230 Horizon Drive
Suite 101B
Verona, WI 53593
608-497-2320 phone
608-497-2321 fax

NAVIGANT Itron

Memorandum

**To:** David Nichols, ComEd

**From:** Data Centers Evaluation Team

**Date:** November 20, 2012

**Re:** ComEd PY4 Data Centers Efficiency Program Evaluation Results Draft

The Data Centers evaluation team has completed an impact evaluation for the PY4 Data Centers Efficiency program. The purpose of this memo is to present a summary of the evaluation results.

## Evaluation Results Summary:

ComEd's Smart Ideas for Your Business suite of energy efficiency programs for business customers introduced a new program in program year 4 (PY4): Data Centers Efficiency program. The new Data Centers Efficiency program provides incentives to both new and existing data centers for implementing energy efficiency measures. The Data Centers PY4 began June 1, 2011 and ended May 31, 2012. In PY4, a total of two projects were completed as part of the Data Centers program.

For the PY4 impact evaluation, gross impact results were developed based on detailed M&V analysis performed for the two projects and net impact results were developed based on survey data collected for the two projects.

Table 1 below provides reported ex ante and Research Findings (ex post) gross and net savings impacts for the PY4 Data Centers Efficiency program. The PY4 evaluation verified a gross energy savings realization rate of 0.80 (realization rate = Research Findings gross / ex ante gross) and a net-to-gross ratio of 0.43 for energy savings. No realization rate was calculated for gross demand savings since there were no ex ante demand savings claims.

### Table 1. PY4 Savings Estimates

| Savings Estimates | Energy Savings (kWh) | Peak Demand Savings (kW) |
|---|---|---|
| Ex ante Gross* | 5,382,384 | 0 |
| Ex ante Net** | 4,305,907 | 0 |
| Research Findings Gross | 4,323,193 | 212 |
| Research Findings Net | 1,840,104 | 133 |

** Ex ante gross savings estimates reported by ComEd*

*** Ex ante net savings include an assumed net-to-gross ratio of 0.80*

For gross and net impact analysis, the sampling approach was a census attempt. Given that the evaluation completed a census for gross and net impact analysis, there is no sampling error and the error bounds are zero; therefore, there is no need for estimating precision levels for the sampling effort.

## Gross Impact Parameter Estimates

Gross impact evaluation activities were completed for each of the two PY4 projects. Project-level gross impact evaluation results are summarized in Table 2.

The program gross realization rate is calculated as a ratio of the total Research Findings kWh savings to the total ex ante kWh savings claimed for the PY4 Data center program. The program level realization rate for energy savings is 0.80.

The program did not report ex ante kW savings for the two PY4 projects. However, the evaluation estimated kW savings for these two projects. A kW savings realization rate cannot be calculated with no ex ante kW savings claims.

**Table 2. Gross Impact Realization Rate Results for Data Center Projects**

| Project ID | Ex ante kWh Impact Claimed | Ex ante kW Impact Claimed | Research Findings Gross kWh Impact | Research Findings Gross kW Impact | Research Findings Gross kWh Realization Rate | Research Findings Gross kW Realization Rate |
|---|---|---|---|---|---|---|
| 14368 | 2,913,591 | 0 | 1,564,700 | 178.6 | 0.54 | N/A |
| 11950 | 2,468,793 | 0 | 2,758,493 | 33.4 | 1.12 | N/A |
| Total | 5,382,384 | 0 | 4,323,193 | 212.0 | 0.80 | N/A |

*Source: Evaluation Analysis*

The following are key observations based on site specific M&V analysis:

- For project #11950, the primary reason for the high realization rate is that the program calculations underestimated the data center cooling load.
- For project #14368, the primary reason for the low realization rate is that the program calculations did not account for all the rooftop units (RTU) serving the data centers in the post retrofit period. The program calculations accounted for only nine (9) rooftop units (RTUs) instead of the 11 RTUs that were operating to estimate the total power (kW) usage for data center cooling in the post period which led to overestimation of savings.

**Net Program Impact Parameter Estimates**

Net impact evaluation activities were completed for each of the two PY4 projects. The calculation of the program's Net-to-Gross Ratio (NTGR) is a multi-step process. The NTGR was assessed using a self-report approach supported by data collected during participant phone surveys. The survey covers a battery of questions used to assess the net-to-gross ratio for a specific project. Responses from the survey are used to calculate a Program Components score, a Program Influence score and a No-Program score for each project for which a survey was completed. All three of these scores represent different ways of characterizing the program's influence on the decision to install energy efficient equipment. These three scores can take values of 0 to 10 where a lower score indicates a lower level of program influence, (i.e., a higher level of free-ridership). The three scores are then averaged to come up with a project-level net-to-gross ratio. The project-specific NTGRs are shown in Table 3.

**Table 3. NTGR Results for the PY4 Data Center Projects**

| Project ID* | Evaluation Adjusted kWh NTGR | Evaluation Adjusted kW NTGR |
|---|---|---|
| PY4 -DC 01 | 0.73 | 0.73 |
| PY4 -DC 02 | 0.06 | 0.06 |
| TOTAL | 0.43 | 0.63 |

** Actual Project IDs are not provided to protect customer confidentiality*

This program has not been evaluated before and so according to the NTG Framework the NTG is to be applied retroactively.

The measured Year 4 kWh NTG ratio was 0.43. The low NTG score is mainly due to one project having a very low NTGR. The project specific NTG score summaries are shown below. The PY4 NTG ratio based on kW weighting is 0.63.

PY4 DC-01 NTG score summary

NTG ratio = 0.73

This customer installed a Data center aisle containment project and made modifications to their HVAC equipment in order to realize significant energy savings. Key reasons for implementing this project included that the project would: (1) increase critical capacity (more power to use); (2) reduce their carbon footprint; (3) reduce their utility usage and help the bottom line; and (4) enable them to provide better service to their clients.

The decision maker assigned the program's importance a 5 out of 10 possible points. If the program had not been available, they gave a 0 in 10 likelihood of installing exactly the same equipment at the same time. However, the decision maker also reported that if the program had not been available,

they would have installed the same equipment 1.5 to 2 years later. In addition the decision maker gave the importance of program incentives 7 out of 10 possible points.

PY4 DC-02 NTG score summary

NTG ratio = 0.06

This customer installed a Data Center Air Flow and Central Plant Optimization project involving air-side economizers, efficient chillers, and reduced pump operation. Their business model is 'build to suit' (for tenants), and optimizing energy use and costs is a goal in new construction projects of this type.

In general, the decision maker indicated they had already made decisions regarding selected equipment prior to learning about the program. However, they also indicated that their knowledge about the availability of incentives through the program may enable them to modify their designs going forward and to move to a more energy efficient design.

In terms of the program's influence on their decision, the decision maker reported it was not very high, rating the program's importance a 2.5 out of 10, and non-program factors a 7.5 out of 10. In addition, the decision maker reported that program implementers arrived after the decision was made to implement the measure. If the program had not been available, the decision maker gave a 10 out of 10 probability they would have installed the same project at the same time.

**Net Program Impact Results**

Net program impacts were derived by multiplying Research Findings gross program savings by the Research Findings Net-to-Gross Ratio (NTGR). Table 4 provides the program-level Research Findings net kWh impact results for the PY4 Data Centers program. The Research Findings gross realization rate for kWh savings is 0.80. The Research Findings NTGR for kWh savings is 0.43. The chained realization rate (gross RR * NTGR) is 0.34 for kWh. **Error! Reference source not found.**Table 5 provides the program-level Research Findings net kW impact results for the PY4 Data Centers program.

**Table 4. Program-Level Research Findings Net kWh Impacts for PY4**

| | Ex Ante Gross kWh | Research Findings Gross kWh | Research Findings Gross kWh RR | Research Findings Net kWh | Research Findings kWh NTGR |
|---|---|---|---|---|---|
| Total | 5,927,508 | 4,323,193 | 0.80 | 1,840,104 | 0.43 |

*Source: Evaluation Analysis*

**Table 5. Program-Level Research Findings Net kW Impacts for PY4**

| | Ex Ante Gross kW | Research Findings Gross kW | Research Findings Gross kW RR | Research Findings Net kW | Research Findings kW NTGR |
|---|---|---|---|---|---|
| Total | 0 | 212 | N/A | 133 | 0.63 |

*Source: Evaluation Analysis*

**Key Gross Impact Findings and Recommendations**

Peak kW Savings

**Finding:** The program did not report peak kW savings claims for the PY4 projects.

- **Recommendation:** The program should calculate peak kW savings for all completed projects. The program should also ensure that calculated peak kW savings are reported consistently in the program tacking system.

Data Collection Activities

**Finding:** The program did a thorough job collecting data for the two projects.

- **Recommendation:** For data center projects, we found that the customer data collection system typically trends only the amperage data for the cooling equipment. We recommend that the program attempt to collect power factor and voltage readings through spot measurements in such cases. This will allow for an accurate estimation of the equipment power (kW) consumption. In addition, spot kW measurements can help verify or calibrate logged data.

Project Eligibility Requirements Review

**Finding:** For project #11950, the payback period exceeded the maximum allowable payback period of seven years after the program updated the project savings.

- **Recommendation:** The program should review project eligibility requirements whenever there are changes to the scope or savings of the project. If any project that does not meet the program's payback period is approved, the program should provide reasons for approval in the project documentation.

Estimation of Load for New Construction Projects

**Finding:** For the new construction project #11950, the program estimated savings assuming that the facility would operate at 100% IT load.

- **Recommendation**: For new construction projects, the program needs to document the forecasted facility IT load. Impact estimates are affected by presumed facility IT loads. If the customer cannot provide strong evidence to support forecasted IT loads, then the program should estimate savings based on the typical industry average IT loads. Note that the evaluation team is conducting literature research to determine typical loading for (wholesale and colocation) data centers. Based on the initial evaluation findings, the average loading for wholesale data centers in the U.S. market is 81%[1].

**Key Net Impact Findings and Recommendations**

**Finding:** The kWh NTG ratio for this program, 0.43, is low for this type of program.

- **Recommendation**: To increase the program NTG score, the program should attempt to minimize cases where the customer has already decided to install the same equipment at the same time in the absence of program incentives. The program implementer should interview the project decision maker to check how the program is influencing the customer's selection of equipment and also to verify if the program is significantly accelerating implementation of the project. If the implementers find that the program is not influencing either the timing or efficiency level of the selected equipment, then it is recommended that the implementers put forth additional efforts to influence higher efficiency levels and/or identify other qualifying projects that can be influenced by the program.

If you have any questions or wish to discuss this review, please contact **Vishy Tirumalashetty** at **510-844-2814, vishy.tirumalashetty@itron.com**.

[1] http://www.datacenterknowledge.com/archives/2012/06/12/report-wholesale-space-is-81-percent-occupied/