



ComEd CY2023-CY2025 Evaluation Plan

FINAL

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ComEd**

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1. Introduction

This document outlines the high-level plan for Guidehouse's evaluation of ComEd's Plan 6 CY2022-CY2025 program cycle. Guidehouse edited the plan from the CY2022 version to update activities that have changed. The evaluation's goals include the following:

- **Evaluation, measurement, and verification (EM&V) of energy efficiency programs.** Plan 6 program evaluations will meet the requirements of the Climate and Equitable Jobs Act (CEJA), the Future Energy Jobs Act (FEJA), and Section 8-103B(g)(6) of the Illinois Public Utilities Act (PUA), which states the utility shall provide for an annual independent evaluation of the performance of the cost-effectiveness of the utility's portfolio of programs, a review of the 4-year results of the broader net program impacts, and adjustment of the measures on a going forward basis as a result of the evaluations. Our general approach to this work 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 programs and those undergoing significant changes without over-evaluating any energy efficiency program. For example, for programs whose recent net-to-gross (NTG) ratios have been relatively consistent over time, we propose conducting one or two NTG evaluations over the 4-year program cycle instead of doing annual NTG analysis. Using this approach, funds will be available and prioritized for evaluation research to improve program performance and savings. We plan to work with government and public interest parties including the Illinois Stakeholder Advisory Group (SAG) and the Illinois Commerce Commission (ICC) Staff 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 energy efficiency programs, pilots, and processes.** As needed, 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.

This document is structured as follows.

- Section 2 discusses the overall schedule governing most individual evaluation efforts.
- Section 3 covers evaluation activities that cut across programs.
- Section 4 defines the main approaches we take to evaluating individual programs and pilots. This is a reference section that provides detail on evaluation approaches referenced in the individual program and pilot plans so that definitions are included once in this document instead of repeatedly throughout the individual plans.

The program-specific and pilot-specific impact evaluation plans are presented in a series of appendices. The program- and pilot-specific plans provide an overview of key evaluation activities plus the 4-year timeline for those activities. Once ComEd and stakeholders agree to these key activities, Guidehouse will create detailed schedules for components of each activity and share those with interested parties. For programs or pilots where there are detailed nuances to the evaluation design or analysis approach that would benefit from stakeholder input, Guidehouse will prepare memos to lay out those nuances.

2. Schedule

ComEd will provide final data by January 30 of each year.¹ Guidehouse will deliver the final first draft of the program-specific impact reports by March 15 of each year; the final reports, including the summary report, will be delivered by April 30. Reviewers will be given 15 business days to review the first draft of the program-specific impact reports and 5 business days to review the second draft.

The draft cost-effectiveness report will be delivered by June 1 and the final by June 30.

Program-specific free ridership results will be delivered in draft memos as the research is completed. The evaluation team will use best efforts to deliver all memos by August 1 of each year. The evaluation team will deliver the complete set of draft NTG ratios to SAG by September 1 of each year and the final recommended values by October 1.

All other research activities will follow a schedule unique to the activity.

Guidehouse will build detailed schedules for each evaluation activity and share them with ComEd and any interested parties once this plan is approved.

¹ For Voltage Optimization, data through the end of the evaluation year will be delivered by January 30 but the evaluation will also use data from the month of January following the evaluation year. This data will be delivered by February 15.

3. Cross-Cutting Components

This section covers evaluation activities that cut across programs.

3.1 Annual Summary Report

Guidehouse will produce an annual summary report providing a program-by-program and portfolio-level summary of key impact evaluation results. The report will consist mostly of tables and figures illustrating the energy and demand impacts produced from the ComEd programs. The tables will include the following:

- Ex post savings template tables agreed to by the SAG, which will be provided in the summary report and in an accompanying spreadsheet
- Portfolio total and program-specific ex ante gross, verified gross, and verified net savings for energy and peak demand
- Savings by sector (Residential, Business, and Pilots) and specific to Income Eligible participants
- Savings spread over time based on measure-specific effective useful life (EUL) and the calculation of cumulative persisting annual savings (CPAS)
- Savings from energy efficient electrification, secondary water savings, and carryover savings, while accounting for potential adjustment from electric heating penalties
- Calculation of the weighted average measure life (WAML)
- Fuels other than electricity and water-related energy savings converted to electricity in total and the amount that ComEd can claim
- Estimation of the portfolio Applicable Annual Total Savings (AATS) achieved
- Savings by end-use type (broad measure categories such as lighting, HVAC, refrigeration, etc.)
- Table listing the high impact measures (those with the largest savings across the portfolio)
- Program costs

3.2 4-Year Summary Report

In 2026, Guidehouse will provide a report that summarizes savings across the 4 years of Plan 6. It will provide a summary of portfolio-level results for verified CPAS, peak demand reduction, and WAML. It will also summarize the total resource cost (TRC) results from each year.

3.3 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:

- Develop a cost model reflecting ComEd’s costs by program
- Evaluate the assumptions provided by ComEd and included in Guidehouse’s cost model
- After agreement on the cost model and inputs, develop the TRCs for each program
- Provide a report with any recommended improvements and comments on the costs and the resulting TRCs

The final TRCs are used to validate the statutory requirement and in the related ICC proceeding to show that ComEd’s portfolio has adhered to state law and regulations. As part of Guidehouse’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 Peoples Gas and North Shore Gas companies. The joint TRC calculations will be completed after each utility completes its relevant cost-effectiveness analysis; the joint analysis will focus on the joint programs between the companies.

Guidehouse will calculate program and portfolio TRCs, which will include monetized non-energy impacts (NEIs). In addition, we will develop a 4-year TRC report to summarize the 4-year cycle and provide an overview of CY2022-CY2025 including final 4-year TRCs for each program and the portfolio. The 4-year report will also include findings for each calendar year by program.

We anticipate the TRC assumptions review will support EM&V and regulatory reporting objectives for ComEd and will also inform future ComEd planning efforts. The evaluation team will work with ComEd to establish that the appropriate 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. For programs that are jointly implemented by ComEd and one or more Illinois gas utilities (including Nicor Gas, Peoples Gas, and North Shore Gas), only the electric portion of the program savings and cost-benefit calculations will be included. The combined joint calculations for the joint programs will be included in a separate memo attached as an appendix to the report.

Guidehouse will comply with the Illinois Energy Efficiency Policy Manual v2.0, Section 8, or any other future relevant Policy Manual sections. The Illinois TRC test is defined in the Illinois Power Agency Act (see 20 ILCS 3855/1 – 10) 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.²

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 (GHGs) and the use of the societal discount rate. These differences add an additional benefit to investments in efficiency programs that are typically included in the societal cost test in other jurisdictions.

3.3.1 Illinois TRC Equation

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

Equation 3-1. Illinois TRC

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

Where,

BCR_{ILTRC}	=	Benefit-cost ratio of the Illinois TRC test
B_{ILTRC}	=	Present value of benefits of an Illinois program or portfolio
C_{ILTRC}	=	Present value of costs of an Illinois program or portfolio

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

Equation 3-2. Illinois TRC Benefits

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

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

Equation 3-3. Illinois TRC Costs

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

Where benefits are defined as:

UAEP _t =	Utility avoided electric production costs in year t
UATD _t =	Utility avoided transmission and distribution costs in year t

² See Sections 1-10, Definitions of the Illinois Power Agency Act:
<http://www.ilga.gov/legislation/ilcs/ilcs5.asp?ActID=2934&ChapterID=5>

UAA_t = Utility avoided ancillary costs in year t
 EB_t = Environmental benefits in year t
 UAC_{at} = Utility avoided supply costs for the alternate fuel in year t
 RC_t = Replacement costs of incandescent equivalents in year t
 SNEI_t = Societal NEI in year t
 And costs are defined as:

PNIC_t = Program non-incentive costs in year t
 IMCN_t = Net incremental costs in year t
 UICT = Utility increased supply costs in year t
 d = Societal discount rate

3.3.2 Utility Cost Test Equation

The utility cost test (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 TRC, with a few key changes. Because 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, because 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 TRC equation, the UCT equation that will be used is defined as follows:

Equation 3-4. UCT

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

Where,

BCR_{UCT} = Benefit-cost ratio of the UCT
B_{UCT} = Present value of benefits to a utility of a program or portfolio
C_{UCT} = Present value of costs to a utility of a program or portfolio

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

Equation 3-5. 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 3-6. UCT Costs

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

Where the new term, PIN_t , is defined as the program incentives provided by the utility in year t .

3.3.3 Cost-Effectiveness Data Requirements

The data points needed to conduct the TRC test are provided in Table 3-1 and are divided into generic and program-specific categories. The program-specific data points are further subdivided into those provided by ComEd versus those that are a result of Guidehouse's evaluation activities.

Table 3-1. Data Points Needed to Conduct Cost-Effectiveness Analyses

Category	Data Point	Source
Generic	• Avoided energy costs (\$/kWh)	ComEd and relevant joint program gas company costs
	• Avoided capacity costs (\$/kW-year)	
	• Avoided T&D electric (\$/kWh)	
	• Avoided gas production (\$/Therm)	
	• Discount rate	
	• Escalation rates	
	• Avoided GHG emission costs	
Program-Specific	• Participants / measure count	Guidehouse and relevant joint program gas company costs
	• Verified ex post energy savings (kWh)	
	• Verified ex post capacity savings (kW)	
	• Realization rate	
	• NTG ratio	
	• Measure life	
	• Incremental measure costs	
	• NPV replacement costs	
	• Societal NEI benefit (\$/kWh)	
	• Non-incentive costs	
• Utility incentive costs		
• Direct install costs		
• Incremental measure costs		

Source: Guidehouse analysis

Our cost model will build up from the measure-level 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 to arrive at final program TRCs and finalize a portfolio-level TRC.

3.3.4 Custom Program Cost Method

Custom programs may contain a mix of retrofit and replace-on-burnout measures in one project or across projects. In most cases, the project invoices will contain full costs of installations and maybe additional non-energy-related costs. Because the program does not require the

implementer (or the installation contractor) to do a detailed incremental cost analysis for each measure installed or a detailed line-item invoice as a part of the program, the fully encumbered project costs tracked for the program will not represent the true incremental cost.

The savings calculation for replace-on-burnout measures will be incremental to the standard (industry standard practices or equipment code baseline efficiency). The incremental cost calculations will vary for each project as there is no common approach that can be applied to all Custom projects. Guidehouse is recommending doing a preliminary TRC test using the actual project costs, which would lead to a conservatively low TRC value because the actual project costs will either be equal or greater than the incremental measure costs. Guidehouse only recommends a detailed incremental cost analysis for a sample of projects in the program to develop a program-level incremental cost estimate (\$/kWh) or if the program fails the initial TRC test performed using the conservative cost assumptions.

Therefore, for the Custom programs (i.e., Industrial Systems, Custom, Retrocommissioning), we recommend the following steps for assessing appropriate measure costs for a program:

1. Use the documented invoices for the program's measure costs
2. Calculate the TRC
3. If the TRC is less than 1.0, then:³
 - a. Sample project invoices and project measures to reassess if the cost represents incremental or other services
 - b. Calculate the \$/kWh saved for all projects and troubleshoot the high and low values for reasonableness

As a result, the overall documented measure costs should be aligned with the Illinois Energy Efficiency Policy Manual guidance and result in a more accurate assessment of the cost-effectiveness.

3.3.5 Evaluation Schedule

Guidehouse will strive to provide timely delivery of the results outlined above, but all are contingent on ComEd delivering timely cost detail and proper backup assumption detail to the evaluation team.

³ There may be a need to do further analysis even if the program TRC exceeds 1.0. If the overall portfolio is not cost-effective, a deeper review of the custom programs may be necessary to help bolster the portfolio.

Table 3-2. Evaluation Research Tasks – Cost Analyses

Research Task	Description	2022	2023	2024	2025
Annual ComEd cost-effectiveness analysis and report	Analyze costs and benefits associated with the TRCs and UCTs. Produce draft and final results.	✓	✓	✓	✓
Annual joint utility cost-effectiveness analysis and report	Analyze costs and benefits associated with the TRCs and UCTs for programs jointly offered by ComEd and gas utilities. Produce draft and final results.	✓	✓	✓	✓

3.4 Cross-Cutting Research

Cross-cutting evaluation research includes initiatives that contribute toward calculating CPAS, such as EUL and measure persistence research, NTG research, NEI research, and working with the SAG and the TRM administrator to update the TRM. Evaluation research is coordinated statewide with the evaluators for Ameren Illinois, Nicor Gas, Peoples Gas, and North Shore Gas. A list of current activities is included in Table 3-3 below.

3.4.1 Illinois TRM Measure Updates

All evaluators in Illinois, including Guidehouse, are part of the Illinois SAG Technical Advisory Committee (TAC) and are charged with providing materials to continually update and improve the TRM to provide the most accurate input parameter assumptions and impact evaluation methodology. We will continue to participate in the TAC proceedings in Plan 6 and be involved with TRM working groups as applicable.

The goal of TRM measure updates process is to improve TRM input parameter assumptions and formulas. Each year, Guidehouse reviews current TRM measures and priority recommendations from the TAC to inform updates 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 addition, we may develop research for high priority measures identified by the TRM subcommittee and measures with high portfolio impact or outdated references. The evaluation team plans to revisit this list on an ongoing basis as, for example, the SAG releases new updates on TRM research priorities and the ComEd portfolio measure mix shifts over time. This ongoing review will enable Guidehouse's participation to focus on the most important topics for ComEd and SAG stakeholders.

As new measures are proposed to the TRM, Guidehouse will conduct secondary research in coordination with the TRM administrator to determine whether the measure has been evaluated in other locations (e.g., reviewing TRMs from other states). Working with stakeholders, we will analyze a range of savings values for a particular measure if such values are known.

3.4.2 NEI Research

In CY2023-CY2025, Guidehouse will continue NEI research to quantify and monetize NEIs associated with income eligible and non-income eligible programs. We will complete the

participant NEI research associated with several income eligible programs and include the monetized results in the TRC values for those programs. Annually, we will conduct societal NEI analysis to include in the cost-effectiveness report, and economic and employment analysis to report results in a memo to ComEd and ICC. We will also provide updates via SAG NEI Working Group meetings. We will continue the process of including the monetized NEIs in the TRM or Policy Manual.

3.4.3 Evaluation Research Activities

The purpose of evaluation research is to inform updates to the TRM or to ComEd’s go-to-market strategies for increasing program participation. Table 3-3 summarizes evaluation research tasks underway or in the planning stages. The evaluation team will revisit this list on an ongoing basis as, for example, the SAG releases new updates on TRM research priorities and the ComEd portfolio measure mix shifts over time. This regular review will enable Guidehouse’s research to focus on the most important topics for ComEd’s evaluation and SAG stakeholders. Guidehouse has included existing research plans in Appendix E. New research plans will be developed over the course of Plan 6 as new needs arise.

Table 3-3. Cross-Cutting Evaluation Research

Research Task	Description	2023	2024	2025
Income Eligible Program Participant NEIs	Research to estimate participant (residents and multifamily building owner and operators) NEIs from income eligible program measures to include in annual cost-effectiveness tests	✓	✓	
Societal NEIs	Conduct analysis to estimate societal NEIs associated with ComEd’s portfolio to include in annual cost-effectiveness test results	✓	✓	✓
Economic and Employment NEIs	Conduct analysis to estimate economic and employment NEIs associated with ComEd’s portfolio	✓	✓	✓
Compressed Air Leak Repair EUL	Research to estimate the EUL for compressed air leak repair	✓	✓	
Business Energy Analyzer EUL	Research to estimate EUL for participants engaged with ComEd’s Business Energy Analyzer platform	✓		

3.5 PJM Reporting

Guidehouse will support ComEd’s annual portfolio capacity resource reporting to PJM. This support includes compiling the PJM-compliant peak demand reductions from ComEd’s portfolio, transforming the data to match PJM’s reporting requirements, applying current year evaluation factors to the data, and preparing the updated reports for PJM. Each task will reference and be consistent with PJM’s Manual 18b. The Guidehouse PJM team may also advise ComEd on PJM compliance-related matters, including measure eligibility and the measurement and verification (M&V) activities required for PJM compliance. We will host weekly or biweekly conference calls with ComEd during the reporting season, which typically runs from January through July. We will also participate in calls with PJM, as requested by ComEd.

Guidehouse will deliver two reports for each season of PJM reporting. The first report is the Post-Installation M&V Report, which documents ComEd's energy efficiency capacity resource for the past 4 years. This report is due 15 business days prior to start of the delivery year, which occurs every June 1. The second report is the M&V Plan, which documents ComEd's projections of its energy efficiency capacity resource for the four installation periods covered by the current year's Base Residual Auction (BRA). This report is due 30 days before the auction, the date of which varies each year. Both documents will be consistent with the reporting requirements of PJM's Manual 18b.

4. Evaluation Approaches

This section describes M&V methods Guidehouse will use to evaluate ComEd's Plan 6 programs. This section details the evaluation approaches referenced in individual program plans in the appendices so that we include definitions once in this document instead of repeatedly throughout the individual plans. Guidehouse will create annual evaluation reports for each program to deliver verified net savings using the appropriate mixture of these methods. For programs or pilots where there are detailed nuances to the evaluation design or analysis approach described in this section that would benefit from stakeholder input, Guidehouse will prepare memos to lay out those nuances.

4.1.1 ComEd Staff and Implementer Interviews

Guidehouse will conduct in-depth interviews with program managers and implementation contractors to understand current program design and status as well as the program's future plans. While the audiences and research topics for these interviews will vary by year, program, component, and engagement pathway, the evaluation team will adhere to a cross-cutting best practice framework for in-depth interview implementation delivering portfolio consistency. This will provide team members with a solid understanding of the program to inform evaluation activities.

4.1.2 Sampling

For some programs, the evaluation team will conduct its M&V work on a sample of projects. Sampling allows us to use knowledge from a few constituents of a population to make an inference regarding the entire population. By reducing the number of projects evaluated, limited evaluation resources can be re-focused on increasing the M&V rigor for the sampled projects. This approach optimally balances the need for statistical certainty against inherent measurement uncertainties.

4.1.3 Impact Evaluation

The impact evaluation determines verified energy and demand savings for each program component using methods that align with the TRM, the Policy Manual, the requirements of the CEJA, Revised Stipulation Agreement (February 28, 2022), Section 8-103B of the Illinois PUA, and the International Performance Measurement and Verification Protocol (IPMVP).⁴ Once results are confirmed as final for each component, the evaluation team will conduct rollup calculations to compile program- and portfolio-level verified savings. Guidehouse will document and deliver these impact evaluation results according to the established reporting requirements.

The evaluation team also calculates gross savings realization rates to adjust ex ante savings based on verified gross savings estimates. The realization rate is defined as the percentage of ex ante gross savings achieved as determined through the independent evaluation review. A realization rate of 1.0, or 100%, indicates no difference between the ex ante gross and verified gross savings for a particular measure. Realization rates are determined by certain attributes relative to one of three measure types.

⁴ International Performance Measurement & Verification Protocol (IPMVP): <https://www.nrel.gov/docs/fy02osti/31505.pdf>

- **Deemed measures** have fully stipulated energy and demand savings in the TRM. For deemed measures, realization rates are driven primarily by differences in the number of installed measures and by errors in the ex ante savings calculations and assumptions.
- **Partially deemed measure**⁵ realization rates are driven by differences in the installation rate and differences in the open variable inputs as specified in the TRM.
- **Custom measure** realization rates are driven by differences in the installation rate, equipment capacity and efficiency, and equipment operating profile as determined by the evaluation team as it examines all input assumptions and calculations.

The remainder of this section discusses details for specific aspects of the impact evaluation. The evaluation of any given ComEd program will include some but not all of these approaches. Refer to the appendices for plans specifying each program's approaches.

4.1.3.1 eTRM Savings Calculator and Workpaper Review

Guidehouse will conduct an annual review of ComEd's eTRM savings calculator tool and measure workpapers. ComEd will calculate prescriptive measure savings through the new eTRM software package starting in CY2023. Guidehouse will support ComEd's transition through shifting the annual Savings Calculator and Workpaper Review to an annual eTRM Savings Calculator and Workpaper Review. The eTRM savings calculator review will generally occur before the beginning of each program year to provide feedback to ComEd and the implementation team ahead of rolling out program changes. For CY2023, the evaluation team will review the eTRM savings algorithms for IL TRM v11 and:

- Confirm the implementation team is using and collecting the data points needed to calculate savings.
- Confirm the eTRM savings algorithms used to calculate and report savings align with the TRM algorithms that will be applied to verify savings.

Savings calculation review of different measure permutations (such as sizes, efficiencies, capacities, etc.) will be integrated into the wave and end of year evaluations.

We plan to provide eTRM calculator feedback as soon as possible per a schedule developed to support this effort.

Guidehouse has planned for the following:

- ComEd will provide Guidehouse training and access to the eTRM code, data dictionary, algorithms, assumptions, and input values
- ComEd will provide example database savings outputs for Guidehouse review
- Guidehouse will compare reported database savings outputs to either R-coded or manual savings calculations, identify and provide recommendations to rectify discrepancies
- It is common to expect measure updates, potential changes in the TRM, TRM Errata, policy and regulatory updates during the program year. Guidehouse expects ComEd and

⁵ TRM measures with both stipulated values and open variables.

the implementer to document these changes in eTRM and any supporting review document and request evaluator review of these updates to ensure the program assumptions are current.

To support and successfully complete eTRM measure review, the evaluation team requests ComEd provide:

- List of eTRM measures mapped to CY2023 programs.
- Clearly identify measures that are not in the eTRM and will need a manual workpaper review.
- Clearly document the average/custom assumption value used in the eTRM in case the implementer is unable to collect the data.
- Tag eTRM measures to indicate the TRM version in use.
- Maintain a measure tracker to identify status and date last edit for each eTRM measure.

4.1.3.2 Program Tracking Data Review

The evaluation team will conduct a tracking database analysis of the gross ex ante savings for all measures included in the tracking system. The data review establishes that the fields provided in the tracking data are sufficient for the team to calculate savings for the targeted measures and the fields contain data within expected parameters. This analysis will serve as an initial step for all verification activities.

The tracking system review for programs that are largely based on measures in the TRM will verify approaches, algorithms, and assumptions used to estimate ex ante gross savings at the measure level.

The tracking system review for programs that have custom savings calculations will concentrate on establishing the data is complete and provides the data needed to support accurate program and evaluation calculation of savings. This effort will typically not include checking the accuracy of the ex ante savings estimates as that work is done through other methods discussed in other sections in this plan.

In instances where the previous year's realization rate is applied to reported savings, the evaluation team will confirm the program tracking data is consistent with the previous year and calculate verified net savings applying the previous year's realization rate to the Program Tracking Data Review results. If the program tracking data is inconsistent (for example, due to a substantial savings calculation change or new measure added to the program) the evaluation team may adjust the plan to re-evaluate the identified discrepancy (at the measure, end use, or program level, as appropriate based on the program and portfolio savings impact).

4.1.3.3 Measure-Level Deemed Savings Review

Guidehouse will conduct a measure-level deemed savings review for all sampled measures and projects with project-specific documentation.

Core review activities will include the following:

- Engineering examination of ComEd workpapers and tracking system calculations of claimed savings.
- Engineering review of measure-level project documentation 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 confirm deemed input values.

The gross savings impact approach will review the ex ante measure type to determine whether it is covered by the TRM or 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:
 - Verified gross savings will be 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.⁶
- Measures with custom or partially deemed savings values:
 - Ex ante savings inputs 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.

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.

4.1.3.4 Custom Savings Review

Guidehouse will use custom analysis to verify savings estimates for programs whose measures are not covered by the TRM, particularly for programs with complex projects and large savings impacts but also covering programs with smaller projects whose savings are by nature not amenable for inclusion in the TRM. The custom analysis may take several forms, which are covered in this section. The evaluation for any given program or project will not necessarily include all of the methods described in this section. Rather, the approaches will be tailored to the specifics of the program, project, and data available.

The evaluation team will verify custom measure savings estimates with an approach grounded in site-specific data using engineering models and analyses. Core activities will include the following:

⁶ Illinois Statewide Technical Reference Manual for Energy Efficiency Version 10.0, available at: <http://www.ilsag.info/technical-reference-manual.html>

- Request and collect pre-metering and post-installation interval data from the program implementers for the sampled projects, if available. 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.
- Perform engineering desk reviews to complete the ex post analysis. Desk reviews involve review of project documentation provided by the program, an engineering review of the algorithms, and an audit of 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. 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.
- As needed, complete custom measure analysis with onsite verification visits or survey, phone, or virtual customer verification surveys. Evaluators will sample and select these projects for metering so that evaluation metering efforts can contribute significantly to developing ex post results.

A site-specific engineering analysis will be performed for the sampled 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. 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 onsite 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. Typically, 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 based on kWh savings to the program population using a ratio estimation approach to calculate program-level gross impact estimates. Any therm or water savings identified will be converted to kWh savings. Gross realization rates will be developed for energy and demand savings for the population.

Modeling

The ex ante and ex post savings for some programs and projects are calculated using modeling software that is typically created by external third parties. For example, building simulation models that calculate whole building energy consumption are commonly used for new construction projects. Where possible and appropriate, the evaluation will use the same modeling software used by the program to estimate savings. On occasion, the evaluation will choose different software when the program's software is proprietary or the evaluation concludes different software will produce a more accurate result.

The evaluation team will request data to verify or update the assumptions that feed into the energy model for each site. This data may include program tracking data and supporting documentation (project specifications, invoices, etc.), utility billing and interval data, building automation system trend logs, and production data. The evaluation will also look for evidence that major changes have occurred at the site during or after the program activities and will

incorporate them into the model. The changes that could affect the model savings include but are not limited to:

- Changes in hours of operation
- Changes in employees
- Changes in production
- Other measures installed at the site that were implemented through other utility energy efficiency or demand response programs or outside of ComEd.

Results from modeled project-specific results are rolled up to the population using the same methods described previously.

4.1.3.5 Survey, Phone, or Virtual Verification

The evaluation team will conduct online survey, phone, or virtual verifications for a sample of projects reviews to gather additional information and verify installation. The verification consists of interviewing customers about their project, including, as appropriate, the quantities and type of each measure installed, the operating status of the measures, equipment nameplate data, operating schedules, a careful description of site conditions, and overall verification of the information contained in the tracking system or project files.

We will recalculate project savings as informed by the customer's responses. In the case where a participant clearly states a reported measure was not installed or purchased or a different quantity was installed, the measure variable will be adjusted in accordance with the TRM. In the case where a customer confirms measures were installed but they are unsure of the specific quantity or product details (such as size or efficiency rating), the implementer's reported measure variables from the project documentation or the tracking database will be retained.

4.1.3.6 Onsite Verification

Onsite visits verify the installation and operation of installed measures within each sampled project. The specific verification activities confirm the measures' relevant parameters and assumptions sourced from the TRM or project documentation to calculate savings. Verification activities also confirm the presence of other equipment that interact with measures. Onsite verified variables will be used to calculate ex post savings in the case of a discrepancy between reported variables and onsite verified variables.

Prior to onsite verification, the evaluation team will create a site-specific M&V plan that specifies which data is required for verification and collection while onsite. Guidehouse will communicate the evaluation M&V approach to the implementation team before conducting the site visit. The data gathered onsite will be used to independently estimate verified gross savings based on the data collected, the requirements of the TRM, or the appropriate custom calculation methodology. Onsite verification is used in instances where virtual verification cannot obtain the same quality of data collection.

Onsite M&V will include participant interviews, baseline assessment, installed equipment verification, and performance measurement. Measurement may include spot measurements, runtime hour data logging, review of participant energy management system trend data, and post-installation interval metering. The evaluation team uses common meter types including

state (on/off), current, and power loggers to measure runtimes (e.g., lighting hours of use) or power consumption of equipment of interest (e.g., chillers or motors). Our approach to selecting M&V strategies follows the IPMVP; Option A or Option B is typically selected.

The COVID-19 pandemic may impact Guidehouse's ability to perform the full scope of onsite verification activities during each program year. The evaluation team will continue to confer with ComEd and Guidehouse field safety staff to determine the extent to which field verification visits are allowable and appropriate given pandemic-related travel and safety restrictions. Guidehouse will continue to prioritize onsite verification activities for sites with the highest savings, highest savings uncertainty, and where onsite verification would provide high value data that virtual verification or requests for customer supplemental trend or billing data cannot be reasonably obtained.

4.1.3.7 Population-Level Consumption Data Analysis

Guidehouse will conduct billing analyses for impact evaluation using econometrics-based methods. The evaluation team will use billing analysis when sufficient pre- or post-installation data is available, and the impact of the load is not lost as noise in the data. Using billing analysis facilitates accurate evaluation while keeping costs and customer fatigue low by reducing the need for onsite metering.

Specifically, we will validate the randomized control trial (RCT) for new Home Energy Report (HER) waves launched in the Behavior Program during Plan 6. The validation confirms the recipient and control groups within a wave have balanced usage in the 12 months prior to that wave's launch. If the two groups are comparable during this period within statistical reason, then the RCT is valid and the econometric analysis is also valid. The evaluation team will complete this process for all new waves prior to considering regression analysis.

To confirm savings are properly attributed, specifically for the HER component of the Behavior Program, the evaluation team will conduct an additional double counting analysis to adjust for participation in other energy efficiency programs. When participation in these other programs is affected by HER receipt, total savings is adjusted net of downstream program participation via the double counting analysis. Differences in participation rates in additional programs and deemed savings values determine the adjustment value for each wave.

Our approach to persistence calculations and estimating demand impacts will follow the IL-TRM.

4.1.3.8 Wave Impact Analysis

Guidehouse will perform assessments of program calculations, data, and impacts at predetermined intervals throughout the year. This wave impact analysis work is an opportunity for us to provide early program savings feedback to the implementation contractor and ComEd with ample time to discuss potential discrepancies and adjust prior to the end of the program year. To provide actionable and relevant feedback, wave impact analysis activities will be tailored to the needs of each program. Typically, the wave analysis will follow some or all of the steps that will be performed after the end of the year to calculate full program savings. The precise nature of those steps will vary by program.

The evaluation team will draft a memo detailing verified savings for measures with key findings and recommendations explaining any discrepancies.

4.1.3.9 Calculation of CPAS and Annual Savings

As required by FEJA and stipulations, each impact report will include a calculation of electric savings, gas savings, secondary savings from water, savings from electrification measures, total CPAS, and when relevant non-electric fuel savings. For measures that achieve gas savings, Guidehouse will convert gas savings to electric savings and include that in a calculation of total CPAS. The evaluation team will calculate the WAML for each measure and each program. The team will roll up the program-level CPAS results to the portfolio level when creating the summary report.

4.1.3.10 Net Savings Research

Deemed NTG ratios are determined in an annual SAG deliberation process documented in the Policy Manual.⁷ The evaluation team performs research on NTG values and proposes those to SAG for its annual deliberation.

Guidehouse will perform customer, provider, and market research to proposed free ridership, participant spillover, nonparticipant spillover, and NTG values for the SAG annual deliberation. For that research, we will follow the NTG protocols outlined in the Illinois TRM, which specifies survey designs (in broad terms) and calculation approaches (in a more detailed manner). When the TRM does not specify a protocol appropriate for a given program or when Guidehouse believes a protocol should be modified significantly to be appropriate for a given program, we will present proposed modifications to the statewide NTG Working Group for deliberation and approval.

The evaluation team will use survey methods appropriate for a given program and target, including online, phone, and in-person surveys. When appropriate, we will include interviews with program representatives and participating equipment vendors or influential facility assessment representatives to support the analysis. When appropriate, we include secondary research on standard industry practices.

Guidehouse will continue to participate in the NTG Working Group as it seeks to improve the TRM NTG methodologies. We will present the results of our research and facilitate working meetings to deliberate on translating our research results into specific improvements to the methodology. As in previous years, we will solicit other proposals for improvements from the NTG Working Group, facilitate discussions on these proposals, and manage the proposed updates to the TRM.

4.1.4 Process Evaluation

Process evaluations gather primary and secondary data to assess program performance or research opportunities to improve program performance. Per the Stipulation Agreement, income-qualified program components will have process evaluation activity during Plan 6. The process methodologies will vary depending on program design and customers served, as well as stakeholder input.

As with any multiyear evaluation, process evaluation research topics will continuously emerge throughout Plan 6. The methods and frequency Guidehouse will use to conduct the ongoing process evaluation research will vary depending on research goals, budget, timeline, and

⁷ Illinois Energy Efficiency Policy Manual available at <https://www.ilsag.info/policy/illinois-ee-policy-manual/>

sample availability. The evaluation team will seek to address the topics most relevant to ComEd staff and customers and to support continuous program improvement throughout Plan 6 for the:

- Portfolio as a whole
- Programs
- Components
- Engagement pathways

Throughout Plan 6, we will document ongoing process evaluation results that may have an impact on portfolio success in feedback memos to the ComEd program management team. Where appropriate, we will implement process evaluation research in tandem with the impact evaluation efforts to minimize respondent fatigue. At other times, the research will be done on its own timeline rather than being tied to the annual impact evaluation.

This section describes some of the process evaluation approaches Guidehouse expects to employ. These approaches include program materials review and surveys. Other methods may be appropriate for certain components, measures, or delivery channels and will be employed as needed.

4.1.4.1 Research Surveys

Participant, nonparticipant, and market actor surveys will be developed to explore experiences, participation motivators and barriers, and satisfaction with implementation services, measures, and incentives. Guidehouse will send all survey instruments to ComEd and any interested stakeholders for review ahead of fielding the survey.

4.1.4.2 Research Interviews

Guidehouse will conduct stakeholder interviews to gain in-depth insights in program participation barriers and motivators. Stakeholders may be program participants, energy efficiency service providers (EESPs), or representatives of a particular group of participants (for example, multifamily building managers). Subject matter experts may be included in interviews to represent a particular set of technical or implementation expertise to provide a more detailed understanding of the topic.

The evaluation team will send all data collection instruments to ComEd and relevant stakeholders for review.

Appendix A. Business Programs Evaluation Plans

As in Plan 5, ComEd is continuing to promote the portfolio under the banner of the ComEd Energy Efficiency Program during Plan 6. Starting with Plan 6, ComEd is approaching the portfolio with a more consolidated structure compared to Plan 5. The new consolidated structure accomplishes several objectives: it reduces duplication of programs and offerings; simplifies the suite of programs, making energy-saving opportunities easier for customers to navigate; and provides greater flexibility in managing the portfolio overall.

ComEd is continuing gas utility program coordination as part of Plan 6. Table A-1 shows the Business programs and gas utility coordination status.

Table A-1. Business Programs

Program	Gas Utility Coordination
Incentives – Custom	-
Incentives – Standard	-
Small Business	-
Targeted Systems - RetroCommissioning (RCx) component	Yes
Targeted Systems – Industrial Systems	-
Targeted Systems – Virtual Commissioning (VCx)	-
New Construction – Bus/Pub	Yes
Behavior Bus/Pub – Strategic Energy Management (SEM)	-
Assessments – Facility Assessments	-
Midstream/Upstream – Instant Discounts	-
Upstream Commercial Food Service Equipment	Yes

The following sections outline the program and program component-specific evaluation activities and the planned schedule.

A.1 Incentives – Custom

The Custom Program is a component of the Incentives Program, along with the Standard Program. Because the evaluation approach for these components differs, we have included them as separate sections in this plan. The Incentives – Custom Program provides custom incentives to commercial, industrial, and public sector customers for less common or more complex energy-saving measures that are not included in the Standard offering.

The evaluation of this program will include the activities shown in Table A-2.

Table A-2. Evaluation Activities, Custom

Category	Tasks	CY2022	CY2023	CY2024	CY2025
General	ComEd Staff Interview		X		X
General	Implementer Interview		X		X
Impact	Savings Calculator and Work Paper Review *	X	X	X	X
Impact	Program Tracking Data Review	X	X	X	X
Impact	Custom Savings Review	X	X	X	X
Impact	Survey, Phone, or Virtual Verification	X	X	X	X
Impact	Onsite Verification †	X	X	X	X
NTG	Net Savings Research – Customer Free Ridership Survey	X	X	X	X
NTG	Net Savings Research – Customer Spillover Survey	X	X	X	X

* The evaluation team will review any standardized calculators or workbooks that are used for Custom Program savings.

† Onsite surveys will be performed when deemed necessary.

The evaluation team will stratify the Custom Program’s population into three strata by ex ante gross savings. Based on the results from the previous years, the team used an error ratio of 0.3 for the population. With an assumed population of around 150, the team estimates that a sample size of 25 projects for CY2023 will meet the 90% confidence and 10% relative precision requirements.

The evaluation team made changes to the gross evaluation approach in CY2022 and those will be continued in CY2023. The main changes are noted below:

- The data center projects will not be sampled separately, and a combined sample will be drawn for the entire custom program.
- Early phased projects will be excluded from the evaluation sample and not extrapolated to the entire population. The evaluation team will review up to five early phased projects in detail and provide feedback to ComEd. Final-phased projects will be randomly sampled along with all other custom projects

For CY2023, the evaluation team will conduct interviews with the key ComEd staff and implementers to understand program goals and objectives, barriers to program participation, any potential changes to the program and new measures in consideration.

A.2 Incentives – Standard

The Standard Program is a component of the Incentives Program, along with the Custom Program. Because the evaluation approach for these components differs, we have included them as separate sections in this plan. As part of the Incentives Program,⁸ the Standard Program offers prescriptive financial incentives and a streamlined application to facilitate the implementation of energy efficiency improvements for non-residential (commercial, industrial, and public) customers and market segments through a program network of energy efficiency

⁸ The Incentives Program consists of the non-residential Standard and Custom Programs. The incentive structure is either on a standard per-unit basis as with most lighting measures or is custom with the incentive based on the calculated annual energy savings for the customer.

service providers (EESP). Starting in CY2022, Resource Innovations is the program implementation contractor.

Eligible measures include the following:

- Energy efficient indoor and outdoor lighting
- HVAC equipment
- Refrigeration
- Energy management systems (EMSs)
- Commercial kitchen equipment
- Variable speed drives (VSDs)
- Compressed air equipment
- Other qualifying products

The program also targets new system installation opportunities (e.g., networked lighting controls) by offering incentives that bundle equipment and controls technologies.

The evaluation of this program will include the activities shown in Table A-3.

Table A-3. Evaluation Activities, Standard

Category	Tasks	CY2022	CY2023	CY2024	CY2025
General	ComEd Staff Interview	X	X	X	X
General	Implementer Interview	X	X	X	X
Impact	Savings Calculator and Work Paper Review	X	X	X	X
Impact	Program Tracking Data Review	X	X	X	X
Impact	Measure-Level Deemed Savings Review	X	X	X	X
Impact	Engineering Desk Review & Impact Analysis	X	X	X	X
Impact	Survey, Phone, or Virtual Verification	X	X	X	X
Impact	Onsite Verification	X	X	X	X
NTG	Net Savings Research – Customer Free Ridership Survey			X	
NTG	Net Savings Research – Customer Spillover Survey			X	
NTG	Net Savings Research – Trade Ally Free Ridership Survey			X	
NTG	Net Savings Research – Trade Ally Spillover Survey			X	

Each year the Standard Program’s evaluation starts with a detailed review of the program tracking database and a measure-level review of deemed savings to confirm that the implementer and supplemental eTRACK processes have applied the correct Technical Reference Manual (TRM) methodology.

Net-to-gross (NTG) research is recommended for the Standard Program per the TRM’s guidance to update these values when significant changes to either the market or the program have occurred. At present, the lighting market and the program in general are rapidly changing. The planned NTG activities can be found in Table A-3. The “X” indicates the calendar year in which NTG recommendations will be made to be applicable the following program year.

During CY2023, the evaluation team will continue to use the same approach taken during CY2022.

- The evaluation will leverage a sample of projects broken down into three cohorts; EMS, lighting, and non-lighting measures.
- The evaluation team will conduct three waves of evaluation reviews. The first in June, the second in October, and the third at year-end.
- The evaluation of the EMS cohort will gather onsite trended data and customized engineering analyses when feasible.

In addition to the standard impact evaluation activities, the evaluation team will assist with reviewing and potentially updating the EMS measure workpapers during CY2023. The evaluation team will provide guidance regarding the level of rigor required, normalization of savings due to COVID, and review updates to the EMS workpaper.

A.3 Small Business

The Small Business Program is designed to assist qualified ComEd private and public sector non-residential customers⁹ in achieving electric energy savings. The program educates these customers about energy efficiency opportunities through no-cost onsite energy assessments conducted by authorized, specially trained EESPs and installs no-cost direct install measures.¹⁰ Further savings are available to participating customers through incentives of 30%-75% offered for select contractor-installed measures.¹¹ The program also offers Kit measures to all customers in CY2022 and will discontinue kits in CY2023 – CY2025.¹²

The evaluation of this program will include the activities shown in Table A-4.

⁹ Participants must be ComEd commercial or industrial customers with monthly peak demand levels up to 200 kW for private businesses and 400 kW for the public sector in CY2022. In CY2023 – CY2025, commercial or industrial private business customers with monthly peak demand levels up to 400 kWh will be eligible to align with public sector customer eligibility.

¹⁰ 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. The program also offers kits consisting of a variety of measures including lighting (BR30, PAR30, and candelabra lamps), hot water (bathroom and kitchen aerators, pre-rinse spray valves, and low flow showerheads), and consumer electronics (smart sockets) for fire stations, the general public, or private facilities and restaurants. Kits are offered to customers in CY2022 and will be discontinued in CY2023 – CY2025.

¹¹ Incented measures may include LED retrofits and fixtures, lighting controls, VSDs and HVAC system components, electric water heaters, refrigeration system components, commercial kitchen equipment, compressed air system measures, smart thermostats, building envelope measures.

¹² Kit measures include bathroom aerators, LED Directional R/BR Lamps, LED Omnidirectional Lamps, and Smart Strips. There is one type of Kit available for all private and public customers, in both Distressed and non-Distressed communities. These Kits are offered to customers in CY2022 and will be discontinued in CY2023 – CY2025.

Table A-4. Evaluation Activities, Small Business

Category	Tasks	CY2022	CY2023	CY2024	CY2025
General	ComEd Staff Interview	X	X	X	X
General	Implementer Interview	X	X	X	X
Impact	Savings Calculator and Work Paper Review	X	X	X	X
Impact	Program Tracking Data Review	X	X	X	X
Impact	Measure-Level Deemed Savings Review	X	X	X	X
Impact	Wave impact analysis	X	X	X	X
Impact/NTG	Sample Design	X	X	X	X
Impact	Project File Reviews	X	X	X	X
Impact	Survey, Phone, or Virtual Verification	X	X	X	X
NTG	Net Savings Research – Customer Free Ridership Survey		X		
NTG	Net Savings Research – Customer Spillover Survey		X		
NTG	Net Savings Research – Trade Ally Free Ridership Survey		X		
NTG	Net Savings Research – Trade Ally Spillover Survey		X		
Process	Research			TBD	

Guidehouse will conduct the impact evaluation in three waves. The Wave 1 will involve tracking system review and engineering examination of ComEd workpapers, tracking system and quarterly data, and measure workbook calculations of claimed savings. The Wave 2 review will focus on the midyear evaluation data during the summer and into the fall. with findings documented in a memorandum of review outlining issues to be addressed by ComEd to inform the final evaluation during Wave 3. The Wave 2 review will include engineering review of a random sample of projects documentation to confirm compliance and eligibility, verify participation, installed measure quantities, and associated savings. This may be supplemented by phone or virtual verifications depending on the rigor of the project file reviews we determine. Wave 3 will be based on the end of year data delivered to Guidehouse by January 30 and the final analysis from Wave 2.

Given the extent of the program changes (i.e., changes to the size and composition of the target customer population), Guidehouse decided not to do the NTG until CY2023 to ensure that we will be able to obtain a sufficient representative sample; however, we will develop research instruments in the fourth quarter in 2022. The NTG will involve participant and EESP populations from 2022 with the goal of reporting results in August 2023.

The process evaluation for CY2022 and CY2023 will be limited to conducting periodic check-ins, interview ComEd staff, and interview the implementer to facilitate a detailed understanding of the current program design, identify points of friction in the program, and remain responsive to the growth and changes in the program. There will be no formal process evaluation of the program during CY2023 NTG research except for inclusion of some satisfaction survey questions. This insight will inform discussions about process evaluation and other research needs as CY2024 unfolds.

A.4 Targeted Systems – RetroCommissioning (RCx)

RetroCommissioning (RCx) is a component of the Targeted Systems Program, along with Virtual Commissioning and Industrial Systems. Because the evaluation approach for these components differs, we have included them as separate sections in this plan.

The RCx Program seeks to realize energy savings by restoring building HVAC systems and optimizing controls to meet the needs of the current building occupants. The program is managed by ComEd, and ComEd coordinates with Nicor Gas, Peoples Gas, and North Shore Gas to account for gas savings generated through the program.

In CY2023, the RCx Program will also include the Building Operator Certification (BOC) offering. BOC is a training and certification for commercial building operators. The curriculum teaches participants how to improve building comfort and efficiency by optimizing the building’s systems. The program will offer partial participant tuition reimbursement for ComEd customers who complete the curriculum.

The evaluation of this program will include the activities shown in Table A-5.

Table A-5. Evaluation Activities, RCx

Category	Tasks	CY2022	CY2023	CY2024	CY2025
General	ComEd Staff Interview	X	X	X	X
General	Implementer Interview	X	X	X	X
Impact	Program Tracking Data Review	X	X	X	X
Impact	Custom Savings Review	X	X	X	X
Impact	Wave impact analysis	X	X	X	X
Impact	Survey, Phone, or Virtual Verification	X	X	X	X
Impact	Onsite Verification	X	X	X	X
Impact	Measure-Level Deemed Savings Review		X	X	X
NTG	Net Savings Research – Customer Free Ridership Survey			X	
NTG	Net Savings Research – Customer Spillover Survey			X	
NTG	Net Savings Research – EESP Free Ridership Survey			X	
NTG	Net Savings Research – EESP Spillover Survey			X	

For RCx projects, Guidehouse will perform program tracking data review and project reviews quarterly in CY2023. The tracking data review will concentrate on establishing the data is complete and will be used to inform the impact research sample. Our overarching goal is to research savings impacts sufficiently to report program-level savings at ±10% precision and 90% confidence. The default strata will be defined by project size or offering type.

The impact research sample will be drawn quarterly based on the projects labeled “Ready for Evaluation” in the Ops Report provided by the implementation contractor. After program ex ante results are final, the progressive quarterly sample will be compared to the year-end program participation and savings, and we will adjust the sample to comply with sampling goals.

For the BOC offering, Guidehouse will perform tracking data review which will include obtaining regular updates on trainees completing BOC courses and review of the participant facility data collection forms submitted by trainees. We will also use the TRM to conduct a measure level deemed savings review and estimate savings for this measure.

The evaluation team will conduct a NTG study to research free ridership and spillover. We will survey participants and interview active EESPs to research free ridership and spillover. We will triangulate their results using methods defined in the Illinois TRM and recommend the final NTG value in September 2024.

A.5 Targeted Systems – Virtual Commissioning

Virtual Commissioning (VCx) is a component of the Targeted Systems program, along with RetroCommissioning and Industrial Systems. Because the evaluation approach for these components differs, we have included them as separate sections in this plan. The VCx is an energy efficiency pathway within the Retro-Commissioning component that provides qualified ComEd business customers with energy management information services and works with them to identify low- and no-cost energy-saving operational changes.¹³ It does not target gas savings and is not associated with a gas utility.

The evaluation of this program will include the activities shown in Table A-6.

Table A-6. Evaluation Activities, VCx

Category	Tasks	CY2022	CY2023	CY2024	CY2025
General	ComEd Staff Interview	X	X	X	X
General	Implementer Interview	X	X	X	X
Impact	Site-level consumption data analysis	X	X	X	X
Impact	Program Tracking Data Review	X	X	X	X

As in prior years, Guidehouse plans to hold periodic calls with the ComEd VCx Program manager and implementers throughout the year, which will serve as the staff and implementer interviews.¹⁴ We will review program tracking data requirements with the IC roughly midway through the year. The impact analysis will entail construction and estimation of site-specific econometric energy usage models for all participating customers, using hourly advanced metering infrastructure (AMI) meter data and matching hourly weather data supplied by the implementer.

The evaluation team will derive savings estimates from the impact analysis from the standard hourly model unless deviations are sufficiently documented and justified per guidance included in the data request. Guidehouse is also currently planning to conduct research on the impact of normalizing savings to typical weather and may propose updating the model to one that can achieve weather normalized savings pending the outcome of that research.

A.6 Targeted Systems – Industrial Systems

Industrial Systems is a component of the Targeted Systems Program, along with RetroCommissioning and Virtual Commissioning. Because the evaluation approach for these components differs, we have included them as separate sections in this plan. Industrial Systems offers a combination of technical assistance and financial incentives, performing industrial systems studies that assess the performance of the facility's industrial compressed air system, process cooling system, refrigeration system, process efficiency or wastewater treatment plant to ensure efficient, economical operation.

¹³ The VCx Program is implemented by Power TakeOff and administered by Resource Innovations.

¹⁴ We will use these meetings to clarify program goals, address any data issues if and as they arise, and discuss modeling issues encountered during our verification analyses, including the handling of non-routine events requiring adjustments to the standard hourly model.

The evaluation of this component will include the activities shown in Table A-7.

Table A-7. Evaluation Activities, Industrial Systems

Category	Tasks	CY2022	CY2023	CY2024	CY2025
General	ComEd Staff Interview	X	X	X	X
General	Implementer Interview	X	X	X	X
Impact	Savings Calculator and Work Paper Review *	X	X	X	X
Impact	Program Tracking Data Review	X	X	X	X
Impact	Custom Savings Review	X	X	X	X
Impact	Survey, Phone, or Virtual Verification	X	X	X	X
Impact	Onsite Verification †	X	X	X	X
NTG	Net Savings Research – Customer Free Ridership Survey			X	
NTG	Net Savings Research – Customer Spillover Survey			X	

* The evaluation team will review any standardized calculators or workbooks are created and used for Industrial Systems savings.

† Onsite surveys will be performed when deemed necessary.

The evaluation team will stratify the Industrial Systems population into three strata by ex ante gross savings. Based on the results from the previous years, the team used an error ratio of 0.35 for the population. With an assumed population of 350 projects, the team estimates that a sample size of 15 projects for CY2022 will meet 90% confidence and 15% relative precision for the program.

As the NTG results for the Industrial Systems program were consistent for many years, the evaluation team skipped the NTG analysis for CY2021 and CY2022. However, the evaluation team has been surveying participants and active EESPs to research free ridership and spillover. For CY2023, the evaluation team will conduct NTG study for the three years combined using methods defined in the Illinois TRM and recommend the final NTG value in September 2024.

A.7 New Construction – Bus/Pub

The New Construction Program is offered jointly to non-residential (including public sector) customers served by ComEd and Nicor Gas.¹⁵ The program aims to capture immediate and long-term energy efficiency opportunities that are available during the design and construction of non-residential and multifamily buildings in ComEd’s service territory. The program covers new buildings, additions, and major renovations. Slipstream implements the program for ComEd and Nicor Gas.

The program offers two different program tracks to tailor program support to different types of participants and specific business segments.

- Performance path:** Offers a custom, hands-on technical approach to new construction projects and targets projects that are early in the design phase to maximize opportunities to influence the incorporation of high-performance design strategies. Technical staff use whole building energy simulations (including energy models and spreadsheet calculations) to optimize the building design for energy performance. Modeling results include incentive amounts and annual energy cost savings estimates. This allows the

¹⁵ Peoples Gas and North Shore Gas offered the program in the previous program cycle and continue to support legacy projects, although they are no longer accepting new applications.

design team to identify design strategies and technologies that will take their building design further and have the greatest impact on the building's energy use.

- **Best Practices path:** Offers a more prescriptive approach to new construction projects. This pathway was designed for fast-moving, developer-led projects or small projects. This includes predetermined lists of measures and incentives that are available for specific building types along with resources and guidelines for how to best implement those measures. This path provides an optimized and predictable incentive pathway with predefined, per-square foot incentives for achieving specific energy efficiency best practices, as well as optional advanced measures. The building types that are available through the Best Practices path are:
 - Warehouse and industrial
 - Multifamily and assisted living
 - Office
 - Retail and grocery
 - Parking garage

The program is still serving projects that entered the program prior to CY2020 under one of the legacy participation tracks.

The evaluation of this program will include the activities shown in Table A-8

Table A-8. Evaluation Activities, New Construction

Category	Tasks	CY2022	CY2023	CY2024	CY2025
General	ComEd Staff Interview	X	X	X	X
General	Implementer Interview	X	X	X	X
Impact	Program Tracking Data Review	X	X	X	X
Impact	Custom Savings Review	X	X	X	X
Impact	Survey, Phone, or Virtual Verification	X	X	X	X
Impact	Wave Impact Analysis	X	X	X	X
NTG	Net Savings Research - Customer Free Rideship Survey		X		X

The gross impact evaluation will be based on a custom savings review. We will perform a program tracking data review and custom savings review in two waves. The first wave is expected to cover the first half of the calendar year (January 1-June 30) and the second wave is expected to cover the second half (July 1-December 31). Each wave will consist of a tracking data review to ensure all relevant variables are included to support sampling and inform sample design, followed by stratified random sampling of all completed projects and a custom savings review of sampled projects.

The custom savings review will include desk reviews of all sampled projects, including reviewing and, if needed, revising building energy simulation models. On a project-by-project basis, the evaluation team will determine if survey, phone, or virtual verification activities are necessary to complement desk review activities. We will present realization rate results overall for the program by fuel type, inclusive and exclusive of interactive effects.

Per the program design, the baseline for all projects will typically be based on the applicable Illinois Energy Conservation Code for Commercial Buildings. The Illinois Code references the International Energy Conservation Code (IECC), which also allows for use of ASHRAE Standard 90.1 as an alternate compliance method. For each project, the applicable code

version will be determined by the issuance date of the construction permit. We will also allow for a grace period (in years) with IECC code updates. Therefore, projects with permit issuance dates at or after January 1 of the year following an IECC code update will be assigned the newest IECC code version as a baseline.

The evaluation will include an assessment of customer free ridership estimated based on in-depth interviews with participating customers and a review of project documentation. Net savings research will be based on rolling interviews with program participants in the reservation phase of program participation, which would have been conducted throughout the year. The findings from the research will inform recommended NTG values for the Illinois Stakeholder Advisory Group (SAG) approval and future program application. Although interviews will be conducted throughout all three calendar years, we will conduct NTG analysis to report NTG ratios in only CY2023 and CY2025. NTG analysis will employ enhanced rigor review for approximately 10%-20% of the largest projects in the pool of completed interviews by ex ante savings.

Microdata from free ridership research will be shared with the program implementation team along with findings upon completion of the NTG analysis. This includes component scores for each project, relevant quotes and excerpts from respondents, and other relevant details that could be used to inform program design or delivery. The data shall be scrubbed of identifying details in order to protect the confidentiality of the respondents.

A.8 Behavior Bus/Pub – Strategic Energy Management

The Strategic Energy Management (SEM) Program provides training and tools to help participants identify and install low-cost and no-cost measures at their sites.

The evaluation of this program will include the activities shown in Table A-9.

Table A-9. Evaluation Activities, SEM

Category	Tasks	CY2022	CY2023	CY2024	CY2025
General	ComEd Staff Interview	X	X	X	X
General	Implementer Interview	X	X	X	X
Impact	Custom Savings Review	X	X	X	X
Impact	Wave impact analysis	X	X	X	X

The evaluation team will evaluate this program through desk reviews of custom measure calculations.

The team may conduct a wave analysis or early review subject to data availability or if the implementation contractor or utility requests it. Due to the nature of the SEM energy savings models, which require 12 months of post-data, data is not typically available to complete wave analysis throughout the year.

Sampling for this program is done based on three measure savings categories: small, medium, and large. A sample is chosen to achieve the 90/10 confidence and precision required for this program.

A.9 Assessments – Facility Assessments

The Facility Assessments Program identifies and claims savings for low-cost/no cost operational and behavioral measures identified during ComEd’s commercial onsite audits.

The evaluation of this program will include the activities shown in Table A-10.

Table A-10. Evaluation Activities, Facility Assessments

Category	Tasks	CY2022	CY2023	CY2024	CY2025
General	ComEd Staff Interview	X	X	X	X
General	Implementer Interview	X	X	X	X
Impact	Custom Savings Review	X	X	X	X
Impact	Wave impact analysis	X	X	X	X

Guidehouse will evaluate this program through desk reviews of custom measures calculations. Typically, one or two waves of analysis are completed throughout the year. Timing of this analysis depends on data availability.

Sampling for this program is done based on three measure savings categories: small, medium, and large. A sample is chosen to achieve the 90/10 confidence and precision required for this program.

A.10 Midstream/Upstream – Instant Discounts

The Instant Discounts Program provides incentives to increase the market share of energy efficient products commonly sold to business customers. The 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 evaluation of this program will include the activities shown in Table A-11.

Table A-11. Evaluation Activities, Instant Discounts

Category	Tasks	CY2022	CY2023	CY2024	CY2025
General	ComEd Staff Interview	x	x	x	x
General	Implementer Interview	x	x	x	x
Impact	Savings Calculator and Work Paper Review	x	x	x	x
Impact	Program Tracking Data Review	x	x	x	x
Impact	Measure-Level Deemed Savings Review	x	x	x	x
Impact	Wave 1 Impact Analysis	x	x	x	x
NTG	Net Savings Research – Customer Free Ridership Survey - Wave 1		x		x
NTG	Net Savings Research – Customer Free Ridership Survey - Wave 2		x		x
NTG	Net Savings Research – Customer Spillover Survey - Wave 1		x		x
NTG	Net Savings Research – Customer Spillover Survey - Wave 2		x		x
NTG	Net Savings Research – Trade Ally Free Ridership Survey		x		x
NTG	Net Savings Research – Trade Ally Spillover Survey		x		x
NTG	Net Savings Research – NTG Ratio Estimation		x		x

The Instant Discounts evaluation will include annual ComEd staff and program implementer interviews, tracking data reviews, savings calculator and workpaper reviews, measure-level deemed savings reviews, and Wave 1 and end of year impact analyses.

The biannual impact analyses will be a census review of program sales and will not require a larger sampling strategy. Additionally, these components will rely on deemed savings algorithms as outlined by the Illinois TRM.

Customer free ridership and spillover surveys will be conducted annually (in the fall of 2022 and 2024 and in the spring of 2023 and 2025). EESP free ridership and spillover surveys will be conducted for CY2022 and CY2024 and will be conducted in January (2023 and 2025) immediately following the completion of the program year being evaluated. The customer and EESP data will be combined such that joint 2-year NTG ratios can be calculated in mid-2023 and mid-2025 for application in CY2024 and CY2026, respectively. This approach allows the evaluation team to collect data annually to ensure the results are representative of each program year, but it reduces and spreads out the cost of the NTG research over two program years. The customer-level research conducted to estimate the NTG ratio will also be used to collect data to develop measure-level estimates of installation rates, residential and non-residential splits, and leakage outside of ComEd territory. Each wave of the customer survey will pull sample from the population of customers who purchased program measures during the previous 6-month period. The sample for the EESP surveys will include all program retailers who sold program measures during the program year.

In CY2023, the Instant Discounts Program will include a new Lithium Ion Forklift Battery System measure. This measure will include both new electric forklifts that are purchased with lithium ion battery systems, as well as existing electric forklift that are retrofitted to use a lithium ion battery system. As this is a new measure for ComEd (in previous years Instant Discounts has included non-lithium ion battery chargers) the evaluation team plans to conduct research on this new measure. Additionally, this measure may be qualified for a fuel-switching incentive in addition to the midstream incentive, and thus research may be required to ensure these dual incentives are being calculated and applied appropriately.

A.11 Midstream/Upstream Commercial Food Service Equipment

The Midstream/Upstream Commercial Food Service Equipment Program works to increase the uptake of energy efficient commercial food service equipment among food service operators through a simplified administrative process, point of sale customer rebates, and upstream incentives. The goal of the program is to reduce barriers of this efficient equipment uptake by the food service operators, thereby reducing electricity and gas usage in the commercial food sector.

Collaboration: Nicor Gas, People's Gas, and North Shore Gas claim all program-associated gas savings. Ameren Illinois also has a food service pilot.

The evaluation of this program will include the activities shown in Table A-12.

Table A-12. Evaluation Activities, Midstream/Upstream Commercial Food Service Equipment

Category	Tasks	CY2022	CY2023	CY2024	CY2025
General	ComEd Staff Interview	X	X	X	X
General	Implementer Interview	X	X	X	X
Impact	Measure-Level Deemed Savings Review	X	X	X	X
Impact	Program Tracking Data Review	X	X	X	X
Impact	Savings Calculator and Work Paper Review	X	X	X	X
Impact	Wave impact analysis	X	X	X	X

Guidehouse will conduct annual interviews with ComEd staff and implementers to understand how the program is progressing, its growth, and its challenges and successes.

We will review the savings calculator annually and the program tracking data biannually to complete the impact analysis. These impact analyses will be a census review of the program and will not require sampling. Program components will rely on deemed savings algorithms as outlined by the Illinois TRM. The impact analysis will be done using a measure-level deemed savings review.

A.12 Cross-Cutting Business Program Evaluation Activities

ComEd operates its Business Program in a coordinated fashion wherever possible to ensure continuity of customer service and conversion of opportunities wherever possible. The evaluation team identifies opportunities to conduct cross-cutting research in coordination with other utilities in Illinois.

In 2023, the evaluation team will update Business Program-wide non-participant spillover (NPSO) estimates by conducting a non-participant survey with eligible ComEd business customers who have not participated in the Business Program within the past three years. The non-participant survey will focus on assessing NPSO resulting from the Program, as well as on barriers to participation that ComEd can overcome to boost engagement among key market segments. The evaluation team currently expects to conduct this study as a partial statewide effort coordinated with the evaluation team for AIC and Nicor Gas.

Appendix B. Residential and Income Eligible Programs Evaluation Plans

As in Plan 5, ComEd is continuing to promote the portfolio under the banner of the ComEd Energy Efficiency Program during Plan 6. Starting with Plan 6, ComEd is approaching the portfolio with a more consolidated structure compared to Plan 5. The new consolidated structure accomplishes several objectives: it reduces duplication of programs and offerings; simplifies the suite of programs, making energy-saving opportunities easier for customers to navigate; and provides greater flexibility in managing the portfolio overall.

ComEd is continuing gas utility program coordination as part of Plan 6. Table B-1 shows the Residential and Income Eligible programs, and gas utility coordination status.

Table B-1. Residential and Income Eligible Programs

Program	Gas Utility Coordination
Retail/Online	Smart thermostats only
Single-Family Upgrades	Yes
Multifamily Upgrades	Yes
Product Distribution	Kit Components*
Behavior – Res/Income Eligible	-
New Construction – Income Eligible	Nicor Gas only
Contractor/Midstream Rebates	-

*Both School (Market Rate and Income Eligible) and Income Eligible (IE) Kits are joint in 2022. Gas utility partnership with Income Eligible Kits is new in 2022; the school kit program was expanded to include a Market Rate and Income Eligible savings depending on the school location.

The following sections outline the program and program component-specific evaluation activities and the planned schedule.

B.1 Retail/Online

The Retail/Online Program offers residential customers rebates and instant discounts on select ENERGY STAR-certified appliances, lighting, and other home products. Purchases can be made at any retailer that sells the qualifying ENERGY STAR-certified appliances, including online retailers, such as the ComEd Marketplace. In this program, a portion of the budget is dedicated to income eligible customers by offering higher discounts at participating retailers on select products in targeted geographic areas (e.g., income eligible census tracts), making energy-saving products more affordable for income eligible customers.

Collaboration: It is ComEd’s intent that, to the extent possible, it will coordinate with Nicor Gas, Peoples Gas, and North Shore Gas to offer customers a single incentive on eligible smart thermostats.

The Retail/Online Program consists of five distinct components that provide incentives for high efficiency lighting and appliances, appliance recycling, and educational materials on high efficiency appliances and lighting. The five components include Appliance Rebates, Lighting Discounts, Income Eligible Retail Discounts, Appliance Recycling, and Efficient Choice.

The evaluation of this program will include the activities shown in Table B-2.

Table B-2. Evaluation Activities, Retail/Online

Component	Category	Tasks	CY2022	CY2023	CY2024	CY2025
All	General	ComEd Staff Interview	X	X	X	X
All	General	Implementer Interview	X	X	X	X
All	Impact	EOY Impact Analysis	X	X	X	X
All	Impact	Program Tracking Data Review	X	X	X	X
All	Impact	Savings Calculator and Work Paper Review	X	X	X	X
All	Impact	Wave 1 Impact Analysis	X	X	X	X
Appliance Rebates	Impact	Measure-Level Deemed Savings Review	X	X	X	X
Appliance Rebates	NTG	Net Savings Research – Customer Free Ridership Survey		X		X
Appliance Rebates	NTG	Net Savings Research – Customer Spillover Survey		X		X
Appliance Recycling	Impact	Measure-Level Deemed Savings Review	X	X	X	X
Appliance Recycling	NTG	Net Savings Research – Trade Ally/Retailer Free Ridership Survey		X	X	
Appliance Recycling	NTG	Net Savings Research – Trade Ally/Retailer Spillover Survey		X	X	
Appliance Recycling	Process	Program Satisfaction and Trade Ally Research of Barriers, Drivers,	X			
Efficient Choice	Impact	Custom Savings Review	X	X	X	X
Efficient Choice	Impact	Wave 2 Impact Analysis	X	X	X	X
Efficient Choice	NTG	Net Savings Research – Customer Free Ridership Survey		X		X
Efficient Choice	NTG	Net Savings Research – Customer Spillover Survey		X		X
Efficient Choice	Process	Program Satisfaction, Barriers, Drivers, etc.	X			
IE Retail Discounts	Impact	Measure-Level Deemed Savings Review	X	X	X	X
IE Retail Discounts	NTG	Net Savings Research – Freeridership Method TBD		X		X
IE Retail Discounts	NTG	Net Savings Research – Method Spillover TBD		X		X
Lighting Discounts	Impact	Measure-Level Deemed Savings Review	X	X	X	X
Lighting Discounts	NTG	Net Savings Research – Freeridership Method TBD				
Lighting Discounts	NTG	Net Savings Research – Spillover Method TBD				

Note: CY2023 changes: Lighting NTG research has been removed, Efficient Choice NTG researched moved from CY2023 and CY2024 to CY2023 and CY2025 reflecting delayed CY2022 program launch.

While net-to-gross (NTG) research activities were initially planned for Lighting Discounts and Income Eligible Retail Discounts in CY2023, the TRM v11 has included updates to LED baselines and EULs that make it unlikely that LED lighting will continue to be a viable energy efficiency measure for future program years. As a result, Guidehouse has placed this NTG research permanently on hold. Guidehouse will reopen this NTG research if LED lighting continues to be included as a program measure. For all program components, Guidehouse will conduct annual ComEd staff and program implementer interviews, tracking data reviews, savings calculator and workpaper reviews, measure-level deemed savings reviews, and Wave 1 and end of year impact analyses. The Wave 1 analyses will take place in July of each program year, and the Wave 2 Efficient Choice analysis will take place in October or November.

The impact analyses of Appliance Rebates, Lighting Discounts, Income Eligible Retail Discounts, and Appliance Recycling will be a census review of program sales and will not require a larger sampling strategy. Additionally, these components will rely on deemed savings algorithms as outline by the Illinois Technical Reference Manual (TRM).

B.1.1 Efficient Choice Component Details

The Efficient Choice Component will use a blend of customer surveys website tracking data and deemed savings algorithms to estimate program savings. Surveys will be sent to Efficient Choice participants who used the Efficient Choice website to shop for efficient appliances. The goal of these surveys, in conjunction with available website tracking data, is to establish a purchase rate, an efficiency rate, and cross-participation with other ComEd programs. These

values will be applied to the deemed per-unit energy savings and participant population to calculate the program's gross energy savings as detailed in the following equation.

$$\begin{aligned} \textit{Verified Gross Savings} \\ &= \textit{Per Unit Energy Savings} * \textit{Customer Population} * \textit{Purchase Rate} \\ &* \textit{Efficiency Rate} - \textit{Cross Participation} \end{aligned}$$

The Efficient Choice platform was introduced into the TRM v11 with the purposes of deeming purchase rates and outlining how purchase rates should be calculated during surveying efforts. It is the intention of the CY2023 Efficient Choice evaluation to use deemed purchase rate values for the pilot and CY2022 evaluation research. However, purchase rate surveying for CY2023 may need to be reintroduced if results from the CY2022 research are not statistically sufficient for deeming measure level purchase rate values.

If surveying is required, the evaluation team proposes a nested sampling approach. The sample frame in the first stage of this approach will include all customers who have taken one of ten specific actions on the ComEd Efficient Choice website. To estimate the purchase rate, the sample of recent actively-engaged website users will be surveyed to determine how many eventually made a purchase and to collect information on the make and model purchase to identify the efficiency of the measure purchased and the timing of the purchase (to determine if the purchase was before or after the website surfing took place).

A follow-up survey will be sent to a nested sample of those from the first survey who reported they had not made a purchase but planned to in the near future. The second survey of this smaller sample will be used to identify any incremental purchases that occurred since the first survey. Analysis of proof of purchase or make and model numbers will be completed to determine the efficiency rate (the percentage of purchases identified that were of high efficiency equipment).

The Efficient Choice component will include a Wave 1 and Wave 2 analysis to support the overall impact analysis.

B.1.2 Appliance Recycling Component Details

The Appliance Recycling component is under development and has not yet been implemented at the time of this evaluation plan's development. As a result, the Appliance Recycling evaluation tasks and details are subject to change to accommodate program design and delivery. NTG research planned for CY2022 has been rescheduled to coincide with CY2023 program launch.

In general, the CY2023 through CY2025 Retail/Online evaluation plan does not call for process-related activities. However, the evaluation team will conduct process research for the Appliance Recycling component in CY2023 since it is the first year of this specific midstream offering (prior ComEd Appliance Recycling programs used a downstream delivery approach). This process evaluation will focus on ways to improve the Appliance Recycling component for future program years and determine the program is operating per the program theory.

Once the Appliance Recycling component is implemented, the evaluation team will more clearly define the process research. At this time, it is anticipated that this effort will focus on used appliance dealers' satisfaction with the program, challenges and barriers to participation,

likelihood of future participation, and standard practices absent the Appliance Recycling component. The process evaluation will be conducted through a combination of research, participant interviews, and surveys depending on final program component design and implementation.

B.2 Single-Family Upgrades

The Single-Family Upgrades Program provides income eligible single-family homeowners a fully subsidized, whole building approach to energy efficiency, ranging from energy assessments to weatherization. Funding to remedy health and safety issues is also available. A portion of this program will provide non-income eligible single-family customers with a free energy assessment, free or discounted energy efficiency products, and a customized report identifying additional ways to save energy and money through other energy efficiency offerings or actions. The income eligible portion of this program element will be offered per the Weatherization Principles/Requirements provisions of the Stipulation.

Collaboration: It is ComEd’s intent that, to the extent possible, it will offer this program jointly or in coordination with Nicor Gas, Peoples Gas, and North Shore Gas.

The Single-Family Upgrades Program is delivered through three components: Home Energy Assessment, Illinois Home Weatherization Assistance Program (IHWAP), and Income Eligible Upgrades.

The evaluation of this program will include the activities shown in Table B-3.

Table B-3. Evaluation Activities, Single-Family Upgrades Program

Component	Category	Tasks	CY2022	CY2023	CY2024	CY2025
All	General	ComEd Staff Interview	X	X	X	X
All	General	Implementer Interview	X	X	X	X
All	Impact	Savings Calculator and Work Paper Review	X	X	X	X
All	Impact	Program Tracking Data Review	X	X*	X	X*
All	Impact	Measure-Level Deemed Savings Review	X		X	
All	Impact	Wave impact analysis	X		X	
Home Energy Assessment	NTG	Net Savings Research – Customer Free Ridership Survey			X	
Home Energy Assessment	NTG	Net Savings Research – Customer Spillover Survey			X	

*The evaluation team will calculate verified net savings applying the previous year’s realization rate to the Program Tracking Data Review results.

Guidehouse will review the tracking data and savings calculator annually to complete the wave impact analysis. The CY2022 realization rate will be applied to CY2023; the CY2024 realization rate will be applied to CY2025. We will apply realization rates at the end use or technology level to capture year to year changes in measure mix. The evaluation team will use an R-based analysis to verify measure savings.

In CY2023 through CY2025, Guidehouse will continue to engage with the implementation team on a regular basis and be available for technical questions upon request. Additionally the team will:

- Conduct quality assurance review of the CY2023 and CY2025 program and project measure savings to confirm savings are consistent with the prior year’s reported savings and realization rate findings.

- Report verified program savings by applying the CY2022 and CY2024 realization rates at the end use or technology level to the CY2023 and CY2025 reported savings, respectively.

We will perform net savings research in CY2024 to update the NTG values for the market rate program.

The evaluation will be reported through a single report document, with income eligible and market rate savings disaggregated.

B.3 Multifamily Upgrades

The Multifamily Upgrades Program provides income eligible multifamily building owners, managers, public housing authorities, and tenants a fully or largely subsidized, whole building approach to energy efficiency, including free multifamily building energy assessments, implementation contractor or service provider installation of free energy-saving products in tenant spaces and common areas, free or deeply discounted larger capital projects, technical assistance to support implementation, and, as needed, resolution of health and safety issues. A portion of this program element will provide non-income eligible multifamily building owners, managers, and tenants with energy assessments and implementation contractor or service provider installation of free or discounted energy-saving products in tenant spaces and common areas. The income eligible portion of this program element will be offered per the Weatherization Principles/Requirements provisions of the Stipulation.

Collaboration: It is ComEd’s intent that, to the extent possible, it will offer this program jointly or in coordination with Nicor Gas, Peoples Gas, and North Shore Gas.

The Multifamily Upgrades Program is delivered through four components: Multifamily Market Rate, Income Eligible Multifamily Upgrades, IHWAP, and Public Housing Upgrades.

The evaluation of this program will include the activities shown in Table B-4.

Table B-4. Evaluation Activities, Multifamily Upgrades

Component	Category	Tasks	CY2022	CY2023	CY2024	CY2025
All	General	ComEd Staff Interview	X	X	X	X
All	General	Implementer Interview	X	X	X	X
All	Impact	Savings Calculator and Work Paper Review	X	X	X	X
All	Impact	Program Tracking Data Review	X	X*	X	X*
All	Impact	Measure-Level Deemed Savings Review	X		X	
All	Impact	Wave impact analysis	X		X	
IE MF IHWAP	Impact	Custom Savings Review	X		X	
IE MF IHWAP	Impact	Survey, Phone, or Virtual Verification	X		X	
MF Market Rate	NTG	Net Savings Research – Customer Free Ridership Survey		X		
MF Market Rate	NTG	Net Savings Research – Customer Spillover Survey		X		
IE MF IHWAP	Process	Research		X	X	
IE MF Upgrades	Process	Research		X	X	

*The evaluation team will calculate verified net savings applying the previous year’s realization rate to Program Tracking Data Review results.

Guidehouse will review the tracking data and savings calculator annually to complete the wave impact analysis. The CY2022 realization rate will be applied to CY2023; the CY2024 realization

rate will be applied to CY2025. We will apply realization rates at the end use or technology level to capture year to year changes in measure mix. The impact analysis will use an R-based analysis to verify savings. If there are custom projects in the sample, we will perform phone verification to supplement the data review.

In CY2023 through CY2025, Guidehouse will continue to engage with the implementation team on a regular basis and be available for technical questions upon request. Additionally the team will:

- Conduct quality assurance review of the CY2023 and CY2025 program and project measure savings to confirm savings are consistent with the prior year's reported savings and realization rate findings.
- Report verified program savings by applying the CY2022 and CY2024 realization rates at the end use or technology level to the CY2023 and CY2025 reported savings, respectively.

A single impact evaluation report will be developed for the Multifamily Upgrades Program, disaggregated as follow:

1. **Public Housing Upgrades** program component results will be reported in a single standalone report section.
2. **Multifamily Market Rate, Income Eligible Multifamily Upgrades, and IHWAP** component results will be reported together in a single report section, with Market Rate and Income Eligible savings disaggregated.

NTG savings research for free ridership and spillover will be completed in 2023 for the Market Rate component.

The evaluation team will conduct additional income eligible process evaluation research in 2023 and 2024 to support ComEd's compliance with the Plan 6 Stipulation Agreement.¹⁶ The purpose of the research will be to develop recommendations leading to increased income eligible program participation, reflecting higher Plan 6 participation targets. The approach is designed to gain insights from multiple ComEd income eligible program stakeholders including members of the Income Qualified Advisory Group North, community-based organizations (CBOs), community action agencies (CAAs), income eligible program implementers, and multifamily building owners and managers. Table B-5 summarizes the research tasks. Guidehouse will draft a detailed research plan memo for review and iteration once the Plan 6 evaluation plan is approved.

¹⁶ "Evaluation of Customer Engagement and Targeted Energy Efficiency Delivery Efforts: ComEd will direct its independent evaluator to perform one or more process evaluations of the Customer Engagement and Mapping of Assistance Needs and Targeting Delivery of Weatherization Services efforts described above during the Plan 6 Period and will share the results at a joint SAG and Committee meeting." (Revised Stipulation Agreement, February 28, 2022, section IV.A.6.c)

Table B-5. Additional Research Activities, Income Eligible Multifamily Upgrades

Research Activities	Description
Research interviews: income eligible stakeholders	Interview income eligible local champions and stakeholders in ComEd’s service territory to gain their insights on best practice recommendations that could increase income eligible program participation
Research interviews: income eligible non-participating multifamily building owner and managers	Identify awareness of ComEd’s income eligible programs, participation barriers, and opportunities to identify and serve non-participating multifamily buildings
Process evaluation research: income eligible program outreach best practice	Identify peer utility best practices to engage income eligible populations

Source: Guidehouse

B.4 Product Distribution

The Product Distribution Program distributes free energy-saving products and kits via local community channels including but not limited to participating local schools, CAAs, CBOs, local food banks, and food pantries. The program also provides energy efficiency educational information and product installation instructions.

Collaboration: It is ComEd’s intent that, to the extent possible, it will offer a portion of this program’s kit components (including Income Eligible Kits, Income Eligible and Market Rate School Kits) jointly or in coordination with Nicor Gas and Peoples Gas/North Shore Gas.

The Product Distribution Program consists of three separate components, which deliver energy-saving products to income eligible and market rate ComEd customers: Foodbank LED, Income Eligible (IE) Kits, and School Kits.

The evaluation of this program will include the activities shown in Table B-6.

Table B-6. Evaluation Activities, Product Distribution

Component	Category	Tasks	CY2022	CY2023	CY2024	CY2025
All	General	ComEd Staff Interview	X	X	X	X
All	General	Implementer Interview	X	X	X	X
All	Impact	Savings Calculator and Work Paper Review	X	X	X	X
All	Impact	Program Tracking Data Review	X	X	X	X
All	Impact	Measure-Level Deemed Savings Review	X	X	X	X
All	Impact	Wave impact analysis	X	X	X	X
Elementary Education Kits	NTG	Net Savings Research – Customer Free Ridership Survey			X*	
Elementary Education Kits	NTG	Net Savings Research – Customer Spillover Survey			X*	

*School Kits NTG research is to be determined based on market conditions.

Guidehouse will complete the impact evaluation in two waves. The first wave will begin midway through the program year and will include an examination of the tracking and savings data. The second wave will begin once the program data is finalized at the end of the year.

As this program focuses heavily on the income eligible population for all three program tracks and secondary NTG research was conducted in 2021 on the market rate School Kit program, the evaluation team does not anticipate needing to conduct NTG research for this plan cycle. However, if substantive changes to the program or market occur, we will revisit the need for this research in CY2024 or CY2025. The evaluation team plans to compile available data during CY2023 and develop in service rate research priorities for CY2024.

B.5 Behavior – Res/Income Eligible

Home Energy Reports is an opt-out only, behavioral-based program that provides residential customers with information on how they use energy in their households and leverages social norms to drive customer adoption of energy efficient behaviors. Customers receive up to six paper or monthly emailed reports a year. Both paper and emailed reports include neighbor comparison information, personalized energy efficiency tips, and information on additional ComEd energy efficiency offerings. All ComEd customers are encouraged to visit www.ComEd.com/MyAccount to access additional online energy management tools, including the option to receive alerts and notifications like a High Bill Alert sent based on a pre-established threshold or a Weekly Usage Report that provides insights by comparing the current and previous week’s usage to highlight the days and hours when a customer uses the most energy.

The evaluation of this program will include the activities shown in Table B-7.

Table B-7. Evaluation Activities, Behavior – Res/Income Eligible

Component	Category	Tasks	CY2022	CY2023	CY2024	CY2025
N/A	General	ComEd Staff Interview	X	X	X	X
N/A	General	Implementer Interview	X	X	X	X
N/A	Impact	Population-level consumption data analysis	X	X	X	X
N/A	Impact	Program Tracking Data Review	X	X	X	X

The program tracking data review will be completed at midyear to assess data completeness and findings will be summarized in a corresponding memo. The population-level consumption data analysis will follow the methods laid out in the Evaluation Approaches section of this plan.

B.6 New Construction – Income Eligible

The New Construction – Income Eligible Program offers technical assistance and incentive funding to building developers for new construction or major renovation of affordable housing, including single-family, low-rise, mid-rise, and high-rise multifamily buildings. Bundled energy conservation measures and custom or prescriptive approaches for specific building types are designed to result in significant energy savings over the current Illinois energy code.

Collaboration: This program is offered in coordination with Nicor Gas.

The New Construction – Income Eligible Program is implemented as Affordable Housing New Construction.

The evaluation of this program will include the activities shown in Table B-8.

Table B-8. Evaluation Activities, New Construction – Income Eligible

Component	Category	Tasks	CY2022	CY2023	CY2024	CY2025
N/A	General	ComEd Staff Interview	X	X	X	X
N/A	General	Implementer Interview	X	X	X	X
N/A	Impact	Savings Calculator and Work Paper Review	X	X*	X	X*
N/A	Impact	Custom Savings Review	X		X	
N/A	Impact	Wave impact analysis	X		X	
N/A	Impact	Survey, Phone, or Virtual Verification	X		X	

*The evaluation team will calculate verified net savings applying the previous year's realization rate to Program Tracking Data Review results.

The CY2022 realization rate will be applied to CY2023; the CY2024 realization rate will be applied to CY2025. We will apply realization rates at the end use or technology level to capture year to year changes in measure mix.

In CY2022 and CY2024, Guidehouse will complete the impact evaluation in two waves. The first wave will begin midway through the program year and will include a review of a sample of projects. This review will focus on reviewing and validating the program savings calculator. Consistent with recent practice, the first wave will be conducted as a 'Project Pre-Review'. Wave 1 projects, and any changes made by the implementer, will be re-reviewed at the 2nd and final wave.

The second wave will be completed at the end of the program year and will include a custom savings review. The savings review will include desk reviews of all projects completed during the program year; it will also include reviewing and, if needed, revising building energy savings calculations or simulation models. On a project-by-project basis, the evaluation team will determine if survey, phone, or virtual verification activities are necessary to complement desk review activities. We will present realization rate results overall for the program by fuel type, inclusive and exclusive of interactive effects. Guidehouse will coordinate these activities with the Electric Homes New Construction Pilot programs when possible given their similarities.

In CY2023 and CY2025, Guidehouse will complete a limited evaluation in two waves. The first wave will begin midway through the program year, similar to the CY2022 and CY2024 evaluations. This review will focus on reviewing and validating the program savings calculator, no project pre-reviews will be completed in CY2023 and CY2025.

The second wave will be completed at the end of the program year and will include a tracking system and project calculator review. Additionally, the team will:

- Conduct quality assurance review of the CY2023 and CY2025 program and project measure savings to confirm end use and technology savings are consistent with the prior year's reported savings and realization rate findings.
- Report verified program savings by applying the CY2022 and CY2024 realization rates at the end use or technology level to the CY2023 and CY2025 reported savings, respectively.
- Complete desk reviews for projects or technologies not included in CY2022 or CY2024 evaluations, such as Passive Building Pathway projects.

The program has four program tracks to support different types of construction projects.

1. **New Construction:** New Construction projects are buildings not previously constructed. Incentives are paid per gross square foot of eligible living space and the measures completed. Savings are calculated using a custom calculation template for standardized measures.
2. **Major Renovation:** Major Renovation projects are existing buildings that alter or replace most components of major building systems: envelope, mechanical, electrical, plumbing. Incentives are paid per gross square foot of eligible living space and the measures completed. Savings are calculated using a custom calculation template for standardized measures.
3. **Moderate Rehab:** Moderate Rehab projects are existing buildings that may alter or replace major building systems but may retain some existing equipment. Incentives are paid per gross square foot of eligible living space and the measures completed. Savings are calculated using a custom calculation template for standardized measures.
4. **Passive Building Pathway:** Passive Building Pathway projects are high performance buildings constructed and certified by the Passive House Institute US, Inc. Fixed pre-construction incentives are paid based on completed participation steps with post-construction incentives being paid per income eligible unit. Savings are calculated using building simulations.

B.7 Contractor/Midstream Rebates

The Contractor/Midstream Rebates Program provides rebates or instant discounts to the purchaser when buying specified HVAC equipment and services from a participating service provider or approved distributor. Intercepting end users and service providers at their common product purchasing channel provides a convenient and simple process for receiving incentives for higher efficiency HVAC equipment and services.

The evaluation of this program will include the activities shown in Table B-9.

Table B-9. Evaluation Activities, Contractor/Midstream Rebates

Component	Category	Tasks	CY2022	CY2023	CY2024	CY2025
N/A	General	Implementer Interview	X	X	X	X
N/A	Impact	Savings Calculator and Work Paper Review	X	X	X	X
N/A	Impact	Program Tracking Data Review	X	X*	X	X*
N/A	Impact	Measure-Level Deemed Savings Review	X		X	
N/A	Impact	Wave impact analysis	X		X	
N/A	NTG	Net Savings Research – Customer Free Ridership Survey		X		
N/A	NTG	Net Savings Research – Customer Spillover Survey		X		

*The evaluation will calculate verified net savings using results from the Program Tracking Data Review and the previous year's impact results.

The CY2022 realization rate will be applied to CY2023; the CY2024 realization rate will be applied to CY2025. We will apply realization rates at the end use or technology level to capture year to year changes in measure mix.

NTG research will be conducted for the four midstream measures: central air conditioners, air source heat pumps, ductless mini-split heat pumps, and advanced thermostats (evaluators will determine if a joint study with applicable IL Gas Utilities would be most appropriate for the advanced thermostats measure). Research will include a free ridership and spillover survey with

participating distributors that captures at least 12 months of data. The research will consider NTG with respect to both fuel switching and energy efficiency projects (pending availability of appropriate sample sizes and responses in each category). As Table B-9 indicates, research will be conducted throughout CY2023 and will be applicable for CY2024.

In CY2022 and CY2024, Guidehouse will conduct impact analysis twice for the program year. The Wave 1 impact analysis will be conducted midyear followed by a final impact analysis focusing on the final evaluation data after the end of the program year.

In CY2023 and CY2025, Guidehouse will continue to engage with the implementation team on a regular basis and be available for technical questions upon request. Additionally the team will:

- Conduct quality assurance review of the CY2023 and CY2025 program and project measure savings to confirm savings are consistent with the prior year's reported savings and realization rate findings.
- Report verified program savings by applying the CY2022 and CY2024 realization rates at the end use or technology level to the CY2023 and CY2025 reported savings, respectively.

Appendix C. Voltage Optimization

The Voltage Optimization (VO) Program comprises ComEd’s plan to install hardware and software systems on a significant portion of its electric power distribution grid to achieve voltage and reactive power optimization (Volt/VAR optimization, or VVO)

The evaluation of this program will include the activities shown in Table C-1.

Table C-1. Evaluation Activities, VO

Category	Tasks	CY2023	CY2024	CY2025
General	ComEd Staff Interview	X	X	X
Impact	Measure Net Savings Impact of VO in Affected Feeders	X	X	X
Impact	Annual Calibration	X	X	X
Impact	Program Tracking Data Review	X	X	X

The evaluation team will interview the ComEd program staff in the context of our ongoing biweekly meetings with the ComEd VO team.

We will perform regular reviews of the program tracking and SCADA system data throughout the year. The evaluation team will review data transfers from ComEd and produce quality control memos to ensure the transfer has worked properly and Guidehouse has the best available data. This review is needed due to the volume of data involved in our evaluation and allows us to identify any missing or problematic data and receive updated data as needed throughout the year. We will continue to use our biweekly meetings with ComEd and ICC staff to discuss, document, and resolve any issues or concerns as they arise throughout the year.

We will measure the net savings impact of VO in affected feeders by calculating the annualized energy savings and summer coincident peak demand savings separately for each VO-enabled feeder as described in the Illinois Technical Reference Manual (TRM).¹⁷ Once during the program year, the evaluation team will conduct a midyear calibration to confirm our methods are aligning with those of the ComEd team.

¹⁷ Because the VO Program requires no actions by any affected ComEd customers, net and gross impacts are identical.

Appendix D. Pilot and Market Transformation Program Evaluation Plans

ComEd’s Plan 6 includes pilots and market transformation programs to test feasibility for inclusion in ComEd’s portfolio and adding new measures to the Technical Reference Manual (TRM). As in Plan 5, ComEd is continuing to launch pilots and market transformation programs that explore new avenues for energy savings in all sectors, especially the income eligible sector. Due to the nature of pilot and market transformation program offerings, their evaluations are individualized and often the evaluation schedule does not track with the portfolio program evaluations.

When appropriate, Guidehouse conducts impact and process evaluations for pilots and market transformation programs in a similar manner to the programs in the portfolio. Market Transformation Programs will be evaluated consistent with the guidelines of Attachment C in the ILTRM. We will also assist in assessing the feasibility of adding the pilot’s measures to the TRM using primary and secondary research.

Because pilots and market transformation programs are launched throughout the program year, Guidehouse develops evaluation plans for these efforts when our understanding of the design and implementation has advanced to the point where we can plan for specific evaluation activities. We have already developed draft evaluation plans for some ComEd pilots and have included them in this appendix.

Table D-1 shows the CY2023 pilots and market transformation programs with evaluation plans currently available. Additional evaluation plans will be posted to the SAG website as they are available.

Table D-1. Pilot and Market Transformation Programs with Evaluation Support

Pilot / MT Initiative	Gas Utility Coordination
Electric Homes New Construction Pilot	-
ENERGY STAR Retail Product Platform Market Transformation Program	-
Advanced Codes and Building Performance Standards Market Transformation Program	Yes
Industrial Energy Management Information Systems	-
Variable Speed Heat Pumps as AC Replacement	-
Automated System Optimization	-
Communities of the Future Next Gen HVAC Demonstrations	-
Refrigeration Thermal Energy Storage	-
Variable Refrigerant Flow HVAC Systems for Cold Climates	-
Very High Efficiency HVAC Retrofit	-
Air Source Heat Pump Contractor Training	-
Heat Pump Water Heater Pilot	-
Income-Qualified Whole Home Electrification	-

The following sections outline these pilot-specific and market transformation program-specific evaluation activities and the planned schedule.

D.1 Electric Homes New Construction Pilot

The Electric Homes New Construction (EHNC) offering provides incentives to builders for the construction of energy efficient, all-electric single-family homes, duplexes, townhomes, 2-4 flats, small multifamily, or accessory dwelling units.

The evaluation of this offering will include the activities shown in Table D-2.

Table D-2. Evaluation Activities, EHNC

Component	Category	Tasks	CY2022	CY2023	CY2024	CY2025
N/A	General	ComEd Staff Interview	X	X	X	X
N/A	General	Implementer Interview	X	X	X	X
N/A	Impact	Measure-Level Deemed Savings Review	X	X	X	X
N/A	Impact	Program Tracking Data Review	X	X	X	X
N/A	Impact	Savings Calculator and Work Paper Review	X	X	X	X
N/A	Impact	Wave impact analysis	X	X	X	X
N/A	NTG	Net Savings Research – Customer/Trade Ally Free Ridership Survey			X	

For Electric Home New Construction, the Trade Ally research will be conducted with participating home builders.

The EHNC evaluation will include two waves. The first wave will begin midway through the program year and will include a review of a sample of projects. This review will focus on reviewing and validating the program savings calculator. Consistent with recent practice, the first wave will be conducted as a 'Project Pre-Review'. Wave 1 projects, and any changes made by the implementer, will be re-reviewed at the 2nd and final wave.

The second wave will be completed at the end of the program year and will include a custom savings review. The savings review will include desk reviews of all projects completed during the program year; it will also include reviewing and, if needed, revising building energy savings calculations or simulation models. On a project-by-project basis, the evaluation team will determine if survey, phone, or virtual verification activities are necessary to complement desk review activities. We will present realization rate results overall for the program by fuel type, inclusive and exclusive of interactive effects. Guidehouse will coordinate these activities with the New Construction – Income Eligible Program when possible given their similarities.

The wave analysis and final report may leverage a sampling approach depending on the level of EHNC participation. The sample design will be a stratified random sample. Guidehouse will define each stratum based on project size, measure mix, home type, or builder to accurately represent the participation in a given year.

ComEd has expressed interest in expanding EHNC into a market transformation initiative or new construction program. Guidehouse will support this effort on an ongoing basis by reviewing measure- or project-level engineering analyses and program theory and logic models and supporting market progress indicator development.

This was a new pilot for CY2021 and did not have a net-to-gross (NTG) value deemed through the Illinois Stakeholder Advisory Group (SAG) process. Guidehouse provided a NTG research memo to ComEd in September 2021, which recommended a NTG value of 0.80.¹⁸ NTG

¹⁸ Guidehouse, "ComEd EHNC CY2021 NTG Memo," September 30, 2021. <https://ilsag.s3.amazonaws.com/ComEd-EHNC-CY2021-NTG-Memo-2021-09-30-Final.pdf>

research has been scheduled for CY2024, to incorporate potential program changes. Until then, EHNC will continue to use the deemed NTG of 0.80.

D.2 ENERGY STAR Retail Product Platform Market Transformation Program

The evaluation plan for this program requires more discussion with ComEd. SAG small working groups will convene between Q4 of 2022 and Q1 2023 to make clarifications on three key elements of the ERSPP evaluation methodology, after which Guidehouse will revise evaluation plan activities in greater detail. The plan will be delivered as a separate document.

D.3 Advanced Codes and Building Performance Standards Market Transformation Program

The Advanced Codes and Building Performance Standards Program is a MT program where utilities influence municipalities to adopt stretch codes as defined in the Climate and Equitable Jobs Act (CEJA) and to adopt Building Performance Standards (BPS). The program additionally seeks to influence market actors to have high compliance rates with the CEJA stretch code where the stretch code is adopted.

Guidehouse will support the development of evaluation pathways documents for both advanced codes and BPS, with the goal of the evaluation pathways proposals being included in the Illinois Statewide Technical Reference Manual (TRM). Guidehouse will further evaluate savings for ComEd associated with the Advanced Codes and BPS Program using a Market Transformation evaluation framework. Included activities are shown in Table D-3.

Collaboration: Nicor Gas, People’s Gas, and North Shore Gas claim all pilot-associated gas savings. ComEd claims all pilot-associated electric savings.

Table D-3. Evaluation Activities, Advanced Codes and BPS Activities

Category	Tasks	CY2022	CY2023	CY2024	CY2025
General	Conduct Secondary Research for Delphi Panel - Advanced Codes (AC) only		X		X
General	Support Development of Stretch Codes Evaluation Pathways - AC only	X			
Impact	Calculate Market Potential Savings - AC only				X
Impact	Support Development of Baselines and Savings Estimates		X		X
Impact	Evaluate Savings Impacts by Assessing the Preponderance of Evidence			X	X
Impact	Evaluate Market Transformation Savings - AC only				X
Impact	Research BPS Evaluation Precedence - Building Performance Standards (BPS) only	X			
General	Support Development of BPS Evaluation Pathways - BPS only	X	X		
General	Assemble Delphi Panel and Facilitate Meetings		X	X	X
General	Coordinate with Stakeholders	X	X	X	X
General	Participate in SAG MT Meetings	X	X	X	
General	Review MT Program Elements Developed by Initiative Implementer	X	X	X	X

Guidehouse will work collaboratively with stakeholders and the SAG MT Savings Working Group to support the development of the evaluation pathways proposals on both advanced stretch codes and BPS. The codes evaluation pathways document has been drafted by Slipstream, MEEA, and Guidehouse. It has received multiple rounds of comments in the SAG meetings.

In CY2023 the CEJA stretch code will be developed and ready for adoption by municipalities. Once the stretch code is finalized Guidehouse will begin the evaluation process by working with ComEd to support the development and review the establishment of certain key values such as baselines and savings estimates. The process will include assembling a Delphi panel of neutral market experts, providing available research to inform the deeming of values, and facilitating the panel's determination of the deemed values. The deemed values will be in effect for CY2024 – CY2025. In CY2025 this Delphi panel process of deeming critical evaluation values will be repeated relative to the updated statewide and stretch codes that will be in effect CY2026 – CY2028.

Stretch codes may be in effect as early as January 1, 2024, assuming municipalities have adopted the stretch code. Guidehouse would then evaluate utility attributable impacts in CY2024 and CY2025 as municipalities adopt the stretch code as outlined in the evaluation pathways proposal. Note, some details related to the evaluation process are still under discussion such as transitioning from an attribution score to a Theory-Based Evaluation and preponderance of evidence-based approach. This evaluation plan will be updated annually with further clarification on the direction taken provided as this stakeholder discussion evolves. As early as CY2025 evaluation of CY2024 code MT programs can be finalized with the calculation of Market Potential Savings and the final Market Transformation Savings attributed to each utility.

Currently there is not a BPS MT evaluation proposal. Guidehouse will conduct research into cities and territories that have adopted BPS policies and seek precedents on evaluating the savings from BPS policy advancement. Guidehouse will combine the BPS precedent research with knowledge from developing the advanced codes evaluation pathways proposal to support the development of a new BPS evaluation pathways document. As was done with advanced codes, the BPS evaluation proposal will be vetted and commented through the SAG MT review process and Guidehouse will collaboratively respond to comments until the proposal is finalized.

BPS policies could be adopted and effective as early as CY2024 in areas that already have building benchmarking and disclosure policies, such as Chicago and Evanston. However, savings will lag the adoption of the BPS policy because low scoring existing buildings typically have two to three years to improve their building's energy performance. As such, Guidehouse would only determine utility BPS policy impacts as municipalities adopt BPS policies in CY2024 and CY2025. Note, as with stretch codes, the evaluation methods used for BPS MT initiatives is currently under discussion by stakeholders. Guidehouse will remain engaged in these discussions, providing input and guidance, and will ensure future, annual updates to this evaluation plan remain in alignment with decisions made by the SAG.

For both advanced codes MT and BPS MT, Guidehouse will review MT program elements such as program theory, logic models, natural market baselines, and market progress indicators for both advanced codes and BPS.

D.4 Industrial EMIS

This pilot is evaluating four industrial customers with the goal of installing a new energy management information system (EMIS) and implementing related energy efficiency recommendations. The measures and savings calculations rely heavily on the newly established data streams and the pilot team plans to work with customers to set up the EMIS system as well

as educate customers on proper use to identify savings opportunities and to validate realized energy savings.

The evaluation of this pilot will include the activities shown in Table D-4.

Table D-4. Evaluation Activities, Industrial EMIS

Category	Tasks	CY2022	CY2023	CY2024	CY2025
General	ComEd Staff Interview	X	X		
General	Implementer Interview	X	X		
Impact	Program Tracking Data Review		X		
Impact	Custom Savings Review	X	X		
Impact	Survey, Phone, or Virtual Verification	X	X		

Guidehouse will coordinate evaluation activities with the progress of the pilot. This includes ongoing discussions with the ComEd Emerging Tech and Pilot implementation teams. Initially, Guidehouse will complete engineering reviews of the M&V plans and workbooks created by the pilot team for each of the four projects. Once projects have been installed and the pilot team collects post implementation data, Guidehouse will conduct custom reviews of each project to verify electric energy, demand, and natural gas savings (if applicable). The pilot team has indicated projects may complete in CY2022 or CY2023 depending on installation and data collection progress.

D.5 Variable Speed Heat Pumps as AC Replacement

This pilot is a field evaluation of the performance, energy and cost savings of variable speed heat pumps as replacements for air conditioners. Since the pilot is targeting the replacement of the air conditioner, the existing ducted heating system remains in-place as a backup heat source. The pilot is targeting 30-40 customers from a range of home types and with varying baseline system types. The pilot team plans to conduct detailed data collection and metering at all sites, along with interviews of participants and installers.

Table D-5. Evaluation Activities, Variable Speed Heat Pumps

Category	Tasks	CY2022	CY2023	CY2024	CY2025
General	ComEd Staff Interview	X	X		
General	Implementer Interview	X	X		
Impact	Savings Calculator and Work Paper Review	X			
Impact	Program Tracking Data Review		X		
Impact	Custom Savings Review		X		
Impact	Wave Impact Analysis		X		

Guidehouse will conduct interviews with the Pilot team during CY2022 and will review the proposed M&V plan once it is available. During CY2023, Guidehouse will continue to work with the pilot team to review the detailed data collected from the participating sites. Guidehouse will verify savings claims for this pilot during CY2023 using custom analyses for a sample of completed projects. The custom reviews may be staggered using a wave approach, where half of the anticipated sample is drawn midway through 2023, with the remainder of site analyses conducted upon conclusion of the data collection.

D.6 Automated System Optimization

Automated System Optimization will seek implementation of artificial intelligence software that can adjust building systems in real time using observed data and machine learning. ComEd is currently in the RFP process where they will review submissions and select a vendor.

Table D-6. Evaluation Activities, ASO

Category	Tasks	CY2022	CY2023	CY2024	CY2025
General	ComEd Staff Interview		X	X	
General	Implementer Interview		X	X	
Impact	Savings Calculator and Work Paper Review		X		
Impact	Custom Savings Review			X	
Impact	Survey, Phone, or Virtual Verification			X	
Impact	Onsite Verification			X	

Guidehouse will coordinate evaluation activities with the progress of the pilot. This includes ongoing discussions with the ComEd Emerging Tech and Pilot implementation teams. Initially, Guidehouse will complete engineering reviews of baselines and technical assumptions used by the pilot team. As the pilot progresses, Guidehouse will complete detailed custom savings reviews of completed projects.

D.7 “Communities of the Future” Next Gen HVAC Demo

This pilot seeks to better understand the broader needs of specific communities and its businesses. Through a more comprehensive community-driven outreach approach, this project will engage residents, landlords, businesses, property owners and community organizations to determine their specific needs and how energy efficiency solutions may address those needs. The project team will then coordinate installation, monitoring and verification of energy savings.

Table D-7. Evaluation Activities, Communities of the Future

Category	Tasks	CY2022	CY2023	CY2024	CY2025
General	ComEd Staff Interview	X	X	X	X
General	Implementer Interview	X	X	X	X
Impact	Savings Calculator and Work Paper Review		X	X	X
Impact	Custom Savings Review		X	X	X
Impact	Survey, Phone, or Virtual Verification		X	X	X

Guidehouse will coordinate evaluation activities with the progress of the pilot. This includes ongoing discussions with the ComEd Emerging Tech and Pilot implementation teams. Initially, Guidehouse will complete engineering reviews of baselines and technical assumptions used by the pilot team. As the pilot progresses, Guidehouse will complete detailed custom savings reviews of completed projects from CY2023 to CY2025.

Guidehouse is also aware that specific projects within this pilot may also fall under other emerging tech initiatives. Guidehouse will coordinate the savings claims for overlapping projects with the pilot team to verify savings under the appropriate pilot program.

D.8 Refrigeration Thermal Energy Storage

The Refrigerated Thermal Storage Pilot is investigating the savings potential and economic viability of thermal energy storage for refrigeration and advanced monitoring systems of commercial refrigeration applications within ComEd territory.

Table D-8. Evaluation Activities, Refrigerated Thermal Energy Storage

Category	Tasks	CY2022	CY2023	CY2024	CY2025
General	ComEd Staff Interview		X		
Impact	Savings Calculator and Work Paper Review		X		
Impact	Custom Savings Review		X		
Impact	Survey, Phone, or Virtual Verification		X		
Impact	Onsite Verification		X*		

*A site visit will only be conducted if the magnitude of savings, data uncertainty or data availability require.

Guidehouse will coordinate evaluation activities with the progress of the pilot. This includes ongoing discussions with the ComEd Emerging Tech and Pilot implementation teams. Initially, Guidehouse will complete engineering reviews of the M&V plan proposed by the pilot team, as well as the pilots Phase I report of available technologies. As the pilot progresses, Guidehouse will complete detailed custom savings reviews of completed projects to verify the electrical energy, demand, and natural gas (if applicable) savings, along with providing recommendations around measure life.

D.9 Variable Refrigerant Flow HVAC Systems for Cold Climates

The Variable Refrigerant Flow (VRF) HVAC for Colder Climates Pilot will seek to create awareness of the technology improvements that have made these systems viable in Illinois' colder climate, as well as reduce financial barriers to installing VRF systems in commercial and multifamily buildings.

Table D-9. Evaluation Activities

Category	Tasks	CY2022	CY2023	CY2024	CY2025
General	ComEd Staff Interview		X		
General	Implementer Interview		X		
Impact	Savings Calculator and Work Paper Review		X		

In CY2022, four sites completed installation of VRF HVAC systems. Guidehouse will conduct M&V desk reviews of the installed VRF HVAC equipment in CY2023. ComEd does not plan to claim savings from these installations, as they occurred outside of the pilot program. Data collected from installations will instead inform ComEd's development of a TRM work paper. Guidehouse will review language and provide comment for the work paper. ComEd seeks to create a VRF system measure during the 2023 or 2024 update of the Illinois TRM.

D.10 Very High Efficiency HVAC Retrofit

The Very High Efficiency HVAC Pilot will seek to install very high efficiency HVAC systems and compare the savings to traditional code-compliant forced air HVAC systems in small to medium-sized commercial buildings.

Table D-10. Evaluation Activities, VHE HVAC

Category	Tasks	CY2022	CY2023	CY2024	CY2025
General	ComEd Staff Interview	X	X		
General	Implementer Interview	X	X		
Impact	Savings Calculator and Work Paper Review	X			
Impact	Custom Savings Review		X	X	
Impact	Survey, Phone, or Virtual Verification		X	X	
Impact	Onsite Verification		X	X	

ComEd anticipates approximately five completed projects during CY2023 or CY2024. Guidehouse will complete a census review of completed projects in two waves. The first wave will commence during the middle summer of 2023 to capture projects completed early in the year and allow Guidehouse to provide early feedback to pilot staff. The second wave will start once all pilot projects are finished and documentation is finalized.

Guidehouse will complete detailed project file reviews comprised of the following components:

- Review and provide feedback on baseline selection
- Review model inputs, building setup, baseline selection, and model calibration
- Review modeled savings estimates for pilot participants.

Depending on the specific projects, Guidehouse may complete phone or onsite verification with pilot participants to collect necessary technical or operational data.

D.11 Air Source Heat Pump Training

This pilot is designed to educate HVAC contractors about air source heat pump technology and build competency towards quality installations of heat pumps in single family homes. The pilot activities primarily include contractor trainings in person and through online webinars, a “product ownership” program, and new recruitment channels for contractor workforce development.

The evaluation of this program will include the activities shown in Table D-11.

Table D-11. Evaluation Activities, ASHP Training

Category	Tasks	CY2022	CY2023	CY2024	CY2025
General	ComEd Staff Interview		X	X	
General	Implementer Interview		X	X	

Beyond the annual interviews, Guidehouse has not yet determined specific activities to support evaluation of this pilot. We will work collaboratively with the ComEd pilot team to identify relevant activities.

D.12 Heat Pump Water Heater

The pilot will examine heat pump water heater (HPWH) technology and market to better understand potential energy savings, customer experiences and supply chain implications. The pilot looks to install 50 HPWH’s across various income levels and fuel types for residential

customers. Energy savings goal are not the main focus for this pilot. ComEd seeks to understand the market actors and customer experience when installing HPWH's.

Table D-12. Evaluation Activities, HPWH

Category	Tasks	CY2022	CY2023	CY2024	CY2025
General	ComEd Staff Interview		X	X	
General	Implementer Interview		X	X	
Impact	Savings Calculator and Work Paper Review	X			
Impact	Program Tracking Data Review	X	X	X	
Impact	Measure-Level Deemed Savings Review	X	X	X	
Impact	Custom Savings Review		X	X	

As the pilot progresses, savings will be claimed in the year installation of the equipment occurred. Guidehouse will use the appropriate TRM algorithm measure to validate energy savings. Monitoring equipment will be used for a portion of installed measures. Guidehouse will perform an engineering desk review of the custom data collected by the monitoring equipment.

D.13 IQ Whole Home Electrification

This pilot seeks to complete large-scale whole-home weatherization and electrification of income qualified (IQ) single family homes and multifamily units. The pilot team is recruiting 100 participants from across the service territory and will conduct air quality monitoring as well as in-depth interviews with the pilot participants.

Table D-13. Evaluation Activities, IQ Electrification

Category	Tasks	CY2022	CY2023	CY2024	CY2025
General	ComEd Staff Interview	X			
General	Implementer Interview	X			
Impact	Savings Calculator and Work Paper Review	X	X		
Impact	Measure-Level Deemed Savings Review		X		
Process	Research		X		

Guidehouse conducted a review of the overall pilot design and savings methods during CY2022. During CY2023, Guidehouse will not conduct specific impact activities to verify savings for this pilot as the savings will be claimed under ComEd's existing Single Family and Multifamily offerings. Guidehouse will provide reviews of any savings calculation workpapers, electrification savings workpapers, and M&V plans based on ongoing discussions with the pilot team. Guidehouse will also assist with reviewing any of the customer interview findings for lessons learned or evaluability findings related to IQ electrification, if requested.

Appendix E. Cross-Cutting Research Evaluation Plans

ComEd's Plan 6 includes conducting research studies to estimate savings and non-energy impacts. These research studies test feasibility for inclusion of various measures in ComEd's portfolio, inform adding new measures in the Technical Reference Manual (TRM), or lead to updated savings calculations in the TRM.

Because research studies are launched throughout the program year and may last multiple years, Guidehouse develops a scope of work for these studies once consensus is reached with ComEd on the most appropriate path forward. We have already begun the joint ComEd-Ameren Illinois Compressed Air Leak Repair EUL research study and have outlined the process for estimating non-energy impacts. Guidehouse plans to develop additional research studies throughout ComEd's Plan 6 to address strategic priorities.

E.1 Joint ComEd-Ameren Illinois Compressed Air Leak Repair EUL Research Plan

E.1.1 Introduction

Compressed air leak repairs commonly involve addressing air leaking through threaded connections, push-lock fittings, hose connections, hose punctures, and hose clamps. Between ComEd and Ameren Illinois (AIC), this measure accounted for roughly 27 verified gross GWh of electric energy savings in CY2019.^{19,20} AIC is not currently offering leak repair through its programs as of the time of this research plan; leak repair offerings were discontinued in mid-2020, partly as a result of concerns with respect to measure life. The Illinois Technical Reference Manual version 10 (TRM v10) provides a range of effective useful life (EUL) values of 1-5 years,²¹ while leaving the utility and implementer susceptible to evaluation risk within that range.²² This EUL range was originally provided in TRM v7 with the idea that it would be updated in TRM v8. However, to date, a supported EUL value for compressed air leak repair has not been found and the language remains in TRM v9. This document proposes a research approach to address that issue.

¹⁹ The ComEd Industrial Systems Program saved 23,069,816 kWh (gross verified) from leak survey and repair in CY2019. *ComEd Industrial Systems Impact Evaluation Report*, Table 5-1. April 15, 2020.

<https://ilsag.s3.amazonaws.com/ComEd-Industrial-Systems-CY2019-Impact-Evaluation-Report-2020-04-15-Final.pdf>

²⁰ AIC saved 3,682 MWh (verified gross) from compressed air retro-commissioning (the Opinion Dynamics evaluation team indicated that the majority of these savings are derived from leak repair) and 888 MWh (verified gross) from standard prescriptive leak survey and repair. <https://ilsag.s3.amazonaws.com/2019-AIC-Business-Program-Annual-Impact-Evaluation-Report-FINAL-2020-04-30.pdf>

²¹ Attachment B: Effective Useful Life for Custom Measure Guidelines. Illinois Technical Reference Manual, Version 10. Volume 4. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://ilsag.s3.amazonaws.com/IL-TRM_Effective_010122_v10.0_Vol_4_X-Cutting_Measures_and_Attach_09242021.pdf

²² Footnote from the TRM v9: "A range of possible lifetime values is provided. Therefore, the implementers of this measure must justify the reason for selecting an appropriate measure life for each project and the decision will be subject to evaluation with the risk of adjustments."

E.1.2 Research Approach

Overview

Previous research plans on this subject proposed to consider compressed air leaks as a system of air leak generation but were never finalized and the research was not conducted.²³ Conversely, this plan treats the air leaks as individual leaks. The previous research plan relied on measuring the overall percent change of leakage at the compressor and would have required significant contextual data (i.e., condition changes in the facility) to be collected and interpreted. This research plan is in response to feedback provided on the previous plans and should simplify the analysis and reduce subjectivity.

Participants for this research will be ComEd customers, and the research will rely on ComEd's existing leak repair channels (Fix It Now, Industrial Systems). While the intended purpose of this study is to provide one EUL for compressed air leak repair based on research and empirical evidence, ComEd's existing leak repair channels also collect the type of leak, or the equipment that is leaking, including threaded connections, push-lock fittings, hose connections, hose punctures, hose clamps, etc. This additional information will allow the evaluation to identify whether the EUL differs for different leak types.

EUL Definition

For this research, the EUL will be defined as the time it takes for 50% of the leak repairs to fail (i.e., for the leak to reoccur). For example, if 100 leak repairs are made, the EUL is the amount of time it takes for 50 leak repairs to fail. For the purposes of this research, the presence of a leak is the only consideration: it either exists or it does not. The magnitude of leak failure (i.e., how many CFM) will be captured in the data collection but is not anticipated to be considered in this analysis. There is no objective lower limit to the leak (i.e., how small does a leak need to be to be considered unworthy of repair?),²⁴ though there is a practical lower limit that can be determined based on leak repair history. Based on a review of past leak projects, leaks below 20 decibel (dB) are commonly left unrepaired.

Research Activities

Table E-1 summarizes the tasks for this research and details follow.

²³ See memo titled "ComEd-Ameren EUL Research CY2020 Compressed Air Leakage Audit and Repair Updated Plan Memo 2020-07-09" sent to ComEd on July 9, 2020.

²⁴ Based on conversation with EESP Mike Byrd from Air Services Company. March 10, 2021. Guidehouse's initial investigation into ComEd leak data shows dB readings as low as 5 dB, with most leaks identified between 10 dB and 20 dB.

Table E-1. Air Leak EUL Research Activities

Task	Description	CY2021	CY2022	CY2023	CY2024	CY2025
Planning	Draft and finalize research plan	X				
Coordination with Service Providers	Establish service provider buy-in, get input and agree to terms	X	X			
Identification of the Participants	Energy efficiency service providers (EESPs) find willing participants to join the study		X			
Initial Site Visits	Conduct leak audit and repair, tag, or log leak repairs to make follow-up visits successful		X			
Subsequent Site Visits	Conduct leak audit of the repairs that occurred in the initial site visit and log findings			X	X	X
Analysis	Each time data is generated by the EESPs, the EUL estimate will be re-evaluated					X
Reporting	At the time that enough data is generated, the research will conclude, and the results will be reported					X

Coordination with Energy Efficiency Service Providers

The EESPs for ComEd’s Fix It Now and Industrial Systems Programs (excluding small businesses) will solicit interest in participating in the study from their customers as they implement the program. The EESPs will forward contact information from customers willing to participate in this research to Guidehouse for additional screening and an opportunity to answer any questions from the potential participants.

Guidehouse, in combination with ComEd, will develop materials for the EESPs to use in this effort including ComEd-branded leak tags, ComEd-branded breakroom flyers, and a leak survey log Excel file.

- The leak tags will be branded with the ComEd logo and brightly colored to aid the EESPs in identifying the leak repairs in the future.
- The breakroom flyers will be branded with the ComEd logo and will explain the purpose of the research and the ComEd leak repair tags. Guidehouse will provide the message and ComEd will provide the formatting for this document.
- The Excel-based leak survey log will be modified to accommodate this research. The modifications will be minimal and the information collection burden on the EESP will be minimized.

In addition to the three documents listed, Guidehouse will offer a participant appreciation benefit to the participants, likely to be in the form of a food gift card, doughnuts and coffee, etc. This appreciation benefit will also garner attention to the research, its purpose, and the importance of

leaving the leak tags in place. We expect the combination of the ComEd-branded materials and the food benefit to increase compliance during the research period.²⁵

Sample

Due to the nature of a manufacturing environment, this research assumes a large amount of initially identified leaks (tagged or otherwise) may be unidentifiable in subsequent visits. To account for this attrition, the research will oversample based on initial estimates to achieve 90/10, 2-tailed precision. The target sample is 400 leaks,²⁶ which based on past projects, corresponds to approximately 14 sites.²⁷ Guidehouse will encourage the EESPs to recruit customers with larger compressed air systems, so it is possible that the leak sample is greater than 400. The budget reflects this possibility.

Data Collection

At sites where the customer has agreed to participate in the research, the compressed air EESP will conduct a leak audit and repair. The EESP will attach a leak tag, take a photo of the repaired component, log a detailed description of the location, and may mark the leak with a marking device such as a paint pen to effectively identify the repairs during subsequent site visits. The leak survey log will collect, at a minimum, the following pieces of information:

- Leak location: This will be one of the primary means that the EESP has of finding the previously repaired leak. A detailed description will be useful for locating those repairs in subsequent phases.
- Leak description or category (pipe, hose, fitting, joint, etc.)
- Pressure at leak (psig)
- Decibel reading (dB)
- Whether the leak was repaired (Y/N)
- Whether the leak would have been repaired if incentives were available²⁸

During the leak survey and repair visit, the EESP will identify and repair the air leaks as they normally would as part of the program and also tag their leak repairs with a research tag to aid in future identification during subsequent site visits. Additionally, the EESP will explain the purpose of the research and the importance of leaving the tags in place. The EESP will leave a flyer with the customer explaining what the purpose of the tags and the instruction to leave them in place unless removal is necessary.

Every 6 months, Guidehouse will contact the EESPs to confirm they have scheduled their follow-up site visits with the research participants. To encourage participants to join and stay in the study, we will provide the participants with the food benefit identified previously for each site visit. The EESP will audit the leak repairs, document the findings, and report them to the evaluation team. The standard that the EESP will use to determine if a repair is leaking will be

²⁵ Based on conversation with EESP Mike Byrd from Air Services Company. March 10, 2021.

²⁶ This is a preliminary estimate based on budget considerations. We will review the statistics to support or revise the sample quantity.

²⁷ Based on a review of past leak repair projects, there are 28 leaks per project on average.

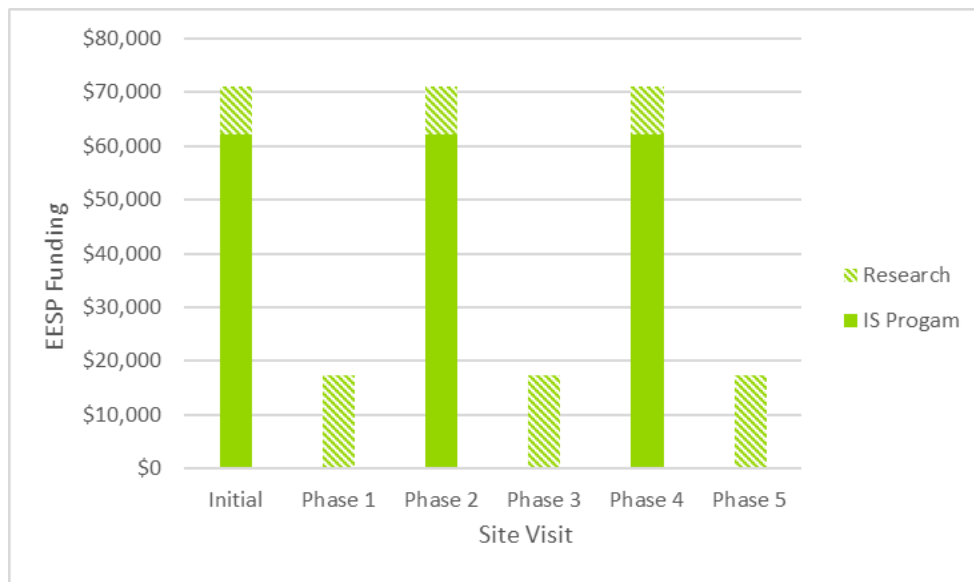
²⁸ During the 6-, 18-, and 30-month intervals, the repair incentives (\$100 per leak repaired) will not be available.

the same standard that is presently used to identify air leaks. The EESP will also document whether any reoccurring leaks or leaks in the vicinity of repaired leaks are:

- Reoccurrences of the same leak
- Expansion or extension of a repaired leak beyond the repair
- New leak adjacent to but separate from the repaired leak

The follow-up site visits will be repeated five times until 30 months have elapsed since the beginning of the research.

Figure E-1. EESP Funding Sources Over Research Period



Participant Experience

After the participant schedules a leak survey and repair with their EESP and have indicated interest in participating in the research, Guidehouse will contact participants and provide additional details about the research and its requirements. If the participant agrees to be part of the research, we will make a food benefit available to the customer on the days of the site visits. During the initial visit, Phase 2, and Phase 4 visits, the leak survey and repair will come at no additional cost to the participant, as typical with the Industrial Systems and Fix It Now Programs. During the Phase 1, 3, and 5 visits, the leak survey will be free of charge, but the leak repairs will not be incentivized. During the site visit, the EESP will provide the participant with an educational flyer relating to the research. The only other difference from a typical leak survey and repair will be that the EESP will tag a repaired leak with a research tag.²⁹

Every 6 months, the participant will be contacted by their EESP to schedule a follow-up site visit. Guidehouse will coordinate with the EESP and participant to provide a food benefit on or near the day of the follow-up site visits. During the follow-up site visit, the EESP will identify and record the condition of the previously tagged leak repairs (failed or not failed). To take

²⁹ Typically, repaired leaks are not tagged.

advantage of the opportunity and to provide additional benefit to the customer, the EESP will conduct a program-funded air leak survey to identify and repair any new air leaks that have been created since the previous visit. This provides the participants with the additional benefit of very proactive leak repair support.

The primary elements of the customer experience are:

- Increased interaction with compressed air service providers
- Increased leak repair support
- Tags on equipment with repaired leaks³⁰
- Light interaction with Guidehouse (initial phone call, food benefit coordination)

Analysis

Guidehouse will analyze the data provided by the EESPs after each site visit.

There are three analysis scenarios depending on the data that is generated by the research.

1. Interpolation: If half the leak repairs fail in the research period.
2. Extrapolation: If fewer than half the leak repairs fail in the research period, but there is a strong trend in the data.
3. Informed Engineering Judgment: If fewer than half the leak repairs fail in the research period, and there is no strong trend within the data.

The analysis will be relatively straightforward and should not require sophisticated analysis methods or tools. It is expected to be an interpolation, extrapolation, or an estimate based on engineering judgment and available data. If a customer drops out from the research group, their data will be included up to the point that they dropped out. After that point, their leak repairs (denominator) and the leak repair failures (numerator) will be removed from the cumulative failure rate calculation. We will analyze the dropouts to make sure that they do not dramatically affect the failure rate.

The following are examples of how the analysis is expected to work and how the EUL will be estimated.

Interpolation

If half the leaks fail within the research period, the analysis will be a relatively simple interpolation. Table E-2 presents an example of this scenario.

³⁰ Use of tags will be at the judgement of the EESP. If a tag is likely to be cumbersome to the participant (e.g., near a hand tool), then a documented description of the location can be used to locate the leak repair in the future.

Table E-2. Example of Interpolation Analysis

Phase	Sites*	Leaks†	Incremental Failed Repairs	Total Failed Repairs‡	Cumulative Failure Rate (%)§
Initial (0 mos.)	14	400	N/A	N/A	0.0%
One (6 mos.)	13	360	10	10	2.8%
Two (12 mos.)	12	330	23	22	6.7%
Three (18 mos.)	11	295	30	47	15.9%
Four (24 mos.)	10	270	68	115	42.6%
Five (30 mos.)	9	240	70	178	74.2%

* Sites may drop out from the research due to lack of interest, going out of business, or other reasons.

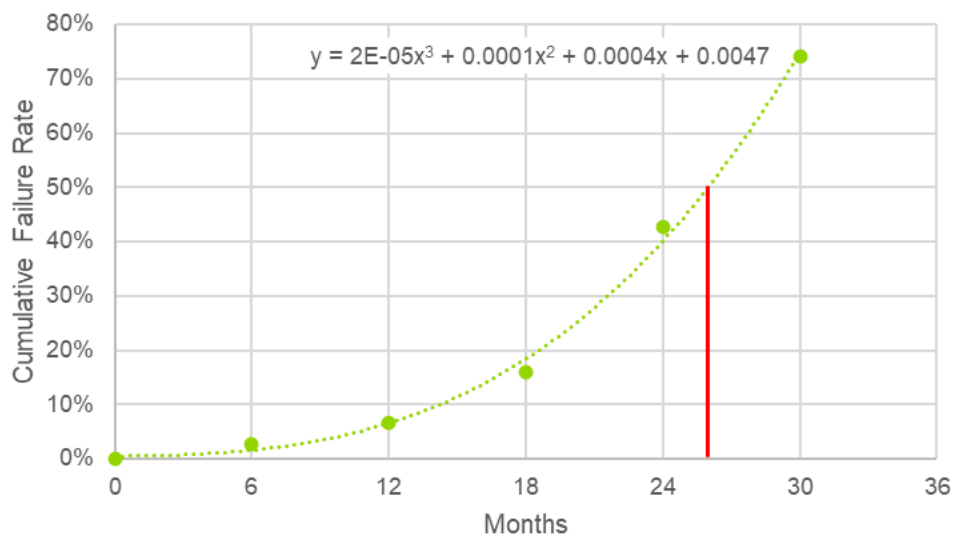
† Leaks may drop out from the research due to sites pulling out of the research, equipment changes at the site, changes in process, or other reasons.

‡ Because some sites or leaks may disappear from the research, Total Repaired Leaks is a sum of the Additional Failed Repairs minus any failed repairs from sites that drop out of the research.

§ Cumulative Failure Rate = Total Failed Repairs / Leaks

A trendline will be fit to the leak data and used to estimate the point at which 50% of the leaks have occurred (see Figure E-2). Using the example data in Table E-2, the half-life of the measure calculates to 26 months, or 2.2 years.

Figure E-2. Example of Interpolation Equation



Extrapolation

There is the possibility that the research finds that fewer than half the leaks fail in the research period. Guidehouse will review the data and recommend one or both of the following:

- To continue the research

- To use an evaluation estimate of greater than 3 years

If there is a strong trend in the data,³¹ extrapolation will be used to estimate EUL. Table E-3 presents an example of this scenario.

Table E-3. Example of Extrapolation Analysis

Phase	Sites*	Leaks†	Additional Failed Repairs	Total Failed Repairs‡	Cumulative Failure Rate (%)§
Initial (0 mos.)	14	400	N/A	N/A	N/A
One (6 mos.)	13	360	2	2	0.6%
Two (12 mos.)	12	330	5	7	2.1%
Three (18 mos.)	11	295	8	14	4.7%
Four (24 mos.)	10	270	15	29	10.7%
Five (30 mos.)	9	240	30	54	22.5%

* Sites may drop out from the research due to lack of interest, going out of business, or other reasons.

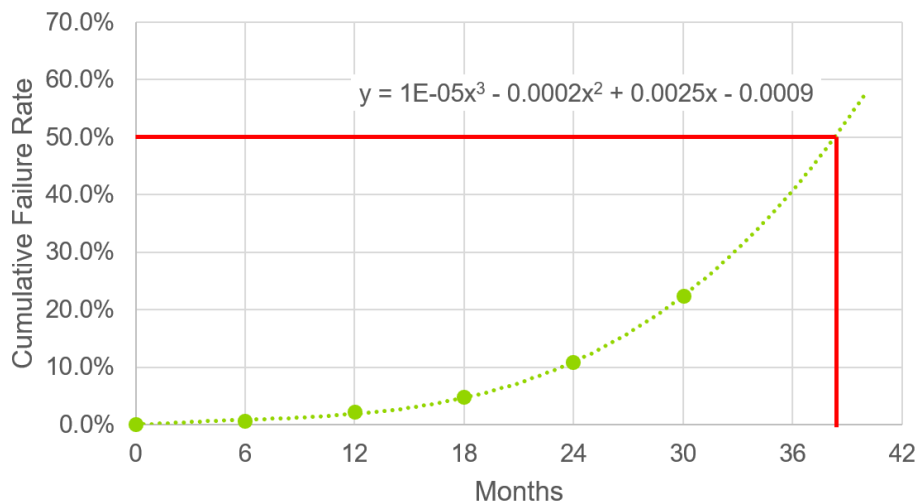
† Leaks may drop out from the research due to sites pulling out of the research, equipment changes at the site, changes in process, or other reasons.

‡ Because some sites or leaks may disappear from the research, Total Repaired Leaks is a sum of the Additional Failed Repairs minus any failed repairs from sites that drop out of the research.

§ Cumulative Failure Rate = Total Failed Repairs / Leaks

In extrapolation, a trendline will be fit to the leak data and used to estimate the point at which 50% of the leaks would have occurred (see Figure E-3). Using the example data in Table E-3, the half-life (i.e., EUL) of the measure calculates to be 38 months, or 3.2 years.

Figure E-3. Example of Extrapolation Equation



³¹ The strength of the trend will be based on evaluation judgement.

There is the possibility that extrapolation of the collected data results in a large half-life (e.g., 20 years). In this event, our deliverable will show the EUL that could be projected from the results, but we will provide a recommendation in the absence of conclusive research results.³²

Informed Engineering Judgment

If fewer than half the leaks fail in the research period and there is a not strong trend,³³ evaluation will need to apply engineering judgment on whether to use a trendline or to make an estimate that considers the observed data. Given that 50% of the leak repairs would not have failed at the end of the 30-month period, the informed engineering estimate would have a minimum value of 3 years. Guidehouse may also recommend additional research phases in this scenario. Table E-4 shows an example of data with a weak trend.

Table E-4. Example of Data with a Weak Trend (Judgement Analysis)

Phase	Sites*	Leaks†	Additional Failed Repairs	Total Failed Repairs‡	Cumulative Failure Rate (%)§
Initial (0 mos.)	14	400	N/A	N/A	N/A
One (6 mos.)	13	360	38	38	11%
Two (12 mos.)	12	330	2	40	12%
Three (18 mos.)	11	295	3	41	14%
Four (24 mos.)	10	270	3	44	16%
Five (30 mos.)	9	240	68	107	45%

* Sites may drop out from the research due to lack of interest, going out of business, or other reasons.

† Leaks may drop out from the research due to sites pulling out of the research, equipment changes at the site, changes in process, or other reasons.

‡ Because some sites or leaks may disappear from the research, Total Repaired Leaks is a sum of the Additional Failed Repairs minus any failed repairs from sites that drop out of the research.

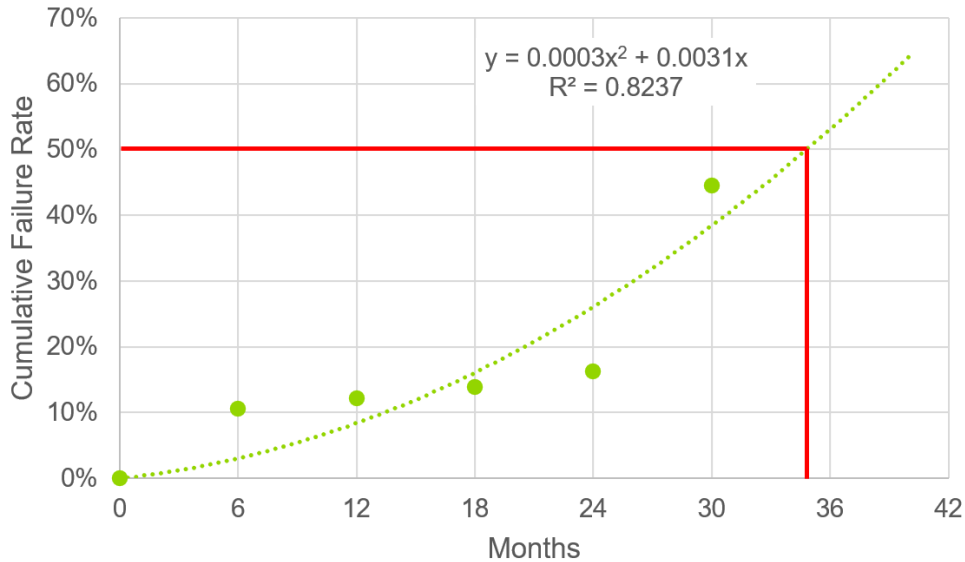
§ Cumulative Failure Rate = Total Failed Repairs / Leaks

A trendline with a weak fit could still be used to estimate the half-life (see Figure E-4. Using the example data in Table E-4, the half-life of the measure (i.e., EUL) calculates to be 36 months, or 3.0 years.

³² This is the upper bound of the range provided in Appendix B of TRM v9.

³³ The strength of the trend will be based on evaluation judgement.

Figure E-4. Example of a Weak Trend



E.2 Non-Energy Impacts

E.2.1 Introduction

In CY2017, Guidehouse began researching non-energy impacts (NEIs) in accordance with FEJA with the goal to include monetized values in ComEd’s cost-effectiveness analyses and to report the economic and employment impacts associated with ComEd’s EE portfolio. Societal public health NEIs accrue to society and include improvements to the environment, and the health, safety, and comfort of citizens and include reduced morbidity and mortality associated with reduced air pollution. Economic and employment NEIs accrue to the citizens and industries affected by the economic activities of the energy efficiency portfolio and include job creation and other economic benefits. Participant NEIs accrue to participants living in homes that received energy efficiency upgrades through comprehensive IE programs and include decreased symptoms and medical costs associated with asthma, arthritis, and thermal stress. Participant NEIs also accrue to building owners and property managers of multifamily buildings and include reduced tenant turnover and reduced tenant comfort complaints. Beginning in CY2020, we included societal NEIs in ComEd’s TRC values, reporting the TRCs with and without the societal NEIs. Beginning in CY2018, we reported the economic and employment impacts of ComEd’s EE portfolio on the Illinois economy. Our IE participant NEI research is ongoing with results expected for ComEd’s single family IE program channels in CY2023 and IE multifamily program channels in CY2024 or CY2025.

E.2.2 Assessing Economic and Employment NEIs

Guidehouse estimates economic and employment impacts associated with ComEd’s EE programs on the Illinois economy annually. The assessment of the economic and employment impacts includes the activities shown in Table E-5.

Table E-5. Evaluation Activities – Economic and Employment NEI

This assessment is based on the portfolio of programs implemented during the program year with impacts occurring over the life of each measure – up to 25 years. The impacts are both positive (e.g., net bill savings) and negative (e.g., bill surcharges) and involves a 3-step process which is documented annually in a memo:

- 1) Data Collection
- 2) Economic Modeling
- 3) Analysis of Findings

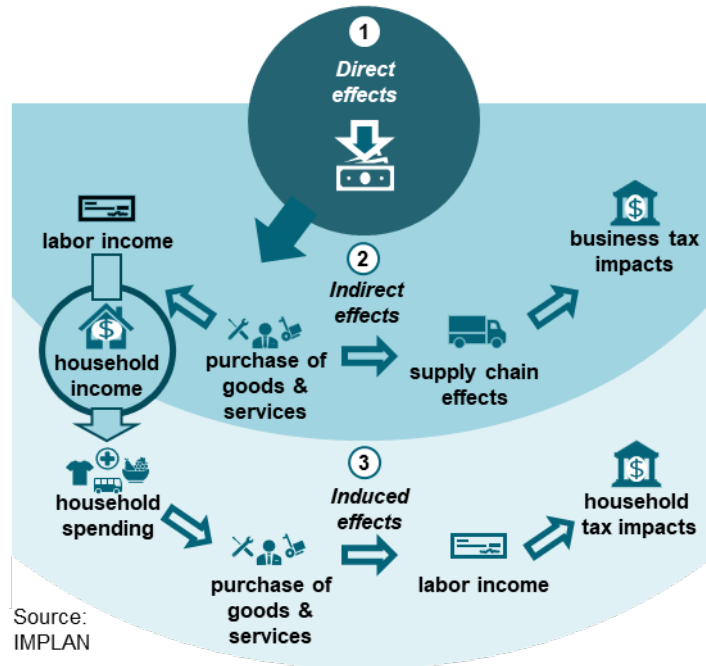
The impacts are based on the changes in household and business spending patterns due to changes in bill surcharges, bill savings, incentives and rebates, and changes in spending via net incremental costs, fuel/transportation services, and program administration.

This assessment uses input-output analysis models that show how money flows through the economy based on supply chain relationships; the effects are categorized into direct, indirect, and induced (Table E-6). Direct impacts results from changes in demand for industries/commodities, households, or spending patterns. Indirect impacts are due to changes in supplier purchases, and induced impacts are generated from changes in household spending from changes in labor income (Figure E-5).

Table E-6. Description of Impacts

Type of impact	Example
Direct Effects resulting from direct spending	Net Incremental Costs, Program Administration, and changes in HH and Business Spending
Indirect Effects resulting from industries purchasing from each other	Spending on materials, components, and services
Induced Effects resulting from household spending of labor income	Spending on housing, healthcare, transportation, food, retail and entertainment by workers

Figure E-5. Example of changes in spending via Direct, Indirect, and Induced Impacts



This assessment uses four types of economic metrics to reflect changes in the economy:

- 1) Jobs: Employment
- 2) Labor Income: Total Compensation
- 3) Gross Domestic Product (GDP) (Value Added): Premium created from each stage of the supply chain (Business Sales – Inputs)
- 4) Business Sales: Sales of goods and services across the supply chain

The economic modeling includes the use of IMPLAN, a regional economic analysis software application to estimate the ripple effects of a given economic activity through the implementation of an Input-Output (I/O) model. The following assumptions regarding the I/O model include:

- 1) Constant Returns to Scale: Same quantity of inputs needed per unit of output.
- 2) Fixed Input Structure / No Substitution Effects: Same recipe of inputs always will be used to create the output.
- 3) Industry Homogeneity: All firms within an industry are characterized by a common production process
- 4) No Supply Constraints: No restrictions to inputs, raw materials, and employment.
- 5) Technology Assumption: An industry and production of commodities uses the same technology to produce each of its output
- 6) Constant Byproducts: Industry byproduct coefficients are constant
- 7) Static Model: Prices remain constants and data/relationships are not affected by impact runs

- 8) Backward Linkages: Type I multipliers measure on the upstream effects
- 9) Time Dimension: Length of time for economy to settle at new equilibrium after an initial change in economic activity is unclear

E.2.3 Quantifying and Monetizing Societal NEIs

The Societal NEI research objective is to quantify and monetize societal NEIs associated with ComEd’s portfolio. This research started in CY2018 and will continue annual analyses and reporting in CY2022-CY2025.

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

- How many deaths, hospital admissions, non-fatal heart attacks, cases of acute bronchitis, for example, will be avoided?
- How much work loss will be avoided?
- What is the dollar value of associated costs avoided by society?

The evaluation of this program will include the activities shown in Table E-7.

Table E-7. Evaluation Activities – Societal NEIs

Category	Tasks	CY2022	CY2023	CY2024	CY2025
Impact	AVERT analysis	X	X	X	X
Impact	COBRA analysis	X	X	X	X
Impact	Generate societal NEI values for cost-effectiveness analysis	X	X	X	X
Impact	Annual report	X	X	X	X

Guidehouse developed a modeling strategy to utilize the EPA’s CO-Benefits Risk Assessment (COBRA) and AVoided Emissions and geneRation Tool (AVERT) models to quantify the avoided emissions and health benefits of ComEd’s CY 2021 programs. Guidehouse will pull energy efficiency program evaluation MW and MWh savings results to use as inputs for AVERT. AVERT produces an estimate of PM2.5, SO2, NOx, VOCs, and CO2 avoided emissions within the Great Lakes / Mid-Atlantic Region defined in the EPA’s eGrid tool.

The avoided emissions estimates will be an input to the COBRA tool, which calculates the changes in ambient particulate matter in the region. Then, COBRA calculates the societal avoided cost of chronic and acute bronchitis, non-fatal heart attacks, respiratory or cardiovascular hospital admissions, work loss days, and other impacts associated with improved ambient particulate matter.

Guidehouse developed a strategy to utilize the EPA AVERT and COBRA modeling tools for the following reasons:

- The tools were built by a trusted source
- Commonly used in state energy efficiency and renewable energy analyses
- Monetized impacts align with other impacts calculated at the participant level of this study

Guidehouse will use AVERT and COBRA to monetize health impacts from reduced emissions in the following categories:

- Avoided death
- Hospital admissions
- Non-fatal heart attacks
- Acute bronchitis
- Upper and lower respiratory symptoms
- Emergency room visits
- Minor restricted activities
- Work loss
- Asthma exacerbation

Guidehouse will use the monetized societal NEI values for the program and pilot TRC analyses to include in the annual cost-effectiveness report.

E.2.4 Quantifying and Monetizing Participant NEIs

The Participant NEI research objective is to quantify and monetize NEIs related to participants in comprehensive ComEd’s IE single-family and multifamily energy efficiency programs for ComEd to include in future cost effectiveness tests. These research activities are based on the Stipulation and Future Energy Jobs Act (FEJA) legislation. This research started in CY2018 and will continue data collection and reporting CY2022-CY2025.

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

- Do IE ComEd program participants experience reductions in medical visits, missed days of school and/or work, and instances of thermal stress?
- Do building owners and property managers of multifamily buildings that receive energy upgrades through ComEd programs experience reductions in costs associated with maintenance, tenant complaints, and tenant turnover?

The evaluation of this program will include the activities shown in Table E-8.

Table E-8. Evaluation Activities – Participant NEIs

Category	Tasks	CY2022	CY2023	CY2024	CY2025
Impact	Participant Surveys	X	X	X	
Impact	Building Owner and Property Manager Interview	X			
Impact	Monetize Quantified NEIs	X	X	X	
Impact	SAG Working Group Presentation	X	X	X	

Guidehouse developed a survey instrument in conjunction with ODC to quantify NEIs associated with IE program participation. Surveys will be distributed to IE single-family and multifamily participants as a pre-survey at the time of their weatherization and HVAC energy upgrades, and as a post-survey 12 months after receiving upgrades. The 12-month lag between surveys is intended to allow time for changes to participant health from their energy upgrades.

Guidehouse will quantify the following NEIs based on feedback from participants:

- Reduced medical visits due to reduced asthma symptoms
- Reduced medical visits due to reduced arthritis symptoms
- Reduced missed days of school
- Reduced missed days of work
- Reduced medical visits due to thermal stress
- Reduced need for heating assistance

We will collect data from income-eligible single-family and multi-family participants until we achieve quotas of 80 incidences each of asthma, arthritis, heat stress, and cold stress.

Guidehouse will interview multi-family building owners and property managers to quantify:

- Reduced vacancy
- Reduced equipment maintenance
- Marketability
- Reduced tenant turnover
- Home improvements
- Durability of property
- Reduced tenant complaints

The income-eligible single-family pre-survey is fielded January 2021 through June 2023 (or until we achieve quotas). The post-survey will be fielded through June 2024 (or longer if we needed to extend the pre-survey to achieve quotas).

The income-eligible multifamily pre-survey will be fielded July 2022 through July 2023 (or until we achieve quotas). The post-survey is anticipated to be fielded through July 2024 (or longer if we needed to extend the pre-survey to achieve quotas).

Following the conclusion of the primary research, we will monetize the quantified NEIs using Illinois-specific medical costs and other monetized Illinois-specific values. We will document the monetized values to be used in the TRC analyses and present our findings to the SAG NEI WG.

In addition, we will produce a memo with the findings of our building owner and property managers interviews and update the SAG NEI WG as requested.

Appendix F. Budgets

The evaluation budget for the work represented in this evaluation plan is presented in Figure F-1 and Table F-1.

Figure F-1. CY2023 Evaluation Budget by Forecast Category

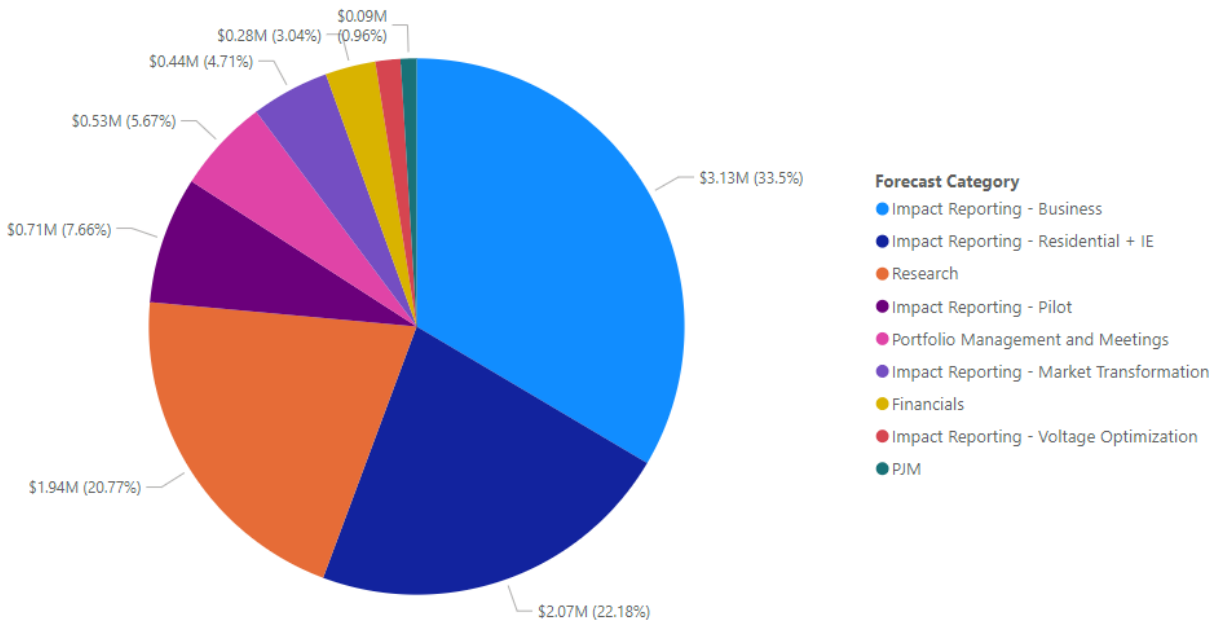


Table F-1. CY2023 Evaluation Budget Summary

Category	Total
Impact Reporting - Business	3,125,067
Impact Reporting - Residential + IE	2,068,499
Research	1,937,716
Impact Reporting - Pilot	714,268
Portfolio Management and Meetings	528,853
Impact Reporting - Market Transformation	439,641
Financials	283,127
Impact Reporting - Voltage Optimization	141,053
PJM	89,542
Total	9,327,767