NAVIGANT

ComEd
Root3 Pilot Program Evaluation Report

FINAL

Energy Efficiency / Demand Response Plan:
Plan Year 8 (PY8)
(6/1/2015-5/31/2016)

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Commonwealth Edison Company

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E. EXECUTIVE SUMMARY

This report presents a summary of the findings and results from the impact evaluation of the PY8[1] Root3 pilot program. The Root3 Pilot program uses a cloud based energy data model that works with a building's existing energy management system and evaluates variables such as thermal and electric loads, energy prices, equipment efficiencies and operational issues to understand the site performance and make recommendations that optimize performance. This pilot program targeted up to four industrial central plant customers for participation, and implemented one. The first project's duration is December 2015 – December 2016.

E.1. Program Savings

Table E-1 summarizes the electricity savings from the Root3 pilot program. Navigant received the implementer's revised calculation sheet for March 2016[2], and after reviewing, found the reviewed savings for March was around 39 percent of the reported value. Since there was no additional data provided, Navigant applied this realization rate to the six months the program claimed savings from this project to verify the energy gross savings to be 108.1 MWh. The provided documentation for this program did not claim demand savings. In addition, the measures installed by this program would most likely achieve savings during non-peak hours. For this reason, Navigant did not calculate demand savings for this program.

Table E-1.PY8 Total Program Electric Savings

Savings Category	Energy Savings (MWh)
Ex Ante Gross Savings	279.7
Verified Gross Savings	108.1
Verified Net Savings	102.6

Source: ComEd tracking data and Navigant team analysis.

E.2. Results Summary

The following table summarizes the key metrics from PY8.

[1] The PY8 program year began June 1, 2015 and ended May 31, 2016.
[2] Navigant reviewed "____M&V March.xlsx" loaded onto ShareFile 08.24.16 and provided feedback. Navigant reviewed and used the revised file "___M&V March _ag2.xlsx" loaded onto ShareFile 11.21.16.

Table E-2. PY8 Results Summary

Metric	Units	PY8
Verified Net Savings	MWh	102.6
Verified Gross Savings	MWh	108.1
Program Realization Rate	%	39
Program NTG Ratio †	#	0.95
Projects Implemented	#	1
Customers Touched	#	1

Source: ComEd tracking data and Navigant team analysis.
† A deemed value. Source: "ComEd_NTG_History_and_PY8_Recommendations.xls", found on the IL SAG web site: http://ilsag.info/net-to-gross-framework.html. Accessed: September 30, 2016.
* "Customers Touched" is defined by the number of customers who signed "participation agreements."

E.3. Findings and Recommendations

The following provides insight into key program findings and recommendations.

Impact Findings.

Finding 1. Navigant found that the calculation spreadsheet was difficult to review and contained some inaccuracies as noted in Section 2.2.1.

Recommendation 1. Navigant recommends that Root3 implement a more easily reviewable and defensible calculation sheet. During our review of this project, Navigant worked closely with the Root3 team to develop a more robust calculation sheet. The format developed with Root3 should serve as the template for their savings calculation spreadsheet moving forward.

Finding 2. Navigant found transcription errors when values in the calculation spreadsheet to the program savings reports.

Recommendation 2. Navigant recommends that Root3 use additional rigor in documenting their calculations and results as they are transferred from the calculations to the tracking system.

Finding 3. In reviewing the calculation spreadsheet, Navigant identified several periods where the savings was greater than 90 percent, and several times when the total energy usage by equipment was recorded as greater than the 100 percent load of that equipment.

Recommendation 3: Navigant recommends that Root3 implement a more stringent quality control process to identify potential outliers and either note them as suspicious or remove them from the savings calculations.

1. INTRODUCTION

1.1 Program Description

This report presents a summary of the findings and results from the impact evaluation of the PY8 Root3 pilot program. The Root3 pilot program uses a cloud based energy data model that works with a building's existing energy management system and evaluates variables such as thermal and electric loads, energy prices, equipment efficiencies and operational issues to understand the site performance and make recommendations that optimize performance. This pilot program targeted up to four industrial central plant customers for participation, but implemented one. The first project's duration was December 2015 – December 2016. Due to the highly custom nature of this project, savings was calculated month to month and could not be easily annualized. This meant that only six months of claimed savings were included in PY8.

The single participant in this program used the Root3 energy data model to provide detailed information to chiller operating staff. Sensors were installed on the chiller at this facility and system-operating data was provided using a web-based platform. The operators were able to make changes to the chiller's operation based on the provided information. Changes made include turning off heavily under loaded pumps and fans as needed and adjusting temperatures based on system load and outside air temperature. This project did not include system variable speed drive or automated controls.

1.2 Evaluation Objectives

The evaluation team identified the following key researchable questions for PY8.

1. What are the program's verified gross savings?
2. What are the program's verified net savings?

Since the program had only one project, Navigant did not conduct a process evaluation.

2. EVALUATION APPROACH

The evaluation approach for the PY8 Root3 pilot program included reviewing tracking system data and savings calculations.

2.1 Overview of Data Collection Activities

In order to review the project, Navigant received a number of detailed calculation Excel sheets that Root3 developed on a monthly basis for this facility. Navigant worked closely with ComEd and the implementer to improve these spreadsheets. After several review sessions Navigant, ComEd, and Root3 came to an agreement on a spreadsheet template that could be used to calculate savings for similar projects moving forward.

The core data collection activity included verification of the program tracking data and savings calculations (Table 2-1).

Table 2-1. Primary Data Collection Activities

What	Who	Target Completes	Completes Achieved	When
Engineering Review	Participating Customer	1	1	September 2016 – January 2017

2.2 Verified Savings Parameters

Savings for this pilot program are calculated using a customer calculation spreadsheet.

2.2.1 Verified Gross Program Savings Analysis Approach

Since only one project was completed in PY8, Navigant provided a detailed review of the calculation methodology for that project in order to provide guidance to the implementer as they complete future projects. As part of this review, Navigant requested, received and reviewed the calculation spreadsheet for this project. Navigant conducted several meetings with ComEd and the implementer in order to create a calculation method that would be more easily reviewable and defensible, and the implementer made changes to their calculation methodology in response to these meetings.

2.2.2 Verified Net Program Savings Analysis Approach

Verified net energy savings were calculated by multiplying the verified gross savings estimates by a NTGR. In PY8, the NTGR estimate used to calculate the net verified savings was defined through a negotiation process through SAG as documented in a spreadsheet.[3]

The NTG value for this program is deemed to be 0.95[4].

[3] Source: ComEd_NTG_History_and_PY8_Recommendation_2016-02-26_Final_EMV_Recommendations.xlsx, which is to be found on the IL SAG web site here: http://ilsag.info/net-to-gross-framework.html

[4] Source: Illinois Energy Efficiency Stakeholder Advisory Group http://www.ilsag.info/net-to-gross-framework.html. Accessed July 24, 2016.

3. GROSS IMPACT EVALUATION

3.1 Gross Program Impact Parameter Estimates

As described in Section 2, energy savings are estimated using a custom calculation sheet.

3.2 Verified Gross Program Impact Results

Initially, Navigant expressed concern regarding the calculation methodology used in the calculation spreadsheet provided as documentation for the project implemented in PY8. The implementer's calculation spreadsheet had a number of concerning issues:

- The baseline values were hard-coded and in some cases reported energy usage that was much higher than expected.
- Baseline power was calculated in groups of temperature ranges and number of chillers operating. The calculator did not use regression or trend lines to represent baseline operation between temperature groups. This meant for any values in a given temperature group the calculator often used power that was much larger or much smaller than expected.
- The calculator used rounding when estimating power usage of the pumps. This meant that if the system flow required 1.4 pumps, the calculator would calculate the energy usage equal to one pump. This underestimated the energy use of the pump in the energy efficient condition, as it did not account for partially loaded systems.
- The energy efficient power usage was calculated using pump flow, manufacturer sheets for motor power and by subtracting pump and fan power from total chiller power. The implementer calculated baseline power usage using temperature bins, the number of chillers operating and measured system power. These two calculation methodologies were vastly different and are not likely appropriate for comparison.
- The calculator showed savings that were much higher than expected (90 percent or more) and in some cases showed energy usage in the baseline condition with no usage in the energy efficient condition. Typically, savings this large is unexpected and should be clearly explained in the calculator.
- The calculator used rated power usage from manufacturer sheets for a number of systems and did not use measure power usage. If possible, the calculator sheet should use measured or trended power data.

After Navigant provided recommendations, Root3 modified the calculation spreadsheet to address Navigant's concerns, resulting in a change in savings. The new calculation methodology addressed a large number of these issues identified above:

- The updated calculator uses total system power trend data for both the baseline and energy efficient condition. This means that the values measured are the same for both the pre and post conditions and the calculator is no longer calculating energy usage using indirect methods. The old calculator used trend data for the entire system power in the baseline condition, but calculated pump, fan and chiller system power individually for the energy efficient condition. This method resulted in an "apple to orange" comparison.
- Regression curves were created for the baseline condition so that it could easily be compared to the energy efficient condition. The original calculator did not create regression curves resulting in inaccurate baseline energy usage.
- The calculations were greatly simplified and streamlined and all calculations were live and fairly easy to track. The original calculator included hard coded values and was very complex, making it very difficult to review.

The updated calculator resulted in significantly less savings than claimed ex ante. For this reason, the project received a realization rate of 39 percent.

The resulting total program verified gross savings is 108.1 MWh as shown in the following table.

Table 3-1. PY8 Verified Gross Impact Savings Estimates

	Sample Size	Gross Energy Savings (MWh)
Ex-Ante Gross Savings		279.7
Verified Gross Realization Rate	1	39%
Verified Gross Savings		108.1

Source: Evaluation Team analysis.
†NA when the TRM determines the gross savings.

4. NET IMPACT EVALUATION

The verified net savings is shown in Table 4-1. The SAG determined that the NTG values for this program is 0.95[5].

Table 4-1. PY8 Verified Net Impact Savings Estimates

	Sample Size	Energy Savings (MWh)
Total		
Ex-Ante PY8 Gross Savings	1	279.7
Realization Rate	1	39%
Verified Gross Savings	1	108.1
NTG	1	0.95
Verified Net Savings	1	102.6

Source: Evaluation Team analysis.

[5] Source: Illinois Energy Efficiency Stakeholder Advisory Group http://www.ilsag.info/net-to-gross-framework.html. Accessed July 24, 2016.

5. FINDINGS AND RECOMMENDATIONS

The following provides insight into key program findings and recommendations.

Impact Findings.

Finding 1. Navigant found that the calculation spreadsheet was difficult to review and contained some inaccuracies as noted in Section 2.2.1.

Recommendation 1. Navigant recommends that Root3 implement a more easily reviewable and defensible calculation sheet. During our review of this project, Navigant worked closely with the Root3 team to develop a more robust calculation sheet. The format developed with Root3 should serve as the template for their savings calculation spreadsheet moving forward.

Finding 2. Navigant found transcription errors when values in the calculation spreadsheet to the program savings reports.

Recommendation 2. Navigant recommends that Root3 use additional rigor in documenting their calculations and results as they are transferred from the calculations to the tracking system.

Finding 3. In reviewing the calculation spreadsheet, Navigant identified several periods where the savings was greater than 90 percent, and several times when the total energy usage by equipment was recorded as greater than the 100 percent load of that equipment.

Recommendation 3: Navigant recommends that Root3 implement a more stringent quality control process to identify potential outliers and either note them as suspicious or remove them from the savings calculations.