



# ComEd CY2018-2021 Evaluation Plan

**FINAL**

**Presented to**

**Commonwealth Edison Company**

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## 1. INTRODUCTION

This document provides a four-year overview of evaluation activities for the Calendar Year (CY) 2018-2021 cycle. An overview of the evaluation's goals includes:

- **Evaluation, measurement, and verification (EM&V) of energy efficiency programs.** These evaluations will meet the requirements of the Future Energy Jobs Act (FEJA), Section 8-103(f)(7) and Section 16-111 of the Public Utility Act (PUA), which states that the utility shall provide for an annual independent evaluation of the performance of the cost-effectiveness of the utility's portfolio of programs, as well as a full review of the four-year results of the broader net program impacts and for adjustment of the measures on a going forward basis as a result of the evaluations. Our general approach to this work for the 2018-2021 period will be to focus on programs that require deeper analysis. We will continue to conduct thorough, high-quality annual impact evaluations for ComEd's largest energy efficiency (EE) programs and those undergoing significant changes. However, we will not over-evaluate any EE program. For example, for programs whose recent net-to-gross (NTG) ratios have been consistent over time, we propose to conduct about two NTG evaluations over the upcoming four-year program cycle instead of doing NTG analysis every year, as we have usually done to date. Using this approach more funds will be available for program process improvement activities and new cross-cutting research. Navigant plans to work with government and public interest parties, including the Illinois Stakeholder Advisory Group (SAG) and the Illinois Commerce Commissions (ICC) to ensure issues and topics relevant to EM&V are addressed in an efficient manner.
- **EM&V oversight and support that provides continuous improvement of ComEd's EE programs and processes.** As stated in ComEd's Plan 5 filing, evaluation efforts will support the program administrator's continuous improvement process by identifying the program's actual performance, showing how this performance differs from the planned performance, and identifying opportunities to improve the program processes over time. We propose to use a broader array of continuous improvement methodologies for our work for Plan 5 than the customer surveys and trade ally surveys that were used in the past for our EM&V work. The new techniques include benchmarking to identify the ComEd programs that are best-in-class in terms of normalized energy savings, costs of conserved energy, and customer satisfaction, as well as those that could be improved in one or more of the main parameters of interest to ComEd. The benchmarking analysis will focus on Midwest EE programs, Exelon operating company programs, and other programs of interest to ComEd. After the benchmarking analyses are completed, we will use continuous improvement methodologies including Lean Six Sigma to help ComEd improve program performance.
- **Conduct significant research in 2018-2021 focusing on innovative evaluation techniques.** Previously, for most programs in most years, the Navigant team has performed detailed impact evaluations and often process evaluations. We have worked with ComEd and their implementation contractors to improve the ex ante estimate of savings and thus the evaluation realization rate. This improvement now allows Navigant, in coordination with ComEd and the Stakeholder Advisory Group (SAG), to re-allocate some funds from standard verification work to other, newer, and more innovative evaluation research to support the programs. We expect to reserve a significant portion of our budget each year to support this research. Some research will support improvements to the Illinois Technical Reference Manual (IL TRM) and other research will help ComEd define the technical side of new programs and new measures. For example, we are currently supporting ComEd as it works out details on advanced thermostats, advanced power strips, and behavioral program persistence. We will propose research at the sector level that will support multiple programs, target specific market segments, and examine market characteristics to help improve portfolio and program design and implementation. Evaluation techniques throughout the country are in the midst of significant changes, some driven by "big

data” approaches. Navigant is conducting several pilot evaluations for other clients investigating how well “EM&V 2.0” software works in developing ex post impact estimates. From these pilot programs, we have determined that most of the existing EM&V 2.0 approaches and software are geared toward developing more refined ex ante impact estimates, not ex post evaluation estimates. However, we think that various types of billing analysis are appropriate techniques to validate IL TRM savings estimates, such as the billing analysis for weatherization measures that is currently underway in Illinois. In addition, increased use of engineering metering studies is useful to refine parameters used to calculate energy and demand savings in the IL TRM. Some of this research will be used to estimate energy savings expressed in cumulative persisting annual savings (CPAS), non-electric savings, non-energy benefits (NEBs), and other topics discussed below.

Several elements of FEJA drive the need for increased and changed evaluation research, as described below.

**Focus on CPAS.** Under the Future Energy Jobs Act, ComEd’s annual energy savings goals will be based on cumulative persisting annual savings (CPAS). As indicated in ComEd Plan 5, “the CPAS methodology is a new concept for energy efficiency in Illinois, and emphasizes a shift to valuing the lifetime savings of the measure versus only the first-year savings, which was the focus of the prior energy efficiency framework.”<sup>1</sup> In the short term, one focus of evaluation research is to enable effective evaluation of CPAS. Key evaluation research initiatives include estimating measure effective useful life (EUL) and measure persistence, both of which are required to calculate CPAS. Concurrently, the team will be participating in continuous improvement efforts to update the IL TRM in conjunction with the IL SAG, such as researching and updating individual measure energy savings estimates to improve accuracy and reduce evaluation risk.

**Non-electric savings.** Up to 10 percent of ComEd’s annual energy savings goal can be derived from gas savings or savings from other fossil fuels. Priority for these savings must be given to low-income programs. For joint programs, gas conversion does not start until the gas company discontinues funding for the program. For non-joint programs, any gas (or other fuel savings, such as propane or fuel oil) can be counted. Each therm of natural gas savings at the customer’s premise is equivalent to 29.3 kWh of electric savings.

**New customer segments.** FEJA brought Income Eligible and Public Sector customers into ComEd’s portfolio for the first time. ComEd is rolling all Public Sector customers into its existing Business Programs portfolio (except for the Public Housing Authority program and Small Public Facilities programs, which are standalone Business programs). Those programs are the only programs that have separate Public Sector evaluation plans. We also provide separate Income Eligible evaluation plans.

**Third Party Programs.** Under FEJA rules, ComEd will issue an RFP in 2018 to request new program ideas from external parties for CY2019 – CY2021. Each of the programs implemented under this process will need a separate evaluation.

**Voltage Optimization.** Voltage optimization (VO) is categorized as energy efficiency and must be evaluated as such. VO is estimated to contribute 12 percent to 15 percent of the savings each year, and has a measure life of 15 years, per the new legislation. Savings will be annualized based upon requirements of any ComEd stipulation agreements.

**Total Resource Cost Test.** Definition of the total resource cost test (TRC) is amended to include a societal discount rate.

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<sup>1</sup> Commonwealth Edison Company’s 2018-2021 Energy Efficiency and Demand Response Plan dated June 30, 2017, page 6.

**Timeline.** FEJA changed the program year to be based on the calendar year. It specified that ComEd will deliver final program year data by January 30<sup>th</sup> each year and the evaluation reports will be finalized by April 30<sup>th</sup> each year. To meet that deadline (and to improve other aspects of the evaluation), we are separating reporting on energy impacts, which will be completed by the April 30<sup>th</sup> deadline, from reporting on process evaluation research and NTG results. Where possible, NTG research will be completed by August 1 each year, so that reports can be reviewed and finalized in time for the September 1 initial evaluator NTG recommendations to SAG required by the Illinois NTG Policy Manual. In 2020, NTG research will be completed one month earlier, by July 1, to inform development of the next Energy Efficiency and Demand Response Plan. Process evaluation research results will be reported as the research is completed so that it is available as soon as possible.

**Non-Energy Benefits.** Navigant will investigate a range of non-energy benefits (NEBs) for ComEd. The initial focus for NEBs research will be on quantifying NEBs associated with income eligible programs, since previous research has shown NEBs to often be particularly significant for these programs.<sup>2345</sup> In addition, we are adding screening questions to our participant surveys to explore NEBs in other programs. Based on the responses to the screening questions, as well as secondary research, we will conduct primary NEBs research to quantify NEBs associated with additional programs. Other key NEBs areas of interest include:

- Research, data collection, and reporting on non-energy benefits, with an emphasis first on NEBs in the income eligible market sector and secondly, as appropriate, in the Residential and Business sectors.

Navigant will determine:

- Beyond income eligible programs, which specific programs show evidence of NEBs based on participants' responses to screening questions
- Which NEBs are good candidates for primary research – all parties will be included in this selection process
- CY2018 will be the initial year for NEBs program-specific research
- Areas of high-priority focus include job creation (direct, indirect, and induced), reduced collection/arrears/shut-off costs, health improvements, and safety improvements

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<sup>2</sup> Northeast Energy Efficiency Partnerships (2017). Non-Energy Impacts Approaches and Values: An Examination of the Northeast, Mid-Atlantic, and Beyond

<sup>3</sup> NMR Group (2011), Massachusetts Special and Cross-Sector Studies Area, Residential and Low-Income Non-Energy Impacts Evaluation

<sup>4</sup> Oak Ridge National Laboratory (2014). Health and Household-Related Benefits Attributable to the Weatherization Assistance Program

<sup>5</sup> Three<sup>3</sup>, Inc. and NMR Group (2016). Massachusetts Special Cross-Cutting Research Area: Low-Income Single-Family Health- and Safety-Related Non-Energy Impacts (NEIs) Study

## 2. EVALUATING PROGRAMS

Four-year Residential, Business and Income Eligible specific-evaluation tasks are shown in each program-specific evaluation plan attached in the Appendix and also shown in Appendix A. "Program-Specific Four-Year Tasks." Navigant will also develop evaluation plans for the Pilot programs, most of which are currently in a nascent stage of development. Navigant will approach each sector in a unique way given the needs of sector-specific needs. Below we discuss specific research needs for the Residential, Business and Income Eligible sectors, as well as our approach to Pilot programs.

### Residential Sector

Our evaluation strategy for the residential-sector programs includes (1) robust impact analysis based on the IL TRM and regression analysis for behavior based programs (2) episodic NTG research corresponding with changes in program design, delivery, or market changes (3) process analysis (conducted in conjunction with NTG research to reduce participant fatigue) to seek actionable recommendations for program enhancements, (4) process and NTG reporting will be separate from impact reporting which will be completed every April 30<sup>th</sup> and (5) screening questions in program participant surveys looking for evidence of non-energy benefits associated with the program. In consideration of current residential EE program issues, we will focus on ways that EISA 2007 continues to influence retailer decisions on what bulbs to stock and the implications for the residential lighting program. We will also research in-service rates of advanced power strips associated with different delivery channels and sectors. In addition, we will explore the impact of the new requirement of the ICC Energy Efficiency Installer certification on the HVAC rebates program.

### Income Eligible Sector

Given that the income eligible programs are a new program area for ComEd and the spending on these programs has significantly increased compared to their budgets at DCEO, Navigant's evaluation will first focus on (1) the transition of the programs in 2018 (including evaluating satisfaction and program processes), (2) identifying gaps in participation or underserved regions, (3) identifying updates to be made to the IL TRM and (4) coordination with stakeholders, including the Income Eligible Stakeholder Advisory Committee.

We will conduct process research across the income eligible programs, with efforts first concentrated on programs that are planned for four years (i.e., the Affordable Housing New Construction, Income Eligible Lighting Discounts, Single Family and Multi-Family programs). In 2018, this process research will include (1) program manager and implementer interviews focused on understanding the intent of the program (2) geographic (GIS) research to identify geographical gaps in participation, (3) customer, trade ally and stakeholder interviews and surveys to evaluation satisfaction, and (4) assessment of demographic data. The findings from these efforts will inform both recommendations to enhance income eligible programs as well as additional process research efforts going forward.

We will prioritize impact research that will result in updates to the IL TRM parameters for these programs. In addition to conducting an engineering review resulting in the prioritization of IL TRM measure updates for these programs, we plan to conduct a billing analysis using a quasi-experimental design for the Multi-Family and Single-Family programs in 2019. Navigant will use the results of this billing analysis to update the applicable IL TRM measures and the results will inform both recommendations to enhance income eligible programs as well as additional impact related research efforts for the income eligible programs.

Finally, we plan to coordinate with Illinois stakeholders with an interest in income eligible programs and incorporate feedback from these groups into our evaluation plans and research as applicable. The Illinois stakeholders will provide input to a NTG research strategy, if needed, for the income eligible programs.

## Business Sector

Our evaluation strategy for the business sector programs includes (1) impact analysis in each of the four years leveraging the IL TRM, when appropriate (e.g., Standard, Small Business and Instant Discounts) and custom evaluation for other business programs (e.g., Custom, Data Centers, Industrial, etc.), (2) NTG research at least twice during the four-year plan cycle corresponding with changes in program design, delivery, or market changes, (3) process analysis (conducted in conjunction with NTG research to reduce participant fatigue) to seek actionable recommendations for program enhancements, (4) process and NTG reporting will be separate from impact reporting which will be completed every April 30<sup>th</sup>, (5) market effects research for programs that appear to be impacting market change (e.g., Instant Discounts), (6) screening questions in program participant surveys looking for evidence of non-energy benefits associated with these programs, (7) research of proper measure-level effective useful lives will be undertaken for various programs including RCx, Custom, Industrial, Data Centers, SEM, and (8) evaluation of Public Sector Programs and process research will be undertaken to determine the correct level of Public Sector incentives. We will focus on ways EISA 2007 continues to influence bulb decisions and the implications for the Instant Discounts program. EUL research will be a priority based upon the CPAS requirements of FEJA.

## Pilot Programs

ComEd's plan includes pilot programs to test feasibility for inclusion in ComEd's portfolio as well as adding new measures to the IL TRM. Although many of these pilot programs are currently in a nascent stage, Navigant plans to evaluate the pilots in a similar manner to other programs in the portfolio including:

- Determining the data needed to conduct impact evaluations
- Tracking system review
- Engineering file review
- Assessing feasibility of measure added to a future IL TRM using primary and secondary research as needed
- Research on behavioral measure savings and custom measure savings and evaluation approaches
- Process evaluations (including program manager, implementation contractor and trade ally interviews)
- Other research (e.g., load shape) as needed

Navigant will produce separate evaluation plans and reports for pilot programs, as needed. For smaller pilots, evaluation memos may be take the place of formal reports.

### 3. COST-EFFECTIVENESS RESEARCH

The primary objective of the cost-effectiveness research and calculations is to comply with the Illinois legislative requirement that all energy efficiency portfolios be shown to be cost-effective. The key tasks of the cost-effectiveness analysis are to: (1) develop a cost model reflecting Commonwealth Edison Company's (ComEd) costs by program, (2) evaluate the assumptions provided by ComEd and included in Navigant's cost model, (3) after agreement on the cost model and inputs, develop the Total Resource Costs (TRC) for each program, and (4) provide a report with any recommended improvements and comments on the costs and the resulting TRCs. As part of Navigant's evaluation of ComEd energy efficiency and demand response programs, we will develop a cost model and resulting TRCs, as well as joint TRCs for programs that are jointly implemented by ComEd and one or both of Nicor and/or Peoples Gas / North Shore Gas Companies, using an excel based tool and leverage Analytica for developing the final TRCs. Analytica is a tool that allows Navigant to analyze data at different levels (measure, program and portfolio) and provides greater data certainty in inputting program costs to run final TRCs.

We anticipate that the TRC assumptions review will support evaluation, measurement and verification and regulatory reporting objectives for ComEd and will also inform future ComEd planning efforts. The Navigant team will work with ComEd to ensure that the proper data is available for the modeling and evaluation. We will apply the most recent Illinois cost-effectiveness methodology and ICC rulings in reviewing the TRC test calculations.

The savings numbers and cost-benefit results included in Navigant's report will be reflective of the Energy Efficiency Portfolio Standard (EEPS) portion of the ComEd energy efficiency and demand response programs. Any other programs determined to be included in the TRC analysis will also be included. Additionally, for programs that are jointly implemented by ComEd and one or more Illinois gas utilities (including Nicor Gas, Peoples Gas, and/or North Shore Gas), only the electric portion of the program savings and cost-benefit calculations are included here. The combined joint calculations for the joint programs will be included in a separate memo attached as an appendix to the report.

Navigant will comply with the Illinois Energy Efficiency Policy Manual v 1.1, Sections 8 or any other future relevant Policy Manual sections. The Illinois TRC test is defined by the Illinois General Assembly as follows:

*'Total resource cost test' or 'TRC test' means a standard that is met if, for an investment in energy efficiency or demand-response measures, the benefit-cost ratio is greater than one. The benefit-cost ratio is the ratio of the net present value of the total benefits of the program to the net present value of the total costs as calculated over the lifetime of the measures. A total resource cost test compares the sum of avoided electric utility costs, representing the benefits that accrue to the system and the participant in the delivery of those efficiency measures and including avoided costs associated with reduced use of natural gas or other fuels, avoided costs associated with reduced water consumption, and avoided costs associated with reduced operation and maintenance costs, as well as other quantifiable societal benefits, to the sum of all incremental costs of end-use measures that are implemented due to the program (including both utility and participant contributions), plus costs to administer, deliver, and evaluate each demand-side program, to quantify the net savings obtained by substituting the demand-side program for supply resources. In calculating avoided costs of power and energy that an electric utility would otherwise have had to acquire, reasonable estimates shall be included of financial costs likely to be imposed by future regulations and legislation on emissions of greenhouse gases. In discounting future societal costs and benefits for the purpose of calculating net present values, a societal discount rate based on actual, long-term Treasury bond yields should be used. Notwithstanding any to the contrary, the TRC test shall not include or take into account a calculation of market price suppression effects or demand reduction induced price effects.'*<sup>6</sup>

<sup>6</sup> See <http://www.ilga.gov/legislation/publicacts/99/099-0906.htm>

The Illinois TRC test was modified by the Illinois General Assembly in December 2016 (for application starting in CY2018) to explicitly include a societal discount rate, avoided water and avoided operations and maintenance costs, and exclude market price suppression effects. The Illinois test makes it clear that the TRC requirement for plan approval is only at the portfolio level and excludes low income programs. Individual measures need not be cost effective. The Illinois TRC test differs from traditional TRC tests in its requirement to include a reasonable estimate of the financial costs associated with future regulations and legislation on the emissions of greenhouse gases (GHG). This difference adds an additional benefit to investments in efficiency programs that are typically included in the Societal Test in other jurisdictions.

### Illinois TRC Equation used in the Assessment

The benefit-cost formulas will include avoided water costs, avoided O&M costs and other quantifiable societal benefits. Consistent with the principles laid out in the new *National Standard Practice Manual for Assessing Cost-Effectiveness of Energy Efficiency Resources*, cost-effectiveness analyses other quantifiable benefits can include quantified participant NEBs and evaluation will make every attempt to quantify this in the cost effectiveness calculations.

The equation that will be used to calculate the Illinois TRC is presented below:

#### Equation 1 – Illinois TRC

$$BCR_{ILTRC} = B_{ILTRC} / C_{ILTRC}$$

Where,

- BCR<sub>ILTRC</sub>** = Benefit-cost ratio of the Illinois total resource cost test
- B<sub>ILTRC</sub>** = Present value of benefits of a Illinois program or portfolio
- C<sub>ILTRC</sub>** = Present value of costs of a Illinois program or portfolio

The benefits of the Illinois TRC are calculated using the following equation:

#### Equation 2 – IL TRC Benefits

$$B_{ILTRC} = \sum_{t=1}^N \frac{UAEP_t + UATD_t + UAA_t + EB_t}{(1 + d)^{t-1}} + \sum_{t=1}^N \frac{UAC_{at} + PAC_{at}}{(1 + d)^{t-1}}$$

The costs of the Illinois TRC are calculated using the following equation:

#### Equation 3 - IL TRC Costs

$$C_{ILTRC} = \sum_{t=1}^N \frac{PNIC_t + IMCN_t + UIC_t}{(1 + d)^{t-1}} - RC$$

Where benefits are defined as:

- UAEP<sub>t</sub> = Utility avoided electric production costs in year t
- UATD<sub>t</sub> = Utility avoided transmission and distribution costs in year t
- UAA<sub>t</sub> = Utility avoided ancillary costs in year t
- EB<sub>t</sub> = Environmental Benefits in year t
- UAC<sub>at</sub> = Utility avoided supply costs for the alternate fuel in year t

PACat = Participant avoided costs in year t for alternate fuel devices

Navigant will include all relevant costs outlined in Section 8.4 of the Illinois Energy Efficiency Policy Manual v 1.1 or any future relevant section, example costs are defined as:

- RC = NPV of replacement costs of incandescent equivalents
- PNICt = Program Non-Incentive costs in year t
- IMCNt = Net Incremental costs in year t
- UICt = Utility increased supply costs in year t
- D = Utility weighted average cost of capital, used as discount rate

The Illinois TRC test allows for utilities to account for the avoided baseline replacement measure costs that would accrue to program participants because of the significantly longer lifetimes of efficient CFLs and LED light bulbs. In general, the avoided cost per bulb is determined by comparing the estimated useful life of efficient and baseline bulbs to determine the number of baseline bulb purchases that are avoided. Based on the average purchase price of baseline bulbs, an NPV is determined by discounting the value of these avoided purchases over the course of the lifetime of the efficient bulb. The IL TRM provides deemed NPV values per bulb based on efficient bulb-type, socket type (commercial or residential), and lumen range.

### UCT Equation used in the Assessment

The results of the Utility Cost Test are also presented in Section 2 of this report. The UCT (a subset of the Program Administrator Cost Test) approaches cost effectiveness from the perspective of the utility. It determines whether the energy supply and capacity costs avoided by the utility exceed the overhead and cost outlays that the utility incurred to implement energy efficiency programs. The structure of the calculation is similar to the IL TRC, with a few key changes. Since the UCT is primarily focused on utility outlays, incentives paid by the utility to either participants or third party implementers are included in the calculation in place of incremental or participant costs. Additionally, since non-energy benefits accrue to society rather than to the utility implementing energy efficiency programs, these benefits are not included in the UCT formula.

Using the equation terms previously defined for the IL TRC equation, the UCT equation that will be used is defined as:

#### Equation 4 – UCT

$$BCR_{UCT} = B_{UCT} / C_{UCT}$$

Where,

- BCR<sub>UCT</sub>** = Benefit-cost ratio of the Utility Cost Test
- B<sub>UCT</sub>** = Present value of benefits to a utility of a program or portfolio
- C<sub>UCT</sub>** = Present value of costs to a utility of a program or portfolio

The benefits of the UCT are calculated using the following equation:

#### Equation 5 – UCT Benefits

$$B_{UCT} = \sum_{t=1}^N \frac{UAEP_t + UATD_t + UAA_t}{(1 + d)^{t-1}} + \sum_{t=1}^N \frac{UAC_{at}}{(1 + d)^{t-1}}$$

The costs of the UCT are calculated using the following equation:

**Equation 6 - UCT Costs**

$$C_{UCT} = \sum_{t=1}^N \frac{PRC_t + PIC_t + PEAM_t + PIN_t + UIC_t}{(1+d)^{t-1}}$$

$$C_{ILTRC} = \sum_{t=1}^N \frac{PNIC_t + UIC_t + PIN_t}{(1+d)^{t-1}}$$

Where the new term, *PIN<sub>t</sub>*, is defined as the program incentives provided by the utility in year *t*.

### Cost-Effectiveness Data Requirements

The data points needed to conduct the Illinois TRC test are provided in Table 1, below, and are divided into generic and program specific categories. The program specific data points are further subdivided into those that are provided by ComEd versus those that are a result of the Navigant's evaluation activities.

**Table 1. Data points needed to conduct EEPS TRC**

Category	Data Point	Source
Generic	• Avoided Energy Costs (\$/kWh)	ComEd and Relevant Joint Program Gas Company Costs
	• Avoided Capacity Costs (\$/kW-year)	
	• Discount Rate	
	• Escalation Rates	
	• Line Losses	
	• Avoided GHG Emission Costs	
Program Specific	• Participants / Measure Count	Navigant and Relevant Joint Program Gas Company Costs
	• Verified Ex-Post Energy Savings (kWh)	
	• Verified Ex-Post Capacity Savings (kW)	
	• Realization Rate	
	• Net to Gross Ratio	
	• Measure life	ComEd and Relevant Joint Program Gas Company Costs
	• Non-Incentive Costs	
	• Utility Incentive Costs	
	• Incremental Costs (Gross)	
	• Incremental Costs (Net)	

*Source: Navigant analysis*

Our cost model will build-up from the measure and project level, cost detail by program which will roll-up into a portfolio level cost analysis. That cost analysis will be used to run the TRCs for each program so to arrive at final program TRCs and finalize a portfolio-level TRC.

### Evaluation Approach

This four-year evaluation plan summary identifies tasks by year on a preliminary basis for CY2018 - CY2021 (Table 2). Activities for CY2019 are subject to change based upon the demands of the portfolio and other factors, and during the program year as program circumstances are better known.

**Table 2. Four Year Evaluation Plan Summary for the Cost-Effectiveness Assessment**

Activity	CY2018	CY2019-2021	Final 4 Year TRC
ComEd Provides Cost Data and Assumptions	ComEd	ComEd	ComEd
Analysis of Cost Detail and Related Assumptions	Navigant Develops Cost Model	Navigant Develops Cost Model	Navigant Develops Cost Model
Run Cost-Effectiveness Calculations Using Model	Navigant Runs TRC Calculations	Navigant Runs TRC Calculations	Navigant Runs TRC Calculations
Draft Cost-Effectiveness Report	Navigant	Navigant	Navigant

## Evaluation Schedule

Table 3 provides the schedule for key deliverables and data transfer activities. Adjustments will be made, as needed, as assessment and evaluation activities progress or changes in program delivery may be required.

Plan start and delivery dates will be the same in most cases for CY2018 and subsequent years, except for potential changes in the timelines and specific calendar dates in CY2019 and following years. Navigant will strive to provide timely delivery of the results outlined above, but all are contingent upon ComEd delivering timely cost detail and proper back-up assumption detail to Navigant.

**Table 3. Schedule – Key Deadlines in CY2018**

Activity/Deliverables	Responsible Party	Date Delivered
Cost Assumptions and Detail	ComEd	May 15, 2019 (annually) *
Navigant Develops Initial Cost Model	Navigant	July 1, 2019 (annually)
Iterative Cost and Assumptions Discussions w/ComEd	ComEd / Navigant	July-August 2019
Finalize Cost Model	Navigant	August 20, 2019 (annually)
Navigant Develops Initial TRCs	Navigant	September 15, 2019 (annually)
Discussion of Initial TRCs	ComEd / Navigant	September 20, 2019 (annually)
Finalize TRCs	Navigant	September 30, 2019 (annually)
Finalize Joint TRCs	Navigant	October 20, 2019 (annually)
Navigant Draft TRC Report – Delivered (15 Bus Day R'vw)	Navigant	October 8, 2019 (annually)
Comments on Draft TRC Report due from Parties	ComEd / Navigant	October 29, 2019 (annually)
Navigant Redraft of TRC Report Based on Comments	Navigant	November 7, 2019 (annually)
Navigant Draft of Joint TRC Report	Navigant	November 15, 2019 (annually)
Final Report to ComEd and SAG	Navigant	November 19, 2019 (annually)
Comments on Navigant Draft of Joint TRC Report	ComEd / Navigant	December 5, 2019 (annually)
Final Joint TRC Report	Navigant	December 20, 2019 (annually)

\*Note: Receipt of the initial assumption and cost data from ComEd is the initial step and without timely receipt of data and detail, the entire schedule shifts by an equal amount of time – each date will be delayed. Dates above for Joint TRC analysis are also contingent on timely receipt of joint program cost detail from ComEd, Peoples Gas, North Shore Gas and Nicor Gas.

## 4. CROSS-CUTTING RESEARCH

Navigant will perform cross-cutting research to support improving the programs and improving the IL TRM. This research is geared toward three general topic areas: Exploring Savings, Markets & Innovation, and Process and Customer Engagement. These three topic areas are designed to mirror priorities listed in the ComEd Plan 5 settlement stipulation. In addition, Navigant will support ComEd's pilot programs' development and market-testing by providing technical assistance and evaluation insights on which potential pilot program design aspects could yield the most savings, with the highest reliability and repeatability. When a pilot is successful, Navigant will contribute to the work paper to include the measure the IL TRM.

Navigant has activated several high priority evaluation research initiatives, with an early emphasis on evaluation research to support calculating CPAS, such as EUL and measure persistence research, and working with the IL SAG and the IL TRM administrator to contribute to the continuous improvement of the IL TRM through secondary and primary research to inform IL TRM measure workpapers. A list of current activities is included in the tables below. Additionally, the team has initiated planning for other evaluation research activities in the next year, such as NEB studies and developing load profiles to update the IL TRM. Navigant expects to conduct a broad range of evaluation research during the ComEd Plan 5 timeframe. However, many factors could affect the scope and timing of these activities; therefore, these plans will be sent separately and are not described in detail in this document. Evaluation research is coordinated statewide with the evaluators for Ameren Illinois, Nicor Gas, Peoples Gas and North Shore Gas.

### Exploring Savings

The Exploring Savings research topic area includes evaluation research for EUL and measure persistence to support calculating CPAS and working with the IL SAG and the IL TRM administrator to contribute to the continuous improvement of the IL TRM. In the short term, one focus of evaluation research is to enable effective evaluation of CPAS. Key evaluation research initiatives include estimating measure effective useful life (EUL) and measure persistence, both of which are required to calculate CPAS. Concurrently, the team will be participating in continuous improvement efforts to update the IL TRM in conjunction with the IL SAG, such as researching and updating individual measure energy savings estimates to improve accuracy and reduce evaluation risk.

The overall goal of IL TRM evaluation research is to improve IL TRM input parameter assumptions. All evaluators in Illinois, including Navigant, are part of the Illinois Stakeholder Advisory Group Technical Advisory Committee (TAC) and are charged with providing materials to continually update and improve the IL TRM to provide the most accurate input parameter assumptions and impact evaluation methodology. Navigant will continue to produce IL TRM measure workpapers including primary and secondary research. Navigant will review current IL TRM measures and priority recommendations from TAC to develop evaluation research based on energy savings, historical realization rate, variability and uncertainty in measure impacts, feasibility to update, relative contributions of measures and planned future use, among others. In CY2018, the emphasis is on high priority measures identified by the IL TRM subcommittee and measures with high portfolio impact or outdated references. The team plans to revisit this list on an ongoing basis as, for example, the IL SAG releases new updates on IL TRM research priorities and the ComEd portfolio measure mix shifts over time. This ongoing review will ensure Navigant's research will focus on the most important topics for ComEd and IL SAG stakeholders. Over the course of the next four years, we expect to continue updating IL TRM measures using the criteria above.

As new measures are proposed to the IL TRM, Navigant will conduct secondary research in coordination with the IL TRM administrator to determine whether the measure has been evaluated in other locations,

such as IL TRMs from other states. Working with stakeholders, we will analyze a range of savings values for a particular measure, if such values are known.

## Markets and Innovation

The Markets and Innovation section includes areas of evaluation research designed to address new customer segments and technologies and to test innovative evaluation methods. Examples include identifying opportunities to use advanced metering infrastructure (AMI) data in evaluation and evaluating M&V 2.0 pilot initiatives (as described in the stipulation agreement), smart home initiatives and illustrating customer energy usage patterns with AMI data. Navigant will develop an evaluation framework to develop impact savings estimates from R&D activities. To the extent practicable, the team will coordinate with ComEd's R&D team to avoid duplication of efforts while still maintaining independence as ComEd's evaluator. Additional details will be included in separate evaluation research plans.

## Process and Customer Engagement

According to Plan 5, a key component to success is education and outreach. This component has two specific goals: (1) educate and raise awareness about the value and benefits of energy efficiency among ComEd's customers, and (2) drive customers to participate in energy efficient activities to help them save money on their electric bills. Key items within the process and the customer engagement evaluation research include supporting program evaluations with innovative survey approaches and reviewing how surveys are deployed to avoid duplication with ComEd market research efforts and integrate data collection when feasible while maintaining independence as the third-party evaluation contractor. Separate research tasks will include coordinating with ComEd's baseline study and evaluating market effects and market impacts through market transformation programs.

## Pilot Programs

ComEd's R&D team is focused on exploring new platforms, programs and technologies to offer customers to promote energy efficiency. Many of these ideas will take the shape of pilot programs, which, as noted in ComEd Plan 5, Navigant's evaluation team will evaluate to assess energy savings. For these pilot programs, the team will help ComEd to best structure these pilots to maximize the value of evaluation research. For example, the ComEd Plan 5 stipulation notes that pilots should use randomized control trials where practical. The Navigant research team will work with ComEd to ensure pilot offerings are structured to enable defensible evaluated savings. When pilot programs are successful, Navigant will work with ComEd to develop work papers to include the technology or treatment in the IL TRM.

## Current and Future Evaluation Research

ComEd and Navigant have identified several areas for evaluation research based on past evaluation findings and the priorities of the IL SAG for IL TRM development. Evaluation research is underway in several areas previously identified by ComEd and Navigant as high priority. This section includes a summary of active and future evaluation research activities. Evaluation research plans with additional details will be sent separately and made available for comment.

Table 4 through Table 8 summarize evaluation research tasks currently underway and being planned. The research team plans to revisit this list on an ongoing basis as, for example, the IL SAG releases new updates on IL TRM research priorities and the ComEd portfolio measure mix shifts over time. This ongoing review will ensure Navigant's research will focus on the most important topics for ComEd's evaluation and IL SAG stakeholders. Updates to required and planned research will occur on an ongoing basis and the detail below will be updated on an ongoing basis.

Note, the check marks (✓) in Table 4 through Table 8 indicate the year in which the research is planned and will occur.

**Table 4. Exploring Savings Research Tasks: IL TRM Measure Research**

Research Task	Description	Timeline				
		2017	2018	2019	2020	2021
IL TRM 5.2.2: Advanced Power Strip Tier 2 - ISR/Persistence	Metering study to determine the in-service rate and persistence of savings from Tier 2 Advanced Power Strips	✓	✓			
IL TRM 5.3.16 Advanced Thermostats - Cooling Savings Factor	Billing analysis using AMI data to estimate cooling savings factors for advanced thermostats	✓	✓			
IL TRM 5.6.1-5.6.4: Shell Measures - Savings Verification	Engineering and billing analysis to update de-rating factors for air sealing and insulation	✓	✓			
IL TRM 6.1.1: Weather Normalization for Behavior Measures	Billing analysis to determine whether weather normalization is required for evaluating behavior measure savings	✓				
IL TRM 6.1.1: Adjustments to Behavior Savings to Account for Persistence	Billing analysis to estimate decay rates for behavior measure savings	✓				
LED Street Lighting O&M Cost Savings Research (separate municipal and ComEd)	Secondary research to determine avoided operations and maintenance costs from upgrading to LED street lighting	✓	✓			
IL TRM 4.4.17: Variable Speed Drives for HVAC Pumps and Cooling Tower Fans - Measure Cost	Secondary research to update incremental cost estimates for VSDs	✓	✓			
IL TRM 4.4.19: Demand Controlled Ventilation - Savings Factors	Secondary research to update savings factors for demand-controlled ventilation	✓	✓			
IL TRM 4.5.4, 5.5.6, and 5.5.8: LED Bulbs and Fixtures - Incremental Costs	Web scraping and secondary research to update LED product incremental costs	✓	✓			
Retro-commissioning Measure Persistence Study	Study to determine the persistence of savings from Retro-commissioning measures	✓	✓			
IL TRM 4.4.17: Variable Speed Drives for HVAC Pumps and Cooling Tower Fans – Measure Impacts	Metering study to update TRM savings estimates and input parameters for VSDs			✓	✓	
LED Streetlighting Impacts	Secondary research and metering study to update savings estimates for LED Streetlighting measures		✓	✓		
IL TRM 4.4.1 Air Conditioner Tune-Up: Deemed Savings Percentages	Metering and AMI study to update deemed savings percentages for AC Tune-up measures		✓	✓		
IL TRM Measures	Additional measures added each year, to be determined			✓	✓	✓

Source: Navigant

**Table 5. Exploring Savings Research Tasks: Cross-Cutting**

Research Task	Description	Timeline				
		2017	2018	2019	2020	2021
Commercial Lighting Load Shape Study	Metering study to update load shapes, coincidence factors, and hours of use for commercial lighting		✓	✓		
Residential Load Shape Study	Metering and AMI data analysis to update load shapes and coincidence factors for high priority measures		✓	✓	✓	
Income Eligible Program NEBs	Research to estimate non-energy benefits from income-eligible program measures	✓	✓			
Business Program NEBs	Conduct primary research on selected programs based on results from screening questions			✓	✓	✓
Residential Program NEBs	Conduct primary research on selected programs based on results from screening questions			✓	✓	✓
EUL Research: Technical Measure Life	Research to refine estimates of effective useful life for high priority measures	✓	✓	✓		
EUL Research: Persistence	Staged study to investigate persistence for high priority measures		✓	✓	✓	✓

Source: Navigant

**Table 6. Markets and Innovation Research Tasks**

Research Task	Description	Timeline				
		2017	2018	2019	2020	2021
Evaluating AMI for Individual Programs	Conduct secondary research and document in memorandum summarizing possible applications for using AMI data in evaluation	✓	✓	✓		
Pilot M&V 2.0 approaches for select programs	Conduct pilot evaluations using innovative M&V 2.0 approaches		✓	✓	✓	✓
Evaluating Smart Home Initiatives	Develop EM&V methods for smart home products and programs			✓	✓	✓
Community Energy Management	Develop EM&V methods for community energy management programs			✓	✓	✓

Source: Navigant

**Table 7. Process and Customer Engagement Research Tasks**

Research Task	Description	Timeline				
		2017	2018	2019	2020	2021
Benchmarking	Conduct benchmarking research to identify innovative program design ideas		✓	✓		
GIS Mapping Opportunities	Identify geographic areas for increased trade ally involvement		✓	✓		
Program channeling	Understand where channeling has occurred and how to increase channeling		✓	✓		
Market Transformation Evaluation Design	Determine evaluation approaches for ComEd's market transformation programs		✓			
Market Transformation Evaluations	Implement evaluation designs from previous task			✓	✓	✓
Evaluation Coordination with Baseline Study	Coordinate evaluation with baseline study		✓	✓		

Source: Navigant

**Table 8. Pilot Programs' Evaluation Timeline**

Pilot	Description	Timeline				
		2017	2018	2019	2020	2021
Bidgely	Similar to program running in PY9. Continuing to test additional technologies and more granular data through Sensor IQ (Expected Q1/Q2 2018)		✓	✓		
Connected Savings Wi-Fi Thermostat Optimization [with Nicor]	Smart thermostat optimization	✓	✓	✓		
HVAC SAVE	Quality install program for HVAC	✓	✓	✓		
Nest Seasonal Savings	Smart thermostat optimization	✓	✓	✓		
Ductless Heat Pump & Building Envelope Measures in Income Eligible, All-electric Multi-Family Buildings	Determining whether high performance, cold climate ductless heat pumps are a good fit for the ComEd Energy Efficiency Program both technically and economically.		✓	✓		
Commercial Geothermal	Training classes for geothermal installers combined with incentives for 25 – 30 pilot participants, depending on project size.		✓	✓		
“Pay-It-Forward”	Using a transaction-based digital platform, can ComEd empower residential and small business customers to reduce their electricity usage by offering performance-based incentives that can be kept or shared with family, friends, or community organizations?		✓	✓		

Source: Navigant

## APPENDIX A. PROGRAM-SPECIFIC FOUR-YEAR TASKS

**Table A. Income Eligible Programs Four-Year Plan**

Program	Task	2018	2019	2020	2021
Affordable Housing New Construction	Tracking System Review	X	X	X	X
Affordable Housing New Construction	Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Affordable Housing New Construction	Data Collection – Stakeholder Interviews	X	X	X	
Affordable Housing New Construction	Impact – Engineering Review	X	X	X	X
Affordable Housing New Construction	Impact – Measure-Level Deemed Savings Review	X	X	X	X
Affordable Housing New Construction	Impact – Verification & Realization Rate	X	X	X	X
Affordable Housing New Construction	Impact Research – Calibrated Simulation Modeling		X		
Affordable Housing New Construction	Process Analysis	X		X	X
Food Bank LED Distribution	Tracking System Review	X			
Food Bank LED Distribution	Data Collection – Participant Surveys	X			
Food Bank LED Distribution	Data Collection – Program Manager and Implementer Interviews	X			
Food Bank LED Distribution	Impact – Engineering Review	X			
Food Bank LED Distribution	Impact – Measure-Level Deemed Savings Review	X			
Food Bank LED Distribution	Impact – Verification & Realization Rate	X			
Food Bank LED Distribution	Process Analysis	X			
Lighting Discounts – Income Eligible	Tracking System Review	X	X	X	X
Lighting Discounts – Income Eligible	Data Collection – Participant Surveys	X	X	X	X
Lighting Discounts – Income Eligible	Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Lighting Discounts – Income Eligible	Impact – Engineering Review	X	X	X	X
Lighting Discounts – Income Eligible	Impact – Modeling	X	X	X	X
Lighting Discounts – Income Eligible	Impact – Verification & Realization Rate	X	X	X	X
Lighting Discounts – Income Eligible	Process Analysis	X	X	X	X
Multi-Family Retrofits	Tracking System Review	X	X	X	X
Multi-Family Retrofits	Data Collection – Participant Surveys	X		X	
Multi-Family Retrofits	Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Multi-Family Retrofits	Data Collection – Property Manager Interviews	X		X	
Multi-Family Retrofits	Impact – Billing Analysis		X		
Multi-Family Retrofits	Impact – Engineering Review	X	X	X	X
Multi-Family Retrofits	Impact – Measure-Level Deemed Savings Review	X	X	X	X
Multi-Family Retrofits	Impact – Verification & Realization Rate	X	X	X	X
Multi-Family Retrofits	Net-to-Gross – Customer Self-Report Surveys		X		
Multi-Family Retrofits	Process Analysis	X	X	X	X
Single-Family Retrofits	Tracking System Review	X	X	X	X
Single-Family Retrofits	Data Collection – Participant Surveys	X		X	
Single-Family Retrofits	Data Collection – Program Manager and Implementer Interviews	X	X	X	X

Program	Task	2018	2019	2020	2021
Single-Family Retrofits	Data Collection – Trade Ally Interviews	X		X	
Single-Family Retrofits	Impact – Billing Analysis		X		
Single-Family Retrofits	Impact – Engineering Review	X	X	X	X
Single-Family Retrofits	Impact – Measure-Level Deemed Savings Review	X	X	X	X
Single-Family Retrofits	Impact – Verification & Realization Rate	X	X	X	X
Single-Family Retrofits	Impact – Field Work	X		X	
Single-Family Retrofits	Process Analysis	X	X	X	X
Low Income Kits	Tracking System Review	X			
Low Income Kits	Data Collection – Program Manager and Implementer Interviews	X			
Low Income Kits	Impact – Engineering Review	X			
Low Income Kits	Impact – Measure-Level Deemed Savings Review	X			
Low Income Kits	Impact – Verification & Realization Rate	X			
Low Income Kits	Process Analysis	X			

**Table B. Business Programs Four-Year Plan**

Program	Task	2018	2019	2020	2021
AirCare Plus (AC Tune-Up)	Tracking System Review	X	X	X	X
AirCare Plus (AC Tune-Up)	Data Collection – Participant Surveys	X	X	X	X
AirCare Plus (AC Tune-Up)	Data Collection – Program Manager and Implementer Interviews	X	X	X	X
AirCare Plus (AC Tune-Up)	Data Collection – Trade Ally Interviews	X		X	
AirCare Plus (AC Tune-Up)	Impact – Engineering Review	X	X	X	X
AirCare Plus (AC Tune-Up)	Impact – Measure-Level Deemed Savings Review	X	X	X	X
AirCare Plus (AC Tune-Up)	Impact – Verification & Realization Rate	X	X	X	X
AirCare Plus (AC Tune-Up)	Impact – Field Work (On-Site Metering)	X			
AirCare Plus (AC Tune-Up)	Net-to-Gross – Customer Self-Report Surveys		X		X
AirCare Plus (AC Tune-Up)	Net-to-Gross – Trade Ally Interviews		X		X
AirCare Plus (AC Tune-Up)	Process Analysis	X	X	X	X
Business Energy Analyzer (BEA)	Tracking System Review	X	X	X	X
Business Energy Analyzer (BEA)	Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Business Energy Analyzer (BEA)	Impact – Modeling	X	X	X	X
CHP	Tracking System Review	X	X	X	X
CHP	Data Collection – Participant Surveys	X	X	X	X
CHP	Data Collection – Program Manager and Implementer Interviews	X	X	X	X
CHP	Impact – Engineering Review	X	X	X	X
CHP	Impact – Modeling	X	X	X	X
CHP	Impact – Verification & Realization Rate	X	X	X	X
CHP	Net-to-Gross – Customer Self-Report Surveys		X		X
CHP	Net-to-Gross – Trade Ally Interviews		X		X
CHP	Process Analysis	X	X	X	X
Custom	Tracking System Review	X	X	X	X
Custom	Data Collection – Participant Surveys	X	X	X	X
Custom	Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Custom	Impact – Engineering Review	X	X	X	X
Custom	Impact – Modeling	X	X	X	X
Custom	Impact – Verification & Realization Rate	X	X	X	X
Custom	Net-to-Gross – Customer Self-Report Surveys		X		X
Custom	Net-to-Gross – Trade Ally Interviews		X		X
Custom	Process Analysis	X	X	X	X
Data Centers	Tracking System Review	X	X	X	X
Data Centers	Data Collection – Participant Surveys	X	X	X	X
Data Centers	Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Data Centers	Impact – Engineering Review	X	X	X	X

Program	Task	2018	2019	2020	2021
Data Centers	Impact – Modeling	X	X	X	X
Data Centers	Impact – Verification & Realization Rate	X	X	X	X
Data Centers	Net-to-Gross – Customer Self-Report Surveys		X		X
Data Centers	Net-to-Gross – Trade Ally Interviews		X		X
Data Centers	Process Analysis	X	X	X	X
Industrial Systems Optimization	Tracking System Review	X	X	X	X
Industrial Systems Optimization	Data Collection – Participant Surveys	X	X	X	X
Industrial Systems Optimization	Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Industrial Systems Optimization	Impact – Engineering Review	X	X	X	X
Industrial Systems Optimization	Impact – Modeling	X	X	X	X
Industrial Systems Optimization	Impact – Verification & Realization Rate	X	X	X	X
Industrial Systems Optimization	Net-to-Gross – Customer Self-Report Surveys		X		X
Industrial Systems Optimization	Net-to-Gross – Trade Ally Interviews		X		X
Industrial Systems Optimization	Process Analysis	X	X	X	X
Instant Discounts	Tracking System Review	X	X	X	X
Instant Discounts	Data Collection – Participant Surveys	X	X	X	X
Instant Discounts	Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Instant Discounts	Data Collection – Trade Ally Interviews/Roundtables	X	X	X	X
Instant Discounts	Impact – Measure-Level Deemed Savings Review	X	X	X	X
Instant Discounts	Impact – Verification & Realization Rate	X	X	X	X
Instant Discounts	Net-to-Gross – Participant Self-Report Surveys	X		X	
Instant Discounts	Net-to-Gross – Trade Ally Interviews	X		X	
Instant Discounts	Process Analysis	X	X	X	X
Street Lighting	Tracking System Review	X	X	X	X
Street Lighting	Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Street Lighting	Data Collection – Stakeholder Interviews	X	X	X	X
Street Lighting	Impact – Engineering Review	X	X	X	X
Street Lighting	Impact – Verification & Realization Rate	X	X	X	X
Street Lighting	Impact – Measure-Level Deemed Savings Review	X	X	X	X
Street Lighting	Process Analysis	X		X	
Business New Construction	Tracking System Review	X	X	X	X
Business New Construction	Data Collection – Participant Surveys	X	X	X	X
Business New Construction	Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Business New Construction	Impact – Engineering Review	X	X	X	X

Program	Task	2018	2019	2020	2021
Business New Construction	Impact – Modeling	X	X	X	X
Business New Construction	Impact – Verification & Realization Rate	X	X	X	X
Business New Construction	Net-to-Gross – Customer Self-Report Surveys	X	X	X	X
Business New Construction	Net-to-Gross – Trade Ally Interviews		X		X
Business New Construction	Process Analysis	X	X	X	X
Appendix	Tracking System Review	X	X	X	X
Operational Efficiency/Facility Assessments	Data Collection – Participant Surveys		X		X
Operational Efficiency/Facility Assessments	Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Operational Efficiency/Facility Assessments	Data Collection – Stakeholder Interviews	X	X	X	X
Operational Efficiency/Facility Assessments	Impact – Billing Analysis	X	X	X	X
Operational Efficiency/Facility Assessments	Impact – Engineering Review	X	X	X	X
Operational Efficiency/Facility Assessments	Impact – Measure-Level Deemed Savings Review	X	X	X	X
Operational Efficiency/Facility Assessments	Impact – Modeling	X	X	X	X
Operational Efficiency/Facility Assessments	Impact – Verification & Realization Rate	X	X	X	X
Operational Efficiency/Facility Assessments	Researched NTG Analysis		X		X
Operational Efficiency/Facility Assessments	Participant Interviews	X	X	X	X
Operational Efficiency/Facility Assessments	Effective Useful Life Determination	X	X	X	X
Operational Efficiency/Facility Assessments	Process Analysis	X	X	X	X
Power TakeOff	Tracking System Review	X	X	X	X
Power TakeOff	Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Power TakeOff	Net-to-Gross – Customer Self-Report Surveys	X			
Power TakeOff	Impact – Modeling	X	X	X	X
Public Housing Authorities	Tracking System Review	X	X	X	X
Public Housing Authorities	Data Collection – Participant Surveys	X	X	X	X

Program	Task	2018	2019	2020	2021
Public Housing Authorities	Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Public Housing Authorities	Impact – Engineering Review	X	X	X	X
Public Housing Authorities	Impact – Modeling	X	X	X	X
Public Housing Authorities	Impact – Verification & Realization Rate	X	X	X	X
Public Housing Authorities	Net-to-Gross – Customer Self-Report Surveys		X		X
Public Housing Authorities	Net-to-Gross – Trade Ally Interviews		X		X
Public Housing Authorities	Process Analysis	X	X	X	X
Retrocommissioning	Tracking System Review	X	X	X	X
Retrocommissioning	Data Collection – Participant Surveys		X		X
Retrocommissioning	Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Retrocommissioning	Data Collection – Trade Ally Interviews		X		X
Retrocommissioning	Impact – Project-specific Billing Analysis	X	X	X	X
Retrocommissioning	Impact – Engineering Review	X	X	X	X
Retrocommissioning	Impact – Verification & Realization Rate	X	X	X	X
Retrocommissioning	Net-to-Gross – Customer Self-Report Surveys		X		X
Retrocommissioning	Net-to-Gross – Trade Ally Interviews		X		X
Retrocommissioning	Process Analysis	X	X	X	X
Rural Small Business EE Kits	Tracking System Review	X			
Rural Small Business EE Kits	Data Collection – Program Manager and Implementer Interviews	X			
Rural Small Business EE Kits	Impact – Measure-Level Deemed Savings Review	X			
Rural Small Business EE Kits	Impact – Verification & Realization Rate	X			
Strategic Energy Management	Tracking System Review	X	X	X	X
Strategic Energy Management	Data Collection – Participant Surveys		X		X
Strategic Energy Management	Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Strategic Energy Management	Data Collection – Stakeholder Interviews	X	X	X	X
Strategic Energy Management	Impact – Billing Analysis	X	X	X	X
Strategic Energy Management	Impact – Engineering Review	X	X	X	X
Strategic Energy Management	Impact – Measure-Level Deemed Savings Review	X	X	X	X
Strategic Energy Management	Impact – Modeling	X	X	X	X
Strategic Energy Management	Impact – Verification & Realization Rate	X	X	X	X
Strategic Energy Management	Process Analysis	X	X	X	X

Program	Task	2018	2019	2020	2021
Small Business (private sector)	Tracking System Review	X	X	X	X
Small Business (private sector)	Data Collection – General Population Surveys	X	X		
Small Business (private sector)	Data Collection – Participant Surveys	X	X	X	X
Small Business (private sector)	Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Small Business (private sector)	Data Collection – Stakeholder Interviews	X	X	X	X
Small Business (private sector)	Data Collection – Trade Ally Interviews	X	X	X	
Small Business (private sector)	Impact – Billing Analysis	X	X	X	X
Small Business (private sector)	Impact – Engineering Review	X	X	X	X
Small Business (private sector)	Impact – Measure-Level Deemed Savings Review	X	X	X	X
Small Business (private sector)	Impact – Modeling	X		X	
Small Business (private sector)	Impact – Verification & Realization Rate	X	X	X	X
Small Business (private sector)	Net-to-Gross – Customer Self-Report Surveys	X		X	
Small Business (private sector)	Net-to-Gross – Trade Ally Interviews	X		X	
Small Business (private sector)	Process Analysis	X	X	X	X
Small Public Facilities (public sector)	Tracking System Review	X	X	X	X
Small Public Facilities (public sector)	Data Collection – General Population Surveys	X		X	
Small Public Facilities (public sector)	Data Collection – Participant Surveys	X	X		X
Small Public Facilities (public sector)	Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Small Public Facilities (public sector)	Data Collection – Stakeholder Interviews	X	X	X	X
Small Public Facilities (public sector)	Data Collection – Trade Ally Interviews	X	X		X
Small Public Facilities (public sector)	Impact – Billing Analysis (as needed)	X	X	X	X
Small Public Facilities (public sector)	Impact – Engineering Review	X	X	X	X
Small Public Facilities (public sector)	Impact – Measure-Level Deemed Savings Review	X	X	X	X
Small Public Facilities (public sector)	Impact – Modeling (as needed)	X	X	X	X
Small Public Facilities (public sector)	Impact – Verification & Realization Rate	X	X	X	X
Small Public Facilities (public sector)	Net-to-Gross – Customer Self-Report Surveys		X		X

Program	Task	2018	2019	2020	2021
Small Public Facilities (public sector)	Net-to-Gross – Trade Ally Interviews		X		X
Small Public Facilities (public sector)	Process Analysis	X	X	X	X
Standard	Tracking System Review	X	X	X	X
Standard	Data Collection – General Population Surveys			X	
Standard	Data Collection – Participant Surveys	X	X	X	
Standard	Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Standard	Data Collection – Stakeholder Interviews	X		X	
Standard	Data Collection – Trade Ally Interviews	X	X		X
Standard	Impact – Billing Analysis	X		X	
Standard	Impact – Engineering Review	X	X	X	X
Standard	Impact – Measure-Level Deemed Savings Review	X	X	X	X
Standard	Impact – Verification & Realization Rate	X			
Standard	Net-to-Gross – Customer Self-Report Surveys		X	X	
Standard	Net-to-Gross – Trade Ally Spillover Research		X		
Standard	Process Analysis	X	X	X	X

**Table C. Residential Programs Four-Year Plan**

Program	Task	2018	2019	2020	2021
Appliance Rebates	Tracking System Review	X	X	X	X
Appliance Rebates	Data Collection – Participant Surveys	X	X	X	X
Appliance Rebates	Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Appliance Rebates	Data Collection – Trade Ally Interviews	X		X	
Appliance Rebates	Impact – Measure-Level Deemed Savings Review	X	X	X	X
Appliance Rebates	Impact – Verification & Realization Rate	X	X	X	X
Appliance Rebates	Net-to-Gross – Customer Self-Report Surveys	X	X	X	X
Appliance Rebates	Process Analysis	X	X	X	X
Elementary Education Kits	Tracking System Review	X	X	X	X
Elementary Education Kits	Data Collection – Parent, Teacher, and Student Surveys	X	X	X	X
Elementary Education Kits	Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Elementary Education Kits	Impact – Measure-Level Deemed Savings Review	X	X	X	X
Elementary Education Kits	Impact – Verification & Realization Rate	X	X	X	X
Elementary Education Kits	Net-to-Gross – Participant Take-Home Surveys to Estimate FR		TBD	TBD	TBD
Elementary Education Kits	Net-to-Gross – Survey to Estimate Spillover		TBD	TBD	TBD
Elementary Education Kits	Process Analysis	X	X	X	X
Fridge/Freezer Recycling	Tracking System Review	X	X	X	X
Fridge/Freezer Recycling	Data Collection – Participant Surveys	X	X	X	X
Fridge/Freezer Recycling	Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Fridge/Freezer Recycling	Impact – Modeling (Metering Study)		X		
Fridge/Freezer Recycling	Impact – Verification & Realization Rate	X	X	X	X
Fridge/Freezer Recycling	Net-to-Gross – Customer Self-Report Surveys	X	X	X	X
Fridge/Freezer Recycling	Net-to-Gross – Trade Ally Interviews	X	X	X	X
Fridge/Freezer Recycling	Net-to-Gross Analysis		TBD	X	TBD
Fridge/Freezer Recycling	Process Evaluation	TBD	X	TBD	X
HEA - Single Family	Tracking System Review	X	X	X	X
HEA - Single Family	Data Collection – Program Manager and Implementer Interviews	X	X	X	X
HEA - Single Family	Impact – Measure-Level Deemed Savings Review	X	X	X	X
HEA - Single Family	Impact – Research “Leave Behind” Power Strips ISRs	X	X		
HEA - Single Family	Impact – Verification & Realization Rate	X	X	X	X
HEA - Single Family	Net-to-Gross – Customer Self-Report Surveys			X	
HEA - Single Family	Net-to-Gross – Trade Ally Interviews			X	
HEA - Single Family	Process Analysis	X	X	X	X
HVAC Rebates	Tracking System Review	X	X	X	X
HVAC Rebates	Data Collection – Participant Surveys	X		X	

Program	Task	2018	2019	2020	2021
HVAC Rebates	Data Collection – Program Manager and Implementer Interviews	X	X	X	X
HVAC Rebates	Data Collection – Trade Ally Interviews	X		X	
HVAC Rebates	Impact – Measure-Level Deemed Savings Review	X	X	X	X
HVAC Rebates	Impact – Verification & Realization Rate	X	X	X	X
HVAC Rebates	Net-to-Gross – Customer Self-Report Surveys	X		X	
HVAC Rebates	Net-to-Gross – Trade Ally Interviews	X		X	
HVAC Rebates	Process Analysis	X		X	
Lighting Discounts	Tracking System Review	X	X	X	X
Lighting Discounts	Data Collection – In-store Intercept Participant Surveys	X	X	X	X
Lighting Discounts	Data Collection – In-store Shelf Surveys		X		X
Lighting Discounts	Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Lighting Discounts	Data Collection – Trade Ally Interviews	X	X		X
Lighting Discounts	Impact – Measure-Level Deemed Savings Review	X	X	X	X
Lighting Discounts	Impact – Verification & Realization Rate	X	X	X	X
Lighting Discounts	Net-to-Gross – Customer Self-Report Surveys	X	X	X	X
Lighting Discounts	Process Analysis	X	X	X	X
Multi-Family Market Rate	Tracking System Review	X	X	X	X
Multi-Family Market Rate	Data Collection – Participant Surveys	X		X	
Multi-Family Market Rate	Data Collection – Program Manager and Implementer Interviews	X		X	
Multi-Family Market Rate	Data Collection – Property Manager Interviews	X	X	X	X
Multi-Family Market Rate	Data Collection – Trade Ally Interviews	X		X	
Multi-Family Market Rate	Impact – Billing Analysis	X	X	X	X
Multi-Family Market Rate	Impact – Engineering Review	X	X	X	X
Multi-Family Market Rate	Impact – Measure-Level Deemed Savings Review	X	X	X	X
Multi-Family Market Rate	Impact – Verification & Realization Rate	X	X	X	X
Multi-Family Market Rate	Net-to-Gross – Customer Self-Report Surveys	X			
Multi-Family Market Rate	Process Analysis	X	X	X	X
Multi-Family Market Rate	Impact – In-Service rates and persistence of APS	X	X		
Middle School Kits	Tracking System Review	X			
Middle School Kits	Data Collection – Participant Surveys	X			
Middle School Kits	Data Collection – Program Manager and Implementer Interviews	X			
Middle School Kits	Impact – Measure-Level Deemed Savings Review	X			
Middle School Kits	Impact – Verification & Realization Rate	X			
Middle School Kits	Impact – In-Service Rates for A{S Measures				
Home Energy Reports	Tracking System Review	X	X	X	X
Home Energy Reports	Data Collection – Program Manager and Implementer Interviews	X	X	X	X

Program	Task	2018	2019	2020	2021
Home Energy Reports	Impact – Modeling	X	X	X	X
Residential New Construction	Tracking System Review	X	X	X	X
Residential New Construction	Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Residential New Construction	Data Collection – Trade Ally Interviews		X		
Residential New Construction	Impact – Calibrated Simulation Modeling		X		
Residential New Construction	Impact – Verification & Realization Rate	X	X	X	X
Residential New Construction	Net-to-Gross – Trade Ally Interviews		X		
Residential New Construction	Process Analysis	X	X	X	X
Weatherization – Market Rate	Tracking System Review	X	X	X	X
Weatherization – Market Rate	Data Collection – Participant Surveys	X	X	X	X
Weatherization – Market Rate	Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Weatherization – Market Rate	Data Collection – Trade Ally Interviews	X		X	
Weatherization – Market Rate	Impact – Measure-Level Deemed Savings Review	X	X	X	X
Weatherization – Market Rate	Impact – Verification & Realization Rate	X	X	X	X
Weatherization – Market Rate	Net-to-Gross – Customer Self-Report Surveys	X	X	X	X
Weatherization – Market Rate	Net-to-Gross – Trade Ally Interviews	X		X	
Weatherization – Market Rate	Process Analysis	X			X

## APPENDIX B. BUSINESS PROGRAMS EVALUATION PLANS

### ComEd AirCare Plus Program CY2018 to CY2021 Evaluation Plan

#### Introduction

The aim of the AirCare Plus Program is to optimize the energy performance of HVAC packaged rooftop units and split systems, including mechanical adjustments (tune-ups) and hardware retrofits. AirCare Plus is implemented by CLEAResult and was launched during PY7. The measures available through AirCare Plus are AC tune-up, thermostat replacement and adjustment, and cogged v-belt installation. The program also includes incentives for economizer repair, replacement and adjustment of economizer changeover sensor, digital economizer upgrade, replacement of damper assembly, and mechanical reduction of over-ventilation. The energy savings net planning targets are shown in Table 1.

**Table 1. AirCare Plus CY2018 Savings Goals**

Sector	Net Energy Savings (MWh)
Private	19,686
Public	3,474

The primary objective of the Calendar Year 2018 (CY2018) evaluation of the AirCare Plus program is to assess energy savings by (1) verifying quantities of measures installed and (2) reviewing impact parameters, algorithms and assumptions.

Notable program changes made from PY9 to CY2018 include:

- Increasing the Advanced Rooftop Control incentives to increase contractor participation.
- The addition of an RTU sealing measure that seeks to prevent air leakage to the supply/return air streams (including evaporator).
- The addition of an Early Retirement measure that seeks to retire old, inefficient--but still functional--air conditioning equipment.

The CY2018 gross impact evaluation will not vary from the previous years, but adjustments will be made to reflect specific measure and project characterizations.

The evaluation of this program over the coming four years will include a variety of data collection and analysis activities, including those indicated in Table 2.

**Table 2. Evaluation Approaches - Four Year Plan**

Tasks	CY2018	CY2019	CY2020	CY2021
Tracking System Review	X	X	X	X
Data Collection – Participant Surveys		X		X
Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Data Collection – Trade Ally Interviews		X		X
Impact – Engineering Review	X	X	X	X
Impact – Measure-Level Deemed Savings Review	X	X	X	X
Impact – Verification & Gross Realization Rate	X	X	X	X
Impact – Field Work (On-Site Metering)	X			
Net-to-Gross – Customer Self-Report Surveys		X		X
Net-to-Gross – Trade Ally Interviews		X		X
Process Analysis	X	X	X	X

The evaluation team determined the evaluation approach for the 2018-2021 period, based upon the needs of the program and the program’s history. The 4-year evaluation approach for this program is based on the following:

- Gross and net impact analyses will be conducted each year
- Optimized timing on when to conduct each year
- NTG analysis every other year when programs are stable and NTG results are consistent over time
- NTG analysis each year when markets or program designs are changing
- CPAS will be calculation based upon the requirements of FEJA
- Process surveys will be conducted each year based upon client request, program performance, and trade ally network details.

**Coordination**

Other Illinois utilities have parallel programs (e.g., boiler tune-ups), but there do not appear to be other programs that are highly similar to AirCare Plus. No coordination with other utilities’ evaluation teams is necessary for this program.

**Evaluation Research Topics**

The evaluation will seek to answer the following key researchable questions:

**Impact Evaluation**

1. Are the engineering work paper algorithms and inputs accurate and reasonable?
2. What are the program’s verified gross savings?
3. What are the program’s verified net savings?

**Process Evaluation and Other Research Topics**

The process evaluation effort for CY2018 will focus on program delivery. The process research will address the following questions:

1. Are participants satisfied with the program? Should the implementer consider making process changes to increase satisfaction?
2. How can the program be improved?
3. How is the merging with the public-sector programs impacting the program in CY2018?

**Evaluation Approach**

This evaluation plan identifies tasks on a preliminary basis (Table 3). Calendar year (CY) refers to the year of participation that will be researched, not the time that the research will occur.

**Table 3. Evaluation Plan Summary**

Activity	CY2018
Gross Impact Approach	Engineering File Review
Gross Sampling Frequency	Twice (Wave 1 and Final)
Verified Net Impact Approach	Deemed value
Program Manager and Implementer Interviews/ Review Materials	Yes
Participant Survey	Yes (Process)
Additional Activities	Trade Ally Surveys and Field Work to be performed in CY2018

Table 4 summarizes data collection methods, data sources, timing, and targeted sample sizes that will be used to answer the evaluation research questions.

**Table 4. Core Data Collection Activities and Sample**

CY	What	Who	Target Completes CY2018	When
2018	Engineering Review	Participating Customers	Based on participation	June 2018 – August 2018 and February - March 2019
2018	Telephone Surveys	Participating Customers	Based on participation	January - February 2019
2018	In-Depth Interviews	Program Management	2	December 2018

In line with program changes and accelerated evaluation schedule for delivering tracking data to the valuation team, Navigant will perform tracking system review and M&V project sampling in waves in 2018. The first wave of M&V sampling is expected to cover about one half of the projects.

### Gross Impact Evaluation

The impact evaluation will consist of two different components: (1) verification of quantity and type of measure installed using the tracking system database, and (2) engineering review of algorithms and inputs for each type of measure. The Illinois Technical Reference Manual (TRM) v6.0 deems algorithms for the major program measures. Through the course of the engineering review, Navigant may make recommendations for updates or changes to the program measure algorithms. These recommendations will be provided to the Illinois Stakeholders Advisory Group (SAG) for consideration in future TRMs.

Navigant will perform tracking system review and impact analysis in two waves in CY2018. The first wave of M&V sampling is expected to cover about one half of projects completed in CY2018. Proposed gross impact sampling timelines are as follows:

- a) Wave 1 sample will start in June 2018 and complete in August 2018.
- b) Final Wave will start February 2019 (or earlier, if final data is available) and will complete in 60 days.

Core data collection activities will include an engineering examination of ComEd workpapers and tracking system calculations of claimed savings.

The gross savings impact approach will review the ex ante measure type to determine whether it is covered by the Illinois TRM or whether it is a non-deemed measure that is subject to retrospective per unit savings adjustment of custom variables. The measure type, deemed or non-deemed, will dictate the savings verification approach.

#### Savings Verification

- Measures with per unit savings values deemed by the TRM, would have verified gross savings estimated by multiplying deemed per unit savings (kWh and kW) by the verified quantity of eligible measures installed. Eligible deemed measures must meet all physical, operational, and baseline characteristics required to be assigned to the deemed value as defined in the TRM.<sup>7</sup>
- Measures with fully custom or partially-deemed ex ante savings will be subject to retrospective evaluation adjustments to gross savings on custom variables. For fully custom measures, Navigant will subject the algorithm and parameter values to evaluation adjustment, where necessary. For partially-deemed measures, TRM algorithms and deemed parameter values will be used where specified by the TRM, and evaluation research will be used to verify custom variables.

The measure-level realization rates will be determined using a census sampling method to yield ex post evaluation-adjusted gross energy savings. Gross realization rates will be developed for energy and demand savings.

The evaluation team will calculate gas savings achieved by the program and convert it to electric savings.

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<sup>7</sup> Illinois Statewide Technical Reference Manual for Energy Efficiency Version 6.0, available at: <http://www.ilsag.info/technical-reference-manual.html>

**Verified Net Impact Evaluation**

The verified net impact evaluation will apply the net-to-gross (NTG) ratio accepted by Illinois Stakeholders Advisory Group (SAG) consensus to estimate the verified net savings for the program.

**Table 5. Deemed NTG Values for CY2018**

Program Measure	CY2018 Deemed NTG Value
All Measures	0.90

Source:  
[http://ilsagfiles.org/SAG\\_files/NTG/2017\\_NTG\\_Meetings/Final/ComEd\\_NTG\\_History\\_and\\_PY10\\_Recommendations\\_2017-03-01.xlsx](http://ilsagfiles.org/SAG_files/NTG/2017_NTG_Meetings/Final/ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.xlsx)

**Research NTG Impact Evaluation**

The evaluation will conduct NTG research in CY2019 to inform NTG recommendations for the future. This NTG research will be done through participant interviews, trade ally interviews and will account for the different types of measures within the program.

**Calculation of CPAS and Annual Savings**

As required by the Future Energy Jobs Act (FEJA), Navigant will report ex post gross and ex post net savings for the program and the cumulative persisting annual savings (CPAS) in CY2018 will be calculated along with the total CPAS. Additionally, the weighted average measure life will be estimated, if possible. Evaluation will also add the savings converted from gas savings to electric savings so that it's documented in the report.

**Process Evaluation**

The process evaluation will include program manager surveys and participant surveys. In addition to quantifying NTG, the participant surveys will assess program satisfaction. The process evaluation will also include a review of the tracking system. Project overviews for selected projects will be requested from the implementer.

Navigant will perform additional process research, upon the request of the program manager, to support the program manager and implementer in transitioning into the revised regulatory requirements starting in CY2018.

**Use of RCT and QED**

Navigant is not evaluating the AirCare Plus Program via a randomized controlled trial (RCT) because the program was not designed with randomly assigned treatment and control groups. Navigant is not using quasi-experimental consumption data (QED) for the following reasons.

- There are not enough participants in this program to achieve statistically significant savings estimates using this method.
- It would not be possible to create a valid matched group for the customers in this program.

### *CY2018 Impact Research*

The air conditioner tune-up measure uses pre-tune-up and post-tune-up field efficiency measurements to calculate savings, as allowed by the TRM. The TRM v6.0 also provides deemed savings values for this measure, when pre-post testing data is unavailable. The pre-post methodology consistently achieves higher savings than the deemed energy savings percentages prescribed in the TRM. On average, the pre-post testing methodology results in 21 percent energy savings, whereas the deemed methodology allows 15 percent savings as the highest savings estimate. Navigant believes the magnitude of savings claimed warrants further analysis. We recommend reviewing the protocols for measuring EER values, reviewing the measures involved in achieving the ex ante savings (e.g., coil cleaning, refrigerant charge correction), and conducting a field metering effort in 2018. Navigant will use the results from this additional research effort to provide recommendations for future revisions of the IL TRM.

## Evaluation Schedule

Table 6 below provides the schedule for key deliverables and data transfer activities. (See Table 3 for other schedule details.) Adjustments will be made, as needed, as evaluation activities progress.

**Table 6. Schedule - Key Deadlines**

Activity or Deliverable	Responsible Party	Date Delivered
Program Operations Manual and Workpapers	ComEd	January 2, 2018
CY2018 participating customer survey design	Evaluation	May 15, 2018
CY2018 program tracking data for QA/QC	ComEd	June 1, 2018
CY2018 program tracking data for sampling Wave 1	ComEd	July 2, 2018
Tracking System Ex Ante Review Findings and Recommendations	Evaluation	August 1, 2018
Tracking System Ex Ante Review Findings and Recommendations	Evaluation	August 1, 2018
Wave 1 project documentation, engineering reviews, schedule, conduct on-site M&V, feedback	Evaluation	September 15, 2018
Wave 1 participating customer process survey fielding	Evaluation	September 28, 2018
CY2018 Program tracking data for sampling Final Wave	ComEd	January 30, 2019
Final Wave project documentation, engineering reviews, schedule, feedback	Evaluation	February 28, 2019
Illinois TRM Update Research Findings	Evaluation	March 4, 2019
Process Analysis Findings	Evaluation	March 4, 2019
Internal Report Draft by Navigant	Evaluation	March 4, 2019
Draft Report to ComEd and SAG	Evaluation	March 8, 2019
Comments on draft (15 Business Days)	ComEd and SAG	March 29, 2019
Revised Draft by Navigant	Evaluation	April 5, 2019
Comments on redraft (5 Business Days)	ComEd and SAG	April 12, 2019
Final Report to ComEd and SAG	Evaluation	April 23, 2019

## ComEd Business Energy Analyzer Program CY2018 to CY2021 Evaluation Plan

### Introduction

The ComEd Business Energy Analyzer (BEA) Program is a free, opt-in program for ComEd business and public sector customers consisting of a suite of self-serve tools they can access by logging into an integrated online platform. The tools at the site enable users to leverage the energy usage data collected by their meters to gain greater insight and control over their energy use, improve their energy efficiency, and reduce their utility bills. Participating customers can use the BEA web platform at any time, and as frequently as they wish. To participate, customers need only navigate to the BEA page on the ComEd website and provide their ComEd account ID, a valid email address, and the zip code for their business premise. No further actions are required.<sup>8</sup> Customers can use the BEA platform to review their recent energy consumption and compare it to their consumption in previous years, as well as to that of similar businesses in their area. They can also research possible energy efficiency projects to improve their energy efficiency and save money, and identify other ComEd programs they may qualify for. The current BEA platform and application were designed for ComEd by Agentis Energy (Agentis). During Calendar

<sup>8</sup> See <https://www.youtube.com/watch?v=dKX6FBKrALU> for more information on the BEA Program.

Year 2018 (CY2018), ComEd will transition the program to a new platform which will be designed and run by FirstFuel, but the intent is to have it continue to provide a similar customer experience.<sup>9</sup>

Since BEA is an opt-in program, Navigant will use matching methods to obtain a comparison group to measure the program savings of new enrollees in CY2018. The evaluation in CY2018 will mirror the approach we took in evaluating the program in PY6-PY8, which is described in the PY8 evaluation report.<sup>10</sup>

The evaluation of this program over the coming four years will include a variety of data collection and analysis activities, including those shown in Table 1

**Table 1. Evaluation Approaches – Four Year Plan**

Tasks	CY2018	CY2019	CY2020	CY2021
Tracking System Review	X	X	X	X
Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Impact – Regression Analysis	X	X	X	X
Midyear Comparison Legacy Savings: Agentis and FirstFuel	X			

Over the 2018 to 2021 cycle, the evaluation team expects to conduct the same type of analysis for each of the four years in this evaluation cycle, except for the comparison between the old and the new platform which will only occur in CY2018. We will conduct impact evaluation to estimate net savings each year. Net-to-gross research is not needed for this program as the results are net by nature of the quasi-experimental evaluation design. Evaluation of the program may be altered slightly going forward, depending on various findings or needs of the program.

**Coordination**

At this time, there are not equivalent programs at other Illinois utilities. We will continue to monitor that situation.

**Evaluation Research Topics**

The evaluation will seek to answer the following key researchable questions:

**Impact Evaluation**

1. What are the program’s annual total verified gross savings?
2. What are the program’s verified net savings?

<sup>9</sup> Some differences in the new platform are: (1) all ComEd non-residential customers will have access to the FirstFuel platform via MyAccount, (2) customers with only monthly consumption data will also be able to use the new tools (though those with “smart” (AMI or AMR) meters will have more granular insight into their usage patterns), and (3) where applicable, participants will be able to see usage by building and meter as well as by account.

<sup>10</sup> Navigant Consulting, “ComEd Agentis Business Energy Analyzer Pilot Program Evaluation Report,” (March 20, 2017).

[http://ilsagfiles.org/SAG\\_files/Evaluation\\_Documents/ComEd/ComEd\\_EPY8\\_Evaluation\\_Reports\\_Final/ComEd-Agentis\\_Business\\_Energy\\_Analyzer\\_PY8\\_Evaluation\\_Report\\_2017-03-20\\_Final.pdf](http://ilsagfiles.org/SAG_files/Evaluation_Documents/ComEd/ComEd_EPY8_Evaluation_Reports_Final/ComEd-Agentis_Business_Energy_Analyzer_PY8_Evaluation_Report_2017-03-20_Final.pdf)

## Evaluation Approach

Table 2 summarizes the evaluation tasks for CY2018, including data collection methods, data sources, timing, and targeted sample sizes that will be used to answer the evaluation research questions.

We have prepared an evaluation plan summary to identify tasks on a preliminary basis (Table 2). Final activities will be determined annually as program detail and requirements become known.

**Table 2: Evaluation Plan Summary for BEA**

Activity	CY2018
Gross, Net* Impacts Evaluation	Regression Analysis
Uplift Savings Adjustment	Difference-in-Difference
Sampling Frequency	Annual
Program Manager and Implementer Interviews / Review Materials	Yes

\*The regression analysis produces impact estimates that are intrinsically net of free-ridership and most spillover bias, although not of uplift savings.

## Gross Impact Evaluation

As in previous evaluations, Navigant will measure the BEA Program’s CY2018 energy savings using a regression with pre-program matching (RPPM) approach. The matching method relies on energy usage data obtained from the meters of program participants, as well as from a set of non-participating customers, to estimate program savings. The pool of non-participants from which the matches are drawn will consist of a large sample of eligible non-participant ComEd Business customers. For each BEA participant, Navigant will compare the average daily energy consumption in each month during the pre-enrollment year to that of all customers in the pool of potential matches over the same period. The quality of the potential match is indicated by the Euclidean distance between their usage and that of the participant calculated over the matching period. The non-participant whose energy usage minimizes this distance during the pre-enrollment year will be chosen as the match for that participant. Once matches are drawn Navigant will run a lagged dependent variable (LDV) model<sup>11</sup> comparing participants and their matched controls to determine energy usage. A full description of this method is provided in the PY8 evaluation report.<sup>12</sup>

Navigant will estimate savings due to the uplift in enrollment in other ComEd EE programs caused by the BEA program using the same approach we used to evaluate the program in previous years. We will report BEA Program energy savings net of uplift savings to avoid double-counting of savings. Savings from enrollment uplift in both CY2018 and PY6-PY9 will be considered.

<sup>11</sup> The model is identical to the post-program regression (PPR) model used in previous evaluations. We have changed the nomenclature to better align with academic research and because LDV is more descriptive of the model structure than PPR.

<sup>12</sup> *Ibid.* See also Daniel Ho, Kosuke Imai, Gary King, Elizabeth A. Stuart, “Matching as Nonparametric Preprocessing for Reducing Model Dependence in Parametric Causal Inference,” *Political Analysis* (2007) 15: 199-236 (downloadable at: <http://gking.harvard.edu/files/matchp.pdf>).

### Verified Net Impact Evaluation

Program savings calculated using the RPPM approach are inherently net savings, due to the use of a matched control group. As long as the participant and control groups are similar with respect to the distribution of factors driving spillover and free-ridership, the nature of the savings calculation ensures that the effects will be differenced out. Therefore, no further net-to-gross (NTG) adjustment is necessary.

### Calculation of CPAS and Annual Savings

As required by the Future Energy Jobs Act (FEJA), Navigant will report ex post gross and ex post net savings for the program and the cumulative persisting annual savings (CPAS) in CY2018 will be calculated. Converted gas savings cannot be calculated for this program, due to a lack of gas usage data.

### Process Evaluation

The process evaluation for this program will be limited to interviews with the program manager and implementation contractor.

### *Comparison of Legacy Savings on New, Old BEA Platforms*

To verify that the new platform developed by FirstFuel is providing participants with a level of service comparable to those available on the previous platform developed by Agentis, Navigant will draw a random, one-in-three sample from the set of approximately 1,500 legacy BEA participants that enrolled between PY6 and PY9. ComEd will actively encourage these customers to continue using BEA on the Agentis-designed platform for several months; the remaining legacy BEA participants will be asked to shift to the new FirstFuel platform.<sup>13</sup> Navigant will compare the savings of these two random subsets of legacy participants over the first five months of CY2018, testing the hypothesis that there is no statistically meaningful difference between the two.

## Data Requirements

Table 3 shows the data Navigant will need for the CY2018 evaluation.

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<sup>13</sup> Any customers enrolling for the first time in PY9 will use the FirstFuel platform.

**Table 3. Data Requirements for CY2018 BEA Evaluation**

Required Data	Relevant Information Requested
Tracking Data	For all BEA participants:
	• Account ID
	• Date participant was enrolled in BEA
	• Move-out date (if relevant)
Customer Usage Data	• Type of Business or Segment
	For Legacy Waves 1-4* BEA participants:
	• Account ID
	• Daily energy usage values <sup>†</sup> for CY2018 (Jan 1, 2018 – Dec 31, 2018)
	For all Wave 5* BEA participants and a suitable sample of non-participants:
• Account ID	
• Daily energy usage values <sup>†</sup> from at least one year prior to enrollment date through the end of CY2018 (Dec 31, 2018)	

\* Waves 1-4 comprise participants who enrolled in PY6, PY7, PY8 and PY9, respectively. Wave 5 comprises participants who enrolled during CY2018 (Jan 1 – Dec 31, 2018).

† Daily values rolled up from 30-minute interval AMI/AMR meter data obtained from Agentis and FirstFuel.

## Evaluation Schedule

Table 4 below provides the schedule for key deliverables and data transfer activities. Adjustments will be made, as needed, as evaluation activities progress.

**Table 4. Schedule – Key Deadlines**

Activity or Deliverable	Responsible Party	Date Delivered
Interim evaluation data request sent to ComEd / ICs*	Navigant	May 31, 2018
Interim evaluation data delivered to Navigant	ComEd / ICs	June 30, 2018
Interim comparison findings sent to ComEd	Navigant	July 31, 2018
Final evaluation data request sent to ComEd / ICs	Navigant	December 31, 2018
Final evaluation data delivered to Navigant	ComEd / ICs	January 30, 2019
Draft Report to ComEd and SAG	Navigant	March 15, 2019
Comments on draft (15 Business Days)	ComEd and SAG	April 5, 2019
Revised Draft by Navigant	Navigant	April 12, 2019
Comments on redraft (5 Business Days)	ComEd and SAG	April 19, 2019
Final Report to ComEd and SAG	Navigant	April 27, 2019

\* Data required for the interim savings comparison include daily usage values for Jan 1 – May 31, 2018 for both legacy enrollees and potential matched controls.

## ComEd Business New Construction Program CY2018 to CY2021 Evaluation Plan

### Introduction

This plan covers the ninth program year for the Business New Construction Program. Calendar Year 2018 (CY2018) is the tenth program year of ComEd's energy efficiency savings portfolio and the seventh program year for energy efficiency gas savings (January 1, 2018 to December 31, 2018).

This evaluation plan reflects evaluation approaches designed for the unique characteristics of this program and which originated in discussions between the implementation and evaluation teams over the course of the past several years. The primary objectives of this evaluation are as follows:

- Provide adjusted gross impacts for all completed projects using a researched realization rate.
- Provide verified net savings for all electric and gas projects completed in CY2018.
- Use a "real time" approach for the eventual derivation of NTGR, interviewing project representatives as they enter the reservation stage.

The CY2018 program did not change significantly from PY9. The program has continued to develop and offer different program tracks to cater to different types of participants. These include the legacy Comprehensive Track, the Expedited Assistance Track, the Design Replication Track, and the Accelerate Performance Track. The tracks vary in the incentives and technical assistance offered by the program based on the type of project and the point at which the project enters the program. In addition to these tracks, the program began serving public sector projects in Program Year 9 (PY9) and the first public sector projects are slated to complete in CY2018.

The Business New Construction Program is coordinated between ComEd, Nicor Gas, Peoples Gas and North Shore Gas Companies. The evaluation activities and timing for each utility evaluation are the same, as this is one evaluation effort for all four utilities. Desk reviews and participant interviews are done without respect to which gas utility it is associated. In PY8, there were no gas projects completed in Peoples Gas or North Shore Gas territories. Net-to-gross (NTG) ratios are deemed prospectively with separate NTG values for electric and for gas. Beyond these points, the ComEd evaluation team will coordinate on any relevant evaluation issue on an as needed basis.

### Joint Evaluation Approach

This plan outlines the evaluation objectives and activities for the program and how results pertain to each utility. To recognize the singular nature of the program, the evaluation team will synthesize process findings from each fuel type into a single set of findings. The impact evaluation work will be slightly more fuel-specific: the electric impact evaluation will focus on a sample of projects with electric savings (75 projects expected in CY2018), while the gas impact evaluation will focus on a sample of projects claiming gas savings (30 projects expected in CY2018).

The CY2018 gross impact evaluation will not vary from the previous years, and will rely on engineering desk reviews. As in past years, the CY2018 evaluation will include rolling customer free ridership research. The findings from the study will inform recommended NTG values for the Illinois Stakeholder Advisory Group (SAG) approval and future program application. The CY2018 free ridership research will include in-depth interviews with participating customers to learn about their perspectives and satisfaction with the program, the energy assessment services and incentive offerings, and how to improve the program in the future.

The evaluation team will use the same general evaluation approach for all tracks of the program, including the public-sector projects, but will account for the variations in the tracks (e.g., qualified measures) as needed. To the extent there are enough projects to be meaningful, we will present results for each track as well as overall results for the program.

**Table 1. Evaluation Approaches – Four Year Plan**

Tasks	CY2018	CY2019	CY2020	CY2021
Tracking System Review	X	X	X	X
Data Collection – Participant Interviews	X	X	X	X
Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Impact – Engineering Review	X	X	X	X
Impact – Modeling	X	X	X	X
Impact – Verification & Gross Realization Rate	X	X	X	X
Net-to-Gross – Free Ridership Self-Report Surveys	X	X	X	X
Net-to-Gross – Spillover Research			X	
Process Analysis	X	X	X	X

The evaluation of this program over the coming four years (2018-2021) will include a variety of data collection and analysis activities, including those indicated in Table 1. The evaluation team determined the approach for the four-year period based on the program’s needs and history. Given that the program includes very large custom projects and that the program is rolling out several new initiatives to better serve specific customer groups, we plan to conduct most research activities, including impact, process, and free-ridership analyses, annually. This approach will ensure that any year-to-year variations due to individual projects will not affect future years as well as provide the program with timely information to continue to improve the program’s design.

**Coordination**

Navigant will coordinate with the evaluation teams for other utilities on any issues relevant to this program.

**Evaluation Research Topics**

The objectives of the CY2018 evaluation are as follows:

1. Provide adjusted gross impacts for all completed projects using a researched realization rate.
2. Provide verified net savings for all projects completed in CY2018.
3. Update the verification, due diligence, and tracking system review from CY2018, if needed.
4. Continue the existing approach for NTG derivation. This includes:
  - a. Review of program documentation for projects that have recently reached the reservation stage, including:
    - i. Project narratives and technical assistance summaries
    - ii. Design documents collected throughout the customer’s participation process and final design and engineering plans, and building models to help guide in-depth interview questioning. If needed, coordinate with the implementation team

to discuss their understanding of the project's participation prior to the evaluation team interviewing the project contacts.

- b. Collection of NTGR data from an interview conducted within 30 days of, or as soon as possible after the reservation date to minimize possible measurement issues associated with respondent recollection.

The CY2018 evaluation will seek to answer the following key researchable questions:

### *Impact Evaluation*

- What are the researched gross energy and demand impacts?
- What are the verified net impacts from the program using SAG-approved NTG ratios?
- Did the program meet its energy and demand savings goals? If not, why not?
- What are the free ridership values to be used prospectively in future program years?

### *Process Evaluation*

- What design or implementation changes, including changes to the gas portion of the program, occurred in CY2018, and how has this, if at all, changed the way the program is offered?
- What is the level of participation for the different program tracks?
- How do participants' experience with the program differ for the different program tracks?
- What challenges did the program face over the course of the program year and how did the program respond to them?

## Evaluation Approach

Table 2 summarizes the surveys, interviews, and other primary data sources that will be used to answer these research questions in CY2018. We anticipate employing similar sources and data collection activities in the evaluation of future program years, though quantities of projects reviewed will differ.

**Table 2. Core Data Collection Activities, Sample, and Analysis**

Activity	Target	Target Completes CY2018	Timeline	Notes
In Depth Interviews	Program Management and Implementers	2	April – Dec 2018	Augment with monthly calls
Gross Impact	Early Feedback File Review	5	June 2018 – Feb 2019	Early Feedback for Large Projects, As Needed
Gross Impact	Engineering Desk Review	30†	June 2018 – Feb 2019	Two Waves*†
Verified Net Impact	Calculation using deemed NTG ratio	n/a	March 2019	
Researched NTG and Process	Telephone Interview with Participating Customers	~50	April 2018 – March 2019	FR, Process, Targeting Projects Currently in Reservation Phase
Process and Impact Research on CY2018 Operations	Literature review, secondary research	n/a	April 2017 – March 2019	Process, Impact

Note: FR = Free Ridership

\* The total number of projects receiving engineering desk reviews for each year may change based on the final list of projects and their savings. Navigant will coordinate with ComEd to determine appropriate dates to pull tracking data extracts for each wave.

† Navigant will coordinate with ComEd to determine appropriate dates to pull tracking data extracts for each wave.

Table 3 lists other secondary data sources that will be referenced to answer the research questions.

**Table 3. Secondary Data Sources**

Reference Source	Author	Gross Impacts	Net Impacts	Process
Program Tracking Database	Program Administrator	X	X	X
Email Correspondence	Program Administrator		X	
Building Plans	Program Administrator	X	X	
Program Marketing and Outreach Materials	Program Administrator			X
International Energy Conservation Code (IECC) 2015	International Code Council	X		
ASHRAE Building Standards and Guidelines	ASHRAE	X		

Note: The program will use IECC 2018 beginning in CY2019

In line with program changes and an accelerated evaluation schedule for delivering tracking data to the valuation team, Navigant will perform tracking system review and M&V project sampling in waves in 2018. The first wave of M&V sampling is expected to cover about two-thirds of the projects.

Proposed gross impact sampling timelines are shown below.

#### CY2018 Gross Impact Sampling Waves

- a) First wave sample drawn in July 2018 and completed September 2018
- b) Final wave starts January 2019 (or projects completion date)

## Gross Impact Evaluation

The evaluation team will conduct gross savings research on a sample of approximately 30 projects to determine CY2018 savings and calculate realization rates. This research will include an engineering desk review of each project in our sample. The evaluation team will also develop a summary sheet for each project reviewed that outlines the evaluation activities completed, the resulting changes to the model (as applicable), and the effect on the electric and therm savings claimed.

Per the program design, the baseline for all projects (when not using deemed values) will typically be based on the appropriate Illinois Energy Conservation Code for Commercial Buildings. As in prior evaluations, the evaluation team will use the project's application date to determine which version of the Illinois Energy Conservation Code, which references the International Energy Conservation Code (IECC), is the most appropriate to use as baseline. Notably, this reference specifically allows for use of ASHRAE Standard 90.1 as an alternate compliance method.

The evaluation team will also calculate interactive savings associated with projects for each utility to be used within the cost-effectiveness analysis by each fuel type. We include all interactive effects for projects the program database indicates are within participating gas companies' service territories (e.g., the project receives natural gas service from Nicor Gas and electric service from ComEd, but may or may not have received a gas incentive). We will also present researched savings without interactive effects for comparison to utility goals.

Some new construction projects have high uncertainty surrounding the baseline selection (e.g., major renovations with HVAC reconfiguration), resulting in higher risk for downward evaluation savings adjustment. In such cases, a review of the baseline by the evaluation team prior to incentive commitment may reduce savings uncertainty. As a part of monthly evaluation update calls, there will be an opportunity for the program staff to identify projects where they perceive higher uncertainty. After discussion, the program staff and evaluation team may agree to have the evaluation team follow-up with a brief but deeper review of project details, and provide feedback on baseline selection within 10 days. The evaluation follow-up review will be optional, advisory and non-binding, but may serve to reduce downward savings adjustments.

### *Gross Impact Evaluation Sampling Approach*

The evaluation team plans to create two sample frames, one focused on electric projects and the other focused on gas projects. The electric sample frame will be composed only of projects with electric savings. These projects may or may not have gas savings and may or may not be in any of the participating gas utilities' service territories. The gas sample frame will consist of all gas projects with positive therm savings before interactive effects from electric measures, regardless of whether the project received a gas incentive.<sup>14</sup> Within each of the sample frames, we plan to use a stratified random sample design. Each sample will be designed to reach 90% confidence and 10% precision two tailed for MWh and therms, respectively. The overall sample will include 30 projects, approximately 12 of which will have received gas incentives.<sup>15</sup>

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<sup>14</sup> Similarly, when estimating verified savings, the evaluation will include all therm savings in the gas utilities' service territories with the interactive effects removed whether or not the project received a gas incentive.

<sup>15</sup> The number of projects in the sample may change based on the final list of projects and their savings.

**Table 4. Estimated Number of Projects in Sample**

Fuel-Type	Estimate of Projects in Sample (Approximate)
Electric	18
Gas	12
<b>Total</b>	<b>30</b>

Navigant will perform tracking system review and M&V project sampling in two waves in CY2018. The first wave of M&V sampling is expected to cover about one-third of projects completed in CY2018. Proposed gross impact sampling timelines are shown below.

**Verified Net Impact Evaluation**

The verified net impact evaluation will apply the net-to-gross (NTG) ratio accepted by Illinois Stakeholders Advisory Group (SAG) consensus to estimate the verified net savings for the program.

**Table 5. Deemed NTG Values for CY2018**

Utility	CY2018 Deemed NTG Value
ComEd (MW and MWh)	0.60
Gas Utilities (therms)	0.77

Source:  
[http://ilsagfiles.org/SAG\\_files/NTG/2017\\_NTG\\_Meetings/Final/ComEd\\_NTG\\_History\\_and\\_PY10\\_Recommendations\\_2017-03-01.xlsx](http://ilsagfiles.org/SAG_files/NTG/2017_NTG_Meetings/Final/ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.xlsx), [PGL\\_and\\_NSJ\\_GPY7\\_NTG\\_Values\\_2017-03-01\\_Final.xlsx](#), and [Nicor Gas GPY7 NTG Values 2017-03-01 Final.xlsx](#)

**Research NTG Impact Evaluation**

The team will implement a real-time approach for deriving the NTGRs, which captures data as projects progress through the stages of participation. This methodology will include the following:

1. **Documentation Review.** The evaluation team will begin by reviewing the documentation on each sampled project provided by the implementation contractor to identify potential points of influence. This component will include:
  - a. Reviewing project narratives for indications of program influence.
  - b. Reviewing building plans from throughout the project’s participation to identify changes in efficiency throughout the construction process.
  - c. If needed, discussing the project with the implementation contractor to confirm areas where they believe the program was influential.
  
2. **Post-Reservation Interview.** Once a sampled project reaches the reservation stage, the implementation contractor will provide the evaluation team contact information for key decision makers and the team will conduct a post-reservation interview within 30 days or as soon as possible. We will also incorporate customized questions for each project linked to the points of influence identified in the documentation review. During these interviews, the team will also collect process data.

To fully implement the real time NTGR approach, we will conduct interviews with all projects currently in the reservation stage, regardless of program year, to best capture the program’s early influence. Because

we will attempt to interview a census of projects, no sampling of projects or differentiation between electric and gas savings is needed. While we will attempt a census of all such projects, based on past evaluations, we expect to complete about 50 interviews.

### Calculation of CPAS and Annual Savings

As required by the Future Energy Jobs Act (FEJA) for electric energy efficiency, the Navigant will report ex post gross and ex post net savings for the program and the cumulative persisting annual savings (CPAS) in CY2018 will be calculated along with the total CPAS. Additionally, we will develop a weighted average measure life based on recent program years, if possible. The evaluation team will also add the savings converted from gas savings to the electric savings so that it is documented in the report.

### Process Evaluation

The program instituted several new participation tracks to the program in EPY9/GPY6 and these are fully rolling out in CY2018. Additionally, the program will begin to serve public sector customers in CY2018. The process evaluation explores participants' characteristics, satisfaction, and experiences, as well as other program implementation changes—such as changes to the program's marketing and outreach strategy, and program challenges. We will collect this information through program manager interviews, program participant interviews, and a review of program materials. In program participant interviews, we will ask about their experience with elements of the specific program tracks, as applicable, to provide the program with actionable information about the different tracks. Because of the nature of the questions and the fact that we will be asking these process-related questions to a census of participants in the reservation phase as part of the net-to-gross interviews, a randomized controlled trial or quasi-experimental design is not applicable for this research.

Navigant will perform additional process research, upon the request of the program manager, to support the program manager and implementer in transitioning into the revised regulatory requirements starting in CY2018. Possible topics may include, but will not be limited to, research on impact of public sector projects introduced into the program and investigation of the effects of codes and standards on the baseline of new construction in the ComEd service territory.

### Use of RCT and QED

The evaluation team will not use the Randomized Control Trials (RCT) or Quasi-Experimental Design for process evaluation because:

- There are not enough participants in this program to achieve statistically significant savings estimates using this method.
- It would not be possible to create a valid matched control group for the customers in this program.
- This method would estimate average savings across all program participants which is not the desired savings estimate for this program

### Evaluation Schedule

Table 6 below provides the schedule for key deliverables and data transfer activities. (See Table 2 for other schedule details.) Adjustments will be made, as needed, as evaluation activities progress.

**Table 6. Schedule – Key Deadlines**

Activity or Deliverable	Responsible Party	Date Delivered
Monthly calls with program/implementation staff	Evaluation Team, ComEd	Ongoing
CY2018 program tracking data for participant interviews	ComEd	April 1, 2018
Post-reservation phase participant interviews	Evaluation	April 1, 2018 through November 30, 2018
CY2018 program tracking data for sampling Wave 1	ComEd	June 1, 2018
Wave 1 engineering desk reviews	Evaluation	September 30, 2018
Process Analysis Findings	Evaluation	December 15, 2018
EUL Research Memo	Evaluation	December 15, 2018
CY2018 program tracking data for sampling Wave 2	ComEd	January 30, 2019
Wave 2 engineering desk reviews	Evaluation	February 28, 2019
NTG Analysis Findings	Evaluation	March 1, 2019
Internal Report Draft by Navigant	Evaluation	March 1, 2019
Draft Report to ComEd, Gas Utilities, and SAG	Evaluation	March 8, 2019
Comments on draft (15 Business Days)	ComEd and SAG	March 29, 2019
Revised Draft by Navigant	Evaluation	April 9, 2019
Comments on redraft (5 Business Days)	ComEd and SAG	April 16, 2019
Final Report to ComEd, Gas Utilities, and SAG	Evaluation	April 24, 2019

**ComEd CHP Program CY2018 to CY2021 Evaluation Plan**

**Introduction**

The ComEd Energy Efficiency Program includes a combined heat and power (CHP) program for business customers. This program provides a deemed or custom incentive, based on eligibility requirements outlined in TRM v.6, for CHP installations incentivized under Retrofit, New Construction, or Custom programs. CHP incentives are available based on the project’s kWh savings, provided the project meets all program eligibility requirements.

Notable program considerations in CY2018 include:

- The program will report annual savings and lifetime savings
- CHP Program savings will be reported separate from other ComEd Business projects.

The objective of the evaluation is to quantify net savings impacts from the Combined Heat and Power (CHP) Program for each Calendar Year in the four-year plan (CY2018 - CY2021). Key evaluation activities for CY2018 will take place from January 2018 through March 2019. For the CY2018 evaluation, the evaluation team will work towards parallel, real-time verification and analysis, and parallel impact evaluation per ComEd. The main purpose of this is that it allows earlier engineering review and M&V work, ensuring that critical impact issues are resolved in early stages. Navigant expects most or all CHP projects will utilize a parallel impact evaluation approach, allowing Navigant, the implementers, and the ComEd team to provide information regarding appropriate savings approaches early in the process. Since large projects are likely to be selected in the sample, the evaluation team will review them in early stages of the project and provide feedback to ComEd as needed. This is to ensure that the calculation methodology and M&V plans align with the expectations of the evaluation team.

The evaluation of this program over the coming four years will include a variety of data collection and analysis activities, including those indicated in the following table.

**Table 1. Evaluation Approaches – Four Year Plan**

Tasks	CY2018	CY2019	CY2020	CY2021
Tracking System Review	X	X	X	X
Data Collection – Participant Surveys	X	X	X	X
Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Impact – Engineering Review	X	X	X	X
Impact – Modeling (as needed)	X	X	X	X
Impact – Verification & Gross Realization Rate	X	X	X	X
Net-to-Gross – Customer Self-Report Surveys	X		X	
Net-to-Gross – Trade Ally Interviews	X		X	
Process Analysis (as needed)	X	X	X	X

Process evaluation will be performed as needed and it will be triggered based on the changes to the program scope, goals or to the implementation team.

## Coordination

Navigant will coordinate with the evaluation teams for other utilities on any issues relevant to this program. Specifically, Ameren Illinois currently incentivizes CHP projects under their custom program provided they are below the 10 MW statewide maximum threshold. The small number of Ameren pipeline projects in recent years exceeded the 10 MW limit and therefore will not be completed under an Ameren program. Other CHP system improvements for existing CHP systems are being incentivized under the Ameren custom program. Ameren hopes to have a small number of CHP projects near the end of the four-year plan.

The ComEd evaluation team will coordinate with the Ameren evaluators to ensure that the two CHP evaluations use similar approaches, following the guidance in the TRM where applicable, and to identify and report on any substantive differences.<sup>16</sup> The ComEd evaluation team will coordinate with the Ameren team on data collection and survey instrument design to ensure consistency and appropriate questions in the customer surveys.

## Evaluation Research Topics

The evaluation will seek to answer the following key researchable questions:

### Impact Evaluation

1. What are the program's annual and total lifetime verified gross savings?
2. What is the research estimate of gross electric and gas savings (energy, peak demand, and total demand) for the program?
3. What are the program's annual and lifetime verified net savings?
4. Secondary questions include:
  - o Are the ex ante per-unit gross impact savings correctly implemented by the tracking system and reasonable for this program?
  - o What updates are recommended for the Illinois Technical Reference Manual (TRM)?
  - o What are the results of field data collection?
  - o Are the measure life assumptions valid and up-to-date?
5. Identify opportunities for improvement to the program impact calculations and estimates.
6. Assess whether the program has met its energy savings goals. If not, explain why.
7. Provide real-time, parallel evaluation for a sample of large projects to provide evaluation input, starting as early as the pre-application phase while M&V plans and baseline are being established. Feedback from the evaluation team will be provided before each application is finalized and paid by the program.

### Process Evaluation and Other Research Topics

The process evaluation effort for CY2018 will focus on program delivery. The process research will address the following questions:

1. What are participants' perspectives and overall satisfaction with the program?
2. What are effective marketing strategies to inform customers of the CHP program?

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<sup>16</sup> Opinion Dynamics is the lead evaluator for Ameren Illinois energy efficiency programs.

3. How can the program be improved?

### Evaluation Approach

The table below summarizes the evaluation tasks for CY2018 including data collection methods, data sources, timing, and targeted sample sizes that will be used to answer the evaluation research questions.

We have prepared an evaluation plan summary to identify tasks on a preliminary basis (Table 2). Final activities will be determined annually as program detail and requirements become known.

**Table 2: Evaluation Plan Summary for CHP Program**

Activity	CY2018
Gross Impact Approach	Engineering File Review/ On-site M&V
Gross Sampling Frequency	Quarterly Census Sample & Early Feedback for Pipeline Projects
Verified Net Impact Approach	Deemed Value
Researched NTG Approach	Participant Survey
Researched NTG Timing	CY2018 Participants
Program Manager and Implementer Interviews/ Review Materials	Yes
Decision Maker Survey <sup>17</sup>	FR, SO
NTG Trade Ally Interviews	As needed

<sup>17</sup> FR refers to Free-Ridership and SO refers to Spillover

Table 3 below summarizes the proposed data collection activities for CY2018 including the sample sizes and timing of each activity. At the time of this plan, three known CHP projects are in the pipeline, with possible savings for two expected to occur in Q4 2018 and Q4 2019.

**Table 3. Core Data Collection Activities, Sample, and Analysis**

Activity	Target	Target Completes CY2018	Timeline	Notes
Tracking System Review	Tracking system	Census	Quarterly March 30, 2018 June 29, 2018 September 28, 2018 January 11, 2019 (final program tracking data)	
In Depth Interviews	Program Management and Implementers	2	April 2018	Augment with monthly calls
Onsite M&V Audit	Participating Customers	TBD	June 2018 – Feb 2019	
Gross Impact	Early Feedback File Review	TBD	June 2018– Feb 2019	Early Feedback for Pipeline Projects
Gross Impact	Engineering File Review	TBD	April 2018 – Feb 2019	Quarterly
Gross Impact	On-site M&V	TBD	April 2018 – Feb 2019	
Verified Net Impact	Calculation using deemed NTG ratio	NA	March 2019	
EUL Research	Develop EUL from secondary research	NA	Jan 2018 onwards	Ongoing effort
Use of AMI	Leverage AMI data to confirm savings as needed	TBD	June 2018 – March 2019	
Researched NTG and Process	Telephone Survey with Participating Customers	TBD	June 2018 – March 2019	FR & SO, Process, as needed
Researched NTG and Process ‡	Telephone Interviews with Influential Trade Allies Triggered by Customer Responses	TBD	June 2018 – March 2019	FR & SO, Process, as needed
Process and Impact Research on CY2018 Operations	Literature review, secondary research	TBD	April 2018 – Feb 2019	Process, Impact

Note: FR = Free Ridership; SO = Spillover

† Navigant will coordinate with ComEd to determine appropriate dates to pull tracking data extracts.

‡ Trade ally surveys are triggered by high importance ratings by participating customers to the trade ally or vendor. Therefore, the number of trade ally or vendor surveys is dependent on the results of the participating customer surveys.

### Gross Impact Evaluation

The evaluation will analyze program-level savings data for all CHP projects (census sample). In the event that more than 35 CHP projects are completed in a single evaluation year, the sampling approach will

change to a random sampling approach targeting 90 percent confidence and 10 percent relative precision (90/10). Final annual program gross and net impact results will be based upon evaluation results for each entire program year (e.g., CY2018). A census sample approach will comply with the PJM verification requirements outlined in Manual 18B.

Regarding core data collection methodologies, ComEd will have an opportunity to review and comment on the M&V plans as they are drafted, prior to conducting a site visit. Navigant expects all CHP projects to utilize a parallel evaluation approach, so that Navigant, the implementer, and ComEd have an opportunity to discuss the recommended verification approach in advance of the CHP system being purchased or installed. Any comments provided by ComEd will be reviewed and addressed accordingly before finalizing the M&V plan. However, because of the tight timeline, the evaluation team expects to receive the comments on these M&V plans within five business days after the draft plans are completed.

Pre-metering and post-installation interval metering data will be collected from the program implementers for all projects. The evaluators will also request all available production data and other pertinent records and files from the implementers for all projects.

On-site M&V audits will be performed for all projects above 5 MW.<sup>18</sup> Out of these projects, the evaluation team will select projects for metering from stratum one and stratum two sample points. These projects will be selected based on the verified conditions and available ex ante project documentation so that evaluation metering efforts can contribute significantly to developing ex post analysis.

Additionally, on-site audits will also include collecting information from dedicated facility meters for the system power usage or load profile (e.g., air-flow profile), when available. Production data and spot measurements will be collected to support ex post savings calculations. The evaluation will verify both net generation and total system efficiency. Specific types of data that need to be considered in the evaluation of CHP projects, and are expected to be available from the CHP unit interface, targeted datalogging, or equipment nameplate, include annual hours of operation of the CHP system, annualized useful thermal energy output, useful annualized electricity output, total annualized fuel consumed by the CHP system, CHP nameplate capacity, parasitic electric load required to run the CHP system, on-site boiler efficiency for energy that is displaced by the CHP system, and other proxy variables as needed to annualize and verify savings, including relevant temperature setpoints and schedules. The expected level of granularity for data is hourly or sub-hourly.

Engineering desk reviews will be performed for all projects to complete ex post analysis. Desk reviews do not incorporate on-site audits. Desk reviews involve review of project documentation provided by the program, an engineering review of the algorithms and auditing ex ante calculation models used by the program to estimate energy savings. The engineering audit of program calculations determines if the inputs that feed the program calculations are reasonable and acceptable or need revision based on evaluation findings. Additionally, telephone interviews with the site contact(s) will be conducted in support of these desk reviews and information obtained from the interviews will be used to verify savings. Also, site contact(s) will be requested to provide production data electronically for measure(s) installation detail. The savings will be adjusted based on all the available information.

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<sup>18</sup> The evaluation team may choose to perform additional onsite visits if there is uncertainty associated with the savings or if enough documentation was not provided for the desk review sites.

In addition to these data collection methods highlighted above, Navigant staff responsible for CHP program evaluation will attend standing monthly Custom program calls with ComEd to discuss CHP project status, evaluation updates, and project-specific issues. This will allow for early discussion and feedback on project findings, as well as provide a setting for early feedback and real-time, parallel evaluation discussions. ComEd will also have an opportunity to review and comment on the M&V plans as they are drafted, prior to conducting a site visit. Any comments provided by ComEd will be reviewed and addressed accordingly before finalizing the M&V plans for a project.

A site-specific engineering analysis will be performed for all projects. The engineering analysis methods will vary from project-to-project, depending on the complexity of the measures installed, the size of the associated electric and gas savings and the availability and reliability of existing data. Gross impact calculation methodologies are generally based on IPMVP protocols, options A through D. We will communicate the evaluation M&V approach to the implementation team before conducting the site visit.

Navigant will utilize the guidance in the TRM v.6 CHP measure to assess the appropriate evaluation methodology, whether deemed or custom, for both gas and electric savings. Navigant will coordinate with Nicor Gas, Peoples Gas, and Northshore Gas evaluators relative to gas savings allocation as defined in the TRM. Based on the TRM, a deemed or prescriptive evaluation method will be used depending on the deemed eligibility requirements in TRM v. 6. Where not eligible for deemed savings, the evaluation will follow a custom methodology. Gas savings will be addressed based on avoided fuel use that would have been used to generate electricity, avoided boiler use due to the CHP system, gas consumption by the CHP system itself, and the appropriate heat rate per the TRM for a topping system. For a bottoming (waste-heat-to-power) system, the net avoided gas that would have been purchased to provide some or all of the useful thermal energy output of the CHP system.<sup>19</sup> Per the TRM, custom calculations may be used subject to agreement between the participant, the program administrator, and the independent evaluator (Navigant), however this does not eliminate ex post evaluation risk (retro-active adjustments), and CHP custom projects custom will be evaluated using custom methods.

The measure-level engineering review will verify documentation and installed measure inventory and characteristics, hours of operation, modes of operation, and characteristics of replaced equipment. Any measured values obtained during on-site M&V audits will also be used to revise algorithm assumptions as appropriate.

The gross realization rate will be calculated for each site as ex post divided by ex ante electric and/or gas savings, based on Navigant's determination of the appropriate variables and project boundaries according to the TRM, such as whether the CHP system is a topping or bottoming system, and whether the CHP system participated in both a gas and electric EEPS program. Given the long lead times for development of CHP projects, the evaluation will address projects that start during the plan period but do not complete one year of production within the evaluation year, by annualizing the savings based on IPMVP best practices, and attributing a full year of savings to the current evaluation year. Where insufficient information is available to extrapolate the savings beyond the available metering period (production period) for the current evaluation year, Navigant will develop a realization rate relative to a pro-rated ex ante value, covering only the period where production data is reasonably available for the current evaluation year.

For each site in the sample, a site-specific report detailing evaluation findings will be prepared. ComEd will have an opportunity to review and comment on the site-specific reports prior to each being finalized.

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<sup>19</sup> TRM, pp. 282-286.

## Verified Net Impact Evaluation

Net-to-Gross (NTG) evaluations have not been performed for this program since this is a new program. The evaluation will analyze NTG starting in CY2018. Note that the NTG approach will be fully compliant with the Illinois NTG framework for CHP programs that has been adopted by the SAG and is part of the Illinois statewide TRM. Evaluation will provide project-specific NTG values early for each project - we will apply a real-time, parallel evaluation approach on a project-by-project basis. Real-time free-ridership analysis will be conducted through a survey of participants. This approach to NTG research will be done in 2018 and 2020 such that the 2018 NTG values will be applied in 2018 and 2019 and the 2020 values will be applied in 2020 and 2021.

### *Data Collection Methods*

1. Telephone surveys with participant decision makers
2. Trade ally interviews – with participating equipment vendors (suppliers and/or installers).

### *Content*

**Net-to-gross ratio (NTGR):** The telephone surveys will provide all inputs needed for the calculation of the program's NTGR. We expect there will be a small number of CHP projects, and will therefore census sample them all and use enhanced rigor to evaluate the NTGR.

Participating customers will be interviewed in all cases. NTG research will also include interviews with program representatives and participating equipment vendors or influential opportunity assessment or facility assessment representatives. The vendor interviews will be conducted before the customer interviews. NTG research may also include secondary research on standard industry practices.

NTG survey questions will address both free ridership and participant spillover. NTG summaries detailing all the findings from the interview performed by senior consultant will be provided.

### *Sample*

The sampling approach for the participant surveys will attempt to survey all customers.

All telephone sample points selected will be submitted to ComEd to obtain Project Overview documents which provide information on the primary decision maker (name/phone/email address), program staff's role in project implementation and any additional data related to program influence. The evaluation team will review the Project Overview documents before conducting NTG interviews.

A net-to-gross ratio will be calculated in CY2018 using CY2018 participant surveys and applied retrospectively for CY2018. If enough data is available by the time of the SAG NTG deliberations in the fall of 2018, Navigant will present data for potentially deeming CY2019 NTG values through the SAG process. The telephone surveys will provide all inputs needed for the calculation of the program's net-to-gross ratio. Free ridership will be assessed using an algorithm approach which relies on survey self-report measure level data. Where there are multiple data sources, a result will be determined using triangulation between participant surveys, service provider surveys, implementation staff, and program staff interviews. Enhanced cases will include input from any relevant secondary research.

The existence of spillover will be examined using participant surveys self-report data. We will quantify spillover where (1) significant program influence is indicated and (2) significant spillover is revealed by the customer.

Information will be collected so to keep interviews a reasonable length. The self-reported data is based on the level of program influence as reported by the customer and service provider. This could be at either the whole project level or at the individual measure level, if sufficient sample is available and depending on the project.

### Calculation of CPAS and Annual Savings

As required by the Future Energy Jobs Act (FEJA), the measure-specific and total ex ante and verified ex post gross savings for the program and the cumulative persisting annual savings (CPAS) in CY2018 will be calculated for each measure along with the total CPAS for all measures. Additionally, the weighted average measure life will be estimated, if possible.

### Process Evaluation

An abbreviated process evaluation is planned. The process evaluation will: (1) determine participant satisfaction with the program overall, and key program elements; and, (2) assess the effectiveness of various program elements, such as incentive levels, marketing procedures, application processes, and participation procedures. A battery of process questions will be added to the planned surveys with participating customers. The process findings will be summarized in detail and a set of key findings and recommendations will be developed for ComEd's consideration.

The CY2018 process evaluation research will include a synthesis of both qualitative and quantitative data collected during the program staff and implementer interviews and meetings, and during the end-user customer surveys in CY2018. The CY2018 NTG study will include in-depth interviews with participating customers to learn about their perspectives and satisfaction with the program, amidst varying opportunities from program incentive offerings and changes to program application requirements.

Navigant will perform additional process research, upon the request of the program manager, to support the program manager and implementer in transitioning into the revised regulatory requirements starting in CY2018.

### Evaluation Schedule

Table 4 below provides the schedule for key deliverables and data transfer activities. (See Table 2 for other schedule details.) Adjustments will be made, as needed, as evaluation activities progress.

**Table 2. Schedule – Key Deadlines (typical year)**

Activity or Deliverable	Responsible Party	Date Delivered
Program Operations Manual and Workpapers	ComEd	January 15, 2018
CY2018 program tracking data for QA/QC	ComEd	Quarterly March 30, 2018 June 29, 2018 September 28, 2018 January 11, 2019 (final program tracking data)
CY2018 program tracking data (ongoing)	ComEd	Quarterly March 30, 2018 June 29, 2018 September 28, 2018 January 11, 2019 (final program tracking data)
CY2018 participating customer survey design	Evaluation	June 30, 2018
Parallel impact evaluation: project documentation, engineering reviews, schedule, conduct on-site M&V, feedback for pipeline projects (all projects)	Evaluation	July 30, 2018
Tracking System Ex Ante Review Findings and Recommendations for paid projects (all projects)	Evaluation	July 30, 2018
Participating customer NTG and process survey fielding	Evaluation	September 30, 2018 – February 28, 2019
Project documentation, engineering reviews, schedule, conduct on-site M&V, feedback	Evaluation	November 30, 2018 – February 28, 2019
Illinois TRM Update Research Findings	Evaluation	March 1, 2019
Process Analysis Findings	Evaluation	March 1, 2019
NTG Analysis Findings	Evaluation	March 1, 2019
Internal Report Draft by Navigant	Evaluation	March 1, 2019
Draft Report to ComEd and SAG	Evaluation	March 5, 2019
Comments on draft (15 Business Days)	ComEd and SAG	March 26, 2019
Revised Draft by Navigant	Evaluation	April 4, 2019
Comments on redraft (5 Business Days)	ComEd and SAG	April 11, 2019
Final Report to ComEd and SAG	Evaluation	April 18, 2019

**ComEd Custom Program CY2018 to CY2021 Evaluation Plan**

**Introduction**

The ComEd Custom Incentive Program provides a custom incentive, based on a formula, for less common or more complex energy-saving measures installed in qualified retrofit and equipment replacement projects for commercial and industrial customers. Custom incentives are available based on the project's kWh savings, provided the project meets all program eligibility requirements. For eligible projects, the program pays an incentive of \$0.07 per first-year kWh saved and the incentives are capped at 100% of the incremental project cost

Notable program changes made from PY9 to CY2018 include the incorporation of public sector customers.

The objective of the CY2018 evaluation is to quantify net savings impacts from the Custom Program. Evaluation activities for CY2018 will be similar to PY9. For the CY2018 evaluation, the evaluation team will work towards real time verification and analysis. The main purpose of this is that it allows earlier engineering review and M&V work, ensuring that critical impact issues are resolved in early stages. Since large projects are likely to be selected in the sample, the evaluation team will review them in early stages of the project and provide feedback to ComEd as needed. This is to ensure that the calculation methodology and M&V plans align with the expectations of the evaluation team.

The CY2018 gross impact evaluation will not vary from previous years, but adjustments will be made to reflect specific measure and project characterizations. The evaluation will include a participating customer free ridership and spillover study in CY2019. The findings from the study will inform recommended net-to-gross (NTG) values for the Illinois Stakeholder Advisory Group (SAG) approval and future program application. The CY2018 NTG study will include in-depth interviews with participating customers to learn about their perspectives and satisfaction with the program, the energy assessment services and incentive offerings, and how to improve the program in the future.

The evaluation of this program over the coming four years will include a variety of data collection and analysis activities, including those indicated in the following table.

**Table 1. Evaluation Approaches – Four Year Plan**

Tasks	CY2018	CY2019	CY2020	CY2021
Tracking System Review	X	X	X	X
Data Collection – Participant Surveys	X	X	X	X
Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Impact – Engineering Review	X	X	X	X
Impact – Modeling (as needed)	X	X	X	X
Impact – Verification & Gross Realization Rate	X	X	X	X
Net-to-Gross – Customer Self-Report Surveys		X *		X
Net-to-Gross – Trade Ally Interviews		X		X
Process Analysis (as needed)	X	X	X	X

\* A net-to-gross ratio will be calculated in CY2019 using a combination of CY2018 and CY2019 participant surveys for use in future evaluations.

The evaluation team determined the evaluation approach for the 2018-2021 period based upon the needs of the program and program's prior history. The four-year evaluation approach for this program is based on the following:

- Gross and net impact analysis will be conducted each year
- Optimized timing on when to conduct NTG research
- NTG analysis every other year when programs are stable and NTG results are consistent over time
- NTG analysis each year when markets or program designs are changing
- Cumulative Persistence Annual Savings (CPAS) will be calculated based upon the requirements of Future Energy Jobs Act (FEJA)
- Process surveys will be performed as needed as it will be triggered based on the changes to the program scope, goals or to the implementation team.

### Coordination

Navigant will coordinate with the evaluation teams for other utilities on any issues relevant to this program. Note that coordination with other utilities has not typically been needed for this program, but if issues arise, the evaluation team will coordinate needed discussion and evaluation.

### Evaluation Research Topics

The evaluation will seek to answer the following key researchable questions:

#### Impact Evaluation

1. What are the program's annual total lifetime verified gross savings?
2. What is the research estimate of gross savings (energy, peak demand, and total demand) for the program?
3. What are the program's lifetime verified net savings?
4. What are the gas savings created by the program?
5. What is the estimated free-ridership and spillover for CY2018 participating customers? What is the research estimate for participant spillover for this program?
6. Secondary questions include:
  - Are the ex ante per-unit gross impact savings correctly implemented by the tracking system and reasonable for this program?
  - Are the measure life assumptions valid and up-to-date?
7. Estimate the lifetime gross impacts from the program.
8. Identify opportunities for improvement to the program impact calculations and estimates.
9. Assess whether the program has met its energy savings goals. If not, explain why.
10. Estimate net impacts for CY2018. This will include an assessment of ComEd's program influence versus other factors in installing energy efficiency equipment.
11. Provide real-time evaluation for a sample of large projects to provide evaluation input, starting as early as the pre-application phase while M&V plans and baseline are being established.

Feedback from the evaluation team will be provided before each application is finalized and paid by the program.

12. Analyze effective useful life (EUL) of typical measures to report lifetime savings in the CY2018 program.
13. Assess the effectiveness of various program elements, such as incentive levels, marketing procedures, application processes, and participation procedures. Determine customer satisfaction with the program and various program elements.

**Process Evaluation and Other Research Topics**

The process evaluation effort for CY2018 will focus on program delivery. The process research will address the following questions:

1. What are participants’ perspectives and overall satisfaction with the program?
2. What are effective marketing strategies to inform customers of the Comprehensive Energy Savings Offers?
3. How can the program be improved?
4. How is the transition into CY2018 along with the public-sector programs impacting the program?

**Evaluation Approach**

The table below summarizes the evaluation tasks for CY2018 including data collection methods, data sources, timing, and targeted sample sizes that will be used to answer the evaluation research questions.

**Table 2: Evaluation Plan Summary**

Activity	CY2018
Gross Impact Approach	Engineering File Review and On-site M&V
Gross Sampling Frequency	Three Waves and Early Feedback for Large Projects
Verified Net Impact Approach	Deemed Value
Researched NTG Approach	Participant Survey
Researched NTG Timing	CY2018 Participants
Program Manager and Implementer Interviews, Review Materials	Yes
Decision Maker Survey	FR, SO *
NTG Trade Ally Interviews	As needed

FR = Free Ridership; SO = Spillover

Table 3 below summarizes the proposed data collection activities for CY2018 including the sample sizes and timing of each activity.

**Table 3. Core Data Collection Activities, Sample, and Analysis**

Activity	Target	Target Completes CY2018	Timeline	Notes
Tracking System Review	Tracking system	Census	Three waves	
In Depth Interviews	Program Management and Implementers	2	April 2018	Augment with monthly calls
Onsite M&V Audit	Participating Customers	TBD	June 2018 – Feb 2019	
Gross Impact	Early Feedback File Review	TBD	June 2018– Feb 2019	Early Feedback for Large Projects
Gross Impact	Engineering File Review	TBD	April 2018 – Feb 2019	Three Waves*
Gross Impact	On-site M&V	TBD	April 2018 – Feb 2019	
Verified Net Impact	Calculation using deemed NTG ratio	NA	March 2019	
EUL Research	Develop EUL from secondary research	NA	Jan 2018 onwards	Ongoing effort
Use of AMI	Leverage AMI data to confirm savings as needed	TBD	June 2018 – March 2019	
Researched NTG and Process	Telephone Survey with Participating Customers	TBD	June 2018 – March 2019	FR & SO, Process. Two Waves
Researched NTG and Process †	Telephone Interviews with Influential Trade Allies Triggered by Customer Responses	TBD	June 2018 – March 2019	FR & SO, Process. Two Waves
Process and Impact Research on CY2018 Operations	Literature review, secondary research	TBD	April 2018 – Feb 2019	Process, Impact

Note: FR = Free Ridership; SO = Spillover

\* Navigant will coordinate with ComEd to determine appropriate dates to pull tracking data extracts for each wave.

† Trade ally surveys are triggered by high importance ratings by participating customers to the trade ally or vendor. Therefore, the number of trade ally or vendor surveys is dependent on the results of the participating customer surveys.

In line with program changes and accelerated evaluation schedule for delivering tracking data to the evaluation team, Navigant will perform tracking system review and M&V project sampling in waves in 2018. The first wave of M&V sampling is expected to cover about one-third of the projects.

### Gross Impact Evaluation

The evaluation will analyze program-level savings data by project size to inform the sample design for this population of heterogeneous measures. Using the tracking data extract provided by ComEd, we will sort the projects from largest to smallest ex ante kWh claim and place them into one of three strata such that each stratum contains about one-third of the program total kWh claim.

The sample size will be calculated using the following equation:

$$n = \frac{ER^2}{\left(\frac{RP^2}{1.282^2} + \frac{ER^2}{N}\right)}$$

Where:

- n = Sample Size
- ER = Error Ratio
- RP = Relative Precision (10%)
- N = Estimated CY2018 Project Population
- 1.282 = One-tailed Z-Value for 90% Confidence

The error ratio will be calculated from a combination of prior program year results. The evaluation team will increase the cap of sample size to approximately 25 projects, but the final number will be determined when the final count of the CY2018 population is known. This approach is consistent with PY8 and PY9 program evaluations even though CY2018 evaluation is expected to see a larger population than previous years. If the population variability in CY2018 remains close to that in PY9, this cap will allow us to achieve the overall portfolio-level 90/10 requirements.

We will perform sampling in three phases during the CY2018 evaluation period. We will draw the sample for the first wave around May 2018 based on the number of paid projects completed. We will draw the sample for the second wave around October 2018 after majority of the projects have been finalized. The final sample will be drawn after the program participation closes at the end of January 2018 and projects have had a chance to be finalized and paid. Final program gross and net impact results will be based upon the three waves combined.

Proposed gross impact sampling timelines are shown below.

CY2018 Gross Impact Sampling Waves

- a) First wave sample drawn in April or May 2018 and completed July 2018
- b) Second wave sample drawn in October 2018 and completed November 2018
- c) Final wave starts February 2019 (or projects completion date)

Regarding core data collection methodologies, ComEd will have an opportunity to review and comment on the M&V plans as they are drafted, prior to conducting a site visit. Any comments provided by ComEd will be reviewed and addressed accordingly before finalizing the M&V plan. However, because of the tight timeline, the evaluation team expects to receive the comments on these M&V plans within five business days after the draft plans are completed.

Pre-metering and post-installation interval metering data will be collected from the program implementers for all the sampled projects. The evaluators will also request all available production data and other pertinent records and files from the implementers for all projects selected in the sample.

On-site M&V audits will be performed for approximately fifteen projects.<sup>20</sup> Out of these projects, the evaluation team will select projects for metering from stratum one and stratum two sample points. These

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<sup>20</sup> The evaluation team may choose to perform additional onsite visits if there is uncertainty associated with the savings or if enough documentation was not provided for the desk review sites.

projects will be selected based on the verified conditions and available ex ante project documentation so that evaluation metering efforts can contribute significantly to developing ex post analysis.

Additionally, on-site audits will also include collecting information from dedicated facility meters for the system power usage or load profile (e.g., air-flow profile), when available. Production data and spot measurements will be collected to support ex post savings calculations.

Engineering desk reviews will be performed for approximately five projects to complete ex post analysis. Desk reviews do not incorporate on-site audits. Desk reviews involve review of project documentation provided by the program, an engineering review of the algorithms and auditing ex ante calculation models used by the program to estimate energy savings. The engineering audit of program calculations determines if the inputs that feed the program calculations are reasonable and acceptable or need revision based on evaluation findings. Additionally, telephone interviews with the site contact(s) will be conducted in support of these desk reviews and information obtained from the interviews will be used to verify savings. Also, site contact(s) will be requested to provide production data electronically for measure(s) installation detail. The savings will be adjusted based on all the available information.

In addition to these data collection methods highlighted above, monthly calls will be held between the evaluation team and ComEd to discuss program status, evaluation updates, and project-specific issues. This will allow for early discussion and feedback on project findings, as well as provide a setting for early feedback and real-time evaluation discussions. ComEd will also have an opportunity to review and comment on the M&V plans as they are drafted, prior to conducting a site visit. Any comments provided by ComEd will be reviewed and addressed accordingly before finalizing the M&V plans for a project.

A site-specific engineering analysis will be performed for the sampled CY2018 projects. The engineering analysis methods will vary from project to project, depending on the complexity of the measures installed, the size of the associated savings and the availability and reliability of existing data. Gross impact calculation methodologies are generally based on IPMVP protocols, options A through D. We will communicate the evaluation M&V approach to the implementation team before conducting the site visit. The measure-level engineering review will verify documentation and installed measure inventory and characteristics, hours of operation, modes of operation, and characteristics of replaced equipment. Any measured values obtained during on-site M&V audits will also be used to revise algorithm assumptions as appropriate.

The gross realization rate will be calculated for each site, and for the sample. For each site in the sample, a site-specific report detailing evaluation findings will be prepared. ComEd will have an opportunity to review and comment on the site-specific reports prior to each being finalized. Site-level gross impact realization rates from the sample will then be extrapolated to the program population using a ratio estimation approach to calculate CY2018 program level gross impact estimates

The measure type will dictate the savings verification approach. We will also make a research estimate of gross savings based entirely on site-collected data and evaluation engineering analysis of savings. The two methods are described below:

#### 1. Savings Verification

- Measures with fully custom or partially-deemed ex ante savings will be subject to retrospective evaluation adjustments to gross savings on custom variables. For fully custom measures, Navigant will subject the algorithm and parameter values to evaluation adjustment, where necessary. For partially-deemed measures, TRM algorithms and deemed parameter values will be used where specified by the TRM, and evaluation research will be used to verify custom variables.

2. Evaluation Research Savings Estimate

- The evaluation will also include an analysis of on-site collected verification data for a subset of projects. The engineering analysis methods and degree of monitoring will vary from project to project, depending on whether the measure has deemed savings or not, the complexity of the measures, the size of the associated savings, the potential to revise input assumptions, and the availability and reliability of existing data. The evaluators will contact the implementers prior to conducting site visits to ensure that the evaluation team has all correct and relevant information.

The measure-level realization rates will be extrapolated to the program population using a ratio estimation method to yield ex post evaluation-adjusted gross energy savings. Gross realization rates will be developed for energy and demand savings. The sample design will provide 90/10 statistical validity for the overall program. The sample of approximately 15 on-site audits and 10 desk reviews is expected to achieve a 90/10 confidence/relative precision level (one-tailed test) to comply with the PJM verification requirements outlined in Manual 18B.

**Verified Net Impact Evaluation**

The verified net impact evaluation will apply the net-to-gross (NTG) ratio accepted by Illinois Stakeholders Advisory Group (SAG) consensus to estimate the verified net savings for the program.

**Table 4. Deemed NTG Values for CY2018**

Program Measure	CY2018 Deemed NTG Value
kWh	0.58
kW	0.70

Source:  
[http://ilsagfiles.org/SAG\\_files/NTG/2017\\_NTG\\_Meetings/Final/ComEd\\_NTG\\_History\\_and\\_PY10\\_Recommendations\\_2017-03-01.xlsx](http://ilsagfiles.org/SAG_files/NTG/2017_NTG_Meetings/Final/ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.xlsx)

**Research NTG Impact Evaluation**

Previous NTG evaluations have performed a NTG analysis for each program year. Due to the relatively stable results year to year, the evaluation team has scaled back the NTG research. The evaluation is currently analyzing the combined NTG analysis for PY8 and PY9. The evaluation will continue similar two-year cycles going forward. The evaluation team will perform the NTG interviews for CY2018 but the data will not be analyzed. After completing the NTG interviews for the CY2019 period, NTG analysis will be performed for both program years at the end of CY2019 and will be reported in the CY2019 Evaluation Report. The research plan net-to-gross ratios are based on primary data collected as described below. Note that the method described is fully compliant with the framework for Custom programs that has been adopted by the SAG and is part of the most recent Illinois statewide TRM.

**Data Collection Methods**

3. Telephone surveys with participant decision makers.
4. Trade ally interviews – with participating equipment vendors (suppliers and/or installers).

## Content

**Net-to-gross ratio:** The telephone surveys will provide all inputs needed for the calculation of the program's net-to-gross ratio. We will use the self-report method which assigns sampled projects to one of three levels of rigor, based on the size and complexity of the project:

- Basic – small or medium sized projects.
- Standard – larger projects and smaller projects representing those measure categories that comprise the highest percentage of program savings impacts.
- Enhanced – approximately 10-20% of the largest projects - this generally includes those with rebates of \$100,000 or greater.

Participating customers will be interviewed in all cases. Standard and enhanced cases will also include interviews with program representatives and participating equipment vendors or influential opportunity assessment or facility assessment representatives. The vendor interviews will be conducted before the customer interviews. Enhanced cases may also include secondary research on standard industry practices.

NTG survey questions will address both free ridership and participant spillover. For enhanced cases, NTG summaries detailing all the findings from the interview performed by senior consultant will be provided.

## Sample

The sampling approach for the participant surveys will attempt to survey a sample of CY2018 customers to achieve one-tailed 90/10 confidence/precision level at the program level over the two years, and will ensure that the sample points are representative of the program population over the two years.

All telephone sample points selected will be submitted to ComEd to obtain project overview documents which provide information on the primary decision maker (name/phone/email address), program staff's role in project implementation and any additional data related to program influence. The evaluation team will review the project overview documents before conducting NTG interviews

A net-to-gross ratio will be calculated in CY2018 using the combination of CY2018 and CY2019 participant surveys for use in future evaluations. The telephone surveys will provide all inputs needed for the calculation of the program's net-to-gross ratio. Free ridership will be assessed using an algorithm approach which relies on survey self-report measure level data. Where there are multiple data sources, a result will be determined using triangulation between participant surveys, service provider surveys, implementation staff, and program staff interviews. Enhanced cases will include input from any relevant secondary research.

The existence of spillover will be examined using participant surveys self-report data. We will quantify spillover where (1) significant program influence is indicated and (2) significant spillover is revealed by the customer.

The measure level information will be collected for the three largest measures to keep the interview to a reasonable length. However, this is only possible if there are sufficient findings differentiated by measure. The self-reported data is based on the level of program influence as reported by the customer and service provider. This could be at either the whole project level or at the individual measure level, if sufficient sample is available and depending on the project.

### Calculation of CPAS and Annual Savings

As required by FEJA, the measure-specific and total ex post gross and ex post net savings for the program and the CPAS in CY2018 will be calculated along with the total CPAS. Additionally, the weighted average measure life will be estimated, if possible. Evaluation will also add the savings converted from gas savings to the electric savings so that it's documented in the report.

### Process Evaluation

An abbreviated process evaluation is planned. The process evaluation will: (1) determine participant satisfaction with the program overall and key program elements; and, (2) assess the effectiveness of various program elements, such as incentive levels, marketing procedures, application processes, and participation procedures. A battery of process questions will be added to the planned surveys with participating customers. The process findings will be summarized in detail and a set of key findings and recommendations will be developed for ComEd's consideration.

The CY2018 process evaluation research will include a synthesis of both qualitative and quantitative data collected during the program staff and implementer interviews and meetings, and during the end-user customer surveys in CY2018. The CY2018 NTG study will include in-depth interviews with participating customers to learn about their perspectives and satisfaction with the program, amidst varying opportunities from program incentive offerings and changes to program application requirements.

Navigant will perform additional process research, upon the request of the program manager, to support the program manager and implementer in transitioning into the revised regulatory requirements starting in CY2018.

### Use of RCT and QED

The evaluation team will not use the Randomized Control Trials (RCT) or Quasi-Experimental Design for process evaluation because:

- There are not enough participants in this program to achieve statistically significant savings estimates using this method.
- It would not be possible to create a valid matched control group for the customers in this program.
- This method would estimate average savings across all program participants which is not the desired savings estimate for this program

### Evaluation Schedule

Table 5 below provides the schedule for key deliverables and data transfer activities. (See Table 3 for other schedule details.) Adjustments will be made, as needed, as evaluation activities progress.

**Table 5. Schedule – Key Deadlines**

Activity or Deliverable	Responsible Party	Date Delivered
Program Operations Manual and Workpapers	ComEd	January 15, 2018
CY2018 program tracking data for QA/QC	ComEd	May 1, 2018
CY2018 program tracking data for sampling Wave 1	ComEd	June 1, 2018
CY2018 participating customer survey design	Evaluation	June 30, 2018
Wave 1 project documentation, engineering reviews, schedule, conduct on-site M&V, feedback	Evaluation	July 30, 2018
Tracking System Ex Ante Review Findings and Recommendations	Evaluation	July 30, 2018
CY2018 program tracking data for sampling Wave 2	ComEd	August 30, 2018
Wave 1 participating customer NTG and process survey fielding	Evaluation	September 30, 2018
Wave 2 project documentation, engineering reviews, schedule, conduct on-site M&V, feedback	Evaluation	November 30, 2018
EUL Research Memo	Evaluation	December 15, 2018
CY2018 Program EOY Tracking Data	ComEd	January 30, 2019
Wave 2 participating customer NTG and process survey fielding	Evaluation	February 28, 2019
Wave 3 project documentation, engineering reviews, schedule, conduct on-site M&V, feedback	Evaluation	February 28, 2019
Illinois TRM Update Research Findings	Evaluation	March 1, 2019
Process Analysis Findings	Evaluation	March 1, 2019
NTG Analysis Findings	Evaluation	March 1, 2019
Internal Report Draft by Navigant	Evaluation	March 1, 2019
Draft Report to ComEd and SAG	Evaluation	March 5, 2019
Comments on draft (15 Business Days)	ComEd and SAG	March 26, 2019
Revised Draft by Navigant	Evaluation	April 4, 2019
Comments on redraft (5 Business Days)	ComEd and SAG	April 11, 2019
Final Report to ComEd and SAG	Evaluation	April 18, 2019

**ComEd Data Centers Program CY2018 to CY2021 Evaluation Plan**

The Data Centers Efficiency Program provides incentives for installing energy efficiency measures in both new and existing data centers. The program pays an incentive of \$0.07 per first-year kWh saved for eligible efficiency projects, and an incentive of \$0.10 per first-year kWh saved for both eligible relocations to colocation facilities and virtualization/IT measures.

The program also provides an early commitment incentive option to the customers. The early commitment option provides incentive funding certainty once an application is approved. Incentives are paid after successful completion of the project has been verified and will not be subject to change based on actual kWh savings. To qualify for this option, projects must reduce energy consumption by a minimum of 500,000 kWh. For qualifying early commitment projects, the program pays an incentive of \$0.06 per first-year kWh saved. Incentives for the program cannot exceed 100% of the total project cost and 100% of the incremental project cost.

Notable program changes made from PY9 to CY2018 include the incorporation of public sector customers.

The objective of the evaluation is to quantify net savings impacts for the Data Center Efficiency Program. Unlike previous years, key evaluation activities for CY2018 will take place from January 2018 through March 2019. The data analysis and reporting will occur in Q4 2018 and Q1 of 2019. Since large projects are likely to be selected in the sample, the evaluation team will review them in early stages of the project and provide feedback to ComEd as needed. This is done to ensure that the calculation methodology and M&V plans align with the expectations of the evaluation team.

The CY2018 gross impact evaluation will not vary from previous years, but adjustments will be made to reflect specific measure and project characterizations. The evaluation will include a participating customer free ridership and spillover study in CY2018. The findings from the study will inform recommended net-to-gross (NTG) values for the Illinois Stakeholder Advisory Group (SAG) approval and future program application in CY2019. A net-to-gross ratio will be calculated in CY2019 using a combination of CY2018 and CY2019 participant surveys for use in future evaluations. The CY2019 NTG study will include in-depth interviews with participating customers to learn about their perspectives and satisfaction with the program, the energy assessment services and incentive offerings, and how to improve the program in the future.

The evaluation of this program over the coming four years will include a variety of data collection and analysis activities, including those indicated in the following table.

**Table 1. Evaluation Approaches – Four Year Plan**

Tasks	CY2018	CY2019	CY2020	CY2021
Tracking System Review	X	X	X	X
Data Collection – Participant Surveys	X	X	X	X
Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Impact – Engineering Review	X	X	X	X
Impact – Modeling (as needed)	X	X	X	X
Impact – Verification & Gross Realization Rate	X	X	X	X
Net-to-Gross – Customer Self-Report Surveys		X *		X
Net-to-Gross – Trade Ally Interviews		X		X
Process Analysis (as needed)	X	X	X	X

\* A net-to-gross ratio will be calculated in CY2019 using a combination of CY2018 and CY2019 participant surveys for use in future evaluations.

The evaluation team determined the evaluation approach for the 2018-2021 period, based upon the needs of the program and the program’s prior history. The four-year evaluation approach for this program is based on the following:

- Gross and net impact analyses will be conducted each year
- Optimized timing on when to conduct NTG research
- NTG analysis every other year when programs are stable and NTG results are consistent over time
- NTG analysis each year when markets or program designs are changing
- Cumulative Persisting Annual Savings (CPAS) will be calculated based upon the requirements of Future Energy Jobs Act (FEJA)
- Process surveys will be performed as needed and will be triggered by changes to the program scope, goals, or implementation team.

### Coordination

Navigant will coordinate with the evaluation teams for other utilities on any issues relevant to this program. Note that coordination with other utilities has not typically been needed for this program, but if issues arise, the evaluation team will coordinate needed discussion and evaluation.

### Evaluation Research Topics

The evaluation will seek to answer the following key researchable questions:

#### Impact Evaluation

- Estimate the CY2018 total lifetime gross impacts from the program.
- Identify opportunities for improvement to the within-program impact calculations and estimates.
- Assess whether the program has met its energy and demand savings goals. If not, explain why.
- Estimate any gas savings created by the program.

- What is the estimated free-ridership and spillover for CY2018 participating customers? What is the research estimate for participant spillover for this program?
- Provide real-time evaluation for large projects, upon request from ComEd, to provide evaluation input before each application is finalized and paid by the program.
- Analyze effective useful life (EUL) of typical data center measures to update the Illinois TRM and to calculate lifetime savings.
- Assess the effectiveness of various program elements, such as incentive levels, marketing procedures, application processes, and participation procedures. Determine customer satisfaction with the program and various program elements.

**Process Evaluation and Other Research Topics**

The process evaluation effort for CY2018 will focus on program delivery. The process research will address the following questions:

- What are participants’ perspectives and overall satisfaction with the program?
- How can the program be improved?
- How is the transition into CY2018 along with the public-sector programs impacting the program?

Program manager interviews at the beginning of the program year may uncover other areas of research to explore during the process evaluation.

**Evaluation Approach**

The table below summarizes the evaluation tasks for CY2018 including data collection methods, data sources, timing, and targeted sample sizes that will be used to answer the evaluation research questions.

**Table 2. Evaluation Plan Summary for Data Centers Efficiency Program**

Activity	CY2018
Gross Impact Approach	Engineering File Review and On-site M&V
Gross Sampling Frequency	Three Waves and Early Feedback for Large Projects
Verified Net Impact Approach	Deemed Value
Researched NTG Approach	Participant Survey
Researched NTG Timing	CY2018 Participants
Program Manager and Implementer Interviews/ Review Materials	Yes
Decision Maker Survey*	FR, SO *
NTG Trade Ally Interviews	As needed

\*FR = Free Ridership; SO = Spillover

Table 3 below summarizes the proposed data collection activities for CY2018 including the sample sizes and timing of each activity.

**Table 3. Core Data Collection Activities, Sample, and Analysis**

Activity	Target	Target Completes CY2018	Timeline	Notes
Tracking System Review	Tracking System	Census	Three waves	
In Depth Interviews	Program Management and Implementers	2	April 2018	Augment with monthly calls
Onsite M&V Audit	Participating Customers	TBD	June 2018 – Feb 2019	
Gross Impact	Early Feedback File Review	TBD	June 2018 – Feb 2019	Early Feedback for Large Projects
Gross Impact	Engineering File Review	TBD	April 2018 – Feb 2019	Three Waves*
Gross Impact	On-site M&V	TBD	April 2018 – Feb 2019	
Verified Net Impact	Calculation using deemed NTG ratio	NA	March 2019	
EUL Research	Develop EUL from secondary research	NA	Jan 2018 onwards	Ongoing effort
Researched NTG and Process	Telephone Survey with Participating Customers	TBD	June 2018 – March 2019	FR & SO, Process. Two Waves
Researched NTG and Process †	Telephone Interviews with Influential Trade Allies Triggered by Customer Responses	TBD	June 2018 – March 2019	FR & SO, Process. Two Waves
Process and Impact Research on CY2018 Operations	Literature review, secondary research	TBD	April 2018 – March 2019	Process, Impact

Note: FR = Free Ridership; SO = Spillover

\* Navigant will coordinate with ComEd to determine appropriate dates to pull tracking data extracts for each wave.

† Trade ally surveys are triggered by high importance ratings by participating customers to the trade ally or vendor. Therefore, the number of trade ally or vendor surveys is dependent on the results of the participating customer surveys.

In line with program changes and accelerated evaluation schedule for delivering tracking data to the valuation team, Navigant will perform tracking system review and M&V project sampling in waves in 2018. The first wave of M&V sampling is expected to cover about one-third of the projects.

### Gross Impact Evaluation

Navigant will perform tracking system review and M&V project sampling in three waves in CY2018. The first wave of M&V sampling is expected to cover about one-third of projects completed in CY2018. Proposed gross impact sampling timelines are shown below.

#### CY2018 Gross Impact Sampling Waves

- a) First wave sample drawn in April 2018 and completed in July 2018
- b) Second wave sample drawn in August 2018 and completed November 2018
- c) Final wave starts February 2019 (or project completion date)

**Sample**

The evaluation will analyze program-level data center savings data by project size to inform the sample design for this population of heterogeneous measures. Using the tracking data extract provided by ComEd, we will sort the projects from largest to smallest ex-ante kWh claim and place them into one of three strata such that each stratum contains about one-third of the program total kWh claim.

The sample size will be calculated using the following equation:

$$n = \frac{ER^2}{\left(\frac{RP^2}{1.282^2} + \frac{ER^2}{N}\right)}$$

Where:

- n = Sample Size
- ER = Error Ratio
- RP = Relative Precision (5%)
- N = Estimated PY9 Project Population
- 1.282 = One-tailed Z-Value for 90% Confidence

The error ratio will be calculated from a combination of prior program year results. When the population of CY2018 projects is known, we will use the appropriate sample size to achieve 90/10 confidence and precision levels, as we have done in previous program years.

**Data Collection Methods**

1. The gross impact evaluation approach is a combination of on-site M&V audits, desk reviews and in-depth telephone interviews.
2. We will perform on-site M&V audits.
3. We will request all available metering data (and other pertinent records and files) from the implementers for all the sampled projects and use the implementer’s pre- and post- metered data, as applicable, for developing ex post results.
4. On-site M&V audits will include spot measurements, run-time hour data logging and post-installation interval metering. The data collected during the on-site visits will serve to verify measure installation, determine installed measure characteristics, assess hours and relevant modes of operation and identify the characteristics of the replaced equipment and any equipment baselines; and
5. For sites selected for desk reviews, we will collect data through telephone interviews with the site contact to verify the installed measure operating characteristics. We will ask the site contact to provide production data or EMS data electronically. We will collect utility meter data for billing analysis from ComEd, if needed. Also, we will ensure the project invoices are verified to confirm the installed measure specifications. Sites selected for desk reviews will not include on-site audits.
6. Early feedback will be provided by the evaluation team for large sites, where requested.
7. AMI data will be used on various projects to confirm savings.
8. ComEd will have an opportunity to review and comment on the M&V plans as they are drafted, prior to conducting a site visit. Any comments provided by ComEd will be reviewed and addressed accordingly before finalizing the M&V plan. The evaluation team expects to receive the comments on these M&V plans within 10 business days.
9. EULs will be analyzed for measures individually for CY2018 to support updates to the Illinois TRM and calculate final evaluated lifetime savings.

In addition to these data collection methods highlighted above, monthly calls will be held between the evaluation team and ComEd to discuss program status, evaluation updates, and project-specific issues. This will allow for early discussion and feedback on project findings, as well as provide a setting for early feedback and real-time evaluation discussions.

### *Analysis*

We will perform a site-specific analysis for each of the data center projects in the onsite sample. The engineering analysis methods and degree of monitoring will vary from project to project, depending on the complexity of the measures installed, the size of the associated savings and the availability and reliability of existing data. Gross impact calculation methodologies are generally based on IPMVP protocols, options A through D.

Through the engineering review of the algorithms used by the program to calculate energy savings and the review assumptions that feed into those algorithms, we will seek to classify the program's impact calculation approach into one of two categories: 1) reasonable and acceptable, or 2) needs revision based on evaluation findings. We will also make a preliminary judgment to identify those assumptions with higher uncertainty or potential to influence the program savings estimate. Through the measure-level engineering review we will verify documentation and installed measure inventory and characteristics, hours of operation, modes of operation, and characteristics of replaced equipment. We will use any measured values obtained during on-site verification audits to revise algorithm assumptions as appropriate.

We will calculate a gross realization rate for each site and prepare a site-specific report detailing evaluation findings. ComEd will have an opportunity to review and comment on the site-specific reports prior to each being finalized.

We will extrapolate site-level gross impact realization rates from the sample to the program population using a ratio estimation approach to calculate CY2018 program level gross impact estimates.

### *Evaluation Baseline Selection Approach*

Baseline selection seeks to optimize the following:

- Selection of the predominant baseline condition over the EUL of the installed measure.
- Selection of baseline using a consistent approach across all evaluated projects.
- Thorough review of the pre-existing conditions to support baseline selection.
- The selected baseline should support savings estimates that represent actual grid-level impacts.

The gross savings impact approach will review the ex ante measure type to determine whether it is covered by the Illinois TRM or whether it is a non-deemed measure that is subject to retrospective per unit savings adjustment of custom variables. The measure type, deemed or non-deemed, will dictate the savings verification approach. We will also make a research estimate of gross savings based entirely on site-collected data and evaluation engineering analysis of savings. The two methods are described below:

### 3. Savings Verification

- Measures with per unit savings values deemed by the TRM would have verified gross savings estimated by multiplying deemed per unit savings (kWh and kW) by the verified quantity of

eligible measures installed. Eligible deemed measures must meet all physical, operational, and baseline characteristics required to be assigned to the deemed value as defined in the TRM.<sup>21</sup>

- Measures with fully custom or partially-deemed ex ante savings will be subject to retrospective evaluation adjustments to gross savings on custom variables. For fully custom measures, Navigant will subject the algorithm and parameter values to evaluation adjustment, where necessary. For partially-deemed measures, TRM algorithms and deemed parameter values will be used where specified by the TRM, and evaluation research will be used to verify custom variables.

4. Evaluation Research Savings Estimate

- The evaluation will also include an analysis of on-site collected verification data for a subset of projects. The engineering analysis methods and degree of monitoring will vary from project to project, depending on whether the measure has deemed savings or not, the complexity of the measures, the size of the associated savings, the potential to revise input assumptions, and the availability and reliability of existing data. The evaluators will contact the implementers prior to conducting site visits to ensure that the evaluation team has all correct and relevant information.

The measure-level realization rates will be extrapolated to the program population using a ratio estimation method to yield ex post evaluation-adjusted gross energy savings. Gross realization rates will be developed for energy and demand savings. The sample design will provide 90/10 statistical validity for the program overall. The sample for on-sites will be drawn to achieve a 90/10 confidence/relative precision level (one-tailed test) to comply with the PJM verification requirements outlined in Manual 18B.

**Verified Net Impact Evaluation**

The verified net impact evaluation will apply the net-to-gross (NTG) ratio accepted by Illinois Stakeholders Advisory Group (SAG) consensus to estimate the verified net savings for the program.

**Table 4. Deemed NTG Values for CY2018**

Program Measure	CY2018 Deemed NTG Value
Data Centers	0.68

Source:  
[http://ilsagfiles.org/SAG\\_files/NTG/2017\\_NTG\\_Meetings/Final/ComEd\\_NTG\\_History\\_and\\_PY10\\_Recommendations\\_2017-03-01.xlsx](http://ilsagfiles.org/SAG_files/NTG/2017_NTG_Meetings/Final/ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.xlsx)

**Research NTG Impact Evaluation**

Previous NTG evaluations have performed a NTG analysis for each program year. Due to the relatively stable results year to year, the evaluation team has scaled back the NTG research. The evaluation team is currently analyzing the combined NTG analysis for PY8 and PY9. The evaluation will continue similar two-year cycles going forward. The evaluation team will perform the NTG interviews for CY2018 but the data will not be analyzed. After completing the NTG interviews for the CY2019 period, NTG analysis will

<sup>21</sup> Illinois Statewide Technical Reference Manual for Energy Efficiency Version 5.0, available at: <http://www.ilsag.info/technical-reference-manual.html>

be performed for both program years at the end of CY2019 and will be reported in the CY2019 Evaluation Report. The research plan NTG ratios are based on primary data collected as described below. Note that the method described is fully compliant with the framework for study-based programs that has been adopted by the SAG and is part of the Illinois statewide TRM v6.0.

#### *Data Collection Methods*

1. Telephone surveys with participant decision makers
2. Project detail from ComEd

#### *Trade ally interviews – with participating equipment vendors (suppliers or installers)*

**Net-to-gross ratio:** The telephone surveys will provide all inputs needed for the calculation of the program's net-to-gross ratio. We will use the self report method which assigns sampled projects to one of three levels of rigor, based on the size and complexity of the project:

- Basic – small or medium sized projects.
- Standard – larger projects and smaller projects representing those measure categories that comprise the highest percentage of program savings impacts.
- Enhanced – approximately 10-20% of the largest projects, generally those with rebates of \$100,000+.

Participating customers will be interviewed in all cases. Standard and enhanced cases will also include interviews with program representatives and participating equipment vendors or influential opportunity assessment or facility assessment representatives. The vendor interviews will be conducted before the customer interviews. Enhanced cases may also include secondary research on standard industry practices.

NTG survey questions will address both free ridership and participant spillover. For enhanced cases, NTG summaries detailing all the findings from the interview performed by senior consultant will be provided.

#### *Sample*

The sampling approach for the participant surveys will attempt to survey a sample of CY2018 customers to achieve one-tailed 90/10 confidence/precision level at the program level over the two years, and will ensure that the sample points are representative of the program population over the two years.

All telephone sample points selected will be submitted to ComEd to obtain project overview documents which provide information on the primary decision maker (name, phone, email address), program staff's role in project implementation and any additional data related to program influence. The evaluation team will review the project overview documents before conducting NTG interviews.

#### *Analysis*

A net-to-gross ratio will be calculated in CY2019 using the combination of CY2018 and CY2019 participant surveys for use in future evaluations. The telephone surveys will provide all inputs needed for the calculation of the program's NTG ratio. Free ridership will be assessed using an algorithm approach which relies on survey self-report measure level data. Where there are multiple data sources, a result will be determined using triangulation between participant surveys, service provider surveys, implementation staff, and program staff interviews. Enhanced cases will include input from any relevant secondary research.

The existence of spillover will be examined using participant surveys self-report data. We will quantify spillover where (1) significant program influence is indicated and (2) significant spillover is revealed by the customer.

A key goal will be to analyze and report NTG findings at the measure level. The measure level information will be collected for the three largest measures to keep the interview to a reasonable length. However, this is only possible if there are sufficient findings differentiated by measure. The self-reported data is based on the level of program influence as reported by the customer and service provider. This could be at either the whole project level or at the individual measure level, if sufficient sample is available, and depending on the project.

### Calculation of CPAS and Annual Savings

As required by FEJA, the measure-specific and total ex post gross and ex post net savings for the program and CPAS in CY2018 will be calculated along with the total CPAS. Additionally, the weighted average measure life will be estimated, if possible. Evaluation will also add the savings converted from gas savings to the electric savings so that it's documented in the report.

### Process Evaluation

The process evaluation objectives are to determine (1) program strengths and weaknesses, (2) participant satisfaction with program elements, and (3) ways to improve the program. Process questions will be added to all the surveys conducted by the evaluation team. The findings and recommendations will be based on data collected from the surveys. The analysis is likely to include an assessment of the effectiveness of various program elements, such as incentive levels, marketing procedures, application processes, and participation procedures. Determine customer satisfaction with the program and various program elements. These questions will be refined prior to deploying any process survey.

The CY2018 process evaluation research will include a synthesis of both qualitative and quantitative data collected during the program staff and implementer interviews and meetings, and during the end-user customer surveys in CY2018. The CY2018 NTG study will include in-depth interviews with participating customers to learn about their perspectives and satisfaction with the program, amidst varying opportunities from program incentive offerings and changes to program application requirements.

Navigant will perform additional process research, upon the request of the program manager, to support the program manager and implementer in transitioning into the revised regulatory requirements starting in CY2018.

### Use of RCT and QED

The evaluation team will not use the Randomized Control Trials (RCT) or Quasi-Experimental Design (QED) for process evaluation because:

- There are not enough participants in this program to achieve statistically significant savings estimates using this method.
- It would not be possible to create a valid matched control group for the customers in this program.
- This method would estimate average savings across all program participants which is not the desired savings estimate for this program.

## Evaluation Schedule

Table 5 below provides the schedule for key deliverables and data transfer activities. (See Table 3 for other schedule details.) Adjustments will be made, as needed, as evaluation activities progress.

**Table 5. Schedule – Key Deadlines**

Activity or Deliverable	Responsible Party	Date Delivered
Program Operations Manual and Workpapers	ComEd	January 15, 2018
CY2018 program tracking data for QA/QC	ComEd	April 7, 2018
CY2018 program tracking data for sampling Wave 1	ComEd	June 1, 2018
CY2018 participating customer survey design	Evaluation	June 30, 2018
Wave 1 project documentation, engineering reviews, schedule, conduct on-site M&V, feedback	Evaluation	July 30, 2018
Tracking System Ex Ante Review Findings and Recommendations	Evaluation	July 30, 2018
CY2018 program tracking data for sampling Wave 2	ComEd	August 30, 2018
Wave 1 participating customer NTG and process survey fielding	Evaluation	September 30, 2018
Wave 2 project documentation, engineering reviews, schedule, conduct on-site M&V, feedback	Evaluation	November 30, 2018
EUL Research Memo	Evaluation	December 15, 2018
CY2018 Program tracking data for sampling Wave 3	ComEd	January 30, 2019
Wave 2 participating customer NTG and process survey fielding	Evaluation	February 28, 2019
Wave 3 project documentation, engineering reviews, schedule, conduct on-site M&V, feedback	Evaluation	February 28, 2019
Illinois TRM Update Research Findings	Evaluation	March 1, 2019
Process Analysis Findings	Evaluation	March 1, 2019
NTG Analysis Findings	Evaluation	March 1, 2019
Internal Report Draft by Navigant	Evaluation	March 1, 2019
Draft Report to ComEd and SAG	Evaluation	March 5, 2019
Comments on draft (15 Business Days)	ComEd and SAG	March 26, 2019
Revised Draft by Navigant	Evaluation	April 3, 2019
Comments on redraft (5 Business Days)	ComEd and SAG	April 11, 2019
Final Report to ComEd and SAG	Evaluation	April 20, 2019

**ComEd Energy Advisor Monitoring-Based Commissioning Program  
CY2018 to CY2021 Evaluation Plan**

**Introduction**

The ComEd Energy Advisor Monitoring-Based Commissioning (Energy Advisor) program is an energy efficiency program designed and operated for ComEd by Power TakeOff (PTO) that provides qualified ComEd business customers<sup>22</sup> with energy management and information system (EMIS) services to better manage their energy usage, identify energy savings opportunities, and achieve energy savings through low- or no-cost energy-saving measures. The Energy Advisor program follows a step-by-step process to identify customers with significant potential for low- or no-cost energy savings, work with them to understand their energy usage and identify savings opportunities, enroll them in the Energy Advisor program, and monitor their progress throughout the program. All energy savings actions taken by each participant are documented as part of the program, and resulting energy savings claimed for each action are estimated by PTO using a regression analysis of the participant’s pre- and post-enrollment energy usage data.

Unlike energy efficiency (EE) programs that provide participating customers with generic energy savings recommendations, where little or nothing is known about the specific actions taken by individual participants, the Energy Advisor program collects a substantial amount of information about each participant, including a detailed log of each contact PTO had with the customer, the behavioral actions each participant agreed to take, and the date each action was undertaken.<sup>23</sup> Additionally, the program collects at least one year of pre-enrollment and three to six months of post-enrollment interval usage data from each meter. Navigant will employ regression analysis to model the responses of individual participants’ energy usage to measure the program’s savings in Calendar Year 2018 (CY2018). This is a one-year program and, as such, no evaluation activities are planned for CY2019 through CY2021.

**Table 1. Evaluation Approaches for CY2018 (One Year Program)**

Tasks	CY2018	CY2019	CY2020	CY2021
Tracking System Review	X			
Data Collection – Program Manager and Implementer Interviews	X			
Impact – Regression Analysis (Customer Specific)	X			

**Coordination**

At this time there are not equivalent programs at other Illinois utilities. We will continue to monitor that situation.

<sup>22</sup> To qualify, a participant must be a ComEd business customer with at least one year of 30-minute interval smart-meter data available.

<sup>23</sup> Recommended actions may include, but are not limited to, adjusting HVAC schedules to match occupancy, installing smart timers to turn off unneeded equipment during off hours, managing equipment start-up and shut-down schedules, and delamping.

## Evaluation Research Topics

The evaluation will seek to answer the following key researchable questions:

### Impact Evaluation

1. What are the program’s annual total verified gross savings?
2. What are the program’s verified net savings?

## Evaluation Approach

Table 2 summarizes the evaluation tasks for CY2018 including data collection methods, data sources, timing, and targeted sample sizes that will be used to answer the evaluation research questions.

We have prepared an evaluation plan summary to identify tasks on a preliminary basis (Table 2). Final activities will be determined annually as program detail and requirements become known.

**Table 2: Evaluation Plan Summary for Energy Advisor**

Activity	CY2018
Gross Impacts Evaluation	Regression Analysis
Uplift Savings Adjustment	Difference-in-Difference
Sampling Frequency	Annual
Program Manager and Implementer Interviews / Review Materials	Yes

## Gross Impact Evaluation

Navigant will measure the Energy Advisor Program’s CY2018 annualized energy savings by developing baseline daily energy usage models for each CY2018 program participant, *calibrated to their year of pre-enrollment daily usage data* using regression analysis, of the form shown in Equation 1, and use the model to estimate each participant’s gross energy savings attributable to the program. Net CY2018 program savings will be the sum of the individual participants’ gross annualized savings.

**Equation 1. Energy Advisor Load Model**

$$kWh_t = \beta_0 + \beta_1 Weekday_t + \sum_{i=1}^{12} \beta_{2i} Month_{ti} + \beta_3 CDD_t + \beta_4 HDD_t + \sum_{j=1}^J \beta_{5j} Change_{tj} + \varepsilon_t$$

where:

$kWh_t$  is energy usage during day  $t$

$Weekday$  equals 1 when  $t$  is a weekday and 0 otherwise<sup>24</sup>

<sup>24</sup> The day-type granularity can be changed to daily increments (i.e., a Monday dummy, a Tuesday dummy, etc., rather than just a weekday/weekend dummy) if warranted by the customer-specific demand pattern or type of behavioral actions the customer agrees to undertake.

$Month_{ti}$	equals 1 when $t$ falls within month $i$ and 0 otherwise
$CDH_t$	is the cooling degree-hours during day $t$ <sup>25</sup>
$HDH_t$	is the heating degree-hours during day $t$ <sup>4</sup>
$Change_{tj}$	is a binary indicator that equals 1 when day $t$ falls after agreed-upon behavior change $j$ and 0 otherwise
The $\beta_k$ 's	are unknown parameters to be estimated
$\varepsilon_t$	is a white-noise disturbance

Firm-specific parameter values will be obtained by fitting the above model to each participant’s actual daily usage data and weather data using all available (pre- and post-enrollment) data. The parameter values will then be used, together with normal (TMY3) weather data<sup>26</sup>, to forecast annualized usage baselines for the post-install period for all participating customers. Annualized savings will be calculated by simulating each participant’s predicted usage *twice*: once with the change variable(s) set to zero (to simulate their baseline usage) and once with the change variable(s) set to one (to simulate their usage with the changes in place), and subtracting the post-change profile from the baseline profile.

### Verified Net Impact Evaluation

The Illinois Stakeholders Advisory Group (SAG) consensus process agreed to a net-to-gross (NTG) value of 1.0 for this program for PY9 (Table 3). Navigant will apply that NTG ratio to the adjusted gross savings to estimate the verified net savings for the program in CY2018.

The regression analysis described in the previous section does not produce net savings, however since this is a one-year program we do not propose pursuing net-to-gross research for this program.<sup>27</sup>

**Table 3. Deemed NTG Value for PY9**

Program Path/Measure	PY9 Deemed NTG Value
Energy Advisor	1.00

Source: [http://ilsagfiles.org/SAG\\_files/NTG/2016\\_NTG\\_Meetings/Final\\_Documents/ComEd\\_NTG\\_History\\_and\\_PY9\\_Recommendations\\_2016-02-26\\_Final.xlsx](http://ilsagfiles.org/SAG_files/NTG/2016_NTG_Meetings/Final_Documents/ComEd_NTG_History_and_PY9_Recommendations_2016-02-26_Final.xlsx)

### Calculation of CPAS and Annual Savings

As required by the Future Energy Jobs Act (FEJA), Navigant will report measure-specific ex post gross and ex post net savings for the program and the cumulative persisting annual savings (CPAS) in CY2018 will be calculated along with the total CPAS. Additionally, the weighted average measure life will be estimated, if possible. Converted gas savings cannot be calculated for this program, due to a lack of gas usage data.

<sup>25</sup> Navigant will use a grid search to solve for individual premise degree-day balance points.

<sup>26</sup> See [http://rredc.nrel.gov/solar/old\\_data/nsrdb/1991-2005/tmy3/](http://rredc.nrel.gov/solar/old_data/nsrdb/1991-2005/tmy3/) for more information.

<sup>27</sup> In the SAG NTG discussions for this program in PY9 it was assumed that any regression analysis would produce net savings. While the evaluation should capture spillover, it can’t remove free ridership bias. In future NTG deliberations for this program, this fact should be considered.

### Process Evaluation

The process evaluation for this program will be limited to interviews with the program manager and implementation contractor.

### Use of RCT and QED

The evaluation team uses a regression-based evaluation method for this program, but it is not a randomized controlled trail (RCT) or quasi-experimental design (QED). An RCT will not be utilized as the program was not designed with a random control group. A QED is not being used as we expect the program savings to be very different for each customer since they're getting a unique program experience; the method we are utilizing allows us to estimate customer-specific impacts, whereas QED would estimate average program impacts.

### Data Requirements

Table 4 shows the data Navigant will need for the CY2018 evaluation. We intend to receive the full customer usage dataset from PTO but will request a subset of customer usage data from ComEd to ensure that the PTO data is complete and accurate.

**Table 4. Data Requirements for CY2018 Energy Advisor Evaluation**

Required Data	Relevant Information Requested
Tracking Data	For all Energy Advisor participants:
	• Account ID
	• Date participant was enrolled in Energy Advisor
	• Date participant began each agreed-upon Energy Advisor energy-saving action
	• Opt-out/move-out date (if relevant)
Customer Usage Data	• Type of Business or Segment
	For all Energy Advisor participants:
	• Account ID
	• Daily energy usage values* for CY2018 (Jan 1, 2018 – Dec 31, 2018) and at least 1 year prior to enrollment
	• Corresponding 30-minute interval usage data for equivalent period†

\* Daily values rolled up from 30-minute interval AMI/AMR meter data obtained from PTO.

† Navigant will request 30-minute interval AMI/AMR meter data for a random sample of CY2018 participants to ensure that the PTO data is complete and accurate.

### Evaluation Schedule

Table 5 below provides the schedule for key deliverables and data transfer activities. Adjustments will be made, as needed, as evaluation activities progress.

**Table 5. Schedule – Key Deadlines**

Activity or Deliverable	Responsible Party	Date Delivered
Program Manager and Implementer Interviews	Navigant	October 30, 2018
Final evaluation data request sent to ComEd / PTO	Navigant	December 31, 2018
Final evaluation data delivered to Navigant	ComEd	January 31, 2019
Draft Report to ComEd and SAG	Navigant	March 8, 2019
Comments on draft (15 Business Days)	ComEd and SAG	March 29, 2019
Revised Draft by Navigant	Navigant	April 5, 2019
Comments on redraft (5 Business Days)	ComEd and SAG	April 12, 2019
Final Report to ComEd and SAG	Navigant	April 19, 2019

**ComEd Industrial Systems Program CY2018 to CY2021 Evaluation Plan****Introduction**

The Industrial Systems Program offers a combination of technical assistance and financial incentives. Technical assistance includes an industrial systems study which assesses the performance of the facility's industrial compressed air system, process cooling system, refrigeration system, or waste water treatment plant to ensure efficient, economical operation. This service examines the system's operating characteristics to help identify energy saving measures, using a combination of capital investments and low or no cost measures. In addition to the study, ComEd provides a one-time incentive payment of \$0.07 per annual kWh saved after proper implementation of recommendations identified through the Industrial Systems Program with the exception of \$0.21 per annual kWh saved for waste water treatment. Recommendations from the study that are implemented and incentivized by the program are not eligible for any other ComEd incentive. Eligible annual kWh and kW savings are determined through measurement and verification activities. The total incentive cannot exceed 100% of the total implementation costs and 100% of the total incremental costs for improvements recommended in the study.

Notable program changes made from Program Year 9 (PY9) to Calendar Year 2018 (CY2018) include the incorporation of public sector customers.

The objective of the evaluation is to quantify CY2018 net savings impacts for the Industrial Systems Program (Industrial Systems Program). Unlike previous years, key evaluation activities for CY2018 will take place from January 2018 through March 2019. Evaluation activities for CY2018 will be similar to PY9. For the CY2018 evaluation, the evaluation team will work towards earlier engineering review and M&V work, to help ensure that critical impact issues are resolved early. Since large projects are likely to be selected in the sample, the evaluation team will review them in early stages of the project and provide feedback to ComEd as needed. This is to ensure that the calculation methodology and M&V plans align with the expectations of the evaluation team.

The CY2018 gross impact evaluation will not vary from previous years, but adjustments will be made to reflect specific measure and project characterizations. The evaluation will include a participating customer free ridership and spillover study in CY2018. A net-to-gross ratio will be calculated in CY2019 using a combination of CY2018 and CY2019 participant surveys for use in future evaluations. The findings from the study will inform recommended net-to-gross (NTG) values for the Illinois Stakeholder Advisory Group (SAG) approval and future program application. The CY2018 NTG study will include in-depth interviews with participating customers to learn about their perspectives and satisfaction with the program, the energy assessment services and incentive offerings, and how to improve the program in the future.

The evaluation of this program over the coming four years will include a variety of data collection and analysis activities, including those indicated in the following table.

Table 1. Evaluation Approaches – Four Year Plan

Tasks	CY2018	CY2019	CY2020	CY2021
Tracking System Review	X	X	X	X
Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Impact – Engineering Review	X	X	X	X
Impact – Measure-Level Deemed Savings Review	X	X	X	X
Impact – Modeling (as needed)	X	X	X	X
Impact – Verification & Gross Realization Rate	X	X	X	X
Net-to-Gross – Customer Self-Report Surveys		X		X
Net-to-Gross – Trade Ally Interviews		X*		X
Net-to-Gross – Technical Service Provide Interviews	X	X	X	X
Process Analysis (as needed)	X	X	X	X

\* A net-to-gross ratio will be calculated in CY2019 using a combination of CY2018 and CY2019 participant surveys for use in future evaluations.

The evaluation team determined the evaluation approach for the 2018-2021 period, based upon the needs of the program and the program’s prior history. The four-year evaluation approach for this program is based on the following:

- Gross and net impact analyses will be conducted each year
- Optimized timing on when to conduct NTG research
- NTG analysis every other year when programs are stable and NTG results are consistent over time
- NTG analysis each year when markets or program designs are changing
- Cumulative Persistence Annual Savings (CPAS) will be calculated based upon the requirements of Future Energy Jobs Act (FEJA)
- Process surveys will be performed as needed and will be triggered by changes to the program scope, goals, or implementation team.

### Coordination

Navigant will coordinate with the evaluation teams for other utilities on any issues relevant to this program. Note that coordination with other utilities has not typically been needed for this program but, if issues arise, the evaluation team will coordinate needed discussion and evaluation.

### Evaluation Research Topics

The evaluation will seek to meet and report on the following objectives:

- Estimate the lifetime gross impacts from the program.
- Identify opportunities for improvement to the program impact calculations and estimates.
- Assess whether the program has met its energy savings goals. If not, explain why not.

- Estimate net impacts for CY2018 and subsequent years.
- Estimate any gas savings created by the program.
- Perform concurrent evaluation based upon requests from ComEd for a sample of large projects to provide evaluation input before each application is finalized and paid by the program. For these projects, the evaluation team will review the baseline, pre-and post M&V Plan and analysis approach. The evaluation team will also consider the potential issues with these large projects.
- Analyze effective useful life (EUL) of typical measures to support updates to the TRM and the calculation of lifetime savings.
- Assess the effectiveness of various program elements, such as incentive levels, payments and structure for technical assistance, marketing procedures, application processes, and participation procedures. Determine customer satisfaction with the program and various program elements.

## Evaluation Approach

Table 2 shows a summary of the evaluation plan.

**Table 2. Evaluation Plan Summary**

Activity	CY 2018
Gross Impact Approach	Engineering File Review and On-site M&V
Gross Sampling Frequency	Three Waves and Early Feedback for Large Projects.
Verified Net Impact Approach	Deemed Value
Researched NTG Approach	Participant Survey
Researched NTG Timing	CY2018 Participants
Program Manager and Implementer Interviews/ Review Materials	Yes
Decision Maker Survey	Free-ridership and Spillover
NTG Trade Ally Interviews	As needed
Technical Service Provider Survey	As needed

Table 3 summarizes the evaluation tasks for CY2018, including data collection methods, data sources, timing, and targeted sample sizes that will be used to answer the evaluation research questions.

**Table 3. Core Data Collection Activities, Sample, and Analysis**

Activity	Target	Target Completes CY2018	Timeline	Notes
Tracking System Review	Tracking system	Census	Three waves	
In-Depth Interviews	Program Management and Implementers	TBD	April 2018	Augment with monthly calls
Onsite M&V Audit	Participating Customers	TBD	June 2018 – Feb 2019	
Gross Impact	Early Feedback File Review	TBD	June 2018 – Feb 2019	Early Feedback for Large Projects
Gross Impact	Engineering File Review	TBD	April 2018 – Feb 2019	Three Waves*
Gross Impact	On-site M&V	TBD	April 2018 – Feb 2019	
Verified Net Impact	Calculation using deemed NTG ratio	NA	March 2019	
EUL Research	Develop EUL from secondary research	NA	Jan 2018 Onwards	Ongoing effort
Researched NTG and Process	Telephone Survey with Participating Customers	TBD	June 2018 – March 2019	FR & SO, Process. Two Waves
Researched NTG and Process †	Telephone Interviews with Influential Trade Allies Triggered by Customer Responses	TBD	June 2018 – March 2019	FR & SO, Process. Two Waves
Process and Impact Research on CY2018 Operations	Literature review, secondary research	TBD	April 2018 – March 2019	Process, Impact

Note: FR = Free Ridership; SO = Spillover

\* Navigant will coordinate with ComEd to determine appropriate dates to pull tracking data extracts for each wave.

† Trade ally surveys are triggered by high importance ratings by participating customers to the trade ally or vendor. Therefore, the number of trade ally or vendor surveys is dependent on the results of the participating customer surveys.

In line with program changes and accelerated evaluation schedule for delivering tracking data to the evaluation team, Navigant will perform tracking system review and M&V project sampling in waves in 2018. The first wave of M&V sampling is expected to cover about one-third of the projects. Proposed gross impact sampling timelines are shown below.

### Gross Impact Evaluation

The gross impact evaluation is a combination of desk reviews and on-site audits.

On-site audits consist of two types of activities: Measurement and Verification (M&V). On-site metering (full M&V) activity is expected to be performed for a third of the selected sample (approximately three sites). Note that the evaluation team will not perform metering if facility owned meters are already installed for data collection.

Desk reviews will be performed for the rest of the sample (estimated to be seven sites). The ex ante data, including metering data, will be the primary data source for ex post analysis. This desk review approach is like the RCx program's desk review approach--auditing ex ante calculations and adjusting, if needed, based on any additional customer provided data, such as production data.

These evaluation approaches will provide the evaluation team sufficient detail and information to verify program achievements and provide recommendations to improve program performance. Also, these activities will allow the evaluation team to adjust the CY2018 evaluation approach (by reducing or increasing on-site activity) based on PY9 findings. Since the program involves industrial facilities, where conditions may vary more than commercial facilities, the evaluation team believes the proposed approach will help verify the conditions and allow for informed adjustments to savings estimates for such sites. This will also help the evaluation team provide actionable recommendations to improve program M&V guidelines.

Navigant will perform tracking system review and M&V project sampling in three waves in CY2018. The first wave of M&V sampling is expected to cover about one-third of projects completed in CY2018. Proposed gross impact sampling timelines are shown below.

CY2018 Gross Impact Sampling Waves

- a) First wave sample drawn in April 2018 and completed in July 2018
- b) Second wave sample drawn in August 2018 and completed November 2018
- c) Final wave starts February 2019 (or projects completion date)

The evaluation will analyze program-level savings data by project size to inform the sample design for this population of heterogeneous measures. Using the tracking data extract provided by ComEd, we will sort the projects from largest to smallest ex ante kWh claim and place them into one of three strata such that each stratum contains about one-third of the program total kWh claim.

The sample size will be calculated using the following equation:

$$n = \frac{ER^2}{\left(\frac{RP^2}{1.282^2} + \frac{ER^2}{N}\right)}$$

Where:

- n = Sample Size
- ER = Error Ratio
- RP = Relative Precision (10%)
- N = Estimated PY9 Project Population
- 1.282 = One-tailed Z-Value for 90% Confidence

The error ratio will be calculated from a combination of prior program results. Given the projected CY2018 project population, the sample size will be determined to achieve 90/10 confidence and precision levels. The sample size for CY2018 is estimated to be approximately 10 projects, similar to PY8 and PY9 program evaluations.

Core data collection activities will include the following:

Pre-metering and post-installation interval metering data will be collected from the program implementers for all the sampled projects. The evaluators will also request all available production data and other pertinent records and files from the implementers for all projects selected in the sample.

On-site M&V audits will be performed for approximately three projects.<sup>28</sup> Evaluators will select these projects for metering from stratum one and stratum two sample points based on the verified conditions

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<sup>28</sup> The evaluation team may choose to perform additional onsite visits if there is uncertainty associated with the savings or if enough documentation was not provided for the desk review sites.

and available ex ante project documentation so that evaluation metering efforts can contribute significantly to developing ex post analysis.

Additionally, on-site audits will also include collecting information from dedicated facility meters for the system power usage or load profile (e.g., air-flow profile), when available. Production data and spot measurements will be collected to support ex post savings calculations.

Engineering desk reviews will be performed for approximately seven projects to complete ex post analysis. Desk reviews do not incorporate on-site audits. Desk reviews involve review of project documentation provided by the program, an engineering review of the algorithms and auditing ex ante calculation models used by the program to estimate energy savings. The engineering audit of program calculations determines if the inputs that feed the program calculations are reasonable and acceptable or need revision based on evaluation findings. Additionally, telephone interviews with the site contact(s) will be conducted in support of these desk reviews and information obtained from the interviews will be used to verify savings. Also, site contact(s) will be requested to provide production data electronically for measure(s) installation detail. The savings will be adjusted as needed based on all the available information.

In addition to these data collection methods highlighted above, monthly calls will be held between the evaluation team and ComEd to discuss program status, evaluation updates, and project-specific issues. This will allow for early discussion and feedback on project findings, as well as provide a setting for early feedback and concurrent evaluation discussions. ComEd will also have five business days to review and comment on the M&V plans as they are drafted, prior to conducting a site visit. Any comments provided by ComEd will be reviewed and addressed accordingly before finalizing the M&V plans for a project.

The gross savings impact approach will review the ex ante measure type to determine whether it is covered by the Illinois TRM or whether it is a non-deemed measure that is subject to retrospective per unit savings adjustment of custom variables. The measure type, deemed or non-deemed, will dictate the savings verification approach. We will also make a research estimate of gross savings based entirely on site-collected data and evaluation engineering analysis of savings. The two methods are described below:

A site-specific engineering analysis will be performed for the sampled CY2018 projects. The engineering analysis methods will vary from project to project, depending on the complexity of the measures installed, the size of the associated savings and the availability and reliability of existing data.

Engineering calculations will be performed to derive gross kWh and kW savings. These calculations will start with an engineering audit of the algorithms used by the program to calculate energy savings and the inputs used for the algorithms. The engineering review will also include preliminary judgment to identify the assumptions with higher uncertainty or potential to influence the program savings estimate. The focus of the data collection will be to verify or update the assumptions that are used in the engineering algorithms for measure level savings. Data obtained for the sampled sites will serve to verify measure installation, determine installed measure characteristics, assess operating hours and relevant modes of operation, identify the characteristics of the replaced equipment and support the selection of baseline conditions and to perform ex post savings calculations. If needed, the evaluation team will use the data obtained from the sampled sites to model calculations using AIRMaster+<sup>29</sup> for compressed air projects, when the evaluators determine that the facility conditions have changed significantly and the ex ante data or calculation model is no longer representative for estimating savings. The evaluation team will notify the

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<sup>29</sup> AIRMaster+ is a Windows-based software tool used to analyze industrial compressed air systems. It is intended to enable users to model existing and future improved system operation, and evaluate savings from energy efficiency measures with relatively short payback periods.

implementation team when AIRMaster+ is being used for ex post analysis and the evaluation team will communicate any issues identified in the ex ante calculation models to the implementation team. The peak kW savings calculation methodology will be consistent with PJM requirements for each project.

A gross realization rate will be calculated for each site. Site-level gross impact realization rates from the sample will then be extrapolated to the program population using a ratio estimation approach. ComEd will have an opportunity to review and comment on the site-specific reports prior to each being finalized.

### Verified Net Impact Evaluation

The verified net impact evaluation will apply the net-to-gross (NTG) ratio accepted by Illinois Stakeholders Advisory Group (SAG) consensus to estimate the verified net savings for the program.

**Table 4. Deemed NTG Values for CY2018**

Program Measure	CY2018 Deemed NTG Value
Industrial kWh	0.80
Industrial kW	0.81

Source:  
[http://ilsagfiles.org/SAG\\_files/NTG/2017\\_NTG\\_Meetings/Final/ComEd\\_NTG\\_History\\_and\\_PY10\\_Recommendations\\_2017-03-01.xlsx](http://ilsagfiles.org/SAG_files/NTG/2017_NTG_Meetings/Final/ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.xlsx)

### Research NTG Impact Evaluation

Previous NTG evaluations have performed a NTG analysis for each program year. Due to the relatively stable results year to year, the evaluation team has scaled back the NTG research. The evaluation team is currently analyzing the combined NTG analysis for PY8 and PY9. The evaluation will continue similar two-year cycles going forward. The evaluation team will perform the NTG interviews for CY2018 but the data will not be analyzed. After completing the NTG interviews for the CY2019 period, NTG analysis will be performed for both program years at the end of CY2019 and will be reported in the CY2019 Evaluation Report. The research plan net-to-gross ratios are based on primary data collected as described below. Note that the method described is fully compliant with the framework for Industrial Systems programs that has been adopted by the SAG and is part of the Illinois statewide TRM v6.0.

### Data Collection Methods

1. Telephone surveys with participant decision makers
2. Service provider interviews with participating compressed air, process cooling and refrigeration service providers who completed projects in CY2018.

### Content

**Net-to-gross ratio:** The telephone surveys will provide all inputs needed for the calculation of the program’s net-to-gross ratio. We will use the self-report method which assigns sampled projects to one of three levels of rigor, based on the size and complexity of the project:

- Basic – small or medium sized projects.
- Standard – larger projects and smaller projects representing those measure categories that comprise the highest percentage of program savings impacts.

- Enhanced – approximately 10-20% of the largest projects - this generally includes those with rebates of \$100,000 or greater.

Participating customers will be interviewed in all cases. For study-driven programs, the NTG approach is consistent with the TRM. Standard and enhanced cases will also include interviews with program representatives and participating equipment vendors or influential opportunity assessment or facility assessment representatives. Further, for those projects that received a program-sponsored study, an interview with the service provider will be completed. Enhanced cases may also include secondary research on standard industry practices. NTG survey questions will address both free ridership and participant spillover. For enhanced cases, NTG summaries detailing all the findings from the interview performed by senior consultant will be provided.

### *Sample*

The sampling approach for the participant surveys will attempt to survey a sample of CY2018 customers to achieve one-tailed 90/10 confidence/precision level at the program level over the two years, and will ensure that the sample points are representative of the program population over the two years.

All telephone sample points selected will be submitted to ComEd to obtain project overview documents which provide information on the primary decision maker (name, phone, email address), program staff's role in project implementation and any additional data related to program influence. The evaluation team will review the project overview documents before conducting NTG interviews.

### *Analysis*

A net-to-gross ratio will be calculated in CY2019 using the combination of CY2018 and CY2019 participant surveys for use in future evaluations. The telephone surveys will provide all inputs needed for the calculation of the program's net-to-gross ratio. Free ridership will be assessed using an algorithm approach which relies on survey self-report measure level data. Where there are multiple data sources, a result will be determined using triangulation between participant surveys, service provider surveys, implementation staff, and program staff interviews. Enhanced cases will include input from any relevant secondary research.

The existence of spillover will be examined using participant survey self-report data. We will quantify spillover where (1) significant program influence is indicated<sup>30</sup> and (2) significant spillover is revealed by the customer.

A key goal will be to analyze and report NTG findings at the measure level. The measure level information will be collected for the three largest measures to keep the interview to a reasonable length. However, this is only possible if there are sufficient findings differentiated by measure type. The self-reported data is based on the level of program influence as reported by the customer and service provider. This could be at either the whole project level or at the individual measure level, if sufficient sample is available and depending on the project.

### **Calculation of CPAS and Annual Savings**

As required by FEJA, the measure-specific and total ex post gross and ex post net savings for the program and CPAS in CY2018 will be calculated along with the total CPAS. Additionally, the weighted average measure life will be estimated, if possible. Evaluation will also add the savings converted from gas savings to electric savings so that it's documented in the report.

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<sup>30</sup> Corresponding to a score of 8, 9 or 10 for the importance of the program on their decision to do the spillover.

## Process Evaluation

The process evaluation objectives are to determine (1) program strengths and weaknesses and (2) participant satisfaction with program elements. Process questions will be added to all the surveys conducted by the evaluation team. The findings and recommendations will be based on data collected from the surveys. The analysis is likely to include an assessment of the effectiveness of various program elements, such as incentive levels, marketing procedures, application processes, and participation procedures. It will also determine customer satisfaction with the program and various program elements. These questions will be refined prior to deploying any process survey.

The CY2018 process evaluation research will include a synthesis of both qualitative and quantitative data collected during the program staff and implementer interviews and meetings, and during the end-user customer surveys in CY2018. The CY2018 NTG study will include in-depth interviews with participating customers to learn about their perspectives and satisfaction with the program, amidst varying opportunities from program incentive offerings and changes to program application requirements.

Navigant will perform additional process research, upon the request of the program manager, to support the program manager and implementer in transitioning into the revised regulatory requirements starting in CY2018.

## Use of RCT and QED

The evaluation team will not use the Randomized Control Trials (RCT) or Quasi-Experimental Design (QED) for process evaluation because:

- There are not enough participants in this program to achieve statistically significant savings estimates using this method.
- It would not be possible to create a valid matched control group for the customers in this program.
- This method would estimate average savings across all program participants, which is not the desired savings estimate for this program.

## Evaluation Schedule

Table 5 provides the schedule for key deliverables and data transfer activities. (See Table 3 for other schedule details.) Adjustments will be made, as needed, as evaluation activities progress.

**Table 5. Schedule – Key Deadlines**

Activity or Deliverable	Responsible Party	Date Delivered
Program Operations Manual and Workpapers	ComEd	January 15, 2018
CY2018 program tracking data for QA/QC	ComEd	April 7, 2018
CY2018 program tracking data for sampling Wave 1	ComEd	June 1, 2018
CY2018 participating customer survey design	Evaluation	June 30, 2018
Wave 1 project documentation, engineering reviews, schedule, conduct on-site M&V, feedback	Evaluation	July 30, 2018
Tracking System Ex Ante Review Findings and Recommendations	Evaluation	July 30, 2018
CY2018 program tracking data for sampling Wave 2	ComEd	August 30, 2018
Wave 1 participating customer NTG and process survey fielding	Evaluation	September 30, 2018
Wave 2 project documentation, engineering reviews, schedule, conduct on-site M&V, feedback	Evaluation	November 30, 2018
EUL Research Memo	Evaluation	December 15, 2018
CY2018 Program EOY Tracking Data	ComEd	January 30, 2019
Wave 2 participating customer NTG and process survey fielding	Evaluation	February 28, 2019
Wave 3 project documentation, engineering reviews, schedule, conduct on-site M&V, feedback	Evaluation	February 28, 2019
Illinois TRM Update Research Findings	Evaluation	March 1, 2019
Process Analysis Findings	Evaluation	March 1, 2019
NTG Analysis Findings	Evaluation	March 1, 2019
Internal Report Draft by Navigant	Evaluation	March 1, 2019
Draft Report to ComEd and SAG	Evaluation	March 6, 2019
Comments on draft (15 Business Days)	ComEd and SAG	March 27, 2019
Revised Draft by Navigant	Evaluation	April 7, 2019
Comments on redraft (5 Business Days)	ComEd and SAG	April 15, 2019
Final Report to ComEd and SAG	Evaluation	April 22, 2019

## ComEd Instant Discount Program CY2018 to CY2021 Evaluation Plan

### Introduction

The non-residential Instant Discounts Program is designed to provide an expedited, simple solution to business customers interested in purchasing high efficiency products by providing instant discounts at the point of sale. The Instant Discounts Program provides incentives to increase the market share of energy efficient LED lamps (screw based, pin based, and tubular), trim kits, and exit signs, as well as reduced wattage Linear Fluorescent (LF) lamps. Three-phase, high-frequency battery chargers are also offered through the Instant Discounts Program. The CY2018 program energy savings goal is 294,397 gross and 230,514 net MWh, and the capacity goal is 60 gross and 47 net MW.

The CY2018 incentives vary by technology as follows:

- LED lamps and trim kits range from \$2 to \$9
- Reduced wattage linear fluorescents \$1
- LED exit signs range from \$5 to \$20
- LED tube lamps (TLEDs) \$3
- LED HID replacements \$20 to \$55
- 3-Phase High-Frequency battery chargers \$184

The CY2018 program did not change significantly from PY9, in terms of measure mix and end-use. Notable program changes made from PY9 to CY2018 include:

- Addition of LED HID replacements and pin-based LED lamps.
- Removal of dimming requirement for TLEDs and screw-ins to increase sales volume.
- A distinct effort by ComEd to increase participation among mid-size distributors and to incorporate distributor feedback on an ongoing basis.

Additionally, the Instant Discounts Program administrators are considering the addition of more non-lighting measures such as HVAC and motor measures, but these will not be included in CY2018.

The CY2018 gross impact evaluation will not vary from the previous years, but adjustments will be made to reflect specific measure and project characterizations. The evaluation will include a participating customer free ridership and spillover study in CY2018. The findings from the study will inform recommended net-to-gross (NTG) values for the Illinois Stakeholder Advisory Group (SAG) approval and future program application. The CY2018 NTG study will include surveys and interviews with participating customers and distributors to learn about their perspectives and satisfaction with the program, the incentive offerings, and how to improve the program in the future.

The primary objectives of the evaluation of the CY2018 Instant Discounts Program are to: (1) quantify gross and net program impacts; and (2) identify ways in which the program can be improved.<sup>31</sup> The evaluation of this program over the coming four years will include a variety of data collection and analysis activities, including those indicated in the following table. Given that new product classes are being added to the Instant Discounts Program and the overall rate of change of the lighting market (e.g. rapidly decreasing costs, increasing uptake of TLEDs, etc.), we currently recommend that the majority of evaluation activities occur annually. General population surveys and impact modeling are noted as

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<sup>31</sup> Calendar Year (CY) refers to the year of participation that will be researched, not the time that the research will occur.

potential one-time activities. General population surveys have not been used in the Instant Discounts program before, but could be a good compliment to participant surveys and identify reasons for non-participation. This approach is under consideration for CY2018. An impact modeling component is also marked as tentative in CY2018 to examine potential savings from lamps with dimming. A true examination of these savings would require an extensive lighting logger study. Lacking that, a combination of secondary research, modeling, and primary data collection through surveys would provide an initial assessment to inform future research.

**Table 1. Evaluation Approaches – Four Year Plan**

Tasks	CY2018	CY2019	CY2020	CY2021
Tracking System Review	X	X	X	X
Data Collection – Participant Surveys	X		X	
Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Data Collection – Trade Ally Interviews / Roundtables	X	X	X	X
Impact – Measure-Level Deemed Savings Review	X	X	X	X
Impact – Verification & Gross Realization Rate	X	X	X	X
Net-to-Gross – Participant Self-Report Surveys	X		X	
Net-to-Gross – Trade Ally Interviews	X		X	
Process Analysis	X	X	X	X

The evaluation team determined the evaluation approach for the 2018-2021 period based upon the needs of the program and program’s prior history. The 4-year evaluation approach for this program is based on the following:

- A gross and net verification analysis will be performed in each year based on the deemed values in the IL TRM and as determined by the IL SAG in each year.
- The evaluators, program implementers, and ComEd will have regular (at least quarterly) check-in calls to keep the evaluation team informed of any changes to program design or product availability. These calls will also include discussions of data needs, errors, omissions, etc.
- Participant and trade ally surveys / interviews are the primary data source for NTG, installation rate, and residential / non-residential split parameter estimate updates. While some of these parameters have remained relatively stable over time, the lighting market is changing quickly and it may be necessary to complete targeted research for certain lamp types in each year. For instance, TLEDs are rapidly increasing in popularity and there is very little data supporting program drivers. Similarly, prices for LEDs in general have continued to drop dramatically which has NTG implications. The decision on how often to conduct parameter research will be evaluated in each year’s planning period and informed by comparisons to past evaluation research (e.g. PY6, PY7, PY9), market trends, distributor roundtable learnings, and overall evaluation priorities.
- Process analysis will be conducted each year based upon ongoing feedback from program implementers, trade allies, and ComEd.

**Coordination**

Navigant will coordinate with the evaluation teams for other utilities on any issues relevant to this program. In particular, the Instant Discounts team is in close coordination with Ameren, which has an

“Instant Incentives” program, which also provides discounts at the point of sale through commercial lighting distributors.

## Evaluation Research Topics

For the Instant Discount Program, there are three primary areas of evaluation activity: 1) a savings verification analysis that utilizes program tracking data, deemed parameters from the Illinois Technical Reference Manual (TRM), and recommended net-to-gross (NTG) values from the Illinois Energy Efficiency Stakeholder Advisory Group (SAG); 2) evaluation research, which consists of web and telephone surveys of program trade allies<sup>32</sup> and program participants to gather data on key evaluation parameters such as installation rate, residential and non-residential split, and net-to-gross; and 3) process research.

The evaluation research portion serves two functions. First, it allows a comparison of the verified program savings estimates (using deemed values) to evaluation research program savings estimates.<sup>33</sup> Second, it provides key parameter values for deeming in future updates to the IL TRM as well as SAG recommended NTG. These updates are typically done on a two-year cycle (i.e., CY2018 evaluation research results would be used as deemed values for the CY2020 evaluation cycle).

The evaluation will seek to answer the following key researchable questions:

### Impact Evaluation

1. What is the level of gross annual energy (kWh) and gross peak demand (kW) savings induced by the program?
2. What are the net impacts from the program? What is the level of free ridership and spillover associated with this program? What is the researched value for net-to-gross (NTG) ratio?
3. Did the program meet its energy and demand savings goals? If not, why not?

### Process Evaluation and Other Research Topics

The process evaluation effort for CY2018 will focus on program delivery. The process research will address the following questions:

1. How burdensome is the rebate application and submission process for distributors? What elements of the program could be improved from the distributor perspective?
2. How aware are customers of the ComEd-sourced bulb discounts? How effective are the promotional materials (radio, web, e-mail, etc.) supplied by ComEd?
3. What is the distributor experience with selling LEDs and TLEDs in the program in terms of incentive levels and the quality and diversity of approved products?
4. How is the overlap between the Small Business Energy Savings (SBES) and Instant Discounts affecting those programs, and are any changes recommended?
5. What updates are recommended for the Illinois Technical Reference Manual (TRM)?

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<sup>32</sup> In this evaluation “trade allies” refer to the program distributors through which the program is delivered.

<sup>33</sup> Because evaluation research provides the best estimates of installation rate, residential/non-residential split, installation location, and net-to-gross for that program year, evaluation research program savings are considered the most accurate representation of program accomplishments.

## Evaluation Approach

We have updated our evaluation plan summary (from the 3-year plan submitted in August of 2015) to identify tasks specific to CY2018 (Table 2).

As described in further detail below, the evaluation team has begun testing and implementing data collection strategies that will assist in ComEd’s goal of receiving more real-time feedback on an ongoing basis. The evaluation will continue using a primarily web-based survey approach that can be fielded at regular intervals throughout the program year. The web-based approach has proven successful in recent program years for both distributors and participants. Also, the evaluation team will verify the application of TRM parameters in the tracking data on a regular basis throughout the program year. Through close coordination with the ComEd Instant Discounts program manager and program implementer, the evaluation team strives to provide more timely and accurate feedback that can help to increase the effectiveness of the Instant Discounts Program.

Table 2 below summarizes the evaluation tasks for CY2018 including data collection methods, data sources, timing, and targeted sample sizes that will be used to answer the evaluation research questions.

**Table 2. Core Data Collection Activities, Sample, and Analysis**

Activity	CY2018
Gross Impact Approach	Tracking system verification
Gross Sampling Frequency	Regular Interval (2 to 4x)
Verified Net Impact Approach	Deemed Value
Researched NTG Approach	Participant and Distributor Surveys
Researched NTG Frequency	Regular Interval, CY2018 Participants (2 to 4x)
EUL Research	Secondary Research
Process	Program Manager, Implementer, Participant and Distributor Interviews / Review Materials

In line with program changes and accelerated evaluation schedule for delivering tracking data to the valuation team, Navigant will perform tracking system review and M&V project sampling in waves in 2018. Proposed gross impact sampling timelines are shown below.

### Gross Impact Evaluation

At regular intervals throughout the program cycle (every three to four months), the program tracking data will be reviewed for application of TRM v6.0 parameters. The evaluation team will provide a memorandum of findings to ComEd at each interval.

After the program year, a thorough review of savings calculations will be performed. Gross kWh, kW and Peak kW savings will be calculated across all program bulbs using the following equations:

$$\text{Annual kWh Savings} = \text{Program bulbs} * \text{Delta Watts}/1000 * \text{Annual HOU} * \text{Installation Rate} * (1 - \text{Leakage Rate}) * \text{Interactive Effects}$$

Annual kW Savings = Program bulbs \* Delta Watts/1,000 \* Installation Rate \* (1-Leakage Rate) \* Interactive Effects

Annual Coincident Peak = Annual kW Savings \* Peak Load Coincidence Factor<sup>34</sup>  
 kW Savings

Navigant will perform tracking system review and M&V project sampling in three waves in CY2018. The first wave of M&V sampling is expected to cover about one-third of the projects.

Proposed gross impact sampling timelines are shown below.

CY2018 Gross Impact Sampling Waves

- a) First wave sample drawn in April 2018 and completed June 2018
- b) Second wave sample drawn in August 2018 and completed October 2018
- c) Final wave starts December 2018 (or projects completion date)

For the verification analysis in CY2018, the evaluation team will calculate gross savings using the following parameter estimates:

- **Program Bulb Sales** data will be obtained from the CY2018 Instant Discounts tracking database.
- **Program Bulb Installation Rates** (both current program year and delayed program year installations) will come from the IL TRM v6.0.
- **Delta Watts** will be calculated using the lumen-equivalence mapping in the IL TRM v6.0.
- **Non-Residential HOU and Summer Peak CF** estimates will come from the IL TRM v6.0.
- **Residential/Non-Residential Bulb Installation** estimates will come from the IL TRM v6.0.<sup>35</sup>
- **Energy and Demand Interactive Effects** will be estimated using the algorithms presented in the IL TRM v6.0.

The calculation of carryover savings will be broken out by measure and based on the following parameter estimates:

- **Delta Watts** – Verified savings estimate from the year of installation (source: IL TRM v6.0).
- **Res/NonRes Split** - Evaluation research from the year of purchase (PY9 Report and IL TRM v4.0).<sup>36</sup>

<sup>34</sup> Summer Peak is calculated as the percentage of lighting turned on in each room during peak hours of the summer months (hour ending 15:00 – 18:00 EPT, June 1 through August 32). <http://www.pjm.com/~media/documents/manuals/m18.ashx> (pg. 67).

<sup>35</sup> Bulbs installed in residential locations will be assigned residential HOU and Peak CF estimates from the IL TRM v6.0.

<sup>36</sup> Typically, carryover savings would use evaluation research findings from the prior two program years to estimate res/non-res split, installation rate, and NTGR. Evaluation research was not conducted in PY8 so deemed values from PY8 will be used.

- **HOU and Peak CF** – Verified savings estimate from the year of installation (source: IL TRM v6.0).
- **Energy and Demand IE** – Verified savings estimate from the year of installation (source: IL TRM v6.0)
- **Installation Rate** - Verified savings estimate from the year of purchase (source: PY9 report and IL TRM v4.0).<sup>6</sup>
- **NTGR** – Evaluation research from the year of purchase (source: PY9 report and SAG recommended NTGR for PY8)<sup>6</sup>.

Core data collection activities will include the following:

Table 3 below summarizes data collection methods, data sources, timing, and targeted sample sizes that will be used to answer the evaluation research questions in CY2018.

**Table 3. Core Data Collection Activities and Sample**

What	Who	Target Completes CY2018	When
Purchaser CATI Surveys	Program Participants	500	Jun, Oct, Jan
Purchaser Web Surveys	Program Participants		Jun, Oct, Jan
Distributor Web Surveys	Non-Residential Lighting Distributors	Census	December
In-depth Distributor Telephone Interviews	Non-Residential Lighting Distributors	As needed	January
Program Manager and Program Implementer Interviews	Program Manager and Program Implementers	NA	Ongoing

The **Program Tracking Data** collected for the CY2018 gross impact analysis will allow us to verify rebated measure sales and understand the characteristics of the installed measures that drive savings (such as bulb type and wattage).

**Web-Based Purchaser Surveys** will be used as the primary data collection technique for end users in CY2018. Web surveys are distributed via purchaser email addresses collected by the distributors at the time of purchase. These web surveys will be used to verify measure receipt and installation of program bulbs, collect data on the characteristics of the facility (such as business type and room location where program bulbs are being installed, which are related to hours-of-use [HOU] and Peak Coincidence Factor [CF] estimates), and gather other information that will help inform other key lighting parameter estimates (Delta Watts, Installation Rate) for the gross impact analysis. Additionally, as part of this research we will quantify the leakage of program bulbs outside of ComEd service territory and the proportion of program bulbs that are installed in residential locations. Finally, data to support NTGR estimation, including customers’ awareness of program-discounted lamps, and key considerations when purchasing bulbs (price, energy usage, bill savings, etc.) will be gathered.

**CATI (Computer-Assisted Telephone Interviewing) Participant Telephone Surveys** in CY2018 will be used as a supplementary<sup>37</sup> source of data to estimate several gross and net impact parameters, such as leakage, spillover, and free ridership. In prior evaluations, some customers did not provide email

<sup>37</sup> This is supplementary to the purchaser web survey data, which is the primary data source used for the gross and net impact analysis.

addresses or were unresponsive. CATI surveys will be used as a supplement to the web-based survey to achieve the desired number of completes.

**Web-Based Distributor Surveys** will also be used as a supplementary<sup>38</sup> source of data to estimate several gross and net impact parameters, such as leakage, spillover, and free ridership in CY2018. Distributor surveys will also be used to explore process-related issues such as their experience with the rebate application and submission process, availability of approved products and incentive levels, and any recommendations for improving and streamlining the program. A web-based survey will be administered to all program distributors (via email) near the end of the program year. The evaluation team does not anticipate that all distributors will complete the survey, but, with the assistance of ComEd program staff, will make every effort to ensure responses are representative of all types of program distributors. This effort was highly successful in PY7, PY8, and PY9, and we anticipate a high completion rate again in CY2018. Additionally, evaluators were invited to the distributor roundtable for the first time in PY9. In CY2018 and beyond, the evaluation will continue to include participation in the distributor roundtable, where many process and market related topics may be discussed.

**In-depth Distributor Interviews** will be conducted on an as-needed basis to clarify responses received in the web-based distributor survey and to probe specific issues that are of high interest to ComEd. The content and focus of these interviews will be refined over the course of the program year during the monthly evaluation calls with the Instant Discounts program manager and implementers.

**Program Manager and Program Implementer Interviews** will be conducted with the ComEd Instant Discounts program manager as well as DNV GL staff, who manage the implementation of the Instant Discounts Program. These interviews will focus on program design, data collection, program participation, challenges and changes to the program. Interviews with the program manager and program implementer will be informally conducted on an ongoing basis through monthly evaluation calls.

### Verified Net Impact Evaluation

The verified net impact evaluation will apply the net-to-gross (NTG) ratio accepted by Illinois Stakeholders Advisory Group (SAG) consensus to estimate the verified net savings for the program.

**Table 4. Deemed NTG Values for CY2018**

BILD Measure Type	CY2018 Deemed NTG Value <sup>39</sup>
BILD - LEDs	0.78
BILD - Linear Fluorescents	0.75
BILD - LED Exit Signs	0.80
BILD - Battery Chargers	0.80
BILD - Linear LED	0.80

Source:

[http://ilsagfiles.org/SAG\\_files/NTG/2017\\_NTG\\_Meetings/Final/ComEd\\_NTG\\_History\\_and\\_PY10\\_Recommendations\\_2017-03-01.xlsx](http://ilsagfiles.org/SAG_files/NTG/2017_NTG_Meetings/Final/ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.xlsx)

<sup>38</sup> This is supplementary to the purchaser phone and web survey data, which are the primary data sources used for the gross and net impact analysis.

<sup>39</sup> LED Exit Signs and Battery Chargers have historically had very low associated savings and no dedicated NTG research has been done for these measures through the BILD program. Similarly, Linear LEDs are a new measure in PY9 and therefore there is no supporting NTG data. According to the Policy Manual, the default NTG value for measures without adequate supporting research is 0.80.

### **Research NTG Impact Evaluation**

The evaluation team will conduct NTG research in CY2018 that will support the calculation of a NTG ratio that can be used for deeming purposes for future years. To estimate the Instant Discounts Program NTGR in CY2018, two primary methods will be pursued: (1) Customer self-report (based on End-User Web and Telephone Surveys), and (2) Supplier self-report (based on the Distributor Web Surveys). Both methods will focus on estimating free-ridership and participant and nonparticipant spillover. Use of multiple methods for NTGR determination is appropriate, given the dynamic nature of the lighting market and the fact that no single method can definitively capture the extent of program influence. The two methods used will approach net-to-gross estimation using information unique to each data collection method:

- Customer Self-report – Influence of the program on lighting technology purchased, the number of program bulbs purchased, the timing of program bulb purchases, and the purchase of additional non-rebated high efficiency bulbs.
- Distributor Self-report – Distributors will be asked to verify their involvement with participant projects and provide numeric ratings of the importance of the program on the decision to recommend the energy efficiency measures to the program participant. Additional contextual information will be gathered, such as estimates of program bulb sales with and without the program rebates, and whether the program has any impact on program distributors' decision to carry any additional high efficiency lighting products. This approach will comply with the current IL NTG Framework.

The evaluation team and ComEd have expressed concern about using a self-report method for purchases made many months prior to evaluation activities. To address this concern, the evaluation team began deploying surveys at regular intervals (every four to five months) throughout the program year, beginning in PY9. This will continue in CY2018 as outlined in Table 5 below.

Navigant will conduct a NTG study in CY2018 to provide NTG values for potential deeming in future program years through surveys with CY2018 participating customers. We will complete web and CATI surveys with a minimum of 350 contacts who participated in the CY2018 program to quantify participant free-ridership and spillover. We will attempt contact with all participants in the population (for which contact information is available). Surveys will be distributed to all program participants to counteract historically low response rates for this midstream program (<10%), with the goal of providing a 90/10 confidence/precision level of NTG ratios for each major technology grouping (LED lamps, TLEDs, and linear fluorescents) and program-level savings.

### **Lifecycle Savings Estimation – Effective Useful Life Research**

The CY2018 evaluation will continue to examine and refine EULs for measures in the Instant Discounts Program as part of a cross-cutting activity across all programs.

### **Calculation of CPAS and Annual Savings**

As required by the Future Energy Jobs Act (FEJA), Navigant will report the measure-specific and total ex post gross and ex post net savings for the program and the cumulative persisting annual savings (CPAS) for the measures installed in CY2018. Additionally, the weighted average measure life will be estimated, if possible. Key TRC inputs will also be included as an appendix to the report.

## Process Evaluation

The process evaluation will include a brief synthesis of both qualitative and quantitative data collected during the program participant surveys and the distributor surveys. There are several process-related topics that can be explored using the data collected for NTG and other researched parameters including:

- Awareness of the discount provided by ComEd
- Importance of distributor recommendations for efficient lamps
- Importance of ComEd supplied informational materials
- Importance of company or industry standard practice
- Business-type distribution

Additionally, the distributor surveys and distributor roundtable will be used to explore additional process questions. As indicated previously, the focus of this process research will be refined over the course of the program year with input from ComEd. Potential topics may include:

- Distributor experience with the newly added TLEDs in terms of product diversity, product quality, incentive amounts, and sales outside the program.
- Distributor experience with program incentive levels and co-pays for LEDs given widespread customer adoption and rapidly changing prices.

Finally, the Navigant teams evaluating the SBES program and the Instant Discounts program will continue to carefully examine the overlap between these two programs and relevant savings impacts. The evaluation will also make recommendations on areas if improvement between the two programs, if applicable.

### Monthly Evaluation Calls:

As in the PY9 evaluation cycle, the evaluation team will be conducting monthly calls with the ComEd program lead to improve communication and to better tailor evaluation activities to suit ComEd's objectives. The general discussion items for these 30-minute calls will include:

- Planned evaluation tasks
- Data requirements
- Planned project or data reviews
- Setting expectations for the next month

Navigant will perform additional process research, upon the request of the program manager, to support the program manager and implementer in transitioning into the revised regulatory requirements starting in CY2018. Possible topics may include, but will not be limited to, research on impact of public sector projects introduced into the program, and investigation of the popularity of T12 retrofit lightings in the market to understand the viability of continuous use of T12s as a baseline measure in Illinois.

## Use of RCT and QED

No portion of the process or impact analysis will use randomized control trials or quasi-experimental design. These techniques are not possible given the program delivery method. We are not evaluating Instant Discounts via a randomized controlled trial because the program was not designed with randomly assigned treatment and control groups. We are not using quasi-experimental consumption data because

this method would estimate average savings across all program participants which is not the desired savings estimate for this program [use for programs with heterogeneous participants where average impacts are not the desired output (for example, custom C&I where the projects may be quite unique by customer)]

## Evaluation Schedule

Table 5 below provides the schedule for key deliverables and data transfer activities. (See Table 3 for other schedule details.) Adjustments will be made, as needed, as evaluation activities progress.

**Table 5. Schedule – Key Deadlines**

Activity or Deliverable	Responsible Party	Date Delivered
Program Operations Manual and Workpapers	ComEd	January 2, 2018
CY2018 program tracking data for QA/QC	ComEd	February 9, 2018
CY2018 Wave 1 program tracking data for verification and sampling	ComEd	April 30, 2018
CY2018 Wave 1 early impact verification memo	Evaluation	May 31, 2018
CY2018 Wave 1 participating customer survey	Evaluation	June 30, 2018
CY2018 Wave 2 program tracking data for verification and sampling	ComEd	August 30, 2018
CY2018 Wave 2 early impact verification memo	Evaluation	September 30, 2018
CY2018 Wave 2 participating customer survey	Evaluation	October 30, 2018
EUL Research Memo	Evaluation	December 15, 2018
CY2018 Program tracking data for sampling Wave 3	ComEd	December 15, 2018
CY2018 Distributor survey	Evaluation	December 30, 2018
CY2018 Wave 3 participating customer survey	Evaluation	January 31, 2019
CY2018 Final program tracking data for verification	Evaluation	January 31, 2019
Illinois TRM Update Research Findings	Evaluation	March 1, 2019
Process Analysis Findings	Evaluation	March 1, 2019
NTG Analysis Findings	Evaluation	March 1, 2019
Internal Report Draft by Navigant	Evaluation	March 1, 2019
Draft Report to ComEd and SAG	Evaluation	March 7, 2019
Comments on draft (15 Business Days)	ComEd and SAG	March 28, 2019
Revised Draft by Navigant	Evaluation	April 8, 2019
Comments on redraft (5 Business Days)	ComEd and SAG	April 15, 2019
Final Report to ComEd and SAG	Evaluation	April 29, 2019

## ComEd LED Street Lighting Program CY2018 to CY2021 Evaluation Plan

### Introduction

The LED Street Lighting Program seeks to secure energy savings through targeting municipalities with municipal and/or ComEd-owned high-intensity discharge (HID) street lights to replace mercury vapor (MV) and high-pressure sodium (HPS) fixtures with light-emitting diode (LED) fixtures. The program incentivizes early retirement of HID street lights. There are approximately 600,000 municipality-owned and 150,000 ComEd-owned street light fixtures in the ComEd service territory. Assuming that 85% of these street lights are HID lighting fixtures, that leaves approximately 510,000 municipal and 127,500 ComEd-owned fixtures serving municipal customers. The cost savings analysis for municipality-owned fixtures is the energy and maintenance savings. For ComEd-owned fixtures serving a municipality, the municipalities pay a monthly fee that recovers installed capital cost, maintenance cost and electricity cost based on a fixture included street lighting tariff. Municipalities seeking to exchange a ComEd-owned fixture for a more efficient LED fixture prior to the existing fixture's failure would pay a fee (including compensation for ComEd's stranded asset) of approximately \$350 per fixture. Incentives offered under this proposed program would cover this fee, promoting early retirement of the existing HID fixtures for more efficient LED fixtures.

In CY2018, ComEd's target is to replace a total of 142,975 (private and public sector combined) fixtures and produce 95,020<sup>40</sup> MWh of net energy savings. Notable program changes made from Program Year 9 (PY9) to Calendar Year 2018 (CY2018) include:

- The municipality-owned incentive will be reduced from the current \$1.47/watt to \$0.70/watt. The CY2018 incentive level of \$0.70/watt is consistent with what DCEO has historically offered, without bonus, in PY8 and PY9.

The evaluation will assess ComEd's LED Street Lighting tracking data for consistency and accuracy of use of values and proper application of Illinois Technical Resource Manual (TRM) LED savings values. The hours of use agreed to by ComEd and the Illinois Commerce Commission for LED Street Lights is 4,303 hours per year.

### Coordination

Navigant will coordinate with the Ameren streetlight evaluation team on all issues relevant to this program. Navigant will ensure that the evaluation approaches are consistent across utilities, where appropriate, including fixture hours of use, net-to-gross (NTG) values, and baseline assumptions.

### Evaluation Research Topics

The primary objectives of the evaluation of the LED Street Lighting Program are to: (1) quantify gross and net savings impacts from the program, and (2) as the program evolves, make recommendations to enhance the program.

The evaluation will seek to answer the following key researchable questions:

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<sup>40</sup> EE and Demand Response Plan 2018-2021.pdf

### Impact Evaluation

1. What are the program's verified gross savings?
2. What are the program's verified net savings?
3. What updates are recommended for the Illinois Technical Reference Manual, including hours of operation?

### Process Evaluation and Other Research Topics

The evaluation team will conduct a limited process evaluation by interviewing the program manager to explore opportunities to enhance the program. Additionally, the evaluation team will interview municipalities to determine and deem the NTG value for municipality-owned fixtures. The process research will address the following questions:

1. Does the municipality determine the type of fixture to be installed?
2. Are the installed fixtures eligible for incentives?
3. What are the marketing strategies for this program, and are they effective?
4. How can the program be improved?
5. How will CY2018 program changes to the public-sector offering, and including changes to the incentive level and program documentation, impact program participation?

### Operations and Maintenance Cost Research

Navigant will perform secondary research to investigate avoided operations and maintenance (O&M) costs for both ComEd-owned and municipality-owned fixtures. The main objectives of this investigation are to identify the types of maintenance that are avoided by LED retrofits, and quantify the O&M cost savings resulting from installing LED street lighting in lieu of traditional HID street lighting.

The evaluation team will complete a literature review to understand and synthesize the existing research on the installation of LED street lighting in lieu of traditional street lighting. This review will primarily focus on O&M cost savings attributable to LED street lighting and other relevant measure characteristics. Navigant will compile and review relevant reports and studies from reputable sources including, but not limited to, Illuminating Engineering Society of North America, DesignLights Consortium, the Lighting Design Lab and national laboratories.

Navigant will research best practices in utility program offerings pertaining to LED street light replacement at two-three peer utilities. This research will focus primarily on examining implementation methodology employed by the peer utility to work with local municipalities to ensure the success of their LED street lighting program. If possible, Navigant will seek to interview local municipalities that have undergone LED street lighting projects to gather O&M cost data and other relevant measure characterization data.

Based on collected data and information, Navigant will evaluate the avoided O&M costs and other relevant measure characteristics associated with LED street lights. The evaluation team will draft a memorandum to ComEd detailing the results of its study and data evaluation. All external sources will be carefully documented. All data regarding O&M costs or other relevant measure characteristics will be tabulated, and any analysis used will be thoroughly detailed.

## Evaluation Approach

The evaluation of this program over the coming four years will include a variety of data collection and analysis activities, including those indicated in Table 1.

**Table 1. Evaluation Approaches – Four Year Plan**

Tasks	CY2018	CY2019	CY2020	CY2021
Tracking System Review	X	X	X	X
Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Impact – Engineering Review	X	X	X	X
Impact – Verification and Gross Realization Rate	X	X	X	X
Process Analysis <sup>41</sup>	X		X	
NTG Review	X		X	

The evaluation team determined the evaluation approach for the 2018-2021 period outlined in Table 1 above, based upon the needs of the program and the program’s prior history. Navigant realizes that the program is relatively new and will likely change as it matures over the next four years. Navigant also notes that the current approach may change over the next four years as the program grows, but has based the current four-year evaluation approach on the following:

- Gross and net impact analyses will be conducted each year.
- NTG values are not likely to change over time unless major changes to the program occur. Truing up NTG values in 2020 would allow Navigant to update NTG values as new participants are anticipated as the program grows.
- Cumulative Persistence Annual Savings (CPAS) will be calculated annually based upon the requirements of Future Energy Jobs Act (FEJA) but are unlikely to fluctuate yearly because of the limited number and consistency of measures available through the program.
- Process surveys will be conducted every other year, based on the number of program participants. Once initial NTG values are calculated for municipality-owned fixtures, NTG values are not likely to fluctuate significantly unless many new participants engage with the program. Navigant will assess the number of new participants every year to determine if NTG values need to be updated.

Table 2 outlines the evaluation activities to be completed for CY2018.

**Table 2. Evaluation Plan Summary**

Activity	CY2018
Gross Impact Approach	Engineering File Review and Tracking Data Review
Program Manager and Implementer Interviews and Review Materials	Yes

The CY2018 NTG study will include in-depth interviews with participating customers to learn about participant perspectives and satisfaction with the program, the energy assessment services and incentive offerings, and how to improve the program in the future.

Table 3 summarizes the evaluation tasks for CY2018 including data collection methods, data sources, timing, and targeted sample sizes that will be used to answer the evaluation research questions.

<sup>41</sup> Interview municipalities to deem net-to-gross value for municipality owned fixtures.

**Table 3. Core Data Collection Activities, Sample, and Analysis**

Activity	Target	Target Completes CY2018	Timeline	Notes
Tracking System Review	Tracking system	Census	Three waves	
In-Depth Interviews	Program Management and Implementers	1	April – Dec 2018	Augment with monthly calls
Gross Impact	Engineering File Review	All	April 2018 – Feb 2019	Three Waves*
Verified Net Impact	Calculation using deemed NTG ratio		March 2019	
Researched NTG and Process	Telephone Survey with Participating Municipalities	-10-15	June 2018 – March 2019	Various†
National Electrical Manufacturers Association (O&M) Cost Research	Literature review, secondary research	Census	April 2018 – March 2019	Research

\* Navigant will coordinate with ComEd to determine appropriate dates to pull tracking data extracts for each wave.

† The evaluation team will seek ComEd's guidance to reach out to municipalities for process interviews.

The proposed gross impact sampling timelines are shown below.

### Gross Impact Evaluation

The program key gross impact evaluation activities for CY2018 will be based on (1) reviewing the tracking system to determine whether all fields are appropriately populated, (2) reviewing the hours of use information in the tracking system for competitive and non-competitive customers and provide recommendations based on research, if necessary, and (3) cross-checking measure totals and savings recorded in the tracking database.

### Verified Net Impact Evaluation

NTG is deemed at 1.0 for ComEd-owned and municipality-owned fixtures for CY2018. For CY2018, Navigant will assume a NTG value of 1.0 for municipality-owned fixtures and will conduct additional research to calculate a new NTG value for municipality-owned fixtures to be applied in future. If the relevant data required to perform NTG research is available, conclusive, and obtained with sufficient time to apply to CY2019, Navigant will propose to ComEd that the new NTG value be applied to municipality-owned fixtures for CY2019.

**Table 4. Deemed NTG Values for CY2018**

Program Measure	CY2018 Deemed NTG Value
ComEd-owned fixtures	1.0
Municipality-owned fixtures	1.0*

\*Navigant will use a NTG value for the CY2018 evaluation but will conduct research into a more appropriate NTG value for future program years.

Source:

[http://ilsagfiles.org/SAG\\_files/NTG/2017\\_NTG\\_Meetings/Final/ComEd\\_NTG\\_History\\_and\\_PY10\\_Recommendations\\_2017-03-01.xlsx](http://ilsagfiles.org/SAG_files/NTG/2017_NTG_Meetings/Final/ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.xlsx)

### Research NTG Impact Evaluation

Navigant will conduct a participating customer NTG study in CY2018 to provide NTG values for municipality-owned fixtures for potential deeming in future program years through surveys with CY2018 participating municipalities.

### Calculation of CPAS and Annual Savings

Navigant will report ex post gross and ex post net savings for the program as well as the CPAS generated by the program in CY2018 as required by the FEJA. Additionally, Navigant will estimate average measure life for each of the unique LED fixtures in the program and generate a weighted (based on measure counts and energy savings) measure life at the program level.

### Process Evaluation

In CY2018, Navigant will interview the program manager to understand changes in the program, and to make recommendations on program enhancements. Navigant will perform additional process research and interview municipalities to determine and deem the NTG value for municipality-owned fixtures.

### Use of RCT and QED

Given the small number of participants, Navigant does not plan to complete a randomized control trial (RCT) or quasi-experimental design (QED) approach to the process evaluation, but rather attempt to get a census of all participants.

### Evaluation Schedule

Table 5 below provides the schedule for key deliverables and data transfer activities. (See Table 3 for other schedule details.) Adjustments will be made, as needed, as evaluation activities progress.

**Table 5. Schedule – Key Deadlines**

Activity or Deliverable	Responsible Party	Date Delivered
Program Operations Manual and Workpapers	ComEd	January 2, 2018
CY2018 program tracking data for QA/QC	ComEd	April 7, 2018
CY2018 Wave 1 program tracking data	ComEd	June 1, 2018
Wave 1 O&M Cost Research Data	ComEd	July 2, 2018
Wave 1 project documentation, engineering review and memo	Evaluation	August 15, 2018
O&M Cost Research Findings	Evaluation	December 28, 2018
Process Analysis Findings (municipality-owned fixtures)	Evaluation	December 28, 2018
CY2018 program tracking data	ComEd	January 30, 2019
Internal Report Draft by Navigant	Evaluation	March 2, 2019
Draft Report to ComEd and SAG	Evaluation	March 11, 2019
Comments on draft (15 Business Days)	ComEd and SAG	April 4, 2019
Revised Draft by Navigant	Evaluation	April 12, 2019
Comments on redraft (5 Business Days)	ComEd and SAG	April 19, 2019
Final Report to ComEd and SAG	Evaluation	April 28, 2019

## ComEd Operational Efficiency Program CY2018 to CY2021 Evaluation Plan

### Introduction

The Operational Efficiency Program (OEP) is made up of several, specific low-cost and operational measures that are identified as a part of a ComEd engineering commercial & industrial facility assessments. OEP measures are not covered by the Custom or Standard Programs due to their no-cost or low-cost nature. OEP measures are identified in the custom and standard audits and included within the OEP Program. These measures focus on taking advantage of equipment already installed at the site or applying maintenance or operational best practices to realize energy savings for little or no investment by the customer. During the audit, OEP measures are identified and then placed in the OEP tracking system. Implementation may or may not occur at the time of the audit. If it does not occur during the audit, outreach follows up with the customer to see if the operational measures were implemented.

To calculate the savings for measures included in this program, the utility staff has developed a calculator for each measure. The measures identified through this program include, for example, turning off lighting and equipment when not needed, addressing air compressor issues such as leaks and high-pressure adjustments, adjusting space temperatures with pre-existing controls, and simple HVAC maintenance.

In Program Year 9 (PY9), the first year of the program, Navigant's evaluation of this program focused on suggesting adding more measures to the program, reviewing the calculation workbook used for the program and completing a detailed survey with the program manager. In Calendar Year 2018 (CY2018), Navigant will focus on site savings through desk reviews of individual projects. Through this process, Navigant hopes to calculate a realization rate of program savings based on a sampled number of projects and look for inefficiencies in measure documentation.

### Coordination

Navigant will coordinate with the evaluation teams for other utilities on any issues relevant to this program.

### Evaluation Research Topics

The evaluation will seek to answer the following key researchable questions:

#### *Impact Evaluation*

1. How was site information used within the calculators?
2. Do the calculators reflect considerations for standard practice while also accurately reflecting site practice?
3. Do certain measures or groups of measures have fundamental errors that need to be corrected to prevent incorrect estimates of savings?

#### *Process Evaluation and Other Research Topics*

- How is measure information collected during and after the initial audit?
- How is measure information recorded?

- Is the collected information stored in such a way that it can be easily reviewed and what gaps of information collection exist in current practice?

## Evaluation Approach

### Overview

In CY2018, Navigant will focus on site specific savings calculations and processes around the collection and recording of individual site data. Navigant will use telephone supported desk reviews to review individual site savings. These reviews will involve:

- Reviewing each calculation method for each site
- Checking all assumptions and inputs against site information
- Identifying any potential discrepancies and following up with sites as needed

Navigant will complete a process survey with the program management team focused on data collection and recording for individual site projects. This interview will focus on how information is currently collected and how these practices could be improved.

**Table 1. Evaluation Plan Summary**

Activity	CY2018	CY2019	CY2020	CY2021
Gross Impact Approach	X	X	X	X
Gross Sampling Frequency	X	X	X	X
Verified Net Impact Approach	X	X	X	X
Researched NTG Approach		X		X
Program Manager and Implementer Interviews/ Review Materials	X	X	X	X
Participant Interview	X	X	X	X
Effective Useful Life Determination	X	X	X	X

Gross savings will be calculated through a detailed desk review of the sampled projects. Any resulting changes to savings will be rolled up to the sample and a program level realization rate will be calculated. No primary NTG research has been done for this program at this point. If the program continues to grow substantially, then we expect that it will be important to measure NTG in CY2019.

Due to the wide range of measures included in the program, it is difficult to calculate a program measure life. Instead, the program should consider calculating measure life for each of its individual measures and apply this measure life on a site-by-site basis. If requested, Navigant will provide input on individual measure life based upon secondary research in CY2018.

### Use of RCT and QED

The evaluation team will not evaluate this program via a randomized controlled trial (RCT) because the program was not designed with randomly assigned treatment and control groups.

The evaluation will not use quasi-experimental design (QED) because there are not enough participants for individual measures in this program to achieve statistically significant savings estimates.

**Data Collection, Methods, and Sample Sizes**

For CY2018, Navigant will be completing several site-specific calculation reviews. The sampling plan for this review will target overall 10 percent precision at 90 percent confidence using the stratified ratio estimation technique to optimize sample size and control evaluation costs. The strata will be defined by project size and offering type. Depending on the need of the program, Navigant may review a sample of projects in 2018, but the size of this sample will be determined later.

**Table 2. Core Data Collection Activities and Sample**

What	Who/What	Target Completes 2018	When
Engineering Calculation Desk Review	Implementer Tool	*	April – August 2018
Program Manager Interview	Implementer	1	April – August 2018

\*The size of the sample will be determined later once full program data is available.

**Gross Impact Evaluation**

The impact evaluation will be grounded in site-specific desk reviews. Navigant will collect individual site calculation data, review all calculation assumptions and follow up with sites as needed to update any inputs within the calculations.

**Verified Net Savings Evaluation**

The verified net impact evaluation will apply the net-to-gross (NTG) ratio accepted by Illinois Stakeholders Advisory Group (SAG) consensus to estimate the verified net savings for the program. For CY2018 that ratio is 0.91.

**Calculation of CPAS and Annual Savings**

As required by the Future Energy Jobs Act (FEJA), Navigant will report ex post gross and ex post net savings for the program and the cumulative persisting annual savings (CPAS) in CY2018 will be calculated for each measure, along with the total CPAS for all measures. Additionally, the weighted average measure life will be estimated, if possible. Evaluation will also add the savings converted from gas savings to the electric savings so that it's documented in the report.

**Process Evaluation**

The process evaluation research will be informed by a Navigant staff site-by-site measure review, as well as an in-depth program manager interview.

**Evaluation Schedule**

Table 3 below provides the schedule for key deliverables and data transfer activities for 2018.

**Table 3. Evaluation Schedule**

Activity/Deliverables	Responsible Party	Date Delivered
CY2018 Site Calculations are available to Navigant	ComEd	Q2/Q3 2018
Sample of sites determined and approved	Evaluation	Q3/Q4 2018
Project review	Evaluation	Q3/Q4 2018
Program manager interview	Evaluation	Q2/Q3 2018
Internal Navigant Draft Report Review	Evaluation	March 5, 2019
Draft Report to ComEd and SAG	Evaluation	March 12, 2019
Comments on draft (15 Business Days)	ComEd	April 2, 2019
Redraft of Report	Evaluation	April 9, 2019
Comments on Redraft (5 Business Days)	ComEd	April 18, 2019
Final Report to ComEd and SAG	Evaluation	April 26, 2019

## ComEd Public Housing Authorities Program CY2018 to CY2021 Evaluation Plan

### Introduction

The Public Housing Authorities (PHA) Program provides standard and custom incentives for certain categories of federally assisted low-income and public housing, residential and common areas. The program is offered jointly with Nicor Gas, Peoples Gas (PGL) and North Shore Gas (NSG).

The purpose of this program is to work with the 20 Illinois Public Housing Authorities and their portfolios of approximately 33,000 housing units and other buildings in the ComEd service territory to achieve electric and gas savings. This market segment is considered hard to reach and is comprised of extremely low- to very low-income groups, including seniors, disabled persons, and households on federal assistance. PHA residents are renters with incomes at or below 30% to 80% of Area Median Income poverty levels. The PHA Program provides outreach, education, and incentives to management of eligible buildings to upgrade inefficient energy-using equipment in residential units, common areas, maintenance and community buildings, and any other buildings they own and manage in ComEd's territory. In addition, the program partners with Public Housing Authorities, their selected Energy Performance Contractors (EPC), and other funding entities to leverage funds to implement comprehensive energy savings retrofit projects.

Eligibility is limited to applicants who receive electric delivery service from ComEd and manage Public Housing Authority facilities located in the State of Illinois. The program provides incentives for upgrades in electric or natural gas using equipment for both common areas and residential units. Incentives will be awarded in amounts up to, but not exceeding, the cost of the measure for interior lighting improvements, vending machine sensors, ENERGY STAR® rated appliances, high efficiency HVAC equipment, and building shell measures.

The primary objectives of the CY2018 evaluation of the PHA Program are to: (1) quantify the gross and net savings impacts of the program; (2) conduct research to support the program's transition in response to the Future Energy Jobs Act (FEJA); (3) investigate potential gas savings (therms conversion) counted as kWh, and (4) determine key process-related program strengths and weaknesses and identify ways in which the program can be improved.

Navigant will research effective methods to reach PHA managers and buildings. This research may include a review of marketing, promotional, and operational materials; investigation into why eligible PHA buildings are not participating or drop out; and research into trusted sources of energy efficiency information for Public Housing Authorities.

The CY2018 process study will include in-depth interviews with participating customers to learn about their perspectives and satisfaction with the program, and identify ways to improve the program in the future.

The evaluation of this program over the coming four years will include a variety of data collection and analysis activities, including those indicated in Table 1.

**Table 1. Evaluation Approaches – Four Year Plan**

Tasks	CY2018	CY2019	CY2020	CY2021
Tracking System Review	X	X	X	X
Data Collection – Participant Surveys	X	X	X	
Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Data Collection – Stakeholder Interviews	X		X	
Data Collection – Trade Ally Interviews	X	X		X
Impact – Billing Analysis	X		X	
Impact – Engineering Review	X	X	X	X
Impact – Measure-Level Deemed Savings Review	X	X	X	X
Impact – Verification & Gross Realization Rate	X	X	X	X
NTG Research		X		X
Process Analysis	X	X	X	X

The evaluation team determined the evaluation approach for the 2018-2021 period, based upon the needs of the program and the program’s prior history. The four-year evaluation approach for this program is based on the following:

- Gross and net impact analyses will be conducted each year
- Data collection from the program manager and implementers will be conducted each year
- Optimized timing on when to conduct NTG research
- NTG analysis will occur in CY2019 and CY2021 so that the program can be absorbed properly into ComEd in 2018 and such research will be done a second time in the final year of the cycle
- CPAS will be calculated based upon the requirements of FEJA
- Process surveys will be conducted each year to assess program performance with a focus on how it’s operating within the ComEd Business Sector structure

### Coordination

Navigant will coordinate with the evaluation teams for other utilities on any issues relevant to this program. Specifically, Navigant will coordinate impact and process research with the Ameren Illinois Public Housing program evaluation team. Navigant will coordinate with the Ameren team on data collection and survey instrument design to ensure consistency and appropriate questions in the customer and trade ally surveys. Navigant will also coordinate with the Ameren team on recommended updates for the Illinois Technical Reference Manual (TRM), informed by the results of field data collection.

### Evaluation Research Topics

The evaluation will seek to answer the following key researchable questions:

#### Impact Evaluation

1. What are the program’s annual total verified gross savings? What are the verified gross savings from lighting measures? What are the verified gross savings from non-lighting measures?

2. What is the research estimate of gross savings (energy, peak demand, and total demand) for the program?
3. What are the program's verified net savings?
4. Secondary questions include:
  - o Are the ex ante per-unit gross impact savings correctly implemented by the tracking system and reasonable for this program?
  - o What updates are recommended for the Illinois Technical Reference Manual (TRM)? What are the results of field data collection?

#### **Process Evaluation and Other Research Topics**

The process evaluation effort for CY2018 will focus on program delivery. Navigant will work with ComEd to determine top priority process research areas. The process research is likely to address methods and approaches to reduce free ridership in lighting and non-lighting measures. This will likely be done in the Fall and Winter of CY2018.

Navigant will perform additional process research, upon the request of the program manager, to support the program manager and implementer in transitioning into the revised regulatory requirements starting in CY2018.

### **Evaluation Approach**

Table 2 summarizes the evaluation tasks for CY2018 including data collection methods, data sources, timing, and targeted sample sizes that will be used to answer the evaluation research questions.

**Table 2. Core Data Collection Activities, Sample, and Analysis**

Activity	Target	Target Completes CY2018	Timeline	Notes
Tracking System Review	Tracking system	Census	Three waves	
In Depth Interviews	Program Management and Implementers	4	April – Dec 2018	Augment with monthly calls
Onsite M&V Audit	Participating Customers	40	June 2018 – Feb 2019	
Gross Impact	Early Feedback File Review	N	June 2018 – Feb 2019	Early Feedback for Large Projects
Gross Impact	Engineering File Review	85	April 2018 – Feb 2019	Three Waves*
Gross Impact	On-site M&V	x	April 2018 – Feb 2019	
Verified Net Impact	Calculation using deemed NTG ratio	NA	March 2019	NTG deemed at 1.0
Process	Telephone Survey with Participating Customers	125	June 2018 – March 2019	Process. Two Waves
Process	Telephone Interviews Trade Allies	-25	June 2018 – March 2019	Process. Two Waves
Process and Impact Research on CY2018 Operations	Literature review, secondary research	Census	March 2018 – March 2019	Process, Impact

Note: FR = Free Ridership; SO = Spillover

\* Navigant will coordinate with ComEd to determine appropriate dates to pull tracking data extracts for each wave.

In line with program changes and an accelerated evaluation schedule for delivering tracking data to the evaluation team, Navigant will perform tracking system review and M&V project sampling in waves in 2018. The first wave of M&V sampling is expected to cover about one-third of the projects. Proposed gross impact sampling timelines are shown below.

### Gross Impact Evaluation

Navigant will perform tracking system review and M&V project sampling in three waves in CY2018. As noted, the first wave of M&V sampling is expected to cover about one-third of projects completed in CY2018. Proposed gross impact sampling timelines are shown below.

#### CY2018 Gross Impact Sampling Waves

- a) First wave sample drawn in April 2018 and completed in July 2018
- b) Second wave sample drawn in August 2018 and complete November 2018
- c) Final wave starts February 2019 (or projects' completion dates)

Core data collection activities will include the following:

1. Engineering examination of ComEd workpapers and tracking system calculations of claimed savings.

2. Engineering review of project documentation at the measure-level for a sample of projects to verify participation and tracking system entries, check documentation of invoiced quantities and installed measure characteristics, confirm compliance with eligibility, and deemed input values.
3. On-site M&V of measure-level savings on a subset of project sites selected from the engineering review sample to estimate site-specific savings. On-site measurement and verification includes participant interviews, baseline assessment, installed equipment verification, and performance measurement. Measurement may include spot measurements, run-time hour data logging, review of participant energy management system trend data, and post-installation interval metering. Our approach to selecting M&V strategies follows the International Performance Measurement and Verification Protocol (IPMVP); Option A or Option B are typically selected.
4. Computer assisted telephone interviews (CATI) with a sample of Public Housing Program participants, including in-depth interviews with trade allies and account managers to research methods and approaches to reduce free ridership.
5. Interviews with program management and key staff with the implementation contractor (IC). Hold regular monthly meetings by telephone with ComEd program staff and the IC staff.
6. The evaluation team will collect PJM demand savings estimates and program and measure-specific cost detail to further ComEd's PJM auction and TRC analysis.

The gross savings impact approach will review the ex ante measure type to determine whether it is covered by the Illinois TRM or whether it is a non-deemed measure that is subject to retrospective per unit savings adjustment of custom variables. The measure type, deemed or non-deemed, will dictate the savings verification approach. We will also make a research estimate of gross savings based entirely on site-collected data and evaluation engineering analysis of savings. The two methods are described below:

#### 1. Savings Verification

- Measures with per unit savings values deemed by the TRM, would have verified gross savings estimated by multiplying deemed per unit savings (kWh and kW) by the verified quantity of eligible measures installed. Eligible deemed measures must meet all physical, operational, and baseline characteristics required to be assigned to the deemed value as defined in the TRM.<sup>42</sup>
- Measures with fully custom or partially-deemed ex ante savings will be subject to retrospective evaluation adjustments to gross savings on custom variables. For fully custom measures, Navigant will subject the algorithm and parameter values to evaluation adjustment, where necessary. For partially-deemed measures, TRM algorithms and deemed parameter values will be used where specified by the TRM, and evaluation research will be used to verify custom variables.

#### 2. Evaluation Research Savings Estimate

- The evaluation will also include an analysis of on-site collected verification data for a subset of projects. The engineering analysis methods and degree of monitoring will vary from project to project, depending on whether the measure has deemed savings or not, the complexity of the measures, the size of the associated savings, the potential to revise input assumptions, and the

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<sup>42</sup> Illinois Statewide Technical Reference Manual for Energy Efficiency Version 6.0, available at: <http://www.ilsag.info/technical-reference-manual.html>

availability and reliability of existing data. The evaluators will contact the implementers prior to conducting site visits to ensure that the evaluation team has all correct and relevant information.

The measure-level realization rates will be extrapolated to the program population using a ratio estimation method to yield ex post evaluation-adjusted gross energy savings. Gross realization rates will be developed for energy and demand savings. The sample design will provide 90/10 statistical validity for lighting savings, non-lighting savings, and the program overall. The sample of 40 on-sites drawn is also expected to achieve a 90/10 confidence/relative precision level (one-tailed test) to comply with the PJM verification requirements outlined in Manual 18B.

### **Verified Net Impact Evaluation**

The TRM deems NTG at 1.0 for Income Eligible programs.

### **Research NTG Impact Evaluation**

The program has historically seen a deemed NTG ratio of 1.0 because the program targeted the income-eligible sector. However, because the income-eligible customers are not typically the decision makers for this program, Navigant believes the TRM NTG working group should consider whether the PHA Program should have NTG research performed.

### **Calculation of CPAS and Annual Savings**

As required by FEJA, the measure-specific and total ex post gross and ex post net savings for the program and the cumulative persisting annual savings (CPAS) for the measures installed in CY2018 will be calculated along with the total CPAS across all measures. Additionally, the weighted average measure life will be estimated, if possible. Evaluation will also add the savings converted from gas savings to the electric savings so that it's documented in the report.

### **Process Evaluation**

The CY2018 process evaluation research will include a synthesis of both qualitative and quantitative data collected during the program staff and implementer interviews and meetings, and during the end-user customer surveys in CY2018. The CY2018 research will consider methods and approaches to reduce free ridership in lighting and non-lighting measures.

Navigant will perform additional process research, upon the request of the program manager, to support the program manager and implementer in transitioning into the revised regulatory requirements starting in CY2018. Possible topics may include, but will not be limited to, research on impact of public sector projects introduced into the program and impact of any new offerings and measures.

### **Use of RCT and QED**

Navigant will not evaluate this program with a randomized controlled trial (RCT) because the program was not designed with randomly assigned treatment and control groups. We are not using quasi-experimental consumption data (QED) because there are not enough participants in this program to achieve statistically significant savings estimates. Also, it wouldn't be possible to create a valid matched control group for the customers in this program.

## Evaluation Schedule

Table 3 below provides the schedule for key deliverables and data transfer activities. (See Table 2 for other schedule details.) Adjustments will be made, as needed, as evaluation activities progress.

**Table 3. Schedule – Key Deadlines**

Activity or Deliverable	Responsible Party	Date Delivered
Program Operations Manual and Workpapers	ComEd	January 2, 2018
CY2018 program tracking data for QA/QC	ComEd	April 7, 2018
CY2018 program tracking data for sampling Wave 1	ComEd	June 1, 2018
CY2018 participating customer survey design	Evaluation	June 30, 2018
Wave 1 project documentation, engineering reviews, schedule, conduct on-site M&V, feedback	Evaluation	July 30, 2018
Tracking System Ex Ante Review Findings and Recommendations	Evaluation	July 30, 2018
CY2018 program tracking data for sampling Wave 2	ComEd	August 30, 2018
Wave 1 participating customer process survey fielding	Evaluation	Fall 2018
Wave 2 project documentation, engineering reviews, schedule, conduct on-site M&V, feedback	Evaluation	November 30, 2018
EUL Research Memo	Evaluation	December 15, 2018
CY2018 Program tracking data for sampling Wave 3	ComEd	January 30, 2019
Wave 2 participating customer process survey fielding	Evaluation	February 28, 2019
Wave 3 project documentation, engineering reviews, schedule, conduct on-site M&V, feedback	Evaluation	February 28, 2019
Illinois TRM Update Research Findings	Evaluation	March 1, 2019
Process Analysis Findings	Evaluation	March 1, 2019
Internal Report Draft by Navigant	Evaluation	March 1, 2019
Draft Report to ComEd and SAG	Evaluation	March 8, 2019
Comments on draft (15 Business Days)	ComEd and SAG	March 29, 2019
Revised Draft by Navigant	Evaluation	April 8, 2019
Comments on redraft (5 Business Days)	ComEd and SAG	April 15, 2019
Final Report to ComEd and SAG	Evaluation	April 24, 2019

## ComEd Retro-Commissioning Program CY2018 to CY2021 Evaluation Plan

### Introduction

The Retro-Commissioning (RCx) Program seeks to realize energy savings through the RCx process where the emphasis is on restoring building systems or optimizing controls to meet the needs of the current building occupants and save energy. RCx is a study-based process that generates savings through an improved understanding and operation of the existing equipment, rather than capital outlays for installing new equipment.

The Retro-Commissioning Program is managed by ComEd. ComEd coordinates with Nicor Gas, Peoples Gas (PGL) and North Shore Gas (NSG) to account for gas savings generated through the program. The RCx Program continues to evolve to serve more diverse customer segments. To reach smaller customers and market segments, the utilities began expanding the program to support additional offerings in the fifth electric and second gas program years (PY5/GPY2) and in the seventh electric and fourth gas program years (PY7/GPY4).

Traditional RCx represents the original offering for large commercial buildings and completes a four-phase RCx process (Planning, Investigation, Implementation, and Verification). Projects are unique and savings are determined using custom calculations developed by service providers, implementation contractors, and the evaluators.

Monitoring-Based Commissioning (MBCx) is a long-term engagement between the retro-commissioning service provider (RSP) and customer to identify, implement, and monitor measures over time. MBCx features the integration of monitoring software into the building automation system to assist in the identification of deeper energy saving opportunities than those found in traditional RCx. It can also be used as a process to continue and augment prior projects that will help ensure measure persistence and improve building operations over time.

Retro-Commissioning Express (RCxpress) is an offering targeted to mid-sized commercial buildings or buildings interested in a shorter project timeline. RCxpress is differentiated by a more streamlined approach to RCx with a targeted list of measures and use of calculators in addition to custom calculations for savings estimates.

RCx Building Tune-Up (Tune-Up) is for commercial and retail customers less than about 150,000 ft<sup>2</sup>. This offering is more prescriptive and offers an implementation incentive.

Grocery RCx is an electric-only offering for full service and convenience grocery stores and retail refrigeration systems. It has been incorporated into the Tune-Up offering.

SEDAC (in-flight) RCx for public sector participants have been added to the evaluation scope for CY2018. The SEDAC participants enrolled in RCx program when it was under separate administration, according to SEDAC's design and implementation process. Since the SEDAC program is sufficiently different, these projects will form their own evaluation cohort, and will be treated similarly, but separately, from participants with the ComEd administered program. We expect these projects to be a mix of electric only and electric and gas projects. New public sector RCx projects will enroll in the offerings listed above.

Table 1 shows the estimated participation and savings goals as of December 2017.

**Table 1. Anticipated Participation and Savings Goals by Program Offering**

Retro-Commissioning Program Offering	Estimated Participants <sup>43</sup> CY2018	Gross GWh Savings Goals – CY2018	Nicor Gas <sup>44</sup> Gross Therm Savings Goals – CY2018	Peoples Gas Gross Therm Savings Goals – CY2018	North Shore Gas Gross Therm Savings Goals – CY2018
RCx	10	3			
MBCx	30	8	NA	361,080	40,188
RCxpress	15	8			
Tune-Up <sup>45</sup>	55	15	NA	NA	NA
SEDAC public sector	50	7	281,000	7,000	7,000
<b>All Offerings</b>	<b>160</b>	<b>41</b>	<b>NA</b>	<b>368,080</b>	<b>47,188</b>

Source: Nexant estimates and ComEd goals

Notable changes made from GPY6/EPY9 to CY2018 include:

- Integration of the grocery pilot offering into Tune-Up
- Increased RSP fee and implementation incentives for Tune-Up– electric only
- Integration of Public Sector customers with the current program offerings
- Increased RSP and customer incentives for RCx, RCxpress, and MBCx
- SEDAC in-flight projects will be evaluated in parallel with the coordinated program projects for 2018.

The process evaluation and NTG research will interview service providers and participants in alternating years. This schedule is consistent with the planned every-other-year process/NTG research for ComEd.

The process evaluation and NTG research will proscribe SEDAC participants, since their experience differs from the continuing offerings, and the SEDAC program model will be discontinued. SEDAC public sector participants will not be interviewed for process research or NTG.

The primary objectives of the RCx evaluation are: (1) to quantify net savings impacts in therms, kWh, and kW from the program during CY2018 and identify any systemic problems with calculators; (2) to update net-to-gross parameters for program offerings for both gas and electric savings in 2019 and 2021; and (3) to determine key process-related program strengths and weaknesses and identify ways in which the program offering(s) can be improved. The process evaluation will include program management and the experiences of active RSPs and participants.

The CY2018 gross impact evaluation will not vary significantly from the previous years, but adjustments will be made to reflect specific measure and project characterizations.

<sup>43</sup> Participant counts are for ComEd. Counts by gas utility are indeterminant at the time of this Plan.

<sup>44</sup> Nicor Gas RCx goals are not available as they are combined with other Nicor Gas Custom Incentive offerings.

<sup>45</sup> RCx Tune-Up includes Grocery participants in the evaluation plan.

The evaluation of this program over the coming four years will include a variety of data collection and analysis activities, including those indicated in Table 2.

**Table 2. Evaluation Approaches – Four Year Plan**

Tasks	CY2018	CY2019	CY2020	CY2021
Tracking System Review	X	X	X	X
Data Collection – Participant Surveys		X		X
Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Data Collection – Trade Ally Interviews		X		X
Impact – Project-specific Billing Analysis	X	X	X	X
Impact – Engineering Review	X	X	X	X
Impact – Verification & Gross Realization Rate	X	X	X	X
Net-to-Gross – Customer Self-Report Surveys		X		X
Net-to-Gross – Trade Ally Interviews		X		X
Process Analysis	X	X	X	X

NTG research in alternate years follows the pattern of past research, including NTG research for natural gas and electricity in PY9. NTG research with participants and trade allies will conform to statewide NTG methodologies described in the Illinois Technical Reference Manual.

The evaluation team determined the evaluation approach for the 2018-2021 period based upon the needs of the program and program’s prior history. The 4-year evaluation approach for this program is based on the following:

- RCx measures are custom to respective applications and often use custom calculation tools to estimate savings. As a result, we will continue to review and estimate gross and net impacts each year over 2018-2021.
- Because of the longevity and stability of the program we will conduct process research with participants and service providers every other year, in keeping with past patterns. To minimize outreach costs, we will ask NTG questions during the same interview session as our process evaluation.
- CPAS will be calculated based upon the requirements of FEJA.

### Coordination

Navigant will coordinate with the evaluation teams and other utilities on any issues relevant to this program. A collaborative agreement between ComEd and the gas utilities promotes estimating complementary gas savings at ComEd customer sites for all RCx offerings. The ComEd RCx Program evaluation plan parallels the planned work for the Ameren Illinois (AIC) RCx Program. Both the ComEd and AIC programs will conduct annual impact evaluations. Depending on the number of completed projects the AIC impact analysis may include a sample or census of participants. Approximately 30% of sampled projects will also receive on-site verification. Ameren expects a shift toward smaller projects and more public-sector projects in CY2018-CY2021. They currently do not plan on changing their general offering.

### Evaluation Research Topics

The evaluation will seek to answer the following key researchable topics:

## Impact Evaluation

Impact review and analysis will be conducted for all Coordinated RCx offerings, Tune-Up and SEDAC in-flight public sector projects.

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

## Process Evaluation and Other Research Topics

The process evaluation effort for CY2018 will include participants in the ComEd offerings, but will exclude SEDAC in-flight public sector projects. Process research may focus on persistence, channeling, and program delivery, and may address the following questions:

1. Review and integrate in-progress persistence research<sup>46</sup> and effective useful life into program results and reporting.
2. Why do Tune-Up customers drop out of the program?
3. How can controls contractor bottlenecks be alleviated?
4. How can channeling be increased across the portfolio?
5. How can reports be made more valuable to the customers and offer next steps that are easier to follow?

Some insight into these questions may be learned from current GPY6/EPY9 process evaluation research. New information will inform the 2019 TRM.

## Evaluation Approach

Navigant has prepared a plan to identify evaluation tasks for each RCx offering (Table 2). We propose a full impact evaluation and reduced process evaluation research in CY2018. In keeping with the historic pattern, we will conduct full process evaluations in alternate years CY2019 and CY2021.

Navigant conducted impact research in each of the years the program has been offered since inception. Due to the custom analysis for each project, we anticipate continued impact research for each program year.

Navigant will use impact methodologies from the International Performance Measurement and Verification Protocols (IPMVP), as appropriate for the market segment we are researching. As in prior years, we expect to use engineering file review and follow-up monitoring (IPMVP – Option A or B) for RCx, MBCx, RCxpress and SEDAC public sector projects in the on-site sample; however, evaluation methods may differ based on the participant channels and individual site circumstances.

Depending on the measure mix (anticipated dominance of scheduling measures), Navigant may opt to use regression methods with meter data (IPMVP – Option C) for Tune-Ups or select measures in other offerings – matching lower-cost evaluation methods with a lower-savings per project program offering. If the measure-mix assumption does not bear out on a project-by-project basis, electric-only Tune-Up will be evaluated with IPMVP – Option A or B. For electric-only Grocery RCx projects submitted through the

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<sup>46</sup> ComEd has contracted with Seventh Wave to conduct RCx persistence research under the ComEd R&D budget

Tune Up offering, Navigant will review the refrigeration system simulation used for ex ante estimates and we anticipate the evaluation using regression methods with available data for evaluation.

Navigant will conduct secondary research into effective useful life of key RCx measures, to support updates to the TRM and other persistence study efforts.

We anticipate conducting NTG research in CY2019 and CY2021.

The table below summarizes the evaluation tasks for CY2018 including data collection methods, data sources, timing, and targeted sample sizes that will be used to answer the evaluation research questions.

**Table 3. Core Data Collection Activities, Sample, and Analysis**

Activity	Target	Target Complete <sup>47s</sup> CY2018	Timeline	Notes
Tracking System Review	Tracking system	Census	Preliminary of planned and ongoing	Three waves
In Depth Interviews	Program Management and Implementers	4	April – Dec 2018	Augment with monthly calls
Gross Impact	Early Feedback File Review	20	June 2018 – Feb 2019	Early Feedback for Large Projects
Gross Impact	Engineering File Review	57	April 2018 – Feb 2019	Three Waves*
Gross Impact	On-site M&V	28	May 2018 – Feb 2019	
Verified Net Impact	Calculation using deemed NTG ratio	census	March 2019	
Process and Impact Research on CY2018 Operations	Literature review, secondary research	TBD	April 2017 – March 2019	Process, Impact

Note: FR = Free Ridership; SO = Spillover

\* Navigant will coordinate with ComEd to determine appropriate dates to pull tracking data extracts for each wave.

† Trade ally surveys are triggered by high importance ratings by participating customers to the trade ally or vendor. Therefore, the number of trade ally or vendor surveys is dependent on the results of the participating customer surveys.

In line with changes to the RCx offerings and accelerated evaluation schedule for delivering tracking data to the evaluation team, Navigant will perform tracking system review and M&V project sampling in waves in 2018. The three waves of M&V sampling are expected to cover about half of the projects.

Proposed gross impact sampling timelines are shown below.

### Gross Impact Evaluation

RCx, MBCx and RCxpress offerings enroll similar participants and use an overlapping pool of service providers. As such, these projects will be sampled by size-based strata and analyzed together. The RCxpress offering participants may form its own stratum(a) in the sampling protocol to ensure adequate representation in the sampling. All the sampled projects will be subject to engineering file review and on-site inspection and verification of installed measures. Navigant will employ IPMVP – option A or B. Gross impact estimates will mimic ex ante methods to the extent they are reasonable and accurate per data

<sup>47</sup> Participant counts are for global program participants – electric only and electric and gas. Breakouts of pending participation by gas utility and energy type were not provided

collected during verification steps. The evaluation team will modify calculations if methods are not reasonable or if verified operation differs from what was reported.

The sampling plan for these three offerings will target overall 10 percent precision at 90 percent confidence using the stratified ratio estimation technique to optimize sample size and control evaluation costs. The strata will be defined by project size and offering type.

The Tune-Up impacts will be verified by engineering file review and determined with regression analysis of trend or utility billing data and weather or other independent variables that affect energy use (for example, days of operation), as appropriate. This approach parallels IPMVP Option B or C, depending on which data are used. On-site verification will attempt to confirm that measures implemented for the program persist until evaluation verification. If implemented measures are not amenable to regression analysis, the engineering review will form the basis of evaluated savings using IPMVP Option A. This review process may point to special needs of this market segment. Navigant will sample Tune-Up projects to report an offering-specific realization rate at 90/10 confidence and precision.

SEDAC public sector projects will be analyzed as a separate stratum (strata) as the program for these participants is different than the other ComEd offerings. Though the impact evaluation methods will be similar, SEDAC public sector projects will be sampled and reviewed to report a separate realization rate at 90/10 confidence and precision.

Natural gas impacts will be sampled and evaluated in a similar fashion to ensure 90/10 confidence and precision for each gas utility. All projects with gas savings will be organized in a single sampling frame and stratified for sampling by savings magnitude. To avoid over-sampling of electric savings participants, Navigant will sample gas projects first and then sample the appropriate number of electric-only projects to complete the sample.

Navigant will perform tracking system review and M&V project sampling in three waves in CY2018. The first wave of M&V sampling is expected to cover about one-quarter of the projects.

Proposed gross impact sampling timelines are shown below.

#### CY2018 Gross Impact Sampling Waves

- a) First wave sample drawn in April 2018 and completed in July 2018
- b) Second wave sample drawn in August 2018 and completed November 2018
- c) Final wave starts January 2019 (or project's completion date).

Table 4 below summarizes data collection methods, data sources, timing, and targeted sample sizes that will be used to answer the evaluation research questions for each program offering. For planning purposes, Navigant assumes CY2018 participation based on March 2017 estimates: RCx (10), MBCx (30), RCxpress (15), and Tune-Up<sup>48</sup> (55)<sup>49</sup>. Participation by gas utility customers is unknown now, but we anticipate approximately 40% of participants based on recent history necessitating attempted census or near-census sampling of gas participants for process and impact research, respectively.

SEDAC forecasts about 60 completed projects for CY2018<sup>50</sup>.

<sup>48</sup> Including grocery participants. ComEd electric-only participants.

<sup>49</sup> The participation numbers are based on counts of participating sites so the total number of participating customers may be lower.

<sup>50</sup> SEDAC 2018 RCx verification goals 2-12-18.xlsx

Table 4. CY2018 Core Data Collection Activities and Sample\*

What	Who	RCx, MBCx & RCxpress Target Completes (approx.)	RCx Tune-Up Target Completes (approx.)	SEDAC PS completes (approx.)	When
Engineering Review	Participating Customers	24	24	18	February 2018 – Feb. 2019 (concurrent)
Onsite M&V Audit†	Participating Customers (nested among engineering review sample)	8	10	6	May 2018 – February 2019
In Depth Interviews	Program Management‡	4	2		May 2018

\* Final sample sizes may change based on actual participation and stratification

† Onsite M&V Audits are a subset of Engineering Reviews, not a unique sample

‡ Includes interviews with implementation contractor management as well as utility program management. Interviews across offerings may be combined if management teams are shared. Due to the length of the program year, Navigant plans to interview some managers twice.

Navigant will analyze electric-only Tune-Up impacts with billing analysis utilizing appropriate meter interval data.

The gross savings impact approach will review the ex ante measure type to determine whether it is covered by the Illinois TRM or whether it is a non-deemed measure that is subject to retrospective per unit savings adjustment of custom variables. The measure type, deemed or non-deemed, will dictate the savings verification approach. We will also make a research estimate of gross savings based entirely on site-collected data and evaluation engineering analysis of savings. The two methods are described below:

### 3. Savings Verification

- Any measures with per unit savings values deemed by the TRM, or otherwise directed by the TRM, would have verified gross savings estimated by multiplying deemed per unit savings (therm, kWh and kW) by the verified quantity of eligible measures installed. Eligible deemed measures must meet all physical, operational, and baseline characteristics required to be assigned to the deemed value as defined in the TRM.<sup>51</sup>
- Measures with fully custom or partially-deemed ex ante savings will be subject to retrospective evaluation adjustments to gross savings on custom variables. For fully custom measures, Navigant will subject the algorithm and parameter values to evaluation adjustment, where necessary. For partially-deemed measures, TRM algorithms and deemed parameter values will be used where specified by the TRM, and evaluation research will be used to verify custom variables.

### 4. Evaluation Research Savings Estimate

<sup>51</sup> Illinois Statewide Technical Reference Manual for Energy Efficiency Version 5.0, available at: <http://www.ilsag.info/technical-reference-manual.html>

- The evaluation will also include an analysis of on-site collected verification data for a subset of projects. The engineering analysis methods and degree of monitoring will vary from project to project, depending on whether the measure has deemed savings or not, the complexity of the measures, the size of the associated savings, the potential to revise input assumptions, and the availability and reliability of existing data. The evaluators will contact the implementers prior to conducting site visits to ensure that the evaluation team has all correct and relevant information.

The measure-level realization rates will be extrapolated to the program population using a ratio estimation method to yield ex post evaluation-adjusted gross energy savings. Gross realization rates will be developed for energy and demand savings. The sample design will provide 90/10 statistical validity for non-lighting savings and program savings overall. The sample of 28 on-site visits drawn is also expected to achieve an approximate 90/10 confidence/relative precision level (one-tailed test) to comply with the PJM verification requirements outlined in Manual 18B.

### Verified Net Impact Evaluation

The verified net impact evaluation will apply the net-to-gross (NTG) ratio accepted by Illinois Stakeholders Advisory Group (SAG) consensus to estimate the verified net savings for the program.

**Table 5. Deemed NTG Values for CY2018**

Coordinated Energy Efficiency Program Offering	CY2018 Deemed NTG Value
RCx	0.95
MBCx	0.95
RCxTune-Up	0.95
RCxpress	0.95
SEDAC	1.01
All Natural Gas	1.02

Source:  
[http://ilsagfiles.org/SAG\\_files/NTG/2017\\_NTG\\_Meetings/Final/ComEd\\_NTG\\_History\\_and\\_PY10\\_Recommendations\\_2017-03-01.xlsx](http://ilsagfiles.org/SAG_files/NTG/2017_NTG_Meetings/Final/ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.xlsx)  
 Nicor Gas GPY7 NTG Values 2017-03-01 Final.xlsx  
 PGL\_and\_NSJ\_GPY7\_NTG\_Values\_2017-03-01\_Final.xlsx

Navigant is applying the overall values for the other Retro-Commissioning Program offerings to each of the newer offerings (i.e., RCx Tune-Up, and RCxpress). Given that these participants tend to be smaller and have fewer resources, Navigant proposes a NTG value of 0.95 will be appropriate for these offerings until we can apply PY9 research to participants.

### Research NTG Impact Evaluation

The evaluation team will conduct NTG research to inform NTG recommendations for the future for each program offering. Evaluators will collect NTG data for all program offerings in CY2019 and CY2021. By this time all public sector projects will have been enrolled though the coordinated offerings and not SEDAC. All NTG research will address free-ridership and participant spillover using survey protocols developed by the Illinois EM&V NTG Working Group and incorporated into the TRM.

Our NTG research sampling will attempt a census of service providers participating in each offering. The participant surveys will target a 90/10 sample by program offering. For natural gas NTG research, we will attempt a census of all gas projects. Each gas participant data point will also constitute an electric participant data point.

## Calculation of CPAS and Annual Savings

As required by the Future Energy Jobs Act (FEJA) for electric energy efficiency, the measure-specific and total ex post gross and ex post net savings for the program and the cumulative persisting annual savings (CPAS) for the electric measures installed in CY2018 will be calculated along with the total CPAS across all electric measures. Additionally, the weighted average measure life will be estimated, if possible. When gas savings is not attributed to a gas utility, the evaluation will also add the savings converted from gas savings to the electric savings so that it's documented in the report.

## Process Evaluation

While the core Retro-Commissioning Program has remained stable in design and implementation for several years, repeated issues and new challenges have come to light. Navigant will conduct process research in alternating years with NTG research. Topics of research may include: the role that facility staff and their behavior impact persistence; the impact of controls contractors on project time lines; making reports more valuable to customers; encouraging the next energy efficiency improvements and upgrades; enhancing channeling throughout the portfolio and across different implementers; reducing the number of Tune-Up drop-outs.

Navigant will perform additional process research, upon the request of the program manager, to support the program manager and implementer in transitioning into the revised regulatory requirements starting in CY2018. Possible topics may include, but will not be limited to, research on impact of public sector projects introduced into the program, and effective useful life.

SEDAC RCx Program participants will be excluded from process evaluation research, due to differences in the program design. Furthermore, the CY2018 SEDAC cohort should have completed their projects prior to CY2019, the first year for planned process research.

## Use of RCT and QED

We are not evaluating the RCx Program via a randomized controlled trial because the program was not designed with randomly assigned treatment and control groups. We are not using quasi-experimental consumption data because there are not enough participants in this program to achieve statistically significant savings estimates using this method and it would not be possible to create a valid matched control group for the customers in this program.

## Evaluation Schedule

Table 6 below provides the schedule for key deliverables and data transfer activities. (See Table 4 for other schedule details.) Adjustments will be made, as needed, as evaluation activities progress.

**Table 6. Schedule – Key Deadlines**

Activity or Deliverable	Responsible Party	Date Delivered
Program Operations Manual and Workpapers	ComEd	January 2, 2018
CY2018 program tracking data for QA/QC	ComEd	April 6, 2018
CY2018 program tracking data for sampling Wave 1	ComEd	April 30, 2018
Wave 1 project documentation, engineering reviews, schedule, conduct on-site M&V, feedback	Evaluation	July 27, 2018
Tracking System Ex Ante Review Findings and Recommendations	Evaluation	July 27, 2018
CY2018 program tracking data for sampling Wave 2	ComEd	August 30, 2018
Wave 2 project documentation, engineering reviews, schedule, conduct on-site M&V, feedback	Evaluation	November 30, 2018
EUL Research Memo	Evaluation	December 15, 2018
CY2018 Program tracking data for sampling Wave 3	ComEd	January 18, 2019
Wave 3 project documentation, engineering reviews, schedule, conduct on-site M&V, feedback	Evaluation	January 31, 2019
Illinois TRM Update Research Findings	Evaluation	March 1, 2019
Process Analysis Findings	Evaluation	March 1, 2019
Internal Report Draft by Navigant	Evaluation	March 1, 2019
Draft Report to ComEd, Gas Utilities, and SAG	Evaluation	March 8, 2019
Comments on draft (15 Business Days)	ComEd and SAG	March 29, 2019
Revised Draft by Navigant	Evaluation	April 11, 2019
Comments on redraft (5 Business Days)	ComEd and SAG	April 18, 2019
Final Report to ComEd, Gas Utilities, and SAG	Evaluation	April 25, 2019

**ComEd Rural Small Business Kits Program CY2018 Evaluation Plan**

**Introduction**

The ComEd Rural Small Business Kits (Rural Small Business Kits) Program aims to cost-effectively capture electric savings in small commercial facilities located in ComEd’s rural counties by targeting customers that operate office, restaurant, and other facilities with electric hot water. This is an opt-in program where customers must request to receive an energy efficiency kit that includes self-install measures. The measures included in the energy efficiency kit depend on the type of facility the customer ordering the kit operates, as seen in Table 1 below.

To participate in the program, the ComEd customer must have a peak electric load of 100 kW or less and take delivery from ComEd, regardless of their choice of electric supplier. The customer also must be located within a “rural” area, as defined by the federal government, and cannot have participated in the current ComEd Small Business program. Franklin Energy (Franklin) is responsible for implementing the program and kits are delivered by direct mail. Customers can order a kit via telephone call, website request, or email request. A majority of the kit orders are received by outbound calling. Resource Action Programs (RAP), a Franklin Energy company, creates and ships the small business energy efficiency kits directly to customer facilities. The kits contain products particularly selected for the specific business types, as well as detailed installation instructions. A customer service representative follows up with a statistically representative random sample of customers within three weeks of energy kit receipt to verify that each customer received the kit, confirm what measures were installed or learn of the customer plans to install, answer any questions about the measures or program, and determine customer satisfaction with the products and program.

**Table 1. Energy Efficiency Kit Measures for Each Customer Segment**

Offices	Restaurants	Other General
2 LEDs: 9W	3 LEDs: 9W	2 LEDs: BR30 8
2 Exit Sign Retrofit Kit	2 Exit Sign Retrofit Kit	2 Exit Sign Retrofit Kit
2 Bathroom Aerators	2 Bathroom Aerators	1 LED: BR30 Track
1 Kitchen Aerator	1 Pre-Rinse Spray Valve	1 Bathroom Aerator
1 Advanced Power Strip	2 Kitchen Aerators	Installation Guide DVD
Installation Guide DVD	Installation Guide DVD	Marketing Materials
Marketing Materials	Marketing Materials	

ComEd’s net savings planning target is 2,333 MWh for CY2018.

Notable program changes made from PY9 to CY2018 include:

- No longer including CFL bulbs in kits
- Addition of two exit sign lighting retrofit kits in all kits
- Replacing MR16 LED bulb with BR30 LED bulb in kits

The primary objectives of the evaluation of the Rural Small Business Kits Program are to: (1) quantify gross and net savings impacts from the program, and (2) make recommendations to enhance this type of program for similar future programs.

The CY2018 gross impact evaluation will not vary significantly from the previous years. The evaluation will include a variety of data collection and analysis activities, including those indicated in the following table.

**Table 2. Evaluation Approaches**

Tasks	CY2018	CY2019	CY2020	CY2021
Tracking System Review	X			
Data Collection – Program Manager and Implementer Interviews	X		TBD <sup>52</sup>	
Impact – Measure-Level Deemed Savings Review	X			
Impact – Verification & Gross Realization Rate	X			

### Coordination

Although Ameren has a rural efficiency kits program, it is a residential sector program rather than a business sector program and the TRM parameters for kit programs are different for these two sectors.

### Evaluation Research Topics

The evaluation in CY2018 will seek to answer the following key researchable questions:

#### Impact Evaluation

1. What are the program’s verified gross savings?
2. What are the program’s verified net savings?
3. Did the program meet its energy and demand savings targets? If not, why?
4. What updates (if any) are recommended for the Illinois Technical Reference Manual (TRM)?

#### Process Evaluation and Other Research Topics

Navigant will conduct limited process research for the program in CY2018 based on program manager and implementation contractor interviews.

### Evaluation Approach

This evaluation plan identifies tasks on a preliminary basis for CY2018 (Table 2). Activities are subject to change based upon the demands of the portfolio and other factors, and during the program year as program circumstances are better known.

For CY2018, the primary method to determine net and gross savings will be a program tracking system review and applying program-level net-to-gross ratio (NTGR) that is deemed through a consensus process by the Illinois Stakeholder Advisory Group (IL SAG).

The table below summarizes the evaluation tasks for CY2018.

<sup>52</sup> <sup>52</sup>The ComEd 2018-2021 plan shows this program is currently planned for a duration of one year.

**Table 3. Evaluation Plan Summary**

Activity	CY2018
Gross Impact Approach	Tracking System Review
Verified Net Impact Approach	Deemed Value
Program Manager and Implementer Interviews/ Review Materials	Yes

Table 4 summarizes the proposed data collection activities for CY2018, including the sample sizes and timing of each activity.

**Table 4. Core Data Collection Activities, Sample, and Analysis**

Activity	Target	Target Completes CY2018	Timeline	Notes
Tracking System Review	Tracking system	Census	Wave 1* and Final data	
In Depth Interviews	Program Management and Implementers	~2	April – Dec 2018	
Gross Impact	Tracking System Review	All	June 2018– Feb 2019	Two Waves*
Verified Net Impact	Calculation using deemed NTG ratio	NA	March 2019	

\* Navigant will coordinate with ComEd to determine appropriate dates to pull tracking Wave 1 data extract.

In line with program changes and accelerated evaluation schedule for delivering tracking data to the valuation team, Navigant will a perform tracking system review in waves in 2018. The first wave of the tracking system review is expected to cover about half of the projects.

### Gross Impact Evaluation

Since almost all the program’s savings are derived based on the Illinois Technical Reference Manual (TRM), the evaluation team will conduct a limited gross impact evaluation in CY2018. For this impact evaluation, gross savings will be evaluated by (1) reviewing the tracking system to be assured that all fields are appropriately populated and (2) cross-checking totals.

### Verified Net Impact Evaluation

The verified net impact evaluation will apply a program-level NTGR of 0.90 deemed through a consensus process by the IL SAG to estimate the verified net savings for the program in CY2018, as shown in the table below.

**Table 5. Deemed NTG Values for CY2018**

Program Measure	CY2018 Deemed NTG Value
Rural SB Kits Program	0.90

Source:  
[http://ilsagfiles.org/SAG\\_files/NTG/2017\\_NTG\\_Meetings/Final/ComEd\\_NTG\\_History\\_and\\_PY10\\_Recommendations\\_2017-03-01.xlsx](http://ilsagfiles.org/SAG_files/NTG/2017_NTG_Meetings/Final/ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.xlsx)

### Calculation of CPAS and Annual Savings

As required by the Future Energy Jobs Act (FEJA), Navigant will report ex post gross and ex post net savings for the program and the cumulative persisting annual savings (CPAS) in CY2018 will be calculated along with the total CPAS. Additionally, the weighted average measure life will be estimated, if possible. Evaluation will also add the savings converted from gas savings to the electric savings so that it's documented in the report.

### Process Evaluation

We will conduct in-depth telephone interviews with program managers and implementation contractors to make recommendations for potential program enhancements for future programs of a similar design.

### Use of Randomized Controlled Trial and Quasi-Experimental Design

We are not evaluating the Rural Small Business Kits program via a randomized controlled trial because the program was not designed with randomly assigned treatment and control groups. We are not using quasi-experimental design because the savings from the program measures represents less than 5% of whole home usage, and the program does not have sufficient participation to achieve statistically significant savings estimates using this method.

### Evaluation Schedule

Table 6 below provides the schedule for key deliverables and data transfer activities. Adjustments will be made, as needed, as evaluation activities progress.

**Table 6. Schedule – Key Deadlines**

Activity or Deliverable	Responsible Party	Date Delivered
Program Operations Manual	ComEd	February 1, 2018
CY2018 program tracking data for sampling Wave 1	ComEd	June 4, 2018
Tracking System Wave 1 Ex Ante Review Findings and Recommendations	Evaluation	July 31, 2018
CY2018 final program tracking data	ComEd	January 30, 2019
Internal Report Draft by Navigant	Evaluation	February 15, 2019
Draft Report to ComEd and SAG	Evaluation	February 25, 2019
Comments on draft (15 Business Days)	ComEd and SAG	March 18, 2019
Revised Draft by Navigant	Evaluation	March 26, 2019
Comments on redraft (5 Business Days)	ComEd and SAG	April 2, 2019
Final Report to ComEd and SAG	Evaluation	April 13, 2019
Process Analysis Findings	Evaluation	May 15, 2019

## ComEd Small Business Program CY2018 to CY2021 Evaluation Plan

### Introduction

The Small Business Program is designed to assist qualified ComEd non-residential customers<sup>53</sup> to achieve electric energy savings by educating them about energy efficiency opportunities through no-cost on-site energy assessments conducted by preapproved, specially-trained trade allies (TAs) and installation of no-cost direct-install (DI) measures.<sup>54</sup> Further savings are available to participating customers through incentives of thirty to seventy five percent offered for select contractor-installed measures.<sup>55</sup> Trade allies are the primary means of promoting the Small Business Program and obtaining participants.

The program offerings did not change from PY9 to CY2018. The program may consider continuing in CY2018 some or all of the program promotions introduced during the PY9 bridge period (June 1 – December 31, 2017), which included lighting retrofit and indoor or outdoor LED and controls promotions, a past customer promotion, an RTU promotion, and an AC replacement promotion. Starting January 1, 2018, all trade allies or service providers are required to obtain Illinois Commerce Commission (ICC) certification to qualify for participation in the Small Business Program.

ComEd's CY2018 net planning target for the Small Business Program is 164,818 MWh for both first year and cumulative persisting annual energy savings.<sup>56,57</sup>

The primary objectives of the CY2018 evaluation of the Small Business Program will be to: (1) quantify the gross and net savings impacts of the program; (2) investigate potential gas savings counted as kWh (therms conversion); (3) conduct research to support the program's transition in response to the Future Energy Jobs Act (FEJA)<sup>58</sup>; and (4) determine key process-related program strengths and weaknesses to aid in program improvement.

The evaluation of this program over the coming four years will include a variety of data collection and analysis activities, including those indicated in the following table.

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<sup>53</sup> To qualify, participants must be ComEd commercial or industrial customers with monthly peak demand levels up to 100 KW.

<sup>54</sup> No-cost direct-install measures include low-flow showerheads and faucet aerators, pre-rinse spray valves, power strips, and controls for novelty coolers, beverage machines, and snack machines.

<sup>55</sup> Incented measures may include upgrades to T8/T5 lighting, LED retrofits and fixtures, high bay fluorescents, lighting controls, HVAC system components, electric water heaters, refrigeration system components, commercial kitchen equipment, compressed air system measures, smart thermostats, and building envelope measures.

<sup>56</sup> Per Section 8-103B of the Public Utility Act (as amended), beginning in CY2018 energy savings goals will be based on, and verified energy savings measured as, Cumulative Persisting Annual Savings (CPAS).

<sup>57</sup> There are no project or customer engagement goals listed in the 2018-2021 ComEd Plan beyond gross and net savings goals and numbers of measures installed.

<sup>58</sup> Illinois Public Act 099-0906 (<http://www.ilga.gov/legislation/publicacts/99/099-0906.htm>).

**Table 1. Evaluation Approaches – Four Year Plan**

Tasks	CY2018	CY2019	CY2020	CY2021
Tracking System Review	X	X	X	X
Data Collection – General Population Surveys	X	X		
Data Collection – Participant Surveys	X	X	X	X
Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Data Collection – Stakeholder Interviews	X	X	X	X
Data Collection – Trade Ally Interviews	X	X	X	
Impact – Billing Analysis (as needed)	X	X	X	X
Impact – Engineering Review	X	X	X	X
Impact – Measure-Level Deemed Savings Review	X	X	X	X
Impact – Modeling (as needed)	X		X	
Impact – Verification & Gross Realization Rate	X	X	X	X
Net-to-Gross – Customer Self-Report Surveys	X		X	
Net-to-Gross – Trade Ally Interviews	X		X	
Process Analysis	X	X	X	X

The evaluation team determined the evaluation approach for the 2018-2021 period based upon the needs of the program and program’s history. The 4-year evaluation approach for this program is based on the following:

- Gross and net impact analysis will be conducted each year
- Optimized timing on when to conduct NTG research
- NTG analysis every other year when programs are stable and NTG results are consistent over time
- NTG analysis each year when markets or program designs are changing
- Cumulative Persisting Annual Savings (CPAS) will be calculated based upon the requirements of FEJA
- Process surveys will be conducted each year based upon client request and program performance details.

### Coordination

Ameren Illinois’s Small Business Incentives Program is similar to ComEd’s Small Business Program.<sup>59</sup> The ComEd evaluation team will coordinate with the independent evaluator of the Ameren program to ensure that the two evaluations use similar approaches, and to identify and report on any substantive differences.<sup>60</sup>

<sup>59</sup> See <https://amerenillinoisavings.com/for-my-business/explore-incentives/small-business-incentives> for more information.

<sup>60</sup> Opinion Dynamics is the lead evaluator for Ameren Illinois energy efficiency programs.

Navigant will coordinate any NTG or process research with the Ameren Illinois Small Business Program evaluation team. Navigant will coordinate with the Ameren team on data collection and survey instrument design to ensure consistency and appropriate questions in the customer surveys.

## Evaluation Research Topics

The evaluation will seek to answer the following key researchable questions:

### Impact Evaluation

1. What are the program's verified gross savings?
2. What are the program's verified net savings?
3. What are the program's demand savings?
4. What updates are recommended for the Illinois Technical Reference Manual (TRM)?
5. What are the effective useful lives (EUL) of measures within the program?

### Process Evaluation and Other Research Topics

The process evaluation effort for CY2018 will focus on program delivery. The process research will address the following topics:

1. What are effective methods to reach small business owners amidst varying demands and calls for their attention?
2. What is the program's cumulative penetration by region and business segment?
3. What prevents former participants from re-enrolling, from two perspectives: the TAs business model on customer relationship management, and the former participants' interest, ability and barriers?
4. What is the TA experience, reach, and operation, focusing on comprehensive measures, impact of cumulative savings, and prior research on regional and business segment penetration?
5. Other research upon request to support the program manager and implementer in transitioning to the revised Illinois regulatory requirements starting in Calendar Year 2018 (CY2018).

## Evaluation Approach

The table below summarizes the evaluation tasks for CY2018 including data collection methods, data sources, timing, and targeted sample sizes that will be used to answer the evaluation research questions.

**Table 2. Core Data Collection Activities, Sample, and Analysis**

Activity	Target	Target Completes CY2018 (approx.)	Timeline	Notes
Tracking System Review	Tracking system	Census	Two waves	
In Depth Interviews	Program Management and Implementers	6	April – Dec 2018	Augment with monthly calls
Gross Impact	Early Feedback File Review	Census	June 2018 – Feb 2019	Wave one and final data*
Gross Impact	Engineering File Review	30	September 2018	Early Feedback for Sampled Projects (One Wave)
Gross Impact	QED literature review, secondary research	Census	Sept 2018 – Dec 2018	Investigate QED approach for TRM recommendation
Verified Net Impact	Calculation using deemed NTG ratio	Census	March 2019	
Researched NTG and Process	Telephone Survey with Participating Customers	Up to 120†	June 2018 – May 2019	FR & SO, Process. Three Waves
Researched NTG and Process	Telephone Interviews with Trade Allies	Up to 30†	June 2018 – May 2019	FR & SO, Process. Three Waves
Process and Impact Research on CY2018 Operations	Literature review, secondary research		April 2018 – March 2019	Process, Impact

Note: FR = Free Ridership; SO = Spillover; QED = Quasi Experimental Design

\* Navigant will coordinate with ComEd to determine appropriate date to pull wave one tracking data extract.

† Navigant will complete an appropriate number of surveys with participants and interviews with trade allies achieve to research NTG.

Navigant will perform tracking system review and engineering file reviews on a sample of participant projects in three waves in CY2018. Navigant will have interviews with program management and key staff with the implementation contractor (IC) in CY2018 for impact or process and NTG research related issues (three waves of data collection). Navigant will use the SAG approved net-to-gross ratios for CY2018 to calculate program net savings in CY2018.

### Gross Impact Evaluation

Since most Small Business Program savings are derived from deemed values contained in the TRM, gross savings will continue to be evaluated primarily by (1) reviewing the tracking system data and savings workbook to ensure that all fields are appropriately populated and savings are consistent with the implementation contractor workpapers and savings calculators that feed into the tracking system; (2) reviewing new measures' algorithms and values in the tracking system and savings workbook to assure that they are appropriately applied; and (3) cross-checking totals. This approach will be supplemented where possible with a review of project documentation on a random sample of projects to verify participation, installed measure quantities, and associated savings. Findings from the impact files will be reviewed to provide an opportunity for improving the tracking system and data collection.

Proposed CY2018 gross impact and sampling timelines are shown below.

1. Mid-year early impact review of Wave 1 data in June 2018 and completed in July 2018. This will include developing a memorandum of findings from early impact review.

2. Wave 2 sample of project files and documentation drawn in September 2018 and completed November 2018.
3. Final and third wave of tracking data in February 2019 and completed by March 31, 2019.

Core data collection activities will include the following:

1. Engineering examination of ComEd workpapers, tracking system and measure workbook calculations of claimed savings.
2. Engineering review of project documentation at the measure-level for a sample of projects to verify participation and tracking system entries, check documentation of invoiced quantities and installed measure characteristics, confirm compliance with eligibility, and deemed input values.
3. Computer assisted telephone interviews (CATI) with a sample of Small Business Program project contacts completed to quantify participating customer free-ridership and spillover, and trade ally free ridership and spillover.
4. Hold regular monthly meetings by telephone with ComEd program staff and the IC staff to discuss specific impact issues that need to be addressed during program implementation.
5. The evaluation team will collect PJM demand savings estimates and program and measure-specific cost detail to further ComEd’s PJM auction and TRC analysis.
6. Investigate potential gas measures with kWh savings, and review the parameters ComEd used to estimate potential kWh savings (therms conversion).

**Use of Randomized Control Trial and Quasi-Experimental Design**

Navigant is not evaluating the Small Business Program via a randomized controlled trial (RCT) because the program was not designed with randomly-assigned treatment and control groups. Nor will we base the CY2018 impact analysis on a quasi-experimental design (QED), because the program targets a heterogeneous group of businesses and has many unique measures with significant cross-participation. While the evaluation will continue to be based primarily on deemed TRM values, Navigant will investigate using a QED approach to prospectively update the TRM for certain measure-business type combinations.

**Verified Net Impact Evaluation**

The verified net impact evaluation will apply the net-to-gross (NTG) ratio accepted by Illinois Stakeholders Advisory Group (SAG) consensus to estimate the verified net savings for the program.

**Table 3. Deemed NTG Values for CY2018**

Program Measure	CY2018 Deemed NTG Value
Small Business (all private sector measures)	0.91

Source: [http://ilsagfiles.org/SAG\\_files/NTG/2017\\_NTG\\_Meetings/Final/ComEd\\_NTG\\_History\\_and\\_PY10\\_Recommendations\\_2017-03-01.xlsx](http://ilsagfiles.org/SAG_files/NTG/2017_NTG_Meetings/Final/ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.xlsx)

**Research NTG Impact Evaluation**

Navigant will conduct a participating customer NTG study in CY2018 to provide NTG values for potential deeming in future program years through surveys with CY2018 participating customers. We will complete computer assisted telephone interviews (CATI) with a minimum of 120 contacts who participated in the CY2018 program to quantify participant free-ridership and spillover. We will interview up to 30

participating trade allies to quantify free ridership and spillover, and average the results with customer participants results, to estimate program level NTG. Sample design will attempt to achieve a 90/10 confidence/precision level of NTG ratios for lighting and non-lighting, and a roll up at the program-level, through a weighted average of lighting and non-lighting energy savings in the program.

Proposed CY2018 NTG and process research sampling timelines are shown below.

1. Wave 1 data collection and sampling in May 2018 and completed in August 2018.
2. Wave 2 data collection and sampling in October 2018 and completed in January 2019.
3. Third and final wave of CY2018 tracking data in February 2019 and completed in May 2019.
4. Results from the NTG analysis will be used in the SAG NTG deeming process.

### Calculation of CPAS and Annual Savings

As required by the Future Energy Jobs Act (FEJA), Navigant will report ex post gross and ex post net savings for the program and the cumulative persisting annual savings (CPAS) in CY2018 will be calculated along with the total CPAS. Additionally, the weighted average measure life will be estimated, if possible. Evaluation will also add the savings converted from gas savings to the electric savings so that it's documented in the report.

### Process Evaluation

The CY2018 process evaluation research will include a synthesis of both qualitative and quantitative data collected during the program staff and implementer interviews and meetings, and during the end-user customer surveys in CY2018. The CY2018 NTG study will include in-depth interviews with participating customers to learn about their perspectives and satisfaction with the program, amidst varying opportunities from program incentive offerings and changes to program application requirements.

Navigant will research effective methods to reach small business owners amidst varying demands and calls for their attention. This research may include a review of customer-facing marketing, promotion and operational materials; investigation into why eligible businesses refuse to engage or drop out; and research into trusted sources of energy efficiency information within the community.

Navigant will measure program penetration geographically, by business segment, measure type and trade ally saturation to aid in developing a strategy to expand the program and recruit TAs by underserved measure type.

Navigant will investigate why the re-enrollment rate is low among participants, including research on TA business models, customer relationship management (CRM) efforts, and former participants' experience, interest and barriers to participating again in the program.

Navigant will research the TA experience and operations, focusing on the impact of delivering cumulative savings, offering comprehensive measures.

Navigant will perform additional process research, upon the request of the program manager, to support the program manager and implementer in transitioning into the revised regulatory requirements starting in CY2018.

For the direct install program offer, Navigant will assess comprehensiveness of treatment of savings opportunities, extent of missed opportunities, particularly for major non-lighting measures.

## Evaluation Schedule

Table 4 and 5 below provide the schedule for key deliverables and data transfer activities (see Table 2 for other schedule details.) The April 30th deadline in Table 4 is for the impact report. The process and NTG findings will be delivered in different documents and on a different schedule as shown in Table 5. Adjustments will be made, as needed, as evaluation activities progress.

**Table 4. Schedule – Key Impact Deadlines**

Activity/Deliverables	Responsible Party	Date Delivered*
Monthly Impact/Process Meetings	ComEd/Navigant & IC Staff	Every month as needed
Program Operations Manual and Workpapers/Workbook Review	ComEd/Implementation Contractor	March 15 – April 15, 2018
CY2018 Wave 1 Tracking Data	ComEd	June 30, 2018
Early impacts findings memo	Evaluation Team	August 31, 2018
Sample Projects Documentation for Review	ComEd	September 30, 2018
QED Investigation and Findings Memo	Evaluation Team	December 31, 2018
Wave 2 and Final CY2018 Tracking Data to Navigant	ComEd	January 30, 2019
Internal Report Draft by Navigant	Evaluation Team	March 2, 2019
Draft Report to ComEd and SAG	Evaluation Team	March 11, 2019
Comments on draft (15 Bus. Days)	ComEd / SAG	April 1, 2019
Revised Draft by Navigant	Evaluation Team	April 9, 2019
Comments on redraft (5 Bus. Days)	ComEd / SAG	April 16, 2019
Final Report to ComEd and SAG	Evaluation Team	April 26, 2019

**Table 5. Schedule – Key NTG & Process Deadlines**

Activity/Deliverables	Responsible Party	Date Delivered <sup>61</sup>
Monthly Impact/Process Meetings	ComEd/Navigant & IC Staff	Every month as needed
Develop Process and NTG Survey, Interview Guides	Evaluation Team	March 15, 2018 – April 15, 2018
CY2018 Wave 1 Tracking Data	ComEd	June 30, 2018
CY2018 Wave 2 Tracking Data	ComEd	September 30, 2018
Draft Process Research Findings	Evaluation Team	December 30, 2018
CY2018 Wave 3 & Final Tracking Data	ComEd	January 30, 2019
Final Process Research Findings	Evaluation Team	March 30, 2019
Internal NTG Report Draft by Navigant	Evaluation Team	July 30, 2019
Draft NTG Report to ComEd and SAG	Evaluation Team	September 1, 2019
Comments on draft (10 Bus. Days)	ComEd / SAG	September 15, 2019
Final NTG Recommendation to ComEd and SAG	Evaluation Team	October 1, 2019

<sup>61</sup> Draft NTG recommendations are due to the SAG September 1st and final October 1<sup>st</sup> every year. The Small Business private sector NTG research findings on CY2018 participants will be ready in CY2019, to meet the deadline for NTG recommendation in 2019, for future application. The NTG research on public sector will be conducted on CY2019 participants for future recommendation. Process analysis findings will be delivered as near to the data collection as possible (unless that falls during the impact reporting season).

**ComEd Small Public Facilities Program CY2018 to CY2021 Evaluation Plan****Introduction**

The Small Public Facilities Program is designed to assist qualified ComEd public sector non-residential customers<sup>62</sup> to achieve electric energy savings by educating them about energy efficiency opportunities through no-cost on-site energy assessments conducted by preapproved, specially-trained trade allies (TAs) and installation of no-cost direct-install (DI) measures.<sup>63</sup> Further savings are available to participating customers through incentives of thirty to seventy five percent offered for select contractor-installed measures.<sup>64</sup> Trade allies are the primary means of promoting the Small Public Facilities program and obtaining participants.

ComEd's CY2018 net planning target for the Small Public Facilities Program is 7,189 MWh for both first year and Cumulative Persisting Annual Savings (CPAS).<sup>65,66</sup> Willdan, Inc is the implementation contractor for the Small Public Facilities Program throughout ComEd's service territory.

The primary objectives of the CY2018 evaluation of the Small Public Facilities Program will be to: (1) quantify the gross and net savings impacts of the program; (2) investigate potential gas savings counted as kWh (therms conversion); (3) conduct research to support the program's transition in response to the Future Energy Jobs Act (FEJA)<sup>67</sup>; and (4) determine key process-related program strengths and weaknesses to aid in program improvement.

The evaluation of this program over the coming four years will include a variety of data collection and analysis activities, including those indicated in Table 1

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<sup>62</sup> To qualify, participants must be ComEd public sector non-residential customers with monthly peak demand levels up to 100 KW.

<sup>63</sup> No-cost direct-install measures include low-flow showerheads and faucet aerators, pre-rinse spray valves, power strips, and controls for novelty coolers, beverage machines, and snack machines.

<sup>64</sup> Incented measures may include upgrades to T8/T5 lighting, LED retrofits and fixtures, high bay fluorescents, lighting controls, HVAC system components, electric water heaters, refrigeration system components, commercial kitchen equipment, compressed air system measures, smart thermostats, and building envelope measures.

<sup>65</sup> Per Section 8-103B of the Public Utility Act (as amended), beginning in CY2018 energy savings goals will be based on, and verified energy savings measured as, cumulative persisting annual savings (CPAS). Since CY2018 is the first year of a new four-year plan, planned First Year Savings and planned CPAS are equal. See "Commonwealth Edison Company's 2018 – 2021 Energy Efficiency and Demand Response Plan," June 30, 2017, pp. 6-7, 51-52.

<sup>66</sup> There are no project or customer engagement goals listed in the 2018-2021 ComEd Plan, just gross and net savings goals and numbers of measures installed.

<sup>67</sup> Illinois Public Act 099-0906 (<http://www.ilga.gov/legislation/publicacts/99/099-0906.htm>).

**Table 1. Evaluation Approaches – Four Year Plan**

Tasks	CY2018	CY2019	CY2020	CY2021
Tracking System Review	X	X	X	X
Data Collection – General Population Surveys	X		X	
Data Collection – Participant Surveys	X	X		X
Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Data Collection – Stakeholder Interviews	X	X	X	X
Data Collection – Trade Ally Interviews	X	X		X
Impact – Billing Analysis (as needed)	X	X	X	X
Impact – Engineering Review	X	X	X	X
Impact – Measure-Level Deemed Savings Review	X	X	X	X
Impact – Modeling (as needed)	X	X	X	X
Impact – Verification & Gross Realization Rate	X	X	X	X
Net-to-Gross – Customer Self-Report Surveys		X		X
Net-to-Gross – Trade Ally Interviews		X		X
Process Analysis	X	X	X	X

The evaluation team determined the evaluation approach for the 2018-2021 period, based upon the needs of the program and program’s history. The four-year evaluation approach for this program is based on the following:

- Gross and net impact analysis will be conducted each year
- Optimized timing on when to conduct net-to-gross (NTG) research
- NTG analysis every other year when programs are stable and NTG results are consistent over time
- NTG analysis each year when markets or program designs are changing
- CPAS will be calculated based upon the requirements of FEJA
- Process research will be conducted each year based upon client request and program performance details

### Coordination

Ameren Illinois does not currently have a program analogous to ComEd’s Small Public Facilities Program, and instead will serve small public-sector customers through their existing Small Business Program, according to the Ameren Illinois Small Business Program evaluation team lead.<sup>68</sup> Navigant will coordinate with the Ameren Illinois Small Business Program evaluation team on data collection, analytical methods, and survey instrument design to ensure consistency in our evaluation approaches for small public-sector facilities.

<sup>68</sup> Email communication (February 9, 2018) from Hannah Howard, Managing Director, Opinion Dynamics.

## Evaluation Research Topics

The evaluation will seek to answer the following key researchable questions:

### Impact Evaluation

1. What are the program’s verified gross savings?
2. What are the program’s verified net savings?
3. What are the program’s demand savings?
4. What updates are recommended for the Illinois Technical Reference Manual (TRM)?
5. What are the effective useful lives (EUL) of measures within the program?

### Process Evaluation and Other Research Topics

The process evaluation effort for CY2018 will focus on program delivery. The process research may address the following topics:

1. What are effective methods to reach decision makers for small public facilities amidst varying demands and calls for their attention?
2. What is the TA experience, reach, and operation, focusing on comprehensive measures, and impact of cumulative savings?
3. Other research upon request to support the program manager and implementer in transitioning to the revised Illinois regulatory requirements starting in Calendar Year 2018 (CY2018).

## Evaluation Approach

Table 2 summarizes the evaluation tasks for CY2018 including data collection methods, data sources, timing, and targeted sample sizes that will be used to answer the evaluation research questions.

**Table 2. Core Data Collection Activities, Sample, and Analysis**

Activity	Target	Target Completes CY2018 (approx.)	Timeline	Notes
Tracking System Review	Tracking system	Census	Two waves	
In Depth Interviews	Program Management and Implementers	6	February – Dec 2018	Augment with monthly calls
Gross Impact	Early Feedback File Review	Census	June 2018 – Feb 2019	Two Waves*
Gross Impact	Engineering File Review	30	September 2018	Early Feedback for Sampled Projects (One Wave)
Verified Net Impact	Calculation using deemed NTG ratio	Census	March 2019	
Process and Impact Research on CY2018 Operations	Literature review, primary and secondary research		April 2018 – March 2019	Process, Impact

Note: FR = Free Ridership; SO = Spillover

\* Navigant will coordinate with ComEd to determine appropriate dates to pull tracking data extracts for each wave.

† Navigant will complete an appropriate number of surveys with participants and interviews with trade allies achieve to research NTG.

Navigant will perform tracking system review and engineering file reviews on a sample of participant projects in three waves in CY2018. Navigant will have interviews with program management and key staff

with the implementation contractor (IC) in CY2018 for impact or process and NTG research related issues (three waves of data collection). Navigant will use the SAG approved net-to-gross ratios for CY2018 to calculate program net savings in CY2018.

### Gross Impact Evaluation

Since most Small Public Facilities Program savings are derived from deemed values contained in the TRM, gross savings will continue to be evaluated primarily by (1) reviewing the tracking system data and savings workbook to ensure that all fields are appropriately populated and savings are consistent with the implementation contractor's workpapers and savings calculators that feed into the tracking system; (2) reviewing new measures' algorithms and values in the tracking system and savings workbook to assure that they are appropriately applied; and (3) cross-checking totals. This approach will be supplemented where possible with a review of project documentation on a random sample of public-sector projects to verify participation, installed measure quantities, and associated savings. Findings from the impact files will be reviewed to provide an opportunity for improving the tracking system and data collection.

Proposed CY2018 gross impact and sampling timelines are shown below.

1. Mid-year early impact review of Wave 1 data in June 2018 and completed in July 2018. This will include developing a memorandum of findings from early impact review.
2. Wave 2 sample of project files and documentation drawn in September 2018 and completed November 2018.
3. Final and third wave of tracking data in February 2019 and completed by March 31, 2019.

Core data collection activities will include the following:

1. Engineering examination of ComEd workpapers, tracking system and measure workbook calculations of claimed savings.
2. Engineering review of project documentation at the measure-level for a sample of projects to verify participation and tracking system entries, check documentation of invoiced quantities and installed measure characteristics, confirm compliance with eligibility, and deemed input values.
3. Computer assisted telephone interviews (CATI) with a sample of Small Public Facilities program project contacts completed to quantify participating customer free-ridership and spillover, and trade ally free ridership and spillover.
4. Hold regular monthly meetings by telephone with ComEd program staff and the IC staff to discuss specific impact issues that need to be addressed during program implementation.
5. The evaluation team will collect PJM demand savings estimates and program and measure-specific cost detail to further ComEd's PJM auction and TRC analysis.
6. Investigate potential gas measures with kWh savings, and review the parameters ComEd used to estimate potential kWh savings (therms conversion).

### Verified Net Impact Evaluation

The verified net impact evaluation will apply the net-to-gross (NTG) ratio accepted by Illinois Stakeholders Advisory Group (SAG) consensus to estimate the verified net savings for the program (Table 3).

**Table 3. Deemed NTG Values for CY2018**

Program Measure	CY2018 Deemed NTG Value
Small Public Facilities (all public-sector measures)	0.91

Source: [http://ilsagfiles.org/SAG\\_files/NTG/2017\\_NTG\\_Meetings/Final/ComEd\\_NTG\\_History\\_and\\_PY10\\_Recommendations\\_2017-03-01.xlsx](http://ilsagfiles.org/SAG_files/NTG/2017_NTG_Meetings/Final/ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.xlsx)

### Calculation of CPAS and Annual Savings

As required by FEJA, Navigant will report ex post gross and ex post net savings for the program and the CPAS in CY2018 will be calculated along with the total CPAS. Additionally, the weighted average measure life will be estimated, if possible. Evaluation will also add the savings converted from gas savings to the electric savings so that it's documented in the report.

### Process Evaluation

The CY2018 process evaluation research will include a synthesis of both qualitative and quantitative data collected during the program staff and implementer interviews and meetings, and additional appropriate primary and secondary research in response to programmatic need.

Navigant will perform additional process research, upon the request of the program manager, to support the program manager and implementer in transitioning into the revised regulatory requirements starting in CY2018.

### Use of RCT and QED

Navigant is not evaluating the Small Public Facilities Program via a randomized controlled trial (RCT) because the program was not designed with randomly assigned treatment and control groups. Navigant is not using quasi-experimental consumption data (QED) for the following reasons.

- It would not be possible to create a valid matched control group for the customers in this program
- This method would estimate average savings across all program participants which is not the desired savings estimate for this program
- This program contains many unique measures with significant cross-participation. In this case, quasi-experimental consumption data analysis would produce savings estimates for bundles of commonly-installed measures, rather than for each measure individually, which is not the desired output for all analysis

### Evaluation Schedule

Table 4 provides the schedule for key deliverables and data transfer activities (see Table 2 for other schedule details.) The April 30th deadline in Table 4 is for the impact report. The process and NTG findings will be delivered in different documents and on a different schedule. Adjustments will be made, as needed, as evaluation activities progress.

**Table 4. Schedule – Key Impact Deadlines**

Activity/Deliverables	Responsible Party	Date Delivered*
Monthly Impact/Process Meetings	ComEd/Navigant & IC Staff	Monthly as needed
Program Operations Manual and Workpapers/Workbook Review	ComEd/Nexant	March 15 – April 15, 2018
CY2018 Wave 1 Tracking Data	ComEd	June 30, 2018
Early impacts findings memo	Evaluation Team	July 31, 2018
Sample Projects Documentation for Review	ComEd	September 30, 2018
Wave 2 and Final CY2018 Tracking Data to Navigant	ComEd	January 30, 2019
Internal Report Draft by Navigant	Evaluation Team	March 2, 2019
Draft Report to ComEd and SAG	Evaluation Team	March 11, 2019
Comments on draft (15 Bus. Days)	ComEd / SAG	April 1, 2019
Revised Draft by Navigant	Evaluation Team	April 9, 2019
Comments on redraft (5 Bus. Days)	ComEd / SAG	April 16, 2019
Final Report to ComEd and SAG	Evaluation Team	April 26, 2019

## ComEd Standard Program CY2018 to CY2021 Evaluation Plan

### Introduction

As part of the Business Incentives Program<sup>69</sup> the Standard Program offers prescriptive financial incentives and a streamlined application to facilitate the implementation of cost-effective energy efficiency improvements for non-residential (commercial and industrial) customers and market segments, with a program network of trade allies and service providers. Eligible measures include energy-efficient indoor and outdoor lighting, HVAC equipment, refrigeration, Energy Management Systems (EMS), commercial kitchen equipment, variable speed drives, compressed air equipment and other qualifying products. The program also targets new system installation opportunities (e.g., lighting systems) by offering incentives that “bundle” equipment and controls technologies.

Notable program changes made from PY9 to CY2018 include:

- Changed incentives (several reduced, some increased) for some refrigeration and commercial kitchen end-use measures, and some lighting offerings.
- The addition of five new measures (Type C TLED, 3 LED traffic signals and compressed air storage tank) and four new offerings (offerings include bonus for public sector, VSD, chillers, and retail space).
- Public sector facilities over 100kW are integrated into the Standard Program.<sup>70</sup>
- Changes to comprehensive package to one tier, and include custom offerings
- Introducing new tracking system (eTRACK), with capabilities of online-entry for customers and contractors from project start, and also allow measure savings calculations in the system (based on TRM and program workpapers).

In addition, the CY2018 program will continue with the Office Space and Made in Illinois promotions introduced during PY9 bridge period. ComEd continued the marketing strategy of presenting its overall portfolio to customers in the marketplace. Streamlined incentive application and verification and quality control processes are expected to facilitate ease of participation and minimize the time required for incentive payment.

ComEd's CY2018 net planning target for the Business Incentives Program<sup>71</sup> is 313,333 MWh for both first year and Cumulative Persisting Annual Savings (CPAS).<sup>72</sup> This is expected to be achieved through 77 percent of measures installed in qualifying private sector commercial and industrial facilities, and 23

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<sup>69</sup> The Business Incentive Program is comprised of the non-residential Standard and Custom programs. Incentive structure is based either on a “standard,” per-unit basis, as with most lighting measures, or “custom,” with the incentive based on the calculated annual energy savings for the customer.

<sup>70</sup> PS facilities under 100kW would be allowed in the Standard program, if they did not participate in the Small Business program, for that specific measure.

<sup>71</sup> The ComEd 2018-2021 EE/DR Plan does not split the savings target of the Business Incentive Program for the Standard and Custom portions of the program. See “Commonwealth Edison Company’s 2018 – 2021 Energy Efficiency and Demand Response Plan,” June 30, 2017, pp. 6-7, 51-52.

<sup>72</sup> Per Section 8-103B of the Public Utility Act (as amended), beginning in CY2018 energy savings goals will be based on, and verified energy savings measured as, cumulative persisting annual savings (CPAS). Since CY2018 is the first year of a new four-year plan, planned First Year Savings and planned CPAS are equal. See “Commonwealth Edison Company’s 2018 – 2021 Energy Efficiency and Demand Response Plan,” June 30, 2017, pp. 6-7, 51-52.

percent of measures installed in qualifying public sector premises.<sup>73</sup> ICF International Inc. is the program implementation contractor for the Standard Program. ICF collaborates with DNV-GL for the program day-to-day operations of both the private sector and public-sector customers.

Starting January 1, 2018, prior to issuing certain standard energy efficiency incentives, ComEd will need to verify that the contractor responsible is certified through the Illinois Commerce Commission (ICC) to install energy efficiency measures.

<sup>74</sup>

The primary objectives of the CY2018 evaluation of the ComEd Standard Incentives (Standard) Program are to: (1) quantify the gross and net savings impacts of the program; (2) conduct research to support the program's transition in response to the Future Energy Jobs Act (FEJA)<sup>75</sup>; (3) investigate potential gas savings (therms conversion) counted as kWh, and (4) determine key process-related program strengths and weaknesses and identify ways in which the program can be improved.

The CY2018 gross impact evaluation will not vary significantly from the previous years, but adjustments will be made to reflect specific measure and project characterizations. Navigant will research effective methods to reach business owners amidst varying demands and calls for their attention. This research may include a review of customer-facing marketing, promotion and operational materials; investigation into why eligible businesses refuse to engage or drop out; and research into trusted sources of energy efficiency information within the community.

Navigant will measure program penetration geographically, by business segment, measure type and trade ally saturation to aid in developing a strategy to expand the program and recruit TAs by underserved measure type-free ridership and spillover study in CY2018. The findings from the study will inform recommended net-to-gross (NTG) values for the Illinois Stakeholder Advisory Group (SAG) approval and future program application. The CY2018 NTG study will include in-depth interviews with participating customers to learn about their perspectives and satisfaction with the program, the energy assessment services and incentive offerings, and how to improve the program in the future.

The evaluation of this program over the coming four years will include a variety of data collection and analysis activities, including those indicated in the following table.

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<sup>73</sup> There are no project or customer engagement goals listed in the 2018-2021 ComEd Plan, just gross and net savings goals and numbers of measures installed.

<sup>74</sup> Energy Efficiency Measure Installer certification is only required to seek certification pursuant to Code Part 462 if the entity performs, while installing energy efficiency measures, electrical connections other than connections of class 2 circuits as defined in the National Electric Code effective August 24, 2016 and the incentive for the measure is \$300 or more. These rules do not apply if the customer self-installs the measure.

<sup>75</sup> Illinois Public Act 099-0906 (<http://www.ilga.gov/legislation/publicacts/99/099-0906.htm>), passed in 2016.

Table 1. Evaluation Approaches – Four Year Plan

Tasks	CY2018	CY2019	CY2020	CY2021
Tracking System Review	X	X	X	X
Data Collection – General Population Surveys			X	
Data Collection – Participant Surveys	X	X	X	
Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Data Collection – Stakeholder Interviews	X		X	
Data Collection – Trade Ally Interviews	X	X		X
Impact – Billing Analysis	X	X	X	X
Impact – Engineering Review	X	X	X	X
Impact – Measure-Level Deemed Savings Review	X	X	X	X
Impact – Verification & Gross Realization Rate	X	X	X	X
Net-to-Gross – Customer Self-Report Surveys		X		X
Net-to-Gross – Trade Ally Spillover Research		X		
Process Analysis	X	X	X	X

The evaluation team determined the evaluation approach for the 2018-2021 period, based upon the needs of the program and the program’s history. The four-year evaluation approach for this program is based on the following:

- Gross and net impact analysis will be conducted each year
- Optimized timing on when to conduct NTG research
- NTG analysis every other year when programs are stable and NTG results are consistent over time
- NTG analysis each year when markets or program designs are changing
- CPAS will be calculated based upon the requirements of FEJA
- Process surveys will be conducted each year based upon client request and program performance details.

### Coordination

Navigant will coordinate with the evaluation teams for other utilities on any issues relevant to this program. Specifically, Navigant will coordinate planned NTG or process research with the Ameren Illinois Standard program evaluation team. Navigant will coordinate with the Ameren team on data collection and survey instrument design to ensure consistency and appropriate questions in the customer and trade ally surveys.

### Evaluation Research Topics

The evaluation will seek to answer the following key researchable questions:

### Impact Evaluation

1. What are the program's annual total verified gross savings? What are the verified gross savings from lighting measures? What are the verified gross savings from non-lighting measures?
2. What is the research estimate of gross savings (energy, peak demand, and total demand) for the program?
3. What are the program's verified net savings?
4. What is the estimated free-ridership and spillover for CY2018 participating customers? What is the research estimate for participant spillover for this program?
5. Secondary questions include:
  - o Are the ex ante per-unit gross impact savings correctly implemented by the tracking system and reasonable for this program?
  - o What updates are recommended for the Illinois Technical Reference Manual (TRM)? What are the results of field data collection?

### Process Evaluation and Other Research Topics

The process evaluation effort for CY2018 will focus on program delivery. The process research will address methods and approaches to reduce free ridership for lighting and non-lighting measures.

Navigant will perform additional process research, upon the request of the program manager, to support the program manager and implementer in transitioning into the revised regulatory requirements starting in CY2018. Possible topics may include, but will not be limited to research on impact of public sector projects introduced into the program, impact of the new offerings and measures, trade ally perspectives and impact of the changed incentives.

### Evaluation Approach

Table 2 summarizes the evaluation tasks for CY2018 including data collection methods, data sources, timing, and targeted sample sizes that will be used to answer the evaluation research questions.

**Table 2. Core Data Collection Activities, Sample, and Analysis**

Activity	Target	Target Completes CY2018	Timeline	Notes
Tracking System Review	Tracking system	Census	Three waves	
In Depth Interviews	Program Management and Implementers	4	April – Dec 2018	Augment with monthly calls
Gross Impact	Early Feedback Concurrent File Review	~20	June 2018 – Feb 2019	Early Feedback for Large Projects
Gross Impact	Engineering File Review	85	April 2018 – Feb 2019	Three Waves*
Gross Impact	On-site M&V	40	April 2018 – Feb 2019	
Verified Net Impact	Calculation using deemed NTG ratio	NA	March 2019	
Process	Telephone Survey with Participating Customers	125	June 2018 – March 2019	Process. Two Waves
Process	Telephone Interviews Trade Allies	~25	Feb 2018 – March 2019	Process. Two Waves
Process and Impact Research on PY10 Operations	Literature review, secondary research	Census	April 2018 – March 2019	Process, Impact

Note: FR = Free Ridership; SO = Spillover

\* Navigant will coordinate with ComEd to determine appropriate dates to pull tracking data extracts for each wave.

In line with program changes and accelerated evaluation schedule for delivering tracking data to the valuation team, Navigant will perform tracking system review and M&V project sampling in waves in 2018. The first wave of M&V sampling is expected to cover about one-third of the projects.

### Gross Impact Evaluation

Navigant will perform tracking system review and M&V project sampling in three waves in CY2018. The first wave of M&V sampling is expected to cover about one-third of projects completed in CY2018. Proposed gross impact sampling timelines are shown below.

#### CY2018 Gross Impact Sampling Waves

- a) First wave sample drawn in April 2018 and completed in July 2018
- b) Second wave sample drawn in August 2018 and completed in November 2018
- c) Final wave starts February 2019 (or projects completion date)

Core data collection activities will include the following:

1. Engineering examination of ComEd workpapers and tracking system calculations of claimed savings.
2. Engineering review of project documentation at the measure-level for a sample of projects to verify participation and tracking system entries, check documentation of invoiced quantities and installed measure characteristics, confirm compliance with eligibility, and deemed input values.

3. On-site M&V of measure-level savings on a subset of project sites selected from the engineering review sample to estimate site-specific savings. On-site measurement and verification includes participant interviews, baseline assessment, installed equipment verification, and performance measurement. Measurement may include spot measurements, run-time hour data logging, review of participant energy management system trend data, and post-installation interval metering. Our approach to selecting M&V strategies follows the International Performance Measurement and Verification Protocol (IPMVP); Option A or Option B are typically selected.
4. Computer assisted telephone interviews (CATI) with a sample of Standard Program projects and in-depth interviews with trade allies and account managers to research methods and approaches to reduce free ridership.
5. Interviews with program management and key staff with the implementation contractor (IC). Hold regular monthly meetings by telephone with ComEd program staff and the IC staff.
6. The evaluation team will collect PJM demand savings estimates and program and measure-specific cost detail to further ComEd's PJM auction and TRC analysis.
7. Screening of CY2018 participant data to identify customers beginning the Spring of 2018, do not meet the less than 10MW peak demand eligibility threshold to participate in the program. These customers are expected to be excluded from the program claimed energy and demand savings, and the evaluation team will exclude them from the impact M&V sample, and likely from the NTG survey sample.

The gross savings impact approach will review the ex ante measure type to determine whether it is covered by the Illinois TRM or whether it is a non-deemed measure that is subject to retrospective per unit savings adjustment of custom variables. The measure type, deemed or non-deemed, will dictate the savings verification approach. We will also make a research estimate of gross savings based entirely on site-collected data and evaluation engineering analysis of savings. The two methods are described below:

#### 5. Savings Verification

- Measures with per unit savings values deemed by the TRM, would have verified gross savings estimated by multiplying deemed per unit savings (kWh and kW) by the verified quantity of eligible measures installed. Eligible deemed measures must meet all physical, operational, and baseline characteristics required to be assigned to the deemed value as defined in the TRM.<sup>76</sup>
- Measures with custom or partially-deemed ex ante savings input will be subject to retrospective evaluation adjustments to gross savings on custom variables. TRM algorithms and deemed parameter values will be used where specified by the TRM, and evaluation research will be used to verify or adjust custom variables.

#### 6. Evaluation Research Savings Estimate

- The evaluation will also include an analysis of on-site collected verification data for a subset of projects. The engineering analysis methods and degree of monitoring will vary from project to project, depending on whether the measure has deemed savings or not, the complexity of the measures, the size of the associated savings, the potential to revise input assumptions, and the

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<sup>76</sup> Illinois Statewide Technical Reference Manual for Energy Efficiency Version 6.0, available at: <http://www.ilsag.info/technical-reference-manual.html>

availability and reliability of existing data. The evaluators will contact the implementers prior to conducting site visits to ensure that the evaluation team has all correct and relevant information.

The measure-level realization rates will be extrapolated to the program population using a ratio estimation method to yield ex post evaluation-adjusted gross energy savings. Gross realization rates will be developed for energy and demand savings. The sample design will provide 90/10 statistical validity for lighting savings, non-lighting savings, and the program overall. The sample of 40 on-sites drawn is also expected to achieve a 90/10 confidence/relative precision level (one-tailed test) to comply with the PJM verification requirements outlined in Manual 18B.

The 40 on-site projects will be randomly selected based on the magnitude of the project savings in the stratified sample. The on-site sample design will consider both lighting and non-lighting technologies, including measures with high savings variations and certain new technologies with potential savings impact (e.g., advance lighting, EMS, etc.). Where the TRM allows retrospective adjustment of savings using site collected data (e.g., lighting quantities, VSD hours and controls), the savings are recalculated based on site-specific data but still using the approach set forth in the TRM. Parameters defined in the TRM are not adjusted even if the site findings suggest alternate values are more appropriate. For these projects the collected information will be used to develop a “research estimate” savings level in addition to the TRM verified savings level. This can be tracked over time to identify measures where the TRM may not accurately represent the projects being completed. The information collected will be useful and will be aggregated over time for TRM updates. For measures not covered in the TRM (such as EMS), the on-site data collection will be used to develop an independent assessment of project savings. For these projects, all available information is used to recalculate savings.

### Verified Net Impact Evaluation

The evaluation team will apply the net-to-gross (NTG) ratios accepted by Illinois Stakeholders Advisory Group (SAG) consensus to estimate the verified net savings for the program (Table 3). Therms savings will be subjected to the electric NTG adjustments.

**Table 3. Deemed NTG Values for CY2018**

Program Measure	CY2018 Deemed NTG Value
Lighting	0.71
Non-Lighting	0.70

Source:  
[http://ilsagfiles.org/SAG\\_files/NTG/2017\\_NTG\\_Meetings/Final/ComEd\\_NTG\\_History\\_and\\_PY10\\_Recommendations\\_2017-03-01.xlsx](http://ilsagfiles.org/SAG_files/NTG/2017_NTG_Meetings/Final/ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.xlsx)

### Research NTG Impact Evaluation

Navigant will conduct a participating customer NTG study in CY2018 to provide NTG values for potential deeming in future program years through surveys with CY2018 participating customers. We will complete computer assisted telephone interviews (CATI) with a minimum of 125 contacts who participated in the CY2018 program to quantify participant free-ridership and spillover. We will attempt contact with all participants in the gross impact sample. Program influence on participating customers through interviews with trade allies and account managers will be conducted in CY2018 if triggered by customer NTG responses for the largest projects, or with contacts identified for multiple smaller projects. The sample design developed for gross impact research will be applied to the NTG interviews. This will provide a 90/10 confidence/precision level of NTG ratios for lighting and non-lighting, and program-level savings.

### Calculation of CPAS and Annual Savings

As required by FEJA, Navigant will report ex post gross and ex post net savings for the program and the CPAS in CY2018 will be calculated along with the total CPAS. Additionally, the weighted average measure life will be estimated, if possible. Evaluation will also add the savings converted from gas savings to the electric savings so that it's documented in the report.

### Process Evaluation

The CY2018 process evaluation research will include a synthesis of both qualitative and quantitative data collected during the program staff and implementer interviews and meetings, and during the end-user customer surveys in CY2018. The CY2018 research will consider methods and approaches to reduce free ridership in lighting and non-lighting measures.

Navigant will perform additional process research, upon the request of the program manager, to support the program manager and implementer in transitioning into the revised regulatory requirements starting in CY2018. Possible topics may include, but will not be limited to, research on impact of public sector projects introduced into the program, impact of the new offerings and measures, and impact of the changed incentives.

### Use of RTC and QED

Navigant is not evaluating the Standard Program via a randomized controlled trial because the program was not designed with randomly assigned treatment and control groups. Navigant is not using quasi-experimental consumption data for the following reasons:

- It would not be possible to create a valid matched control group for the customers in this program.
- This method would estimate average savings across all program participants which is not the desired savings estimate for this program.
- This program contains many unique measures with significant cross-participation. In this case, quasi-experimental consumption data analysis would produce savings estimates for bundles of commonly-installed measures, rather than for each measure individually, which is not the desired output for all analysis.

### Evaluation Schedule

Table 4 provides the schedule for key deliverables and data transfer activities. (See Table 2 for other schedule details.) Adjustments will be made, as needed, as evaluation activities progress.

**Table 4. Schedule – Key Deadlines**

Activity or Deliverable	Responsible Party	Date Delivered
Program Operations Manual and Workpapers	ComEd	January 2, 2018
CY2018 program tracking data for QA/QC	ComEd	April 7, 2018
CY2018 program tracking data for sampling Wave 1	ComEd	June 1, 2018
CY2018 participating customer survey design	Evaluation	June 30, 2018
Wave 1 project documentation, engineering reviews, schedule, conduct on-site M&V, feedback	Evaluation	July 30, 2018
Tracking System Ex Ante Review Findings and Recommendations	Evaluation	July 30, 2018
CY2018 program tracking data for sampling Wave 2	ComEd	August 30, 2018
Wave 1 participating customer NTG and process survey fielding	Evaluation	September 30, 2018
Wave 2 project documentation, engineering reviews, schedule, conduct on-site M&V, feedback	Evaluation	November 30, 2018
EUL Research Memo	Evaluation	December 15, 2018
CY2018 Program tracking data for sampling Wave 3	ComEd	January 30, 2019
Wave 2 participating customer NTG and process survey fielding	Evaluation	February 28, 2019
Wave 3 project documentation, engineering reviews, schedule, conduct on-site M&V, feedback	Evaluation	February 28, 2019
Illinois TRM Update Research Findings	Evaluation	March 1, 2019
Internal Report Draft by Navigant	Evaluation	March 1, 2019
Draft Report to ComEd and SAG	Evaluation	March 6, 2019
Comments on draft (15 Business Days)	ComEd and SAG	March 27, 2019
Revised Draft by Navigant	Evaluation	April 4, 2019
Comments on redraft (5 Business Days)	ComEd and SAG	April 11, 2019
Final Report to ComEd and SAG	Evaluation	April 24, 2019

## ComEd Strategic Energy Management Program CY2018 to CY2021 Evaluation Plan

### Introduction

The Strategic Energy Management (SEM) Program is designed to provide training and guidance to participating commercial and industrial customers at once, gathered in cohorts. Each cohort is a group of SEM participants that receive training together and work with each other to provide practical insight on how to implement energy efficiency measures at their sites. The program is jointly managed by ComEd and Nicor Gas who contracted with CLEAResult to implement the training and day to day operation of the SEM Program.

The goal of the SEM Program is to implement a process of continuous energy management improvements which result in energy savings and reductions in energy intensity. Energy savings are expected to be achieved through operational and maintenance (O&M) improvements, incremental increases in capital energy efficiency projects, additional capital projects that would not otherwise have been considered (e.g., process changes, consideration of energy efficiency in all capital efforts), and improved persistence for O&M and capital projects. The program seeks to educate participants in the identification of low cost or no cost measures, improve process efficiency, and reduce energy usage through behavioral changes.

Currently the program has two types of participants : (1) New Cohort made up of new participants, (2) The Practitioners Cohort for customers that continue to participate after this first year. Due to the timing of available data Navigant will focus on the practitioner cohort in CY2018 and will review cohort 3 in CY2019.

As a part of the evaluation, Navigant will review the documentation and savings for the practitioner cohort with a focus on persistence of savings and SEM activities. As needed, site interview will be completed to support Navigant research into site persistence.

The impact evaluation of the SEM Program will characterize and quantify:

- Energy savings achieved through SEM improvements and behavior change beyond capital projects (prescriptive and custom)
- The persistence of achieved behavioral savings
- Persistence of SEM activities and practices

Notable program changes made from GPY6/EPY9 to Calendar Year 2018 (CY2018) include:

- Persistence of savings will be a focus of this year's evaluation for the practitioner cohort. We will be focusing on persistence of both savings and SEM activities and processes.
- As sites transition into the practitioner cohort, the evaluation activities will change to meet the needs of the client and implementer without overburdening the site. Navigant will not complete onsite surveys with sites that have already been surveyed in the past or complete simpler surveys to not overburden participants. Impact evaluation may be reduced as well for site that have already received impact evaluations in the past.

The CY2018 gross impact evaluation will not vary from the previous years. Over the course of 2018 we will examine the program theory and evaluation approach to inform discussions in the fall SAG NTG deliberations about the need for doing free ridership surveys with SEM participants in future years. We have tentatively planned to do NTG research in CY2019 and CY2021 pending the outcome of those

deliberations. The CY2018 process study will include program manager and implementer interviews to learn about their perspectives and satisfaction with the program, the energy assessment services and incentive offerings, and how to improve the program in the future.

The evaluation of this program over the coming four years will include a variety of data collection and analysis activities, including those indicated in the following table. As noted above, a limited process evaluation will be completed with the practitioner cohort with a focus on persistence but not normal detailed evaluation. The sites in this cohort have received several years of process evaluation and we do not expect that much has changed within the last year.

**Table 1. Evaluation Approaches – Four Year Plan**

Tasks	CY2018	CY2019	CY2020	CY2021
Tracking System Review	X	X	X	X
Data Collection – Participant Surveys		X		X
Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Data Collection – Stakeholder Interviews	X	X	X	X
Impact – Billing Analysis	X	X	X	X
Impact – Engineering Review	X	X	X	X
Impact – Measure-Level Deemed Savings Review	X	X	X	X
Impact – Modeling	X	X	X	X
Impact – Verification & Gross Realization Rate	X	X	X	X
Impact – NTG Analysis		X		X
Process Analysis	X	X	X	X

The evaluation team determined the evaluation approach for the 2018-2021 period based upon the needs of the program and program’s prior history. The four-year evaluation approach for this program is based on the following:

- Gross and net impact analysis will be conducted each year
- Site specific process surveys will occur every other year. If the program participation changes greatly from one year to the next and/or the utility has interest in specific site surveys could be completed as needed.
- NTG analysis every other year when programs are stable and NTG results are consistent over time
- CPAS will be calculated based upon the requirements of FEJA

**Coordination**

SEM is independently and jointly managed program with Nicor Gas. ComEd will coordinate with Nicor Gas on issues relevant to the program. The SEM evaluation report is developed as a combined ComEd and Nicor evaluation report. Navigant leads the evaluation and will work with Nicor to finalize the report. There are special data collection issues with the SEM program and Navigant will manage those data issues with ComEd and Nicor.

## Evaluation Research Topics

The evaluation will seek to answer the following key researchable questions:

### Impact Evaluation

1. What are the actual achieved energy behavior savings in this program?
2. What were the realization rates of the projects? [Defined as evaluation-verified (ex post) savings divided by program-reported (ex ante) savings].
3. Are there any major changes occurring during or after program implementation (production, size, hours etc.) which may have affected the results?

### Process Evaluation and Other Research Topics

The process evaluation effort for CY2018 will focus on program persistence. The process research will address the following questions:

1. What SEM activities have the sites continued to implement after the first year of training?
2. What new activities have the sites incorporated into their operation?
3. What SEM activities have they stopped implementing since the training?
4. If their savings have increased over time, why?
5. If their savings have stopped or reversed over time, why?

## Evaluation Approach

The CY2018 evaluation plan summary identifies tasks on a preliminary basis (Table 2). Final activities will be determined as program circumstances are better understood. CY2018 refers to the year of participation that will be researched, not the research timeframe.

**Table 2. CY2018 Evaluation Plan Summary for SEM Program**

Activity	CY2018
Gross Impact Approach	Billing meter data/regression and Survey (as needed)
Gross Sampling Frequency	One Time
Verified Net Impact Approach	Electric (0.95) Gas (1.00) Deemed Value
Researched NTG Approach	None
Program Manager and Implementer Interviews/ Review Materials	Yes
Participant Interview	Process and Impact
Effective Useful Life Determination	3 years (further research is needed to increase up to 5 years)

### Data Collection, Methods, and Sample Sizes

Table 3 summarizes data collection methods, data sources, timing, and targeted sample sizes that will be used to answer the evaluation research questions. Evaluation of the SEM Program is based upon availability of SEM cohorts, thus, evaluation for CY2018 will be completed by the end of 2018.

**Table 3. Core Data Collection Activities and Sample**

What	Who	Target Completes CY2018	When	Comment
Engineering Review-Practitioner Cohort	Participating Customers	*	June - July 2018	
Telephone Survey-Practitioner Cohort	Participating Customers Implementer Program Staff	*	July – August 2018	Engineering review to provide guidance to surveys
Second Engineering Review- Practitioner Cohort	Participating Customers	*	August – September 2018	A second review based on survey results

\*Sample size will be determined to achieve 90/10

The main impact review will be completed before conducting the surveys to identify any site-specific issues that could be addressed in the interviews. Prior to the interviews, both Nicor Gas and ComEd will review the surveys to ensure they meet the needs of the program. Once the surveys are complete, Navigant will complete the engineering review by making any additional changes identified by the surveys.

Navigant will sample projects from these sites and apply the sample realization rates to the entire population to calculate overall savings. Navigant will consider several ways to stratify the SEM projects to design a sample once initial program data is received. Navigant will use a stratified ratio estimation sampling design to develop an efficient sample achieving 90/10 confidence/precision on the program-level realization rate. Once all sampled sites are evaluated, the realization rate of each stratum will be calculated. This realization rate will be applied to the total claimed savings within each stratum to calculate the final program savings.

Table 4 summarizes the evaluation tasks for CY2018, including data collection methods, data sources, timing, and targeted sample sizes that will be used to answer the evaluation research questions.

**Table 4. Core Data Collection Activities, Sample, and Analysis**

Activity	Target	Target Completes CY2018	Timeline	Notes
Tracking System Review	Tracking system	Census	Based on data availability	
In Depth Interviews	Program Management and Implementers	~2	April – Dec 2018	Augment with monthly calls
Gross Impact	Engineering File Review *	Census	April 2018 – Feb 2019	Timing is based on data availability

\* This is a multi-regression model based upon whole-building data, production data and other key variables.

As participating sites complete their one year of activities within the SEM Program, Navigant will collect the information regarding these sites and begin the evaluation. Navigant expects that the timing of this information will be dependent on the timing of the cohort training.

**Gross Impact Evaluation**

The impact evaluation will be grounded in site-specific data using engineering models and analysis.

1. A site-specific analysis approach will be implemented. Because this program contains primarily behavioral-based changes, the International Performance Measurement and Verification Protocol (IPMVP) option C – billing/metered data regression, will be the main method of impact evaluation.
2. The data collection will focus on verifying or updating the assumptions that feed into the implementer’s energy model for each site. This data may include: program tracking data and supporting documentation (project specifications, invoices, etc.), utility billing and interval data, Navigant-calibrated building automation system (BAS) trend logs, production data and telephone conversations with onsite staff.

Energy models have been provided for all the sites within the SEM Program. This data will be used with other collected information from the site to identify operating characteristics of the site both pre-and post these activities. If major changes have occurred at the site during or after the SEM activities, it is expected the model will need to be adjusted to account for these changes. The changes that could affect the model savings include:

- Changes in hours of operation
- Changes in employees
- Changes in production
- Other measures installed at the site that were implemented through other Utility EE/DR programs or outside of the ComEd and Nicor Gas programs<sup>77</sup>

Due to the small number of participating sites, Navigant will be performing the impact analysis on all participating customers. Sampling will be considered as number of participants grow.

**Verified Net Impact Evaluation**

The 2018 net impact evaluation will apply the net-to-gross ratio (NTGR) deemed through the Illinois Stakeholders Advisory Group (SAG) consensus process. The deemed NTGRs are provided Table 5.

**Table 5. Deemed NTG Values for CY2018**

Program Channel	CY2018 Deemed NTG Value
Comprehensive	0.95
Monitoring-Based	0.95
All-Natural Gas	1.00

Source:  
[http://ilsagfiles.org/SAG\\_files/NTG/2017\\_NTG\\_Meetings/Final/ComEd\\_NTG\\_History\\_and\\_PY10\\_Recommendations\\_2017-03-01.xlsx](http://ilsagfiles.org/SAG_files/NTG/2017_NTG_Meetings/Final/ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.xlsx), and  
 Nicor Gas GPY7 NTG Values 2017-03-01 Final.xlsx.

<sup>77</sup> These measures are rebated separately from SEM program and savings for these measures are not counted in the SEM savings

### Calculation of CPAS and Annual Savings

As required by the Future Energy Jobs Act (FEJA) for electric energy efficiency, Navigant will report ex post gross and ex post net savings for the program and the cumulative persisting annual savings (CPAS) in CY2018 will be calculated for each electric measure along with the total CPAS for all electric measures. Additionally, the weighted average measure life will be estimated, if possible. Evaluation will also add the savings converted from gas savings to the electric savings so that it's documented in the report.

### Process Evaluation

The CY2018 process evaluation research will include a synthesis of both qualitative and quantitative data collected during the program staff and implementer interviews, and during the participant surveys in CY2018. The CY2018 NTG study will include in-depth interviews with participating customers to learn about their perspectives and satisfaction with the program.

### Use of RCT and QED

The evaluation team will not evaluate this program via a randomized controlled trial because the program was not designed with randomly assigned treatment and control groups.

The evaluation will not use quasi-experimental design because there are not enough participants for individual measures in this program to achieve statistically significant savings estimates using this method.

### Evaluation Schedule

Table 6 provides the schedule for key deliverables and data transfer activities. Adjustments will be made, as needed, as evaluation activities progress.

**Table 6. Schedule – Key Deadlines**

Activity or Deliverable	Responsible Party	Date Delivered
CY2018 site reports and models are available to Navigant	ComEd/Nicor Gas	*
Engineering review early findings	Evaluation	*
Detailed Surveys	Evaluation	*
Final engineering review completed	Evaluation	*
Draft Report to ComEd, Nicor Gas and SAG	Evaluation *	October 13, 2018
Comments on draft (15 Business Days)	ComEd/Nicor Gas	November 3, 2018
Redraft of Report	Evaluation	November 10, 2018
Comments on Redraft	ComEd/Nicor Gas	December 1, 2018
Final Report to ComEd, Nicor Gas and SAG	Evaluation	December 22, 2018

\* Timing of tasks depends on timing of data availability are to be determined later.

**ComEd Voltage Optimization Program CY2018 to CY2021 Evaluation Plan**

**Introduction**

The ComEd Voltage Optimization (VO) Program comprises ComEd’s plan to install hardware and software systems on a significant fraction of its electric power distribution grid to achieve voltage and reactive power optimization (volt-var optimization, or VVO) over the 2018-2025 time frame. VVO is a smart grid technology that uses distributed sensors, two-way communications infrastructure, remote controls on substation transformer load-tap changers and capacitor banks, and integrating/ optimizing software to flatten voltage profiles and lower average voltage levels on an electric power distribution grid.

ComEd is working with an automation-optimization hardware and software vendor<sup>78</sup> to implement the VO Program on selected parts of its distribution grid over the 2018-2025 period. The anticipated 2018-2021 timeline for installing and commissioning the VO Program is shown in Table 1.

**Table 1. Anticipated VO Program Time Line CY2018–CY2021<sup>\*</sup>**

Planned VO Targets	CY2018 <sup>b</sup>	CY2019	CY2020	CY2021	Total <sup>*</sup>
Incremental Participation (Distribution Substations) <sup>a</sup>	99	36	48	43	226
Incremental Participation (Distribution Feeders) <sup>a</sup>	470	364	459	372	1,665
Incremental Annual Savings (MWh) <sup>c</sup>	82,500	200,000	210,000	260,000	752,500
Cumulative Persistent Annual Savings (MWh) <sup>c</sup>	82,500	282,500	492,500	752,500	752,500
Incremental Demand Reduction (MW) <sup>d</sup>	13	28	36	43	120
Cumulative Demand Reduction (MW) <sup>d</sup>	13	41	77	120	120

<sup>\*</sup> ComEd plans to install VO on a total of 2,958 feeders at 450 substations through CY2025.

<sup>a</sup> Communication from ComEd distribution automation team (Data\_Share\_VO\_Navigant\_12\_20\_17.xlsx).

<sup>b</sup> Includes 129 feeders at 23 substations where installation work began in 2017.

<sup>c</sup> ComEd 2018 – 2021 EE DR Plan, p. 52.

<sup>d</sup> Ibid., p. 195.

This Evaluation Plan covers the first four years (CY2018 to CY2021) of the planned VO Program roll-out, and is based on the program description provided in ComEd’s 2018-2021 Portfolio Plan<sup>79</sup> and information provided to Navigant by ComEd’s VO implementation team. The evaluation of this program will include a variety of data collection and analysis activities, including those indicated in Table 2.

<sup>78</sup> Open Systems International (OSI) of Medina, Minnesota.

<sup>79</sup> “Commonwealth Edison Company’s 2018-2021 Energy Efficiency and Demand Response Plan,” June 30, 2017.

**Table 2. Evaluation Approach – Four Year Plan**

Tasks	CY2018	CY2019	CY2020	CY2021
Tracking System Review	X	X	X	X
Sample Selection of Test Feeders	X			
Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Data Collection – AMI and SCADA data from VO substations/feeders	X	X		
Impacts – Regression and Simulation Analysis of Sample Feeders	X	X		

### Coordination

Navigant will coordinate with the evaluation teams of other Illinois utilities, as well as with regulatory staff, on issues relevant to measurement and verification of VO impacts. Ameren Illinois has confirmed that it is planning to implement a VVO program similar to, albeit smaller than, ComEd’s VO Program. Navigant will continue to coordinate with the independent evaluator of the Ameren VVO program and regulatory staff as the two programs unfold, and will identify and report on any substantive differences when and if they arise.

### Evaluation Research Topics

The evaluation will seek to answer the following key researchable questions:

#### Impact Evaluation

1. What are the program’s incremental and cumulative persistent annual verified energy savings?
2. What are the program’s incremental and cumulative peak demand reductions?
3. Other research topics:
  - a) What voltage reductions did the program achieve?
  - b) What are the program’s impacts on reactive power (or alternatively, power factor)?
  - c) What are the effects of season, time of day, day-type, customer load type, feeder length, and distributed energy generation penetration on the program’s energy and demand savings?

### Evaluation Approach

Navigant will measure energy and demand impacts on a representative sample drawn from the population of feeders on which ComEd plans to install VO over the CY2018-CY2025 period. The sample results will be used to estimate impacts for the remaining VO feeders.

The table below summarizes the evaluation tasks for CY2018 including data collection methods, data sources, timing, and targeted sample sizes that will be used to answer the evaluation research questions.

**Table 3: Evaluation Plan Summary for CY2018 VO**

Activity	CY2018
Target Sample Size (# of Test Feeders)	149*
Gross Impacts Evaluation	Regression Analysis
Program Manager Interviews / Review Materials	Yes

\* Sampling will be split across CY2018 and CY2019. Sample size designed to achieve at least ±10% precision with 90% confidence on aggregate estimates. Total sample size and sampling plan not yet finalized.

### Gross Impact Evaluation

#### Measured Impacts on Sampled Feeders

Navigant will employ robust statistical techniques to measure the VO program’s annualized impacts for all feeders on which VO has been commissioned in each calendar year. We will work with ComEd to develop a statistically valid representative sample of the distribution feeders on which VO will be installed during the CY2018-CY2025 period. The volt-var controls on the feeders in the sample will be operated on a pre-set alternating schedule<sup>80</sup>, shifting periodically between the baseline (i.e., non-VO) and test (i.e., VO) control states, and 30-minute interval data collected on voltage, energy usage, and reactive power. We anticipate that the sample of feeders will be drawn and tested over the roughly two-year period spanning CY2018 and CY2019, with each sampled feeder being operated on an alternating VO-on/VO-off schedule for a period sufficient to generate test data covering at least three complete seasons (summer, winter, and either spring or autumn). Once sufficient test data have been generated for a given sample feeder, it will then be released from the alternating schedule and remain continuously in VO mode. Navigant will analyze the impacts of VO on a seasonal basis using a regression model of the form shown in Equation 1, applied to the sample feeders with sufficient test data during each test period (season), and use the fitted models to develop seasonal and annualized impact estimates.<sup>81,82</sup>

#### Equation 1. VO Load/Voltage Model

$$\begin{aligned}
 X_{i,j,t,p} = & \sum_{j \in \left\{ \begin{smallmatrix} \text{weekday,} \\ \text{weekend} \end{smallmatrix} \right\}} \sum_{t=1}^{24} \beta_{i,j,t,p}^{VVOxHr} Hr_t \cdot DayType_j + \\
 & \sum_{j \in \left\{ \begin{smallmatrix} \text{weekday,} \\ \text{weekend} \end{smallmatrix} \right\}} \sum_{t=1}^{24} \beta_{i,j,t,p}^{VVOxHr} Hr_t \cdot DayType_j \cdot VO_{i,t,p} + \\
 & \beta_{i,p}^{CDH} CDH_{t,p} + \beta_{i,p}^{HDH} HDH_{t,p} + \varepsilon_{i,j,t,p}
 \end{aligned}$$

<sup>80</sup> Adherence to a pre-set alternating schedule will ensure that the volt-var control state on a sample feeder at a given point in time is exogenous with respect to systematic determinants of load or voltage (e.g., time of day, day-type, weather conditions, season).

<sup>81</sup> Navigant may determine that other variables are needed besides those shown in Equation once we have inspected the data and reviewed the quality of the model fits.

<sup>82</sup> If insufficient test data are available to permit Navigant to develop reliable statistical estimates of CY2018 VO impacts for some sample feeders on which VO has been commissioned in 2018, we will base our savings estimates on the best information available at the time. This may include empirical estimates developed from other ComEd VO feeders, or empirical estimates developed in other jurisdictions that are available in the published literature. See also the discussion in the next section describing extrapolation to non-sample feeders.

where:

- $i, t, p$  and  $j$  index the feeder, time interval, test period, and day-type, respectively
- $X_{i,j,t,p}$  is load measured at the substation bus or feeder head-end – measured in  $MW$  for real power ( $P$ ) and  $|MVAR|$  for reactive power ( $Q$ ) – or voltage ( $V$ ) measured at the customer service points<sup>83</sup> on feeder  $i$  at time  $t$  on day-type  $j$  in test period  $p$
- The  $Hr_t$  variables are a set of 24 binary indicators, each of which equals 1 when observation  $t$  falls within the associated hour of the day, and 0 otherwise
- $DayType_j$  is a set of binary variables indicating day-type (weekday/weekend)
- $VO_{i,t,p}$  is a variable that equals 1 when VO control on feeder  $i$  are fully enabled at time  $t$  in period  $p$ , 0 when VO controls are fully disabled, and ranges between 0 and 1 during step-in/step-out transitions between control states
- $CDH_t$  is the cooling degree-hours accruing during time  $t$
- $HDH_t$  is the heating degree-hours accruing during time  $t$
- $\varepsilon_t$  is a mean-zero random disturbance representing the variation in  $X_{i,j,t,p}$  that is not captured by the model
- The  $\beta$  s are unknown parameters that are estimated by fitting the model to the experimental data on each feeder in each test period (season)

The estimated VO impacts on each sample feeder will be derived by first fitting the regression model using all the experimental data in each seasonal test period to obtain unbiased estimates of the model coefficients for that feeder in that period. With these in hand, the fitted models will then be used to simulate the load and voltage profiles for each sample feeder in that season under two scenarios: one assuming VO controls are fully engaged ( $VO = 1$ ) and the other assuming baseline controls ( $VO = 0$ ). Differencing the two profiles will yield the measured impacts of VO on voltage and energy usage on each sample feeder during each season; aggregating the impacts across seasons for a given feeder will yield the annualized impact for that feeder.<sup>84</sup> Aggregating across feeders will yield the aggregate impact for a given period. To express these impacts in percentage terms, the estimated impacts for each feeder will be divided by the corresponding simulated usage, load or voltage value under the baseline ( $VO = 0$ ) scenario. CVR factors for each sample feeder will be calculated as the ratio of the percentage usage or load reduction to the percentage voltage reduction:

<sup>83</sup> Interval voltage measurements on each feeder will consist of the load-weighted mean voltage readings (on a common 120V nominal basis) from all reporting AMI meters served by the feeder. Voltage readings at customer service points are preferred for measuring VO voltage reductions because the bulk of VO energy savings are expected to occur behind customers' meters, the result of more efficient operation of customer loads. Thus, the voltage reductions delivered to customer service points are the relevant statistic for measuring VO impacts.

<sup>84</sup> Shoulder-season (spring, autumn) results will be assumed to be substitutes for each other to reduce the length of the alternating on/off testing required on each sample feeder.

**Equation 2. Definition of CVR Factor**

$$CVRf_{i,p} = \% \Delta E_{i,p} / \% \Delta V_{i,p} \cdot^{85}$$

*Extrapolating Results to Other VO Feeders in CY2018 and Subsequent Years*

Navigant expects to use the results from the analyses performed on the portion of the sample feeders that were operated on an alternating (VO-on/VO-off) schedule during CY2018 to develop estimates of the distribution of VO impacts in CY2018, and to refine these estimated results using the results of the evaluation of the CY2019 portion of the sample. Per the language in the stipulation agreement pertaining to VO<sup>86</sup>, Navigant will strive to base impact estimates for non-sampled VO feeders, to the greatest feasible extent, on results obtained from our evaluation of the sample feeders described in the previous section. However, we recognize that uncertainties in the commissioning process leaves some inevitable indeterminacy in the VO roll-out schedule, which may impact our ability to perform such analyses. We will base CY2018 impact estimates on the best available information regarding the likely savings levels. Savings on non-sample VO feeders will be extrapolated based on similarity of substation and feeder characteristics.

Following the evaluation of the CY2019 sample feeders, Navigant expects to have sufficient information on VO impacts that such on/off cycling could cease for the remainder of ComEd’s VO feeders. We will develop and propose a method of measuring VO impacts in future years following CY2019. In doing so, we will compare the results of our robust statistical analysis on the entire sample of VO feeders to other M&V methods, including an approach based on deemed CVR factor values and measured voltage reductions proposed by ComEd<sup>87</sup> and at least one additional method, and will report our findings and recommendations after the evaluation of the CY2019 portion of the VO sample is completed. Following the evaluation of the CY2019 sample feeders, we will submit our findings and recommendations concerning VO to the IL-TRM Update Process for possible inclusion in future versions of the IL-TRM.

**Verified Net Impact Evaluation**

Since the VO program will require no actions by any affected ComEd customers, net and gross impacts are identical by definition.

**Calculation of CPAS and Annual Savings**

As required by the Future Energy Jobs Act (FEJA), Navigant will report ex post gross and ex post net savings for the program and the cumulative persisting annual savings (CPAS) in CY2018 will be calculated along with the total CPAS.

<sup>85</sup> The CVR factor, or voltage elasticity of energy consumption, in principle varies by feeder and season. It can be used to project VO energy savings to out-of-sample feeder circuits as its product with a measured or assumed percentage voltage reduction.

<sup>86</sup> The stipulation states that VO impacts are to be annualized for every feeder on which commissioning is completed within a given program year. Navigant will determine annualized savings estimates for CY2018 VO feeders in consultation with ComEd, regulatory staff, and other stakeholders, based on the best available information regarding likely savings levels. Such best available information for CY2018 may include results of ComEd VO pilot feeders evaluated during CY2018, but may also include results of relevant evaluations from other jurisdictions, information on the circuits on which ComEd began to apply VO in calendar 2018, and other relevant information. For CY2019 and beyond, Navigant will base annualized savings estimates, to the greatest extent possible, on evaluation of savings from ComEd distribution system infrastructure subjected to VO.

<sup>87</sup> ComEd’s proposed method involves applying an assumed or estimated CVR factor to the empirically-measured average VO voltage reduction achieved on a given feeder circuit during a given season:

$$\% \hat{\Delta} E_{i,p} = CVRf \cdot \% \Delta V_{i,p} \cdot$$

### Process Evaluation

The process evaluation for this program will be limited to interviews with the program manager.

### Data Requirements

Table 4 shows the data Navigant will need for the CY2018 evaluation.

**Table 4. Data Requirements for CY2018 VO Evaluation**

Data Source	Information Required
<b>AMI Meters of Customers on Each VO Feeder</b>	<ul style="list-style-type: none"> <li>• Account / Meter ID</li> <li>• Feeder</li> <li>• Substation</li> <li>• Date / Time Stamp (30-minute intervals)</li> <li>• Load-Weighted Service Voltage from all meters served by feeder</li> </ul>
<b>Substation SCADA System</b>	<ul style="list-style-type: none"> <li>• Feeder</li> <li>• Substation</li> <li>• Date / Time Stamp (30-minute intervals)</li> <li>• Voltage (at substation bus)</li> <li>• Real Power (MW or MWh)</li> <li>• Reactive Power (Mvar) / Power Factor</li> </ul>
<b>Other</b>	<ul style="list-style-type: none"> <li>• Weather data (temperature, humidity, wind speed) *</li> <li>• VO Control Status</li> <li>• Capacitor Status (for capacitor banks controlled by VO)</li> <li>• Log of Substation / Feeder Status (outages, reconfigurations)</li> </ul>

\* Navigant will obtain required weather data from area NOAA weather stations.

### Evaluation Schedule

Table 5 below provides the schedule for key deliverables and data transfer activities for the work leading to the CY2018 results. The CY2019 schedule will be defined at a later time. Adjustments will be made, as needed, as evaluation activities progress.

**Table 5. Schedule – Key Deadlines**

Activity or Deliverable	Responsible Party	Date Delivered
Spring 2018 evaluation data request sent to ComEd	Navigant	May 31, 2018
Spring 2018 evaluation data delivered to Navigant	ComEd	June 29, 2018
Spring 2018 interim data quality / impacts memo to ComEd	Navigant	July 20, 2018
Summer 2018 evaluation data request to ComEd	Navigant	August 31, 2018
Summer 2018 evaluation data delivered to Navigant	ComEd	September 28, 2018
Summer 2018 interim impacts memo to ComEd	Navigant	October 26, 2018
Autumn 2018 evaluation data request sent to ComEd	Navigant	November 30, 2018
Autumn 2018 evaluation data delivered to Navigant	ComEd	December 31, 2018
Draft CY2018 report to ComEd and SAG	Navigant	March 8, 2019
Comments on draft (15 Business Days)	ComEd and SAG	March 29, 2019
Revised Draft by Navigant	Navigant	April 5, 2019
Comments on redraft (5 Business Days)	ComEd and SAG	April 12, 2019
Final Report to ComEd and SAG	Navigant	April 19, 2019

## APPENDIX C. INCOME ELIGIBLE PROGRAMS EVALUATION PLANS

### ComEd Affordable Housing New Construction Program CY2018 to CY2021 Evaluation Plan

#### Introduction

The ComEd Affordable Housing New Construction Program provides incentives for energy-efficient construction and major renovation of affordable housing. The program offers technical assistance and incentive funding and serves both single-family and multi-family housing. The program targets income-eligible customers in ComEd’s service territory with incomes at or below 80% of the Area Median Income. An additional goal of the program is to educate housing developers on cost-effective energy efficient building practices. The program is a coordinated program with Peoples Gas (PG), North Shore Gas (NSG), and Nicor Gas.

The program has three participation levels: major renovation, new multi-family, and new single-family. Altogether, the CY2018 savings goal is 1,656 net MWh of cumulative persisting annual savings and the same for first year annual savings.

The evaluation of this program over the coming four years will include a variety of data collection and analysis activities, including those indicated in Table 1.

**Table 1. Evaluation Approaches Over Time**

Tasks	CY2018	CY2019	CY2020	CY2021
Tracking System Review	X	X	X	X
Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Data Collection – Stakeholder Interviews	X		X	
Impact – Engineering Review	X	X	X	X
Impact – Measure-Level Deemed Savings Review	X	X	X	X
Impact – Verification & Gross Realization Rate	X	X	X	X
Impact Research – Calibrated Simulation Modeling*		X		
Process Analysis	X	X	X	X

*\*Study to be considered*

The evaluation team determined the evaluation approach for the 2018-2021 period based on the needs of the program and the program’s prior history. In 2018, the evaluation will focus on evaluating program guideline changes. In 2019, the evaluation will focus on updating the TRM through calibrated simulation modeling. The results of these efforts will inform specific research questions for upcoming years. The four-year evaluation approach for this program is based on the following:

- Gross and net impact analysis will be conducted each year
- Calibrated simulation modeling research in CY2019 to inform potential updates to the TRM
- Program manager and implementer interviews will be conducted each year
- Interviews with affordable housing developers will be conducted every other year; in 2018 the focus of these interviews will be on the program transition

- CPAS will be calculated based on the requirements of FEJA

### Coordination

Navigant will coordinate with the evaluation teams from other utilities on any issues relevant to this program. Specifically, as this is a coordinated program with Nicor Gas and Peoples and North Shore Gas, the evaluation team will coordinate closely with these gas utilities on issues common to this program. The evaluation activities and timing for each utility evaluation are the same as this is one evaluation effort for all utilities. Ameren Illinois has a suite of energy efficiency programs for income eligible customers and the evaluation team will coordinate with Ameren on an as needed basis. Additionally, Navigant will solicit feedback from and coordinate with the Income Eligible Stakeholder Advisory Committee.

### Evaluation Research Topics

The evaluation will seek to answer the following key researchable questions:

#### Impact Evaluation

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

#### Process Evaluation and Other Research Topics

The process evaluation effort for CY2018 will focus on program delivery. The process research will address the following questions:

1. What are participants' perspectives and overall satisfaction with the program?
2. How can the program be improved? Are there changes or improvements which could be made to the educational component of the program?
3. How is the transition into CY2018 impacting the program?

### Evaluation Approach

Table 2 summarizes the evaluation tasks for CY2018 including data collection methods, data sources, timing, and targeted sample sizes that will be used to answer the evaluation research questions.

**Table 2. Core Data Collection Activities, Sample, and Analysis**

Activity	Target	Target Completes CY2018	Timeline	Notes
Tracking System Review	Tracking system	Census	Two waves	
In Depth Interviews	Program Management and Implementers	2	April – June 2018	Augment with monthly calls
Gross Impact	Early Feedback Review	As Needed	June 2018 – Feb 2019	Early Feedback for Large Projects
Gross Impact	Engineering Review	All	April 2018 – Feb 2019	Two Waves*
Verified Net Impact	Calculation using deemed NTG ratio	NA	March 2019	
Process and Impact Research on CY2018 Operations	Literature review, secondary research	Census	April 2018 – Dec 2018	Process, Impact

\* Navigant will coordinate with ComEd to determine appropriate dates to pull tracking data extracts for each wave.

### Gross Impact Evaluation

Since the Affordable Housing New Construction Program savings are derived from deemed values contained in the TRM<sup>88</sup>, gross savings will be evaluated primarily by (1) reviewing the tracking system data to ensure that all fields are appropriately populated; (2) reviewing measure algorithms and values in the tracking system to assure that they are appropriately applied; and (3) cross-checking totals. This approach will be supplemented, where possible, with a review of project documentation in each program year to verify participation, installed measure quantities, and associated savings.

Navigant will perform a tracking system review in two waves during the CY2018 evaluation period. Final program gross and net impact results will be based on the two waves combined. Proposed gross impact timelines for CY2018 are shown below:

- a) First wave drawn in May 2018 and completed in August 2018
- b) The final tracking data is provided by ComEd by January 30, 2019, with reporting finalized by April 30, 2019

We are not evaluating the AHNC via a randomized controlled trial because the program was not designed with randomly assigned treatment and control groups. We are not using quasi-experimental consumption data because it would not be possible to create a valid matched control group for the customers in this program. Navigant is planning to conduct research through modeling calibrated with actual billing data, as described in research section below.

### Gross Impact Evaluation Research

In CY2019, Navigant will conduct evaluation research to confirm TRM estimates of savings. Navigant will develop models and use actual consumption data to calibrate them in order to determine accuracy of TRM savings estimates. This research may be used to provide revisions to the TRM in 2020, which could impact energy savings for CY2021 and beyond.

<sup>88</sup> Illinois Statewide Technical Reference Manual for Energy Efficiency Version 6.0 for 2018, available at: <http://www.ilsag.info/technical-reference-manual.html>

### Verified Net Impact Evaluation

The TRM deems NTG at 1.0 for Income Eligible programs.

### Research NTG Impact Evaluation

The program has historically seen a deemed NTG ratio of 1.0 because the program targeted the income-eligible sector. However, because the income-eligible customers are not typically the decision makers for this program, Navigant believes the TRM NTG working group should consider whether the Affordable Housing New Construction Program should have NTG research performed.

Potential NTG research activities and timeline will be coordinated with the other utilities. Navigant will coordinate the data collection and survey instruments design to capture the appropriate questions in the decision maker surveys. The coordinated program evaluation and reporting timelines will be the same.

### Calculation of CPAS and Annual Savings

As required by the Future Energy Jobs Act (FEJA), the measure-specific and total ex post gross savings and ex post net savings for the program and the cumulative persisting annual savings (CPAS) in CY2018 will be calculated for each measure along with the total CPAS for all measures. Additionally, the weighted average measure life will be estimated, if possible. Evaluation will also add the savings converted from gas savings to the electric savings so that it's documented in the report.

### Process Evaluation

The CY2018 process evaluation research will include a synthesis of both qualitative and quantitative data collected during the program staff and implementer interviews and meetings. The focus of the interviews will be to understand the intent of program. Navigant will also interview other program stakeholders (affordable housing developers) to identify any gaps between how ComEd intends to have the program work and how stakeholders see it working. The process research will be coordinated with the gas utilities in the program implementation.

Navigant will perform additional process research, upon the request of the program manager, to support the program manager and implementer in transitioning into the revised regulatory requirements starting in CY2018. Process work may include surveys to assess customer demographics and satisfaction and estimation of job impacts.

### Evaluation Schedule

Table 3 provides the schedule for key deliverables and data transfer activities. (See Table 2 for other schedule details.) Adjustments will be made, as needed, as evaluation activities progress.

**Table 3. Schedule – Key Deadlines**

Activity or Deliverable	Responsible Party	Date Delivered
Program Operations Manual and Workpapers	ComEd	March 15, 2018
CY2018 program tracking data for QA/QC	ComEd	May 4, 2018
Wave 1 project documentation and engineering review	Evaluation	August 31, 2018
Tracking system ex ante review findings and recommendations	Evaluation	August 31, 2018
CY2018 program tracking data request	Evaluation	October 1, 2018
Process Analysis Findings	Evaluation	December 1, 2018
CY2018 program tracking data	ComEd	January 30, 2019
CY2018 project documentation and engineering review	Evaluation	February 28, 2019
Illinois TRM Update Research Findings (if applicable)	Evaluation	March 1, 2019
Draft Report to ComEd and SAG	Evaluation	March 6, 2019
Comments on draft (15 Business Days)	ComEd and SAG	March 27, 2019
Revised Draft by Navigant	Evaluation	April 5, 2019
Comments on redraft (5 Business Days)	ComEd and SAG	April 12, 2019
Final Report to ComEd and SAG	Evaluation	April 26, 2019

## ComEd Food Bank LED Distribution Program CY2018 to CY2021 Evaluation Plan

### Introduction

The LED Distribution Program provides packages of ENERGY STAR certified LEDs to select Feeding America food banks. The food banks use their network of local food pantries within ComEd’s service territory to distribute the bulbs to utility customers in need, who receive four LEDs per household. The LED products are distributed at no cost to the food banks, food pantries and their customers. The program implementation contractor coordinates program activities, including engaging with the food banks and their participating food pantries.

From PY9 to CY2018, the eligible measure changed from ENERGY STAR certified CFLs to ENERGY STAR certified 10W A-Line LED screw based omnidirectional bulbs. Additionally, the program is offering advanced power strips. The CY2018 net cumulative persisting annual savings (CPAS) forecast is 15,241 MWh and the net first year annual savings forecast is 15,241 MWh. The CPAS values for CY2018 will change in future years depending on the lifetimes of the measures distributed in the program. The program executed participation agreements with three Feeding America food banks, and the target participant level is 1,003,800 households in CY2018.

The primary objectives of the CY2018 evaluation of the Food Bank LED Distribution (LED Distribution) Program are to: (1) quantify gross and net electricity and demand savings impacts from the program, (2) estimate distributed LED installation and leakage rates by conducting surveys, (3) review program materials and processes and (4) investigate participants’ perspectives about the program and their satisfaction with the program.

The evaluation of this program will include a variety of data collection and analysis activities, including those indicated in the following table.

**Table 1. Evaluation Approaches – Four Year Plan**

Tasks	CY2018	CY2019	CY2020	CY2021
Tracking System Review	X			
Data Collection – Participant Surveys	X			
Data Collection – Program Manager and Implementer Interviews	X			
Data Collection – Food Bank/Pantries Interviews	X			
Impact – Engineering Review	X		TBD <sup>89</sup>	
Impact – Measure-Level Deemed Savings Review	X			
Impact – Verification & Gross Realization Rate	X			
Process Analysis	X			

This evaluation plan details the evaluation approach for CY2018 as the program is currently planned for a duration of one year. If a decision is made to extend the program the evaluation team will determine the evaluation approach for the remaining period based upon the needs of the program.

### Coordination

The other Illinois utilities do not currently have similar programs; thus, evaluation will coordinate with other Illinois utilities on issues common to this program (e.g., sharing findings which could be used to update the kit measure inputs in the TRM)

### Evaluation Research Topics

The evaluation will seek to answer the following key researchable questions:

#### Impact Evaluation

1. What are the program’s first year annual verified gross savings?
2. What are the program’s total cumulative persisting annual verified gross savings?
3. What are the program’s first year annual verified net savings?
4. What is the In-Service Rates (ISR) for the measures distributed during the year?

#### Process Evaluation and Other Research Topics

The CY2018 process evaluation activities for LED Distribution Program will focus on interviews with program staff and the implementation contractor staff, to verify information included in the tracking database and review of project documentation and processes. The evaluation includes surveys to investigate what impacted customer participation and satisfaction with the program. The process research will address the following questions:

1. What are participants’ perspectives and overall satisfaction with the program?

<sup>89</sup> The ComEd 2018-2021 plan shows this program is currently planned for a duration of one year.

- Are there additional ways to engage the income eligible population in energy efficiency through this program?

## Evaluation Approach

The table below summarizes the evaluation tasks for CY2018 including data collection methods, data sources, timing, and targeted sample sizes that will be used to answer the evaluation research questions.

**Table 2. Core Data Collection Activities, Sample, and Analysis**

Activity	Target	Target Completes CY2018	Timeline	Notes
Tracking System Review	Tracking system	Census	Two waves	
In Depth Interviews	Program Management and Implementers	2	February-March 2018	
Gross Impact	Engineering File Review	All	June 2018 – March 2019	Two Waves*
Verified Net Impact	Calculation using deemed NTG ratio	NA	March 2019 – April 2019	
ISR Calculations for CY2018 measures	Participant Interview. Literature review	Census	Feb 2018 – Feb 2019	Impact

\* Navigant will coordinate with ComEd to determine appropriate dates to pull tracking data extracts for each wave.

## Gross Impact Evaluation

The program key gross impact evaluation activities will be based on (1) reviewing the tracking system to determine whether all data required to verify program participation and distribution of LED products are appropriately collected, (2) reviewing measure algorithms and savings values in the tracking system to assure that they are appropriately applied, and (3) cross-checking measure totals and savings recorded in the tracking database. The evaluation team will conduct gross impact verification for program savings using the applicable Illinois TRM (v6.0). Verified gross savings will be estimated by multiplying deemed per unit kWh savings by the verified quantity of eligible LEDs distributed at the food pantries.

Table 3 summarizes data input parameters for estimating the distributed LED savings in CY2018.

**Table 3. Savings Input Parameters**

IL TRM Version 5.0	Assumption	Notes
$\Delta kWh = ((WattsBase - WattsEE) / 1000) * ISR * (1 - Leakage) * Hours * WHFe$		
WattsBase	43	Lumen range 750-1049
WattsEE	11.4	Actual LED wattage (deemed)
ISR	To be calculated	1st year ISR for LED Distribution
Leakage	0%	Navigant supports the use of a 0% leakage assumption
Hours	847	Assumes Unknown installation type
WHFe	1.06	Unknown location
$\Delta kWh$	16.74	Gross kWh/bulb
$\Delta KW$	0.002	Gross KW/bulb
NTGR	1.00	Recommended by Navigant, accepted by the SAG

Impact research for future TRM review will include participant surveys to investigate installation rate and potential leakage of bulbs distributed.

Navigant is not evaluating the Food Bank LED Distribution Program via a randomized controlled trial because the program was not designed with randomly assigned treatment and control groups. Navigant is not using quasi-experimental consumption data because the savings are not large enough to achieve statistically significant estimates using this method and account numbers are not collected from participants.

### Verified Net Impact Evaluation

The TRM deems NTG at 1.0 for Income Eligible programs.

### Research NTG Impact Evaluation

Navigant will not be conducting NTG research for this program.

### Calculation of CPAS and Annual Savings

As required by the Future Energy Jobs Act (FEJA), Navigant will report ex post gross and ex post net savings for the program and the cumulative persisting annual savings (CPAS) in CY2018 will be calculated along with the total CPAS. Additionally, the weighted average measure life will be estimated, if possible. Navigant will consider baseline changes for the LED bulb in the CPAS calculation.

### Process Evaluation

Navigant will interview the program staff and the implementation contractor staff, and further verify information about the tracking database and project documentation and processes to determine whether program eligibility rules were adhered to, and that the appropriate participant information was documented and readily available for evaluation.

Navigant will collect contact information and field a participant survey. As mentioned above, the research will include gathering data for estimating and reviewing leakage and installation rate parameters for the TRM review.

The evaluation survey will cover the following topics:

- The number of bulbs received and installed
- Distribution timeline of bulbs
- Purchasing habits regarding efficient bulbs
- Satisfaction with the bulbs received
- Ideas to engage the population in energy efficiency
- Barriers (if any) to installing the bulbs
- Home heating and cooling equipment and household demographics
- Potential leakage
- Customer demographics

## Evaluation Schedule

Table 4 below provides the schedule for key deliverables and data transfer activities. (See Table 2 for other schedule details.) Adjustments will be made, as needed, as evaluation activities progress.

**Table 4. Schedule – Key Deadlines**

Activity or Deliverable	Responsible Party	Date Delivered
Participating customer survey design	Evaluation	January - March, 2018
Program Operations Manual Review	ComEd	January - March, 2018
CY2018 program tracking data for Wave 1 early impact review	ComEd	June 30, 2018
Early impact findings memo	Evaluation	August 15, 2018
CY2018 program data for survey	ComEd/Evaluation	September 30, 2018
Data request for PY2018 final tracking data	Evaluation	October 1, 2018
Participating customer survey fielding	Evaluation	October 28, 2018
Survey analysis findings	Evaluation	December 15, 2018
Final CY2018 Tracking Data to Navigant	ComEd	January 30, 2019
Illinois TRM Update Research Findings	Evaluation	March 3, 2019
Draft Report to ComEd and SAG	Evaluation	March 15, 2019
Comments on draft (15 Business Days)	ComEd and SAG	April 5, 2019
Revised Draft by Navigant	Evaluation	April 12, 2019
Comments on redraft (5 Business Days)	ComEd and SAG	April 19, 2019
Final Report to ComEd and SAG	Evaluation	April 28, 2019

**ComEd Income-Eligible Lighting Discounts Program CY2018 to CY2021 Evaluation Plan**

**Introduction**

The ComEd Income-Eligible Lighting Discounts Program provides incentives to increase the market share of ENERGY STAR® certified LED bulbs and fixtures sold through retail sales channels. The program includes instant discounts (at the time of sale) to decrease customer costs, and provides educational materials aimed at increasing customer awareness and acceptance of energy-efficient lighting technologies and promoting proper bulb disposal. The program will be targeted in retail sale channels that serve, in part or in full, ComEd residential customers with incomes at or below 80% of the Area Median Income. Regardless of their choice of supplier, all income eligible residential customers taking delivery service from ComEd are eligible.

The PY2018 program saving’s goal is 16,494 net MWh of cumulative persisting annual savings and the same for first year annual savings.

The evaluation of this program over the coming four years will include a variety of data collection and analysis activities, including those indicated in the following table.

**Table 1. Evaluation Approaches Over Time**

Tasks	CY2018	CY2019	CY2020	CY2021
Tracking System Review	X	X	X	X
Data Collection – Participant Surveys	X	X	X	X
Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Impact – Engineering Review	X	X	X	X
Impact – Measure-Level Deemed Savings Review	X	X	X	X
Impact – Verification & Gross Realization Rate	X	X	X	X
Process Analysis	X	X	X	X

In 2018 the evaluation will focus on understanding the intent of the program to identify any gaps in impact methodology, program participation or geography. The evaluation will answer the following overarching questions:

- Are there updates which should be made to the TRM specifically for the income eligible lighting discounts program?
- Are the participating stores in income eligible neighborhoods or visited by income eligible population?
- Are there areas that are underserved?

The answers to the above questions will inform additional impact and process research priorities to be explored in 2019-2021. Additional research will likely include GIS mapping, secondary literature review, customer surveys, and focus groups with retailers.

### Coordination

Navigant will coordinate with the evaluation teams from other utilities on any issues relevant to this program. Specifically, Ameren Illinois has a residential energy-efficient lighting program offering time of sale discounts to residential electric customers, but does not have a similar program targeting income eligible participants. The program leads will collaborate with other utilities on issues common to this program.

### Evaluation Research Topics

The evaluation will seek to answer the following key researchable questions:

#### Impact Evaluation

1. What are the program’s annual total verified gross savings (kWh) and peak demand (kW) savings?
2. What are the program’s verified net savings? The NTG ratio for the Income Eligible Lighting Discounts Program is 1.0 for PY2018.
3. Did the program meet savings goals, and if not, why?
4. What updates are recommended for the Illinois Technical Reference Manual (TRM)?

#### Process Evaluation and Other Research Topics

The process evaluation effort for CY2018 will focus on program delivery. The process research will address the following questions:

1. What are participants’ perspectives and overall satisfaction with the program?
2. How can the program be improved?
3. How is the transition into CY2018 impacting the program?
4. How aware are customers of the ComEd-sourced LED bulb discounts? How effective are the in-store displays and marketing materials?
5. How aware are customers of changes in available lighting products? How have customers’ lighting purchasing decisions been affected by the changes in the options available for purchase?
6. What are the key barriers to LED purchases and how can they be addressed by the program?
7. What is the current level of LED availability and pricing in ComEd territory for common retail channels? How does this compare to similar regions (with or without lighting programs) and how is this changing over time?
8. What are ComEd customers’ preferences, acceptance, and use of various efficient lighting technologies, and what are the primary factors influencing them?
9. What is the current LED market saturation (# of LEDs/ # of eligible sockets for an average home) in residential income eligible single family or multifamily homes in ComEd territory?

### Evaluation Approach

The table below summarizes the evaluation tasks for CY2018 including data collection methods, data sources, timing, and targeted sample sizes that will be used to answer the evaluation research questions.

Table 2. Core Data Collection Activities, Sample, and Analysis

Activity	Target	Target Completes CY2018	Timeline	Notes
Tracking System Review	Tracking system	Census	One Wave	
In Depth Interviews	Program Management and Implementers	2	Feb – May 2018	Augment with monthly calls
Gross Impact	Early Feedback File Review	NA	June 2018 – Feb 2019	Early Feedback for Large Projects
Gross Impact	Engineering File Review	85	April 2018 – Feb 2019	Two Waves*
Process and Impact Research on PY10 Operations	Literature review, secondary research	Census	April 2018 – Feb 2019	Process, Impact

\* Navigant will coordinate with ComEd to determine appropriate dates to pull tracking data extracts for each wave.

### Gross Impact Evaluation

Navigant will perform an engineering review of savings calculations. We will calculate Gross kWh, kW and summer and winter peak kW savings across all program bulbs based on the following equations:

$$\text{Annual kWh Savings} = \text{Program bulbs} * \text{Delta Watts}/1000 * \text{Annual HOU} * \text{Realization Rate}$$

$$\text{Annual kW Savings} = \text{Program bulbs} * \text{Delta Watts}/1000 * \text{Realization Rate}$$

$$\text{Annual Summer Coincident Peak kW Savings} = \text{Annual kW Savings} * \text{Summer Peak Load CF Factor}^{90}$$

$$\text{Annual Winter Coincident Peak kW Savings} = \text{Annual kW Savings} * \text{Winter Peak Load CF}^{91}$$

$$\text{Where Realization Rate} = \text{Installation Rate} * (1 - \text{Leakage Rate}) * \text{Interactive Effects}$$

For the verification analysis in CY2018, the evaluation team will calculate gross savings using the following parameter estimates:

- **Program Bulb Sales** data will be obtained from the CY2018 EM&V tracking database analysis.
- **Program Bulb Installation Rates** will be obtained from the IL TRM v6.0.
- **Delta Watts** will be calculated using the bulb type lumen-equivalence mapping in the IL TRM v6.0.
- **HOU and Summer Peak CF** will be obtained from the IL TRM v6.0.
- **Winter Peak CF** will be determined based upon analysis done by the evaluation team.
- **Residential Bulb Installation Rate** will be obtained from the IL TRM v6.0.
- **Interactive Effects** will be obtained from the IL TRM v6.0.

<sup>90</sup> Summer Peak CF is calculated as the percentage of lighting turned on in each room during peak hours of the summer months (1-6 pm on summer weekdays).

<sup>91</sup> Winter Peak CF is calculated as the percentage of lighting turned on in each room during peak hours of the winter months (6-8 am and 5-7pm, between January 1 and February 28).

- **Leakage** will be obtained from the three-year rolling average evaluation research recommendation. Navigant will examine zip codes of the applicable stores to determine if there should be an update to the leakage rate.

We are not evaluating Income Eligible Lighting Discounts Program via a randomized controlled trial because the program was not designed with randomly assigned treatment and control groups. We are not using quasi-experimental consumption data because the savings are not large enough to achieve statistically significant estimates using this method.

### Verified Net Impact Evaluation

The TRM deems NTG at 1.0 for Income Eligible programs.

### Research NTG Impact Evaluation

Navigant will not conduct NTG research for this program.

### Calculation of CPAS and Annual Savings

As required by the Future Energy Jobs Act (FEJA), the total ex post gross savings and ex post net savings for the program and the cumulative persisting annual savings (CPAS) in CY2018 will be calculated for each measure along with the total CPAS for all measures. Additionally, the weighted average measure life will be estimated, if possible. Evaluation will also add the savings converted from gas savings to the electric savings so that it's documented in the report.

### Process Evaluation

The CY2018 process evaluation research will include a synthesis of both qualitative and quantitative data collected during the program staff and implementer interviews and meetings. The CY2018 study will include interviews with participating customers to learn about their perspectives and satisfaction with the program, amidst varying opportunities from program incentive offerings and changes to program application requirements.

Additionally, geographic analysis will map income eligible census tracts, overlay with participating stores, and help identify underserved regions. The customer surveys will also determine if in-service rate (ISR) or other parameters are the same for the Income Eligible Lighting Discounts Program compared to the market rate Lighting Discounts Program.

There are several process-related topics and research parameters that can be explored through these methods, including:

- Awareness of the discount provided by ComEd
- Importance of retailer recommendations and in-store placement of program sponsored lamps
- Importance of ComEd supplied informational materials
- Timing of bulb installation
- Identification of underserved regions
- Confirmation of percentage of income eligible customers visiting selected stores

## Evaluation Schedule

Table 3 below provides the schedule for key deliverables and data transfer activities. (See Table 2 for other schedule details.) Adjustments will be made, as needed, as evaluation activities progress.

**Table 3. Schedule – Key Deadlines**

Activity or Deliverable	Responsible Party	Date Delivered
Program Operations Manual and Workpapers	ComEd	February 28, 2018
CY2018 participating customer survey design	Evaluation	March 1, 2018
CY2018 program tracking data for sampling Wave 1	ComEd	May 31, 2018
Participating customer and process survey fielding	Evaluation	June 30, 2018
Wave 1 impact memo	Evaluation	August 15, 2018
Data request for PY2018 final tracking data	Evaluation	October 1, 2018
Process Analysis Findings	Evaluation	December 21, 2018
CY2018 Program tracking data for final wave	ComEd	January 30, 2019
Internal Report Draft by Navigant	Evaluation	March 2, 2019
Draft Report to ComEd and SAG	Evaluation	March 6, 2019
Comments on draft (15 Business Days)	ComEd and SAG	March 28, 2019
Revised Draft by Navigant	Evaluation	April 6, 2019
Comments on redraft (5 Business Days)	ComEd and SAG	April 13, 2019
Final Report to ComEd and SAG	Evaluation	April 27, 2019

**ComEd Income-Eligible Multi-family Program CY2018 to CY2021 Evaluation Plan**

**Introduction**

The Income-Eligible Multi-family Energy Efficiency Program offers direct installation of energy efficiency measures and replacement of inefficient equipment as well as educational information to further save money on energy bills. Eligible measures include LED and energy efficient lighting retrofits, programmable thermostats, advanced power strips, water efficiency devices, weatherization measures, pipe insulation, and heating and cooling equipment.

There are two different components for this program. The Income Eligible Multi-family Savings Program (IEMS) is administered by Commonwealth Edison Company (ComEd), and Peoples Gas (PGL) and North Shore Gas (NSG) companies. The Income Eligible Retrofits Multi-family Program (IER-MF) is administered by ComEd, PGL and NSG, and Nicor Gas.

The IEMS CY2018 net composite savings target is 14,867 MWh of cumulative persisting annual savings (CPAS) outlined in Table 1. The target participant level is 5,694 property assessments in CY2018. The IER-MF CY2018 net composite savings target is 1,433 MWh of annual savings outlined in Table 1. The target participant level is 2,065 property assessments in CY2018. These target numbers are in flux as the gas utility participation is still being incorporated.

Both the IEMS and IER-MF programs provide retrofits in common areas and tenant spaces to eligible multi-family properties in the ComEd service territory, and serve as a “one stop shop” to multi-family building owners and managers whose buildings are targeted to income-eligible residents.<sup>92</sup>

The primary objectives of the CY2018 evaluation of IEMS and IER-MF are to: (1) quantify gross and net savings impacts from the program; (2) quantify gas savings counted as kWh (therms conversion); (3) conduct research to support the program’s transition in response to the Future Energy Jobs Act (FEJA)<sup>93</sup>; and (4) determine key process-related program strengths and weaknesses and identify ways in which the program can be improved.

**Table 1. CY2018 Cumulative Persisting Annual Savings (CPAS) Targets**

Program Implementer	Net CPAS Electric Savings (MWh)	Net CPAS Gas Savings (therms)	Net CPAS Gas Conversion Savings (MWh)	Net Composite Savings (MWh)
IEMS	3,680	375,676	11,007	14,687
IER-MF	NA	NA	NA	1,433

The evaluation of this program over the coming four years will include a variety of data collection and analysis activities, including those indicated in the following table.

<sup>92</sup> Multi-family properties served by the IHWAP, nonprofits that manage HUD 811 and HUD 202 housing, other building owners/managers and tenants in qualified geographic areas (e.g., Census tracts).

<sup>93</sup> Illinois Public Act 099-0906 (<http://www.ilga.gov/legislation/publicacts/99/099-0906.htm>).

Table 2. Evaluation Approaches – Four Year Plan

Tasks	CY2018	CY2019	CY2020	CY2021
Tracking System Review	X	X	X	X
Data Collection – Participant Surveys	X		X	
Data Collection – Property Manager Interviews	X		X	
Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Impact – Billing Analysis		X		
Impact – Engineering Review	X	X	X	X
Impact – Measure-Level Deemed Savings Review	X	X	X	X
Impact – Verification & Gross Realization Rate	X	X	X	X
Impact – Field Work	X		X	
Net-to-Gross – Customer Self-Report Surveys (if needed)		X		
Process Analysis	X	X	X	X

The evaluation team determined the evaluation approach for the 2018-2021 period based upon the needs of the program and program’s history. In 2018, Navigant will plan a billing analysis study to take place in 2019 to confirm TRM estimates of savings. Additionally in 2018, Navigant will focus on process evaluation to answer questions related to gaps in participation and the program transition. Navigant will use the results of the billing analysis and process evaluation to inform additional research conducted in upcoming years. The 4-year evaluation approach for this program is based on the following:

- Gross and net impact analysis will be conducted each year
- CPAS will be calculated based upon the requirements of FEJA
- Process surveys conducted each year based upon client request, program performance and trade ally network details
- Billing analysis conducted in 2019 to confirm TRM savings estimates
- Coordination with the Illinois Income Eligible Stakeholder Advisory Group and SAG to determine if NTG research is warranted
- Field work in 2018 and 2020 to confirm measure installation and to assess any missed energy savings opportunities

### Coordination

These are joint programs with the gas utilities and evaluation will coordinate closely with these gas utilities on issues common to the programs. We will pull our sample for field work and surveys with the aim of creating efficiencies between the programs and utilities, while still meeting statistical significance. Ameren Illinois has a suite of energy efficiency programs for income eligible customers and we will coordinate with Ameren on as-need basis (e.g., regarding possibility of NTG research). Additionally, Navigant will solicit feedback from and coordinate with the Income Eligible Stakeholder Advisory Committee.

### Evaluation Research Topics

The evaluation will seek to answer the following key researchable questions:

### Impact Evaluation

1. What are the program’s annual total verified gross savings? What are the verified gross savings from lighting measures? What are the verified gross savings from non-lighting measures?
2. What are the program’s verified net savings?

### Process Evaluation and Other Research Topics

The process evaluation effort for CY2018 will focus on program delivery. The process research will address the following questions:

1. What are property managers’ and property owners’ perspectives and overall satisfaction with the program? How does this vary by geography and demographics?
2. Are there gaps in participation? What are the demographics of the trade allies and customers?
3. How can the program be improved?
4. How is the transition into CY2018 impacting the program for customers and for stakeholders (IHWAP, CAAs, etc.)?
5. Are there trust or confusion issues for customers or stakeholders due to program transition?
6. Are there barriers to participation? Particularly barriers around incentive levels, health and safety issues, and master metered vs individually metered properties.
7. What are the job impacts of the program?

### Evaluation Approach

The table below summarizes the evaluation tasks for CY2018 including data collection methods, data sources, timing, and targeted sample sizes that will be used to answer the evaluation research questions.

**Table 3. Core Data Collection Activities, Sample, and Analysis**

Activity	Target	Target Completes CY2018	Timeline	Notes
Tracking System Review	Tracking system	Census	Three waves	
In Depth Interviews	Program Management and Implementers	2	April – June 2018	
In Depth Interviews	Property Manager/Owner	1	May - July 2018	
Gross Impact	Engineering File Review	all	June 2018 – March 2019	Two Waves*
Verified Net Impact	Calculation using deemed NTG ratio	NA	March 2019 – April 2019	
Process and Impact Research on CY2018 Operations	Literature review, secondary research	Census	April 2018 – Feb 2019	Process, Impact

\* Navigant will coordinate with ComEd, PGL, NSG and Nicor to determine appropriate dates to pull tracking data extracts for each wave.

### Gross Impact Evaluation

The IEMS and IER-MF savings verification will be based on using the applicable Illinois TRM (v6.0), or secondary research for any measure with custom savings input. Gross savings will be evaluated primarily by: (1) reviewing the tracking system data to ensure that all fields are appropriately populated; (2)

reviewing measure algorithms and values in the tracking system to assure that they are appropriately applied; and (3) cross-checking totals. This approach will be supplemented where possible with a review of project documentation in each program year to verify participation, installed measure quantities, and associated savings, and verification of installation of energy efficient measures through participant surveys or field work. Verified gross savings will be estimated by multiplying deemed per unit kWh savings by the verified quantity of eligible measures.

The impact evaluation will quantify gas measures eligible for kWh conversion, and review the parameters ComEd used to estimate eligible gas savings

Navigant is not evaluating the IEMS and IER-MF programs via a randomized controlled trial because the program was not designed with randomly assigned treatment and control groups. Navigant will likely use a quasi experimental design in order to conduct a billing analysis in 2019 to confirm TRM savings estimates for bundles of measures.

### Verified Net Impact Evaluation

The TRM deems NTG at 1.0 for Income Eligible programs.

### Research NTG Impact Evaluation

No NTG research will be done for the income-eligible program in CY2018. Navigant may consider NTG research in CY2019 or CY2020, depending on findings from CY2018 participant process surveys and feedback from the Illinois statewide NTG working group.

Potential NTG research activities and timeline will be coordinated with the joint implementation with the gas utilities. Navigant will coordinate the data collection and survey instruments design to capture the appropriate questions in the decision maker surveys. The joint program evaluation and reporting timelines will be the same.

### Calculation of CPAS and Annual Savings

As required by the Future Energy Jobs Act (FEJA), Navigant will report ex post gross and ex post net savings for the program and the cumulative persisting annual savings (CPAS) in CY2018 will be calculated along with the total CPAS. Additionally, the weighted average measure life will be estimated, if possible. Evaluation will also add the savings converted from gas savings to the electric savings so that it's documented in the report.

### Process Evaluation

The CY2018 process evaluation research will include a synthesis of both qualitative and quantitative data collected during the program staff and implementer interviews and meetings, and during the property owner or manager interview, or customer surveys in CY2018. The CY2018 study will include in-depth interviews with participating stakeholders to learn about their perspectives and satisfaction with the program, amidst varying opportunities from program offerings. The process research will be coordinated with the gas utilities in the joint program implementation.

## Evaluation Schedule

Table 4 below provides the schedule for key deliverables and data transfer activities. (See Table 3 for other schedule details.) Adjustments will be made, as needed, as evaluation activities progress.

**Table 4. Schedule – Key Deadlines**

Activity or Deliverable	Responsible Party	Date Delivered
Program Operations Manual Review	ComEd	January - March, 2018
Participating customer survey design	Evaluation	April 30, 2018
CY2018 program tracking data for Wave 1 early impact review and process	ComEd	June 30, 2018
Wave 1 participating customer process survey fielding	Evaluation	July 15, 2018
Early impact findings memo	Evaluation	July 30, 2018
CY2018 program tracking data for Wave 2 process	ComEd	November 15, 2018
Wave 2 participating customer process survey fielding	Evaluation	November 30, 2018
CY2018 Tracking Data Request	Evaluation	December 1, 2018
Process Analysis Findings	Evaluation	December 12, 2018
Wave 3 and Final CY2018 Tracking Data to Navigant	ComEd	January 30, 2019
Illinois TRM Update Research Findings	Evaluation	March 1, 2019
Internal Report Draft by Navigant	Evaluation	March 2, 2019
Draft Report to ComEd and SAG	Evaluation	March 7, 2019
Comments on draft (15 Business Days)	ComEd and SAG	March 28, 2019
Revised Draft by Navigant	Evaluation	April 7, 2019
Comments on redraft (5 Business Days)	ComEd and SAG	April 26, 2019
Final Report to ComEd and SAG	Evaluation	April 30, 2019

**ComEd Income-Eligible Single-Family Retrofit Program CY2018 to CY2021 Evaluation Plan**

**Introduction**

The Income-Eligible Single-Family Retrofit Program provides retrofits to single-family households in ComEd service areas with incomes at or below 80% of the Area Median Income. The program offers assessments, direct installation of energy efficiency measures, replacement of inefficient equipment, technical assistance, and educational information to further save money on energy bills through two program components. One program component is delivered with the Chicago Bungalow Association. This program component is jointly offered with Peoples Gas. The other component is delivered leveraging the State of Illinois’ Home Weatherization Assistance Program (“IHWAP”).

Eligible program measures include, but are not limited to:

- LED lighting
- Smart and programmable thermostats
- HVAC equipment such as boilers, furnaces, central and room air conditioners and ductless heat pumps
- Water heaters
- Low-flow faucet aerators and showerheads
- Attic and wall insulation
- Air sealing

ComEd’s CY2018 cumulative persisting annual savings targets for both components of this program are outlined in Table 1.

**Table 1. CY2018 Cumulative Persisting Annual Savings (CPAS) Targets**

Program Period	Net CPAS Electric Savings (MWh)	Net CPAS Gas Savings (therms)	Net CPAS Gas Conversion Savings (MWh)	Net Composite Savings (MWh)
CY2018	6,985	349,525	10,241	17,226

The primary objectives of the CY2018 evaluation of the Income-Eligible Single-Family Retrofit Program are to: (1) quantify gross and net savings impacts from the program, and (2) review program processes. This four-year evaluation plan includes activities scheduled to evaluate the program savings impact and process activities for CY2018 through CY2021.

The evaluation of this program over the coming four years will include a variety of data collection and analysis activities, including those indicated in the following table.

**Table 2. Evaluation Approaches – Four Year Plan**

Tasks	CY2018	CY2019	CY2020	CY2021
Tracking System Review	X	X	X	X
Data Collection – Participant Surveys	X		X	
Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Data Collection – Trade Ally Interviews	X		X	
Impact – Engineering Review	X	X	X	X
Impact – Measure-Level Deemed Savings Review	X	X	X	X
Impact – Verification & Gross Realization Rate	X	X	X	X
Impact – Field Work	X		X	
Impact – Billing Analysis		X		
Process Analysis	X	X	X	X

The evaluation team determined the evaluation approach for the 2018-2021 period based upon the needs of the program and program’s history. In 2018, Navigant will plan a billing analysis study to take place in 2019 to confirm TRM estimates of savings. Additionally in 2018, Navigant will focus on process evaluation to answer questions related to gaps in participation and the program transition. Navigant will use the results of the billing analysis and process evaluation to inform additional research conducted in upcoming years. The 4-year evaluation approach for this program is based on the following:

- Gross and net impact analysis will be conducted each year
- CPAS will be calculated based upon the requirements of FEJA
- Process surveys conducted each year based upon client request, program performance and trade ally network details
- Billing analysis conducted in 2019 to confirm TRM savings estimates
- Coordination with the Illinois Income Eligible Stakeholder Advisory Group and SAG to determine if NTG research is warranted
- Field work in 2018 and 2020 to confirm measure installation and to assess any missed energy savings opportunities

### Coordination

One component of this program is jointly offered with Peoples Gas so the evaluation team will coordinate closely with the gas utility evaluation team on issues common to this program. Ameren Illinois has a suite of energy efficiency programs for income eligible customers and evaluation will coordinate with Ameren on an as needed basis.

### Evaluation Research Topics

The evaluation will seek to answer the following key researchable questions:

**Impact Evaluation**

1. What are the program’s annual total verified gross savings? What are the verified gross savings from lighting measures? What are the verified gross savings from non-lighting measures?
2. What is the research estimate of gross savings (energy, peak demand, and total demand) for the program?
3. What are the program’s verified net savings?

**Process Evaluation and Other Research Topics**

The process evaluation effort for CY2018 will focus on program delivery. The process research will address the following questions:

1. What are participants’ perspectives and overall satisfaction with the program?
2. How can the program be improved?
3. How did customers become aware of the program? What marketing strategies could boost program awareness?
4. Are there any geographical gaps in participation?
5. What are the demographics of participants and trade allies? Are there gaps in participation?
6. Are there any program pain points and if yes, what are ways to improve these points? Specifically related to health and safety issues encountered by trade allies and program transition.

**Evaluation Approach**

The table below summarizes the evaluation tasks for CY2018 including data collection methods, data sources, timing, and targeted sample sizes that will be used to answer the evaluation research questions. These tasks will be performed for both program components.

**Table 3. Core Data Collection Activities, Sample, and Analysis**

Activity	Target	Target Completes CY2018	Timeline	Notes
Tracking System Review	Tracking systems	Census	Two waves	Wave 1, Final wave for each program component
In-Depth Interviews	Program Management and Implementers	2	March 2018	Will conduct for both program components
Gross Impact	Engineering Impact Review	NA	July 2018	Two waves* for each program component
Participant Survey	Participants	Sample	One wave	Will conduct for both program components
In-Depth Interviews	Trade Allies	Sample	One wave	Will conduct for both program components

\* Navigant will coordinate with ComEd and Peoples Gas to determine appropriate dates to pull tracking data extracts for each wave.

### Gross Impact Evaluation

Since the Income-Eligible Single-Family Retrofit Program savings are derived from deemed values contained in the TRM<sup>94</sup>, gross savings will continue to be evaluated primarily by (1) reviewing the tracking system data to ensure that all fields are appropriately populated; (2) reviewing measure algorithms and values in the tracking system to assure that they are appropriately applied; and (3) cross-checking totals.

This approach will be supplemented where possible (1) with a review of project documentation in each program year to verify participation, installed measure quantities, and associated savings and (2) verification of installation of energy efficient measures through participant surveys or field work. These activities will also serve to assess program comprehensiveness and missed opportunities.

Navigant is not evaluating the program via a randomized controlled trial because the program was not designed with randomly assigned treatment and control groups. Navigant will likely use a quasi experimental design in order to conduct a billing analysis in 2019 to confirm TRM savings estimates for bundles of measures.

### Verified Net Impact Evaluation

The TRM deems NTG at 1.0 for Income Eligible programs.

### Research NTG Impact Evaluation

No NTG research is planned for this income-eligible program.

### Calculation of CPAS and Annual Savings

As required by the Future Energy Jobs Act (FEJA), the measure-specific and the total ex post gross savings and ex post net savings for the program and the cumulative persisting annual savings (CPAS) for the measures installed in CY2018 will be calculated along with the total CPAS across all measures. Additionally, the weighted average measure life will be estimated, if possible. Evaluation will also add the savings converted from gas savings to the electric savings so that it's documented in the report.

### Process Evaluation

The CY2018 process evaluation research will include a synthesis of both qualitative and quantitative data collected during the program staff and implementer interviews and meetings, and during the end-user customer surveys in CY2018. The CY2018 study will include in-depth interviews with participating customers to learn about their perspectives and satisfaction with the program, amidst varying opportunities from program incentive offerings and changes to program application requirements. The process research will be coordinated with the gas utilities in the joint program implementation.

Customer interview questions and geographic analysis will be used to map income-eligible census tracts and overlay income-eligible participation. The result will show any gaps in participation, underserved

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<sup>94</sup> Illinois Statewide Technical Reference Manual for Energy Efficiency Version 6.0, <http://www.ilsag.info/technical-reference-manual.html>

regions, and where the program could expand. Interviews will also help to discover pain points with the program, barriers to participation, and ways to improve. The results will inform future process research.

Navigant will also use geographic analysis to map income-eligible census tracts and overlay the business locations of program trade allies. The result will show the geographic distribution of trade allies, and reporting will indicate (1) whether trade allies are participating in the program for the first time; and (2) if they meet the definition of “not-for-profit entities and government agencies that have existing relationships with or experience serving low-income communities in the State.”

In addition, Navigant will explore researching the reduction in energy burden for participants and jobs creation.

## Evaluation Schedule

Table 4 below provides the schedule for key deliverables and data transfer activities. (See Table 3 for other schedule details) Adjustments will be made, as needed, as evaluation activities progress.

**Table 4. Schedule – Key Deadlines**

Activity or Deliverable	Responsible Party	Date Delivered
CY2018 program tracking data for sampling Wave 1	ComEd	July 2, 2018
CY2018 participating customer survey design	Evaluation	July 16, 2018
Wave 1 project documentation, engineering reviews, schedule, conduct on-site M&V, feedback	Evaluation	August 15, 2018
Participating customer process survey fielding and first wave on-sites	Evaluation	August 15, 2018
Tracking System Ex Ante Review Findings and Recommendations	Evaluation	August 30, 2018
Participating customer in-depth interviews	Evaluation	September 28, 2018
Trade Ally in-depth interviews	Evaluation	October 12, 2018
CY2018 Final Tracking Data Request	Evaluation	November 1, 2018
Process Analysis Findings	Evaluation	December 12, 2018
CY2018 Program tracking data for sampling Final Wave	ComEd	January 30, 2019
Final Wave project documentation, engineering reviews, schedule, conduct on-site M&V, feedback	Evaluation	February 28, 2019
Internal Report Draft by Navigant	Evaluation	March 3, 2019
Draft Report to ComEd and SAG	Evaluation	March 11, 2019
Comments on draft (15 Business Days)	ComEd and SAG	April 16, 2019
Revised Draft by Navigant	Evaluation	April 17, 2019
Comments on redraft (5 Business Days)	ComEd and SAG	April 25, 2019
Final Report to ComEd and SAG	Evaluation	April 30, 2019

**ComEd Low Income Kit Program CY2018 Evaluation Plan**

**Introduction**

The Low-Income Kit Energy (LIKE) Program provides qualified customers with a kit containing energy-saving devices such as advanced power strips and LEDs. Households with electric hot water will also receive low flow faucet aerators and low flow showerheads. The kits also include educational information on additional energy-saving actions customer can do to reduce their energy bills. The target population is low income customers living in single-family and small multi-family housing (two to four units) that are currently underserved by existing energy efficiency programs. Eligibility will be limited to customers whose incomes are at 80% AMI or below 250% of the federal poverty line for their household size.

The implementation contractor is responsible for the program implementation, including purchasing the kit materials, assembling the kits, delivering the kits to Community Action Agencies for distribution, and collecting the data required for proper evaluation, measurement and verification (EMV). The IACAA through the 15 participating Community Action Agencies will be responsible for hand delivering the kits to eligible participants.

The IACAA is responsible for customer recruitment which takes place in the (15) Community Action Agencies facilities. Customers go to these facilities to receive assistance from several programs available to them and among those programs is the Low-Income Home Energy Assistance Program (LIHEAP). The LIHEAP has the same income-qualification requirements as the LIKE Program (need to be at 80% AMI or below 250% of the federal poverty line). After a customer provides proof they are eligible to participate in the LIHEAP (proof of income eligibility AND receives electricity from ComEd), a Community Action Agency staff member will ask them if they would like to participate in the LIKE Program and receive a free energy efficiency kit. The customer will then fill out a form to receive the kit, receive a brochure explaining the kit contents, and have the kit hand-delivered to them on site.

ComEd’s net target in CY2018 is 9,012 net MWh in cumulative persisting annual savings and the same for first year annual savings.

The primary objectives of the evaluation of the LIKE Program are to: (1) quantify gross and net savings impacts from the program, and (2) make recommendations to enhance the program focused on the current priorities as determined by the program manager. The evaluation of this program over the coming year will include a variety of data collection and analysis activities, including those indicated in the following table.

**Table 1. Evaluation Approaches Over Time**

Tasks	CY2018	CY2019	CY2020	CY2021
Tracking System Review	X			
Data Collection – Program Manager and Implementer Interviews	X			
Impact – Engineering Review	X			
Impact – Measure-Level Deemed Savings Review	X		TBD <sup>95</sup>	
Impact – Verification & Gross Realization Rate	X			
Process Analysis	X			

<sup>95</sup>The ComEd 2018-2021 plan shows this program is currently planned for a duration of one year.

This evaluation plan details the evaluation approach for CY2018 as the program is currently planned for a duration of one year. If a decision is made to extend the program, the evaluation team will determine the evaluation approach for the remaining period based upon the needs of the program.

### Coordination

The other Illinois utilities do not currently have similar programs; thus, evaluation will coordinate with other Illinois utilities on issues common to this program (e.g., sharing findings from the process evaluation questions noted below).

### Evaluation Research Topics

The evaluation will seek to answer the following key researchable questions:

#### Impact Evaluation

1. What are the program’s annual total verified gross savings?
2. What is the research estimate of gross savings (energy, peak demand, and total demand) for the Program?
3. What are the program’s verified net savings?

#### Process Evaluation and Other Research Topics

The process evaluation effort for CY2018 will focus on program delivery. The process research will address the following questions:

1. Are there additional ways to engage the income eligible population in energy efficiency through this program?
2. Based on program manager interviews, implementation contractor interviews, and reviewing program outreach and marketing materials and other program materials, recommend potential program enhancements.

### Evaluation Approach

The table below summarizes the evaluation tasks for CY2018 including data collection methods, data sources, timing, and targeted sample sizes that will be used to answer the evaluation research questions.

**Table 2. Core Data Collection Activities, Sample, and Analysis**

Activity	Target	Target Completes CY2018	Timeline	Notes
Tracking System Review	Tracking system	Census	Three waves	
In Depth Interviews	Program Management and Implementers	2	April – June 2018	
Gross Impact	Tracking System Review	All	April 2017 – Feb Sept 2018	Two Waves*
Verified Net Impact	Calculation using deemed NTG ratio	NA	March 2019	

\* Navigant will coordinate with ComEd to determine appropriate dates to pull tracking data extracts for each wave.

### Gross Impact Evaluation

Since almost all the program's savings are derived based on the Illinois Technical Reference Manual (TRM), the evaluation team will conduct a limited gross impact evaluation. For this impact evaluation, gross savings will be evaluated by (1) reviewing the tracking system to be assured that all fields are appropriately populated and (2) cross-checking totals.

Navigant is not evaluating the LIKE Program via a randomized controlled trial because the program was not designed with randomly assigned treatment and control groups. Navigant is not using quasi-experimental consumption data because the savings are likely not large enough to achieve statistically significant estimates using this method.

### Verified Net Impact Evaluation

The TRM deems NTG at 1.0 for Income Eligible programs.

### Calculation of CPAS and Annual Savings

As required by the Future Energy Jobs Act (FEJA), Navigant will report ex post gross and ex post net savings for the program and the cumulative persisting annual savings (CPAS) in CY2018 will be calculated along with the total CPAS. Additionally, the weighted average measure life will be estimated, if possible. Evaluation will also add the savings converted from gas savings to the electric savings so that it's documented in the report.

### Process Evaluation

Navigant will conduct in-depth telephone interviews with program managers and implementation contractors and review program materials to make recommendations for potential program enhancements for this program or similar future programs.

Navigant will also conduct geographic analysis to analyze the target geography and determine if there are areas that do not currently receive kits but would benefit from being included. =

This process research may be expanded or streamlined based on ComEd's plans for additional programs of this type.

### Evaluation Schedule

Table 3 below provides the schedule for key deliverables and data transfer activities. (See Table 2 for other schedule details.) Adjustments will be made, as needed, as evaluation activities progress.

**Table 3. Schedule – Key Deadlines**

Activity or Deliverable	Responsible Party	Date Delivered
Program Operations Manual and Workpapers	ComEd	March 2, 2018
CY2018 program tracking data for sampling Wave 1	ComEd	June 1, 2018
Early impact findings memo	Evaluation	August 15, 2018
Process Analysis Findings	Evaluation	January 11, 2019
Final CY2018 Program tracking data to Navigant	ComEd	January 30, 2019
Draft Report to ComEd and SAG	Evaluation	March 7, 2019
Comments on draft (15 Business Days)	ComEd and SAG	March 28, 2019
Revised Draft by Navigant	Evaluation	April 5, 2019
Comments on redraft (5 Business Days)	ComEd and SAG	April 12, 2019
Final Report to ComEd and SAG	Evaluation	April 26, 2019

## APPENDIX D. RESIDENTIAL PROGRAMS EVALUATION PLANS

### ComEd Appliance Rebates Program CY2018 to CY2021 Evaluation Plan

#### Introduction

The Appliance Rebates Program is designed to increase the market share of ENERGY STAR® appliances sold through retail (in-store or online) sales channels by providing rebates to decrease customer costs as well as information and education to increase customer awareness and acceptance of energy efficient appliances. The program targets residential customers who purchase new or replacement ENERGY STAR® appliances including air purifiers, electric clothes washers, electric dryers, freezers, refrigerators, window air conditioners, dehumidifiers, bathroom exhaust fans, water coolers, variable speed pool pumps, learning thermostats, and advanced power strips.

The primary objectives of the evaluation of the ComEd Appliance Rebates (AR) Program are to: (1) determine gross and net program savings and (2) examine the effectiveness of program processes in achieving savings.

The CY2018 gross impact evaluation will not vary from the previous years, but adjustments will be made to reflect specific measure and project characterizations. The evaluation will include a participating customer free ridership and spillover study in CY2018. The findings from the study will inform recommended net-to-gross (NTG) values for the Illinois Stakeholder Advisory Group (SAG) approval and future program application. The CY2018 NTG study will include surveys with participating customers to learn about their perspectives and satisfaction with the program, incentive offerings, and how to improve the program in the future.

The evaluation of this program over the coming four years will include a variety of data collection and analysis activities, including those indicated in the following table.

**Table 1. Evaluation Approaches – Four Year Plan**

Tasks	CY2018	CY2019	CY2020	CY2021
Tracking System Review	X	X	X	X
Data Collection – Participant Surveys	X	X	X	X
Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Data Collection – Retailer Interviews	X		X	
Impact – Measure-Level Deemed Savings Review	X	X	X	X
Impact – Verification & Gross Realization Rate	X	X	X	X
Net-to-Gross – Customer Self-Report Surveys	X	X	X	X
Process Analysis	X	X	X	X

The evaluation team determined the evaluation approach for the CY2018-CY2021 period based upon the needs of the program and program’s history. The 4-year evaluation approach for this program is based on the following:

- Annual gross and net impact analysis
- NTG research on free ridership will be conducted on-going and real-time using an online survey which is linked to the online rebate application – a method which is cost effective and which imposes minimally on participants.

- Process analysis will be conducted annually based upon questions included in the online free ridership survey
- Interviews with participating retailers will be conducted every other year to seek opportunities to improve program processes and expand program savings
- CPAS will be calculated based upon the requirements of FEJA

### Coordination

Navigant will coordinate with the evaluation teams for other utilities on any issues relevant to this program, including coordinating with the evaluation team for Ameren on survey instruments for NTG research on participating customer free ridership and spillover. In addition, Navigant will coordinate with the evaluation team for Ameren’s Retail Products program as they begin to offer rebates on appliances in 2020.

### Evaluation Research Topics

The evaluation will seek to answer the following key researchable questions:

#### Impact Evaluation

1. What are the program’s verified gross savings?
2. What are the program’s verified net savings?
3. What is the researched value for net-to-gross (NTG) ratio?
4. What updates are recommended for the Illinois Technical Reference Manual (TRM)?

#### Process Evaluation and Other Research Topics

The process evaluation effort for CY2018 will focus on program delivery. The process research will address the following questions:

1. How did customers become aware of the program?
2. What is the level of participant satisfaction with the program?
3. What is the level of satisfaction with the program amongst participating retailers?
4. What marketing strategies could boost program awareness?
5. What opportunities exist for program improvement?
6. Is there evidence of non-energy impacts associated with this program?

### Evaluation Approach

The tables below summarize the evaluation tasks for CY2018 including data collection methods, data sources, timing, and targeted sample sizes that will be used to answer the evaluation research questions.

We have prepared an evaluation plan summary to identify tasks on a preliminary basis (Table 2). Final activities will be determined annually as program detail and requirements become known.

**Table 2. Evaluation Plan Summary for Appliance Rebate Program**

Activity	CY2018
Gross Impact Approach	Measure-Level Deemed Savings Review
Gross Sampling Frequency	One Interim Review & One Final Review -- Census
Verified Net Impact Approach	Deemed Value
Researched NTG Approach	Participant Survey*: FR real time, SO end of year
Researched NTG Timing	CY2018 Participants
Program Manager and Implementer Interviews - Review Materials	Yes

\*FR refers for Free Ridership and SO refers to Spillover

Table 3 below summarizes the proposed data collection activities for CY2018 including the sample sizes and timing of each activity.

**Table 3. Core Data Collection Activities, Sample, and Analysis**

Activity	Target	Target Completes CY2018	Timeline	Notes
Tracking System Review	Tracking system	Census	One interim and one final	
In Depth Interviews	Program Management and Implementers	2	April – Dec 2018	Augment with monthly calls
In Depth Interviews	Program Retailers	15	January 2018	
Gross Impact	TRM Review	Census	One interim and one final	
Verified Net Impact	Calculation using deemed NTG ratio	NA	March 2019	
Researched NTG and Process--FR	Surveys with Participating Customers	Census	Real time, online	Online program application automatically redirects to online survey
Researched NTG and Process--SO	Surveys with Participating Customers	100	End of year	Telephone

Note: FR = Free Ridership; SO = Spillover

The primary data collection activities for CY2018 will consist of two participant surveys to assess the effectiveness of the program processes and participant free ridership and spillover. Interviews of retailers will inform our process evaluation. We will continue to conduct NTG research on free ridership real time using the program’s online survey in CY2018.

In line with accelerated evaluation schedule for delivering tracking data to the valuation team, Navigant will perform an interim tracking system review in the summer of 2018.

### Gross Impact Evaluation

This analysis will include a review of deemed savings estimates for all measures in the program.

The evaluation team will also calculate gas savings from the program.

### Verified Net Impact Evaluation

The verified net impact evaluation will apply the Net-to-Gross (NTG) ratio accepted by Illinois Stakeholders Advisory Group (SAG) consensus to estimate the verified net savings for the program.

**Table 4. Deemed NTG Values for CY2018**

Program Measure	CY2018 Deemed NTG Value
Clothes Washer	0.58
Refrigerator	0.57
Air Purifier	0.74
Learning Thermostat	NA
Freezers	0.54
Electric Clothes Dryer	0.62
Dehumidifier	0.78
Variable Speed Pool Pump	0.80
Bathroom Exhaust Fan	0.66
Water Cooler	0.83
Window AC	0.63
Advanced Power Strips	0.86

Source:  
[http://ilsagfiles.org/SAG\\_files/NTG/2017\\_NTG\\_Meetings/Final/ComEd\\_NTG\\_History\\_and\\_PY10\\_Recommendations\\_2017-03-01.xlsx](http://ilsagfiles.org/SAG_files/NTG/2017_NTG_Meetings/Final/ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.xlsx)

### Research NTG Impact Evaluation

The evaluation will conduct NTG research in CY2018 to inform NTG recommendations for future use with two surveys: one for free ridership and one for spillover. The free ridership survey will be online and real time throughout the program year in that it will be offered to every participant who submits a program application online (when the participant submits the application, the website automatically links the participant to the survey). This enables us to collect information on free ridership close to the time when the customer made the decision to participate in the program. We will provide quarterly preliminary reports on free ridership.

The spillover survey will be conducted by telephone at the end of CY2018 with CY2018 participants. This allows enough time to have passed for participants to make any improvements that would qualify as spillover. The survey will be conducted with a random sample of participants, targeting 100 completes.

### Calculation of CPAS and Annual Savings

As required by the Future Energy Jobs Act (FEJA), Navigant will report ex post gross and ex post net savings for the program and the cumulative persisting annual savings (CPAS) in CY2018 will be calculated along with the total CPAS. Additionally, the weighted average measure life will be estimated, if possible.

## Process Evaluation

The process evaluation will include a synthesis of both qualitative and quantitative data collected during the program implementer interview, participant online surveys, and retailer interviews.

The process evaluation will (1) determine participant satisfaction with the program overall, and key program elements and (2) assess the effectiveness of various program elements, such as incentive levels, marketing procedures, application processes, and participation procedures, and (3) through a small set of screening questions seek for potential non-energy impacts associated with the program. A battery of process questions will be included in the surveys with participating customers. The process findings will be summarized in detail and a set of key findings and recommendations will be developed for ComEd's consideration.

### *Use of Randomized Controlled Trial and Quasi-experimental Design*

We are not evaluating the Appliance Rebate program via a randomized controlled trial because the program was not designed with randomly assigned treatment and control groups. We are not using quasi-experimental design consumption data because the savings from this appliance rebate program represent a small percentage of the total household's savings and there are not enough participants in this program to achieve statistically significant savings estimates using this method.

## Evaluation Schedule

Table 5 below provides the schedule for key deliverables and data transfer activities. (See Table 3 for other schedule details.) Adjustments will be made, as needed, as evaluation activities progress.

**Table 5. Schedule – Key Deadlines**

Activity or Deliverable	Responsible Party	Date Delivered
Program Operations Manual and Workpapers	ComEd	January 2, 2018
Participating customer NTG-FR and process survey fielding	Evaluation	January 12, 2018
Quarterly FR Analysis Findings	Evaluation	March 30, 2018
CY2018 program tracking data for Wave 1 Data Review and Analysis	ComEd	June 1, 2018
Tracking System Wave 1 Ex Ante Review Findings and Recommendations	Evaluation	July 30, 2018
Quarterly FR Analysis Findings	Evaluation	June 29, 2018
Quarterly FR Analysis Findings	Evaluation	September 28, 2018
Participating customer NTG-SO and process survey fielding	Evaluation	November 1, 2018
EUL Research Memo	Evaluation	December 15, 2018
Quarterly FR Analysis Findings	Evaluation	December 20, 2018
Final TRM review	Evaluation	February 28, 2019
Process Analysis Findings	Evaluation	January 31, 2019
Internal Report Draft by Navigant	Evaluation	February 15, 2019
Draft Report to ComEd and SAG	Evaluation	February 25, 2019
Comments on draft (15 Business Days)	ComEd and SAG	March 18, 2019
Revised Draft by Navigant	Evaluation	March 25, 2019
Comments on redraft (5 Business Days)	ComEd and SAG	April 4, 2019
Final Report to ComEd and SAG	Evaluation	April 16, 2019

**ComEd Elementary Energy Education Program CY2018 to CY2021 Evaluation Plan**

**Introduction**

The Elementary Energy Education (EEE) Program’s primary focus is to produce electricity and natural gas savings in the residential sector by motivating students and their families to take steps through reducing energy consumption for water heating and lighting in their home. The program is offered in service areas for ComEd, Nicor Gas, Peoples Gas, and North Shore Gas.

ComEd’s net planning target is 4,650 MWh for CY2018.

Notable program changes made from PY9 to CY2018 include:

- Offering ComEd-only kits

The primary objectives of the CY2018 evaluation of the EEE Program are to: (1) quantify net and gross electric savings impacts (as well as natural gas savings from ComEd-only kits) from the program and (2) identify enhancements to the program.

The CY2018 gross impact evaluation will not vary significantly from the previous years. In debating PY9 net-to-gross (NTG) potential values for this program, the Illinois Stakeholder Advisory Group (SAG) considered the ComEd NTG results and results from other utilities and reached a consensus on a value of 1.0. We are not currently planning NTG research but will consider conducting NTG research in future years. If Navigant conducts NTG research, the evaluation would include a participating customer free ridership and spillover study. The findings from the study would inform recommended NTG values for the SAG approval and future program application. The NTG study would include participant take-home surveys with participating customers to learn about their perspectives and satisfaction with the program. In addition, Navigant would develop a survey to estimate spillover. Table 1 lists the different surveys associated with this program.

The evaluation of this program over the coming four years will include a variety of data collection and analysis activities, including those indicated in the following table.

**Table 1. Evaluation Approaches – Four Year Plan**

Tasks	CY2018	CY2019	CY2020	CY2021
Tracking System Review	X	X	X	X
Data Collection – Parent, Teacher and Student Surveys (collected by RAP)	X	X	X	X
Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Impact – Measure-Level Deemed Savings Review	X	X	X	X
Impact – Verification & Gross Realization Rate	X	X	X	X
Net-to-Gross – Participant Take-Home Surveys to estimate FR*		TBD	TBD	TBD
Net-to-Gross – Survey to estimate SO*		TBD	TBD	TBD
Process Analysis	X	X	X	X

\*FR= free ridership, SO=spillover

The evaluation team determined the evaluation approach for the 2018-2021 period based upon the needs of the program and program’s prior history. The 4-year evaluation approach for this program is based on the following:

- Annual gross and net impact analysis
- Optimized timing on when to conduct NTG research based on if the EEE program’s design or measures change to warrant conducting additional NTG research
- CPAS will be calculated based upon the requirements of FEJA

**Table 2. Impact and Process Surveys – Four Year Plan**

Survey	Purpose	CY2018	CY2019	CY2020	CY2021
Parent Survey (RAP)	Process	X	X	X	X
Student Survey (RAP)	Impact	X	X	X	X
Teacher Survey (RAP)	Process	X	X	X	X
Participant Take-Home Survey (Navigant)	NTG		TBD	TBD	TBD
Participant Survey to estimate Spillover (Navigant)	NTG		TBD	TBD	TBD

### Coordination

Navigant will coordinate with the evaluation teams from other utilities on any issues relevant to this program, since the EEE Program is jointly offered by ComEd, Nicor Gas, Peoples Gas and North Shore Gas Companies with Resource Action Programs (RAP) as the implementation contractor. In addition, Navigant will coordinate with the evaluation team for Ameren’s Direct Distribution Efficient Products program which has a similar program design to the EEE program.

### Evaluation Research Topics

The evaluation will seek to answer the following key researchable questions:

#### Impact Evaluation

1. What are the program’s verified gross savings?
2. What are the program’s verified net savings?
3. Did the program meet its energy and demand savings targets? If not, why?
4. Are there any updates recommended for the Illinois Technical Reference Manual (TRM)?

#### Process Evaluation and Other Research Topics

Navigant will conduct limited process research for the EEE Program in CY2018 based on program manager and implementation contractor interviews and the analysis of parent and teacher survey responses (collected by RAP).

## Evaluation Approach

Table 3 below identifies tasks by year on a preliminary basis for CY2018 and CY2019. Activities are subject to change based upon the demands of the portfolio and other factors, and during the program year as program circumstances are better known.

For CY2018 and CY2019, the primary method to determine net and gross savings will be a program tracking system review and applying program-level net-to-gross ratio (NTGR) that is deemed through a consensus process by the Illinois Stakeholder Advisory Group (IL SAG).

The table below summarizes the evaluation tasks for CY2018 and CY2019.

**Table 3. Evaluation Plan Summary for First Two Years**

Activity	CY2018	CY2019
Gross Impact Approach	Tracking System Review	Tracking System Review
Verified Net Impact Approach	Deemed Value	Deemed Value
Researched NTG Approach	None	TBD
Program Manager and Implementer Interviews/ Review Materials	Yes	Yes
Participant Take-Home Surveys	None	TBD pending decision whether to conduct NTG research

Note: FR = Free Ridership; SO = Spillover

Table 4 below summarizes the proposed data collection activities for CY2018 including the sample sizes and timing of each activity.

**Table 4. Core Data Collection Activities, Sample, and Analysis**

Activity	Target	Target Completes CY2018	Timeline	Notes
Tracking System Review	Tracking System	Census	Wave 1 and Final	
In Depth Interviews	Program Management and Implementers	4	April – Dec 2018	
Gross Impact Analysis	Tracking System Review	All	April 2018 – Feb 2019	Wave 1 and Final*
Gross Impact Analysis	Student Survey Analysis	All	April 2018 – Feb 2019	Wave 1 and Final*
Process Analysis	Parent and Teacher Survey Responses from RAP	All	January – March 2019	
Verified Net Impact Analysis	Calculation using deemed NTG ratio	NA	March 2019	

Note: FR = Free Ridership; SO = Spillover

\* Navigant will coordinate with ComEd to determine appropriate dates to pull Wave 1 tracking data extract.

In line with program changes and accelerated evaluation schedule for delivering tracking data to the evaluation team, Navigant will perform tracking system review in waves in 2018. The first wave of

measurement and verification (M&V) sampling is expected to cover about a half of the projects and will align with the close of the school year.

### Gross Impact Evaluation

Since all of the EEE Program’s savings are based on the Illinois Technical Resources Manual (IL TRM), the evaluation team will conduct a limited gross impact evaluation in CY2018. The gross impact evaluation’s foundation will be a review of program tracking data that substantiates the type and quantity of measures installed. Navigant will perform independent verification of the program tracking database and determine the level of input completeness, outliers, missing values, and potentially missing variables. If necessary, the Navigant team will include recommendations for additional fields to be added to the tracking system for use in the impact evaluation effort as well as program process monitoring.

Verified gross savings for all the measures included in the kits will be calculated for each participant using appropriate IL TRM algorithms and customer-specific data collected in the tracking system. For custom input variables, the evaluation analysis will be supplemented by additional research, and then summed across participants to calculate program totals. To be eligible, a measure must meet the physical, operational, and baseline characteristics as defined in the applicable version of the IL TRM.

The evaluation team will convert therm savings to kWh savings for water saving measures in the ComEd-only kits.

### Verified Net Impact Evaluation

The verified net impact evaluation will apply the program-level NTGR deemed through a consensus process by the IL SAG to estimate the verified net savings for the EEE program. The NTG value for CY2018 is shown in Table 5.

**Table 5. Deemed NTG Values for CY2018**

Program Measure	CY2018 Deemed NTG Value
EEE Program	1.0

Source:  
[http://ilsagfiles.org/SAG\\_files/NTG/2017\\_NTG\\_Meetings/Final/ComEd\\_NTG\\_History\\_and\\_PY10\\_Recommendations\\_2017-03-01.xlsx](http://ilsagfiles.org/SAG_files/NTG/2017_NTG_Meetings/Final/ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.xlsx)

### Research NTG Impact Evaluation

NTG research was last performed in PY7 and Navigant will consider conducting this research again in CY2019.

The NTG analysis would use the data collected from the participant take-home surveys intended to collect free-ridership and spillover information. Navigant would deliver take-home surveys to randomly selected classrooms in the ComEd service territory and instruct teachers to distribute them to their students. The students would be asked to take these surveys home and have their parents fill them out. Once their parents have completed the surveys, the students will return them to their teacher. Teachers would be incentivized to collect a certain percentage of surveys and once that is accomplished, they will return the surveys to Navigant.

### Calculation of CPAS and Annual Savings

As required by the Future Energy Jobs Act (FEJA), Navigant will report ex post gross and ex post net savings for the program and the cumulative persisting annual savings (CPAS) in CY2018 will be calculated along with the total CPAS. Additionally, the weighted average measure life will be estimated, if possible.

### Process Evaluation

Navigant will conduct limited process research for the EEE Program in CY2018 and CY2019. The research for CY2018 will be based on program manager and implementation contractor interviews and the analysis of parent and teacher survey responses collected by RAP.

Navigant can perform additional process research, upon the request of the program manager, to support the program manager and implementer in transitioning into the revised regulatory requirements starting in CY2018.

### Use of Randomized Controlled Trial and Quasi-experimental Design

We are not evaluating the EEE program via a randomized controlled trial because the program was not designed with randomly assigned treatment and control groups. We are not using quasi-experimental design because the savings from the program measures represents less than ~5% of whole home usage, and the program does not have sufficient participation to achieve statistically significant savings estimates using this method.

### Evaluation Schedule

Table 6 below provides the schedule for key deliverables and data transfer activities. (See Table 4Table for other schedule details.) Adjustments will be made, as needed, as evaluation activities progress.

**Table 6 Schedule – Key Deadlines**

Activity or Deliverable	Responsible Party	Date Delivered
Program Operations Manual and Workpapers	ComEd	February 28, 2018
CY2018 Program Tracking Data for Sampling Wave 1	ComEd	July 1, 2018
Tracking System Ex Ante Review Findings and Recommendations	Evaluation	August 31, 2018
CY2018 Final Program Tracking Data	ComEd	January 30, 2019
Process Analysis Findings	Evaluation	March 1, 2019
Internal Report Draft by Navigant	Evaluation	March 1, 2019
Draft Report to ComEd and SAG	Evaluation	March 5, 2019
Comments on draft (15 Business Days)	ComEd and SAG	March 26, 2019
Revised Draft by Navigant	Evaluation	April 2, 2019
Comments on redraft (5 Business Days)	ComEd and SAG	April 9, 2019
Final Report to ComEd and SAG	Evaluation	April 17, 2019

## ComEd Fridge and Freezer Recycling Program CY2018 to CY2021 Evaluation Plan

### Introduction

The Fridge and Freezer Recycling (FFR) Program offers free pickup and recycling services for older, working refrigerators, freezers and room air conditioners that households no longer want. Program savings are based on the accelerated removal, dismantling and recycling of these older, inefficient units. To encourage participation during CY2018, the program is providing incentives for up to two recycled refrigerators or freezers of \$50/unit during all months of the year. Operational room air conditioner (AC) units are also eligible for pick up and recycling but can only be picked up from sites where the program implementer was already collecting a refrigerator or freezer (so the room AC unit can “ride for free”). Participants contributing these working room AC units receive a \$10 program incentive. Similarly, smaller dorm-sized refrigerators that are ineligible for program rebates can also be picked up at the time the program implementer is already collecting a refrigerator or freezer.

The FFR Program originally began operation in June 2008. During CY2018, the FFR Program is continuing its rebound from the program suspension which occurred in mid-year of PY8. At that time, the program operation was suspended for five months, then resumed operation during the last two months of the year. The program currently forecasts approximately 45,000 units will be collected and recycled in CY2018. The associated CY2018 ex ante net savings target 21,715 MWh.

During CY2018, the full spectrum of traditional impact-related evaluation activities will be completed, including surveys of retailers associated with replacement unit purchases. In addition, the evaluation team may conduct a process evaluation to explore possible enhancements to the program, depending on the outcome of the PY9 process evaluation.

The objectives of the CY2018 evaluation are to quantify net energy and peak demand savings impacts from the program and, from an impact perspective, to assess program strengths and weaknesses and provide recommendations to improve program performance. In addition, the CY2018 evaluation will include data collection to support an in-depth assessment of free ridership associated with recycled units that were reported to be replaced by participants. This assessment includes surveys of participating customers plus repeat surveys of the largest and most active retailers reported to have sold new replacement units to these participants.

The evaluation of this program over the coming four years will include a variety of data collection and analysis activities, including those indicated in the following table. As the following table shows, most evaluation activities will be conducted each year, with the exception of Net-to-Gross Ratio (NTGR) analysis and Process Evaluation, which may be skipped in alternating years if the NTGRs and the Program Design and Delivery Approach are found to be stable from year-to-year. In addition, a new joint metering study will be conducted in CY201. The participating customer surveys include a number of free ridership and spillover questions; findings will be used to update the net-to-gross ratio for the FFR program in CY2019<sup>96</sup>.

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<sup>96</sup> Assuming NTG analysis is not conducted in CY2018.

**Table 1. Evaluation Approaches – Four Year Plan**

Tasks	CY2018	CY2019	CY2020	CY2021
Tracking System Review	X	X	X	X
Data Collection – Participant Surveys	X	X	X	X
Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Data Collection – Retailer Interviews	X	X	X	X
Impact – Metering Study		X		
Impact – Measure-Level Deemed Savings Review	X	X	X	X
Impact – Verification & Gross Realization Rate	X	X	X	X
Net-to-Gross – Customer Self-Report Surveys	X	X	X	X
Net-to-Gross Analysis		TBD	X	TBD
Process Evaluation	TBD	X	TBD	X

The evaluation team determined the evaluation approach for the 2018-2021 period based upon the needs of the program and the program’s prior history. The 4-year evaluation approach for this program is based on the following:

- Annual gross and net impact analysis
- Optimized timing on when to conduct NTG research
- NTG analysis every other year when programs are stable and NTG results are consistent over time
- NTG analysis each year when markets or program designs are changing
- CPAS will be calculated based upon the requirements of FEJA
- Process evaluation will be conducted on an as-needed basis. Given that the program design has been relatively stable for many years, this affords an opportunity to conduct process evaluation every two to three years.

### Coordination

Navigant will coordinate with the other utility evaluation teams on any issues relevant to this program. The approaches used by both the ComEd and Ameren Illinois evaluation teams to evaluate the FFR programs are closely coordinated. The methods used in both evaluations are specified by the Illinois TRM and are generally consistent. The one exception is the approaches being used to compute Net-to-Gross ratios, which differ somewhat. The ComEd team calculates a Retailer-Based NTG ratio as its main method, which is consistent with the Enhanced method in the TRM. The Ameren team, with a more limited budget, calculates a Participating Customer-based NTG ratio as its main method and computes a Retailer-Based NTG ratio as a sensitivity case. The two teams then compare and discuss results at the end of the evaluation process.

## Evaluation Research Topics

The evaluation will seek to answer the following key researchable questions:

### Impact Evaluation

1. What are the program's verified gross savings?
2. What are the program's verified net savings?
3. Did the program meet its energy and demand savings targets? If not, why?
4. Does spillover exist in the program? If so, how much spillover is occurring?
5. Should the program design be modified to reduce free ridership, and if so, how?
6. Are there any updates recommended for the Illinois Technical Reference Manual (TRM)?

### Process Evaluation and Other Research Topics<sup>97</sup>

Navigant will conduct process research for the FFR Program in CY2018, if needed, depending on the outcome of the PY9 Process evaluation. The decision will also be based on changes to the program, as determined from program manager and implementation contractor interview findings. Navigant will consult with ComEd program leads on focused, key process questions to be answered to help improve and inform the program. Process research is planned for alternating years (CY2019, CY2021) and may also be conducted in the remaining years of this plan (CY2018 and CY2020) if justified. During those years when a Process evaluation is done, it will focus on the following researchable questions:

- Has the program, as implemented, changed from the prior year? If so, how, why, and was this an advantageous change?
- What are the strengths and weaknesses of the program? How can the program be improved?
- What are key barriers to participation by ComEd's customers and how can they be addressed by the program? How do customers become aware of the program? What marketing strategies could be used to boost program awareness?
- What is the program satisfaction among participating customers?
- Is the program outreach to customers effective in increasing awareness of the program opportunities?
- Is the program incentive level sufficient to encourage participation?

## Evaluation Approach

We have prepared a CY2018 evaluation plan summary to identify tasks by year on a preliminary basis (Table 2). Final activities will be determined annually as program circumstances are better known.

The CY2018 evaluation will include several impact evaluation activities.

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<sup>97</sup> Process evaluation is TBD depending on if program changes significantly.

**Table 2. CY2018 Evaluation Plan Summary for Fridge Freezer Recycling Program\***

Activity	CY2018
Verified Gross Impact Approach	Bottom-up regression-based estimation. Part-use factor from surveys.
Verified Net Impact Approach	Deemed Value
Researched NTG Approach	Participating Customer + Retailer Surveys
Researched NTG Timing	The timing of the CY2018 Analysis is to be determined depending on if the program changes significantly. If deferred, CY2018 data will be pooled with CY2019 data and analyzed in the CY2019 evaluation.
Program Manager and Implementer Interviews and Review Materials	Yes
Participant Survey	Yes

\*These activities are the same for CY2019, 2020 and 2021.

For the CY2018 evaluation, traditional primary data collection activities will take place. Table summarizes the CY2018 data collection methods, data sources, approximate timing, and targeted sample sizes that will be used to answer the evaluation research questions.

**Table 3. Core Data Collection Activities, Sample and Analysis\***

Activity	Target	Target Completes CY2018	Timeline	Notes
In Depth Interviews	Program Management	2	May 2018	
Telephone and Web Surveys	Participating Customers	300	May – June 2018	Focus on verification and net-to-gross assessment
In-Depth Interviews	Retailers Associated with Appliance Replacements	5 - 7	–July - Dec 2018	Determine used appliance disposal practices by named retailers in the program's absence. (CY2018 activity)

\*These activities are the same for CY2019, 2020 and 2021.

In line with program changes and the accelerated evaluation schedule for delivering tracking data to the evaluation team, Navigant will perform a Wave 1 tracking system review in waves in 2018 as well as reviewing the final tracking data. The Wave 1 of M&V sampling is expected to cover about half of the projects.

Proposed gross impact sampling timelines are shown In Table 5.

### Gross Impact Evaluation

The CY2018 ex-ante and evaluation-verified gross energy savings will be calculated directly using procedures specified in the Illinois Technical Reference Manual (TRM) version 6.0 (CY2018). The program tracking database and TRM v6 provide inputs needed to calculate verified gross savings. In addition to program tracking data, a telephone and web survey of program participants determines: (1) the unit's location (when used) prior to customer decision to participate in the program; and (2) a verification factor. The first term, the unit's prior location, is used directly in the regression based

calculation of unit energy savings. The second term, the verification factor, calculates the percentage of units that were verified as being recycled through the program. A mixed mode approach is being used, to achieve efficiencies in web-based survey data collection, while still obtaining results that mirror the characteristics of the population. Historically, telephone surveys have attracted older respondents, while web surveys attract younger respondents. Therefore, a mixed mode approach (50% web-based and 50% telephone-based) is planned to provide approximately the same balance between these two groups as is present in the program population.

The source of the part-use factor is the PY6 evaluation. Savings estimates will be developed for the full population of units collected in CY2018 to estimate CY2018 Unit Energy Consumption (UECs). The ex-post savings estimates of energy (kWh) savings will rely on regression equations as specified in the TRM v6. Gross energy savings are expressed in terms of full-year UECs. UEC estimates will be made using a regression-based approach that models full-year energy savings as a function of unit characteristics (i.e., age, size, configuration, defrost mode, and unit location prior to being recycled).

Gross peak demand (kW) savings will also be calculated according to the algorithm specified in the TRM v6. The coincidence factors in the TRM v6.0 were calculated using the regression equations to predict consumption on summer peak days. These values are based on the same peak period definitions as used by PJM.

Both energy (kWh) and peak demand (kW) savings estimates will be made based on the characteristics of the population of units collected by the program during CY2018. In addition, gross energy savings estimates will be adjusted for part-use, by applying part-use factors from the PY6 evaluation.

### Verified Net Impact Evaluation

Evaluation verified net savings will be computed by applying the NTG ratio(s) approved by the Stakeholder Advisory Group (SAG) to the estimate of evaluation-verified Gross savings. Separate estimates will be made for each appliance type – refrigerators, freezers, and window AC units, as shown in the following table.

**Table 4. Deemed NTG Values for CY2018**

Program Measure	CY2018 Deemed NTG Value
Refrigerator	0.57
Freezers	0.54
Window AC	0.63

Source:  
[http://ilsagfiles.org/SAG\\_files/NTG/2017\\_NTG\\_Meetings/Final/ComEd\\_NTG\\_History\\_and\\_PY10\\_Recommendations\\_2017-03-01.xlsx](http://ilsagfiles.org/SAG_files/NTG/2017_NTG_Meetings/Final/ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.xlsx)

This program is functioning in a dynamic market where there are an increasing number of disposal options outside of the program. In addition to traditional methods (giving the unit away to a friend or relative, selling the unit to a used appliance dealer, or paying to have the unit taken away and permanently recycled or destroyed), there are other avenues for disposal, such as having an appliance retailer remove the unit after a new one is purchased, or using Craigslist.com or similar local market bulletin board systems to identify a purchaser or taker of the appliance.

In recognition of this, the PY7 evaluation included a set of interviews with the three retailers that participated in the FFR Program, and with two non-participating retailers that sold a high volume of replacement units to FFR Program participants. The purpose of these interviews was to further investigate these participating and non-participating retailers' disposal practices in the absence of the

program. Note that ComEd has eliminated the participating retailer component of the program. However, the need for interviews with retailers associated with unit replacements continues. Therefore, as in previous evaluation cycles, our plan is to use the existing participant survey to guide the analytical approach for the retailer associated units, as well as the non-replaced units picked up by Reclaim at customers' homes. Specifically, for those participating customers surveyed that indicate they would otherwise had their appliance retailer remove the old unit after a new one is acquired, the NTGR is based on the results of the survey of the retailer that they bought the replacement unit from. This survey reflects the retailers' self-reported disposal practices absent the program.

**Program Induced Replacements.** The final NTG ratio also includes a term for program-induced replacements (PIR). This term accounts for the role played by the FFR Program and incentive in inducing a customer to replace their unit after the old unit was removed by the program and recycled. Such inducement could result from the program incentive, the convenience of the home pickup, or some other factor named by the respondent. Savings from participants who indicate that the program caused them to replace their old unit are reduced by the estimated consumption of the replacement unit. We estimate the consumption of the replacement units using the Energy Star Appliance Savings Calculator<sup>98</sup>. The average characteristics of new units captured in the survey are used for inputs into the Appliance Savings Calculator.

If applied equally to all units, the program-induced replacement effect on the NTGR is a **net reduction** of savings for refrigerators and freezers. Equal application of the full PIR value could result in a negative NTGR and negative net savings for retailers with very low NTGRs. In the PY5 evaluation, a decision was made to apply the PIR in a way that it limited individual retailers to not less than zero savings. This same approach was used in PY6 and PY7, and will also be applied in the CY2018 evaluation.

### Research NTG Impact Evaluation

The following data sources will be used:

1. *Telephone and web surveys with participating customers.* As in previous years, we will rely heavily on findings from telephone and web-based surveys of participating customers to determine how their units would have been disposed of if the program had not picked them up. For those that replaced their old units, the survey will include a question to probe on who they bought the new unit from. Also, for those that replaced their unit, new response categories and related consistency checking questions will be included to ensure the responses given to the critical question used to determine free ridership<sup>99</sup> include the disposal options available to them via the retailer they bought it from. The survey will also include an extensive battery of process-related questions.
2. *In-depth interviews with retailers associated with unit replacements.* In addition, we will conduct interviews with a sample of the most active retailers who sold FFR participants a new unit to replace the old one that was picked up by the program. These interviews will focus on their disposal practices absent the program. These findings will be used to determine the disposition of used appliances absent the program for those that purchase a new unit from these non-participating retailers. The names of these retailers will be obtained from the participating customer telephone surveys, wherein participants that replaced their unit will be asked who they bought it from.

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<sup>98</sup> This calculator is available on the U.S. EPA Energy Star website. The URL for the refrigerator calculator is: <http://www.energystar.gov/index.cfm?fuseaction=refrig.calculator>

Data analysis will be conducted following completion of each year's primary data collection via web and telephone surveys. Note that the analysis of NTG data for CY2018 may be deferred to the CY2019 evaluation cycle. The decision to defer will depend on if the CY2018 program changes significantly. If it is deferred, the CY2018 data will be pooled with CY2019 data and analyzed in the CY2019 evaluation. In either case, the free ridership calculation will be completed using the method described below.

**Free Ridership** – The NTG ratio will be computed using an algorithm approach which utilizes a blend of nonparticipating retailer and participating customer survey self-report data. The initial NTG ratio is adjusted for the fraction of units that would have been kept but not used and those that would have been discarded through a method in which the unit was destroyed absent the program.

**Spillover** – Based on our understanding of the program design, we do not see a program theory that supports an expectation of significant spillover. However, we will include questions in the participating customer survey to assess whether spillover has occurred because of their experience with FFR Program participation. Any spillover reported that is associated with a high degree of program influence will be incorporated into the NTGR calculation.

### Calculation of CPAS and Annual Savings

As required by the Future Energy Jobs Act (FEJA), Navigant will report ex post gross and ex post net savings for the program and the cumulative persisting annual savings (CPAS) in CY2018 will be calculated along with the total CPAS. Additionally, the weighted average measure life will be estimated, if possible.

### Process Evaluation

The process evaluation will include a synthesis of both qualitative and quantitative data collected during the program implementer interview, participant online surveys, and retailer interviews.

The process evaluation will (1) determine participant satisfaction with the program overall, and key program elements and (2) assess the effectiveness of various program elements, such as incentive levels, marketing procedures, application processes, and participation procedures. A battery of process questions will be included in the surveys with participating customers. The process findings will be summarized in detail and a set of key findings and recommendations will be developed for ComEd's consideration.

We are not evaluating the program via a randomized controlled trial because the program was not designed with randomly assigned treatment and control groups. We are not using quasi-experimental design because the savings from the program measures represents less than 5% of whole home usage and the program does not have sufficient participation to achieve statistically significant savings estimates using this method.

### Evaluation Schedule

The table below provides the schedule for key deliverables and data transfer activities. (See Table 3 for other schedule details.) Adjustments will be made, as needed, as evaluation activities progress.

**Table 5. Schedule – Key Deadlines**

Activity or Deliverable	Responsible Party	Date Delivered
CY2018 program tracking data request	ComEd	April 7, 2018
CY2018 program tracking data for sampling Wave 1	ComEd	June 1, 2018
Tracking System Ex Ante Review Findings and Recommendations	Evaluation	July 30, 2018
CY2018 program tracking data	ComEd	January 30, 2019
Process Analysis Findings	Evaluation	TBD
Internal Report Draft by Navigant	Evaluation	March 1, 2019
Draft Report to ComEd and SAG	Evaluation	March 7, 2019
Comments on draft (15 Business Days)	ComEd and SAG	March 28, 2019
Revised Draft by Navigant	Evaluation	April 4, 2019
Comments on redraft (5 Business Days)	ComEd and SAG	April 11, 2019
Final Report to ComEd and SAG	Evaluation	April 20, 2019

## ComEd Home Energy Assessment Program CY2018 to CY2021 Evaluation Plan

### Introduction

The Home Energy Assessment Program (HEA) seeks to: (1) secure energy savings through direct installation of low-cost efficiency measures, such as water efficient showerheads and faucet aerators, pipe insulation, programmable thermostats, LEDs and install smart thermostats with co-pays and leave behind advanced power strips at eligible single family residences, and (2) perform a brief assessment of additional energy-efficiency opportunities (e.g., furnace, boiler, air conditioning, insulation, and air sealing) from the respective utility portfolios.

For CY2018, the program is being offered jointly between ComEd, Peoples Gas (PG) and North Shore Gas (NSG) and Nicor Gas. The program is marketed as the Home Energy Assessment Program for ComEd, Home Energy Jumpstart program for Peoples Gas and North Shore Gas, and Home Energy Savings Program for Nicor Gas. Franklin Energy Services LLC (Franklin Energy) is the implementation contractor for all the programs.

The ComEd CY2018 net savings forecast is 20,754 MWh.

Notable program changes made from PY9 to CY2018 include:

- No longer including Tier 2 Advanced Power Strip
- No longer directly installing Tier 1 Advanced Power Strip, only offering leave-behind Tier 1 Advanced Power Strips
- Offering an additional Smart Thermostat (a lower co-pay option)
- Offering additional LEDs (three-way lamp and medium-base flood lamp)

The primary objectives of the evaluation of the Home Energy Assessment (HEA) Program are to: (1) quantify gross and net savings impacts from the program, and (2) as the program continues to evolve, make recommendations to enhance the program focused on the current priorities as determined by the program. Our evaluation report will capture the electric savings for ComEd, and the gas savings will be captured in separate reports for Peoples Gas and North Shore Gas and Nicor Gas. The CY2018 gross impact evaluation will not vary significantly from the previous years, but adjustments will be made to reflect specific measure and project characterizations. Navigant will conduct in-service rate research on Tier 1 advanced power strips that are left behind at a customer's home rather than directly installed by a contractor. Navigant is currently in the process of defining this research, and it may continue into 2019. The evaluation of this program over the coming four years will include a variety of data collection and analysis activities, including those indicated in the following table.

**Table 1. Evaluation Approaches – Four Year Plan**

Tasks	CY2018	CY2019	CY2020	CY2021
Tracking System Review	X	X	X	X
Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Impact – Measure-Level Deemed Savings Review	X	X	X	X
Impact – Verification & Gross Realization Rate	X	X	X	X
Impact – Research on “Leave Behind” Advanced Power Strips	X	X		
Impact – NTG Research			X	X
Process Analysis	X	X	X	X

### Coordination

Navigant will coordinate with the evaluation teams for other utilities on any issues relevant to this program. Specifically, the HEA Program is jointly offered by ComEd, Nicor Gas, Peoples Gas and North Shore Gas Companies with Franklin Energy as the implementation contractor. The evaluation tasks for this program over the next four years are similar for these utilities.

Also, Navigant will submit changes to the TRM for certain parameters (and if warranted) for the measure equation or definition from our current electric billing and may consider follow on research (through survey analysis) in CY2018. Navigant is also developing a scope of work for a billing analysis on smart thermostats in CY2018 for the gas companies. We plan on conducting primary billing data research on the gross impact of smart thermostats to inform future updates to the TRM. If the study goes forward, this research is likely to begin in 2018 Q3 with Navigant developing the detailed scope of work, data requests and related methodology.

### Evaluation Research Topics

The evaluation will seek to answer the following key researchable questions:

#### Impact Evaluation

1. What are the program’s verified gross savings?
2. What are the program’s verified net savings?
3. What updates, if any, are recommended for the Illinois Technical Reference Manual (TRM)?

#### Process Evaluation and Other Research Topics

Navigant will conduct limited process research for the HEA Program in CY2018 based on program manager and implementation contractor interviews. The process research will address the following questions:

1. What are participants’ overall satisfaction levels regarding the program?
2. How can the program be improved?

### Evaluation Approach

The table below summarizes the evaluation tasks for CY2018 including data collection methods, data sources, timing, and targeted sample sizes that will be used to answer the evaluation research questions.

We prepared an evaluation plan summary to identify tasks for CY2018 on a preliminary basis (Table 2Table ). Calendar Year (CY) refers to the year of participation that will be researched, not the time that the research will occur. Activities are subject to change based upon the demands of the portfolio and other factors, and during the program year as program circumstances are better known.

For CY2018, the primary method to determine net and gross savings will be a program tracking system review and applying program-level net-to-gross ratio (NTGR) that is deemed through a consensus process by the Illinois Stakeholder Advisory Group (IL SAG).

**Table 2.: Evaluation Plan Summary**

Activity	CY2018
Gross Impact Approach	Tracking System Review
Verified Net Impact Approach	Deemed Value
Program Manager and Implementer Interviews/ Review Materials	Yes

Table 3 below summarizes the proposed data collection activities for CY2018 including the sample sizes and timing of each activity.

**Table 3. Core Data Collection Activities, Sample, and Analysis**

Activity	Target	Target Completes CY2018	Timeline	Notes
Tracking System Review	Tracking system	Census	Wave 1 and Final data*	
In Depth Interviews	Program Management and Implementers	2	April – Dec 2018	
Gross Impact	Tracking System Review	All	April 2018 – Feb 2019	Wave 1 and Final data*
Verified Net Impact	Calculation using deemed NTG ratio	NA	March 2019	
Research on Leave-Behind APS	Literature review, secondary research, primary research	Census	December 2017 –2019	Process, Impact

Note: APS = Advanced Power Strips

\* Navigant will coordinate with ComEd to determine appropriate dates to pull tracking data extract for Wave 1 data.

In line with program changes and accelerated evaluation schedule for delivering tracking data to the evaluation team, Navigant will perform tracking system review in waves in 2018. Wave 1 of M&V sampling is expected to cover about half of the projects.

Proposed gross impact sampling timelines are shown below.

### Gross Impact Evaluation

The program key gross impact evaluation activities for CY2018 will be based on (1) reviewing the tracking system to determine whether all fields are appropriately populated, (2) reviewing measure algorithms and savings values in the tracking system to assure that the TRM are appropriately applied, and (3) cross-checking measure totals and savings recorded in the tracking database.

### Verified Net Impact Evaluation

The verified net impact evaluation will apply the NTGR accepted by Illinois Stakeholders Advisory Group (SAG) consensus to estimate the verified net savings for the program. Those NTG values are shown in the following table.

**Table 4. Deemed NTG Values for CY2018**

Measure	CY2018 Deemed NTG Value
Lighting	0.80
Bath Aerators	0.80
Kitchen Aerators	0.80
Showerheads	0.80
Programmable Thermostats	0.90
Pipe Wrap	0.80
Advanced Power Strips	0.95
Co-Pay Smart Thermostats	NA

Source:  
[http://ilsagfiles.org/SAG\\_files/NTG/2017\\_NTG\\_Meetings/Final/ComEd\\_NTG\\_History\\_and\\_PY10\\_Recommendations\\_2017-03-01.xlsx](http://ilsagfiles.org/SAG_files/NTG/2017_NTG_Meetings/Final/ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.xlsx)

### Research NTG Impact Evaluation

Evaluation will conduct NTG research in CY2020 and CY2021.

### Calculation of CPAS and Annual Savings

As required by the Future Energy Jobs Act (FEJA), Navigant will report ex post gross and ex post net savings for the program and the cumulative persisting annual savings (CPAS) in CY2018 will be calculated along with the total CPAS. Additionally, the weighted average measure life will be estimated, if possible. The evaluation will also add the savings converted from gas savings to the electric savings so that it's documented in the report.

### Process Evaluation

Navigant will conduct limited process research for the HEA Program in CY2018 and CY2019 and will determine the level of effort for future years at a later time. The research for CY2018 will be based on program manager and implementation contractor interviews. Navigant will incorporate screening questions for evidence of non-energy impacts into participant surveys conducted in CY2019, 2020 or CY2021. If we find evidence of non-energy impacts, we may conduct primary research to quantify them.

Navigant can perform additional process research, upon the request of the program manager, to support the program manager and implementer in transitioning into the revised regulatory requirements starting in CY2018.

### *Use of Randomized Controlled Trial and Quasi-experimental Design*

We are not evaluating the Weatherization Rebates program via a randomized controlled trial because the program was not designed with randomly assigned treatment and control groups. We are not using quasi-experimental design because the savings from the program measures represents less than 5% of whole home usage, and the program does not have sufficient participation to achieve statistically significant savings estimates using this method.

## Evaluation Schedule

Table 5 below provides the schedule for key deliverables and data transfer activities. Adjustments will be made, as needed, as evaluation activities progress.

**Table 5. Schedule – Key Deadlines**

Activity or Deliverable	Responsible Party	Date Delivered
Program Operations Manual and Workpapers	ComEd	January 2, 2018
CY2018 program tracking data for sampling Wave 1	ComEd	June 1, 2018
Tracking System Wave 1 Ex Ante Review Findings and Recommendations	Evaluation	July 30, 2018
CY2018 Final Program tracking data	ComEd	January 30, 2019
Internal Report Draft by Navigant	Evaluation	March 1, 2019
Draft Report to ComEd and SAG	Evaluation	March 7, 2019
Comments on draft (15 Business Days)	ComEd and SAG	March 28, 2019
Revised Draft by Navigant	Evaluation	April 4, 2019
Comments on redraft (5 Business Days)	ComEd and SAG	April 11, 2019
Final Report to ComEd and SAG	Evaluation	April 20, 2019
Process Analysis Findings	Evaluation	May 15, 2019

## ComEd Home Energy Report (Opower) Program CY2018 to CY2021 Evaluation Plan

### Introduction

The Home Energy Report (HER) Program is a behavioral-based energy efficiency program implemented by Opower.

In Calendar Year 2018 (CY2018)<sup>100</sup>, ComEd's HER Program consists of the following twelve waves:

- Wave 1: 50,000 customers started the pilot program in the summer of 2009
- Wave 2: 5,000 customers started in the fall of 2010 to fill in for inactive accounts
- Wave 3: 200,000 customers added in the spring of 2011
- Wave 4: 20,000 customers started in the winter of 2011-12 to fill in for inactive accounts
- Wave 5: 20,000 customers added in the summer of 2012<sup>101</sup>
- Wave 6: 100,000 customers added in the summer of 2013
- Wave 7 Low: 630,000 low usage customers added in the summer of 2014
- Wave 7 High: 630,000 high usage customers added in the summer of 2014
- Wave 8: 75,000 customers added in the summer of 2015
- Wave 9: 350,000 customers added September 2016
- Wave 10: 162,000 customers added June 2017
- New Mover Wave: this wave was launched in September 2014 and consists of customers who just moved into their home. New customers stopped being added to this wave in the fall of 2016.

ComEd intends to add one or two refill waves in each year through CY2021. Any new waves added in 2018 will be included in the CY2018 analysis.

Waves 1, 3, and 5 are part of a persistence study to determine the degree to which savings persist after report termination. Waves 1 and 3 each have 10,000 randomly-chosen customers who stopped receiving reports in October 2012 and began receiving them again in August 2013; these customers are referred to as "lapsed report" (LR) customers. Waves 1, 3, and 5 each have 10,000 randomly-chosen customers who stopped receiving reports in October 2013 and did not receive reports through the duration of PY9; these customers are referred to as "terminated report" (TR) customers.

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<sup>100</sup> CY2018 spans January 1, 2018 to December 31, 2018.

<sup>101</sup> In previous evaluations, Wave 5 has been split into AMI and Non-AMI portions. Wave 5 AMI was discontinued in August 2014, when all 60,000 customers stopped receiving reports, and will not be included in future evaluations. Therefore, going forward 'Wave 5' will reference the Non-AMI portion of the wave.

The HER Program also includes a High Usage Alert (HUA) component. HUAs notify customers when their usage is at least 30% higher than during the same billing period of the previous year. Customers for whom ComEd can model rates can also assign a dollar amount threshold that triggers an HUA. With this feature, customers receive an HUA when their projected bill trends above this threshold. Energy savings from HUAs will be included in the overall HER impact analysis.

The primary objective of the evaluation is to estimate energy savings generated by regularly mailing customers reports that provide information about energy use and conservation.

The evaluation of this program over the coming four years will include a variety of data collection and analysis activities, including those indicated in the following table.

**Table 1. Evaluation Approaches – Four Year Plan**

Tasks	CY2018	CY2019	CY2020	CY2021
Tracking System Review	X	X	X	X
Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Impact – Regression Analysis	X	X	X	X

Over the 2018-2021, evaluation expects:

- To conduct the same type of analysis for each of the four years in this evaluation cycle as we have in the past.
- We will conduct impact evaluation to estimate net savings each year.
- Net-to-gross research is not needed for this program as the results are inherently net due to the randomized controlled trial (RCT) design of the program.
- We do not expect to conduct process surveys as the savings from the program have been stable over time and there is no need to survey customers.

### Coordination

Navigant will coordinate with the evaluation teams for other utilities on any issues relevant to this program. Navigant has regular discussions with the lead evaluators for Ameren and People Gas and North Shore Gas to ensure consistency in our annual evaluations. As needed, we will continue to coordinate research for this program across the utilities, as we did for the weather normalization study.

### Evaluation Research Topics

The evaluation will seek to answer the following questions:

#### Impact Evaluation

1. How much energy do customers in the program save during CY2018?
  - a. What is the apparent long-run trend in program savings?
  - b. Are CY2018 energy savings flat, increasing, or falling compared to prior program years?
2. What is the uplift in other ComEd EE programs due to the reports?

## Evaluation Approach

The table below summarizes the evaluation tasks for CY2018 that will be used to answer the evaluation research questions. Final activities will be determined annually as program detail and requirements become known.

**Table 2. Evaluation Plan Summary**

Activity	CY2018
Gross, Net Impact Approach	Regression analysis
NTG Approach*	Uplift analysis
Program Manager and Implementer Interviews/ Review Materials	Yes

*\*The billing analysis produces impacts which are intrinsically net savings, aside from uplift.*

### Gross Impact Evaluation

For all waves, Navigant will measure CY2018 program impacts through billing analysis using a lagged dependent variable (LDV)<sup>102</sup> model. The model will differ slightly from the PY8 evaluation to adjust the results to be weather normalized.<sup>103</sup> Navigant will use a weather normalization method that includes cooling degree day and heating degree day interaction terms in the LDV regression model. This method is described in detail in the 2017 HER weather normalization study.<sup>104</sup> Billing analysis implicitly estimates net impacts so no net-to-gross adjustment is necessary.

The New Mover Wave evaluation will be slightly different from the other waves because this wave does not have full year pre-program customer data. The New Mover Wave is created by randomly assigning customers who just moved into their home in ComEd’s service territory to participant (80% of customers) or non-participant (20% of customers) groups. Customers are placed into one of these two groups one month after they move into their home, meaning only one month of consumption data is available from before they were placed in the program. For this wave, pre-period data will come from the home’s previous occupant, as identified by the service point id, for one year before the new occupant was placed in the HER Program. Therefore, the twelve months of pre-program data will consist of eleven months of consumption data from the previous occupant and one month from the current occupant. Using data from the previous occupant as the pre-program data will act as a stand-in for the effects of fixed household characteristics on energy usage. Using this pre-program data, Navigant will run the same LDV model as for the other waves.

Enrollment uplift in other energy efficiency programs due to the HER Program will be estimated the same way as in previous evaluation. Uplift savings will be netted out of HER results to avoid double counting. Navigant will consider both uplift that occurs in CY2018 and legacy uplift from PY4 to PY9.

### Verified Net Impact Evaluation

A key feature of the RCT design of the HER Program is that the analysis inherently estimates net savings because there are no participants who would have received the individualized reports in the absence of

<sup>102</sup> The model is identical to the post-program regression (PPR) model used in previous evaluations. We have changed the nomenclature to better align with academic research and because LDV is more descriptive of the model structure than PPR.

<sup>103</sup> Navigant Consulting, Inc. 2016. *ComEd Home Energy Report Program PY8 Evaluation Report*. Presented to Commonwealth Edison Company.

<sup>104</sup> Navigant Consulting, Inc. 2017. *Home Energy Report Weather Normalization Study*. Presented to Commonwealth Edison Company.

the program. While some customers receiving reports may have taken energy-conserving actions or purchased high-efficiency equipment anyway, the random selection of program participants (as opposed to voluntary participation) implies that the control group of customers not receiving reports would be expected to exhibit the same degree of energy-conserving behavior and purchases. Therefore, this method estimates net savings and no further NTG adjustment is necessary.

### Calculation of CPAS and Annual Savings

As required by the Future Energy Jobs Act (FEJA), Navigant will report ex post gross and ex post net savings for the program and the cumulative persisting annual savings (CPAS) for CY2018 will be calculated. Converted gas savings will not be calculated for this program.

### Process Evaluation

The process evaluation for this program will be limited to interviews with the program manager and implementation contractor.

### TRM Research

Regarding measure 6.1.1 in the IL-TRM,<sup>105</sup> Navigant will update the decay rate and persistence study done in PY9<sup>106</sup> with a fourth year of data. We will calculate annual decay rates for the fourth year after reports were discontinued (October 2016 – September 2017) for the terminated report groups in Waves 1, 3, and 5. The decay rate will be equal to one minus the ratio of the percentage savings in the second year after the reports were discontinued to percentage savings in the last year before the reports were discontinued.

### Data Requirements

Table 3 shows the data Navigant will need for the CY2018 evaluation.

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<sup>105</sup> Measure 6.1.1 is “Adjustments to Behavior Savings to Account for Persistence” in Illinois Statewide Technical Reference Manual, Version 5.0, Volume 4.

<sup>106</sup> Navigant Consulting, Inc. 2017. *ComEd Home Energy Report Program Decay Rate and Persistence Study – Year Three*. Presented to Commonwealth Edison Company.

**Table 3. Core Data Collection Activities and Sample**

Required Data	Relevant Information Requested	
	For all HER participants (treatment and control):	
Customer Usage and Tracking Data	<ul style="list-style-type: none"> <li>• Account ID</li> <li>• Treatment indicator</li> <li>• Terminated report customer indicator</li> <li>• Program start date</li> <li>• Opt out date (if applicable)</li> <li>• Meter type</li> <li>• Usage value</li> <li>• Estimate indicator</li> </ul>	<ul style="list-style-type: none"> <li>• Wave identifier</li> <li>• Lapsed report customer indicator</li> <li>• Flag for customers to exclude</li> <li>• Move out date (if applicable)</li> <li>• Bill end date</li> <li>• Usage units</li> <li>• Bill duration in days</li> <li>• Zip code</li> </ul>

## Evaluation Schedule

Table 4 below provides the schedule for key deliverables and data transfer activities for the CY2018 evaluation. Table 5 shows the same for TRM research. Adjustments will be made, as needed, as evaluation activities progress.

**Table 4. CY2018 Evaluation Schedule – Key Deadlines**

Activity/Deliverables	Responsible Party	Date Delivered
Interviews with program manager and IC	Evaluation	Jun 29, 2018
Mid-year data request	Evaluation	Jul 6, 2018
Mid-year data delivery	ComEd	Jul 27, 2018
Early data characterization memo	Evaluation	Aug 17, 2018
Final data request	Evaluation	Dec 3, 2018
Final data delivery <sup>107</sup>	ComEd	Jan 30, 2019
Draft report to ComEd and SAG	Evaluation	Mar 12, 2019
Comments on draft (15 Business Days)	ComEd	Apr 2, 2019
Revised draft by Navigant to ComEd and SAG	Evaluation	Apr 11, 2019
Comments on redraft (5 Business Days)	ComEd/SAG	Apr 19, 2019
Final report to ComEd and SAG	Evaluation	Apr 28, 2019

<sup>107</sup> This data will include all bills ending on or before December 31, 2018.

**Table 5. TRM Research Schedule – Key Deadlines**

Activity/Deliverables	Responsible Party	Date Delivered
Data request	Evaluation	May 14, 2018
Deliver Data	ComEd	June 18, 2018
Draft Decay Rate and Persistence Study and draft workpaper to ComEd	Evaluation	Jul 23, 2018
Comments on drafts (15 Business Days)	ComEd	Aug 20, 2018
Submit workpaper to the TAC	Evaluation	Aug 27, 2018

## ComEd HVAC Rebates Program CY2018 to CY2021 Evaluation Plan

### Introduction

The HVAC Rebates Program offers incentives for the installation of qualifying, high efficiency equipment such as central air conditioning systems (CACs), heat pumps, furnace blower motors (ECMs), water heaters, and smart thermostats. The program is implemented as a “closed network” trade ally program, meaning that only installations completed by a contractor in the ComEd Residential Trade Ally Network qualify for a rebate. ComEd Residential Trade Allies must be ICC Energy Efficiency Installer certified and meet the eligibility requirements.

Notable program changes made from PY9 to CY2018 include:

- Dividing the Heating, Cooling, and Weatherization Rebates Program of PY9 into two programs for CY2018-21: Weatherization Rebates Program and HVAC Rebates Program.
- Requiring smart thermostats to be ENERGY STAR certified to qualify for rebates
- Establishing a new energy efficiency rebate tier for CACs and air-source heat pumps at 18 SEER (to align with the ENERGY STAR Most Efficient category)

The primary objectives of the evaluation of the HVAC Rebates Program are to: (1) determine gross and net program savings and (2) examine the effectiveness of program processes in achieving savings.

The CY2018 gross impact evaluation will not vary significantly from the previous years, but adjustments will be made to reflect specific measure and project characterizations. The evaluation will include a participating customer free ridership and spillover study in CY2018. The findings from the study will inform recommended net-to-gross (NTG) values for the Illinois Stakeholder Advisory Group (SAG) approval and future program application. The CY2018 NTG study will include surveys with participating customers to learn about their perspectives and satisfaction with the program, incentive offerings, screening questions regarding potential non-energy impacts, and how to improve the program in the future.

The evaluation of this program over the coming four years will include a variety of data collection and analysis activities, including those indicated in the following table.

**Table 1. Evaluation Approaches – Four Year Plan**

Tasks	CY2018	CY2019	CY2020	CY2021
Tracking System Review	X	X	X	X
Data Collection – Participant Surveys	X	X	X	X
Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Data Collection – Trade Ally Interviews	X		X	
Impact – Measure-Level Deemed Savings Review	X	X	X	X
Impact – Verification & Gross Realization Rate	X	X	X	X
Net-to-Gross – Customer Self-Report Surveys	X	X	X	X
Net-to-Gross – Trade Ally Interviews	X		X	
Process Analysis	X	X	X	X

The evaluation team determined the evaluation approach for the CY2018-CY2021 period based upon the needs of the program and program’s history. The 4 year evaluation approach for this program is based on the following:

- Annual gross and net impact analysis
- NTG research on free ridership will be conducted on-going and real-time using an online survey whose link is sent to a random sample of participants monthly
- Process analysis will be conducted periodically based upon questions included in the online free ridership survey
- Interviews with participating trade allies will be conducted every other year to seek opportunities to improve program processes and expand program savings

**Coordination**

Navigant will coordinate with the evaluation teams for other utilities on any issues relevant to this program. This will include coordinating with evaluation teams for Ameren and the gas utilities on survey instruments for NTG research on participating customer free ridership and spillover as well as on survey instruments, samples, and administration for NTG and process research on participating trade allies.

**Evaluation Research Topics**

The evaluation will seek to answer the following key researchable questions:

**Impact Evaluation**

1. What are the program’s verified gross savings?
2. What are the program’s verified net savings?
3. What is the researched value for net-to-gross (NTG) ratio?
4. What updates are recommended for the Illinois Technical Reference Manual (TRM)?

**Process Evaluation and Other Research Topics**

The process evaluation effort for CY2018 will focus on program delivery. The process research will address the following questions:

1. How did customers become aware of the program?

2. What is the level of participant satisfaction with the program?
3. What is the level of satisfaction with the program amongst participating trade allies?
4. What marketing strategies could boost program awareness?
5. What opportunities exist for program improvement?

## Evaluation Approach

The table below summarizes the evaluation tasks for CY2018 including data collection methods, data sources, timing, and targeted sample sizes that will be used to answer the evaluation research questions.

Evaluation activities will include phone-based participant surveys intended to estimate spillover and to collect information to inform a process evaluation. The evaluation will also include participant and trade ally online surveys intended to inform a process evaluation and collect NTG information, including free ridership and spillover analysis questions.

We have prepared an evaluation plan summary to identify tasks on a preliminary basis (Table 2). Final activities will be determined annually as program detail and requirements become known.

**Table 2. Evaluation Plan Summary for HVAC Rebates Program**

Activity	CY2018
Gross Impact Approach	Measure-Level Deemed Savings Review
Gross Sampling Frequency	One Interim Review & One Final Review -- Census
Verified Net Impact Approach	Deemed Value
Researched NTG Approach	Participant Survey*: FR real time, SO end of year Trade Ally Survey†: FR and NPSO end of year
Researched NTG Timing	CY2018 Participating customers and trade allies
Program Manager and Implementer Interviews/ Review Materials	Yes

\* FR refers to free Ridership; SO refers to spillover

† NPSO refers to nonparticipant spillover

Table 3 below summarizes the proposed data collection activities for CY2018 including the sample sizes and timing of each activity.

**Table 3. Core Data Collection Activities, Sample, and Analysis**

Activity	Target	Target Completes CY2018	Timeline	Notes
Tracking System Review	Tracking system	Census	One interim and one final	
In Depth Interviews	Program Management and Implementers	2	April – Dec 2018	Augment with monthly calls
Gross Impact	TRM Review	Census	One interim and one final	
Verified Net Impact	Calculation using deemed NTG ratio	NA	March 2019	
Researched Free Ridership and Process	Surveys with Participating Customers	70 monthly	Real time	
Researched Spillover	Surveys with Participating Customers	~100†	End of year	
Researched NTG and Process	Surveys with Participating Trade Allies	75	End of year	

Note: FR = Free Ridership; SO = Spillover

Navigant will coordinate with ComEd to determine appropriate dates to pull tracking data extracts for each wave.

† Navigant will call a sample of 1,000 participants with a screening survey to determine if they have taken additional energy efficiency actions. We target completing 100 full surveys with those who took action.

The primary data collection activities for CY2018 will consist of surveys with participating customers and trade allies to assess the effectiveness of the program processes as well as free ridership and spillover. We will conduct NTG research on free ridership in real time with an online survey of participants. The link to the online surveys will be delivered to all participants via email. Free ridership surveys will be done real-time and sent to participants soon after they submit the application.

Research on participant spillover will be conducted with a random sample of participating customers through a telephone survey at the end of the year. Research on nonparticipant spillover will be conducted with participating trade allies through an online survey (also at the end of the year).

Navigant will perform an interim tracking system review in the summer of 2018 in line with program changes and an accelerated evaluation schedule for delivering tracking data to the evaluation team.

### Gross Impact Evaluation

The gross impact analysis will include a review of deemed savings estimates for all measures in the program. All program measures will be reviewed for compliance with the Illinois TRM. Navigant will document how the deemed measures differ from ComEd’s existing planning or ex ante tracking estimates and provide guidance as to how these differences will impact ComEd’s programs. For new measures, Navigant will perform a desk review of program calculations and compare savings to the Illinois TRM.

The evaluation team will calculate gas savings achieved by the program and convert it to electric savings.

### Verified Net Impact Evaluation

The verified net impact evaluation will apply the net-to-gross (NTG) ratio accepted by Illinois Stakeholders Advisory Group (SAG) consensus to estimate the verified net savings for the program.

**Table 4. Deemed NTG Values for CY2018**

Program Measure	CY2018 Deemed NTG Value
Central AC	0.69
Smart Thermostat	NA
Air Source Heat Pump	0.57
Ductless Mini-Split	0.68
ECM Furnace Motor – with Furnace Upgrade	0.68
ECM Furnace Motor – without Furnace Upgrade	0.80
Geothermal Heat Pump	0.59
Heat Pump Water Heater	0.76

Source:  
[http://ilsagfiles.org/SAG\\_files/NTG/2017\\_NTG\\_Meetings/Final/ComEd\\_NTG\\_History\\_and\\_PY10\\_Recommendations\\_2017-03-01.xlsx](http://ilsagfiles.org/SAG_files/NTG/2017_NTG_Meetings/Final/ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.xlsx)

### Research NTG Impact Evaluation

The evaluation will conduct NTG research in CY2018 on free ridership, spillover, and nonparticipant spillover to inform NTG recommendations for future use. For free ridership, the NTG analysis will use data collected from participant online surveys conducted throughout the year. For participant spillover and nonparticipant spillover, the NTG analysis will use data collected from participant telephone surveys and participating trade ally online surveys, respectively, near the end of the year.

### Calculation of CPAS and Annual Savings

As required by the Future Energy Jobs Act (FEJA), Navigant will report ex post gross and ex post net savings for the program and the cumulative persisting annual savings (CPAS) in CY2018 will be calculated along with the total CPAS. Additionally, the weighted average measure life will be estimated, if possible.

### Process Evaluation

The process evaluation research will include a synthesis of both qualitative and quantitative data collected from the program staff and implementer interviews and from the participating customer and trade ally surveys in CY2018.

The process evaluation will (1) determine participant satisfaction with the program overall and key program elements and (2) assess the effectiveness of various program elements, such as incentive levels, marketing procedures, application processes, and participation procedures. A battery of process questions will be included in the surveys with participating customers. The process findings will be summarized in detail and a set of key findings and recommendations will be developed for ComEd's consideration.

### Use of Randomized Controlled Trial and Quasi-experimental Design

We are not evaluating the HVAC Rebates program via a randomized controlled trial because the program was not designed with randomly assigned treatment and control groups. We are not using quasi-

experimental design consumption data because this program contains many unique measures with significant cross-participation. In this case, quasi-experimental consumption data analysis would produce savings estimates for bundles of commonly-installed measures, rather than for each measure individually, which is not the desired output for analysis.

## Evaluation Schedule

Table 5 below provides the schedule for key deliverables and data transfer activities. (See Table 3 for other schedule details.) Adjustments will be made as needed while evaluation activities progress.

**Table 5. Schedule – Key Deadlines**

Activity or Deliverable	Responsible Party	Date Delivered
Program Operations Manual and Workpapers	ComEd	January 2, 2018
Participating customer NTG-FR and process survey fielding	Evaluation	January 26, 2018
Quarterly FR Analysis Findings	Evaluation	March 30, 2018
CY2018 Wave 1 program tracking data for Interim Review	ComEd	June 1, 2018
Quarterly FR Analysis Findings	Evaluation	June 29, 2018
Tracking System Wave 1 Ex Ante Review Findings and Recommendations	Evaluation	July 30, 2018
Quarterly FR Analysis Findings	Evaluation	September 28, 2018
Participating customer and trade ally NTG-SO and process survey fielding	Evaluation	November 1, 2018
EUL Research Memo	Evaluation	December 15, 2018
Quarterly FR Analysis Findings	Evaluation	December 20, 2018
Final TRM review	Evaluation	February 28, 2019
Process Analysis Findings	Evaluation	January 31, 2019
NTG Analysis Findings	Evaluation	January 31, 2019
Internal Report Draft by Navigant	Evaluation	February 15, 2019
Draft Report to ComEd and SAG	Evaluation	February 25, 2019
Comments on draft (15 Business Days)	ComEd and SAG	March 19, 2019
Revised Draft by Navigant	Evaluation	March 26, 2019
Comments on redraft (5 Business Days)	ComEd and SAG	April 2, 2019
Final Report to ComEd and SAG	Evaluation	April 11, 2019

**ComEd Lighting Discounts Program CY2018 to CY2021 Evaluation Plan**

**Introduction**

The ComEd Residential Lighting Discounts (Lighting Discounts) Program provides incentives to increase the market share of qualified LED bulbs and fixtures sold through retail sales channels. The Lighting Discounts Program also provides educational materials aimed at increasing customer awareness and acceptance of energy-efficient lighting technologies and promoting proper bulb disposal. In CY2018, savings from the program will be included within ComEd’s Residential Energy Efficiency portfolio.

The primary objectives of the evaluation of the Lighting Discounts Program are to: (1) quantify net savings impacts from the program, (2) identify ways the program can be improved, and (3) ascertain the impact of the significant market shift to LEDs has had on ComEd residential customers lighting purchasing decisions.

The evaluation of this program over the coming four years will include a variety of data collection and analysis activities, including those indicated in the following table. As the table below shows, most of the evaluation activities planned will occur in each program evaluation cycle. The exception to this is for the shelf surveys and trade ally interviews, which will only be conducted every other year (and were recently conducted as part of the PY9 evaluation).

**Table 1. Evaluation Approaches Over Time**

Tasks	CY2018	CY2019	CY2020	CY2021
Tracking System Review	X	X	X	X
Data Collection – In-store Intercept Participant Surveys	X	X	X	X
Data Collection – In-store Shelf Surveys		X		X
Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Data Collection – Trade Ally Interviews	X	X		X
Impact – Measure-Level Deemed Savings Review	X	X	X	X
Impact – Verification & Gross Realization Rate	X	X	X	X
Net-to-Gross – Customer Self-Report Surveys	X	X	X	X
Process Analysis	X	X	X	X

The evaluation team determined the evaluation approach for the 2018-2021 period based upon the needs of the program and program’s prior history. The 4-year evaluation approach for this program is based on the following:

- Annual gross and net impact analysis
- Optimized timing on when to conduct NTG research
- NTG analysis each year as the lighting market is still changing rapidly
- CPAS will be calculated based upon the requirements of FEJA

- Process evaluation questions will be embedded within the annual in-store intercept surveys conducted within the aisles of lighting retailers with program participants

### Coordination

Navigant will coordinate with the evaluation teams for other utilities on any issues relevant to this program. Specifically, the intercept survey instrument used in CY2018 will be like the instrument used in previous ComEd evaluations, as well as the evaluation of the Ameren Illinois lighting program.

In CY2018 the ComEd and Ameren residential lighting program evaluations will continue to be closely aligned with respect to data collection activities and analysis methods. The in-store intercept data collection instrument, which is the primary source of participant data used to estimate the gross and net savings parameters, and the NTG methods are closely coordinated and follow the algorithms outlined in the NTG framework document for residential lighting.

## Evaluation Research Topics

The evaluation will seek to answer the following key researchable questions:

### Impact Evaluation

1. What is the level of gross annual energy (kWh) and peak demand (kW) savings induced by the program?
2. Did the program meet its energy and demand savings goals? If not, why not?
3. What are the net impacts from the program? What is the level of free ridership associated with this program? What is the level of participant and nonparticipant spillover from the program? What is the researched value for net-to-gross (NTG) ratio?
4. What updates are recommended for the Illinois Technical Reference Manual (TRM)?

### Process Evaluation and Other Research Topics

The process evaluation effort for CY2018 will focus on program delivery. The process research will address the following items:

1. How aware are customers of the ComEd-sourced LED bulb discounts? How effective are the in-store displays and marketing materials?
2. How have customers' lighting purchasing decisions been affected by the changes in the options available for purchase?
3. Assessment of changes to the program in the face of rapid market changes and upcoming standard changes. Determinization of what areas (bulb types or market segments) are still in need of ComEd incentives to encourage efficient light bulb purchase.
4. What are the key barriers to LED purchases and how can they be addressed by the program?
5. What is the current level of LED availability and pricing in ComEd territory for common retail channels? How does this compare to similar regions (with or without lighting programs) and how is this changing over time?
6. What are ComEd customers' preferences, acceptance, and use of various efficient lighting technologies, and what are the primary factors influencing them?
7. How has the market responded to the introduction of the Energy Star 2.0 LED lamps?

## Evaluation Approach

The table below summarizes the evaluation tasks for CY2018 including data collection methods, data sources, timing, and targeted sample sizes that will be used to answer the evaluation research questions.

**Table 2. Core Data Collection Activities, Sample, and Analysis**

Activity	Target	Target Completes CY2018	Timeline
Upstream Tracking Data	All Program Sales	NA	Wave 1 and Final Data*
In-Store Intercept Surveys	Retail Lighting Purchasers	800	Sept - Oct 2018
In-Depth Interviews	Program Management	2	Ongoing
Trade Ally Interviews	Lighting Retailers and Manufacturers	10	Spring 2018
Gross Impact Assessment	Tracking system verification	NA	Jan – Mar 2019
Verified Net Impacts	Calculation using deemed NTG ratio	NA	Jan – Mar 2019

Note: FR = Free Ridership; SO = Spillover

\* Navigant will coordinate with ComEd to determine appropriate date to pull tracking data extracts for Wave 1.

The CY2018 **Program Tracking Data** will allow for the verification of rebated measure sales and analysis of the characteristics of the installed measures that drive savings (such as bulb type and wattage). The results of the program tracking data analysis will drive CY2018 gross and net impacts.

The CY2018 **In-store Intercept surveys** will be used to estimate the following key residential lighting gross and net savings parameters: (1) first year installation rate (by bulb type), (2) leakage of program bulbs outside of ComEd service territory, (3) percentage of bulbs being installed in non-residential locations and the business type of these non-residential installations (used to determine the appropriate non-residential hours-of-use [HOU] and peak coincidence factor [CF] to estimate program savings), and (4) net-to-gross ratio (for standard, directional, and specialty LEDs). During the in-store intercept surveys, data will also be collected to gauge customers’ awareness of program-discounted LEDs, assess customers’ key considerations when purchasing bulbs (price, energy usage, bill savings, etc.) and ascertain how customers are responding to the changes in the lighting market. The intercept survey instrument used in CY2018 will be like the instrument used in previous ComEd evaluations, as well as the evaluation of the Ameren Illinois lighting program.

Each year, two conference calls will be conducted with the ComEd program manager and CLEAResult program implementation staff. These calls will be focused on the current status of the Lighting Discounts Program, recent changes to the program, and changes likely to occur to the program in CY2018 and beyond.

### Gross Impact Evaluation

Gross kWh, kW and summer and winter peak kW savings will be calculated across all program bulbs based on the following equations:

$$\text{Annual kWh Savings} = \text{Program bulbs} * \text{Delta Watts}/1000 * \text{Annual HOU} * \text{Realization Rate}$$

Annual kW Savings = Program bulbs \* Delta Watts/1,000 \* Realization Rate

Annual Summer Coincident Peak kW Savings = Annual kW Savings \* Summer Peak Load CF Factor<sup>108</sup>

Annual Winter Coincident Peak kW Savings = Annual kW Savings \* Winter Peak Load CF<sup>109</sup>

Where Realization Rate = Installation Rate \* (1-Leakage Rate) \* Interactive Effects

For the verification analysis in CY2018, the evaluation team will calculate gross savings using the following parameter estimates:

- **Program Bulb Sales** data will be obtained from the CY2018 EM&V tracking database analysis.
- **Program Bulb Installation Rates** will be obtained from the IL TRM v6.0.
- **Delta Watts** will be calculated using the bulb type lumen-equivalence mapping in the IL TRM v6.0.
- **HOU and Summer Peak CF** will be obtained from both the residential and non-residential sections of the IL TRM v6.0. The non-residential HOU and Peak CF will be determined based upon the business activities conducted in the non-residential locations where program bulbs are reportedly installed.
- **Winter Peak CF** will be determined based upon analysis done by the evaluation team and presented to ComEd in a memorandum titled “Winter Peak Coincidence Factor Recommendation for Residential Lighting”, dated February 2<sup>nd</sup>, 2015.
- **Residential and Non-Residential Bulb Installation** will be obtained from the IL TRM v6.0.
- **Interactive Effects** will be obtained from the IL TRM v6.0.
- **Leakage** will be obtained from the IL TRM v6.0.

The calculation of carryover savings will be based on the following parameter estimates:

- **Delta Watts** – Verified Savings estimate from the year of installation (source: IL TRM v6.0)
- **Residential and Non-Residential Split** - Evaluation Research from the year of purchase (source: PY8/PY9 report)
- **HOU and Peak CF** – Verified Savings estimate from the year of installation (source: IL TRM v6.0) or recent Evaluation Research (lighting logger study), if available.
- **Interactive Effects** – Verified Savings estimate from the year of installation (source: IL TRM v6.0)
- **Installation Rate** - Verified Savings estimate from the year of purchase (source: PY8/PY9 report)
- **NTG** – Evaluation Research from the year of purchase (source: PY8/PY9 report)

### **Verified Net Impact Evaluation**

The verified net impact evaluation will apply the net-to-gross (NTG) ratio accepted by Illinois Stakeholders Advisory Group (SAG) consensus to estimate the verified net savings for the program. The CY2018

<sup>108</sup> Summer Peak CF is calculated as the percentage of lighting turned on in each room during peak hours of the summer months (1-6 pm on summer weekdays).

<sup>109</sup> Winter Peak CF is calculated as the percentage of lighting turned on in each room during peak hours of the winter months (6-8 am and 5-7pm, between January 1 and February 28).

EM&V NTG estimates are shown in the table below and available on the IL SAG Website: <http://www.ilsag.info/net-to-gross-framework.html>.

**Table 3. Deemed NTG Values for CY2018**

Program Measure	CY2018 Deemed NTG Value
Omni-Directional LED Bulbs	0.58
Directional/Other LED Bulbs	0.58
LED Fixtures	0.73

Source:  
[http://ilsagfiles.org/SAG\\_files/NTG/2017\\_NTG\\_Meetings/Final/ComEd\\_NTG\\_History\\_and\\_PY10\\_Recommendations\\_2017-03-01.xlsx](http://ilsagfiles.org/SAG_files/NTG/2017_NTG_Meetings/Final/ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.xlsx)

**Research NTG Impact Evaluation**

The evaluation will conduct NTG research in CY2018 to inform NTG recommendations for the future. The CY2018 evaluation research NTG ratios will be estimated using a self-report methodology using data collected during in-store intercept surveys.

**In-Store Intercept Self-Report Methodology**

The in-store intercept self-report methodology employed in CY2018 will use data gathered directly from customers at the time of purchase (in-store intercepts) to assess the residential lighting NTG. The data collected during the surveys to estimate the NTG analysis includes items such as the influence of the program on the program bulb purchase (both in terms of monetary incentives and education materials provided), number of program LEDs purchased, the timing of purchase, and purchase of additional non-rebated LEDs (spillover) that were influenced by the program.

In CY2018 the evaluation team will aim to conduct 800 in-store intercept surveys (conducted in the Fall of 2018) at four of the participating program retailers (multiple storefronts per retailer). The CY2018 intercept surveys will be stratified by program retailer and retailer location (like previous ComEd evaluations the retail locations will be classified as Urban [Chicago], Suburban [i.e., Schaumburg] and Other [i.e. Rockford]). In-store intercepts in CY2018 will be conducted at The Home Depot, Lowe’s, Sam’s Club, and Wal-Mart. Cumulatively, these retailers typically account for about 50% of the program bulb sales.

**Lifecycle Savings Estimation – Effective Useful Life Research**

In addition to first year (annual) savings, ComEd will be reporting lifecycle savings in CY2018 and beyond. Lifecycle savings are calculated in the same manner as the gross and net impacts described above except that the annual savings value is then multiplied by the effective useful life (EUL) of the measure to account for savings that accrue over the lifetime of the product. In CY2018 and beyond, EULs will continue to be refined through a combination of primary or secondary research, as needed.

**Calculation of CPAS and Annual Savings**

As required by the Future Energy Jobs Act (FEJA), Navigant will report ex post gross and ex post net savings for the program and the cumulative persisting annual savings (CPAS) in CY2018 will be calculated along with the total CPAS.. Additionally, the weighted average measure life will be estimated, if possible. Evaluation will also add the savings converted from gas savings to the electric savings so that it is documented in the report.

### *Process Evaluation*

The process analysis will include a brief synthesis of both qualitative and quantitative data collected during the program implementer interviews, the in-store intercept surveys, and the trade ally surveys (CY2019 and CY2021). While ComEd indicated that they did not have specific process-related issues that they wanted to explore directly with program participants, there are several process-related topics that can be explored using the data collected for NTG and other researched parameters including:

- Awareness of the discount provided by ComEd
- Importance of retailer recommendations and in-store placement of program sponsored lamps
- Importance of ComEd supplied informational materials
- Location (residential versus nonresidential) and timing of program bulb installation

### *Use of Randomized Controlled Trial and Quasi-experimental Design*

We are not evaluating the Residential Lighting Discounts Program via a randomized controlled trial (RCT) or quasi-experimental design because the program is delivered upstream and it is not possible to select treatment and control groups for programs where the participants are unknown.

## Evaluation Schedule

Table 4 below provides the schedule for key deliverables and data transfer activities. (See Table 2 for other schedule details.) Adjustments will be made, as needed, as evaluation activities progress.

**Table 4. Schedule – Key Deadlines**

Activity or Deliverable	Responsible Party	Date Delivered
Wave 1 CY2018 Data Available for Ex Ante Review and Analysis	ComEd	June 5, 2018
Wave 1 CY2018 Ex Ante Review Assessment Memo	Evaluation	July 7, 2018
CY2018 Program Bulb Data Needed for In-Store Intercepts	ComEd	August 1, 2018
CY2018 In-Store Intercept Surveys	Evaluation	September 1, 2018
In-Store Intercept Surveys Memo	Evaluation	November 15, 2018
Develop CY2018 Self-Report NTG Estimates	Evaluation	November 30, 2018
CY2018 Process Evaluation Memo	Evaluation	December 15, 2018
Memo to ComEd/ICC with CY2020 NTG Recommendations	Evaluation	December 15, 2018
CY2018 EUL Assessment Memo	Evaluation	January 15, 2019
CY2018 Tracking system is final	ComEd	January 30, 2019
Preliminary Impacts Memo	Evaluation	February 15, 2019
CY2018 Draft Report to ComEd and SAG	Evaluation	February 28, 2019
Comments on CY2018 Draft (15 Business Days)	ComEd	March 21, 2019
CY2018 Revised Draft Report to ComEd and SAG	Evaluation	March 28, 2019
Comments on Revised Draft (5 Business Days)	ComEd	April 4, 2019
CY2018 Final Report to ComEd and SAG	Evaluation	April 14, 2019

**ComEd Middle School Take-Home Kits Program CY2018 Evaluation Plan**

**Introduction**

The Middle School Take Home Kits (Middle School Kits) Program targets sixth, seventh, and eighth grade teachers and school staff, students and their families throughout the ComEd service territory to deliver a multiplatform, behavior-driven, in-school program. The program features live, educational theatre performances to the entire school rather than one grade at a time. After students see the performance, they are sent home with workbooks to fill out. In addition to homework assignments, the workbooks contain an offer of a free energy efficiency kit that will be shipped to their home. Parents must request a kit and state whether they have a gas or electric water heater and based on their response, NTC will ship them one of two types of kits. Homes with gas water heaters are delivered a kit with different measures than those with electric water heaters.

The Middle School Kits Program’s primary focus is to produce electricity savings in the residential sector by motivating students and their families to take steps through reducing energy consumption for electric water heating and lighting in their home.

ComEd’s net planning target is 1,277 MWh for CY2018.

Notable program changes made from PY9 to CY2018 include:

- No longer including CFL bulbs in the kits
- Addition of LED bulbs in the kits

The primary objectives of the evaluation of the Middle School Kits Program are to: (1) quantify gross and net savings impacts from the program, and (2) make recommendations to enhance the program focused on the current priorities as determined by the program manager for this program or similar future programs.

The CY2018 gross impact evaluation will not vary significantly from the previous years. Navigant will conduct in-service rate research on advanced power strips (APS). Navigant is currently in the process of defining this research and will issue a separate research plan. The evaluation will include a variety of data collection and analysis activities, including those indicated in the following table.

**Table 1. Evaluation Approaches – One Year Plan**

Tasks	CY2018
Tracking System Review	X
Data Collection – Program Manager and Implementer Interviews	X
Impact – Measure-Level Deemed Savings Review	X
Impact – Verification & Gross Realization Rate	X
Impact – In-Service Rates for APS measures	X

**Coordination**

Navigant will coordinate with the other utility evaluation teams on any issues relevant to this program. Ameren’s Direct Distribution of Efficient Products Initiative is structured similar to the Middle School Kits Program. Both programs provide energy savings kits to 5<sup>th</sup> to 8<sup>th</sup> grade students and also have an energy conservation education component. Although the measure included in the kits are not same, the methods

used in both evaluations are specified by the Illinois TRM and are generally consistent. The net savings for both evaluations will be determined using the SAG approved NTG ratio.

### Evaluation Research Topics

The evaluation will seek to answer the following key researchable questions:

#### Impact Evaluation

1. What are the program’s verified gross savings?
2. What are the program’s verified net savings?
3. Did the program meet its energy and demand savings targets? If not, why?
4. What updates are recommended for the Illinois Technical Reference Manual (TRM)?

#### Process Evaluation and Other Research Topics

Navigant will conduct limited process research for the program in CY2018 based on program manager and implementation contractor interviews.

### Evaluation Approach

This evaluation plan summary identifies tasks on a preliminary basis for CY2018 (Table 2). Calendar Year (CY) refers to the year of participation that will be researched, not the time that the research will occur. Activities are subject to change based upon the demands of the portfolio and other factors, and during the program year as program circumstances are better known.

For CY2018, the primary method to determine net and gross savings will be a program tracking system review and applying program-level net-to-gross ratio (NTGR) that is deemed through a consensus process by the Illinois Stakeholder Advisory Group (IL SAG).

The table below summarizes the evaluation tasks for CY2018.

**Table 2. Evaluation Plan Summary**

Activity	CY2018
Gross Impact Approach	Tracking System Review
Verified Net Impact Approach	Deemed Value
Program Manager and Implementer Interviews/ Review Materials	Yes

Table 3 below summarizes the proposed data collection activities for CY2018 including the sample sizes and timing of each activity.

**Table 3. Core Data Collection Activities, Sample, and Analysis**

Activity	Target	Target Completes CY2018	Timeline	Notes
Tracking System Review	Tracking system	Census	Two waves	
In Depth Interviews	Program Management and Implementers	2	April – Dec 2018	
Gross Impact	Tracking System Review	All	April 2018– Feb 2019	Wave 1 and final*
Verified Net Impact	Calculation using deemed NTG ratio	NA	March 2019	

\* Navigant will coordinate with ComEd to determine appropriate dates to pull tracking data extracts for the Wave 1 data.

In line with program changes and accelerated evaluation schedule for delivering tracking data to the evaluation team, Navigant will perform a tracking system review and M&V project sampling for a Wave 1 data set and a final data set in 2018. The first wave of M&V sampling is expected to cover about half of the projects.

Proposed gross impact sampling timelines are shown below.

### Gross Impact Evaluation

Since most of the program’s savings are derived based on the Illinois Technical Resources Manual (IL TRM), the evaluation team will conduct a limited gross impact evaluation in CY2018. The foundation of the gross impact evaluation will be a review of Wave 1 program tracking data that substantiates the type and quantity of measures installed. Navigant will perform independent verification of the program tracking database and determine the level of input completeness, outliers, missing values, and potentially missing variables. If necessary, the Navigant team will include recommendations from the Wave 1 data review and analysis for additional fields to be added to the tracking system for use in the impact evaluation effort as well as program process monitoring.

For measures covered by the IL TRM, verified gross savings are calculated for each participant using appropriate IL TRM algorithms and customer-specific data collected in the tracking system. For custom input variables or measures not yet in the IL TRM, the evaluation analysis will be supplemented by additional research, and then summed across participants to calculate program totals. To be eligible, a measure must meet the physical, operational, and baseline characteristics as defined in the applicable version of the IL TRM.

### Verified Net Impact Evaluation

The verified net impact evaluation will apply a program-level NTGR of 1.0 deemed through a consensus process by the IL SAG to estimate the verified net savings for the program in CY2018.

**Table 4. Deemed NTG Values for CY2018**

Program Measure	CY2018 Deemed NTG Value
Middle School Kits Program	1.0

Source:  
[http://ilsagfiles.org/SAG\\_files/NTG/2017\\_NTG\\_Meetings/Final/ComEd\\_NTG\\_History\\_and\\_PY10\\_Recommendations\\_2017-03-01.xlsx](http://ilsagfiles.org/SAG_files/NTG/2017_NTG_Meetings/Final/ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.xlsx)

**Calculation of CPAS and Annual Savings**

As required by the Future Energy Jobs Act (FEJA), Navigant will report ex post gross and ex post net savings for the program and the cumulative persisting annual savings (CPAS) in CY2018 will be calculated along with the total CPAS. Additionally, the weighted average measure life will be estimated, if possible. Evaluation will also add the savings converted from gas savings to the electric savings so that it's documented in the report.

**Process Evaluation**

We will conduct in-depth telephone interviews with program managers and implementation contractors to better understand the program and make recommendations for potential program enhancement for future programs, if applicable.

**Use of Randomized Controlled Trial and Quasi-experimental Design**

We are not evaluating the Middle School Kits program via a randomized controlled trial because the program was not designed with randomly assigned treatment and control groups. We are not using quasi-experimental design because the savings from the program measures represents less than ~5% of whole home usage, which is not sufficient to achieve statistically significant savings estimates using this method.

**Evaluation Schedule**

Table 5 below provides the schedule for key deliverables and data transfer activities. Adjustments will be made, as needed, as evaluation activities progress.

**Table 5. Schedule – Key Deadlines**

Activity or Deliverable	Responsible Party	Date Delivered
Program Operations Manual and Workpapers	ComEd	January 2, 2018
CY2018 program tracking data for Wave 1 data review and analysis	ComEd	April 16, 2018
Tracking System Wave 1 Ex Ante Review Findings and Recommendations	Evaluation	June 15, 2018
CY2018 Program tracking data	ComEd	January 30, 2019
Internal Report Draft by Navigant	Evaluation	March 1, 2019
Draft Report to ComEd and SAG	Evaluation	March 6, 2019
Comments on draft (15 Business Days)	ComEd and SAG	March 27, 2019
Revised Draft by Navigant	Evaluation	April 4, 2019
Comments on redraft (5 Business Days)	ComEd and SAG	April 11, 2019
Final Report to ComEd and SAG	Evaluation	April 20, 2019

## ComEd Multi-Family Market Rate Program CY2018 to CY2021 Evaluation Plan

### Introduction

The program Multi-Family Market Rate Program is jointly implemented by ComEd and Nicor Gas Company, and ComEd and Peoples Gas (PGL) and North Shore Gas (NSG) companies. Franklin Energy is the implementation contractor for the joint program. Franklin Energy staff install various energy-saving measures, which may include LEDs in tenant units, water-saving devices, programmable thermostats, pipe insulation, and LEDs in common area screw-in fixtures. The program further provides trade ally installs in common area and exterior areas lighting retrofits and gas measures, such as pipe wrap. Measures not covered by the Multi-Family Market Rate Program are transferred as leads to other programs.

ComEd's CY2018 net savings target is 9,195 MWh of cumulative persisting annual savings (CPAS). The CY2018 filing value for participants is 19,000 residential units, and the target goal for participants is 13,300 residential units.

The Multi-Family Market Rate Program is essentially a combination of offers from the PY9 Multi-Family Assessment Program and the Multi-Family Common Area Pilot Program. The Multi-Family Market Rate Program serves as a "one stop shop" to multi-family building owners and managers to generate electricity and natural gas savings throughout the property.

The electric and natural gas saving services include:

- Electric and gas energy assessments and provision of educational information.
- Direct installation of electric and gas saving measures in tenant and common area spaces.
- Partner Trade Ally (PTA) installation of electric and gas saving measures at no cost to customer, following agreed upon program pricing.
- In addition, the Multi-Family Market Rate Program may provide information to building owners and managers as part of the assessment that explains how they can self-register for Business Energy Analyzer (BEA).

This four-year evaluation plan includes activities scheduled to evaluate the program savings impact and process activities for CY2018 through CY2021. The primary objectives of the CY2018 evaluation of ComEd's Multi-Family Market Rate Program are to: (1) quantify gross and net savings impacts from the program; (2) conduct research to support the program's transition in response to the Future Energy Jobs Act (FEJA)<sup>110</sup>; and (3) determine key process-related program strengths and weaknesses and identify ways in which the program can be improved. The evaluation of this program over the coming four years will include a variety of data collection and analysis activities, including those indicated in the following table.

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<sup>110</sup> Illinois Public Act 099-0906 (<http://www.ilga.gov/legislation/publicacts/99/099-0906.htm>).

**Table 1. Evaluation Approaches – Four Year Plan**

Tasks	CY2018	CY2019	CY2020	CY2021
Tracking System Review	X	X	X	X
Data Collection – Participant Surveys	X		X	
Data Collection – Property Manager Interviews	X		X	
Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Data Collection – Trade Ally Interviews	X		X	
Impact – Billing Analysis (as needed)	X	X	X	X
Impact – Engineering Review	X	X	X	X
Impact – Measure-Level Deemed Savings Review	X	X	X	X
Impact – Verification & Gross Realization Rate	X	X	X	X
Impact – in service rates and persistence of APS	X	X		
Net-to-Gross – Customer Self-Report Surveys	X			
Process Analysis	X	X	X	X

The evaluation team determined the evaluation approach for the 2018-2021 period based upon the needs of the program and program’s history. The 4-year evaluation approach for this program is based on the following:

- Annual gross and net impact analysis
- Conduct annual process surveys based upon client requests and program performance.
- Optimizing timing regarding which years to conduct NTG research based on potential changes to the program design or installed measures.
- CPAS will be calculated based upon the requirements of FEJA
- Conduct in-service rate and persistence research on advanced power strips

### Coordination

Navigant will coordinate with the evaluation teams for other utilities on any issues relevant to this joint program. Specifically, the ComEd NTG research activities and timeline will be coordinated with similar research to be conducted by the Peoples and North Shore Gas, and the Nicor Gas multi-family programs. Navigant will coordinate the data collection and survey instruments design for consistency and capture the appropriate questions in the decision maker surveys. The joint program evaluations and reporting timelines will be the same.

In addition, Navigant will coordinate with the evaluation team for Ameren regarding research topics in their Multifamily initiative, such as on-site verification for advanced power strip in-service rates.

### Evaluation Research Topics

The evaluation will seek to answer the following key researchable questions:

#### Impact Evaluation

1. What are the program’s annual total verified gross savings?
2. What are the program’s verified net savings?

3. What is the estimated free-ridership and spillover for CY2018 participating customers? What is the research estimate for participant spillover for this program?

**Process Evaluation and Other Research Topics**

The process evaluation effort for CY2018 will focus on program delivery. The process research will address the following questions:

1. What are building owners’ and building managers’ perspectives and overall satisfaction with the program?
2. What are trade allies’ perspectives, awareness and overall satisfaction with the program?
3. How can the program be improved?

**Evaluation Approach**

The table below summarizes the evaluation tasks for CY2018 including data collection methods, data sources, timing, and targeted sample sizes that will be used to answer the evaluation research questions.

**Table 2. Core Data Collection Activities, Sample, and Analysis**

Activity	Target	Target Completes CY2018 (approx.)	Timeline	Notes
Tracking System Review	Tracking system	Census	Wave 1* and Final data	
In Depth Interviews	Program Management and Implementers	2	April – Dec 2018	
In Depth Interviews	Property Manager/Owner	1	May - September 2018	
Gross Impact	Wave 1 Data Review and Analysis	Census	June 2018 – Feb 2019	Wave 1 and Final data*
Verified Net Impact	Calculation using deemed NTG ratio	Census	March 2019	
Researched NTG and Process	Telephone Survey with Participating Decision Makers	Up to 80†	June 2018 – May 2019	FR & SO, Process
Process and Impact Research on CY2018 Operations	Literature review, process research with Property Decision Makers and Trade Allies		April 2018 – March 2019	Process, Impact

Note: FR = Free Ridership; SO = Spillover

\* Navigant will coordinate with ComEd to determine appropriate date to pull a Wave 1 tracking data extract.

† Navigant will complete an appropriate number of surveys with participants and interviews with trade allies achieve to research NTG.

**Gross Impact Evaluation**

The Multi-Family Market Rate Program savings verification will be based on using the applicable Illinois TRM (v6.0), or secondary research for any measure with custom savings input. Gross savings will be evaluated primarily by (1) reviewing the tracking system data to ensure that all fields are appropriately populated; (2) reviewing measure algorithms and values in the tracking system to assure that they are appropriately applied; and (3) cross-checking totals. This approach will be supplemented where possible with a review of project documentation in each program year to verify participation; installed measure

quantities; and associated savings. Verified gross savings will be estimated by multiplying deemed per unit kWh savings by the verified quantity of eligible measures.

The impact evaluation will investigate potential gas measures with kWh savings, and review the parameters ComEd used to estimate potential and eligible kWh savings (therms conversion).

The evaluation team will calculate gas savings achieved by the program and convert it to electric savings.

**Verified Net Impact Evaluation**

The verified net impact evaluation will apply the net-to-gross (NTG) ratio accepted by Illinois Stakeholders Advisory Group (SAG) consensus to estimate the verified net savings for the program.

**Table 3. Deemed NTG Values for CY2018**

Program Path/Measure	CY2018 Deemed NTG Value
Programmable Thermostat	0.90
LED Lighting	0.95
Showerhead	0.92
Bath Aerator	0.94
Kitchen Aerator	1.00
Insulation	0.95
Other Measures, Direct Installed in Units	0.95
Comprehensive Non-CFL	0.95

Source:  
[http://ilsagfiles.org/SAG\\_files/NTG/2017\\_NTG\\_Meetings/Final/ComEd\\_NTG\\_History\\_and\\_PY10\\_Recommendations\\_2017-03-01.xlsx](http://ilsagfiles.org/SAG_files/NTG/2017_NTG_Meetings/Final/ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.xlsx)

**Research NTG Impact Evaluation**

Navigant will conduct a participating decision maker NTG study in CY2018 to provide NTG values for potential deeming in future program years through surveys with CY2018 participating customers. We will complete computer assisted telephone interviews (CATI) with a minimum of 80 contacts who participated in the CY2018 program to quantify participant free-ridership and spillover. We will design the sample to achieve a 90/10 confidence/precision level of NTG ratios at the measure category level, and a roll up at the program-level, through a weighted average of measure energy savings in the program.

Proposed CY2018 NTG and process research sampling timelines are shown below.

- a) Wave 1 data collection and sampling drawn in May 2018 and completed in August 2018
- b) Final CY2018 tracking data in February 2019 and completed in May 2019

**Calculation of CPAS and Annual Savings**

As required by the Future Energy Jobs Act (FEJA), Navigant will report ex post gross and ex post net savings for the program and the cumulative persisting annual savings (CPAS) in CY2018 will be calculated along with the total CPAS. Additionally, the weighted average measure life will be estimated, if possible.

## Process Evaluation

The CY2018 process evaluation research will include a synthesis of both qualitative and quantitative data collected during the program staff and implementer interviews and meetings, and during the decision maker customer surveys in CY2018. The CY2018 study will include in-depth interviews with participating decision makers and trade allies to learn about their perspectives and satisfaction with the program, amidst varying opportunities from program offerings and changes to program application requirements. Interview questions will also seek to identify how to qualify properties for this program and the result will be a sector-level customer journey map to visualize customer satisfaction. If possible, Navigant will also ask screening questions of participants to gauge if the program has non-energy impacts which could be researched further. Navigant will coordinate process research in CY2018 with the gas utilities in joint implementation.

### *Use of Randomized Controlled Trial and Quasi-experimental Design*

Navigant is not evaluating the Multi-Family Market Rate Program via a randomized controlled trial because the program was not designed with randomly assigned treatment and control groups. Navigant is not using quasi-experimental consumption data because this program contains many unique measures with significant cross-participation. In this case, quasi-experimental consumption data analysis would produce savings estimates for bundles of commonly-installed measures, rather than for each measure individually, which is not the desired output for all analysis.

## Evaluation Schedule

Table 4 and Table 5 below provide the schedule for key deliverables and data transfer activities (see Table 2 for other schedule details.) The April 30th deadline in Table 5 is for the impact report. The process and NTG findings will be delivered in different documents and on a different schedule as shown in Table 4. Adjustments will be made, as needed, as evaluation activities progress.

**Table 4. Schedule – Key Impact Deadlines**

Activity/Deliverables	Responsible Party	Date Delivered*
Program Operations Manual and Workbook Review	ComEd	March 15 – April 15, 2018
CY2018 Wave 1 Tracking Data	ComEd	June 30, 2018
Wave 1 data review and analysis memo	Evaluation Team	August 31, 2018
Sample Projects Documentation for Review	ComEd	September 30, 2018
Final CY2018 Tracking Data to Navigant	ComEd	January 30, 2019
Internal Report Draft by Navigant	Evaluation Team	March 2, 2019
Draft Report to ComEd and SAG	Evaluation Team	March 8, 2019
Comments on draft (15 Bus. Days)	ComEd / SAG	March 29, 2019
Revised Draft by Navigant	Evaluation Team	April 5, 2019
Comments on redraft (5 Bus. Days)	ComEd / SAG	April 12, 2019
Final Report to ComEd and SAG	Evaluation Team	April 22, 2019

**Table 5. Schedule – Key NTG & Process Deadlines**

Activity/Deliverables	Responsible Party	Date Delivered <sup>111</sup>
Develop Process and NTG Survey and Interview Guides	Evaluation Team	March 15, 2018 – April 15, 2018
CY2018 Wave 1 Tracking Data	ComEd	June 30, 2018
Draft Process Research Findings	Evaluation Team	December 30, 2018
CY2018 Final Tracking Data	ComEd	January 30, 2019
Final Process Research Findings	Evaluation Team	March 30, 2019
Internal NTG Report Draft by Navigant	Evaluation Team	July 30, 2019
Draft NTG Report to ComEd and SAG	Evaluation Team	September 1, 2019
Comments on draft (10 Bus. Days)	ComEd / SAG	September 15, 2019
Final NTG Recommendation to ComEd and SAG	Evaluation Team	October 1, 2019

<sup>111</sup> Draft NTG recommendations are due to the SAG September 1st and final October 1<sup>st</sup> every year. The multi-family NTG research findings on CY2018 participants will be ready in CY2019, to meet the deadline for NTG recommendation in 2019, for future application. Process analysis findings will be delivered as near to the data collection as possible (unless that falls during the impact reporting season).

**ComEd and Nicor Gas Residential New Construction Program CY2018 to CY2021 Evaluation Plan**

**Introduction**

The Residential New Construction Program is jointly offered by Nicor Gas and ComEd. Residential Science Resources (RSR) implements the program for Nicor Gas. Seventhwave (with RSR as their subcontractor) implements the program for ComEd. Program participation requires a minimum efficiency of 20 percent above code for each home, and program homes are ranked in tiers based on performance:

- Tier 1: 20.00-24.99 percent above code
- Tier 2: 25.00-29.99 percent above code
- Tier 3: 30 percent or more above code

RSR uses completed REM/Rate files for each home to calculate whole-house savings. The program relies on networks of builders and Home Energy Rating System (HERS) raters to garner participation and continues to attract raters and builders to the program.

Nicor Gas Company (Nicor Gas) and ComEd are implementing Calendar Year 2018 (CY2018) beginning January 1, 2018 and continuing through December 31, 2018. The target savings goals for CY2018 are shown in Table 1.

**Table 1. CY2018 Savings and Completed Homes Goals**

Goal	Goal Value
Gas Savings	308,322 Gross therms
Electric Savings	915 Gross MWh
Total Homes	850 joint homes

*Source: Seventhwave Scope of Work for Administration of the ComEd Energy Efficiency New Construction Program in 2018*

This document presents the proposed evaluation activities for the CY2018 joint Nicor Gas and ComEd Residential New Construction Program. Navigant is the evaluator for both utilities' programs. The objectives of the CY2018 evaluation are to (1) identify ways in which the program can be improved; (2) determine process-related program strengths and weaknesses; and (3) verify the gross and net kilowatt-hour (kWh), kilowatt (kW), and therm impacts of the program. To evaluate program gross impacts, the evaluation team will verify the quantity of homes incented in CY2018 and apply the GPY5/EPY8 researched realization rates for both gas and electric savings to verified ex ante savings.

The evaluation of this program over the coming four years will include a variety of data collection and analysis activities, including those indicated in Table 2. Navigant will complete a tracking system review, interview program managers and implementers, calculate gross realization rates, and complete a process analysis for each program year. Navigant will perform simulation modeling for the gross impact analysis and trade ally interviews for net-to-gross (NTG) and process research in CY2019 when the residential energy code changes from IECC 2015 to IECC 2018. The trade ally interviews will include interviews with participating raters and builders to learn about their perspectives and satisfaction with the program, incentive offerings, and how to improve the program in the future. The NTG research will include in-depth interviews with both participating and non-participating builders to assess free ridership and spillover. The findings will inform recommended NTG values for the Illinois Stakeholder Advisory Group (SAG) approval and future program application.

**Table 2. Evaluation Approaches – Four Year Plan**

Tasks	CY2018	CY2019	CY2020	CY2021
Tracking System Review	X	X	X	X
Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Data Collection – Trade Ally Interviews		X		
Impact – Calibrated Simulation Modeling		X		
Impact – Verification & Gross Realization Rate	X	X	X	X
Net-to-Gross – Trade Ally Interviews		X		
Process Analysis	X	X	X	X

The evaluation team determined the evaluation approach for the 2018-2021 period based on the needs of the program and the program’s prior history. The four-year evaluation approach for this program is based on the following:

- Annual gross and net impact analysis
- Calibrated simulation modeling for the impact analysis in CY2019 when the residential energy code changes to IECC 2018
- Optimized timing on when to conduct NTG research
- NTG research in CY2019 when the residential energy code changes to IECC 2018
- Trade ally interviews in CY2019 as part of the NTG research
- Program manager and implementer interviews will be conducted each year
- CPAS will be calculated based on the requirements of FEJA

### Coordination

Navigant will coordinate with the evaluation teams for other utilities on any issues relevant to this program. Specifically, the Residential New Construction Program is jointly offered by ComEd and Nicor Gas. The evaluation activities and timing for each utility evaluation are the same as this is one evaluation effort for both utilities.

### Evaluation Research Topics

The CY2018 evaluation will seek to answer the following key researchable questions:

#### Impact Evaluation

1. What are the gross annual energy and demand savings induced by the program?
2. Did the program meet its energy and demand savings goals? If not, why not?
3. What are the net impacts from the program?

#### Process Evaluation and Other Research Topics

The process evaluation effort for CY2018 will focus on program delivery. The process research will address the following questions:

1. How can the program be improved?

2. Are builders and raters satisfied with the program? What improvements, if any, would builders and raters like to see implemented?
3. How is the transition into CY2018 along with the income-eligible programs impacting the program?

## Evaluation Approach

Table 3 summarizes the evaluation plan for CY2018 and CY2019 including data collection methods and sources that will be used to answer the evaluation research questions. Final activities will be determined annually as program detail and requirements become known.

**Table 3. Evaluation Plan Summary**

Activity	CY2018	CY2019
Gross Impact Approach	Apply GPY5/EPY8 Realization Rates	Calibrated Energy Simulation
Verified Net Impact Approach	Deemed Value	Deemed Value
Researched NTG Approach	None	Interviews with Builders
Researched NTG Timing	None	Fall/Winter 2019
Program Manager and Implementer Interviews/Review Materials	Yes	Yes

Table 4 summarizes the proposed data collection activities for CY2018 including the sample sizes and timing of each activity.

**Table 4. Core Data Collection Activities, Sample, and Analysis**

Activity	Target	Target Completes CY2018	Timeline	Notes
Tracking System Review	Tracking system	Census	Two waves: April 2018 and Jan 2019	
Program Material Review	Program manuals, marketing and educational materials	All	Jan – Feb 2019	Process analysis
In Depth Interviews	Program Management and Implementers	3	April – Dec 2018	Augment with monthly calls
Gross Impact	Use GPY5/EPY8 realization rate to adjust claimed savings for CY2018 homes	All	Feb 2019	
Verified Net Impact	Calculation using deemed NTG ratio	NA	March 2019	

In line with program changes and the accelerated evaluation schedule for delivering tracking data to the evaluation team, Navigant will perform an early tracking system review in April 2018. This includes a review of both the tracking system and the ex ante savings methodology to ensure that ex post building simulation models are representative of program homes and any program changes.

### Gross Impact Evaluation

The GPY5/EPY8 evaluation used a rigorous approach of calibrated energy simulation to determine gross realization rates for gas and electric savings and to estimate gross electric demand savings. As the calculation method for determining ex ante savings has not changed for CY2018, the evaluation team plans to apply the GPY5/EPY8 realization rates to the ex ante savings to determine verified gross impacts for CY2018. Navigant will apply the GPY5/EPY8 realization rates by home tier level, as shown in Table 5.

**Table 5. GPY5/EPY8 Realization Rates by Home Tier Level**

Participation Category	Verified Gross Realization Rate (Gas)	Verified Gross Realization Rate (Electric)
Tier 1	103%	99%
Tier 2	89%	98%
Tier 3	88%	116%
Overall	94%	101%

### Verified Net Impact Evaluation

The evaluation will apply the NTG ratio accepted by Illinois Stakeholders Advisory Group (SAG) consensus to estimate the verified net savings for the program.

**Table 6. Deemed NTG Values for CY2018**

Program Measure	CY2018 Deemed NTG Value
Residential New Construction	0.65

Source: [http://ilsagfiles.org/SAG\\_files/NTG/2017\\_NTG\\_Meetings/Final/ComEd\\_NTG\\_History\\_and\\_PY10\\_Recommendations\\_2017-03-01.xlsx](http://ilsagfiles.org/SAG_files/NTG/2017_NTG_Meetings/Final/ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.xlsx), and Nicor Gas GPY7 NTG Values 2017-03-01 Final.xlsx.

### Researched NTG Impact Evaluation

Navigant will complete NTG research as part of the CY2019 evaluation. Navigant will conduct in-depth interviews with both participating and non-participating builders. The evaluation team will attempt to contact a census of builders and aim to complete interviews with as many as possible up to 20 participating builders and up to 20 non-participating builders. Navigant will target the top builders to obtain results for a large share of program homes.

Navigant will use a self-report approach to estimate the program’s NTGR following the statewide approach included in the TRM. The analysis will cover the following components:

- Free-ridership
- Participant Spillover
- Non-participant Spillover

Participant spillover refers to spillover from participating builders in non-program homes and non-participant spillover refers to spillover from builders who are exposed to the program but are not participating. The builder interviews will also assess the current level of energy efficiency knowledge among participating builders to provide a “baseline” for any future spillover or market effects research.

### Calculation of CPAS and Annual Savings

As required by the Future Energy Jobs Act (FEJA) for electric energy efficiency, Navigant will report ex post gross and ex post net savings for the program and the cumulative persisting annual savings (CPAS) in CY2018 will be calculated along with the total CPAS.. Additionally, the weighted average measure life will be estimated, if possible.

### Process Evaluation

The CY2018 process evaluation research will include a synthesis of both qualitative and quantitative data collected during the program staff and implementer interviews and meetings, as well as the review of program manuals and marketing and educational materials developed by the program. The CY2019 NTG study will include interviews with raters and builders to learn about their perspectives and satisfaction with the program.

Navigant will perform additional process research, upon the request of the program manager, to support the program manager and implementer in transitioning into the revised regulatory requirements starting in CY2018. Possible topics may include, but will not be limited to, non-energy impacts, cumulative persisting annual savings and effective useful life.

Navigant is not evaluating the Residential New Construction program via a randomized controlled trial because the program was not designed with randomly assigned treatment and control groups. We are not using quasi-experimental consumption data because it would not be possible to create a valid matched control group for the customers in this program.

### Evaluation Schedule

Table 7 provides the schedule for key deliverables and data transfer activities. Adjustments will be made, as needed, as evaluation activities progress.

**Table 7. Schedule – Key Deadlines**

Activity or Deliverable	Responsible Party	Date Delivered
Program Manuals, Marketing and Educational Materials	Nicor Gas and ComEd	March 15, 2018
CY2018 Program Tracking Data for Wave 1 Review	Nicor Gas and ComEd	April 7, 2018
Tracking System Ex Ante Review Findings and Recommendations	Evaluation	July 30, 2018
CY2018 Program Tracking Data	Nicor Gas and ComEd	January 30, 2019
Illinois TRM Update Research Findings	Evaluation	March 1, 2019
Internal Report Draft by Navigant	Evaluation	March 1, 2019
Draft Report to Nicor Gas, ComEd, and SAG	Evaluation	March 5, 2019
Comments on draft (15 Business Days)	Nicor Gas, ComEd, and SAG	March 26, 2019
Revised Draft by Navigant	Evaluation	April 3, 2019
Comments on redraft (5 Business Days)	Nicor Gas, ComEd, and SAG	April 10, 2019
Final Report to Nicor Gas, ComEd, and SAG	Evaluation	April 19, 2019

**ComEd Weatherization Rebates Program CY2018 to CY2021 Evaluation Plan**

**Introduction**

The Weatherization Rebates Program offers incentives for the installation of qualifying weatherization improvements such as attic and wall insulation, and air and duct sealing. The weatherization rebates are instant rebates that are applied to the customer invoice by a participating contractor. Contractors must have certain credentials (for example, analyst or envelope professional certification from Building Performance Institute, specific insurance thresholds, and one-on-one training on program implementation with a program specialist) and a signed agreement with the implementer for their weatherization project to be eligible for a rebate.

Notable program changes made from PY9 to CY2018 include combining the implementation of the program from two implementation contractors into one to ensure program consistency across the ComEd service territory. In the previous cycle, CLEAResult implemented the program in the portion of ComEd service territory that is served by Nicor Gas, and Franklin Energy implemented the program in the portion served by Peoples Gas and North Shore Gas. In CY2018, Franklin Energy implements the program throughout the ComEd service territory. The program continues to be jointly delivered with the gas utilities.

The primary objectives of the evaluation of the ComEd Weatherization Rebates Program are to: (1) determine gross and net program savings and (2) examine the effectiveness of program processes in achieving savings.

The CY2018 gross impact evaluation will not vary significantly from the previous years, but adjustments will be made to reflect specific measure and project characterizations. The evaluation will include a participating customer free ridership and spillover study in CY2018. The findings from the study will inform recommended net-to-gross (NTG) values for the Illinois Stakeholder Advisory Group (SAG) approval and future program application. The CY2018 NTG study will include surveys with participating customers to learn about their perspectives and satisfaction with the program, incentive offerings, screening questions regarding potential non-energy impacts, and how to improve the program in the future.

The evaluation of this program over the coming four years will include a variety of data collection and analysis activities, including those indicated in the following table.

**Table 1. Evaluation Approaches – Four Year Plan**

Tasks	CY2018	CY2019	CY2020	CY2021
Tracking System Review	X	X	X	X
Data Collection – Participant Surveys	X			X
Data Collection – Program Manager and Implementer Interviews	X	X	X	X
Data Collection – Trade Ally Surveys	X			X
Impact – Measure-Level Deemed Savings Review	X	X	X	X
Impact – Verification & Gross Realization Rate	X	X	X	X
Net-to-Gross – Customer Self-Report Surveys	X			X
Net-to-Gross – Trade Ally Surveys	X			X
Process Analysis	X			X

The evaluation team determined the evaluation approach for the 2018-2021 period based upon the needs of the program and program's history. The 4-year evaluation approach for this program is based on the following:

- Annual gross and net impact analysis
- NTG research on free ridership and spillover will be conducted twice during the planning cycle, in the first and last years
- NTG research on free ridership will be conducted throughout each year of NTG research, real-time, using an online survey whose link is sent to a random sample of participants monthly
- NTG research on spillover will be conducted in a survey administered after the end of the program year each year of NTG research
- Process analysis will be conducted in the first and last years of the planning cycle based upon questions included in the online free ridership survey
- Interviews with participating trade allies will be conducted in the first and last year to seek opportunities to improve program processes and expand program savings

### Coordination

Navigant will coordinate with the evaluation teams from other utilities on any issues relevant to this program, including coordinating with evaluation teams for Ameren and the gas utilities on survey instruments for NTG research on participating customer free ridership and spillover as well as on survey instruments, samples, and administration for NTG and process research on participating trade allies.

### Evaluation Research Topics

The evaluation will seek to answer the following key researchable questions:

#### Impact Evaluation

1. What are the program's verified gross savings?
2. What are the program's verified net savings?
3. What is the researched value for net-to-gross (NTG) ratio?
4. What updates are recommended for the Illinois Technical Reference Manual (TRM)?

#### Process Evaluation and Other Research Topics

The process evaluation effort for CY2018 will focus on program delivery. The process research will address the following questions:

1. How did customers become aware of the program?
2. What is the level of participant satisfaction with the program?
3. What is the level of satisfaction with the program amongst participating trade allies?
4. What marketing strategies could boost program awareness?
5. What opportunities exist for program improvement?

## Evaluation Approach

The table below summarizes the evaluation tasks for CY2018 including data collection methods, data sources, timing, and targeted sample sizes that will be used to answer the evaluation research questions.

Evaluation activities will include phone-based participant surveys intended to estimate spillover (SO) and to collect information to inform a process evaluation. The evaluation will also consist of participant and trade ally online surveys intended to inform a process evaluation and collect NTG information, including free ridership and spillover analysis questions.

We have prepared an evaluation plan summary to identify tasks on a preliminary basis (Table 2). Final activities will be determined annually as program detail and requirements become known.

**Table 2. Evaluation Plan Summary**

Activity	CY2018
Gross Impact Approach	Measure-Level Deemed Savings Review
Gross Sampling Frequency	One Interim Review & One Final Review -- Census
Verified Net Impact Approach	Deemed Value
Researched NTG Approach	Participant Survey*: FR real time, SO end of year Trade Ally Survey†: FR and NPSO end of year
Researched NTG Timing	CY2018 Participating customers and trade allies
Program Manager and Implementer Interviews/ Review Materials	Yes

\* FR refers to free ridership and SO refers to spillover

† NPSO refers to nonparticipant spillover

Table 3 below summarizes the proposed data collection activities for CY2018 including the sample sizes and timing of each activity.

**Table 3. Core Data Collection Activities, Sample, and Analysis**

Activity	Target	Target Completes CY2018	Timeline	Notes
Tracking System Review	Tracking system	Census	One interim and one final*	
In Depth Interviews	Program Management and Implementers	2	April – Dec 2018	Augment with monthly calls
Gross Impact	TRM Review	Census	One interim and one final	
Verified Net Impact	Calculation using deemed NTG ratio	NA	March 2019	
Researched NTG and Process	Surveys with Participating Customers	70 per month for FR, 100 for SO	Real time for FR, end of year for SO	
Researched NTG and Process	Survey with Participating Trade Allies	75	End of year	

Note: FR = Free Ridership; SO = Spillover

\* Navigant will coordinate with ComEd to determine appropriate dates to pull tracking data extracts for each wave.

The primary data collection activities for CY2018 will consist of surveys with participating customers and trade allies to assess the effectiveness of the program processes as well as free ridership and spillover. We will conduct NTG research on free ridership in real time with an online survey of participants. Research on participant spillover will be conducted with participating customers through a telephone survey at the end of the year. Research on nonparticipant spillover will be conducted with participating trade allies through an online survey also at the end of the year.

In line with program changes and accelerated evaluation schedule for delivering tracking data to the evaluation team, Navigant will perform an interim tracking system review in the summer of 2018.

**Gross Impact Evaluation**

The gross impact analysis will include a review of deemed savings estimates for all measures in the program. All program measures will be reviewed for compliance with the Illinois TRM and identify the changes necessary to meet TRM compliance. Navigant will document how the deemed measures differ from ComEd’s existing planning or ex ante tracking estimates and provide guidance as to how these differences will impact ComEd’s programs. For new measures, Navigant will perform a desk review of program calculations and compare savings to the Illinois TRM.

**Verified Net Impact Evaluation**

The verified net impact evaluation will apply the net-to-gross (NTG) ratio accepted by Illinois Stakeholders Advisory Group (SAG) consensus to estimate the verified net savings for the program.

**Table 4. Deemed NTG Values for CY2018**

Program Measure	CY2018 Deemed NTG Value
Weatherization	1.01

Source:  
[http://ilsagfiles.org/SAG\\_files/NTG/2017\\_NTG\\_Meetings/Final/ComEd\\_NTG\\_History\\_and\\_PY10\\_Recommendations\\_2017-03-01.xlsx](http://ilsagfiles.org/SAG_files/NTG/2017_NTG_Meetings/Final/ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.xlsx)

**Research NTG Impact Evaluation**

The evaluation will conduct NTG research in CY2018 on free ridership, spillover, and nonparticipant spillover to inform NTG recommendations for future use. For free ridership, the NTG analysis will use data collected from participant online surveys conducted throughout the year. For participant spillover and nonparticipant spillover, the NTG analysis will use data collected from participant telephone surveys and participating trade ally online surveys, respectively, near the end of the year.

**Calculation of CPAS and Annual Savings**

As required by the Future Energy Jobs Act (FEJA), Navigant will report ex post gross and ex post net savings for the program and the cumulative persisting annual savings (CPAS) in CY2018 will be calculated along with the total CPAS. Additionally, the weighted average measure life will be estimated, if possible. Evaluation will also add the savings converted from gas savings to the electric savings so that it’s documented in the report.

### Process Evaluation

The process evaluation research will include a synthesis of both qualitative and quantitative data collected from the program staff and implementer interviews and from the participating customer and trade ally surveys in CY2018.

The process evaluation will (1) determine participant satisfaction with the program overall and key program elements and (2) assess the effectiveness of various program elements, such as incentive levels, marketing procedures, application processes, and participation procedures. A battery of process questions will be included in the surveys with participating customers. The process findings will be summarized in detail and a set of key findings and recommendations will be developed for ComEd's consideration.

### *Use of Randomized Controlled Trial and Quasi-experimental Design*

We are not evaluating the Weatherization Rebates program via a randomized controlled trial because the program was not designed with randomly assigned treatment and control groups. We are not using quasi-experimental consumption data because there are not enough participants in this program to achieve statistically significant savings estimates using this method.

### Evaluation Schedule

Table 5 below provides the schedule for key deliverables and data transfer activities. (See Table 3 for other schedule details.) Adjustments will be made, as needed, as evaluation activities progress.

**Table 5. Schedule – Key Deadlines**

Activity or Deliverable	Responsible Party	Date Delivered
Program Operations Manual and Workpapers	ComEd	February 16, 2018
Participating customer NTG-FR and process survey fielding	Evaluation	March 30, 2018
CY2018 program tracking data for Wave 1 Data Review and Analysis	ComEd	June 1, 2018
Quarterly FR Analysis Findings	Evaluation	June 29, 2018
Tracking System Wave 1 Ex Ante Review Findings and Recommendations	Evaluation	July 30, 2018
Quarterly FR Analysis Findings	Evaluation	September 28, 2018
Participating customer and trade ally NTG-SO and process survey fielding	Evaluation	November 1, 2018
EUL Research Memo	Evaluation	December 15, 2018
Quarterly FR Analysis Findings	Evaluation	December 20, 2018
CY2018 Tracking Data is final	ComEd	January 30, 2019
Final TRM review	Evaluation	February 28, 2019
Process Analysis Findings	Evaluation	January 31, 2019
Internal Report Draft by Navigant	Evaluation	February 15, 2019
Draft Report to ComEd and SAG	Evaluation	February 25, 2019
Comments on draft (15 Business Days)	ComEd and SAG	March 18, 2019
Revised Draft by Navigant	Evaluation	March 26, 2019
Comments on redraft (5 Business Days)	ComEd and SAG	April 2, 2019
Final Report to ComEd and SAG	Evaluation	April 15, 2019
NTG Analysis Findings	Evaluation	June 31, 2019