ComEd Commercial and Industrial (C&I) Custom SMART Screening Pilot

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Prepared by:

Emily Cross
Navigant

Nishant Mehta
Navigant

Na Yu
Navigant

www.navigant.com

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Submitted to:

ComEd
Three Lincoln Centre
Oakbrook Terrace, IL 60181

Submitted by:

Navigant Consulting, Inc.
150 N. Riverside Plaza, Suite 2100
Chicago, IL 60606

Contact:

Randy Gunn, Managing Director
312.583.5714
Randy.Gunn@Navigant.com

Jeff Erickson, Director
608.616.4962
Jeff.Erickson@Navigant.Com

Rob Neumann, Associate Director
312.583.2176
Rob.Neumann@Navigant.Com

Adam Knickelbein, Associate Director
303.493.5483
Adam.Knickelbein@Navigant.com

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1. INTRODUCTION

1.1 Illinois AMI Research

Navigant has historically used AMI for traditional evaluation of commercial and industrial (C&I) custom programs. The Custom C&I SMART tool pilot is part of Navigant's broader effort to strategically advance the use of AMI data in EE/DR evaluations beyond standard practices. The SMART tool pilot leverages the distinguishing characteristics of AMI to explore alternative M&V methods.

1.2 Description of the SMART Tool

Navigant's Scheduled Meter Analysis Regression Tool (SMART) is an "M&V2.0" methodology[1] that provides a preliminary energy savings estimate for use in energy efficiency program impact evaluation at individual buildings or campuses.

The SMART tool is a regression method that compares pre-project and post-project site level electric usage. The SMART tool uses hourly electric usage data from AMI meters and local dry bulb outdoor air temperature data from National Oceanographic and Atmospheric Administration (NOAA) to quantify the weather-normalized[2] facility-level energy change for all energy efficiency projects at a site, including secondary impacts.[3]

Navigant applies the SMART tool to screen all sites in a program participant population. The SMART tool regressions are time-of-day, time-of-week, and time-of-year-differentiated, which means the savings results are available hourly for weekdays or weekends, and for winter, summer, and shoulder seasons as well as annually. As such, SMART tool savings are available for summer coincident peak demand hours.

1.3 SMART Objectives

The Navigant SMART tool primary objective is to reduce evaluation costs by reducing the number of projects in the impact evaluation sample requiring costly on-site impact evaluation activities.

The SMART tool approach is a special case of the International Performance Measurement and Verification Protocol (IPMVP) Option C – Whole Facility method which is an industry accepted evaluation approach. While typical impact evaluation sample sizes for C&I custom programs may only contain a few projects that can be analyzed using Option C, using the SMART tool to screen the entire participant

[1] Lawrence Berkeley National Laboratory (LBNL) definitions of 'big data' or 'M&V2.0' methods broadly include studies that include at least one of the following (though ideally two or more): very large data sets, e.g. use of hourly or higher resolution usage data; accelerated data acquisition; data from equipment-embedded sensors or equipment/building control systems; some form of automated and/or pre-specified analytics and reporting; some form of modern data analysis or visualization; and very very large samples or even population-scale inputs for the analytics.
[2] Weather normalization is based on the closest National Renewable Energy Lab (NREL) Typical Meteorological Year (TMY3) site. For this pilot analysis, Navigant used the Chicago O'Hare weather station.
[3] An example of secondary impacts from an EE project is the HVAC system / efficient lighting interactive effect. The reduced lighting waste heat for the more efficient fixtures installed by the program also reduces the HVAC cooling load, resulting in additional secondary savings for reduced HVAC system runtime beyond the connected load reduction of the program lighting retrofit.

population scales up the number of possible Option C sites from a few to potentially several times that number.[4]

The Navigant R[5] program code starts by calculating pre-minus-post electric savings for each site in the participant population then filters the sites into 'reliable' and 'not reliable' savings categories based on: (1) how well calibrated the SMART tool is to the utility AMI data,[6] (2) whether the calculated savings is in a reasonable range (i.e., positive savings as expected due to program activity), and (3) whether the ex ante savings is expected to be large enough to read in the data.[7]

The general objectives for a SMART screening run are:

- Reduce evaluation timeline and costs where possible by identifying "AMI-evaluable" sites that have the potential to be used in lieu of an on-site evaluation in some cases
- Provide confirmation of evaluation team results obtained through traditional evaluation activities such as on-site measure-end-use metering
- Highlight contextual data such as facility-level hours of use and facility shut-down schedules that may be useful to the evaluation team for energy impact calculations

While outputs from the SMART screening model may appear authoritative and acceptable, they must be reviewed and validated by an experienced impact evaluation engineer prior to accepting the savings for use in regulatory compliance reporting.

1.4 SMART Comparison with Traditional Impact Evaluation Methods

The benefit of a remote facility level analysis like the SMART approach is it uses substantially more data than is typically available to the impact evaluation team. Notably baseline data is more readily available to the ex post impact evaluation team with AMI meters than has historically been the case.[8]

A remote AMI-data driven evaluation can also reduce evaluation burden on program participants because less contact with the customer is needed for equivalent accuracy in some cases. Thus, in the best-case scenario the remote AMI analysis has the advantage of being able to provide a more accurate savings estimate by using more data, with less evaluation activity and lower cost.

By comparison, the benefit of a traditional boots-on-the-ground ex post evaluation is that the datalogging analysis is targeted to the specific end use of the measure, which makes it more accurate than the facility-level approach in most cases. Further, a traditional impact evaluation approach results in specific actionable feedback to implementers and program administrators that is not available using a remote

[4] In a typical C&I Custom sample size of around 50 projects, only a handful of projects typically meet the IPMVP Option C guidance of annual savings being a minimum of 10% of annual baseline usage in order for Option C to be viable using monthly billing data. For hourly AMI billing data a threshold percentage of 5% can be used. Additionally, since the SMART tool allows the evaluation team to screen the entire population quickly instead of just screening the sample of 50 projects. This will increase the number of projects identified for Option C analysis.
[5] "R" is an industry standard open source statistical computing software package https://www.r-project.org/
[6] SMART tool calibration metrics are based on ASHRAE Guideline 14. The primary metric used is the Normalized Mean Bias Error (NMBE). Navigant also considers the Coefficient of Variation of the Root Mean Square Error (CVRMSE) when reviewing the SMART tool outputs.
[7] Per the IPMVP Option C, the limit of savings expected to be readable in the data is annual savings of 10% of baseline annual usage for monthly billing data. For hourly data this savings threshold can be less than 10% annual.
[8] Large commercial sites have always had sub-hourly data available for peak billing purposes, however the data has not usually been as readily available as that from AMI meters.

measurement and verification (M&V) method. Using a remote data-only approach has advantages, but it is generally not sufficient to satisfy program administrators and regulators.

An AMI-based screening of all program participants combined with 'traditional' evaluation activities such as desk reviews, telephone interviews, and on-site visits only where strictly needed[9] should reduce evaluation costs and shorten timelines.[10]

1.5 ComEd C&I Custom Program AMI Research Questions

Table 1 lists the research questions for this scope of work:

Table 1. C&I Custom AMI Data Pilot Research Questions

	Research Question	Pertains To
1	How many of the CY2018 C&I Custom project savings could potentially be evaluable using AMI data without any on site evaluation activity?	**AMI-evaluability** of projects with the SMART tool regression method
2	Which of the potentially AMI-evaluable projects from Question 1 are actually verifiable without a site visit based on comparison between the available project data and the SMART tool results?[11]	**Engineering reasonableness**[12] of SMART tool AMI savings results
3	Can the SMART tool provide actionable insights and recommendations for the impact evaluation?	**Actionable insights** into implementer ex ante savings calculations and methods based on SMART tool outputs

Source: Navigant

2. METHODOLOGY

2.1 Overview

This section provides an overview of the SMART hourly impact analysis approach.

The SMART approach produces facility-level weather-normalized hourly energy changes between two time periods: (1) the pre-project time period prior to installing the EE measures (also called the project baseline) and (2) the post-project time period after installing the EE measures. The time period during measure installation and commissioning is omitted from the analysis since energy use at the facility may be erratic or atypical during this time period and is therefore not representative of typical energy use.

[9] Where a remote AMI-data-only analysis is inconclusive.
[10] Sampling precision may increase due to over-sampling in certain sample strata when SMART results are added to a traditional sample size. Site specific savings accuracy may increase in some cases due to increased granularity of data (using hourly / time-of-day instead of monthly billing data).
[11] In other words, how much could the evaluation cost be reduced by substituting AMI-only impact evaluations (less expensive) in lieu of on-site evaluations (more expensive)?
[12] "Engineering reasonableness" refers to whether the apparent measure savings in the SMART tool results make sense from an engineering standpoint. For example, if the measure listed in the program ex ante tracking data was supposed to reduce winter heating energy, however the SMART tool results showed a substantial amount of summer savings and no winter savings at that site, the SMART savings are therefore not reasonable for the project from an engineering standpoint and that project would therefore not be eligible for spot in the sample in lieu of a randomly sampled on-site project.

The accuracy of these energy savings[13] due to a particular energy efficiency measure (EEM) or set of measures depends on the savings being large enough to see in the data[14] and on the absence of non-program, other-project, or other-program[15] changes at the facility that are not due to the EEM of interest. The accuracy of savings also depends strongly on the accuracy of measure installation dates in the tracking database. Realization rates calculated by the SMART tool depend on the tracking data ex ante energy and demand savings accurately reflecting the final EE project files.

2.2 Inputs and Outputs

Table 2 list the inputs to and outputs of the SMART tool.

Table 2. SMART Tool Key Inputs and Outputs

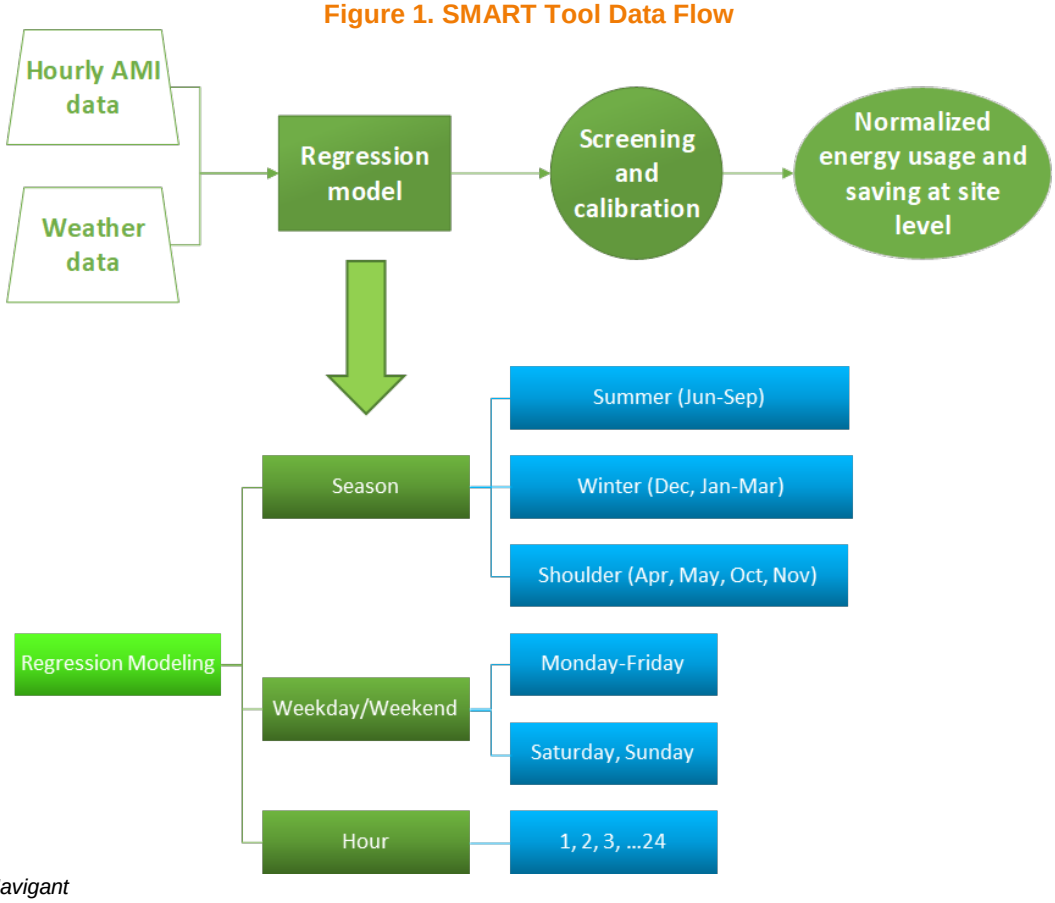
Inputs	Outputs
Hourly electric AMI data from the utility for at least two years	Hourly average site energy visualizations - Pre-project load shapes - Post-project load shapes - Savings load shapes
NOAA dry bulb outdoor air temperature data concurrent with the hourly utility data	Total seasonal energy savings for Summer, Winter, and Shoulder seasons by Weekday and Weekend
Project installation dates and ex ante savings from the tracking data	Total annual energy savings
NREL TMY3 typical-year weather data	Pre- and post-project regression model calibration metrics
	Estimated facility-level hours of use (HOU) for pre- and post-installation periods

Source: Navigant

Figure 1 maps the SMART tool dataflow.

[13] Calculated "savings" in AMI data analysis refers to energy changes at the facility level and could be positive or negative.
[14] The IPMVP Option C identifies this noise floor requirement to be that the total EEM annual savings at the whole building level should be at least 10% of baseline annual energy use for monthly data.
[15] Other-program or other-project energy efficiency activities could occur within a given year if the customer is a repeat participant in multiple ComEd programs.

Figure 1. SMART Tool Data Flow



Source: Navigant

3. Pilot Findings

ComEd provided hourly interval data for 130 participant sites. The following sections describe the findings from the SMART tool for these sites.

3.1 Research Question 1. AMI-Evaluability of C&I Custom Projects

How many of the CY2018 C&I Custom project savings could potentially be evaluable using AMI data without any on site evaluation activity?

Using the SMART screening process, Navigant found that 30 of the 130 projects (15% of CY2018 program savings) had the potential to be evaluable using AMI data without a site visit.

Navigant categorized the SMART screening outputs based on evaluability of savings impacts in the AMI data. Table 3 summarizes Navigant's findings for the CY2018 C&I Custom program participant population.

Projects in Stratum 1 and Stratum 2 of Table 3 had savings with sufficient AMI data readability that non-onsite evaluation activities would likely be sufficient to develop site-level realization rates. Navigant definitions pertaining to readability of savings are summarized in the "Stratum Description" column of Table 3.

The column "Post-Screening Evaluation Activities" summarizes the activities the impact evaluation team would need to carry out to confirm the savings for use in the impact evaluation.

Traditional evaluation activities such as a desk review of tracking data and project folders as well as telephone conversations with the participant and program implementers would be needed even for Stratum 1 sites before using the results in regulatory compliance reporting.

The remaining sites (those in Stratum 3 and Stratum 4 of Table 3) would require traditional evaluation methods including on-sites to yield useable ex post impact savings results.

Table 3. Evaluability Stratification and Illustrative Evaluation Activities*

Stratum Description		Number of Sites	Percent of Ex Ante Savings	Post-Screening Evaluation Activities
Stratum 1 AMI-evaluable	• Annual savings >= 5% of annual baseline usage according to ex ante tracking data savings compared to AMI data total annual usage • Perfect NMBE calibration metrics† • All three seasons (winter, summer, shoulder) have enough pre- and post-project statistically significant regressions‡ to calculate pre-minus-post modeled savings • RR** between 0 and 200%	26	10%	Desk review of model outputs by engineer to calculate final savings value based on engineering judgement; telephone call with the participant to confirm measure installation and other activity at the site besides the project affecting site energy
Stratum 2 Provisionally AMI-evaluable	• Same as Stratum 1 except RR may be unexpectedly large, above 200%. Ex ante savings are still reasonable compared to the total site usage. This may occur if multiple projects were in progress at the site without the knowledge of the evaluator, or if the implementer's ex ante estimate was extremely inaccurate	4	5%	Desk review of model outputs and project file; engineer will need to call the customer and/or the IC† to clarify ex ante calculations and site activity

Stratum Description		Number of Sites	Percent of Ex Ante Savings	Post-Screening Evaluation Activities
Stratum 3 Idiosyncratic	• Same as Stratum 2 except some projects may have ex ante annual savings < 5% of annual baseline usage according to ex ante tracking data compared to the total AMI data annual usage. This may happen if multiple AMI meters are provided for the site whereas the project only affected one meter • Ex ante savings may be unrealistically large relative to the total apparent annual AMI usage, i.e., ex ante savings between 50% and 100% (or more) of total baseline annual usage in the AMI meters. This may happen if one or more AMI meters was inadvertently missing from the analysis	30	46%	Desk and file review, telephone call to the IC and customer, request additional data from the utility, site visit needed to evaluate the realization rate
Stratum 4 Insufficient Data	Remaining projects: • May have negative RR • Some seasons (winter, summer, shoulder) do not have enough pre- and post-project statistically significant regressions*** to calculate pre-minus-post modeled savings	70	39%	Traditional impact evaluation approach with a site visit is required to evaluate the realization rate
TOTAL		**130**	**100%**	

* The post-screening activities are illustrative, Navigant did not follow up with additional activities for the ComEd 2018 C&I Custom AMI data pilot.

† Navigant checked that the SMART tool NMBE metrics for each site were less than 0.1 on average for each site specific SMART regression model compared to the AMI data

‡ Reasons for regressions being statistically significant include (1) sufficient pre- and post-project AMI data (2) site energy use being predictable based on hour-of-day for each season and time-of-week used by the SMART tool

** RR = Realization Rate; IC = Implementation Contractor

*** Reasons for regressions not being statistically significant could include (1) insufficient data such as limited pre- or post-project AMI data (2) site energy use being erratic due to irregular occupancy schedules (3) site energy use being erratic due to irregular equipment use as may occur in industrial plants depending on production

Source: Navigant analysis of ComEd AMI data; ComEd ex ante tracking data

3.2 Research Question 2. Engineering Reasonableness of AMI Analysis

Which of the potentially AMI-evaluable projects from Question 1 are actually verifiable without a site visit based on an engineering-focused comparison between available project information[16] and the SMART tool results?

[16] Such as the tracking data, project files, and discussions with the participant and implementer.

Navigant reviewed selected projects in Stratum 1 of Table 3 to test the engineering review process by which the impact evaluator could determine which of the potentially AMI-evaluable projects from Question 1 were truly verifiable without a site visit.[17]

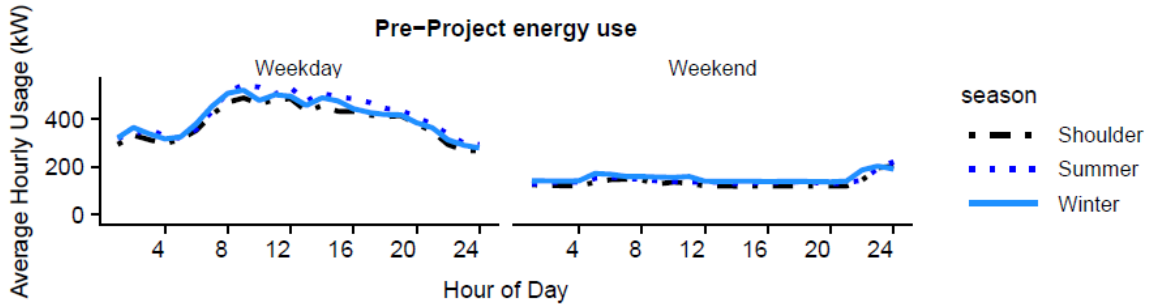
Navigant confirmed the engineering review method as an effective way SMART tool savings could be verified for inclusion in the impact evaluation sample without a site visit.

For example, Navigant considered the engineering reasonableness of SMART tool usage and savings visualizations (see Figure 2 and Figure 3) for a CY2018 C&I Custom program participant project relative to the measure listed in the tracking data for this project. The measure was listed as both "other" and "building shell". Since efficiency measures and load reduction measures tend to follow the usage loadshape of the replaced equipment (in this case some aspect of the building shell), and the savings are generally a relatively small percentage of the total baseline usage, the savings for this project based on Figure 2 and Figure 3 appears reasonable from an engineering standpoint.

Further checks of engineering reasonableness of the savings magnitude could be carried out by the impact evaluation engineer based on experience and calculations of building shell measure savings.[18] Project documents, if requested from ComEd, would reveal more specifically what the measure was (e.g. windows, window film, cool roof, improved external insulation), allowing the engineer to develop an independent opinion about whether the program measure was believable as the cause of the measured AMI data savings without going on site. Further, the evaluation engineer could contact the participant by telephone to confirm the measure is still installed, and no other projects were completed during the same time period.

Therefore, this is an example of a project for which on-site installation verification may not be needed to develop rigorous ex post evaluated savings.[19]

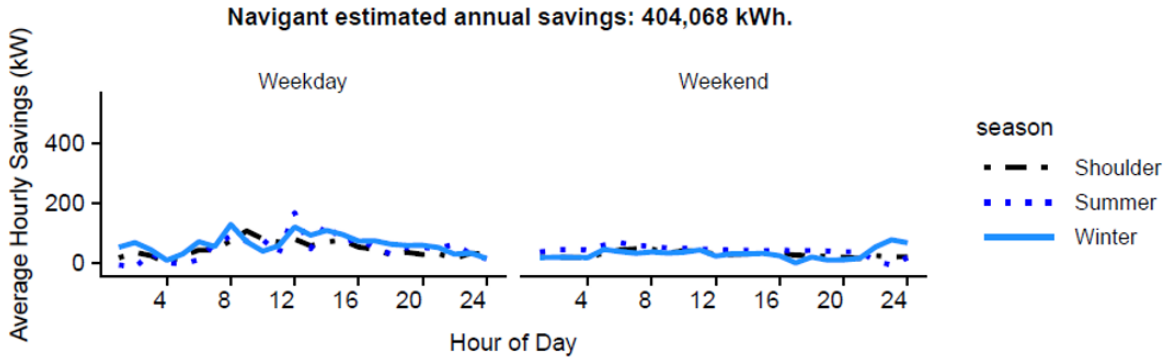
Figure 2. ComEd C&I Custom Program SMART Visualization, Office Building Baseline USAGE



Source: Navigant analysis of ComEd AMI data

[17] It was not a goal of the CY2018 pilot to use SMART tool results in CY2018 C&I Custom program official reporting.
[18] The engineering review could include whole building energy comparison modeling to establish a likely percent savings for a similar measure, and secondary research available in other sources such as technical reference manuals.
[19] Per International Performance Measurement and Verification Protocol (IPMVP) Option C – Whole Facility analysis.

Figure 3. ComEd C&I Custom Program Participant SMART Visualization, Office Building SAVINGS



Source: Navigant analysis of ComEd AMI data

3.3 Research Question 3. Actionable Insights from the SMART Tool

Can the SMART tool provide actionable insights and recommendations for the impact evaluation?

The SMART tool by itself cannot provide actionable insights into whether the implementer ex ante assumptions and approach were sound or provide definitive recommendations on root-cause issues. Combined with additional follow-up activities, it can serve as a solid basis for developing actionable insights and recommendations.

Actionable insights expected from an impact evaluation are insights about the implementer's ex ante savings calculations and assumptions that resulted in savings discrepancies.[20] These could be methodological errors for specific measure types, or they could be one-off human error on the part of the implementer such as spreadsheet calculation errors.[21]

To answer this question, Navigant discussed SMART findings with the C&I Custom program impact evaluation team. The SMART analysis covered thirteen sites of the twenty ComEd 2018 C&I Custom program sampled projects since ComEd provided data for thirteen of the twenty C&I Custom impact evaluation sampled projects. Of these thirteen sites, the SMART tool returned four sites meeting the criteria of Stratum 1 or Stratum 2 of the evaluability table. Navigant discussed the details of these four projects with the Custom impact team with the following findings:

1 For one project the SMART savings approach duplicated the ex post evaluated savings from the Custom evaluation team nearly exactly.

2 The SMART team found a project with a very high realization rate, whereas the Custom team clarified there were known non-program energy management system initiatives which explained the apparent high savings in the facility-level AMI data.

3 SMART savings for one project turned out to be partial savings for a longer-term project. Although the SMART team was able to partially confirm the Custom team analysis, the SMART results themselves were not useful without considering the multi-year context of the project.

4 One project clearly had savings, however was not a "pre-minus-post" project. The Custom program evaluation team clarified it was a "gut renovation" with an energy code baseline.

[20] Discrepancies can include overestimating or underestimating savings.
[21] An example of a spreadsheet calculation error might be a typo in the spreadsheet resulting in a slipped digit in hours of operation, dramatically under-estimating or over-estimating savings.

Therefore the SMART savings are not meaningful for this project even though the SMART tool returned AMI data savings that were accurate on a pre-minus-post basis. A code baseline should have been used instead of the pre-installation AMI data.

Three of the four projects would have resulted in erroneous conclusions if they had been accepted at face value relative to the program savings claim. The SMART tool results alone did not provide useful program insights for most of the projects. Additionally, the SMART team did not have a way to discern which results to attribute to program activity without further discussion with the C&I Custom evaluation team and the participant. Key information about the project can be gathered in a telephone call with personnel at the site knowledgeable about the project.

3.4 Limitations

Navigant identified the following SMART tool barriers to better AMI data integration with the traditional impact evaluation workflow.

- **The SMART tool cannot definitively attribute quantified savings to program activity.** Attribution of whole building savings to program activity has long been a challenge for IPMVP Option C analysis. While hourly savings available with AMI data partially addresses this issue, definitive verification that program-incented equipment is generating savings requires on-site evaluation. Discussion with the ComEd C&I Custom impact evaluation team about the 2018 evaluation results suggests program impacts based on pre-minus-post AMI data analysis alone is insufficient.

- **Using SMART tool results for regulatory compliance reporting without random sampling could introduce statistical bias.** If the majority of the impact evaluation sample were based only on sites where AMI pre-minus-post savings were available and verified through an engineering review, representativeness of this "non-random sample" would need to be addressed.

  For the 2018 C&I Custom program year Navigant found that for the "AMI-evaluable" sites in Stratum 1 of Table 3 the evaluability of the projects did not appear to favor specific building types or measure types.[22] However, the representativeness of the overall sample would need to be confirmed each program year if SMART tool results were to be substituted in lieu of a large number of on-sites.

- **Correlation is not causation.** Limited program insights using a data-only whole facility approach is a standing issue for IPMVP Option C-like analyses. Hourly AMI data and the potential to integrate concurrent trend data such as outdoor air temperature makes progress toward remote program insights, but it does not resolve it completely.

  When readability of savings in whole facility data is seen as the primary function of impact evaluation, actionable program insights are lost for key impact evaluation research areas such as implementer savings assumptions, accurate savings-per-incentive benchmarks, and measure persistence recommendations. Even if both the implementer and evaluator were to use the same hourly billing data to calculate savings, insights into verified root-cause reasons for energy

[22] The Stratum 1 sites in Table 3 represented eleven building types and seven measure types which is a diverse and representative cross-section of the CY2018 program population.

savings are lost using a data-only approach. This is particularly an issue when the savings are much lower than expected by whoever paid for the incentive.[23]

If the reason for discrepancies between the expected savings and actual savings appear to be schedule-related or correlated with other tracked data such as a specific implementer, SMART tool results may provide superficial insights into possible reasons. However, correlation is not causation and the root-cause reasons for discrepancies is not actionable based only on the data without a human in the loop.[24]

4. RECOMMENDATIONS

Based on the results of the ComEd 2018 C&I Custom AMI data pilot, Navigant recommends the following:

1. Integrate the ComEd 2019 C&I Custom program evaluation with Navigant SMART tool to reduce evaluation effort and cost by avoiding costly site visits through substituting validated SMART tool results instead of on-site projects in the impact evaluation random sample.[25]

2. Perform follow-up research to expand AMI data use-cases by addressing known limitations revealed by this pilot.

The following sections expand on these two recommendations.

4.1 Integrate AMI data into C&I Custom Evaluation Workflow

The C&I Custom evaluation team can best incorporate AMI data into the evaluation workflow through a hybrid AMI data / human-in-the-loop approach as follows:

Step 1. **Check AMI evaluability of all program participants.** Use the SMART screening tool to determine how many of the CY2019 C&I Custom project savings could potentially be evaluable using AMI data without any on site evaluation activity.

a. The SMART screening method should be used to develop an AMI-evaluability table (like Table 3) mid-year in July or August to pre-screen candidate projects to receive a desk-review ex post evaluations in lieu of an on-site.[26]

Step 2. Test the **engineering reasonableness** of the SMART tool results to identify which of the potentially AMI-evaluable projects from Step 1 are actually verifiable without a site visit and could be included in the final impact evaluation sample without on-site activity.

a. Perform a “desk review” of SMART tool outputs, including all calibration metrics, seasonal savings, and available project data, to determine the engineering

[23] Even if a program does not have a formal expected ex ante savings process, there may be an expectation on the part of whoever funded the efficiency measures that the savings are in some way commensurate with the money paid.
[24] For example, if the reasons for discrepancies are different quantities of efficient equipment installed, lower efficiency equipment installed, or failed controls, this can only be definitively independently verified through a site visit by the impact evaluation team.
[25] By filling one of the evaluation sample spots with a SMART project, that project goes from a project with on-site evaluation activity which costs more to a site that does not require on-site evaluation activity, which costs less.
[26] This CY2018 pilot was conducted on end-of-year data, so an initial screening at mid-year in CY2019 would have fewer results depending on how many C&I Custom program projects have been completed mid-year in 2019.

reasonableness of each site savings in Stratums 1 and 2 of the evaluability table relative to the incented measures in the project documentation. Call the participant and implementer to clarify whether there was other upgrade activity at the site besides the specific project in the population.

b. Finalize project realization rates for SMART sites that do not require a site visit based on the engineering reasonableness check and integrate these SMART sites into the traditional impact evaluation sample through random sampling[27] of Stratum 1 and 2 site results or through addition of SMART tool sites as an oversample into the traditional sample strata to improve sampling precision.

c. If some Stratum 1 / Stratum 2 sites do not appear reasonable from an engineering standpoint after the engineering reasonableness review,[28] these sites would require a site visit and should not be used to offset a sampled project with a site visit.

Step 3. Develop **actionable insights** for the impact evaluation:

a. Provide SMART usage and savings plots to the on-site team in an M&V plan, and outline SMART findings and outstanding questions for the program participant and implementer based on the AMI data.

b. The on-site engineer should answer all outstanding questions by interviewing the participant on site in addition performing installation verification and metering.

4.2 Future Research Topics

This section proposes 2019 AMI research topics for two different use cases: (1) AMI data for custom program impact evaluation, and (2) AMI data for implementation (non-evaluation) applications.

4.2.1 AMI-based Custom Impact Evaluation Research Topics

Based on findings for the ComEd 2018 C&I Custom AMI data pilot, Navigant recommends the following further research to leverage AMI data for Custom program impact evaluation:

Future Research Area #1. Develop minimum requirements for program tracking data such as:

- Require accurate and up to date measure installation and commissioning dates for all projects
- Ensure the final ex ante savings in the tracking data matches the final incented project file
- Include a total annual baseline electric use column on a 12 month rolling basis for each project for comparison with the total magnitude of EE project savings
- Require meaningful measure names in tracking data i.e., avoid the use of 'other'
- Include known non-program, other-project, and other-program activity at the project site

[27] Random sampling of the two 'readable' strata is recommended to avoid the appearance of bias when integrating Stratum 1 and 2 projects into the evaluation sample. In 2018 Navigant found 15% of C&I Custom program savings had "readable" program savings in the hourly AMI data in the 2018 C&I Custom program evaluability table. Therefore as a best practice Navigant suggests limiting random selection of SMART sites to a maximum of 15% of the total sample savings. Navigant recommends future research to confirm best practices for maintaining statistical representativeness of the impact evaluation sample for each program year evaluation.

[28] For example, a project that was supposed to save winter heating energy instead saving summer energy according to the SMART tool analysis.

Future Research Area #2. Explore the options for including SMART tool sites in the traditional sample without introducing statistical bias.

- Should there be a limit on the quantity of AMI-evaluable SMART tool sites or maximum savings for randomly sampled SMART sites in the Custom sample?
- How can statistical bias be tested for when including AMI-evaluable sites in the traditional sample without random sampling of SMART sites?

4.2.2 AMI-based Implementation Research Topics

Future Research Area #3. Explore how AMI data could be used to support future Standard program implementation and evaluation through technical reference manual (TRM) primary research in areas such as:

- Facility-level annual and seasonal hours of use (HOU) estimates by building type
- Facility-level demand coincidence factor (CF) estimates by building type
- Other TRM research to be determined

Future Research Area #4. Explore how AMI analysis could be used to reduce measure implementation performance risk using the SMART tool.

- Screening could be used by the implementer to document “real time” savings progress on larger projects on a daily, weekly, or monthly basis to try and identify measure performance issues during project implementation, alerting the implementer of possible installation delay or measure commissioning issues.