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Impact and Process Evaluation of the 2016 Illinois Power Agency Public Sector Enhanced Building Optimization Program

Final

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NAVIGANT



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1. Executive Summary

This report presents results from the evaluation of the Public Sector Enhanced Building Optimization Program implemented by 360 Energy Group from June 1, 2016 to May 31, 2017 (also referred to as Program Year 9 [PY9]). The program is one of ten stand-alone Illinois Power Agency (IPA) programs and was approved for a single year of operation.

The program was designed to provide HVAC optimization strategies to small business customers in Ameren Illinois Company (AIC)'s DS-2 rate class and targets businesses in the public sector including municipal buildings, public schools, park districts, and other public real estate. The IPA Public Sector Enhanced Building Optimization Program consists of three main components, any of which may be utilized by a participant:

- **Tune-Up:** A free comprehensive tune-up of under-maintained packaged roof top units and split systems. Tune-ups include a thorough cleaning/checking of the HVAC equipment and the installation of new filters and cogged V-belts.
- **Direct Install:** Installation of programmable thermostats and scheduling/setting back existing programmable thermostats by program allies.
- **HVAC Optimization Assessment:** A free analysis to identify low-cost optimization strategies targeting HVAC energy savings. After the assessment, the customer receives a Customer Selection Form (CSF) detailing cost, energy savings, and incentives for additional optimization measures such as demand controlled ventilation, enthalpy economizer optimization, and dynamic cycle management.

Along with 360 Energy Group staff, the program leveraged a network of six qualified and pre-approved mechanical contractors (program allies) who performed tune-ups, directly installed measures, and implemented the customer-desired HVAC optimization strategies identified through the assessment. However, only two eligible customers completed projects through the program in PY9 achieving 57 MWh in ex post net electric savings, or approximately 1% of the program goal. Program staff attributed the savings shortfall to time constraints in gaining traction for the program not being able to work on roof-top HVAC units during the winter months, and low program ally participation.

The evaluation of the program involved both process and impact assessments. The process evaluation included a review of program-tracking data and program materials, as well as interviews with program administrators and implementation staff. The impact evaluation involved applying savings algorithms and assumptions from the Illinois Statewide Technical Reference Manual for Energy Efficiency Version 5 (IL-TRM V5.0), and the application of Stakeholder Advisory Group (SAG)-approved net-to-gross ratios (NTGR).

Key findings from the PY9 evaluation are presented below.

Program Impacts

Table 1 summarizes the electric energy and demand savings from the PY9 IPA Public Sector Enhanced Building Optimization Program. The program achieved 66 MWh for both ex ante and ex post gross savings, which resulted in an 100% gross realization rate. The evaluation team then applied the SAG-approved NTGR of 1.00 to the ex post gross impacts to estimate the ex post net impacts of 66 MWh for energy savings and 0.04 MW for demand savings.

Table 1. Public Sector Enhanced Building Optimization Program Net Impacts

	Ex Ante Gross	Realization Rate	Ex Post Gross	NTGR	Ex Post Net
Energy Savings (MWh)					
Total MWh	66	100%	66	1.00	66
Demand Savings (MW)					
Total MW	N/A	N/A	0.04	1.00	0.04

Note: The program did not report ex ante gross demand savings.

Key Findings and Recommendations

In PY9, the IPA Public Sector Enhanced Building Optimization Program achieved ex post net energy and demand savings of 57 MWh and 0.04 MW, respectively, which met only 1% of the energy savings goals of the program. Barriers to participation played a key role in poor program performance. The following findings and recommendations for the program are based on the results of our program evaluation:

- **Key Finding #1:** One year of program operation was not long enough for the measures to become popularized and for the program to gain traction with both program allies and participants.
 - **Recommendation:** If HVAC tune-up services are included in future AIC small business programming, program implementers and administrators may expect that it will take time to gain traction across the service territory. Additionally, potential participants expressed interest in multi-year contracts for HVAC tuning and optimization. Because public facility managers must get approval before work is performed, the short timeline of the program did not allow for some public institutions to participate.
- **Key Finding #2:** Participation was low throughout the program year, which may have been due to a lack of interest in the program offerings and/or ineffective recruitment of participants.
 - **Recommendation:** If HVAC tune-up and optimization measures are offered in future program years, a recruitment framework and marketing strategy should be planned prior to program implementation. Program implementation staff reported that program allies were not as effective as anticipated in recruiting participants. As such, implementers and program allies should work closely together to market the program and track recruitment progress.
- **Key Finding #3:** The program tracking database did not provide demand savings.
 - **Recommendation:** The evaluation team was unable to calculate a realization rate for demand, as the program-tracking database did not include ex ante demand savings. We recommend including demand savings for future evaluations.

2. Evaluation Approach

The evaluation of PY9 of the IPA Public Sector Enhanced Building Optimization Program involved both process and impact assessments. We outline the research objectives and methodology employed below.

2.1 Research Objectives

The overall objective of the PY9 evaluation is to assess program performance, a central component of which is providing estimates of gross and net electric savings associated with the program. The evaluation team sought to answer the following impact and process related questions:

Impact Questions

1. What were the estimated gross electric and demand impacts from this program?
2. What were the estimated net electric and demand impacts from this program?

Process Questions

1. Program Participation
 - a. What were the characteristics of participating customers? How many projects were completed? By how many different customers? What types of projects?
 - b. Did customer participation meet expectations? If not, how different was it and why?
2. Program Design and Implementation
 - a. Was the program implemented as planned? If not, what changes were made, and why?
 - b. What, if any, implementation challenges occurred in PY9, and how were they overcome?

2.2 Evaluation Tasks

Table 2 summarizes the PY9 evaluation activities conducted for the IPA Public Sector Enhanced Building Optimization Program.

Table 2. PY9 Evaluation Activities

Activity	Impact	Process	Forward Looking	Details
Program Staff Interviews		✓		Gather information about program marketing and implementation.
Program Materials Review	✓	✓		Review of program data to assess program operations in PY9.
Impact Analysis	✓			Calculate gross and net impacts using the IL-TRM V5.0 and SAG-approved NTGR values for PY9.

2.2.1 Program Staff Interviews

The evaluation team completed in-depth interviews with AIC program administrators, Leidos (IPA Oversight), and 360 Energy Group (implementation staff) in June 2017. These interviews explored implementation changes, program performance, program participation, and marketing and outreach during PY9.

2.2.2 Program Materials Review

The evaluation team conducted a comprehensive review of all tracking data and program materials, including the program implementation plan, program marketing materials, and the PY9 program-tracking database.

2.2.3 Impact Analysis

The evaluation team used the IL-TRM V5.0 to calculate ex post gross savings associated with the measures installed through the program. For net impacts, we applied the SAG-approved NTGR of 1.00 to gross savings.

2.3 Sources and Mitigation of Error

Table 3 provides a summary of possible sources of error associated with research tasks conducted for IPA Public Sector Enhanced Building Optimization Program. We discuss the sources of error below.

Table 3. Possible Sources of Error

Research Task	Survey Errors		Non-Survey Errors
	Sampling Errors	Non-Sampling Errors	
Impact Analysis	N/A	N/A	Analysis Errors

Non-Survey Errors

■ Analysis Errors

- **Impact Analysis:** The evaluation applied IL-TRM V5.0 assumptions and algorithms to the participant data in the tracking database to calculate gross impacts and applied the SAG-approved NTGR to calculate net impacts. To minimize analysis error, the evaluation team had all calculations reviewed by a separate team member to verify that calculations were performed accurately.

3. Detailed Evaluation Findings

This section of the report provides detailed findings related to program processes and impacts.

3.1 Program Design and Implementation

The IPA Public Sector Enhanced Building Optimization Program was adopted through the IPA procurement plan process for the first time in PY9. This single year program provided HVAC optimization strategies to small business customers in AIC's DS-2 rate class, specifically those businesses in the public sector including municipal buildings, public schools, and park districts that fit the program criteria. According to the eligibility criteria, eligible buildings must have a packaged rooftop or split system HVAC unit that does not have a standing maintenance contract or has not received a tune-up within the past 3 years (36 months), and is larger than 5-tons in size.

The IPA Public Sector Enhanced Building Optimization Program was implemented by 360 Energy Group and relied on a network of program allies. The program consisted of three main components:

- **Tune-Up:** A free comprehensive tune-up of under-maintained packaged roof top units and split systems. Tune-ups include a thorough cleaning/checking of the HVAC equipment and the installation of new filters and cogged V-belts.
- **Direct Install:** Installation of programmable thermostats and scheduling/setting back existing programmable thermostats by program allies.
- **HVAC Optimization Assessment:** A free analysis to identify low-cost optimization strategies targeting HVAC energy savings. After the assessment, the customer receives a Customer Selection Form (CSF) detailing cost, energy savings, and incentives for additional optimization measures such as demand controlled ventilation, enthalpy economizer optimization, and dynamic cycle management.

Along with the 360 Energy Group program staff, the program leveraged a network of qualified and pre-approved mechanical contractors (program allies) who performed tune-ups and directly installed measures and implemented the customer-desired HVAC optimization strategies. Program staff qualified all program leads, provided guidance to program allies, performed some of the HVAC Optimization Analyses, verified measure implementation, and paid eligible incentives to customers/program allies.

The program was primarily marketed and delivered through the program allies, as well as through email and telephone marketing by program staff. The program relied on program allies to identify quality leads from their existing customer base and relationships. Program staff also leveraged pre-existing relationships with qualified AIC customers and performed outreach to new customers, providing an approved program ally list to interested parties.

Program staff negotiated pricing with pre-approved providers based on the pre-determined scope of work and directly paid program allies for services rendered for tune-ups, direct install, and advanced optimization measures under the IPA Public Sector Enhanced Building Optimization Program.

3.2 Program Performance and Participation

3.2.1 Program Performance

The program achieved approximately 1% of its intended energy savings and served two participants. Table 4 compares the program's performance to its energy savings goals.

Table 4. PY9 Program Performance against Energy Savings Goal

Metric	MWh
Goal	5632
Ex Post Net Savings	66
% of Goal	1%

3.2.2 Program Participation Analysis

The program had two participants over its year of operation. Participants were recruited directly through phone calls. Though initially program allies were expected to recruit participants, the approach was not effective.

3.2.3 Barriers to Program Implementation

Program staff attributed shortfalls in meeting program goals primarily to the short, one-year lifespan of the program. The lifespan of the program affected results in the following ways:

- **Business were not familiar with the technology offered by the program:** The program implementer cited challenges in recruiting participants. Unlike more common energy efficiency measures such as LED lighting, HVAC tune-ups and optimization were new concepts to participants. The program implementer described the first and only year of the program as being at the bottom of an innovation diffusion curve, where the technology has not been readily adopted. Given more time in the market, the implementer believes higher participation rates may have been seen.
- **Difficulty recruiting program allies:** Implementation staff reported difficulty recruiting program allies because of the steep learning curve associated with performing the program tasks. In addition, because the program was only approved for one year, potential program allies were reluctant to invest time in becoming proficient in the program offerings.
- **Length of time needed to complete projects:** Implementation staff noted that businesses expressed interest in multi-year HVAC tune-up contracts, which were not possible given 360 Energy Group's contract with AIC. Given the lead time and approvals needed to perform work on HVAC systems, particularly in a public-sector setting, businesses were also reluctant to begin the participation process with the chance that work would not be completed by the deadline of the program.
- **Seasonal barriers to completing projects:** According to program implementation staff, all program marketing materials and implementation plans were approved by August 23rd, 2016. After approval, the program began recruiting allies and customers. However, it took a number of months for successful recruitment, by which time the HVAC tune-up season was ending¹.

¹ The HVAC tune-up season typically ends in October or November, due to inclement weather and the necessity of working on rooftops.

3.3 Impact Results

The following sections outline the results of the gross and net impact analysis for the PY9 IPA Public Sector Enhanced Building Optimization Program.

3.3.1 Gross Impacts

Overall, the program achieved a realization rate of 100% and total gross energy and demand ex post impacts of 66 MWh and 0.04 MW. We provide detailed results in the following sub-sections.

Measure Verification and In-Service Rates

The evaluation team applied measure specific in-service rates from the IL-TRM V5.0 to develop a verified measure quantities list (Table 5).

Table 5. Public Sector Enhanced Building Optimization Program Measure Quantities and In-Service Rates

Measure Category	Ex Ante Measure Quantity ^{ab} (a)	Ex Post In-Service Rate ^b (b)	Verified Measure Quantity (a*b)
HVAC Tune-up	19	100%	19
Total	19	N/A	19

^a Source: AIC PY9 Optimization Program Tracking Database

^b Units vary by measure and are instances of occurrence for AC Tune-ups, thermostat adjustments, and scheduling. For V-belts, the unit is belts installed.

^c Ex post in-service rates are from the IL-TRM V5.0.

Ex Post Gross Impact Results

Table 6 summarizes the PY9 ex post gross impacts associated with the Public Sector Enhanced Building Optimization Program. The overall ex post gross impact savings for PY9 are 66 MWh and 0.04 MW. The gross realization rate for energy savings is 100%.

Table 6. Public Sector Enhanced Building Optimization Program Gross Impacts

Program	Ex Ante Gross Impacts ^a		Ex Post Gross Impacts	
	MW ^b	MWh	MW	MWh
Public Sector Enhanced Building Optimization	N/A	66	0.04	66
Gross Realization Rate^c			N/A	100%

^a Source: AIC PY9 Optimization Program Tracking Database

^b The program did not report ex ante gross demand savings

^c Gross realization rate = ex post gross value ÷ ex ante gross value

Table 7 summarizes the gross impact results by measure. We explain potential reasons for differences between ex ante and ex post gross impacts following the table, and provide specific inputs for all ex post savings estimates in Appendix A.

Table 7. Public Sector Enhanced Building Optimization Program Ex Post Gross Impacts

Measure Category	Verified Measure Quantity	Ex Ante Gross			Ex Post Gross			Realization Rate	
		MW ^a	MWh	% of Ex Ante MWh	MW	MWh	% of Ex Post MWh	MW ^a	MWh
HVAC Tune-up	19	N/A	66	100.0%	0.04	66	100.0%	N/A	100%
Grand Total	19	N/A	66	100.0%	0.04	66	100.0%	N/A	100%

^a The program did not report ex ante gross demand savings

The Evaluation Team reviewed all ex ante calculations and algorithms, and found no discrepancies between ex ante and ex post savings.

3.3.2 Ex Post Net Impact Results

In determining the overall net savings associated with the IPA Public Sector Enhanced Building Optimization Program, the team applied the SAG-approved NTGR of 1.00. Thus, the ex post net savings are equal to the ex post gross savings of 66 MWh and 0.04 MW, with an overall net realization rate of 100% for energy.

Table 8. Public Sector Enhanced Building Optimization Program Net Impacts

Program	Ex Ante Net Impacts		Ex Ante NTGR	Ex Post NTGR	Ex Post Net Impacts	
	MW ^a	MWh			MW	MWh
Public Sector Enhanced Building Optimization	N/A	66	1.00	1.00	0.04	66
Net Realization Rate^b					N/A	100%

^a The program did not report ex ante gross demand savings

^b Net realization rate = ex post net value ÷ ex ante net value

4. Key Findings and Recommendations

Overall, the program performed poorly against its goals, achieving only 1% of its targeted energy savings, which may have been due to the measures being unpopular and/or unfamiliar to small businesses, in addition to the seasonality of the program. The following detailed findings and recommendations for the program are based on the results of the program evaluation:

- **Key Finding #1:** One year of program operation was not long enough for the measures to become popularized and for the program to gain traction with both program allies and participants.
- **Recommendation:** If HVAC tune-up services are included in future AIC small business programming, program implementers and administrators may expect that it will take time to gain traction across the service territory. Additionally, potential participants expressed interest in multi-year contracts for HVAC tuning and optimization. Because recruitment for these particular measures may take longer and/or require permission to employ, we recommend utilizing a multi-

year contract system to keep participants engaged. Further, yearly HVAC tune-ups are practical from an energy efficiency and engineering perspective.

- **Key Finding #2:** Participation was low throughout the program year, which may have been due to a lack of interest in the program offerings and/or ineffective recruitment of participants.
 - **Recommendation:** If HVAC tune-up and optimization measures are offered in future program years, a recruitment framework and marketing strategy should be planned prior to program implementation. Program implementation staff reported that program allies were not as effective as anticipated in recruiting participants. As such, implementers and program allies should work closely together to market the program and track recruitment progress.
- **Key Finding #3:** The program tracking database did not provide demand savings.
 - **Recommendation:** The evaluation team was unable to calculate a realization rate for demand, as the program-tracking database did not include ex ante demand savings. We recommend including demand savings for future evaluations.

Appendix A. Public Sector Enhanced Building Optimization Program Assumptions and Algorithms

In PY9, the impact evaluation efforts estimated gross impact savings for the Public Sector Enhanced Building Optimization Program by applying savings algorithms from the Illinois Statewide Technical Reference Manual (TRM) V5.0 (2016)² to the information provided in the program-tracking database.

We present the algorithms used to calculate all evaluation program savings below, along with all input variables.

A.1 Air Conditioner Tune-up

The evaluation team determined ex post savings for air conditioner tune-ups using the algorithms below. The energy and demand savings algorithms are from the IL-TRM V5.0. However, the IL-TRM does not provide guidance when actual pre and post efficiencies are unknown. Therefore, the evaluation team referenced a Department of Energy (DOE) Building America report³ to determine these efficiencies. All other assumptions come from the IL-TRM V5.0 unless otherwise noted.

Equation 1. Air Conditioner Tune-up Algorithms⁴

$$\text{Energy Savings } (\Delta kWh) = \text{Capacity} * \left(\frac{1}{EER_{pre}} - \frac{1}{EER_{post}} \right) * EFLH$$

$$\text{Demand Savings } (\Delta kW) = \text{Capacity} * \left(\frac{1}{EER_{pre}} - \frac{1}{EER_{post}} \right) * CF$$

$$EER_{pre} = EER_{baseline} * (1 - M)^{Age}$$

$$EER_{post} = EER_{pre} + (EER_{pre} * \%improvement)$$

Where:

Capacity	= Size of air conditioner in units of kBTUh (1 ton = 12 kBTUh) = Actual
EER _{baseline}	= Energy Efficiency Ratio of pre-retrofit air conditioner when new = 9.1 EER ³
EER _{pre}	= Energy Efficiency Ratio of the air conditioner prior to a tune-up = Calculated
EER _{post}	= Energy Efficiency Ratio of the air conditioner after the tune-up = Calculated

² Illinois Statewide Technical Reference Manual for Energy Efficiency V5.0. Effective June 1, 2016.

³ Building America U.S. Department of Energy. Building America Performance Analysis Procedures for Existing Homes. Space Conditioning / Air Distribution. May 2006. <https://www.nrel.gov/docs/fy06osti/38238.pdf>

⁴ Energy and demand algorithms from IL-TRM V5.0 Section 4.4.1

EFLH	= Equivalent Full Load Hours for cooling (varies by building type per IL-TRM V5.0 Section 4.4)
CF	= Summer Peak Coincidence Factor = 91.3%
M	= Maintenance Factor = 3% ⁵
Age	= Age of equipment in years = Varies by age in database
%improvement	= Efficiency improvement for air conditioner tune-up = 17.4% ⁶

⁵ Building America U.S. Department of Energy. Building America Performance Analysis Procedures for Existing Homes. Space Conditioning / Air Distribution. May 2006. <https://www.nrel.gov/docs/fy06osti/38238.pdf>

⁶ ASHRAE Report. Field Performance Assessment of Package Equipment to Quantify Benefits of Proper Service. May 2010.

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