Of the

[26] These criteria are specified in AIC's Virtual Commissioning™ M&V Plan, authored by Power Takeoff, and are as follows: the normalized savings uncertainty must be below 50% at 68% confidence, the absolute value of normalized mean bias error (NMBE) must be below 0.5%, and the coefficient of variation of root mean square error [CV(RMSE)] must be below 25%. CV(RMSE) and NMBE are both metrics of how well a regression model explains the data.

[27] One customer was a chain organization that participated in the pilot at multiple facilities.

10 facilities that took part in the pilot, 9 made adjustments to their HVAC system setpoints, 8 made changes to their lighting system scheduling, and 6 made changes to their HVAC system scheduling.

Power TakeOff reported that they worked with additional facilities in 2020. However, they did not claim these projects in the 2020 program year because they were awaiting internal approvals to ensure that the projects had enough post-period data to meet model robustness criteria. As of October 2020, Power TakeOff reported that they had initially verified that participants made energy-saving changes at 28 sites, for which they claimed savings for 10. In addition, Power TakeOff reported that participants were in the process of making changes at 33 additional facilities. The Power TakeOff team began conducting outreach to an additional 173 sites in 2020. In 2021, Power TakeOff plans to claim savings from the projects in this pipeline that meet model robustness criteria.

3.4.3 Pilot Annual Savings Summary

The evaluation team verified the Virtual Commissioning™ pilot gross and net electric savings estimates by validating Power TakeOff's facility-level modeling. Our approach, which leans heavily on the IPMVP Option C guidelines,[28] was limited to verification of Power TakeOff's methods because this offering was a pilot with only 10 projects and three to five months of post-period data in 2020. We anticipate updating this evaluation approach in future years as Virtual Commissioning™ moves beyond pilot status and more projects are completed. We provide high-level savings results below, with additional methodological details in Appendix A of this report.

As part of the verification process, the evaluation team assessed Power TakeOff's data cleaning and processing methods, their model specifications and model evaluation process, and how they calculated gross electric savings. While we identified several minor issues related to data cleaning, they did not affect the final results. These issues, as well as additional recommendations for future program years, are discussed in Section 3.4.5 and Appendix A. Note that the limited three to five months of post-period data for each project may increase the prediction error for the modeling results.

In addition to verifying the savings associated with the Virtual Commissioning™ pilot, the evaluation team independently verified whether the individual project modeling results met the pilot guidelines with respect to model robustness and savings uncertainty. All projects that Power TakeOff claimed as part of the 2020 Virtual Commissioning™ pilot met the model robustness criteria. In some cases, however, the evaluation team was unable to exactly reproduce some of Power TakeOff's model fit and savings uncertainty results. However, our independent assessment of those values also produced estimates for model fit and savings uncertainty that met the criteria for savings claims. These issues are discussed in more detail in Appendix A.

Table 29 presents the annual savings achieved by the Virtual Commissioning™ pilot in 2020: 377 MWh in verified net savings. This resulted in a gross and net realization rate of 100%. AIC and Power TakeOff did not claim demand savings or gas savings through this pilot in 2020. Note that the SAG-approved NTGRs were used to convert gross savings to net savings.

Table 29. 2020 Virtual Commissioning™ Pilot Annual Savings

	Energy Savings (MWh)	Demand Savings (MW)	Gas Savings (Therms)
Ex Ante Gross Savings	337	0	0
Gross Realization Rate	100%	N/A	N/A
Verified Gross Savings	337	0	0

[28] EVO. *International Performance Measurement and Verification Protocol Core Concepts.* 2016.

	Energy Savings (MWh)	Demand Savings (MW)	Gas Savings (Therms)
NTGR	1.000	N/A	N/A
Verified Net Savings	337	0	0

3.4.4 Cumulative Persisting Annual Savings

Table 30 presents CPAS and WAML for the 2020 Virtual Commissioning™ pilot. The measure-specific and total verified gross savings for the pilot are summarized, and CPAS in each year of the 2018–2021 Plan are presented.[29] The WAML for the pilot is 7.3 years.

Table 30. 2020 Virtual Commissioning™ CPAS and WAML

Measure Category	Measure Life	First-Year Verified Gross Savings (MWh)	NTGR	CPAS - Verified Net Savings (MWh)							Lifetime Savings (MWh)
				2018	2019	2020	2021	...	2030	...	
Virtual Commissioning™	7.3	337	1.000			337	337	...	0	...	2,457
2020 CPAS		**337**	**1.000**			**337**	**337**	**...**	**0**	**...**	**2,457**
Expiring 2020 CPAS						**0**	**0**	**...**	**0**	**...**	
Expired 2020 CPAS						**0**	**0**	**...**	**337**	**...**	
WAML	**7.3**										

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

3.4.5 Conclusions and Recommendations

Based on the results of this evaluation, the evaluation team offers the following key findings and recommendations for the Virtual Commissioning™ pilot moving forward:

- **Key Finding #1:** Virtual Commissioning™ pilot participation and electric savings performance fell significantly short of initial expectations due to a delayed rollout of the pilot and COVID-19 impacts. That said, Power TakeOff reported their successful customer outreach and enrollment efforts enabled them to build a robust pipeline of participating sites in 2020 that positions them well to significantly increase participation and claimed savings in 2021.
- **Key Finding #2:** Based on our verification, the Virtual Commissioning™ pilot had a 100% realization rate, indicating that the claimed projects met the performance criteria specified in the Virtual Commissioning™ M&V Plan. However, we note that the limited size of the pilot (10 facilities) and limited post-period data (three to five months) means that this year's results may not be reflective of future program performance. We anticipate that with more sites and more post-period data the evaluation approach will change in future program years.
- **Key Finding #3:** As Virtual Commissioning™ is a new offering, the current deemed NTGR and expected useful life (EUL) values for the pilot are not based on primary research.
  - Recommendation: If AIC intends to make the Virtual Commissioning™ channel a larger portion of the overall portfolio in future years, AIC should consider conducting primary research to inform future EUL values for the IL-TRM and NTGR estimates.
- **Key Finding #4:** While Power TakeOff's modeling approach generally conformed with the Virtual Commissioning™ M&V Plan and IPMVP guidelines, we identified several opportunities for making the model and uncertainty calculations more robust. This is particularly important in an advanced-measurement-and-verification-based program like Virtual Commissioning™, because the eligibility of a particular project hinges on the ability of the regression model to accurately measure savings and thus make the project savings claimable. These are discussed in more detail in Appendix A.

3.5 Streetlighting Initiative

3.5.1 Initiative Description

First made available to AIC customers in 2018, the Streetlighting Initiative incentivizes municipal customers to upgrade their streetlighting fixtures to LED technology. High-intensity discharge lighting is still the standard technology used for streetlighting in the United States. The Initiative targets existing streetlighting and other outdoor lighting for upgrades from high-intensity discharge to LED technology.

The Initiative targets streetlighting for upgrades through two channels:

- **MOSL.** Through this channel, AIC targets municipal customers who own their streetlighting fixtures. Incentives are provided to encourage customers to replace existing streetlights with LED streetlights.
- **UOSL.** Through this channel, AIC targets municipal customers who have AIC-owned streetlighting fixtures. Early replacement of these streetlights with LED 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 of the early replacement to

customers. In addition, through this channel, AIC claims savings from ongoing replacement of existing AIC-owned streetlighting with LED streetlights upon burnout.

Summary of Key Implementation Changes in 2020

The third year of this program demonstrated continued evolution and improvement from the initial launch in 2018 and subsequent growth through the 2019 program year. The incentive for municipal projects decreased from $1.00 per watt reduced in 2019 to $0.75 per watt reduced in 2020. Incentives for early retirement of AIC-owned fixtures were $50 per fixture.

3.5.2 Participation Summary

Table 31 summarizes Streetlighting Initiative participation during 2020, 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 31. 2020 Streetlighting Initiative Participation Summary

Participation	MOSL	UOSL	Total
Participants	4	49	53
Project Count	11	53	64
Fixture Count	1,566	47,948	49,514

The Streetlighting Initiative had significantly more participation in the 2020 program year and generated 31,635 MWh of verified electric energy savings, compared to 2019, when the Initiative saved 4,014 MWh. This represents an increase of more than 7.5 times from the previous year's verified electric energy savings. The primary source for this increase is in the UOSL channel. However, savings also increased significantly in the MOSL channel, nearly doubling the savings achieved in 2019.

3.5.3 Initiative Annual Savings Summary

Table 32 presents Streetlighting Initiative annual savings achieved in 2020. The Initiative achieved 31,306 MWh in verified net energy savings in 2020. Note that the SAG-approved NTGRs were used to convert gross savings to net savings. Streetlights are almost always off at the time of system peak demand, and therefore produce no demand savings.

Table 32. 2020 Streetlighting Initiative Annual Savings

	Energy Savings (MWh)	Demand Savings (MW)	Gas Savings (Therms)
Ex Ante Gross Savings	31,633	0	0
Gross Realization Rate	100%	N/A	N/A
Verified Gross Savings	31,633	0	0
NTGR	0.990	N/A	N/A
Verified Net Savings	31,306	0	0

3.5.4 Initiative Savings Detail

The Streetlighting Initiative distributed four categories of LED streetlighting measures through two channels in 2020, shown in Table 33. Measures distributed through the UOSL channel achieved most of the savings.

Table 33. 2020 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)
MOSL (ENERGY STAR®/DesignLights Consortium [DLC] Standard Tier)	1,628	100%	1,628	0.800	1,302
MOSL (DLC Premium Tier)	7	96%	7	0.800	5
UOSL (Replacing High-Pressure Sodium [HPS])	26,882	100%	26,882	1.000	26,882
UOSL (Replacing Mercury Vapor)	3,116	100%	3,116	1.000	3,116
Total	**31,633**	**100%**	**31,633**	**0.990**	**31,306**

Summary of Savings Discrepancies

Overall, the Streetlighting Initiative achieved a gross realization rate of 100%. However, one small difference between ex ante and verified savings was observed for MOSL DLC Premium Tier streetlighting:

- Database review determined that two measure lines were not using the correct baseline wattage information provided in the project files.
- The correction affects two projects and corrects the reported system wattage of 465 watts to 455 watts, as specified in the project files. It is possible that this error stems from a typo during data entry or perhaps a standard wattage was applied to a less common fixture type.

3.5.5 Cumulative Persisting Annual Savings

Table 34 presents CPAS and WAML for the 2020 Streetlighting 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.[30] The WAML for the Initiative is 12.0 years.

Table 34. 2020 Streetlighting Initiative CPAS and WAML

Channel	WAML	First-Year Verified Gross Savings (MWh)	NTGR	CPAS (Verified Net MWh)							Lifetime Savings (MWh)
				2018	2019	2020	2021	...	2030	...	
MOSL (ENERGY STAR/DLC Standard Tier)	12.0	1,628	0.800			1,302	1,302	...	1,302	...	15,625
MOSL (DLC Premium Tier)	12.0	7	0.800			5	5	...	5	...	65
UOSL (Replacing HPS)	12.0	26,882	1.000			26,882	26,882	...	26,882	...	322,582
UOSL (Replacing Mercury Vapor)	12.0	3,116	1.000			3,116	3,116	...	1,305	...	22,903
2020 CPAS		**31,633**	**0.990**			**31,306**	**31,306**	**...**	**29,494**	**...**	**361,175**
Expiring 2020 CPAS						**0**	**0**	**...**	**0**	**...**	
Expired 2020 CPAS						**0**	**0**	**...**	**1,812**	**...**	
WAML	**12.0**										

A baseline shift occurs in 2024 for measures installed as early replacement of mercury vapor lamps. The IL-TRM stipulates that mercury vapor lamps have a four-year remaining useful life.[31] Because Table 34 is an abbreviated version of the full CPAS table, this adjustment appears only in the column for 2030.

Note that program tracking data applies somewhat different baseline shifts for mercury vapor replacements. The implementation team used different HPS equivalents compared to the evaluation team. Evaluated CPAS in 2024 and beyond are lower than implementation estimates even though annual savings are similar. The evaluation and implementation teams are discussing appropriate equivalencies for future use.

[30] For further detail, including achieved CPAS in years not presented in this table, please see the summary CPAS spreadsheet attached to this report.
[31] *2020 Illinois Statewide Technical Reference Manual for Energy Efficiency Version 8.0, Volume 2: C&I Measures.* Section 4.5.16, footnote 835.

3.5.6 Conclusions and Recommendations

Overall participation in the Streetlighting Initiative has increased substantially relative to the 2019 year, resulting in a large increase in electric energy savings. The realization rate for the Initiative in 2020 is 100%, which is unchanged from the 2019 results.

The evaluation team also checked progress on implementation of the previous year's recommendations. Based on our file reviews and database validation, the evaluation team found that the Initiative continued to attract a large pool of new participants, which allowed for a substantial growth of the realized electric energy savings.

- **Key Finding #1:** The Streetlighting Initiative has grown, with increased savings and participation relative to the previous year. The majority of this growth is attributed to an increase in replacement of utility-owned streetlights. However, municipal participation also increased significantly.
  - Recommendation: Continue to reach out to owners of roadway lighting in the AIC territory and ensure that potential participants are aware of the opportunity to decrease energy and maintenance costs by installing LED streetlights.
- **Key Finding #2:** Some project files contain incorrect or missing invoices/specification sheets for fixtures and work. Some invoices/specification sheets are duplicated across separate projects that are unrelated to the project that originated the invoice/specification sheet. Supporting documents for many of the projects reviewed do not include a copy of the final application.
  - Recommendation: Verify that all invoices/specification sheets are filed within the correct project file and that all project files contain an invoice/specification sheet for the lamps and contractor labor. Also ensure that the supporting documents for all projects include the complete set of required documents: final application, invoice, and product specification sheet.
- **Key Finding #3:** Some projects contain small baseline wattage discrepancies between the tracking data and the project files. These discrepancies are very small and have minimal effects on savings. Nevertheless, the implementation team may want to consider this finding to ensure continued strong realization rates for the Initiative.
  - Recommendation: Verify that the project file baseline wattages in the application match the tracking data baseline wattages. These discrepancies are attributed to DLC wattage discrepancies between tracking data wattage and specification sheet DLC wattage.
- **Key Finding #4:** Two measure lines are mislabeled in the "lighting description" column. These measures are described as "BPL27 Utility-Owned Streetlighting - Replacing Mercury Vapor - Dusk to Dawn Operation," but the project files support HPS as the baseline fixtures type.
  - Recommendation: Verify that all "lighting descriptions" match the actual baseline light fixture type from the project files.

3.6 Building Operator Certification

While not considered an "initiative" like Standard, Custom, RCx, and Streetlighting, AIC offers BOC training to its customers as part of the Business Program. This section details our 2020 evaluation of those efforts.

3.6.1 Training Description

AIC, in partnership with the Midwest Energy Efficiency Alliance, offers 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 that focuses on energy-efficient building operations and preventative maintenance procedures. BOC training consists of two levels of training: Level I and Level II. The courses include classroom training, project assignments to be completed at a participant's facility, and in-class tests at the end of each day. Successful graduates of BOC training earn certificates of completion. Graduates who elect to take the certification exam and pass earn the BOC Certification and become a Certified Building Operator. Certified Building Operators retain their certification by maintaining employment, attending approved continuing education webinars, and implementing projects at their facilities. While the training is open to building operators across Illinois, AIC incentivizes participation among its customers by providing a partial tuition reimbursement to building operators in their service territory ($500 to put toward the total cost of $1,400, provided upon completion of the course).

In 2019, AIC and the Midwest Energy Efficiency Alliance offered a Level I course in Springfield from early June through the end of July. The Level I course consists of seven classes focused on building systems maintenance (Table 35). In total, 10 AIC customers completed the course, including facilities staff from school districts, local governments, manufacturing facilities, colleges, and grocery chains.

Table 35. List of BOC Level I Training Topics

Topics
1001 - Energy-Efficient Operation of Building HVAC Systems
1002 - Measuring and Benchmarking Energy Performance
1003 - Efficient Lighting Fundamentals
1004 - HVAC Controls Fundamentals
1005 - Indoor Environmental Quality
1006 - Common Opportunities for Operational Improvement
1007 - Facility Electrical Systems

Summary of Evaluation Methodology

The evaluation team aligned the impact evaluation of BOC training with Kirkpatrick's Framework for evaluating adult learning interventions (see Appendix A), the gold standard framework for assessing the impacts of adult learning interventions. Opinion Dynamics' approach involved following students throughout the training process and targeting specific research activities at different stages of participation. Research activities included:

- **Baseline operations and maintenance (O&M) 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.

- **Reaction 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 that they made to their facilities during the training, (4) record any future plans for energy efficiency projects, and (5) identify the role BOC training played in these future plans. We provided a $50 incentive to participants for completing these reaction interviews.
- **Post-course savings interview:** We interviewed participants a year after they completed BOC training to understand the actions (if any) that they took as a result of what they learned, including energy efficiency projects and modifications to building or equipment operations. We provided a $100 incentive to participants for completing these post-course interviews.
- **Savings verification:** Due to COVID-19, we did not conduct any on-site audits to verify the details of any energy efficiency projects reported by the participants. In lieu of an on-site audit, we provided participants with an additional incentive to provide documentation of projects, where possible, to support the development of our impact calculations. The incentive ranged from $100 to $500, depending on the amount of information we requested.

Through these activities, we gathered information about the energy-saving actions that participants took and about how BOC training may have motivated participants to take these actions. As 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 were able to estimate savings only for those participants who completed the post-course savings interview. Four participants completed the post-course savings interview, and three provided sufficient information to support savings verification (see Table 37). The fourth participant no longer worked for the organization through which they completed BOC training and did not have access to the project details needed to support impact evaluation.

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. Based on guidance provided in the IL-TRM V8.0, the evaluation team treated these savings as participant spillover, which informed our methodology for determining program influence, as well as the timing of this evaluation.[32]

By their nature, follow-on actions from training interventions require time to be completed, particularly those aimed at encouraging upgrades in large commercial facilities. Because the 2019 BOC training occurred in Q2 and Q3 of 2019, the evaluation team felt strongly that the 2019 evaluation would not capture all of the follow-on work, given that most large commercial projects have long lead times. We, therefore, chose to evaluate follow-on savings resulting from the 2019 training as part of the 2020 evaluation. Similarly, because these savings were evaluated in the manner of spillover, we did not apply a NTGR to evaluated savings. The evaluation team calculated verified savings only for projects we deemed attributable to BOC training based on participant responses to attribution questions in the post-course interviews. More detailed discussion of the evaluation methodology is provided in Appendix A.

[32] *IL-TRM V8.0 Attachment A: Illinois Statewide Net-to-Gross Methodologies*. Page 26.

3.6.2 Participation Summary

Table 36 summarizes participation in 2019 Level I BOC training by segment. Overall, 10 AIC customers participated in the training.

Table 36. 2019 BOC Training Participation Summary

Participant ID	BOC Level	Segment
101	1	Local Government
103	1	Grocery
104	1	Process Industrial
105	1	School/University
106	1	Municipality
107	1	School/University
109	1	School/University
110	1	Local Government
111	1	Local Government
112	1	Local Government

Table 37 presents participation in the evaluation activities that we completed for each student.

Table 37. Summary of Evaluation Activities by Student

Participant ID	Baseline Survey	Reaction Interview	Post-Course Savings Interview	Desk Reviews and Savings Verification
101	✓			
103	✓	✓	✓	
104	✓			
105	✓	✓	✓	✓
106	✓	✓		
107	✓	✓	✓	✓
109	✓	✓		
110	✓	✓	✓	✓
111	✓			
112	✓			

Note: Participants 111 and 112 screened out of the baseline survey because that they indicated they were students and thus not involved in building operations on a permanent basis.

3.6.3 Training Annual Savings Summary

Overall, the 2019 BOC training led to 180 MWh, 0.002 MW, and 2,960 therms in verified net savings during 2020 (Table 38).

Table 38. BOC Training Annual Savings Achieved in 2020

	Electric Energy Savings (MWh)	Electric Demand Savings (MW)	Gas Savings (Therms)
Verified Net Savings	180	0.002	2,960

3.6.4 Training Savings Detail

The 2019 BOC training influenced three participants to implement several different types of energy efficiency projects, including HVAC, lighting, and domestic hot water upgrades. Since the training, surveyed participants completed eight total projects. As shown in Table 39, these projects ranged from common LED lighting upgrades to holistic building improvements, including HVAC system replacements and optimization of EMS scheduling.

Table 39. 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)	
107	1	165	0.0000	0	Return/exhaust fan scheduling
110	1	8	0.0008	0	Fluorescent lighting delamping
105	6	7	0.0017	2,960	LED T8 replacements, LED exit signs, low-flow faucet replacements, split system central air conditioning (CAC) replacement, boiler controls
Total	**8**	**180**	**0.0025**	**2,960**	

Note: Participant 105 installed LED exit signs at multiple sites, which is why we specify six completed projects but only five measures are listed.

All three participants completed projects that produced electric energy savings. In total, the projects resulted in 180 MWh of net energy savings. Two participants also achieved demand savings, totaling 0.0025 MW of net demand savings (see Table 40 and Table 41).

Table 40. BOC Training Electric Energy Savings by Measure

Participant ID	Measure Category	Verified Net Savings (MWh)
107	Return/Exhaust Fan Scheduling	165.0
110	Fluorescent Delamping	8.3
105	LED T8 Replacements	4.2
105	LED Exit Signs	1.2
105	Split System CAC Replacement	1.0
105	Low-Flow Faucet Replacements	0.3
Total		**180.0**

Table 41. BOC Training Electric Demand Savings by Measure

Participant ID	Measure Category	Verified Net Savings (MW)
105	LED T8 Replacements	0.0011
110	Fluorescent Delamping	0.0008
105	Split System CAC Replacement	0.0005
105	LED Exit Signs	0.0001
Total		**0.0025**

Two participants completed projects that produced gas savings, contributing a total of 2,960 therms toward AIC energy efficiency goals.

Table 42. BOC Training Gas Savings by Measure

Participant ID	Measure Category	Verified Net Savings (Therms)
105	Boiler Lockout/Reset Controls	2,693
105	Low-Flow Faucet Replacements	267
Total		**2,960**

BOC training participants also enrolled in other AIC initiatives in 2019 and 2020.[33] Participants saved an additional 164 MWh of verified net energy savings through the Standard Initiative and 2,055 MWh through the Custom Initiative (see Table 43). Approximately 8% of participant's total verified energy savings are not attributable to other AIC initiatives and are therefore claimable by BOC training.

Table 43. 2019 and 2020 Cross-Program Verified Net Electric Energy Savings by Participant

Participant ID	Verified Net Savings (MWh) by AIC Offering						Share of Savings by AIC Offering					
	BOC	SLB	Instant Incentives	Online Store	HVAC	Custom	BOC	SLB	Instant Incentives	Online Store	HVAC	Custom
107	165	83	0	0	19	2,055	7%	4%	0%	0%	1%	89%
105	7	0	0	0	9	0	44%	0%	0%	0%	56%	0%
110	8	0	42	3	8	0	14%	0%	69%	4%	13%	0%
Total	**180**	**83**	**42**	**3**	**36**	**2,055**	**8%**	**3%**	**2%**	**0%**	**1%**	**86%**

Participants also saved an additional 6,292 therms and 46,419 therms of verified net gas savings through the Standard and Custom initiatives, respectively (see Table 44). Approximately 5% of participant's total verified gas savings are not attributable to other AIC initiatives and are therefore claimable by BOC training.

Table 44. 2019 and 2020 Cross-Program Verified Net Natural Gas Savings by Participant

Participant ID	Verified Gross Savings (Therms) by AIC Offering					Share of Savings by AIC Offering				
	BOC	Online Store	HVAC	STRR	Custom	BOC	Online Store	HVAC	STRR	Custom
107	0	0	3,106	0	46,419	0%	0%	6%	0%	94%
105	2,960	0	2,049	996	0	49%	0%	34%	17%	0%
110	0	142	0	0	0	0%	100%	0%	0%	0%
Total	**2,960**	**142**	**5,154**	**996**	**46,419**	**5%**	**0%**	**9%**	**2%**	**83%**

[33] This evaluation quantifies the energy savings produced in the year following the 2019 BOC training. Therefore, our analysis period spans 2019 and 2020. As such, the evaluation team conducted a cross-participation analysis for the year following the training to (1) ensure that we did not claim savings for the BOC training that were already claimed through other initiatives (in 2019 or 2020) and (2) identify all cases where BOC students participated in other AIC initiatives following the training.

3.6.5 Cumulative Persisting Annual Savings

Table 45 presents CPAS achieved in 2020 as a result of BOC training and the resulting WAML. The measure-specific and total verified gross savings for BOC are summarized and CPAS in each year of the 2018–2021 Plan are presented.[34] The WAML for BOC is 8.9 years.

Table 45. BOC Training CPAS Achieved in 2020 and WAML

Measure Category	Measure Life	First-Year Verified Gross Savings (MWh)	NTGR	CPAS - Verified Net Savings (MWh)							Lifetime Savings (MWh)
				2018	2019	2020	2021	...	2030	...	
LED Exit Signs	5.0	1	N/A			1	1	...	0	...	6
LED T8 Replacements	15.0	4	N/A			4	4	...	4	...	62
Fluorescent Delamping	11.0	8	N/A			8	8	...	8	...	92
Boiler Lockout/Reset Controls	20.0	0	N/A			0	0	...	0	...	0
Split System CAC Replacement	15.0	1	N/A			1	1	...	1	...	15
Return/Exhaust Fan Scheduling	8.6	165	N/A			165	165	...	0	...	1,419
Low-Flow Faucet Replacements	10.0	<1	N/A			<1	<1	...	<1	...	3
2020 CPAS		**180**	**N/A**			**180**	**180**	**...**	**13**	**...**	**1,597**
Expiring 2020 CPAS						**0**	**0**	**...**	**0**	**...**	
Expired 2020 CPAS						**0**	**0**	**...**	**167**	**...**	
WAML	**8.9**										

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

3.6.6 Conclusions and Recommendations

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

- **Key Finding #1:** The three 2019 BOC training participants for whom we estimated savings in this evaluation completed energy upgrades of a variety of end uses that resulted in a wide range of energy and demand savings. In fact, one of the overarching goals of BOC training is to empower building operations professionals to proactively, and continuously, optimize energy consumption of facilities in a custom manner (i.e., specific to the needs of their facilities and occupants). As such, we anticipate equally varied projects to be completed by BOC training participants in future years.
  - Recommendation: The evaluation team recommends continuing to take a custom approach to quantifying savings for BOC training. As BOC training encourages a wide range of project types, and participants operate an even broader range of facility types, a custom evaluation approach is critical to accurately capturing the impact of the energy and demand impacts of BOC training.
- **Key Finding #2:** BOC training participants also complete large projects through other Business Program initiatives. The three 2019 BOC training participants included in our impact analysis also participated in the Standard and Custom initiatives since completing their BOC training, resulting in 2,218 MWh and 52,711 therms of additional savings (see Table 43 and Table 44).
  - Recommendation: While annual program evaluations may not attribute large savings totals to BOC training each year, BOC training may be encouraging customers to participate in other AIC offerings, thereby leading indirectly to additional savings. Additional evaluation research to determine BOC's influence on participation in other offerings could be considered in future years.

Appendix A. Impact Analysis Methodology

Standard Initiative

Gross Impact Methodology

The evaluation team calculated verified savings for the Standard Initiative by applying savings algorithms from the IL-TRM V8.0. The team leveraged Initiative tracking data, such as building space conditioning characteristics (e.g., primary heating fuel, presence of cooling), delivery mechanisms (e.g., direct install, time of sale, early replacement), equipment efficiencies (e.g., lighting lumens/watt, air conditioning seasonal energy efficiency rating), and project location for deriving weather-dependent assumptions (e.g., EFLH). Default assumptions in the IL-TRM V8.0 provided guidance when Initiative tracking data did not contain the necessary information, such as baseline lighting wattages for the Online Store and Instant Incentive channels. Table 60 lists the measures in the Standard Initiative, their corresponding IL-TRM entry, and whether or not TRM errata applied to the measure in the 2020 evaluation.

Table 46. Standard Initiative Measures Evaluated

Evaluation Measure Category	IL-TRM Measure	Errata Applied?
High Speed Fans	4.1.3	No errata present for this measure
Livestock Waterer	4.1.4	No errata present for this measure
Commercial Solid and Glass Door Refrigerators & Freezers	4.2.2	No errata present for this measure
Commercial Steam Cooker	4.2.3	No errata present for this measure
ENERGY STAR Dishwasher	4.2.6	No errata present for this measure
ENERGY STAR Fryer	4.2.7	No errata present for this measure
ENERGY STAR Hot Food Holding Cabinets	4.2.9	No errata present for this measure
High Efficiency Pre-Rinse Spray Valve	4.2.11	No errata present for this measure
Kitchen Demand Ventilation Controls	4.2.16	No errata present for this measure
ENERGY STAR Electric Convection Oven	4.2.19	No errata present for this measure
Water Heater	4.3.1	No errata present for this measure
Low Flow Faucet Aerators	4.3.2	No errata present for this measure
Low Flow Showerheads	4.3.3	No errata present for this measure
Commercial Pool Covers	4.3.4	No errata present for this measure
Space Heating Boiler Tune-up	4.4.2	No errata present for this measure
Process Boiler Tune-up	4.4.3	No errata present for this measure
Boiler Lockout/Reset Controls	4.4.4	No errata present for this measure
Electric Chiller	4.4.6	No errata present for this measure
Guest Room Energy Management (PTAC & PTHP)	4.4.8	No errata present for this measure
High Efficiency Boiler	4.4.10	No errata present for this measure
High Efficiency Furnace	4.4.11	No errata present for this measure
Infrared Heaters (all sizes), Low Intensity	4.4.12	No errata present for this measure
Package Terminal Air Conditioner (PTAC) and Package Terminal Heat Pump (PTHP)	4.4.13	No errata present for this measure

Evaluation Measure Category	IL-TRM Measure	Errata Applied?
Single-Package and Split System Unitary Air Conditioners	4.4.15	No errata present for this measure
Steam Trap Replacement or Repair	4.4.16	No errata present for this measure
Variable Speed Drives for HVAC Pumps and Cooling Tower Fans	4.4.17	No errata present for this measure
Demand Controlled Ventilation	4.4.19	No errata present for this measure
Variable Speed Drives for HVAC Supply and Return Fans	4.4.26	No errata present for this measure
High Temperature Heating and Ventilation (HTHV) Direct Fired Heater	4.4.39	No errata present for this measure
Small Commercial Thermostats	4.4.48	No errata present for this measure
Fluorescent Delamping	4.5.2	No errata present for this measure
LED Bulbs and Fixtures	4.5.4	Errata applied
Commercial LED Exit Signs	4.5.5	No errata present for this measure
Lighting Controls	4.5.10	No errata present for this measure
T5 Fixtures and Lamps	4.5.12	No errata present for this measure
LED Open Sign	4.5.15	No errata present for this measure
Automatic Door Closer for Walk-in Coolers and Freezers	4.6.1	No errata present for this measure
Beverage and Snack Machine Controls	4.6.2	No errata present for this measure
Door Heater Controls for Cooler or Freezer	4.6.3	No errata present for this measure
Electronically Commutated Motors (ECM) for Walk-in and Reach-in Coolers / Freezers	4.6.4	No errata present for this measure
Evaporator Fan Control for Electrically Commutated Motors	4.6.6	No errata present for this measure
Night Covers for Open Refrigerated Display Cases	4.6.9	No errata present for this measure
VSD Air Compressor	4.7.1	No errata present for this measure
Compressed Air Low Pressure Drop Filters	4.7.2	No errata present for this measure
Compressed Air No-Loss Condensate Drains	4.7.3	No errata present for this measure
Advanced Power Strip – Tier 1 Commercial	4.8.7	No errata present for this measure
High Frequency Battery Chargers	4.8.9	No errata present for this measure
Variable Speed Drives for Process Fans	4.8.13	No errata present for this measure

Non-TRM Measures

For the LSR channel, the IL-TRM V8.0 does not provide an approach to calculate gross impacts. For this measure, the evaluation team followed the approach summarized below.

Leak Survey and Repair

The 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 V8.0 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 in Table 47.

Table 47. Algorithms for Leak Survey and Repair Measures

Algorithms	
kWh Savings	= $Hours_{annual}$ × ∑(# of Leaks × CFM_{leak}) × kW/CFM
kW Savings	= ∑(# of Leaks × CFM_{leak}) × kW/CFM
Therm Savings	= N/A

In the above equations, kW/CFM represents the system demand reductions in kW per CFM of reduced air demand and is dependent on the fan motor control type (see Table 48).

Table 48. 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[b]	0.178

[a] Sourced from IL-TRM V8.0 Section 4.7.3, Compressed Air No-Loss Condensate Drains.
[b] VFD = Variable Frequency Drive.

The term CFM_{leak} represents the air leakage rate. Air leakage rates are binned into six size categories under two intervention scenarios, repaired and reported but not repaired, summarized in Table 49. 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 rate lower than if repaired by the implementer.

Table 49. 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

Measure Lives and Cumulative Persisting Annual Savings

For prescriptive measures, the evaluation team applied measure lives from the IL-TRM V8.0. For LSR measures, we applied a measure life of five years consistent with previous evaluations. For the SBEP channel, we applied a measure life of 20 years, the IL-TRM V9.0 deemed measure life for air sealing.[35]

Net Impact Methodology

The evaluation team applied SAG-approved 2020 NTGRs to verified gross savings to calculate verified net savings. Table 50 outlines the SAG-approved NTGR values applied to verified gross savings to calculate verified net savings.

Table 50. 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
LSR	0.702	N/A
STRR	N/A	0.608[b]
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]
SBDI	0.908	0.908
SBEP	0.908	0.908
MHVAC – Heat Pump Water Heater	0.890	N/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.
[b] The SAG-approved gas NTGRs are also applied to secondary electric energy savings for water supply and wastewater treatment.

Custom Initiative

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 Initiative projects as part of the 2020 evaluation.

The evaluation team completed desk reviews (and in many cases, remote or on-site M&V to provide increased accuracy) at a sample of the 54 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, to verify consistency

[35] *2020 Illinois Statewide Technical Reference Manual for Energy Efficiency Version 9.0, Volume 3: Residential Measures.* Section 5.6.1.

in savings estimates throughout the project file, and to 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 2020 projects for evaluation in three waves, drawing each sample from the entire population of completed Custom Initiative 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 54 Custom Initiative projects using a stratified random sample design targeting 10% relative precision at the 90% level of confidence. For the stratification, we used an automated implementation of 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 41 projects chosen for the electric sample and 16 projects chosen for the gas sample. The 57 reviews across 54 unique projects that we conducted account for 61% of the total ex ante gross electric energy savings and 67% of ex ante gas savings. Table 51 and Table 52 present details around the sample of electric and gas projects chosen for the 2020 evaluation.

Table 51. Custom Initiative 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	< 35 MWh	30	531	4	82
	2	≥ 35 MWh & < 130 MWh	13	1,171	5	468
	3	≥ 130 MWh & < 1,000 MWh	9	3,484	9	3,443
	4	≥ 1,000 MWh	1	1,245	1	1,204
		Subtotal	*53*	*6,431*	*19*	*5,198*
2	1	< 35 MWh	9	150	1	7
	2	≥ 35 MWh & < 100 MWh	6	400	1	76
	3	≥ 100 MWh & < 500 MWh	9	2,694	8	2,496
	4	≥ 500 MWh	1	980	1	980
		Subtotal	*25*	*4,223*	*11*	*3,560*
3	1	< 250 MWh	39	3,548	3	549
	2	≥ 250 MWh & < 900 MWh	17	8,186	3	1,682
	3	≥ 900 MWh	6	9,792	5	8,747
		Subtotal	*62*	*21,526*	*11*	*10,979*
Total			**140**	**32,180**	**41**	**19,737**

Table 52. Custom Initiative 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	< 2,600 therms	3	5,676	2	3,141
	2	≥ 2,600 & < 10,000 therms	2	9,359	1	4,901
	3	≥ 10,000 therms	3	60,462	3	60,462
		Subtotal	*8*	*75,497*	*6*	*68,504*
2	1	< 7,500 therms	4	22,535	1	6,657
	2	≥ 7,500 & < 20,000 therms	4	59,222	1	11,336
	3	≥ 20,000 & < 250,000 therms	3	133,019	3	133,019
	4	≥ 250,000 therms	1	390,428	1	390,428
		Subtotal	*12*	*605,205*	*6*	*541,439*
3	1	< 12,000 therms	15	85,781	1	1,462
	2	≥ 12,000 & < 50,000 therms	5	161,845	1	21,028
	3	≥ 50,000 & < 150,000 therms	2	190,857	1	54,263
	4	≥ 150,000 therms	1	183,542	1	183,542
		Subtotal	*23*	*622,025*	*4*	*260,294*
Total			**43**	**1,302,727**	**16**	**870,238**

To estimate the Initiative's verified savings, the evaluation team used the ratio adjustment method.[36] As described in Equation 1, 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 2020 Custom Initiative projects with savings (N=154).

Equation 1. Ratio Adjustment Method

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

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

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

Precision Calculations

We calculated precision for our gross impact results by pooling the results from all waves of site visits.[37] To calculate relative precision, the team first determined the variance in the sample and then calculated the standard error and confidence interval. Equation 2 through Equation 5 were used.

Equation 2. Stratified Ratio Estimator

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

Equation 3. Standard Error

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

Equation 4. Confidence Interval

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

Equation 5. Relative Precision

$$Relative\ Precision = \frac{90\%\ Confidence\ Interval}{Stratified\ Ratio\ Estimator}$$

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 Attachment B,[38] the evaluation team reviewed the ex ante measure life assumptions provided by the implementation team for sampled Custom Initiative projects in 2020 and revised these assumptions where necessary. We then calculated an adjustment to ex ante measure lives in a manner similar to that of calculating a gross savings realization rate and applied that adjustment to all population ex ante measure lives. Table 53 provides a summary of 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.

[37] 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.
[38] *Illinois Statewide Technical Reference Manual – Attachment B: Effective Useful Life for Custom Measure Guidelines.*

Table 53. Custom Initiative Measure Life Adjustment Due to Evaluation

Project Number	End Use	Measure Life		Rationale for Adjustment and Notes
		Ex Ante	Verified	
1901068	Lighting	12.5	15.0	LPD approach (IL-TRM Measure 4.5.7) has deemed 15-year EUL.
1902201	Lighting	10.2	5.7	M&V found that lighting is in operation 24/7 and recalculated EUL.
2000079	Lighting	5.7	15.0	LPD approach (IL-TRM Measure 4.5.7) has deemed 15-year EUL.
2000080	Lighting	7.7	15.0	LPD approach (IL-TRM Measure 4.5.7) has deemed 15-year EUL.
2000111	HVAC	15.0	13.0	IL-TRM Attachment B indicates 13-year EUL for Custom HVAC Equip.
2000128	HVAC	23.0	15.0	Implementation team assigned incorrect ex ante EUL based on Electric Chiller (IL-TRM Measure 4.4.6) guidance. Data centers custom EUL is appropriate.
2000264	Lighting	10.1[a]	6.7	EUL calculated from revised hours of use (HOU) used for verified impacts.
2000429	Lighting	10.2	15.0	EUL capped at 15 years. Possible data entry error; project documentation appears to have correct EUL assigned but database does not.
2000572	Compressed Air	13.0	13.7	Implementation team appears to have chosen flat 13-year EUL for variable speed compressor. Verified EUL is calculated as an average of applicable IL-TRM EULs (4.7.1, 4.7.7, and Attachment B) weighted by verified savings for each measure completed as part of the project.
2000941	Compressed Air	14.5[a]	14.5	Implementation team used correct methodology to assign savings-weighted EUL using component project measures; verified EUL slightly reweights value using verified savings; changes are not visible within rounding.
2001465	Lighting	7.6	7.6	Verified EUL is recalculated using verified HOU; changes are not visible within rounding.

[a] Note that the implementation team tracked project measures separately and with individual EULs for this project. Unit of analysis in our sampling is the project, so values have been rolled up into savings-weighted EULs for reporting, but analysis was conducted at the measure level to align with implementation.

Net Impact Methodology

The evaluation team applied SAG-approved 2020 NTGRs to verified gross savings to calculate verified net savings. Table 54 outlines the SAG-approved NTGR values applied to verified gross savings to calculate verified net savings.

Table 54. SAG-Approved Custom Initiative NTGRs

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

Retro-Commissioning Initiative

Discussion of impact analysis methodology in this section refers to only the legacy RCx Initiative channels (Compressed Air Retro-Commissioning and Large Facilities Retro-Commissioning). Virtual Commissioning™ is discussed separately in the next section.

Gross Impact Methodology

The evaluation team examined Initiative impacts to estimate a realization rate of savings between ex ante and verified gross savings. Given the number of completed projects in 2020 (9), the COVID-19 pandemic, and the nature of completed 2020 projects, the evaluation team conducted engineering desk reviews for a census of projects to determine verified gross savings.

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 and conducted "virtual site visits" where necessary.

Because the evaluation team reviewed all projects, there is no sampling error around impact evaluation results.

Measure Lives and Cumulative Persisting Annual Savings

In accordance with the methodology presented and discussed in the IL-TRM Attachment B,[39] the evaluation team reviewed all ex ante measure life assumptions provided by the implementation team for all RCx Initiative projects in 2020. The evaluation team used the most recent available research results in all cases to review and adjust custom measure life assumptions.

Table 55 provides a summary of the RCx Initiative project measure lives that were adjusted after evaluation. All other ex ante measure lives in the population were determined to have been appropriately applied.

Table 55. Retro-Commissioning Initiative Measure Life Adjustment Due to Evaluation

Project Number	Channel	Measure Life		Rationale for Adjustment and Notes
		Ex Ante	Verified	
1000184	Large Facilities Retro-Commissioning	8.8	8.6	Ex ante used incorrect value from IL-TRM.[a]
1901576	Large Facilities Retro-Commissioning	7.5	8.6	Ex ante used outdated value from IL-TRM V7.0.

[a] Please note that IL-TRM V8.0 and V9.0 Attachment B provide a measure life of 8.8 years for electric RCx measures (which apply to the Large Facilities offering only). This is a typo. The correct measure life is 8.6 years, as described in Navigant Memo to ComEd Re: Effective Useful Life for Retro-Commissioning and Behavior Programs: https://ilsag.s3.amazonaws.com/ComEd-EUL-Comm-RCx-and-Behavior-Memo-2019-09-17.pdf.

[39] *Illinois Statewide Technical Reference Manual – Attachment B: Effective Useful Life for Custom Measure Guidelines.*

Net Impact Methodology

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

Table 56 outlines the SAG-approved NTGR value applied to verified gross savings to calculate verified net savings. The RCx Initiative has a single electric and gas NTGR for all legacy offerings under the Initiative.

Table 56. SAG-Approved Retro-Commissioning Initiative NTGRs

Measure	Electric NTGR	Gas NTGR
Retro-Commissioning	0.890	0.890

Virtual Commissioning™

The evaluation team evaluated gross savings resulting from the Virtual Commissioning™ pilot in 2020 by replicating and verifying Power TakeOff's facility-level modeling approach.

Impact Analysis Methodology

Data Cleaning

Opinion Dynamics used each facility's raw AMI data, provided by Power TakeOff, to independently verify the data cleaning process that Power TakeOff used to estimate their models. The evaluation team received AMI data in both hourly and 15-minute intervals. For modeling purposes, the evaluation team cleaned and aggregated the data using the following steps:

1. Dropped records that were exact duplicates
2. Disaggregated one-hour records into 15-minute intervals
3. Corrected inconsistent time zone designations
4. Dropped duplicate records that were created by the disaggregation and time zone correction process using the following prioritization criteria:
    a. Actual over estimated usage values
    b. One-hour over 15-minute intervals
    c. Larger usage values
5. Dropped hours with no observations
6. Imputed missing 15-minute interval data using the average of the remaining intervals in the hour
7. Aggregated 15-minute intervals up to hourly intervals for use with hourly models
8. Aggregated hourly data up to daily intervals for daily models

We then compared our cleaned data to the cleaned data that Power TakeOff uses for modeling to ensure consistency. While there were a few small exceptions, overall, the evaluation team found that Power TakeOff's data cleaning process was robust.

During the data cleaning and aggregation process, the evaluation team identified several minor issues with Power TakeOff's data cleaning process. First, rather than switching from local daylight time to local standard time at 2:00 a.m. (daylight time) as is standard practice, Power TakeOff instead switched from local daylight time to local standard time at 7:00 p.m. local daylight time. Second, there were few instances where Power TakeOff dropped observations without documentation. These minor issues did not affect the modeling results.

Modeling Approach

The evaluation team verified the electric savings results Power TakeOff claimed for the Virtual Commissioning™ pilot by validating their site-level model specifications and replicating Power TakeOff's results. To calculate annualized savings, we first developed regression-based baseline energy usage models. We then used these baseline models, together with the third collection of TMY3 weather data, to estimate normalized gross annual savings from the pilot.

Following Power TakeOff's process, we developed the baseline model by fitting a regression model to pre- and post-intervention data. Power TakeOff selected either an hourly or a daily regression model, depending on the project (these model specifications are defined in Equation 6 and Equation 7 below). The hourly model is the default model; however, the daily model is used when the hourly model does not pass the goodness-of-fit criteria described below. Power TakeOff estimated hourly models for seven facilities and daily models for three facilities. Opinion Dynamics evaluated the same model specification for each project (daily or hourly) as Power TakeOff,

We note that due to Virtual Commissioning™'s pilot status and delayed start there were only three to five months of post-period data for each project. This introduces bias because the model was not able to train on a full range of temperature data after the intervention was initiated. This may increase the prediction error of the model.

Hourly Regression Model

Equation 6. Hourly Regression Model

$$E(i) = \sum_{j=1}^{7\times24} \beta_j HOW_j(i) + H(i) + C(i) + \sum_{j=1}^{7\times24} \alpha_j (Change(i) * HOW_j(i))$$

In Equation 6, $E(i)$ is total electricity consumption for hour i. $HOW_j(i)$ is an indicator variable set to one if hour i is the j^{th} hour of the week and zero otherwise. $Change(i)$ is the treatment variable, set to one if hour i occurs during the reporting period and zero otherwise. $H(i)$ represents the heating component while $C(i)$ reflects the cooling component. $H(i)$ is defined as:

$$H(i) = h_1 T_1(i) + h_2 T_2(i) + h_3 T_3(i) + h_4 T_4(i)$$

Where:

$$T_1(i) = \min(\max(55 - Temp(i), 0), 10)$$
$$T_2(i) = \min(\max(45 - Temp(i), 0), 10)$$
$$T_3(i) = \min(\max(35 - Temp(i), 0), 15)$$
$$T_4(i) = \max(20 - Temp(i), 0)$$

$Temp(i)$ is temperature in degrees Fahrenheit for hour i.

$C(i)$ is defined as:

$$\mathrm{C}(i) = c_1 P_1(i) + c_2 P_2(i) + c_3 P_3(i) + c_4 P_4(i)$$

Where:

$$P_1(i) = \min(\max(Temp(i) - 55, 0), 10)$$
$$P_2(i) = \min(\max(Temp(i) - 65, 0), 10)$$
$$P_3(i) = \min(\max(Temp(i) - 75, 0), 15)$$
$$P_4(i) = \max(Temp(i) - 90, 0)$$

Daily Regression Model

Equation 7. Daily Regression Model

$$E(i) = \beta_0 + \sum_{j=1}^{6} \beta_j W_j(i) + \beta_7 CDD(i) + \beta_8 HDD(i) + \beta_9 Change(i)$$

In Equation 7, $E(i)$ is total electricity consumption for day i. $W_j(i)$ is an indicator variable set to one if day i is the j^{th} day of the week and zero otherwise. To avoid multicollinearity, $W_7(i)$ (the indicator for Sunday) is omitted. $Change(i)$ is the treatment variable, set to one if day i occurs during the reporting period and zero otherwise. $CDD(i)$ and $HDD(i)$ represent the total cooling degree days and total heating degree days for day i, respectively, and are defined as:

$$CDD(i) = \sum_{j=1}^{24} \max\left(Temp(j) - CBP, 0\right)$$
$$HDD(i) = \sum_{j=1}^{24} \max\left(HBP - Temp(j), 0\right)$$

Where $Temp(j)$ is temperature in degrees Fahrenheit for hour j of day i, and CBP and HBP are the cooling balance point and heating balance point, respectively.[40]

Power TakeOff used a grid search algorithm to determine CBP and HBP. The grid search runs the daily regression model repeatedly for various combinations of CBP and HBP and selects the combination with the highest adjusted R^2 as the best-fitting CBP and HBP. The selected CBP and HBP are then used in the final model evaluation. Due to the lack of hourly temperature data for the three facilities for which Power TakeOff estimated the daily model, the evaluation team could not validate Power TakeOff's chosen values of CBP and HBP.

Normalized Gross Annual Savings

To verify gross annual savings resulting from the Virtual Commissioning™ pilot, the evaluation team first estimated the hourly model for seven facilities and daily model for three facilities using actual weather data. Next, we calculated annual predicted baseline and reporting period electricity consumption for each facility using estimated regression coefficients and TMY3 weather data. Finally, we computed the annual savings by

[40] A balance point is the point at which a customer theoretically turns on their heating or cooling.

calculating the difference between the annual predicted baseline and reporting period electricity consumption. The following equations show how we calculated the gross annual savings in detail.

For each facility for which Power TakeOff estimated the hourly regression model specified in Equation 6 , the evaluation team calculated hourly predicted baseline period electricity consumption based on Equation 8 defined below:

Equation 8. Hourly Predicted Baseline Period Electricity Consumption

$$E_B(i) = \sum_{j=1}^{7\times24} \hat{\beta}_j HOW_j(i) + \hat{H}(i) + \hat{C}(i)$$

In Equation 8, $E_B(i)$ is predicted baseline period electricity consumption for hour i. $\hat{\beta}_j$ is the estimated coefficient on the j^{th} hour of the week indicator variable as defined in Equation 6. $\hat{H}(i)$ and $\hat{C}(i)$ specified below are estimated heating and cooling components evaluated using TMY3 weather data and regression coefficients.

$$\hat{H}(i) = \hat{h}_1 T_1(i) + \hat{h}_2 T_2(i) + \hat{h}_3 T_3(i) + \hat{h}_4 T_4(i)$$
$$\hat{C}(i) = \hat{c}_1 P_1(i) + \hat{c}_2 P_2(i) + \hat{c}_3 P_3(i) + \hat{c}_4 P_4(i)$$

We calculated hourly reporting period electricity consumption based on Equation 4 defined below:

Equation 9. Hourly Predicted Reporting Period Electricity Consumption

$$E_R(i) = \sum_{j=1}^{7\times24} \hat{\beta}_j HOW_j(i) + \hat{H}(i) + \hat{C}(i) + \sum_{j=1}^{7\times24} \hat{\alpha}_j HOW_j(i)$$

In Equation 9, $E_R(i)$ is predicted reporting period electricity consumption for hour i. $\hat{\alpha}_j$ is the estimated coefficient on the interaction term between the treatment variable and the j^{th} hour of the week indicator variable as defined in Equation 6.

Annual savings were calculated as:

$$\sum_{i\in TMY} E_B(i) - \sum_{i\in TMY} E_R(i)$$

Where each sum was over all the hours in the TMY.

Similarly, for each facility for which Power TakeOff estimated the daily regression model specified in Equation 7, the evaluation team calculated daily predicted baseline and reporting period electricity consumption based on Equation 10 and Equation 11 defined below. We calculated annual savings using the formula defined above, but the sum included all the days in the TMY.

Equation 10. Daily Predicted Baseline Period Electricity Consumption

$$E_B(i) = \hat{\beta}_0 + \sum_{j=1}^{6} \hat{\beta}_j W_j(i) + \hat{\beta}_7 CDD(i) + \hat{\beta}_8 HDD(i)$$

Equation 11. Daily Predicted Reporting Period Electricity Consumption

$$E_R(i) = \hat{\beta}_0 + \sum_{j=1}^{6} \hat{\beta}_j W_j(i) + \hat{\beta}_7 CDD(i) + \hat{\beta}_8 HDD(i) + \hat{\beta}_9$$

Non-Routine Events

The only non-routine events (NREs) Power TakeOff identified for any of the 2020 projects were shutdowns associated with the COVID-19 pandemic. Both teams handled these NREs in accordance with the IPMVP NRE guidelines[41] by dropping data for the affected period and extending the baseline back in time accordingly.

Model Fitness Criteria

To claim project savings as part of the Initiative, the model for each project must meet the following goodness-of-fit criteria:

- Absolute Value of Normalized Mean Bias Error (NMBE) < 0.5%
- Coefficient of Variation of Root Mean Square Error CV(RMSE) < 25%
- Savings Uncertainty < 50% at 68% confidence.

These goodness-of-fit metrics were calculated consistent with industry best practices. Following the guidance from IPMVP Uncertainty Assessment Guidelines,[42] we calculated the savings uncertainty using the Newey-West estimator of the covariance matrix, which corrects for autocorrelation and heteroskedasticity.

Comments on Power TakeOff's Modeling Approach

In general, Power TakeOff's approach to measuring savings is appropriate and consistent with the Virtual Commissioning™ M&V Plan and IPMVP guidelines. After a detailed review of their approach, we offer the following recommendations for improving the model robustness and accuracy:

- To the extent possible, establish consistency between hourly and daily models by ensuring that both models have the same variables, main effect and interaction terms, and treatment of the intercept.
- Include interaction terms in the models between the treatment variable and any independent variables related to the intervention. For example, if the intervention is to adjust HVAC setpoints, we recommend including an interaction term between the treatment variable and the weather variables. Including this interaction term would improve the ability of the model to represent the mechanism by which the intervention is expected to work.
- Document the model selection process and rationale. The documentation should include the criteria that were used for model selection and the steps that were taken to avoid overfitting.
- Update savings uncertainty calculations. The evaluation team recommends updating the savings uncertainty calculation for two reasons:
  - Power TakeOff's standard error calculation took a sum of the variance and covariance of hourly savings, which did not correctly capture the variance of total normalized savings.

[41] Webster, Lia. 2020.
[42] EVO. *Uncertainty Assessment for IPMVP.* 2019.

- Since the Newey-West variance-covariance matrix already handles autocorrelation, it is not clear why Power TakeOff used an additional adjustment term for autocorrelation in the standard error calculation.

Measure Lives and Cumulative Persisting Annual Savings

The evaluation team applied an EUL of 7.3 for Virtual Commissioning™ based on the most recent available Illinois-specific research.[43]

Detailed Project Impacts

Detailed Project Savings

Table 57 presents the results of the gross savings analysis for the 10 Virtual Commissioning™ pilot projects completed in 2020. Realization rates for individual projects are all 100% for electric savings.

Table 57. 2020 Virtual Commissioning™ Pilot Annual Savings by Project

Project ID	Ex Ante Net kWh	Verified Net kWh	Realization Rate
XXXXXX5773	17,865	17,865	100%
XXXXXX1616	56,655	56,655	100%
XXXXXX5455	9,121	9,121	100%
XXXXXX8099	21,068	21,068	100%
XXXXXX3616	31,300	31,300	100%
XXXXXX0711	10,067	10,067	100%
XXXXXX7616	6,378	6,378	100%
XXXXXX1038	137,045	137,045	100%
XXXXXX6491	27,481	27,481	100%
XXXXXX4031	19,536	19,536	100%
Total	**336,515**	**336,515**	**100%**

Table 58 shows the model goodness-of-fit metrics and savings uncertainty percentages that Power TakeOff and the evaluation team produced for the 10 Virtual Commissioning™ pilot projects. The evaluation team was unable to exactly reproduce Power TakeOff's adjusted R^2 values and savings uncertainty percentages. Given that there are several formulas to calculate adjusted R^2, it is unclear which variation of formulas Power TakeOff used to produce these numbers.

[43] Harris, J. and Maoz, K. "ComEd EUL Research CY2020 Commercial Behavioral and Operations and Maintenance Measures EUL Values Delphi Panel Final Outcomes." (Memo provided to ComEd). 2020. Accessed at: https://ilsag.s3.amazonaws.com/ComEd-EUL-Research-CY2020-Final-Outcomes-Virtual-Delphi-Panel-2020-12-18.pdf.

Table 58. 2020 Virtual Commissioning™ Pilot Model Goodness-of-Fit Metrics and Savings Uncertainty by Project

Project ID	Adjusted R^2		CV(RMSE)		NMBE		Savings Uncertainty (%)	
	Power TakeOff	Opinion Dynamics	Power TakeOff	Opinion Dynamics	Power TakeOff	Opinion Dynamics	Power TakeOff	Opinion Dynamics
XXXXXX5773	0.80	0.98	16%	16%	0%	0%	5%	5%
XXXXXX1616	0.77	0.96	23%	23%	0%	0%	17%	23%
XXXXXX5455	0.92	0.92	14%	14%	0%	0%	34%	34%
XXXXXX8099	0.50	0.50	22%	22%	0%	0%	46%	43%
XXXXXX3616	0.95	0.95	14%	14%	0%	0%	20%	19%
XXXXXX0711	0.83	0.97	18%	18%	0%	0%	14%	14%
XXXXXX7616	0.86	0.97	20%	20%	0%	0%	21%	18%
XXXXXX1038	0.80	0.97	18%	18%	0%	0%	9%	8%
XXXXXX6491	0.56	0.99	11%	11%	0%	0%	7%	8%
XXXXXX4031	0.89	0.98	16%	16%	0%	0%	12%	10%

Instead of using Power TakeOff's approach for calculating savings uncertainty, the evaluation team followed IPMVP's protocol for uncertainty assessment by using the Newey-West estimator of the variance-covariance matrix, and calculated the standard error using the delta method.[44] While Power TakeOff also used the Newey-West estimator of the variance-covariance matrix, Power TakeOff calculated the standard error of the normalized energy savings by summing each element in the variance-covariance matrix. However, a simple sum of the variance and covariance of hourly savings does not capture the true variance of the total normalized savings. Second, Power TakeOff included an additional term in the savings uncertainty calculation to account for autocorrelation. However, given that the Newey-West estimator already adjusts for both heteroskedasticity and autocorrelation, it is unclear why the additional correction for autocorrelation is required.

Although we were unable to exactly reproduce Power TakeOff's adjusted R^2 values and savings uncertainty results, our independently produced values also met the criteria for project inclusion. We did not reject any projects due to failure to meet the goodness-of-fit criteria for the pilot.

Uplift from Other AIC Initiatives

The savings analysis for the Virtual Commissioning™ pilot considers energy savings that resulted from energy-efficient actions taken through other AIC Business Program initiatives. The evaluation team did not find any instances of cross-initiative participation among Virtual Commissioning™ pilot participants in 2020.

Net Impact Methodology

The evaluation team applied the SAG-approved 2020 NTGR of 1.000 to verified gross savings to calculate verified net savings. Table 59 outlines the SAG-approved NTGR value applied to verified gross savings to calculate verified net savings.

Table 59. SAG-Approved Virtual Commissioning™ NTGR

Measure	Electric NTGR
Virtual Commissioning™	1.000

[44] EVO. 2019.

Streetlighting Initiative

Gross Impact Methodology

The evaluation team calculated verified savings for the Streetlighting Initiative by applying savings algorithms from the IL-TRM V8.0. The team leveraged Initiative tracking data, such as fixture quantity, baseline fixture wattage, LED wattage, project location, and reported HOU to inform savings assumptions. For variables outside these parameters, the evaluation team relied on defaults from the IL-TRM V8.0. Table 60 lists the measures in the Streetlighting Initiative, their corresponding IL-TRM entry, and whether or not TRM errata applied to the measure in the 2020 evaluation.

Table 60. Streetlighting Initiative Measures Evaluated

Evaluation Measure Category	IL-TRM Measure	Errata Applied?
LED Streetlighting	4.5.16	No errata present for this measure

Measure Lives and Cumulative Persisting Annual Savings

We applied EULs and baseline adjustments per IL-TRM V8.0 to determine CPAS for this evaluation. The IL-TRM supports an EUL of 12 years for an LED streetlight under standard operation. None of the measures installed as part of the 2020 Initiative are reported as having continuous operation.

Net Impact Methodology

The evaluation team applied SAG-approved 2020 NTGRs to verified gross savings to calculate verified net savings. Table 61 outlines the SAG-approved NTGR values applied to verified gross savings to calculate verified net savings.

Table 61. SAG-Approved Streetlighting Initiative NTGRs

Measure	Electric NTGR
Municipality-Owned	0.800
Utility-Owned	1.000

Building Operator Certification

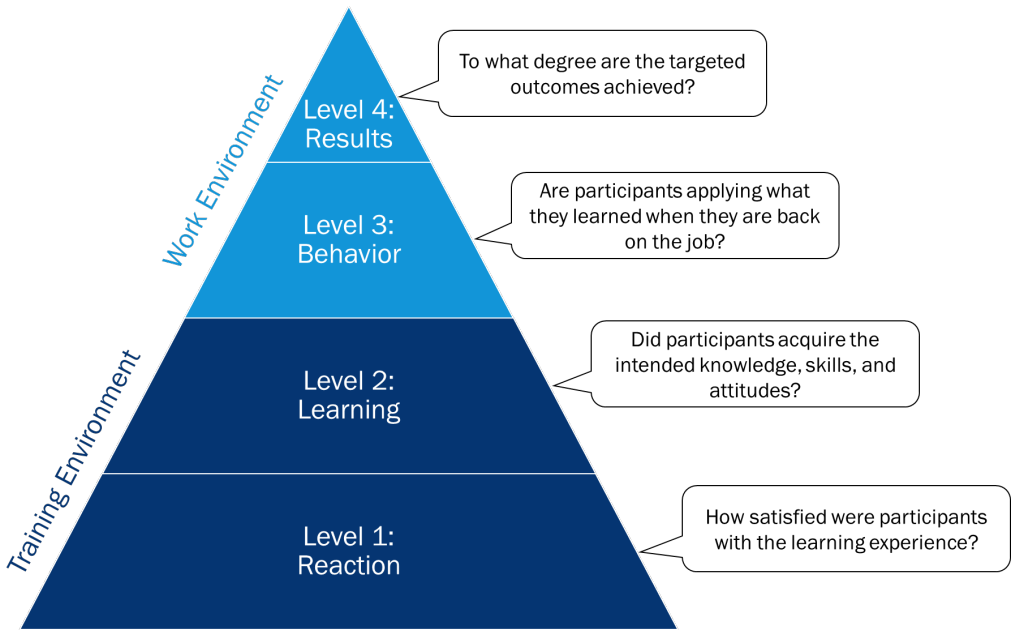
Gross Impact Methodology

The evaluation team leveraged an innovative evaluation approach to calculate the 2020 gross impacts resulting from 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 BOC training 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 62), including:

- **Baseline O&M 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.
- **Review of course materials**: We reviewed the results of several in-class activities, including a baseline knowledge assessment, exam scores, homework scores, and exit surveys for each class in which participants assessed the effectiveness of the class and instructor.
- **Reaction 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 that they made to their facilities during the training, (4) record any future plans for energy efficiency projects, and (5) identify the role BOC training played in these future plans.
- **Post-course savings interview**: We interviewed participants a year after they completed BOC training to understand the actions (if any) that they took as a result of what they learned, including energy efficiency projects and modifications to building or equipment operations.
- **Engineering desk reviews**: Our engineers reviewed the data collected in the post-course savings interviews, set up savings calculations, and identified additional data required to calculate impacts.

- **Savings verification**: Due to COVID-19, we could not conduct on-site audits to verify the details of any energy efficiency projects reported by the participants. In lieu of an on-site audit, we provided participants with an additional incentive to provide documentation of projects, where possible, to support the development of our impact calculations.

Table 62. Summary of Research Activities and the Associated Kirkpatrick Levels

Research Activity	Level 1	Level 2	Level 3	Level 4
Review of course materials	✓	✓		
Reaction interviews	✓	✓	✓	
Baseline O&M and energy efficiency equipment survey			✓	
Post-course savings interviews			✓	✓
Engineering desk reviews				✓
Savings verification				✓

Overall, the evaluation team estimated verified savings for eight projects, from which we collected varying levels of information through the post-course interviews and verification activities. We estimated savings using a combination of data collected through the post-course interviews, a review of EMS data and other documentation participants provided, and assumptions from the IL-TRM V8.0. We also filled in gaps with IL-TRM baseline assumptions where possible.

Projects fell into one of three overarching categories: lighting, HVAC, and domestic hot water (DHW), summarized in Table 63.

Table 63. List of Measure Categories and Relation to Overarching Categories

Measure Category	Lighting	HVAC	DHW
LED T8 Replacements	✓		
Fluorescent Delamping	✓		
LED Exit Signs	✓		
Return/Exhaust Fan Scheduling		✓	
Split System CAC Replacement		✓	
Boiler Lockout/Reset Controls		✓	
Low-Flow Faucet Replacements			✓

In general, the evaluation team utilized project information in conjunction with the IL-TRM V8.0 in developing energy savings estimates. The following provides additional details about the evaluation team's methodology and assumptions by project category.

Lighting

To estimate savings from lighting improvements, we collected information from participants to characterize the baseline and efficient lighting conditions for each project. In cases where we were unable to obtain information on baseline lighting conditions, we defaulted to assumptions from the IL-TRM V8.0.

HVAC

Consistent with recommendations in the IL-TRM V8.0, we employed a prescriptive evaluation approach to estimating savings for two HVAC projects: boiler lockout/reset controls and split system CAC replacement. For

each project, we supplemented prescriptive algorithms with site-specific data gathered through the post-course savings interviews.

We estimated savings for return and exhaust fan scheduling using a custom approach, as the IL-TRM V8.0 does not include savings algorithms for this measure.

The participant-provided EMS data, which included the hp of each return and exhaust fan motor included in the scheduling changes, as well as the hours of operation before ($Hours_{before}$) and after ($Hours_{after}$) scheduling changes. Since the project involved only scheduling changes and did not include any updates to the return and exhaust fans themselves, the evaluation team determined energy savings to be based off the difference in hours of operation before ($Hours_{before}$) and after ($Hours_{after}$) the scheduling changes.

To estimate energy savings, the evaluation team first developed an intermediate algorithm to capture the power consumption of all return and exhaust fan motors. To do so, we borrowed the default fan motor efficiency (η_{motor}=0.917) and load factor (LF=65%) values from Measure 4.4.26 of the IL-TRM V8.0 (Variable Speed Drives for HVAC Supply and Return Fans). We then developed the annual energy savings algorithm by multiplying the fan motor power algorithm by the difference in hours of operation before and after scheduling. The intermediate fan motor power and annual energy savings algorithms are displayed in Equation 12 and Equation 13.

Equation 12. Intermediate Fan Motor Power Algorithm

$$Fan\ Motor\ Power\ = 0.746 \times HP \times \left(\frac{LF}{\eta\_motor}\right)$$

Equation 13. Annual Energy Savings Algorithm

$$Annual\ Energy\ Saved\ (kWh) = \left(0.746 \times HP \times \left(\frac{LF}{\eta\_motor}\right)\right) \times \left(Hours_{before} - Hours_{after}\right)$$

Hot Water Conservation

We estimated savings for efficient faucet replacements by applying the algorithms and default assumptions from Measure 4.3.2 (Low Flow Faucet Aerators) of the IL-TRM V8.0.

Measure Lives and Cumulative Persisting Annual Savings

The evaluation team applied prescriptive measure lives from the IL-TRM V8.0 for the majority of evaluated measures. For HVAC return and exhaust fan scheduling, we applied the IL-TRM Attachment B default for electric retro-commissioning measures of 8.6 years.

Attribution Analysis

Overall, participants reported that BOC training was one of several important factors that influenced the energy efficiency improvements described in Table 63. However, participants also reported that they would not have completed the projects if they had not attended BOC training.

On average, respondents rated the likelihood that they would have completed the projects as a 3.8 out of 10, where 0 means “definitely would not have taken the action” and 10 means “definitely would have taken the action.” Additionally, respondents reported that BOC training was very important when planning their energy-

saving upgrades. On average, respondents rated the importance of BOC training as an 8.4 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 64 out of 100 "points of influence"[45] to BOC training when considering all influencing factors in their decision to complete the energy-savings projects.

As expected, the respondents reported that other non-program factors were influential in their decision-making process; respondents most commonly cited financial benefits, increasing occupant comfort, and sustainability initiatives as influential factors (Table 64).

Table 64. Influence of Non-BOC Training Factors on Decision to Implement Energy-Saving Projects

Factor	Post-Course Interview Responses			
	Total	Influence Score		
		0–3	4–6	7–10
Reducing operating costs	3	0	0	3
Rate of return	3	0	0	3
Increased comfort	3	0	1	2
Commitment to going green	3	1	1	1
Employee, customer, or student complaints	3	1	2	0

Note: Respondents rated the influence of factors other than 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 four participants who completed the post-course savings interview for further research. To understand how those included in the impact analysis (i.e., "respondents") compared to the entire 2019 participant population, we assessed both groups on the following criteria:

- **Participant characteristics**: Respondents held similar positions as non-respondents, but generally held more decision-making power related to O&M practices and energy-related equipment.
- **Facility characteristics**: Respondents and non-respondents managed a similar number of facilities. Respondent and non-respondent facilities were about the same size; most facilities ranged from 20,000 to 100,000 square feet, though one non-respondent managed a facility that was between 750,000 and 1,000,000 square feet.
- **Pre-participation energy-saving actions**: Respondents and non-respondents took energy-saving actions related to similar end uses prior to participating in the training (Table 65).

[45] Respondents were given 100 points to reflect on 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.

Table 65. Participant Energy-Saving Actions Completed Before the BOC Training

Measure Category	Respondents (n=4)	Population (n=8[a])
Lighting	4	8
Economizer and ventilation controls	4	7
HVAC equipment scheduling or space temperature	3	7
Boiler/hot water/steam system	3	6
Package/split system HVAC	2	6
Domestic hot water	2	5
Fan optimization/air distribution	2	4
Chiller/chilled water system	1	2
Water pump optimization	1	2
Cooling tower optimization	1	1
Other	1	1

[a] Two participants were not eligible for our baseline survey as they were not full-time facility staff.

Appendix B. Cost-Effectiveness Inputs

In this appendix, we provide additional inputs for the cost-effectiveness testing of AIC's Business Program. Generally, two specific types of additional inputs are provided: summaries of gas penalties that are not counted toward gas savings goal attainment and summaries of secondary electric savings from water supply and wastewater treatment.

Gas Penalties

By agreement with SAG,[46] AIC is not penalized for gas penalties resulting from the installation of efficient prescriptive measures that create an increase in energy usage when considering savings for goal attainment purposes. 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.

In the following sections, the evaluation team focuses specifically on the following type of gas penalty:

- **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 V8.0 (with applicable errata applied).

Secondary Electric Savings from Water Supply and Wastewater Treatment

Some measures delivered through the Business Program produce water savings as well as energy savings. For applicable measures, the IL-TRM V8.0 includes an algorithm to calculate the secondary electric impacts of these water savings; decreased electricity usage for water supply and wastewater treatment as a result of water savings stemming from the energy efficiency 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 V8.0.

[46] Treatment of interactive effects is consistent with a draft SAG policy agreement on this topic. Illinois Energy Efficiency Stakeholder Advisory Group. "Policy Resolution - 2020 Program Year." 2020. Accessed at: https://ilsag.s3.amazonaws.com/SAG-Policy-Res-Heating-Penalties-Negative-Savings-11-30.docx.

Standard Initiative

Gas Penalties

Table 66 presents gas penalties not reported in the body of the report for the Standard Initiative.

Table 66. 2020 Standard Initiative Gas Penalties

Channel	Therms
SBDI Heating Penalty	−908,784
Instant Incentives Heating Penalty	−490,138
Core Program Heating Penalty	−393,514
Online Store Heating Penalty	−2,060
Green Nozzles Heating Penalty	0
Sink Aerators Heating Penalty	0
Total Gas Penalties	**−1,794,496**

Secondary Electric Savings from Water Supply and Wastewater Treatment

We calculated secondary electric savings from water supply and wastewater treatment for measures installed through the Standard Initiative during 2020. These savings are included in the body of the report and for goal attainment purposes are in line with guidance provided in IL-TRM V8.0.

Table 67 presents secondary electric savings claimed through the Standard Initiative that will be excluded from cost-effectiveness calculations.

Table 67. 2020 Standard Initiative Secondary Electric Savings

Measure	kWh
Low-Flow Showerheads Secondary Electric Savings	10,731
STRR Secondary Electric Savings	1,303
ENERGY STAR Dishwasher Secondary Electric Savings	1,006
Low-Flow Faucet Aerators Secondary Electric Savings	601
Commercial Steam Cooker Secondary Electric Savings	394
High-Efficiency Pre-Rinse Spray Valve Secondary Electric Savings	304
Commercial Pool Covers Secondary Electric Savings	271
Total Secondary Electric Savings	**14,610**

Total Impacts for Cost-Effectiveness

Table 68 presents final total 2020 Standard Initiative verified gross impacts to be used for cost-effectiveness, adjusted for gas penalties and secondary electric savings.

Table 68. 2020 Standard Initiative Verified Impacts for Cost-Effectiveness

	kWh	Therms
Verified Gross Impacts for Goal Attainment	200,341,145	995,732
Gas Penalties	N/A	−1,794,496
Secondary Electric Savings	−14,610	N/A
Final Verified Gross Impacts for Cost-Effectiveness	**200,326,535**	**−798,764**

Custom Initiative

Gas Penalties

No measures delivered through the Custom Initiative in 2020 produced quantifiable gas penalties.

Secondary Electric Savings from Water Supply and Wastewater Treatment

No measures delivered through the Custom Initiative in 2020 produced quantifiable water savings.

Fuel Switching

Custom Initiative Project 2000192 used fuel switching (gas heating to electric heating) calculations. Per the evaluation team's interpretation of general IL-TRM guidance, savings for the project are claimed using source (generation) energy savings, rather than site (at the premises) savings. To correctly align Custom Initiative savings for cost-effectiveness purposes, savings used in cost-effectiveness analysis must be at the site rather than at the source so that line loss adjustments are not double-counted in cost-effectiveness analysis. Table 69 presents final Project 1900192 verified gross impacts to be used for cost-effectiveness, adjusted for these effects.

Table 69. 2020 Custom Initiative Project 2000192 Verified Impacts for Cost-Effectiveness

	kWh	kW	Therms
Project 19000192 Verified Gross Impacts for Goal Attainment	8,977	5.72	4,187
Project 19000192 Verified Gross Impacts for Cost-Effectiveness	8,083	5.02	4,159
Required Adjustment	**-894**	**-0.70**	**-29**

Note: Gross impact values presented in this table do not match project-specific gross impact values presented for this project earlier in this report. This is correct; these values include the population-level realization rate adjustments for the Custom Initiative and reflect the actual verified savings claimed and attributed to this project, rather than project-specific verified savings used in the impact rollup.

Table 70 presents final 2020 Custom Initiative verified gross impacts to be used for cost-effectiveness, adjusted for these effects.

Table 70. 2020 Custom Initiative Verified Impacts for Cost-Effectiveness

	kWh	kW	Therms
Verified Gross Impacts for Goal Attainment	30,787,784	3,189.91	1,507,554
Fuel Switching Adjustment	-894	-0.70	-29
Final Verified Gross Impacts for Cost-Effectiveness	**30,786,890**	**3,189.21**	**1,507,526**

Retro-Commissioning Initiative

Discussion of cost-effectiveness inputs for the RCx Initiative are inclusive of Virtual Commissioning™.

Gas Penalties

No measures delivered through the RCx Initiative in 2020 produced quantifiable gas penalties.

Secondary Electric Savings from Water Supply and Wastewater Treatment

No measures delivered through the RCx Initiative in 2020 produced quantifiable water savings.

Streetlighting Initiative

Gas Penalties

Because all measures installed through the Streetlighting Initiative are located in unconditioned space, no measures installed through the Initiative produced gas heating penalties.

Secondary Electric Savings from Water Supply and Wastewater Treatment

No measures delivered through the Streetlighting Initiative in 2020 produced quantifiable water savings.

Building Operator Certification

Gas Penalties

Table 71 presents gas penalties not reported in the body of the report for BOC training.

Table 71. 2020 BOC Training Gas Penalties

Measure	Therms
Fluorescent Delamping Gas Heating Penalty	−256
Standard LED Gas Heating Penalty	−40
LED Exit Signs Gas Heating Penalty	−16
Total Interactive Effects	**−312**

Secondary Electric Savings from Water Supply and Wastewater Treatment

We calculated secondary electric savings from water supply and wastewater treatment for measures installed by BOC participants during the 2020 evaluation period. These savings are included in the body of the report and for goal attainment purposes are in line with guidance provided in IL-TRM V8.0.

Table 72 presents secondary electric savings claimed through BOC training in 2020 that will be excluded from cost-effectiveness calculations.

Table 72. 2020 BOC Training Secondary Electric Savings

Measure	kWh
Low-Flow Faucet Replacements Secondary Electric Savings	291
Total Secondary Electric Savings	**291**

Total Impacts for Cost-Effectiveness

Table 73 presents final verified gross impacts from BOC training claimed in 2020 to be used for cost-effectiveness, adjusted for interactive effects and secondary electric savings.

Table 73. 2020 BOC Training Verified Gross Impacts for Cost-Effectiveness

	kWh	Therms
Verified Gross Impacts for Goal Attainment	180,007	2,960
Interactive Effects	N/A	−312
Secondary Electric Savings	−291	N/A
Final Verified Gross Impacts for Cost-Effectiveness	**179,716**	**2,648**

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 can be challenging to read; please reference the separately provided CPAS spreadsheet for additional detail as needed.

Table 74 provides CPAS for the 2020 Business Program through 2047 at the initiative level. Note that while most Business Program CPAS expire by 2043, due to one unique ground-source heat pump project completed through the Custom Initiative, the Program produces a small amount of CPAS through 2074. CPAS between 2047 and 2074 are omitted from this report to save space but are included in the companion CPAS spreadsheet. Lifetime savings for the 2020 Business Program through 2074 are 3,009,032 MWh.

Table 74. 2020 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	13.5	200,341	0.884			177,037	177,000	175,837	171,178	167,468	163,903	162,299	160,741	158,888	156,668	153,447	127,613	85,929
Standard Carryover	13.7	6,197	0.845			5,234	5,234	5,234	5,234	4,827	4,801	4,753	4,395	4,386	4,386	4,383	4,383	4,383
Custom	12.8	30,951	0.822			25,442	25,442	25,442	25,442	25,441	25,437	25,123	22,777	22,671	21,967	20,228	18,518	13,628
Retro-Commissioning	6.4	4,522	0.898			4,062	4,062	4,062	3,885	3,133	2,066	2,066	1,831	1,038	0	0	0	0
Streetlighting	12.0	31,633	0.990			31,306	31,306	31,306	31,306	29,494	29,494	29,494	29,494	29,494	29,494	29,494	29,494	0
BOC	8.9	180	N/A			180	180	180	180	180	179	179	179	113	14	13	5	5
Standard (gas conversion)	20.0	1,867	0.908			1,695	1,695	1,695	1,695	1,695	1,695	1,695	1,695	1,695	1,695	1,695	1,695	1,695
2020 Portfolio CPAS		**275,690**	**0.889**			**244,956**	**244,919**	**243,756**	**238,920**	**232,239**	**227,575**	**225,609**	**221,111**	**218,285**	**214,224**	**209,261**	**181,708**	**105,640**
Expiring 2020 Portfolio CPAS						**0**	**37**	**1,163**	**4,836**	**6,681**	**4,664**	**1,966**	**4,498**	**2,826**	**4,061**	**4,964**	**27,552**	**76,068**
Expired 2020 Portfolio CPAS						**0**	**37**	**1,200**	**6,036**	**12,717**	**17,381**	**19,347**	**23,845**	**26,671**	**30,732**	**35,695**	**63,248**	**139,316**

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	13.5	200,341	0.884	79,176	69,898	624	575	526	526	526	252	252	252	0	0	0	0	0
Standard Carryover	13.7	6,197	0.845	4,383	3,495	0	0	0	0	0	0	0	0	0	0	0	0	0
Custom	12.8	30,951	0.822	10,059	5,335	4,085	1,690	1,161	1,161	1,161	1,098	501	379	59	59	59	59	59
Retro-Commissioning	6.4	4,522	0.898	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Streetlighting	12.0	31,633	0.990	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BOC	8.9	180	N/A	5	5	0	0	0	0	0	0	0	0	0	0	0	0	0
Standard (gas conversion)	20.0	1,867	0.908	1,695	1,695	1,695	1,695	1,695	1,695	1,695	0	0	0	0	0	0	0	0
2020 Portfolio CPAS		**275,690**	**0.889**	**95,319**	**80,429**	**6,404**	**3,960**	**3,382**	**3,382**	**3,382**	**1,350**	**753**	**631**	**59**	**59**	**59**	**59**	**59**
Expiring 2020 Portfolio CPAS				**10,321**	**14,890**	**74,025**	**2,444**	**579**	**0**	**0**	**2,032**	**597**	**123**	**572**	**0**	**0**	**0**	**0**
Expired 2020 Portfolio CPAS				**149,637**	**164,527**	**238,552**	**240,996**	**241,574**	**241,574**	**241,574**	**243,606**	**244,203**	**244,325**	**244,897**	**244,897**	**244,897**	**244,897**	**244,897**
WAML	**13.2**																	

Standard Initiative

Table 75 provides CPAS for the 2020 Standard Initiative through 2047 at the channel level. Lifetime savings for the 2020 Standard Initiative are 2,190,614 MWh.

Table 75. 2020 Standard Initiative CPAS and WAML

Channel	Measure Life	First-Year Verified Gross MWh	NTGR	CPAS (Verified Net MWh)														
				2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Lighting	12.4	42,164	0.839			35,384	35,384	35,335	34,992	34,660	34,334	33,609	33,203	32,311	32,106	30,646	21,300	9,608
HVAC	13.7	4,363	0.683			2,981	2,981	2,981	2,978	2,978	2,978	2,978	2,978	2,974	2,974	2,811	2,771	2,771
VSDs	15.0	15,086	0.833			12,570	12,570	12,570	12,570	12,570	12,570	12,570	12,570	12,570	12,570	12,570	12,570	12,570
Specialty Equipment	11.1	958	0.849			813	813	813	813	813	798	798	796	583	583	305	305	270
Steam Traps	6.0	1	0.608			1	1	1	1	1	1	0	0	0	0	0	0	0
Leak Survey and Repair	5.0	1,483	0.849			1,259	1,259	1,259	1,259	1,259	0	0	0	0	0	0	0	0
Green Nozzles	5.0	3	0.920			3	3	3	3	3	0	0	0	0	0	0	0	0
Sink Aerators	10.0	11	0.849			10	10	10	10	10	10	10	10	10	10	0	0	0
Midstream HVAC	15.0	2	0.890			2	2	2	2	2	2	2	2	2	2	2	2	2
Instant Incentives	14.6	35,287	0.916			32,330	32,330	32,330	32,330	31,727	31,713	31,665	31,065	31,035	31,035	31,031	31,030	31,030
Online Store	9.1	350	0.831			291	291	290	280	236	227	220	211	160	157	154	0	0
SBDI	13.6	100,329	0.908			91,119	91,082	89,969	85,665	82,935	80,997	80,174	79,632	78,969	76,957	75,653	59,361	29,404
SBEP	20.0	302	0.908			274	274	274	274	274	274	274	274	274	274	274	274	274
2020 CPAS		**200,341**	**0.884**			**177,037**	**177,000**	**175,837**	**171,178**	**167,468**	**163,903**	**162,299**	**160,741**	**158,888**	**156,668**	**153,447**	**127,613**	**85,929**
Expiring 2020 CPAS						**0**	**37**	**1,163**	**4,660**	**3,709**	**3,566**	**1,604**	**1,558**	**1,853**	**2,220**	**3,222**	**25,834**	**41,684**
Expired 2020 CPAS						**0**	**37**	**1,200**	**5,860**	**9,569**	**13,134**	**14,739**	**16,297**	**18,149**	**20,369**	**23,591**	**49,425**	**91,109**

Channel	Measure Life	First-Year Verified Gross MWh	NTGR	CPAS (Verified Net MWh)														
				2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047
Lighting	12.4	42,164	0.839	7,328	7,078	0	0	0	0	0	0	0	0	0	0	0	0	0
HVAC	13.7	4,363	0.683	2,771	2,771	350	301	252	252	252	252	252	252	0	0	0	0	0
VSDs	15.0	15,086	0.833	12,570	12,570	0	0	0	0	0	0	0	0	0	0	0	0	0
Specialty Equipment	11.1	958	0.849	91	91	0	0	0	0	0	0	0	0	0	0	0	0	0
Steam Traps	6.0	1	0.608	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Leak Survey and Repair	5.0	1,483	0.849	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Green Nozzles	5.0	3	0.920	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sink Aerators	10.0	11	0.849	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Midstream HVAC	15.0	2	0.890	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0
Instant Incentives	14.6	35,287	0.916	30,545	22,284	0	0	0	0	0	0	0	0	0	0	0	0	0
Online Store	9.1	350	0.831	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SBDI	13.6	100,329	0.908	25,595	24,829	0	0	0	0	0	0	0	0	0	0	0	0	0
SBEP	20.0	302	0.908	274	274	274	274	274	274	274	0	0	0	0	0	0	0	0
2020 CPAS		**200,341**	**0.884**	**79,176**	**69,898**	**624**	**575**	**526**	**526**	**526**	**252**	**252**	**252**	**0**	**0**	**0**	**0**	**0**
Expiring 2020 CPAS				**6,753**	**9,278**	**69,274**	**49**	**49**	**0**	**0**	**274**	**0**	**0**	**252**	**0**	**0**	**0**	**0**
Expired 2020 CPAS				**97,861**	**107,139**	**176,413**	**176,462**	**176,512**	**176,512**	**176,512**	**176,786**	**176,786**	**176,786**	**177,037**	**177,037**	**177,037**	**177,037**	**177,037**
WAML	**13.5**																	

Table 76 provides CPAS for 2020 Standard Initiative carryover savings through 2047 by measure. Lifetime savings for 2020 Standard Initiative carryover are 69,514 MWh.

Table 76. 2020 Standard Initiative Carryover CPAS and WAML

Measure	Measure Life	First-Year Verified Gross MWh	NTGR	CPAS (Verified Net MWh)														
				2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
2019 Instant Incentives - Linear LED	14.8	2,685	0.916			2,460	2,460	2,460	2,460	2,460	2,460	2,460	2,460	2,460	2,460	2,460	2,460	2,460
2019 Instant Incentives - Specialty LED	8.1	377	0.916			345	345	345	345	185	181	167	5	1	1	0	0	0
2019 Instant Incentives - Standard LED	7.8	32	0.916			30	30	30	30	12	6	0	0	0	0	0	0	0
2018 Instant Incentives - Linear LED	14.8	2,487	0.773			1,923	1,923	1,923	1,923	1,923	1,923	1,923	1,923	1,923	1,923	1,923	1,923	1,923
2018 Instant Incentives - Specialty LED	8.2	540	0.773			418	418	418	418	224	218	202	6	2	2	0	0	0
2018 Instant Incentives - Standard LED	7.8	75	0.773			58	58	58	58	23	13	0	0	0	0	0	0	0
2020 CPAS		**6,197**	**0.845**			**5,234**	**5,234**	**5,234**	**5,234**	**4,827**	**4,801**	**4,753**	**4,395**	**4,386**	**4,386**	**4,383**	**4,383**	**4,383**
Expiring 2020 CPAS						**0**	**0**	**0**	**0**	**407**	**26**	**48**	**358**	**9**	**0**	**3**	**0**	**0**
Expired 2020 CPAS						**0**	**0**	**0**	**0**	**407**	**433**	**481**	**840**	**848**	**848**	**851**	**851**	**851**

Measure	Measure Life	First-Year Verified Gross MWh	NTGR	CPAS (Verified Net MWh)														
				2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047
2019 Instant Incentives - Linear LED	14.8	2,685	0.916	2,460	1,961	0	0	0	0	0	0	0	0	0	0	0	0	0
2019 Instant Incentives - Specialty LED	8.1	377	0.916	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2019 Instant Incentives - Standard LED	7.8	32	0.916	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018 Instant Incentives - Linear LED	14.8	2,487	0.773	1,923	1,533	0	0	0	0	0	0	0	0	0	0	0	0	0
2018 Instant Incentives - Specialty LED	8.2	540	0.773	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2018 Instant Incentives - Standard LED	7.8	75	0.773	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020 CPAS		**6,197**	**0.000**	**4,383**	**3,495**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Expiring 2020 CPAS				**0**	**889**	**3,495**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Expired 2020 CPAS				**851**	**1,740**	**5,234**	**5,234**	**5,234**	**5,234**	**5,234**	**5,234**	**5,234**	**5,234**	**5,234**	**5,234**	**5,234**	**5,234**	**5,234**
WAML	**13.7**																	

Table 77 provides CPAS for the 2020 Standard Initiative gas conversion through 2047 at the channel level. Lifetime savings for the 2020 Standard Initiative gas conversion are 33,904 MWh.

Table 77. 2020 Standard Initiative Gas Conversion CPAS and WAML

Channel	Measure Life	First-Year Verified Gross MWh	NTGR	CPAS (Verified Net MWh)														
				2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
SBEP	20.0	1,867	0.908			1,695	1,695	1,695	1,695	1,695	1,695	1,695	1,695	1,695	1,695	1,695	1,695	1,695
2020 CPAS		**1,867**	**0.908**			**1,695**	**1,695**	**1,695**	**1,695**	**1,695**	**1,695**	**1,695**	**1,695**	**1,695**	**1,695**	**1,695**	**1,695**	**1,695**
Expiring 2020 CPAS						**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Expired 2020 CPAS						**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Channel	Measure Life	First-Year Verified Gross MWh	NTGR	CPAS (Verified Net MWh)														
				2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047
SBEP	20.0	1,867	0.908	1,695	1,695	1,695	1,695	1,695	1,695	1,695	0	0	0	0	0	0	0	0
2020 CPAS		**1,867**	**0.908**	**1,695**	**1,695**	**1,695**	**1,695**	**1,695**	**1,695**	**1,695**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Expiring 2020 CPAS				**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Expired 2020 CPAS				**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
WAML	**20.0**																	

Custom Initiative

Table 78 provides CPAS for the 2020 Custom Initiative at the channel level through 2047. Note that while most Custom Initiative CPAS expire by 2043, due to one unique ground-source heat pump project, the Initiative produces a small amount of CPAS through 2074. CPAS between 2047 and 2074 are omitted from this report to save space but are included in the companion CPAS spreadsheet. Lifetime savings for the 2020 Custom Initiative through 2074 are 326,024 MWh.

Table 78. 2020 Custom Initiative CPAS and WAML

Channel	Measure Life	First-Year Verified Gross MWh	NTGR	CPAS (Verified Net MWh)														
				2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Custom Incentives	12.8	29,884	0.822			24,565	24,565	24,565	24,565	24,564	24,560	24,311	21,979	21,877	21,215	19,602	17,952	13,273
New Construction Lighting	11.8	1,067	0.822			877	877	877	877	877	877	812	798	794	752	626	566	354
2020 CPAS		**30,951**	**0.822**			**25,442**	**25,442**	**25,442**	**25,442**	**25,441**	**25,437**	**25,123**	**22,777**	**22,671**	**21,967**	**20,228**	**18,518**	**13,628**
Expiring 2020 CPAS						**0**	**0**	**0**	**0**	**0**	**5**	**314**	**2,346**	**106**	**704**	**1,739**	**1,710**	**4,890**
Expired 2020 CPAS						**0**	**0**	**0**	**0**	**0**	**5**	**319**	**2,665**	**2,771**	**3,475**	**5,214**	**6,924**	**11,814**

Channel	Measure Life	First-Year Verified Gross MWh	NTGR	CPAS (Verified Net MWh)														
				2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047
Custom Incentives	12.8	29,884	0.822	9,866	5,221	4,008	1,671	1,161	1,161	1,161	1,098	501	379	59	59	59	59	59
New Construction Lighting	11.8	1,067	0.822	193	115	77	19	0	0	0	0	0	0	0	0	0	0	0
2020 CPAS		**30,951**	**0.822**	**10,059**	**5,335**	**4,085**	**1,690**	**1,161**	**1,161**	**1,161**	**1,098**	**501**	**379**	**59**	**59**	**59**	**59**	**59**
Expiring 2020 CPAS				**3,568**	**4,724**	**1,250**	**2,395**	**529**	**0**	**0**	**62**	**597**	**123**	**320**	**0**	**0**	**0**	**0**
Expired 2020 CPAS				**15,383**	**20,106**	**21,357**	**23,752**	**24,281**	**24,281**	**24,281**	**24,344**	**24,940**	**25,063**	**25,383**	**25,383**	**25,383**	**25,383**	**25,383**
WAML	**12.8**																	

Retro-Commissioning Initiative

Table 79 provides CPAS for the 2020 RCx Initiative at the channel level, including Virtual Commissioning™. Lifetime savings for the 2020 RCx Initiative are 26,204 MWh.

Table 79. 2020 Retro-Commissioning Initiative CPAS and WAML

Channel	Measure Life	First-Year Verified Gross MWh	NTGR	CPAS (Verified Net MWh)														
				2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Compressed Air Retro-Commissioning	4.4	2,242	0.890			1,995	1,995	1,995	1,819	1,066	0	0	0	0	0	0	0	0
Large Facility Retro-Commissioning	8.6	1,944	0.890			1,730	1,730	1,730	1,730	1,730	1,730	1,730	1,730	1,038	0	0	0	0
Virtual Commissioning™	7.3	337	1.000			337	337	337	337	337	337	337	101	0	0	0	0	0
2020 CPAS		**4,522**	**0.898**			**4,062**	**4,062**	**4,062**	**3,885**	**3,133**	**2,066**	**2,066**	**1,831**	**1,038**	**0**	**0**	**0**	**0**
Expiring 2020 CPAS						**0**	**0**	**0**	**176**	**752**	**1,066**	**0**	**236**	**793**	**1,038**	**0**	**0**	**0**
Expired 2020 CPAS						**0**	**0**	**0**	**176**	**929**	**1,995**	**1,995**	**2,231**	**3,024**	**4,062**	**4,062**	**4,062**	**4,062**
WAML	**6.4**																	

Streetlighting Initiative

Table 80 provides CPAS for the 2020 Streetlighting Initiative through 2032 at the measure level. Lifetime savings for the 2020 Streetlighting Initiative are 361,175 MWh.

Table 80. 2020 Streetlighting Initiative CPAS and WAML

Measure	Measure Life	First-Year Verified Gross MWh	NTGR	CPAS (Verified Net MWh)														
				2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
MOSL (ENERGY STAR®/DLC Standard Tier)	12.0	1,628	0.800			1,302	1,302	1,302	1,302	1,302	1,302	1,302	1,302	1,302	1,302	1,302	1,302	0
MOSL (DLC Premium Tier)	12.0	7	0.800			5	5	5	5	5	5	5	5	5	5	5	5	0
UOSL (Replacing HPS)	12.0	26,882	1.000			26,882	26,882	26,882	26,882	26,882	26,882	26,882	26,882	26,882	26,882	26,882	26,882	0
UOSL (Replacing Mercury Vapor)	12.0	3,116	1.000			3,116	3,116	3,116	3,116	1,305	1,305	1,305	1,305	1,305	1,305	1,305	1,305	0
2020 CPAS		**31,633**	**0.990**			**31,306**	**31,306**	**31,306**	**31,306**	**29,494**	**29,494**	**29,494**	**29,494**	**29,494**	**29,494**	**29,494**	**29,494**	**0**
Expiring 2020 CPAS						**0**	**0**	**0**	**0**	**1,812**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**29,494**
Expired 2020 CPAS						**0**	**0**	**0**	**0**	**1,812**	**1,812**	**1,812**	**1,812**	**1,812**	**1,812**	**1,812**	**1,812**	**31,306**
WAML	**12.0**																	

Building Operator Certification

Table 81 provides 2020 CPAS from BOC training through 2047. Lifetime savings from BOC are 1,597 MWh.

Table 81. 2020 BOC Training 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
LED Exit Signs	5.0	1	N/A			1	1	1	1	1	0	0	0	0	0	0	0	0
LED T8 Replacements	15.0	4	N/A			4	4	4	4	4	4	4	4	4	4	4	4	4
Fluorescent Delamping	11.0	8	N/A			8	8	8	8	8	8	8	8	8	8	8	0	0
Split System CAC Replacement	15.0	1	N/A			1	1	1	1	1	1	1	1	1	1	1	1	1
Return/Exhaust Fan Scheduling	8.6	165	N/A			165	165	165	165	165	165	165	165	99	0	0	0	0
Low Flow Faucet Replacements	10.0	0.3	N/A			0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0	0	0
2020 CPAS		**180**	**N/A**			**180**	**180**	**180**	**180**	**180**	**179**	**179**	**179**	**113**	**14**	**13**	**5**	**5**
Expiring 2020 CPAS						**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**66**	**99**	**0**	**8**	**0**
Expired 2020 CPAS						**0**	**0**	**0**	**0**	**0**	**1**	**1**	**1**	**67**	**166**	**167**	**175**	**175**

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
LED Exit Signs	5.0	1	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LED T8 Replacements	15.0	4	N/A	4	4	0	0	0	0	0	0	0	0	0	0	0	0	0
Fluorescent Delamping	11.0	8	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Split System CAC Replacement	15.0	1	N/A	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Return/Exhaust Fan Scheduling	8.6	165	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Low Flow Faucet Replacements	10.0	0	N/A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020 CPAS		**180**	**N/A**	**5**	**5**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Expiring 2020 CPAS				**0**	**0**	**5**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Expired 2020 CPAS				**175**	**175**	**180**	**180**	**180**	**180**	**180**	**180**	**180**	**180**	**180**	**180**	**180**	**180**	**180**
WAML	**8.9**																	

Appendix D. Custom Initiative Project Reports

This appendix is provided under separate cover.

For more information, please contact:

Hannah Howard
Managing Director/V.P.

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

1000 Winter Street
Waltham, MA 02451

Boston | Headquarters

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

1000 Winter Street
Waltham, MA 02451

San Francisco Bay

510 444 5050 tel
510 444 5222 fax

1 Kaiser Plaza
Suite 445
Oakland, CA 94612

San Diego

858 270 5010 tel
858 270 5211 fax

7590 Fay Avenue
Suite 406
La Jolla, CA 92037

Portland

503 287 9136 tel
503-281-7375 fax

3934 NE MLK Jr. Blvd.
Suite 300
Portland, OR 97212