Guidehouse

Memorandum

To:	Erin Daughton, Vince Gutierrez; ComEd
CC:	Jennifer Morris; ICC Staff; Illinois SAG
From:	Jan Harris, Sharon Mullen, Karen Maoz, Paul Higgins; Guidehouse
Date:	May 1, 2020
Re:	ComEd EUL Research CY2020 Commercial Behavioral Contingent Measures

INTRODUCTION

Guidehouse, under the effective useful life (EUL) research task, developed a methodological framework to estimate the measure life for commercial energy efficiency (EE) programs whose measures depend on regular and recurring intervention to realize and maintain savings. Over the past year, Guidehouse, ComEd, and some of ComEd's program implementers had dialogue on how to address the EUL of these programs. As a next step, Guidehouse was asked to develop this framework. The measures for these programs include control settings adjustments, scheduled maintenance, shutdown procedures, and others where a person must perform an action and this action must be checked periodically to ensure compliance. Currently, programs with these measures use the Retro-Commissioning (RCx) Program EUL value, since there is no agreed-upon default value or methodology for determining EULs for these measures. This memo reviews measures of this type and methodologies to quantify savings persistence and recommends that a default EUL value be developed for each of these energy efficiency measures by category as elaborated in the "Recommendations" section.[1]

BACKGROUND

As a result of recent legislation,[2] ComEd must calculate the cumulative persisting annual savings (CPAS) of EE measures in the year they are installed. However, for many behavioral and operations-and-maintenance (O&M) types of measures the annual savings may vary greatly from year to year. Establishing an EUL for CPAS calculations early in the program rollout or prior to data collection in future years should ideally be based on Illinois Technical Reference Manual (TRM) values. EUL is defined as starting from the implementation of the measure to the point when site savings are expected to be 50 percent of first year claimed savings or less. A persistence higher than 50 percent of year one savings reflects that a measure is still within its useful life. For measures not characterized by the IL-TRM, such as those discussed in this memo, the TRM specifies that the evaluator can use either the EUL for similar measures or best professional judgment. In either case, the evaluator must provide the rationale for their

[1] Note, this research would be applicable to certain pathways within the Rcx Program but would not be meant to affect the current EUL for traditional retro-commissioning as that EUL has been extensively studied over the past few years.
[2] The Future Energy Jobs Act (FEJA) of 2016, enacted into law as Public Act 099-0906 (http://www.ilga.gov/legislation/publicacts/99/PDF/099-0906.pdf).

choices. At present, there is little documentation on the persistence of savings for O&M-type programs and measures.[3,4,5]

The types of measures discussed in this memo are commonly used in the following ComEd EE programs:[6]

- RCx program Monitoring-Based Commissioning (MBCx) path[7]
- Business Energy Analyzer (BEA)
- Smart Building Operations (SBO) Pilot[8]
- RCx program Virtual Commissioning (VCx) path[9]
- Facility Assessments

If applicable, the methodological approach proposed in this memo may be used for other programs beyond those discussed here, such as Tune-ups, Building Operator Certification, and Compressed Air Leak Repair.

O&M generally consists of:

- Normal operating labor
- Preventative maintenance labor
- Consumable parts (lamps, filters, etc.)
- Scheduled replacement parts & labor
- Emergency repair parts & labor

There are a wide variety of measure types that fall into the behavioral or O&M category, such as:

- Control settings
    - Thermostat programing, lighting controls (occupancy sensors, daylight sensors), set point and schedule adjustments, and resets
- Preventative or scheduled maintenance
    - Including consumable parts (e.g., lamps, filters, refrigerant), coil cleaning, and minor repair (e.g., freeing stuck dampers or valves, economizer repairs)
- Shutdown procedures

These behavioral and O&M measures are different than other measure types because the CPAS depends on ongoing human interventions that may or may not continue to occur after year one.

PROGRAM DESCRIPTIONS

Below are brief descriptions of the aspects of each program that make use of these measures.

RCx Program's Monitoring-based Commissioning (MBCx)

The MBCx pathway identifies, analyzes, implements and verifies measures for at least 12 months on a rolling basis utilizing software installed to work with the building automation system. The energy efficiency

[3] "Persistence of O&M Energy Efficiency Measures" for the Energy Trust of Oregon. October 19, 2017. By DNV-GL
[4] CA DEER, See D.16-08-018 at 46 Page A36
[5] "Persistence of Savings from Retro-Commissioning Measures A field study of past ComEd Retro-commissioning projects" June 13, 2018. Seventhwave
[6] MBCx and VCx are pathways within the RCx Program.
[7] See footnote 1.
[8] This program was a pilot in CY2018 that was not extended. However, it may be representative of future program types.
[9] See footnote 1.

service provider monitors continual energy usage data periodically to ensure on-going savings. It is this monitoring to confirm persistence of savings, and the ongoing feedback resulting from it, that makes MBCx part of this discussion.

Business Energy Analyzer (BEA)

The BEA Program is a web-based suite of self-service tools accessible to all ComEd non-residential customers that provides easy-to-understand information on their energy usage over time and makes recommendations for practical ways to reduce their energy consumption (called “solutions”) which are customized for each user. These may include behavioral, operational, and capital solutions, as well as suggested ComEd EE programs the customer qualifies for. Behavioral recommendations may include adjusting lighting levels for natural daylight, thermostat setbacks during off hours, powering down equipment when not needed, and similar low- or no-cost changes.

The BEA Program’s web tools show participants their recent energy usage patterns, pulled from their advanced metering infrastructure (AMI, or “smart”) meters, and compares them to their own usage in the same period the previous year as well as to usage of other, similar ComEd business customers. The program then provides customized tips and recommendations for saving energy. Enrollees provide specific information on their business, premise size, complement of lighting fixtures, appliances, and other equipment. The program also channels customers to other ComEd EE programs. The program has been verified, through billing analysis, to yield savings in the 1-3 percent range.

BEA also offers users the ability to keep track of which suggestions they have implemented, and which ones remain outstanding. This information can be used to inform a monthly nudge in the form of a Business Energy Report, similar to the Home Energy Report program. Customers may opt out of the monthly e-mail if desired.

Smart Building Operations (SBO)

The SBO program was a pilot in 2018 and one project implemented the software tool on-site at their commercial facility. The installed software tool calculates the facility’s forecasted baseline and displays real-time energy usage against it to encourage building operators to look for energy-saving actions when usage trends above that baseline. The software analyzes energy usage data from smart meters and sub-meters to inform and encourage energy efficient building operation decisions.

The pilot participant building operators made several energy efficiency improvements after implementing the tool, including adjusting pump speeds, adjusting HVAC setpoints, installing lighting controls, and changing lighting operations. The building operators had a list of operational activities they could implement to meet their ongoing energy saving goal. Guidehouse determined this pilot was primarily behavior-based during communications with the implementer. The SBO Pilot also coaches the on-site building operators about conservation practices, available energy efficiency opportunities, use of the software tool, and an agreement to have submeters installed on equipment if desired by ComEd.

Virtual Commissioning (VCx)

ComEd provides the VCx implementer, Power TakeOff (PTO), with 30-minute interval AMI meter data on a daily basis for every non-residential customer meter. The VCx team screens the data to identify potential operational saving opportunities across a wide range of customer account types and develops a custom set of recommendations based on findings from the meter data, weather data, and other associated business information available to the team. The VCx team then reaches out to the likely candidates for savings through suggesting low- and no-cost measures utilizing a combination of phone calls and email messages to deliver the custom recommendations to the business. If the customer agrees

to implement the recommendations, they are responsible for independently implementing the recommended solutions and then reporting back the operational changes and date they were made. PTO remains actively engaged with the participants to assist virtually, as needed.[10] PTO's M&V team then confirms that the impact of the change is observed in the customer's ongoing AMI data stream and begins to calculate the post-change savings to determine if the change was effective and if additional opportunities exist for the customer to pursue.

If a VCx participant's energy use increases, the VCx team reaches out to the customer to determine whether the change is the result of a non-routine event or a change in operation. The VCx team attempts to work with the customer to bring the energy use back to where it was in the period immediately after the initial intervention.

To qualify, the customer must have at least one year of 30-minute interval AMI data available. Participation does not require a financial commitment from the customer, but the customer is responsible for implementing the recommendations.

IMPROVING PERSISTENCE IN BEHAVIORAL AND O&M PROGRAMS

Behavioral and O&M program savings are susceptible to degradation over time for multiple reasons, including day-to-day operational needs, temporary system overrides that become permanent, and seasonal transitions that fail to transition back. Turnover in personnel, from tenants to custodians, and control and service contractors, as well as physical plant changes, further challenge the persistence of savings.

There are a number of tactics that may be employed to enhance the persistence of savings[11] for these types of measures, including:

- Checklists:
  - List monthly, seasonal and annual tasks and system parameters specific to the equipment and systems changes addressed during the RCx project
  - Reference or incorporate equipment lists, training material and rational for the improvements.
  - Include a form or data-entry system to record actions taken, results observed, challenges experienced.
- Trainings and Reference Material:
  - Energy usage analysis
  - Operating schedules and requirements
  - Methods for identifying problems and deficiencies
  - A description of project findings and measures that were implemented
  - Improvements expected as a result of the project
  - Operations and maintenance procedures needed to ensure that benefits are maintained
  - Staff role in helping to maintain the persistence of savings
- Follow-up Services:
  - Offered by the programs through implementers or energy efficiency service providers to monitor persistence and offer recommendations

[10] According to PTO, they work with the customer to understand their energy usage and identify savings opportunities, enroll them in the VCx Program, and monitor their progress on an ongoing basis. PTO documents all energy-saving actions taken by each participant. The documentation includes a detailed log of each contact PTO has with the customer, the actions each participant agrees to take, and the date each action was undertaken. They continue to monitor the customer's AMI data for a minimum of 3-6 months post-change before invoicing ComEd for the savings but continue to monitor the customer beyond that point for as long as there is a contract vehicle in place. PTO says they will reach out as necessary to ensure the savings are maintained over time.
[11] Navigant, "ComEd Retro-commissioning Tune-Up: Materials and Services to Improve Persistence," April 11, 2019; and Navigant, "Coordinated Retro-commissioning CY2019 Process Evaluation Results," Section 3, September 2019.

- O&M Manuals and Control Systems Documents:
    - Considered an industry best practice, but exceeds the scope of ComEd's EE programs

Improvements in program delivery utilizing these recommended tactics are likely to result in extended persistence, and therefore improved EUL.

BEHAVIORAL EUL ESTIMATION METHODOLOGIES

In this section we examine some possible methodologies for estimating the lifetime of the savings for these types of behavioral and operational measures. As noted in the sources cited in footnotes 3-5, there is currently relatively little primary evidence to support various expected useful lives of behavioral type measures in commercial buildings.[12]

To assess savings persistence, savings should be measured in year one, and then again in subsequent years to document how savings change over time. This can be done with either:

1. Onsite data collection, using sub-meters for end use metering of specific measures and creation of a pre installation baseline, or
2. Whole building energy use modelling using whole building consumption data from pre and post measure installation

While these methods may be employed for evaluation purposes to determine year one savings, they would need to be repeated periodically for several years to determine if the measures were still in place and still generating savings.

Approach 1 requires multiple site visits, data manipulation and analysis over several years. To work properly, baseline data needs to be gathered before the retrofit is implemented requiring close coordination with the evaluator, program implementer and customer. Approach 2 requires the creation of a baseline energy use model calibrated using whole building consumption data. Then appropriate staff must be interviewed to find out what kind of actions were taken. This data must be input into the energy use model and savings calculated. This process must be repeated every year for several years to determine how long the savings persist. The model must be updated if there are any changes to the building which would affect energy use -- such as capital projects, changes in production, changes in operations, changes in employees, etc. Even if this level of study were undertaken for several years, the results of this methodology would only be accurate for that site, that building manager and those specific measures that were used at that site.

Both of these engineering-based approaches also tend to create a false sense of precision. The O&M-type measures considered in this memo typically generate savings on the order of 1 to 5 percent. Finding this amount of savings in whole building AMI meter data can be difficult. There is so much noise in whole building consumption data that, in our opinion, even a carefully planned and executed long term study will not be any more reliable in estimating savings for different projects than a default value would. Due to the time and cost involved in these approaches, it is also not practical to do this level of M&V for all projects.

Being dependent on ongoing human intervention means that there will be wide variation in savings duration even within one program type as each person who implements and maintains these measures will do so differently. For this reason, we do not recommend these engineering-based approaches for

[12] E.g., "the measure by measure results across the eight quantitative studies are highly varied in type, timeframe, and approach. This variance prevents us from compiling specific persistence results by measure across a significant number of buildings." Seventhwave study of studies, 2018

estimating EUL. Also, CPAS requires an ex ante value for the lifetime of savings from a given measure that is locked in at the year of installation. The CPAS policy does not match an approach for a renewed calculation year over year. As a result of all the factors described above, we recommend the development of default EUL values for use in estimation of CPAS.

RECOMMENDATIONS

Participants in these program types represent many different building types and industries, such as office, industrial, healthcare, hospitality, restaurant, and education. Some systems, such as lighting and HVAC, are controlled on-site, while others may be controlled remotely by a corporate or regional office, thereby reducing the probability of savings degradation. Given the disparity of these facilities, controls and associated energy use intensities, savings persistence likely varies considerably. Furthermore, CPAS requires that we have a methodology to calculate savings for the entire measure life in year one. This rules out any ongoing evaluation of savings duration and requires that we have an EUL by program at the beginning of the measure implementation.

For these reasons, we recommend developing default EULs per measure category, control location (remote or onsite), and building type, rather than per program or per measure. For example, we suggest an HVAC commissioning measure category rather than individual measures such as setback, economizers, etc. Other example measure categories include lighting controls, HVAC maintenance, manual control changes for lighting and HVAC, and process control optimization.

As a process to determine the default EULs, we suggest that we:

1. Create a table of measure categories and building types with strawman EUL values.
2. Vet these estimates with a panel of subject matter experts. Iterate using a Delphi approach to arrive at an agreed upon EUL per measure category and building type.

In consideration of the above, take into account the following:

- Clarify required parameters for using this EUL. For example, the program must use monthly prompts, must provide feedback on energy use, etc.
- If there is a dedicated contractor who manages the building automation system, should we allow a longer persistence rate?
- If there are off-site centralized system controls, should we allow a longer persistence rate?
- Is all institutional knowledge lost when the building operator leaves? What are standard turnover rates, and should they vary across building types?
- Are there procedures and policies in place to maintain persistence? Does the program check on facilities in the years following their participation?
- While some actions will be dropped over time, other actions will likely have been initiated and not reported to the program.

The goal is to arrive at agreed upon default EULs by measure category and building type to be used for CPAS calculations.

Suggested EULs – a Starting Point

Table 1 below is a template for use to populate EULs for behavior type EE measures. We will work with participants in the Delphi panel to propose initial values and then iterate.

Table 1. Sample Strawman EUL Values

Building Type➔	Education	Office	Hospitality	Healthcare	Industrial	Restaurant
HVAC Commissioning						
Lighting Controls						
HVAC Maintenance						
Remote Lighting Control Change						
Manual Lighting Control Change						
Remote HVAC Control Changes						
Manual HVAC Control Changes						
Process Control Optimization						

Source: Guidehouse