Nicor Gas Company – Evaluation Plans for 2021 – Final

Plan Years 2018-2021

(1/1/2018-12/31/2021)

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1. INTRODUCTION

This document presents evaluation, measurement and verification (EM&V) plans for evaluating Nicor Gas energy efficiency programs in 2021, which is the final program year of Energy Efficiency Plan 2018-2021 (EEP 2018-2021). This version is an update for 2021.

Enacted energy legislation Section 8-104 was amended through Public Act 99-0906 ("PA 99-0906") that changed the period of the energy efficiency plan and required Illinois gas utilities to provide energy efficiency programs to income-qualified and public sector customers. Guidehouse developed evaluation plans to address the new legislation. PA 99-0906 caused key changes to the previous plans, including:

a. Twenty-five percent (25%) of the budget is no longer allocated to the Department of Commerce and Economic Opportunity (DCEO). Likewise, twenty percent (20%) of the savings goal is no longer allocated to the DCEO. Nicor Gas is now accountable for the entire budget and savings goals. Elements of the DCEO portfolio transferred to Nicor Gas include:
    i. Income-Qualified Programs, targeted at households with incomes at or below 80 percent of area median income.
    ii. Public Sector Programs, targeting energy efficiency measures for entities including, but not limited to, local government, municipal corporations, school districts and community college districts.
    iii. Market Transformation initiatives, which represent 5 percent of the portfolio budget in the approved Nicor Gas plan.
b. The Nicor Gas Energy Efficiency Plan (EEP) is now based on a calendar year.[1]
c. The EEP encompasses four (4) years versus three (3) years – the four year cycle is 2018 to 2021.

The next sections include an overview of evaluation approaches and a proposed high-level schedule for program year 2021 evaluation tasks. The appendix includes detailed, program-level evaluation plans.

[1] Prior to 2018, the previous six program years began on June 1 of each year, and were designated PY1, PY2, PY3, etc. Program years ended May 31, except PY6 was extended seven months and ended December 31, 2017. Under the previous notation, program year 2018 would have been PY7.

2. GUIDING PRINCIPLES

The guiding principles for evaluation activities include:

Impact Evaluation

- Verify the gross and net savings to be applied toward statutory goals for each Nicor Gas program year. Use gross savings calculated from the Illinois Technical Reference Manual (TRM) or custom impact evaluation research, and calculate net savings by applying the Illinois Energy Efficiency Stakeholder Advisory Group (SAG) deemed net-to-gross (NTG) value. When programs are delivered jointly with electric utilities, calculate verified gross natural gas savings without interactive effects from the reduction of electricity usage.
- Estimate the net-to-gross (NTG) ratio for each program, including adjustments for free ridership and spillover, to support annual prospective deeming of NTG ratios consistent with the Illinois NTG Policy. Conduct NTG research at least once during the four-year program cycle for each program following the NTG protocols in the TRM. Some programs, such as income qualified, do not require primary NTG research because NTG values are deemed by consensus at 1.00.
- Where budget and schedule can accommodate, target a larger number of completions for NTG surveys than the minimum required for a 90%+/-10% level of confidence and precision program-level result.
- Wherever possible, consider performing free ridership research online in real time (soon after the participant decision is made), and following technical reference manual (TRM) protocols, collect spillover information via telephone after participation.
- Where practical, conduct program evaluations and measure research using randomized controlled trials (RCT) or quasi-experimental design (QED). When Guidehouse believes that RCTs or QEDs are not practical, as part of its evaluation plan, Guidehouse will provide an explanation and support for its decision.
- Conduct technical reviews and gather Illinois-specific data to update the Illinois TRM and recommend updated verification approaches for applicable measures.

Process Evaluation and Other Research

- Gather data, perform analysis, and create recommendations to help improve the functioning and effectiveness of the Nicor Gas programs.
- Collaborate with Nicor Gas and other Illinois utilities to suggest promising areas for energy efficiency (EE) research, industry best practices, or other topics of interest.

Support Nicor Gas Strategic Goals

- Continue evaluating more of the portfolio in real time, including:
    - Conducting program tracking database reviews during the third quarter (results by September 15 if data is available by July 15) in each program year to ensure the latest TRM algorithms are properly applied.
    - Conducting the first wave of custom project verification starting in July and additional waves later in the program year if participation is sufficient for sampling.
    - Conducting surveys closer to participation, drawing samples across program years when appropriate.
- Improve qualitative approaches with new data collection approaches (email or web based), supplemented with the Nicor Gas energyENGINE data system and/or survey data, when appropriate.

- Leverage infrastructure investments in energyENGINE.
- Provide technical expertise and data to the Illinois Energy Efficiency Stakeholder Advisory Group (SAG) to support statewide goals.
- Provide technical expertise for evaluation in Regulatory Dockets.
- Provide technical expertise to address ad hoc evaluation issues.
- Include diverse vendors on the evaluation team.

Reporting

- Provide annual impact evaluation reports for all Nicor Gas programs.
- Provide annual impact and cost-effectiveness portfolio summary reporting. Include water savings and annual and lifecycle greenhouse gas (GHG) impacts.
- The target delivery for draft joint reports is March 15, with all final joint reports by April 30.
- For Nicor Gas only programs, best efforts will be made to deliver a draft report by March 15, and a final report by April 30. This schedule, however, is dependent on delivery of final tracking data by January 30 of each year and review schedules. For Nicor Gas-only programs with only TRM-based measures, we expect draft delivery not later than April 15, with final reports by June 3. For programs with custom measures, we expect draft delivery not later than May 6, with final reports by June 24.
- After the impact evaluation is final, Guidehouse will provide a spreadsheet file of verified savings at the tracking record level (project or measure ID) for TRM-based programs.
- Requests to update the TRM will be submitted to the TRM Administrator prior to the annual submission deadline (late February), and workpapers for accepted updates will be submitted by the May 15 due date in the TRM update process.
- NTG research results will be reported not later than August 1 each year, so that results can be reviewed and finalized in time for the September 1 initial evaluator NTG recommendations to the SAG as required by the Illinois EE Policy.
- Draft process research results will be delivered by September 15, with preliminary findings and recommendations shared earlier, when available.
- Perform the four-year *ex post* cost-effectiveness analysis per Section 8-104(f)(8).

Planning

- Provide evaluation plans for Nicor Gas programs each program year.
- The target delivery date for initial draft plans will be December 15, with final plans by February 28.
- Seek input from the SAG, Nicor Gas, and other Illinois utilities when drafting and updating annual evaluation plans.

Coordination

- Guidehouse will coordinate with and/or seek input from other Illinois utilities (ComEd, Peoples Gas and North Shore Gas, Ameren Illinois) and their evaluators, the SAG including ICC staff, and the TRM administrator:
    - When planning evaluation research and survey activities.
    - When conducting evaluation research where collaboration to achieve broader coverage and larger sample sizes may improve the research results.

Exceptions to these guiding principles may occur for some programs; if that is the case, exceptions will be noted in program-specific evaluation plans.

3. EVALUATION PLAN OVERVIEW

As part of the evaluation planning process, Guidehouse has updated the high-level portfolio plan and detailed program-level annual evaluation plans to help prioritize research plans and budgets.

EEP 2018 – 2021 Evaluation Research Plan

The evaluation team has summarized the yearly evaluation plans for the EEP 2018 – 2021 portfolio to identify key research tasks by year. The three tables in this section provide an overview of completed and planned impact research studies, net-to-gross research, and in-depth process evaluation research. Gross impact savings verification occurs for each program in all program years.

Cross-cutting notes for the tables:

- **Gross impact savings verification** occurs for each program in all program years.
- **Process Researched Year(s)** and **NTG Researched Year(s)** indicate the program year(s) of participation of the research subjects. The Income-Qualified programs currently have an approved NTG of 1.0 and we have no plans to conduct NTG research on these in 2021; instead, we show process research target and timing plans in Table 2.
- **NTG Results Delivered** indicates the year when draft and final NTG results are completed and recommended to SAG.
- **Other Research / Notes: Year/Activity** indicates the time frame that the research will be conducted. **Notes** are added for some programs to clarify research targets.

Supporting information on evaluation approaches and cross-cutting activities is provided in Section 4.

Annual Evaluation Program Plans

The individual annual program evaluation plans are provided in the Appendix. The program plans provide additional details to describe the approaches for conducting annual gross, net, and process evaluation activities, and detailed schedules.

Table 1. Residential Programs High-Level Plan by Year

Offering	Evaluation Research Activities by Year*				
	Process Researched Year(s)†	NTG Researched Year(s)†	NTG Results Delivered‡	Other Research	
				Year§	Activity
Home Energy Efficiency Rebate (HEER)					
Equipment Rebates	2019-2020	2019-2020	2020		
Education and Outreach Track					
Behavioral Energy Savings	None Planned	N/A	NA	2019-20 (Interim and Final 2021 (Final)	Net impacts for 2019 through 2021 will be analyzed through gas billing usage analysis of an RCT design
Elementary Energy Education	None	None	NA	2018-19	Investigate water heating fuel split (Completed)
Energy Saving Kits	2020	2020	2021	2021	In-Service Rates with Process/NTG
Home Energy Savings (HES)					
Audit/Direct Install Weatherization Rebates	2017-18	2017-18	2018	2018	Air Sealing/Insulation Billing Analysis (Completed)
				2022	Virtual Assessment/Self-Installation ISR, Assessment Recommendation Follow-through (planned)
Multi-Family					
Audit/Direct Install	2018	2018	2019		
Retrofit Projects	2018	2018	2019		
Residential New Construction (RNC)					
Residential New Construction	2021	2021	2022	2019	Calibrated Simulations of 2018 (Completed)
Emerging Technologies Program and Market Transformation					
Research Studies and Pilot Programs				2018-19	Connected Savings Pilot Billing Analysis and Survey (Completed)

*Gross impact savings verification occurs for each program in all program years.

†Process Researched Year(s) and NTG Researched Year(s) indicate the program year(s) of participation of the research subjects.

‡NTG Results Delivered indicates the year when draft and final NTG results are completed and recommended to SAG for application in the subsequent program year.

§Other Research: Year indicates the time frame that the research will be conducted.

Table 2. Income-Qualified Programs High-Level Plan by Year*

Offering	Year	Research Activity
Single-Family Retrofits		
Illinois Home Weatherization Assistance Program (IHWAP)	2018-19	Community Action Agency Focus Groups and Interviews (Completed, 2019 CBA and IHWAP Slidedoc)
	2021	Participating Customers Process Survey (Gas only survey – ComEd is choosing not to participate. Nicor Gas will join study with PGL and NSG to achieve adequate sample size. Expand sample to include Multi-Family IHWAP property owner/managers).
Income Eligible Multi-Family and Public Housing Energy Savings Programs		
IHWAP	2021	Include MF when conducting the SF IHWAP survey
Public Housing Energy Savings (PHES)	2018-19	Implementation Staff, PHA Representatives, and Residents (Completed, 2019 Memo, ComEd funded)
Affordable Housing New Construction		
New Construction	2018-19	Developer Survey and Implementer Interviews (Completed, 2019 Slidedoc)

*Gross impact savings verification occurs for each program in all program years. The NTG ratio is 1.0 for all programs.

Table 3. Business Programs High-Level Plan by Year

Offering	Evaluation Research Activities by Year*				
	Process Researched Year(s)†	NTG Researched Year(s)†	NTG Results Delivered‡	Other Research	
				Year§	Activity
Business Energy Efficiency Rebate (BEER) (includes Public Sector)					
Equipment Rebates	2018	2018	2019		
Steam Traps	GPY4-GPY6 2018	2018	2019	2019 2020	Steam Trap Process, Savings Assessment (Completed) TRM Algorithm Update (Completed)
Public Sector	2018	2018	2019		
Assessment / Direct Install	2018	2018	2019		
Custom Incentives (includes Public Sector)					
C&I Custom Public Custom	2020	2020	2021	2019-21	Document custom measure EULs to support TRM (Ongoing)
Joint Retro-Commissioning (RCx)		2019-20	2021		
Nicor Gas Only RCx		2020	2021		
Combined Heat and Power		Project Specific or 0.80			
Strategic Energy Management (SEM)					
SEM Cohorts	None	NA	NA		
Small Business (includes Public Sector)					
Assessment / Direct Install	2021	2020-2021	2021		
Retrofit Projects	2021	2020-2021	2021	2020-21	Standard Programmable Thermostats Billing Analysis of Past Participants (Ongoing)
Joint Non-Residential New Construction (NRNC)					
NRNC	2018	2018, 2019, 2020, 2021	2019, 2020 2021		

*Gross impact savings verification occurs for each program in all program years.

†Process Researched Year(s) and NTG Researched Year(s) indicate the program year(s) of participation of the research subjects.

‡NTG Results Delivered indicates the year when draft and final NTG results are completed and recommended to SAG.

§Other Research: Year indicates the time frame that the research will be conducted.

4. EVALUATION APPROACHES AND CROSS-CUTTING ACTIVITIES

Impact Evaluation Approaches

The primary goal of impact analysis is to verify the gross and net savings claimed by Nicor Gas to be applied toward statutory goals. The effort has secondary goals of improving the accuracy of ex ante impact estimates, improving the accuracy and relevance of the TRM, and improving the accuracy and usefulness of the program tracking systems. The impact analysis will typically include the following components:

1. **Program Tracking Data Review**. Verify the type of measures installed and the quantities claimed for accuracy as reported in the program tracking database and supplemental data provided by implementation contractors.
2. **Savings Verification for TRM-Based Measures**. For TRM-based measures, Guidehouse will verify ex ante gross measure savings against the allowable input values and algorithms provided in the relevant ICC-approved version of the TRM.
3. **Savings Verification for Custom Measures.** For non-TRM "custom" measures, Guidehouse will conduct evaluation research to verify gross impacts. For each project selected for the participant sample, an in-depth application review is performed to assess the engineering methods, parameters and assumptions used to generate all ex ante impact estimates. For each measure in the sampled project, engineers estimate verified gross savings based on their review of documentation and engineering analysis. Validation of savings through gas usage billing data analysis may be used in combination with the engineering review for individual sites. Site-specific data will be collected for a subset of sampled projects, either through telephone interviews with site contacts, or an on-site visit that follows required safety protocols. On-site data collection includes interviews that are completed at the time of the visit, visual inspection of the systems and equipment, recording energy management system (EMS) settings, and collecting EMS trend data or production records when available and necessary. To support this review, Guidehouse requests project documentation in electronic format for each sampled project.
4. **Parallel Path / Large Project Review**. Guidehouse will conduct project file reviews that fall under a "Parallel Path" designation. These are projects that the implementation contractor has identified early in the project application cycle that may pose a risk to verified realization of gross impacts, either due to the complex technical nature or difficulty in baseline determination. As budget allows, Guidehouse conducts a review of project documentation and energy saving estimates and prepares a brief response that identifies further questions or revisions to the gross savings estimates. The findings are discussed with the implementation contractor who then adopts the findings going forward or proceeds as originally intended with a better knowledge of evaluation risk for the project. Final verified savings for parallel path projects are determined after the project is completed.
5. **Impact Sampling.** For custom measures, impact-related sampling will be designed to achieve a 90%/±10% level of confidence and precision at the program level, and may also include selected high priority measures. Savings verification of TRM-based measures is performed on a census of claimed installations (not sampled).

6. **Consumption Data ("Billing") Analysis with Statistical Validation Check**. A standard regression approach for estimating program natural gas energy savings is a preferred method for the evaluation of the energy use impacts of certain programs and measures. Guidehouse will perform billing analysis to evaluate programs when appropriate. Where practical, program evaluations will be conducted using RCTs or QEDs. When Guidehouse believes that RCTs or QEDs are not practical, we will provide an explanation and support for this decision as part of the program's evaluation plan.
7. **Net Savings Verification**. The net savings impact evaluation for each measure will apply the net-to-gross (NTG) ratio deemed through the Illinois SAG consensus process.
8. **Jointly Implemented or Coordinated Programs.** Evaluations of joint or coordinated programs will be designed to meet the needs of Nicor Gas and ComEd, as well as other Illinois utilities, when appropriate. When programs are delivered jointly with electric utilities, Guidehouse calculates verified gross natural gas savings without applying an interactive effects penalty from the reduction of electricity usage.
9. **Timing for Interim Impact Evaluation.** Guidehouse will conduct mid-year impact evaluation for most programs if data are available prior to the end of year. Guidehouse will conduct a review of the Nicor Gas adjustable savings goal calculations in December and January, checking for correct adoption of updated TRM algorithms and inputs. For programs with TRM-based measures, Guidehouse will conduct an interim review of per-unit savings from tracking data during the third quarter (results by September 15 if data is available by July 15). For programs with non-TRM custom measures, Guidehouse will draw savings verification samples one to three times during the program-year, depending on the number of completed projects, with the first sample drawn about July 15. Guidehouse will review implementer developed ex ante savings calculations if requested, or when a new delivery channel is added to the portfolio.
10. **Timing for End of Year Impact Evaluation.** Final program year impact evaluation will take place after the program-year ends, when we receive final tracking data, expected by January 30. The target delivery for draft joint reports is March 15, with all joint reports final by April 30. For Nicor Gas-only programs, best efforts will be made to deliver a draft report by March 15 and a final report by April 30. This schedule, however, is dependent on delivery of final tracking data by January 30 of each year and review schedules. For Nicor Gas-only programs with only TRM-based measures, we expect draft delivery not later than April 15, with final reports by June 3. For programs with custom measures, we expect draft delivery not later than May 6, with final reports by June 24. We expect billing usage analyses will occur after the end of the program year when final billing data is available (which may be some weeks after January 30) and may include multiple program years to accommodate a full heating season.
11. **Summary Impact Reporting**. After the impact evaluation is final, Guidehouse will provide a spreadsheet file of verified savings at the tracking record level (project or measure ID) for TRM-based programs. Annual impact reporting will include water savings and annual and lifecycle greenhouse gas (GHG) impacts for all programs.

Consumption Data Analysis Applicability

In general, consumption data (billing) analysis methods are best suited to programs with the following characteristics:

1. The expected net savings per participant (i.e., the effect size) are large or when large participant/nonparticipant sample sizes are possible.
2. The program can be designed using a randomized controlled trial.
3. Nonparticipant spillover is expected to be trivial within the comparison group.
4. Self-selection bias can be effectively controlled for.

In an RCT design, evaluators (and sometimes implementation contractors) randomly assign sampled members of a population of interest to a treatment group or a control group. Among the benefits offered by an RCT—when properly applied—is that it produces net savings estimates by netting out free ridership. The evaluation of a program must be designed and implemented this way from the outset; it is not possible for an evaluation team to apply RCT evaluation techniques after the program has been implemented if random assignment to treatment and control groups was not done before program launch. Most often, we do not evaluate programs via a randomized controlled trial because the program was not designed with randomly assigned treatment and control groups. For example, rebate programs are offered to all customers that meet participation criteria, not offered selectively.

Where randomized assignments prove infeasible, QED evaluation methods may be substituted (although experimental designs are typically preferable when possible). Depending on the exact QED implemented, the savings may be net, gross, or somewhere in between with respect to the different pieces of a NTG adjustment (participant spillover, nonparticipant spillover, and free ridership). Quasi-experimental approaches are commonly used to evaluate behavior-based energy efficiency programs that cannot be constructed as experiments. Most often, we do not use quasi-experimental design consumption data because a program contains many unique measures with significant cross-participation. In this case, quasi-experimental consumption data analysis would produce savings estimates for bundles of commonly-installed measures, rather than for each measure individually, which is not the desired output for analysis.

Support for TRM Updates

The evaluation team will provide support to improve the TRM by participating in the Technical Advisory Committee (TAC) meetings and update process. Support may include reviewing new measures; suggesting changes to current methods or approaches, algorithms, and assumptions for existing measures; and analyzing data from completed evaluation activities to support updating TRM assumptions. Guidehouse will provide technical review for workpapers developed by Nicor Gas and its implementation contractors.

The TRM is updated annually based on input from Program Administrators, evaluators, and others through a consensus-based decision-making process. The TRM updates are final by October 1 of each year, and are effective January 1 of the new program year. We will follow the statewide TRM update schedule:

- Before March 1: Submit TRM update requests to the TRM administrator.
- April 1: TRM TAC informs Program Administrators, evaluators, and SAG which measures are high or medium priority measures, for which work papers need to be prepared.
- May 15: Proposed updates to existing measure work papers to clarify terms or approaches, as well as proposed work papers for new measures, are submitted to the TRM Administrator.
- May 15 – September 15: Ongoing TAC meetings and review and comment on submitted workpapers to reach consensus on TRM updates.
- By October 1: Final TRM values for the following program year.

NTG Research and Framework Application

Section 8-104 of the Public Utilities Act requires that evaluations include an assessment of net savings. The net savings analysis requires the evaluator to assess the influence of Nicor Gas programs versus other factors on the customer's decision to install energy efficiency measures, either through the programs or outside of them. These program influences could include free riders, non-participant spillover, market transformation effects, and participant spillover. Evaluation efforts will measure net savings considering free ridership and participant spillover in all programs (except those where consensus values are deemed statewide without further research, such as income eligible programs), and, where supported by the program delivery model, non-participant spillover and market transformation effects. The NTG analysis will apply, follow and incorporate the Illinois Statewide NTG Methodologies Framework (IL NTG Framework or Framework) agreed to among the Illinois SAG participants, approved by the Illinois Commerce Commission and documented in the effective Illinois TRM Version and any subsequent updates to the Illinois NTG Framework.

When NTG research is conducted on a program, the results will be summarized in a memo that is delivered by August 1. This will allow time for program administrator and SAG review prior to evaluators sending initial NTG recommendations to the SAG by September 1, as required by Illinois Policy. In early September of each year, we will present our initial recommended NTG ratios for each Energy Efficiency Program, Sub-Program, and/or Measure group (where applicable) to the SAG, intended to represent the best estimates of future actual NTG values likely to occur for the upcoming program year. SAG participants, including Guidehouse, will make best efforts to reach consensus by October 1 regarding NTG ratios appropriate for deeming for the upcoming program year.

Process Evaluation Approaches

Guidehouse's overarching objective with process evaluations is to provide timely and useful information for each program using the appropriate tools at hand. The evaluation team is prepared to address key issues for individual programs on an as-needed basis. The team does not anticipate conducting a process evaluation for each program in each year, but rather targeting the available budget resources where these have the most value to Nicor Gas and their customers, plus leveraging surveys conducted as part of the NTG research. As appropriate, we will coordinate process activities across programs and across utilities for joint programs to address the whole of the Nicor Gas approach to the market.

While the process evaluation methods for each individual program will vary depending on the program's needs and stage of development, key tasks in conducting process evaluations using interview techniques and documentation review include:

- Developing interview guides.
- Identifying appropriate parties to interview. Frequently, the evaluation will include in-depth qualitative interviews with those directly involved in each program, including program managers and implementation contractors, participating trade allies, and participating customers.
- Conducting interviews and other research data collection tasks.
- Analysis and reporting of findings and recommendations.

Depending upon the circumstances, our team will use either a survey house to conduct structured surveys, online survey tools, or senior staff members to complete interviews. Guidehouse will provide draft process results by September 15.

Additional Research Activities

Based on discussions with Nicor Gas, and input from the SAG, TRM TAC, and other Illinois utilities, we identified the following research tasks for the EEP 2018-2021 evaluation plan (separated into research completed, research currently active, and research not included in the 2020-2021 plan). Program-specific research for NTG and process topics is described in program-level plans and not in this section unless the research affects the TRM.

Completed

1. **Residential Insulation and Air Sealing.** Guidehouse completed an air sealing and insulation billing analysis initiated in PY6, releasing draft results on March 29, 2018 and sending out the final report in September 2018. The findings informed updates to the TRM residential insulation and air sealing measures. Guidehouse developed TRM work papers based on the study that were adopted into TRM version 7.0.
2. **Emerging Technologies Program: Connected Savings Pilot Impact Evaluation.** Guidehouse used billing data analysis to conduct the energy impact evaluation of the joint ComEd and Nicor Gas 2018 Connected Savings Pilot Program. Using energy consumption and weather correlations, the Connected Savings Program creates a thermodynamic model for each home to understand how it responds to weather changes. The model subsequently develops more efficient customer-specific cooling and heating schedules, which inform its adjustment of household thermostats. Whisker Labs, the program implementer, partnered with Honeywell to set up the Connected Savings Program in 2017 using a randomized controlled trial. In addition to the billing analysis, Guidehouse conducted an on-line survey of control and treatment groups. The work was completed in 2019.
3. **Residential New Construction.** For the 2018 impact evaluation, Guidehouse performed simulation modeling calibrated to energy bills for the gross impact analysis. A second round of updates to the simulation models was planned for late CY2020 when the majority of program homes are permitted under the new IECC 2018 code. In 2019, ComEd elected to discontinue the joint program design at the end of 2019. Nicor Gas launched a redesigned program in 2020 that relies upon prescriptive measures with gross impacts defined in the Illinois TRM. Guidehouse cancelled plans to repeat the calibrated simulations in 2020.

4. **Steam Traps Process/Market Study and NTG Research.** In the fourth quarter of 2018, Guidehouse initiated a process/market research study on steam traps with a trade ally NTG research component. The final report was released in January 2020. Research included secondary research on steam traps and utility programs, and surveys conducted with active trade allies, inactive trade allies, manufacturers, and participating customers from GPY4 through GPY6. Study findings informed the BEER Program 2018 steam trap participant NTG research that occurred in 2019, leading to a substantially higher spillover estimate for the measure. The Guidehouse team designed the process study to explore the steam trap market for both large commercial and industrial customers using steam traps for heating and industrial process applications. The research objectives for this study included investigating the following aspects of commercial and industrial steam trap usage:
    - Systems and equipment description, including operating information, such as hours of use, whether the steam trap operates at high or low pressure (e.g., 20 PSI range vs. 100 PSI range), and approach for handling condensate
    - Approach to steam system monitoring and usage tracking
    - Maintenance practices and observed failure rates
    - Corporate policies around maintenance, purchasing, and planning
    - Business sector barriers to steam trap inspection, maintenance, and replacement
    - Business customers' typical interactions with vendors. For example, do they have a contractor or do they talk with manufacturers reps? Who do they call when they need service and replacement of steam traps?
    - Steam trap supply chain, including the flow of products from manufacturers to distributors to contractors to end users
    - Estimated active trade ally perspective of participant free ridership and non-participant spillover
5. **Steam Traps Impact Study Feasibility Assessment.** The large contribution of steam traps to portfolio savings merited consideration of an impact study, but background research was needed in 2018 to assess whether a viable study was feasible. In 2018, the Nicor Gas, Ameren Illinois, Peoples Gas, and North Shore Gas evaluation teams conducted background research to understand (1) what data currently exist to support estimation of steam trap impacts, (2) the available study population of participants that have installed steam traps through energy efficiency programs in Illinois, and (3) the available evaluation methods to update the TRM. We produced a memo summarizing findings of our background research addressing the items above. A statewide conference call with evaluators, implementers, and other parties was held on October 29, 2018 to review the preliminary findings and identify action items prior to determining whether steam trap impact analysis should be pursued.

    Following the statewide conference call, evaluators and utilities investigated the population of dry cleaning businesses statewide as a possible study target, and concluded there were insufficient numbers of participants and non-participants to conduct a viable billing analysis. Another action item from the call, participant feedback on their methods for condensate handling and steam usage monitoring, was included in the steam trap process/market study conducted for Nicor Gas.
6. **Steam Trap TRM Algorithm Update.** The steam trap impact feasibility assessment identified a need to examine the TRM algorithm to determine whether it appropriately models critical factors and applications that affect steam usage. Guidehouse participated in the TRM v9.0

TAC special working group to examine the algorithm, and a substantial update to the algorithm was made for TRM version 10. Guidehouse has no plans for additional research work on steam traps in 2021.

7. **Non-Energy Impacts (NEIs) Economic Impact.** In 2019, Guidehouse and the Ameren Illinois (AIC) evaluator ran the IMPLAN Model for ComEd and AIC to estimate the economic impact from electric energy efficiency programs. Evaluators presented electric findings on job creation to the SAG in November 2019. After incorporating feedback from the electric draft results, Guidehouse extended the IMPLAN model to Nicor Gas using 2018 portfolio evaluation results in the model. The result was an estimate of economic output, labor income, and jobs created.
8. **Non-Energy Impacts (NEIs) Estimation.** NEIs are program impacts that are separate from energy savings. Guidehouse conducted a literature search to determine which states or natural gas utilities use quantified and monetized NEIs for cost-effectiveness tests. The research included identifying methodologies previously used by states or natural gas utilities to evaluate societal, participant, and utility NEIs. This gas-focused research leveraged and built upon the extensive research conducted by Guidehouse for ComEd. In Q3 2020, Guidehouse produced a detailed memo presenting estimates of societal NEIs using EPA emissions modeling, as well as individual state methodologies and proxy values used for participant NEIs. The final monetized societal and participant results were produced in October 2020. In December 2020, Guidehouse reported we do not recommend a monetized utility NEI value based on currently available research and data.

Currently Active or Planned for 2021

1. **Custom Gas Project EUL Secondary Research.** The goal of this research is to establish the effective useful life (EUL) values for non-TRM measures that are common in the Nicor Gas Custom Program. In 2019, Guidehouse reviewed the Custom Program's participation from GPY3 through CY2018 and ranked measure categories by ex ante savings. This effort identified 33 measure categories, 19 of which are accounted for in ComEd's EUL research or in the IL TRM v8.0. Four of the remaining 14 measures account for more than 1 percent of the 5-year population's savings. A memo summarizing Guidehouse's EUL estimates for the 14 measures was sent for comment in September 2019. This effort is ongoing – as new measures are installed through Custom Program, Guidehouse will work with the Nicor Gas implementer to establish an EUL.
2. **Small Business Thermostats Impact Billing Analysis.** To assess the feasibility of a consumption data analysis of gas space heating, Guidehouse conducted a statistical power analysis to estimate a sample size. We then examined past gas utility Small Business Program participation data to determine if there was a viable population to conduct a billing analysis of programmable thermostats, or whether a pilot offering was required. Guidehouse estimated a sample of at least 150 participants was needed. We drew a sample from GPY6, 2018, and 2019 Nicor Gas BEER and Small Business programs. After data cleaning and matching to non-participants, Guidehouse was able to match a sample of 90 sites. Preliminary results found savings of about 6% of heating load, and the error bound was 0% to 12%. Additional potential sample points were identified from GPY4 and GPY5 participants and Guidehouse matched these to non-participants to increase the sample to 152. Results will be available in Q1 2021.

3. **Emerging Technologies Program.** Guidehouse is collaborating with Nicor Gas and implementer GTI to assess new technologies investigated through the Emerging Technologies Program. Nicor Gas and GTI perform primary research and analysis of new technologies, and Guidehouse provides secondary engineering review to support inclusion in the Illinois TRM. Completed, ongoing, and planned research includes air deflectors for unit ventilators, steam traps, commercial weather stripping, and commercial spring loaded door hinges.
4. **Kits In-Service Rate.** Nicor Gas offers energy saving kits through the Elementary Energy Education Program, the Energy Saving Kits Program, and to income-qualified customers. To date, kits have included water-saving and water heating measures and lighting (when joint with ComEd). In 2019, Nicor Gas began distributing home weatherization measures as a kit. The Illinois TRM version 9.0 uses weatherization in-service rates drawn from secondary research. The in-service rates for these measures will be investigated in 2021 as a part of a NTG and satisfaction survey of Nicor Gas kit recipients. The In-Service Rate research results will be presented in a TRM v10 workpaper by May 15, 2021 if accepted as an update.
5. **Virtual Assessment and Self-Installation Research**. Guidehouse plans to conduct survey research with 2021 participants, including those receiving virtual assessment and in-person assessment, likely through an online participant survey. If the survey is conducted online, no sampling will be done; the evaluation team will email a link to the survey to all participants with an email address. Satisfaction, conversion (or not) of major measure assessment findings into implemented projects, and installation rates of virtual assessment and self-installed measures will be research topics for 2021 participants. The In-Service Rate research results will be presented in a TRM v11 workpaper by May 15, 2022 if accepted as an update.
6. **Non-Energy Impacts (NEIs) Primary Research.** NEIs are program impacts that are separate from energy savings. In a study funded by ComEd, Guidehouse will assess participant NEIs from electric and gas energy efficiency improvements through survey research of income-qualified households. Guidehouse will start fielding surveys shortly after ComEd resumes implementation for Income-Eligible Single-Family Retrofit and Multi-family Retrofit programs (paused due to COVID lockdowns). We anticipate preliminary results in Q3 2021 that provide health history and demographics of participants, and post-installation results by June 2022.

Considered, Not Pursued in 2020 – 2021 Plan

Several research topics were considered during 2018 – 2021 evaluation planning, but not pursued. The following topics are retained in the plan for consideration in 2022 and beyond.

1. **Sector Level Non-Participant Spillover**. Guidehouse leveraged secondary research from another jurisdiction to assess the feasibility of conducting a non-participant spillover study at a program, sector or portfolio level for Nicor Gas. We conclude that a study targeting trade allies or customer non-participants could be designed that meets the TRM NTG protocols. The following options are ordered from lowest to highest cost to execute:
    - **Option 1: Market Actor Interviews**: Market actor interviews can be used to examine the effects of upstream influences and potential market effects. These interviews target contractors, trade allies, auditors, and design specialists working in the program field to understand how their sales align with program operations, standards,

and impacts. Market Actor surveys would need to focus on specific end uses / programs with high trade ally involvement.

- **Option 2: Non-Participant Survey**: Non-participant surveys are used to capture additional energy savings achieved when a non-participant implements energy efficiency measures or behavior as a result of a utility program's influence without having participated in the program. A general population survey targeting segments of non-participants could be implemented and used to triangulate with program participant survey results and market actor interview findings. Surveys should be mixed-mode to minimize response bias and may require the purchase of a sample to reach adequate reporting levels.
- **Option 3: Market Sales Data Analysis:** Focused on capturing the total net effect of a utility program, market sales data analysis picks up free ridership, participant, and non-participant spillover by comparing post-program data with data from a non-program comparison area for the same point in time. This is the most difficult option to complete due to difficulties associated with data collection.

2. **Residential New Construction Market Actor Interviews.** The 2019 Residential New Construction Program was jointly offered by Nicor Gas and ComEd, but ceased to be joint in 2020. Nicor Gas launched a new construction program with a prescriptive-based rebate structure, with some completed projects recorded by mid-2020. This study would consist of market actor interviews (builders, raters, contractors) to assess the effects of the program design transition and identify opportunities for improvement. The interviews would also be an opportunity to identify potential energy saving market effects induced by the program. A more limited data collection effort is planned for late 2021 as a NTG survey to update the RNC NTG.
3. **Residential Weatherization Participant Research.** ComEd has recently ended joint weatherization rebates for non-low-income customers, reducing the attractiveness of the Nicor Gas program offering. This study would consist of market actor interviews (homeowners, contractors) to assess the effects of the program design transition and identify opportunities for improvement.
4. **Income-Qualified (IQ) Crosscutting Process Research.** There are several gas and electric energy efficiency program offerings targeting income-qualified populations. Process evaluations have been ongoing on individual offerings since 2018. Members of the SAG have recommended crosscutting process research to examine whether the current slate of offerings is effective at reaching all IQ sub-groups, and whether individual customers and delivery agents are being effectively served. Income-qualified participants surveyed to date have reported high satisfaction with the offerings available to them.
5. **Income Eligible Single-Family Retrofits.** If program volume is sufficient, Guidehouse will consider an energy-bill calibrated-simulation study to determine the accuracy of TRM savings estimates and capture interactive savings effects. For calibrated simulations, Guidehouse recommends a population of at least 1,000 homes from which 500 homes could be used in the sample.
6. **Commercial Energy Management System Gas Billing Analysis.** In 2019 and 2020, Guidehouse scoped out a study to examine gas energy bill impacts for a sample of energy management system (EMS) projects drawn from ComEd's 2018 and 2019 rebate program.

The effort intended to estimate realization rates and other savings metrics (e.g., therms per site or square foot) and produce a TRM workpaper that could support prescriptive rebates. This study requires participation of ComEd and PGL and NSG, however, ComEd chose not to participate, and the study was not pursued. Nicor Gas is acquiring EMS savings through retro-commissioning and custom rebates, rather than prescriptive rebates.

7. **Residential Advanced Thermostat Billing Analysis.** Guidehouse could conduct a gas billing analysis evaluation on residential advanced thermostat installations, taking advantage of a larger population of installations, more robust tracking data, and energyENGINE demographics. Guidehouse would produce a TRM work paper if the assumptions or methodology need to be updated, based on study findings.
8. **Non-Residential Heating System EFLH.** Guidehouse could conduct a study to update the non-residential equivalent full load heating hour research Guidehouse conducted in GPY3 in the business sector. The study would include BEER and Multi-Family participants. The TRM administrator updated non-residential EFLH values in the EEPS 2018 – 2021 plan cycle through simulations that were not calibrated to energy consumption data.
9. **Water Saving Measures.** Guidehouse could conduct a billing analysis to estimate the impact of water saving measures distributed through kits by analyzing summer period energy usage (which may be observable when gas usage is limited to water heating and cooking). The Illinois evaluation teams are not aware of previous studies of this type that have been conducted in Illinois.

The four-year research plan schedule is summarized in Table 4. The table does not include program-level process and NTG research studies that are described in the individual program plans.

Table 4. Four-Year Additional Research Plan Schedule*

Activity	Status	2018	2019	2020	2021
Residential and Income-Qualified Research					
Residential Insulation and Air Sealing Billing Analysis and TRM Workpapers	Completed	1Q-3Q			
Emerging Technologies Program Connected Savings RCT Pilot Impacts and Survey	Completed	1Q-4Q	1Q		
Residential New Construction – Updated Calibrated Simulations	Completed	4Q	1Q		
Kits In-Service Rate (concurrent with ESK NTG Survey)	Planned				1Q-2Q
HES Virtual Assessment In-Service Rate	Planned				3Q-4Q
Business and Public Sector Research					
Steam Traps – Background Research on Viability of Impact Study	Completed	2Q-4Q	1Q		
Steam Traps – Process/Market Assessment Research Study	Completed	2Q-4Q	1Q-4Q		
Steam Traps – Support TRM Algorithm Update	Completed		4Q	2Q	
Custom Gas Measure EULs	Active		2Q-4Q	Ongoing	Ongoing
Small Business Standard Programmable Thermostats – Billing Analysis of Past Participants	Active			2Q-4Q	1Q
Other Research					
Non-Energy Impacts (NEIs) Economic Impact	Completed		4Q	1Q-3Q	
Non-Energy Impacts (NEIs) Monetized Values Estimation and Secondary Research	Completed			1Q-4Q	
Non-Energy Impacts (NEIs) Participate in Primary Research	Planned			4Q	1Q-4Q

* This table does not include NTG and process research conducted for individual programs. Those research tasks are described in the program plans.

Annual and Ad-hoc Reporting

Guidehouse's portfolio evaluation plan(s) will provide details on the exact nature of the annual reports that it will produce. At a minimum, we will produce a draft and final report annually encompassing each specific program evaluation. The annual reports will summarize evaluation findings for the previous year and present overall energy savings for the portfolio, along with any additional information required for annual and plan-cycle reporting. Annual impact reporting will include water savings and annual and lifecycle greenhouse gas (GHG) impacts for all programs.

Guidehouse will produce periodic ad-hoc reports, memos, and presentations providing timely feedback on the results of its data collection and analysis efforts to program managers and implementation staff. Memos produced throughout the program year will typically be included as an appendix to the appropriate evaluation report. Customer-specific information (survey responses, site reports, etc.) will be kept confidential and excluded from public reports.

Cost-Effectiveness Review and Summary Reporting

Guidehouse will provide a brief annual portfolio summary report for each program year, 2018 through 2021, and will produce a final report summarizing the combined results for the four program years after the conclusion of 2021. The annual portfolio summary reporting will be presented in three spreadsheet documents, using templates recommended by the SAG, accompanied by a memo describing Guidehouse's approach and source of assumptions. The tables included are:

1. Total Resource Cost (TRC) and Utility Cost Test (UCT) Cost-Effectiveness Results Tables
2. Verified Energy Savings Summary Tables (including water and GHG savings)
3. High-Impact Measures Tables

The final evaluation summary report for the four years will summarize the results from the four annual reports in a concise format, and include the ex post cost-effectiveness report. Guidehouse will conduct a TRC cost-effectiveness analysis at the conclusion of the four-year program plan pursuant to Section 8-104(f)(8). Both the annual ex post TRC analysis and the four-year TRC cost-effectiveness analysis shall include the gas and electric costs, and benefits for the joint energy efficiency programs that Nicor Gas offers in conjunction with another Program Administrator, such as ComEd.

Work on the annual cost-effectiveness spreadsheet reports will begin after annual impact evaluation reports are final, with draft results available September 15, and final results October 30.

APPENDIX A. DETAILED PROGRAM EVALUATION PLANS

Guidehouse has developed program-specific plans to evaluate the entire portfolio of Nicor Gas energy efficiency programs. The following programs are covered in this plan, including income qualified-programs and Public Sector programs introduced in 2017:

- Residential Programs
  - Program Home Energy Efficiency Rebates (HEER)
  - Program Energy Saving Kits (Kits)
  - Home Energy Savings (HES)
  - Multi-Family Home Energy Savings (MF)
  - Residential New Construction (RNC)
  - Elementary Energy Education (EEE)
  - Behavioral Energy Savings (BES)
- Income-Qualified Programs
  - Affordable Housing New Construction (AHNC)
  - SF Weatherization and Retrofits
  - MF Weatherization and Retrofits
  - Public Housing Energy Savings (PHES)
- Business Programs (includes Public Sector)
  - Business Energy Efficiency Rebates (BEER)
  - Business Custom Incentives (Custom)
  - Small Business Energy Efficiency (SB)
  - Coordinated Non-Residential New Construction (NRNC)
  - Coordinated Retro-Commissioning (RCx)
  - Strategic Energy Management (SEM)
- Market Transformation Initiatives and Emerging Technologies Program (ETP)

A.1 Residential Programs

Home Energy Efficiency Rebate Program Evaluation Plan

Introduction

The Home Energy Efficiency Rebate Program (HEER) provides rebates from Nicor Gas for the purchase and installation of high efficiency natural-gas furnaces and boilers. Customers are encouraged to install the most efficient gas heating equipment when replacing older, less efficient equipment. During the first six program years, customers found a trade ally, submitted a rebate application, and received their check through the mail after the work was done (for the most part). During 2018 through 2021, the participation approach adds a new option where customers may work with one of the Nicor Gas contractor circle members to obtain the desired equipment and receive an instant rebate at the time of installation.

We have prepared an evaluation plan summary to identify tasks by year. Final scope and timing of activities for each year will be refined as program circumstances are better known.

Table 1. Evaluation Plan Summary

Activity	2021
Gross Impact - Interim Impact Review	X
Gross Impact - End-of-Year TRM Savings Verification	X

Evaluation Research Topics

The evaluation team has identified the following key objectives for evaluation research for program year 2021:

Impact Evaluation

1. What are the program's verified gross savings?
2. What are the program's verified net savings?
3. What caused gross realization rate (RR) adjustments and what corrective actions are recommended?

Other Evaluation Research

Guidehouse is not planning to conduct other evaluation research for this program in 2021.

Evaluation Approach

Gross Impact Evaluation

Guidehouse anticipates all measures offered through this program will be defined in the TRM. For measures covered by the TRM, the evaluation team will review the TRM measure characterizations and customer-specific data collected in the tracking system that substantiates the measures installed and make adjustments as needed to calculate verified savings. The gross impact evaluation for TRM measures will include a mid-year review and end-of-year final verification. Midway through the program year, Guidehouse will review the program tracking data to determine the level of input completeness, flag outliers, and identify incorrect algorithms or input assumptions. If necessary, the Guidehouse team will make recommendations for modifications to the tracking data for use in the impact evaluation effort. After the program year ends, verified measure savings are estimated and summed across participants to calculate the total verified savings for the program.

Net Impact Evaluation

The net impact evaluation will apply the net-to-gross (NTG) ratio deemed through the Illinois Stakeholders Advisory Group (SAG) consensus process. The deemed NTGs are provided below.

Table 2. Deemed NTG for 2021

Program Path/Measure	Deemed NTG
Furnace, >95% AFUE	0.84
Furnace, 97+% AFUE	0.86
All Boilers and Other HVAC Equipment (excluding furnaces)	0.84
Advanced (Smart) Thermostats	0.90

Source: https://www.ilsag.info/evaluator-ntg-recommendations-for-2021/

Use of Randomized Controlled Trial and Quasi-Experimental Design

We are not evaluating the HEER program via a randomized controlled trial because the program was not designed with randomly assigned treatment and control groups. In 2017, Guidehouse developed a scope of work for a quasi-experimental design study to conduct primary billing data research on the natural gas impact of Advanced Thermostats, to inform future updates to the TRM.

Data Collection, Methods, and Sample Sizes

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

Table 3. Core Data Collection Activities

Activity	Target	Target Completes	Comments
Interim Impact Review	All Program TRM Measures	Census of projects	Review a mid-year program tracking data extract using the TRM measure characterizations
End-of-Year TRM Savings Verification	All Participating Customers with TRM Measures	Census of projects	Gross savings verification using the TRM and customer-specific data collected in the tracking system

Evaluation Schedule

Table 4 below provides the schedule for evaluation of the HEER Program. Adjustments will be made as needed as program year evaluation activities begin.

Table 4. Evaluation Schedule

Activity/Deliverables	Responsible Party	Completion/Delivery
Interim Tracking Data Extract	Nicor Gas	July 15, 2021
Interim Impact Review and Findings	Evaluation Team	September 15, 2021
Final Tracking Data to Guidehouse	Nicor Gas	January 30, 2022
Draft Impact Report to Nicor Gas and SAG	Evaluation Team	April 15, 2022
Comments on Draft Report	Nicor Gas / SAG	May 6, 2022
Revised Draft Report	Evaluation Team	May 20, 2022
Comments on Revised Draft Report	Nicor Gas / SAG	May 27, 2022
Final Impact Report to Nicor Gas and SAG	Evaluation Team	June 3, 2022

Energy Saving Kits Program Evaluation Plan

Introduction

Nicor Gas plans to continue distributing Energy Saving Kits (ESK) during 2021. The kits are free and include low-flow showerheads (1 or 2 per kit), kitchen aerators, shower timers, and bathroom aerators (1 or 2 per kit). These low-flow devices conserve hot water and therefore save the natural gas needed to heat the water. Weatherization measures (caulk, weatherstripping, door seal, switch/outlet gaskets) are a popular ESK offering that began in 2019, and further contribute to therm savings. The program will target customers through direct email, outreach events, targeted emails, Energy Efficiency Program website promotions, and through financial heating assistance intake centers.

We have prepared an evaluation plan summary to identify tasks by year. Final scope and timing of activities for each year will be refined as program circumstances are better known.

Table 1. Evaluation Plan Summary

Activity	2021
Gross Impact – Interim Impact Review	X
Gross Impact - End-of-Year TRM Savings Verification	X
Present In-Service Rate (ISR) Research Results from 2020 Participant Survey	Q2
Present NTG and Process Research Results from 2020 Participant Survey	Q3

Evaluation Research Topics

The evaluation team has identified the following key objectives for evaluation research for program year 2021:

Impact Evaluation

1. What are the program's verified gross savings?
2. What are the program's verified net savings?
3. What caused gross realization rate (RR) adjustments and what corrective actions are recommended?
4. What updates are recommended for the Illinois Technical Reference Manual (TRM)?

NTG and Other Research

The NTG and process evaluation activities for program year 2021 will focus on completing NTG and process research with 2020 participants and presenting results.

Evaluation Approach

Gross Impact Evaluation

Guidehouse anticipates all measures offered through this program will be defined in the TRM. For measures covered by the TRM, the evaluation team will review the TRM measure characterizations and customer-specific data collected in the tracking system that substantiates the measures installed and make adjustments as needed to calculate verified savings. The gross impact evaluation for TRM measures will include a mid-year review and end-of-year final verification. Midway through the program year, Guidehouse will review the program tracking data to determine the level of input completeness, flag outliers, and identify incorrect algorithms or input assumptions. If necessary, the Guidehouse team will make recommendations for modifications to the tracking data for use in the impact evaluation effort. After the program year ends, verified measure savings are estimated and summed across participants to calculate the total verified savings for the program.

Net Impact Evaluation

The net impact evaluation will apply the net-to-gross (NTG) ratio deemed through the Illinois Stakeholders Advisory Group (SAG) consensus process. The deemed NTGs are provided below.

Table 2. Deemed NTG for 2021

Program Path/Measure	Deemed NTG
Energy Saving Kits – Water Saving Measures	1.00
Energy Saving Kits – Weatherization Measures	0.84

Source: *https://www.ilsag.info/evaluator-ntg-recommendations-for-2021/*

NTG and Other Research

Using program tracking data with 2020 participants' email addresses, we will conduct research on free ridership in Spring of 2021 through an online participant survey. The evaluation team will email a link to the survey to all participants who provide an email address. Satisfaction questions will also be included in the online survey. In Spring 2021, Guidehouse will conduct participant spillover research through a participant telephone survey. The NTG surveys will include process questions. The process analysis will include a synthesis of both qualitative and quantitative data collected during the NTG surveys and in-depth interviews with program management and implementers.

The In-Service Rate research results will be presented in a TRM v10 workpaper if accepted as an update.

Use of Randomized Controlled Trial and Quasi-Experimental Design

We are not evaluating the ESK program via a randomized controlled trial because the program was not designed with randomly assigned treatment and control groups.

Data Collection, Methods, and Sample Sizes

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

Table 3. Core Data Collection Activities

Activity	Target	Target Completes	Comments
Process, NTG, and ISR Survey Research	2020 Participants	TBD	In-Service Rate, Participant FR plus Process On-line Survey; SO plus Process Telephone Survey
Interim Impact Review	All Program TRM Measures		Review program tracking data using the TRM measure characterizations
End-of-Year TRM Savings Verification	All Program Measures		Gross savings verification using the TRM and tracking data

Evaluation Schedule

Table 4 below provides the schedule for evaluation of the ESK Program. Adjustments will be made as needed as program year evaluation activities begin.

Table 4. Evaluation Schedule

Activity/Deliverables	Responsible Party	Completion/Delivery
Interim Tracking Data Extract	Nicor Gas	July 15, 2021
Interim Impact Review and Findings	Evaluation Team	September 15, 2021
2020 Participant Process, Spillover, Free Ridership Surveys	Evaluation Team	Q1-Q2 2021
In Service Rate Findings from Survey Research	Evaluation Team	May 15, 2021
2020 Participant Process and NTG Memos	Evaluation Team	August 1, 2021
Final Tracking Data to Guidehouse	Nicor Gas	January 30, 2022
Draft Impact Report to Nicor Gas and SAG	Evaluation Team	April 15, 2022
Comments on Draft Report	Nicor Gas / SAG	May 6, 2022
Revised Draft Report	Evaluation Team	May 20, 2022
Comments on Revised Draft Report	Nicor Gas / SAG	May 27, 2022
Final Impact Report to Nicor Gas and SAG	Evaluation Team	June 3, 2022

Home Energy Savings Program Evaluation Plan

Introduction

The Home Energy Savings ("HES") program is a whole house single-family assessment and weatherization program with the objective to obtain natural gas and electricity savings in existing single-family buildings. The program targets Nicor Gas and ComEd customers with gas space heating and electric central air conditioning in single-family homes or multi-family buildings with up to 4 units. Nicor Gas also offers program services to select municipalities serviced by municipal electric providers. Starting in 2020, ComEd is only participating in the assessment portion of the program, and has discontinued offering weatherization rebates. A virtual assessment and self-installation component was added in 2020 to adapt to COVID safety protocols, and will continue in 2021.

The HES program provides weatherization and shell improvement opportunities using standard, prescriptive approaches. The standard offering provides home energy assessments to customers and achieves energy savings through the direct installation of energy saving products during the assessment including LED's (offered jointly with ComEd), pipe insulation, showerheads, aerators, programmable thermostats, programmable thermostat reset, and co-pay advanced thermostats. If the participant chooses to implement the recommended weatherization work, financial incentives from Nicor Gas are offered.

The Prescriptive offering includes attic air sealing and insulation, duct sealing, and wall insulation performed by a program approved certified participating contractor. After a customer has expressed interest in the program, a participating contractor schedules a site visit to the home. No assessment is required and the participating contractor will complete the air sealing and insulation weatherization work. The customer receives an "instant discount" provided by Nicor Gas on the completed work.

We have prepared an evaluation plan summary to identify tasks by year. Final scope and timing of activities for each year will be refined as program circumstances are better known.

Table 1. Evaluation Plan Summary

Activity	2021
Gross Impact - Interim Impact Review	X
Gross Impact - End-of-Year TRM Savings Verification	X
Survey Research – 2021 Participant Satisfaction, Assessment Conversion to Major Measures, and In-Service Rate with Virtual Installation	Initiate Q3 2021
Present Research Results	Q2 2022

Evaluation Research Topics

The evaluation team has identified the following objectives for evaluation research for program year 2021:

Impact Evaluation

1. What are the program's verified gross savings?
2. What are the program's verified net savings?
3. What caused gross realization rate (RR) adjustments and what corrective actions are recommended?
4. What updates are recommended for the Illinois Technical Reference Manual (TRM)?

Other Evaluation Research

Satisfaction, conversion (or not) of major measure assessment findings into implemented projects, and installation rates of virtual assessment and self-installed measures will be research topics for 2021 participants.

Evaluation Approach

Gross Impact Evaluation

Guidehouse anticipates all measures offered through this program will be defined in the TRM. For measures covered by the TRM, the evaluation team will review the TRM measure characterizations and customer-specific data collected in the tracking system that substantiates the measures installed and adjust as needed to calculate verified savings. The gross impact evaluation for TRM measures will include a mid-year review and end-of-year final verification. Midway through the program year, Guidehouse will review the program tracking data to determine the level of input completeness, flag outliers, and identify incorrect algorithms or input assumptions. If necessary, the Guidehouse team will make recommendations for modifications to the tracking data for use in the impact evaluation effort. After the program year ends, verified measure savings are estimated and summed across participants to calculate the total verified savings for the program.

Net Impact Evaluation

The net impact evaluation will apply the net-to-gross (NTG) ratio deemed through the Illinois Stakeholders Advisory Group (SAG) consensus process. The deemed NTGs are provided below.

Table 2. Deemed NTG for 2021

Program Path	Measure	Deemed NTG
Direct Install	Showerhead	1.07
	Kitchen Aerator	1.07
	Bathroom Aerator	1.07
	Programmable Thermostat	0.81
	Re-Programming Thermostat	0.85
	Hot Water Pipe Insulation	0.99
	Water Heater Temp Setback	0.98
	Advanced Thermostat	0.90
Weatherization	Air Sealing plus Attic Insulation	0.88 Air Sealing 0.89 Attic Insulation
	Air Sealing (conducted without adding Attic Insulation)	0.83
	Insulation measures, excluding ceiling/attic insulation, including Wall, Floor Above Crawlspace, Basement Sidewall; Rim/Band Joist	0.85
	Duct Sealing	0.93

Source: https://www.ilsag.info/evaluator-ntg-recommendations-for-2021/

Other Research

We will conduct survey research with 2021 participants, including those receiving virtual assessment and in-person assessment, likely through an online participant survey. If the survey is conducted online the evaluation team will email a link to the survey to all participants with an email address. Satisfaction, conversion (or not) of major measure assessment findings into implemented projects, and installation rates of virtual assessment and self-installed measures will be research topics for 2021 participants. The In-Service Rate research results will be presented in a TRM v11 workpaper if accepted as an update.

Use of Randomized Controlled Trial and Quasi-Experimental Design

We are not evaluating the HES program via a randomized controlled trial because the program was not designed with randomly assigned treatment and control groups. In 2018 Guidehouse interpreted results of our air sealing and insulation billing analysis conducted in 2017 and 2018 and updated the TRM residential insulation and air sealing measures.

Data Collection, Methods, and Sample Sizes

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

Table 3. Core Data Collection Activities

Activity	Target	Target Completes	Comments
Interim Impact Review	All Program TRM Measures		Review program tracking data using the TRM measure characterizations
Survey Research	2021 Participants	TBD	Online
End-of-Year TRM Savings Verification	All Program TRM Measures		Gross savings verification using the TRM and tracking system data

Evaluation Schedule

Table 4 below provides the schedule for evaluation of the HES Program. Adjustments will be made as needed as program year evaluation activities begin.

Table 4. Evaluation Schedule

Activity/Deliverables	Responsible Party	Completion/Delivery
Interim Tracking Data Extract	Nicor Gas	July 15, 2021
Interim Impact Review and Findings	Evaluation Team	September 15, 2021
Final Tracking Data to Guidehouse	Nicor Gas	January 30, 2022
Draft Impact Report to Nicor Gas and SAG	Evaluation Team	April 15, 2022
Comments on Draft Report	Nicor Gas / SAG	May 6, 2022
Revised Draft Report	Evaluation Team	May 20, 2022
Comments on Revised Draft Report	Nicor Gas / SAG	May 27, 2022
Final Impact Report to Nicor Gas and SAG	Evaluation Team	June 3, 2022
Conduct Survey Research	Evaluation Team	Q3-Q4 2021
Report Survey Research Results	Evaluation Team	May 15, 2022

Multi-Family Program Evaluation Plan

Introduction

The Multi-Family Comprehensive Energy Efficiency Program (Multi-Family) will address residential (living units) and commercial (common areas, central plants) energy efficiency opportunities available in multi-family buildings. Further, the program will aim to overcome market barriers to the installation of energy efficiency measures in multi-family buildings by offering comprehensive assessments, technical assistance and incentives.

Multi-Family is designed so that customers can participate through three types of offerings. One offering consists of a free energy assessment and free installation of energy saving products. This portion of the program is offered jointly with ComEd. This direct install portion of the program offers free installation of low-flow showerheads, faucet aerators, domestic hot water pipe wrap, programmable thermostats and thermostat education, and lighting and adjustment of the temperature setting of hot water heaters to reduce the consumption of natural gas and electricity.

Customers are also eligible for rebates through the purchase and installation of qualifying energy efficient products and custom projects. Typical projects consist of boiler tune-ups, boiler controls, steam trap repairs/replacement, space and water heating equipment upgrades, and building shell insulation. These upgrades are performed by installing trade allies.

Starting in 2020, Nicor Gas added a central plant gas optimization offering. This path provides a service where Energy Advisors representing the program administrator and contracted engineers complete a detailed review of a facility for capital improvement opportunities and for operation and maintenance issues that, if corrected, often provide short payback projects that are very attractive to owners. Examples of issues uncovered from a gas optimization study include correcting condensing boiler operating temperatures to ensure condensing operation and therefore savings. Resulting projects may qualify for prescriptive or custom rebates.

We have prepared an evaluation plan summary to identify tasks by year. Final scope and timing of activities for each year will be refined as program circumstances are better known.

Table 1. Evaluation Plan Summary

Activity	2021
Gross Impact - Interim Impact Review	X
Gross Impact - End-of-Year TRM Savings Verification	X
Gross Impact – Custom Project Savings Verification Waves and Large Project Pre-Installation Review	X
Gross Impact – End-of-Year Custom Project Savings Verification	X

Guidehouse will coordinate with the ComEd evaluation team on any issues relevant to joint program offerings.

Evaluation Research Topics

The evaluation team has identified the following key objectives for evaluation research for program year 2021:

Impact Evaluation

1. What are the program's verified gross savings?
2. What are the program's verified net savings?
3. What caused gross realization rate (RR) adjustments and what corrective actions are recommended?

Other Evaluation Research

Guidehouse is not planning to conduct other evaluation research for this program in 2021.

Evaluation Approach

Gross Impact Evaluation

For measures covered by the TRM, the evaluation team will review the TRM measure characterizations and customer-specific data collected in the tracking system that substantiates the measures installed and make adjustments as needed to calculate verified savings. The gross impact evaluation for TRM measures will include a mid-year review and end-of-year final verification. Midway through the program year, Guidehouse will review the program tracking data to determine the level of input completeness, flag outliers, and identify incorrect algorithms or input assumptions. If necessary, the Guidehouse team will make recommendations for modifications to the tracking data for use in the impact evaluation effort. After the program year ends, verified measure savings are estimated and summed across participants to calculate the total verified savings for the program.

The gross impact evaluation approach for custom projects will be based on engineering analysis of all or a sample of projects to verify claimed savings or make retrospective adjustment to claimed gross savings. Custom projects will be sampled by size-based strata and analyzed together. All the sampled projects will be subject to engineering file review and a subset may receive on-site inspection and verification of installed measures. Gross impact estimates will mimic *ex ante* methods to the extent they are reasonable and accurate per data collected during verification steps. The evaluation team will modify calculations if methods are not reasonable or if verified operation differs from that which was reported.

Guidehouse will employ IPMVP protocols for on-site measurement and verification of custom projects. The impacts for some projects will be verified by engineering review of site-collected data

and determined with regression analysis of utility billing data and weather and/or other independent variables that affect energy use (for example, days of operation), as appropriate. This approach parallels IPMVP option C. If implemented measures are not amenable to regression analysis, the evaluated savings will be determined by engineering review with site verified data, incorporating historical data when available.

The sampling plan for custom projects, including those for engineering review and billing analysis, will target overall 10 percent precision at 90 percent confidence using the stratified ratio estimation technique to optimize sample size and control evaluation costs. Due to tight end-of-year impact reporting timelines, Guidehouse will sample for impacts in one or two waves – approximately July and/or December, and after the final program year projects are closed. Each sample will be based on lower precision targets for the wave, but when combined at the end of the year, the overall sample will meet targets. The Large Project Pre-Installation Review process provides evaluator feedback on savings methodology and baseline selection on large custom projects in pre-installation stages.

Use of Randomized Controlled Trial and Quasi-Experimental Design

We are not evaluating the Multi-Family program via a randomized controlled trial because the program was not designed with randomly assigned treatment and control groups. Guidehouse is not using quasi-experimental consumption data because this program contains many unique measures with significant cross-participation. In this case, quasi-experimental consumption data analysis would produce savings estimates for bundles of commonly-installed measures, rather than for each measure individually, which is not the desired output for all analysis.

Net Impact Evaluation

The net impact evaluation will apply the net-to-gross (NTG) ratio deemed through the Illinois Stakeholders Advisory Group (SAG) consensus process. The deemed NTGs are provided below.

Table 2. Deemed NTG for 2021

Program Path/Measure	Deemed NTG
Multi-family In-Unit and Common Area Direct Install (all measures except in-unit DI faucet aerators and showerheads)	0.96
Multi-family In-unit Direct Install (faucet aerators and showerheads when using TRM specific baseline average water flow rates)	1.01
Multi-family Comprehensive All Rebated Measures and Central Plant Optimization	0.93

Source: *https://www.ilsag.info/evaluator-ntg-recommendations-for-2021/*

Data Collection, Methods, and Sample Sizes

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

Table 3. Core Data Collection Activities

Activity	Target	Comments
Interim Impact Review	All Program TRM Measures	Review program tracking data using the TRM measure characterizations
Custom Project Savings Verification	Completed Custom Projects	One or two sampling waves, includes custom gas optimization projects
Large Project Pre-Installation Review	Custom Projects in the Pre-Installation Phase	Evaluator feedback on savings methodology and baseline on large projects in pre-installation stages
End-of-Year TRM Savings Verification	All Participating Customers with TRM Measures	Gross savings verification using the TRM and customer-specific data collected in the tracking system
End-of Year Custom Project Savings Verification	Completed Custom Projects	Custom projects not previously sampled

Evaluation Schedule

Table 4 below provides the schedule for evaluation of the Multi-Family Program. Adjustments will be made as needed as program year evaluation activities begin.

Table 4. Evaluation Schedule

Activity/Deliverables	Responsible Party	Completion/Delivery
Interim Tracking Data Extract	Nicor Gas	July 15, 2021
Interim Impact Review and Findings	Evaluation Team	September 15, 2021
Custom Project Savings Verification Waves	Evaluation Team	Q3 2021 to Q1 2022
Large Custom Project Pre-Installation Review	Evaluation Team	Ten business days
Final Tracking Data to Guidehouse	Nicor Gas	January 30, 2022
Draft Impact Report to Nicor Gas and SAG	Evaluation Team	May 6, 2022
Comments on Draft Report	Nicor Gas / SAG	May 27, 2022
Revised Draft Report	Evaluation Team	June 10, 2022
Comments on Revised Draft Report	Nicor Gas / SAG	June 17, 2022
Final Impact Report to Nicor Gas and SAG	Evaluation Team	June 24, 2022

Nicor Gas Residential New Construction Program Evaluation Plan

Introduction

The 2019 Residential New Construction program was jointly offered by Nicor Gas and ComEd, but ceased to be joint in 2020. In 2020, Nicor Gas launched a non-joint prescriptive-based rebate structure for the natural gas measures that provided the majority of therm savings under the joint program. The prescriptive offering will continue for 2021.

We have prepared an evaluation plan summary to identify tasks by year. Final scope and timing of activities for each year will be refined as program circumstances are better known.

Table 1. Evaluation Plan Summary

Activity	2021
Gross Impact - Interim Impact Review	X
Gross Impact - End-of-Year TRM Savings Verification	X
Survey Research – NTG Research with 2021 Participants	Initiate Q3 2021
Present Research Results	Q2 2022

Evaluation Research Topics

The 2021 evaluation will seek to answer the following key researchable questions:

Impact Evaluation

1. What are the program's verified gross savings?
2. What are the program's verified net savings?
3. What caused gross realization rate (RR) adjustments and what corrective actions are recommended?

NTG and Other Evaluation Research

Guidehouse will interview Nicor Gas program managers and implementation contractors to gather essential information about program design, program changes, and builder and rater experience. The team will interview builders and raters to collect the inputs necessary to calculate free ridership and spillover according to the Illinois NTG framework and protocols.

Evaluation Approach

Table 2 summarizes the proposed data collection activities for 2019 including data collection methods, data sources, timing, and targeted sample sizes that will be used to answer the evaluation research questions.

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

Activity	Target	Target Completes	Notes
Interim Impact Review	All Program TRM Measures		Review program tracking data using the TRM measure characterizations
Survey Research	2021 Participants	TBD	The survey approach and interview targets will be determined after additional discussion with program management and implementers
End-of-Year TRM Savings Verification	All Program TRM Measures		Gross savings verification using the TRM and data collected in the tracking system

Gross Impact Evaluation

Guidehouse anticipates all measures installed through the 2021 program will be defined in the TRM. For measures covered by the TRM, the evaluation team will review the TRM measure characterizations and customer-specific data collected in the tracking system that substantiates the measures installed and adjust as needed to calculate verified savings. The gross impact evaluation for TRM measures will include a mid-year review and end-of-year final verification. Midway through the program year, Guidehouse will review the program tracking data to determine the level of input completeness, flag outliers, and identify incorrect algorithms or input assumptions. If necessary, the Guidehouse team will make recommendations for modifications to the tracking data for use in the impact evaluation effort. After the program year ends, verified measure savings are estimated and summed across participants to calculate the total verified savings for the program.

NTG and Other Research

Guidehouse will interview Nicor Gas program managers and implementation contractors to gather essential information about program design, program changes, and builder and rater experience. The team will interview builders and raters to collect the inputs necessary to calculate free ridership and spillover according to the Illinois NTG framework and protocols.

Use of Randomized Controlled Trial and Quasi-Experimental Design

Guidehouse is not evaluating the Residential New Construction program via a randomized controlled trial because the program was not designed with randomly assigned treatment and control groups. We are not using quasi-experimental consumption data because it would not be possible to create a valid matched control group for the customers in this program.

Verified Net Impact Evaluation

The net impact evaluation will apply the net-to-gross (NTG) ratio deemed through the Illinois Stakeholders Advisory Group (SAG) consensus process. The deemed NTGs are provided below.

Table 3. Deemed NTG Values for 2021

Program Measure	Deemed NTG Value
Residential New Construction – Prescriptive-Based	0.80

Source: *https://www.ilsag.info/evaluator-ntg-recommendations-for-2021/*

Evaluation Schedule

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

Table 4. Schedule – Key Deadlines

Activity or Deliverable	Responsible Party	Date Delivered
Interim Tracking Data Extract	Nicor Gas	July 15, 2021
Interim Impact Review and Findings	Evaluation Team	September 15, 2021
Program manager and implementation contractor interviews to establish a NTG research design	Evaluation, Nicor Gas, RSR	July 2021
Plan and Conduct Survey Research	Evaluation Team	Q3-Q4 2021
Report Survey Research Results	Evaluation Team	June 15, 2022
2021 Final Program Tracking Data	Nicor Gas	January 30, 2022
Draft Impact Report to Nicor Gas and SAG	Evaluation	April 15, 2022
Comments on Draft Report	Nicor Gas and SAG	May 6, 2022
Revised Draft Report	Evaluation	May 20, 2022
Comments on Revised Draft Report	Nicor Gas and SAG	May 27, 2022
Final Impact Report to Nicor Gas and SAG	Evaluation	June 3, 2022

Elementary Energy Education Program Evaluation Plan

Introduction

The Elementary Energy Education (EEE) Program's primary focus is to produce electricity and natural gas savings in the residential sector by motivating students and their families to take steps through reducing energy consumption for water heating and lighting in their home. The program is offered in service areas for ComEd, Nicor Gas, Peoples Gas, and North Shore Gas. New to the program in CY2021 is the addition of one BR30 bulb as well as offering a coupon in the education kit for bulbs that the participant can purchase through an online website. These bulbs include a BR30, candelabra 5-watt, globe 6-watt, mini globe, and a three-way A19 LED.

The primary objectives of the CY2021 evaluation of the EEE Program are to: (1) quantify net and gross electric and gas savings impacts (as well as natural gas savings from ComEd-only kits) and (2) determine a net-to-gross (NTG) value for bulbs offered in the energy kit and through the online coupon delivery method. The CY2021 gross impact evaluation will not vary significantly from the previous years.

The evaluation of this program in CY2021 will include a variety of data collection and analysis activities, including those indicated in the following table.

Table 1. Evaluation Approaches

Tasks	CY2021
Impact – Measure-Level Deemed Savings Review	X
Impact – Verification & Gross Realization Rate	X
LED Net-to-Gross – Secondary Research	X

Coordination

Guidehouse will coordinate with the evaluation teams from other utilities on any issues relevant to this program, since the EEE Program is jointly offered by ComEd, Nicor Gas, Peoples Gas and North Shore Gas Companies, with Franklin Energy as the implementation contractor. In addition, Guidehouse will coordinate with the evaluation team for Ameren's Direct Distribution Efficient Products program which has a similar program design to the EEE Program.

Evaluation Research Topics

The CY2021 evaluation will seek to answer the following key researchable questions:

Impact Evaluation

1. What are the program's verified gross savings?

2. What are the program's verified net savings (first year and lifetime)?
3. Are there any updates recommended for the Illinois Technical Reference Manual (TRM)?
4. What NTG values are other utilities using for bulbs offered through a similar program with an online voucher delivery method?

Process Evaluation and Other Research Topics

There will be no formal process evaluation of the program in CY2021.

Evaluation Approach

The table below summarizes the evaluation tasks for CY2021 including data collection methods, data sources, timing, and targeted sample sizes that will be used to answer the evaluation research questions.

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

Activity	Target	Target Completes CY2021	Notes
Program Tracking Data Review	Tracking System	All	Mid-Year*
Gross Impact Approach	Student Survey Analysis	All	Two Waves*
Verified Net Impact	Calculation using deemed NTG ratios	NA	
LED NTG Secondary Research	NTG ratios other utilities are using for bulbs included in energy kits and coupon bulbs	NA	

*Guidehouse will coordinate with ComEd and Nicor Gas to determine appropriate dates to pull tracking data extracts.

Program Tracking Data Review and Gross Impact Approach

EEE Program's savings are based on the TRM estimates. The gross impact evaluation's foundation will be a review of program tracking data that substantiates the type and quantity of measures installed. Guidehouse will perform independent verification of the program tracking database and determine the level of input completeness, outliers, missing values, and potentially missing variables. If necessary, the Guidehouse team will include recommendations for additional fields to be added to the tracking system for use in the impact evaluation effort as well as program process monitoring.

Verified gross savings for all the measures included in the kits will be calculated for each participant using appropriate TRM algorithms and customer-specific data collected in the tracking system. For custom input variables, the evaluation analysis will be supplemented by additional research, and then summed across participants to calculate program totals. To be eligible, a measure must meet the physical, operational, and baseline characteristics as defined in the applicable version of the TRM. The evaluation team will convert therm savings to kWh savings for water saving measures in the ComEd-only kits.

Verified Net Impact Evaluation

The net impact evaluation will apply the net-to-gross (NTG) ratio deemed through the Illinois Stakeholders Advisory Group (SAG) consensus process. The deemed NTGs are provided below.

Table 3. Deemed NTG Values for CY2021

Program Measure	Deemed NTG Value
LEDs	0.84
Other EEE Measures	1.00

Source: Available at https://www.ilsag.info/evaluator-ntg-recommendations-for-2021/.

NTG Research

Guidehouse feels updated NTG research is needed to inform the NTG value for free LEDs included in the energy kit because the current value of 0.84 is based on PY9 NTG research conducted for the Home Energy Assessments Program. Also, new to the program in CY2021 is the addition of a coupon in the energy kit that allows participants to redeem LED bulbs through ComEd's online marketplace. Because conducting primary research for this program is difficult, as we do not have access to participants' contact information, Guidehouse will conduct secondary research on LED bulbs offered in an energy kit and LEDs redeemed through an online marketplace via a coupon.

Use of Randomized Controlled Trial (RCT) and Quasi-Experimental Design (QED)

Guidehouse is not evaluating the EEE Program via an RCT because the program was not designed with randomly assigned treatment and control groups. Guidehouse is not using QED consumption data because this program contains many unique measures with significant cross-participation. In this case, QED consumption data analysis would produce savings estimates for bundles of commonly-installed measures, rather than for each measure individually, which is not the desired output for analysis

Evaluation Schedule

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

Table 4. Schedule – Key Deadlines

Activity or Deliverable	Responsible Party	Date Delivered
CY2021 program tracking data for Wave 1	ComEd/Gas Utilities	July 14, 2021
Deliver Draft LED NTG Results Memo to ComEd	Evaluation	July 19, 2021
Finalize LED NTG Results Memo	Evaluation	August 30, 2021
Submit NTG Recommendation to SAG	Evaluation	September 1, 2021
Wave 1 project documentation, engineering reviews, feedback	Evaluation	September 15, 2021
Final CY2021 Program tracking and customer survey data	ComEd/Gas Utilities	January 30, 2022
Draft Impact Report to ComEd, Gas Utilities, and SAG	Evaluation	March 9, 2022
Comments on Draft Report	ComEd/Gas Utilities, and SAG	March 30, 2022
Revised Draft Report	Evaluation	April 6, 2022
Comments on Revised Draft Report	ComEd Gas Utilities, and SAG	April 13, 2022
Final Impact Report to ComEd, Gas Utilities, and SAG	Evaluation	April 20, 2022

Behavior Energy Savings Program Evaluation Plan

Introduction

The primary objective of the evaluation of the Nicor Gas Behavior Energy Savings Program is to estimate the natural gas savings generated by regularly mailing customers home energy reports (HERs) that provide information about their natural gas consumption and conservation.

This program was designed as a randomized controlled trial (RCT). Customers in the target group of residential customers were randomly assigned to either the recipient group or the control (non-recipient) group to estimate changes in natural gas use due to the program. This approach simplifies the process of verifying energy savings: among other things it effectively eliminates free-ridership and participant spillover bias and thus the need for net-to-gross research. Customers may opt out of the program at any time, but they cannot opt in due to the RCT design.[2]

We have prepared an evaluation plan summary to identify tasks by year, shown in Table 1. Final scope and timing of activities for each year will be refined as program circumstances are better known.

Table 1. Evaluation Plan Summary

Activity	2021
Data Collection – Program Manager and Implementer Interviews	X
Impact – End-of-Year Savings Verification	X

Evaluation Research Topics

Impact Evaluation

Guidehouse will address the following questions in the impact evaluation of the program:

1. How much natural gas savings do customers in the program save in 2021?
2. What is the uplift in other Nicor Gas energy efficiency programs due to the Behavior Energy Savings Program?

Guidehouse's 2021 research activities will include interviews with program management and implementers. These interviews will be used to develop a complete understanding of the final

[2] HER recipients and control group members remain part of the recipient sample unless they move. Keeping HER recipients who opt out of the program in the recipient sample ensures the recipient and control groups remain balanced for evaluation and means that our savings estimate represents the intent to treat effect.

program design, the number of HERs sent and distribution dates, targeting strategies, and other aspects of the program to inform our evaluation efforts.

Evaluation Approach

Table 2 summarizes the evaluation tasks for 2021 that will be used to answer the evaluation research questions.

Table 2. Evaluation Plan Summary

Activity	2021
Gross, Net Impact Approach (End of Year)	Regression analysis
NTG Approach†	Uplift analysis
Program Manager and Implementer Interviews/ Review Materials	Yes

† The RCT regression analysis produces impacts which are intrinsically net savings, aside from uplift. The uplift calculation will be done for the End of Year only.

Gross Impact Evaluation

Guidehouse will measure 2021 program impacts through billing analysis using lagged dependent variable (LDV) and linear fixed effects regression (LFER) models followed by an uplift analysis to account for participation in other programs. Although the LDV and LFER models are structurally different, both produce unbiased estimates of program savings assuming the RCT is well-balanced with respect to the drivers of natural gas use. Billing analysis implicitly estimates net impacts so no net-to-gross adjustment is necessary. However, we will use the LDV model for reporting total program savings in 2020 because we believe that, on balance, it has superior statistical properties.[3] The LFER will be reported as a robustness check.

Depending on the status of the coronavirus pandemic in 2021 and any related guidance from the stakeholder advisory group, Guidehouse will consider whether savings need to be normalized for the pandemic in 2021. Any normalization will align with methods used for 2020.

[3] The LDV model's superior performance results from its greater flexibility relative to the LFER model. While the LDV model can accommodate time-varying individual customer controls, the LFER model treats all unobserved inter-customer heterogeneity affecting energy usage as time-invariant – a particularly unwelcome feature given the highly seasonal nature of gas consumption.

LDV Model

The LDV model controls for non-treatment differences in energy use between treatment and control customers using lagged energy use as an explanatory variable. The model frames energy use in calendar month *t* of the post-program period as a function of both the treatment variable and energy use in the same calendar month of the pre-program period. The underlying logic is that systematic differences between control and treatment customers will be reflected in differences in their past energy use, which is highly correlated with their current energy use. Formally, the model is shown in the following equation.

$$ADU_{kt} = \beta_1 Treatment_k + \sum_J \beta_{2j} Month_{jt} + \sum_J \beta_{4j} Month_{jt} \cdot ADUlag_{kt} + \varepsilon_{kt}$$

Where:

ADU_{kt}	is average daily consumption of therms by household *k* in bill period *t*
$Treatment_k$	is a binary variable taking a value of 0 if household k is assigned to the control group, and 1 if assigned to the treatment group
$Month_{jt}$	is a binary variable taking a value of 1 when j = t and 0 otherwise[4]
$ADUlag_{kt}$	is household *k*'s energy use in the same calendar month of the pre-program year as the calendar month of month *t*
ε_{kt}	is the cluster-robust error term for household *k* during billing cycle *t;* cluster-robust errors account for heteroskedasticity and autocorrelation at the household level.

The coefficient β_1 is the estimate of average therm energy savings due to the program.

LFER Model

The LFER model used by the evaluation team is one in which average consumption of therms by household *k* in bill period *t*, denoted by ADU_{kt}, is a function of the following three terms:

1. The binary variable $Treatment_k$.
2. The binary variable $Post_t$, taking a value of 0 if month *t* is in the pre-treatment period, and 1 if in the post-treatment period.
3. The interaction between these variables, $Treatment_k \cdot Post_t$.

Formally, the LFER model is shown in the following equation.

$$ADU_{kt} = \alpha_{0k} + \alpha_1 Post_t + \alpha_2 Treatment_k \cdot Post_t + \varepsilon_{kt}$$

Three observations about this specification deserve comment. First, the coefficient α_{0k} captures all household-specific effects on energy use that do not change over time, including those that are unobservable. Second, α_1 captures the average effect across all households of being in the post-treatment period. Third, the effect of being both in the treatment group and in the post period, i.e., the effect directly attributable to the program, is captured by the coefficient α_2. In other words, whereas the coefficient α_1 captures the change in average therm use across the pre- and post-treatment for

[4] In other words, if there are *T* post-program months, there are *T* monthly dummy variables in the model, with the dummy variable $Month_{tt}$ the only one to take a value of 1 at time t. These are, in other words, monthly fixed effects.

the control group, the sum $\alpha_1 + \alpha_2$ captures this change for the treatment group, and so α_2 is the estimate of average therm energy savings due to the program.

Uplift Analysis

The HERs sent to participating households include energy-saving tips, some of which encourage participants to enroll in other Nicor Gas energy efficiency (EE) programs. If participation rates in other EE programs are the same for Behavior Energy Savings Program treatment and control groups, the savings estimates from the regression analyses are already "net" of savings from other programs as this indicates the HERs do not increase or decrease participation in other EE programs. However, if the HERs affect participation rates in other EE programs, then savings across all programs are lower than indicated by the simple summation of savings in the Behavior Energy Savings and EE programs. For instance, if the HERs increase participation in other EE programs, the increase in savings may be allocated to either the Behavior Energy Savings Program or the EE program, but cannot be allocated to both programs simultaneously.[5] Note that when the HERs decrease participation in other programs there is no issue of double counting and thus no adjustment to the savings total is made.

Data permitting, the evaluation team uses a difference-in-difference (DID) statistic to estimate uplift in other EE programs. To calculate the DID statistic, the change in the participation rate in another EE program between the current evaluation year and the pre-program year for the control group is subtracted from the same change for the treatment group. For instance, if the rate of participation in an EE program during the current year is 5% for the treatment group and 3% for the control group, and the rate of participation during the year before the start of the Behavior Energy Savings Program is 2% for the treatment group and 1% for the control group, then the rate of uplift due to the Behavior Energy Savings Program is 1%, as reflected in the equation below.

$$(current\ year\ treatment\ group\ participation - prePY\ treatment\ group\ participation)$$
$$- (current\ year\ control\ group\ participation - prePY\ control\ group\ participation)$$
$$= DID\ statistic$$
$$(5\% - 2\%) - (3\% - 1\%) = 1\%$$

The DID statistic generates an unbiased estimate of uplift when the baseline average rate of participation is the same for the treatment and control groups, or when they are different due only to differences between the two groups in time-invariant factors, such as the residence's square footage.

An alternative to the DID statistic is the post-only difference (POD) statistic, which is the simple difference in participation rates between the treatment and control groups during the evaluation year. The POD statistic generates an unbiased estimate of uplift when the baseline average rate of participation in the EE program is the same for the treatment and control groups. The evaluation team uses this alternative statistic in cases where the EE program did not exist in the pre-program year.

An adjustment will also be made for legacy uplift (uplift that occurred in prior years) in CY2021. This subtracts out savings for the duration of the measure life for uplift in prior years of the program.

[5] It is not possible to estimate and remove double counted savings generated by programs for which tracking data are not available, such as upstream rebate programs.

Verified Net Impact Evaluation

A key feature of the RCT design of the HER program is that the analysis inherently estimates net savings because there are no participants who would have received the individualized reports in the absence of the program. While some customers receiving reports may have taken energy-conserving actions or purchased high-efficiency equipment anyway, the random selection of program participants (as opposed to voluntary participation) implies that the control group of customers not receiving reports would be expected to exhibit the same degree of energy-conserving behavior and purchases. Therefore, this method estimates net savings and no further NTG adjustment is necessary.

Evaluation Schedule

Table 3 below presents an estimate of the evaluation schedule. The schedule for the impact analysis depends on receipt of the necessary data from Uplight and Nicor Gas. If end of year data is received after January 30, the schedule will be adjusted accordingly.

Table 3. Evaluation Schedule

Activity/Deliverables	Responsible Party	Completion/Delivery
Interviews with program manager and IC	Evaluation Team	July 31, 2021
Data delivery to Evaluation	Uplight	January 30, 2022
2021 EE Residential Program Tracking Data to Evaluation	Nicor Gas	January 30, 2022
Draft Impact Report to Nicor Gas and SAG	Evaluation Team	April 15, 2022
Comments on Draft Report	Nicor Gas / SAG	May 6, 2022
Revised Draft Report	Evaluation Team	May 20, 2022
Comments on Revised Draft Report	Nicor Gas / SAG	May 27, 2022
Final Impact Report to Nicor Gas and SAG	Evaluation Team	June 3, 2022

A.2 Income-Qualified Programs

Affordable Housing New Construction Evaluation Plan

Introduction

The Affordable Housing New Construction (AHNC) Program provides technical assistance and incentives for energy-efficient construction and major renovation of single-family and multi-family affordable housing. The program targets affordable housing developers and owners for the construction of housing for customers with incomes at or below 80% of the Area Median Income. An additional goal of the program is to educate housing developers on cost-effective energy efficient building practices. The program has three participation levels: major renovation, new multi-family, and new single-family. The program is a coordinated program of ComEd, Peoples Gas, North Shore Gas, and Nicor Gas.

The CY2021 evaluation of this program will include a variety of data collection and analysis activities, including those indicated in Table 1.

Table 1. CY2021 Evaluation Activities

Tasks	CY2021
Impact - Engineering Review	X
Impact - Measure-Level Deemed Savings Review	X
Impact - Verification & Gross Realization Rate	X

Coordination

As this is a coordinated program of ComEd, Nicor Gas, Peoples Gas and North Shore Gas, Guidehouse will work closely with all utilities and their respective evaluation teams on issues common to this program. The evaluation activities and timing for each utility evaluation are the same for all utilities. Additionally, Guidehouse will solicit feedback from and coordinate with the Income-Qualified Energy Efficiency Advisory Committee.

Evaluation Research Topics

The CY2021 evaluation will seek to answer the following key researchable questions:

Impact Evaluation

1. What are the program's verified gross savings?
2. What are the program's verified net savings?
3. Are there any updates recommended for the Illinois Technical Reference Manual (TRM)?

Process Evaluation and Other Research Topics

There will be no formal process evaluation of the program in CY2021.

Evaluation Approach

Table 2 summarizes the evaluation tasks for CY2021 including data collection methods, data sources, timing, and targeted sample sizes that will be used to answer the evaluation research questions.

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

Activity	Target	Target Completes CY2021	Notes
Gross Impact Evaluation	Preliminary project review	3-5 projects	Early feedback
Gross Impact Evaluation	End of Year engineering review	All	
Verified Net Impact Evaluation	Calculation using deemed NTG ratio	NA	

Gross Impact Evaluation

Since the AHNC Program savings are derived from deemed values contained in the TRM[6], gross savings will be evaluated primarily by (1) reviewing the project savings calculators to ensure that all fields are appropriately populated; (2) reviewing measure algorithms and values in the project savings calculators to assure they are appropriately applied; and (3) cross-checking totals. This approach will be supplemented, where possible, with a review of project documentation to verify participation, installed measure quantities, and associated savings.

Guidehouse will conduct two assessments in CY2021:

a) **Preliminary Project Review**: A comprehensive mid-year project review to provide early feedback to the implementation team[7]. The (implementation contractor (IC) may determine which projects to submit for preliminary review. Guidehouse anticipates projects submitted for this review will include:

- Projects likely to close in the current program year
- Projects about which the IC has specific questions and is requesting feedback
- Projects anticipated to demonstrate the greatest savings

Guidehouse expects the IC will submit three to five projects for the Preliminary Project Review and requests the submittal include:

[6] Illinois Statewide Technical Reference Manual for Energy Efficiency, available at: http://www.ilsag.info/technical-reference-manual.html. Guidehouse will apply TRM versions to engineering review based on AHNC project enrollment date.

[7] This is a ComEd deliverable, and while it is focused on electric measures it is a comprehensive review and considers measures that save natural gas as well.

- Project memo, describing analysis approach, and source of relevant measure specific data points. Consistent with the 2020 Preliminary Project Review, Slipstream's Verification Report may be used to deliver the requested topics.
- Savings calculators and relevant tracking data (specific fields detailed in separate submittal)
- Relevant project files (invoices, specification sheets, plans, etc.)

The Guidehouse evaluation team will verify savings calculation methodologies and deliver a memorandum of analysis findings and recommendations. Guidehouse will review calculation accuracy, appropriateness of baselines, and consistency with the Illinois Energy Conservation Code (IL ECC) where appropriate.

The Preliminary Project Review Memo will specifically *not* include:

- Measure-specific and total ex post gross and net savings for the program
- Cumulative Persisting Annual Savings (CPAS)
- Weighted average measure life

The implementation team may make project changes based on the preliminary project review which will be incorporated in the final end of year review.

b) **End of Year (EOY) Evaluation**: A final review of all completed projects. The EOY evaluation will be conducted independently from the Preliminary Project Review and will be limited to the final EOY data and project file submission only. The EOY evaluation will incorporate Preliminary Project Review methodology recommendations, but will not include data, project files, or analyses from the Preliminary Project Review. The end of year analysis will include project verification reports and/or project memos, project savings calculators, project documentation and review of the program data tracking system.

c) Proposed gross impact timelines for CY2021 are shown below:

   a. Preliminary project review will start in May 2021 and be completed in August 2021

   b. The final tracking data is provided by ComEd by January 30, 2022, with reporting finalized by April 30, 2022. The implementation team is encouraged to deliver completed project files as they are finalized.

Verified Net Impact Evaluation

The net impact evaluation will apply the net-to-gross (NTG) ratio deemed through the Illinois Stakeholders Advisory Group (SAG) consensus process. The deemed NTGs are provided below.

Table 3. Deemed NTG Values for CY2021

Program Measure	Deemed NTG Value
All measures	1.0

Source: https://www.ilsag.info/evaluator-ntg-recommendations-for-2021/

Randomized Controlled Trial and Quasi-Experimental Design

The AHNC Program will not be evaluated via a randomized controlled trial because the program was not designed with randomly assigned treatment and control groups. Quasi-experimental design will

not be used because it would not be possible to create a valid matched control group for the customers in this program.

Evaluation Schedule

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

Table 4. Schedule – Key Deadlines

Activity or Deliverable	Responsible Party	Date Delivered
CY2021 Preliminary Project Review: Findings Memo	Evaluation	August 30, 2021
CY2021 End of Year: program tracking data, project savings calculators, and project documentation	ComEd and Slipstream	January 29, 2022
Draft Report to ComEd, Gas Utilities, and SAG	Evaluation	March 8, 2022
Comments on Draft Report	ComEd, Gas Utilities, and SAG	March 29, 2022
Revised Draft Report	Evaluation	April 5, 2022
Comments on Revised Draft Report	ComEd, Gas Utilities, and SAG	April 12, 2022
Final Report to ComEd, Gas Utilities, and SAG	Evaluation	April 26, 2022

Income Eligible Multi-Family Energy Efficiency Evaluation Plan

Introduction

The Nicor Gas Multi-Family Income-Qualified Program offers free weatherization for income-qualified customers in the Nicor Gas service territory. The IHWAP and contractor channels include direct installation of water heating efficiency measures (faucet aerators, showerheads, gas water heaters); advanced programmable thermostats; attic, duct, and basement sidewall insulation; air leakage reduction; and furnaces. The program also provided free energy savings kits of water efficiency or air sealant measures (reported as "Kit 2" and "Kit 4" in the Nicor Gas program tracking data). Kit 2 included low-flow showerheads (SH, 2 per kit), kitchen aerators (KA), shower timers (ST), and bathroom aerators (BA, 2 per kit). Kit 4 included 12 electrical switch/outlet gaskets, 1 door sweep, 30 linear feet of caulk, and 34 linear feet of weather stripping. The program provided one or two kits per customer depending on their request.

There are two different coordinated programs. The Income Eligible Multi-Family Savings Program (IEMS) is administered by ComEd and Peoples Gas (PGL) and North Shore Gas (NSG) companies and is implemented by Elevate Energy. The Income Eligible Retrofits Multi-Family Program (IER-MF) is administered by ComEd, PGL and NSG, and Nicor Gas and implemented by Resource Innovations in partnership with the Illinois Home Weatherization Assistance Program (IHWAP). Both the IEMS and IER-MF programs provide retrofits in common areas and tenant spaces to eligible multi-family properties in the ComEd service territory and serve as a "one stop shop" to multi-family building owners and managers whose buildings are targeted to income eligible residents.[8]

The evaluation of this program for CY2021 will include a variety of data collection and analysis activities, including those indicated in the following table.

Table 1. Evaluation Approaches – One Year Plan

Tasks	CY2021
Process – Survey of IHWAP Participants	X
Impact – Measure-Level Deemed Savings Review	X
Impact - Custom Analysis to confirm non-TRM savings estimates	X
Impact – Verification & Gross Realization Rate	X

Coordination

For coordinated programs with ComEd and the gas utilities, Guidehouse will work closely with the utilities on issues common to the programs. We will ensure that the program tracking data provided by ComEd aligns with that provided by the gas utilities and will pull our samples for field work and

[8] Multi-family properties served by the IHWAP, nonprofits that manage HUD 811 and HUD 202 housing, other federal or state subsidized housing, other building owners/managers and tenants in qualified geographic areas (e.g., Census tracts).

surveys with the aim of creating efficiencies between the programs and utilities. There will be separate impact reports for the gas utilities. Ameren Illinois has a suite of energy efficiency programs for income eligible customers and we will coordinate with Ameren Illinois' evaluation team as needed. Additionally, Guidehouse will solicit feedback from and coordinate with the Income-Qualified Advisory Committee North, as appropriate.

Evaluation Research Topics

The CY2021 evaluation will seek to answer the following key researchable questions:

Impact Evaluation

1. What are the program's verified gross savings?
2. What are the program's verified net savings?
3. Are there any updates recommended for the Illinois Technical Reference Manual (TRM)?

Process Evaluation and Other Research Topics

Guidehouse will survey facility contacts for 2020 participants in the IHWAP component through telephone interviews in the first half of 2021 as a gas only study. Interviews will focus on customer awareness, perspectives, and satisfaction. These results will be reported in 2021.

Evaluation Approach

The table below summarizes the evaluation tasks for CY2021 including data collection methods, data sources, timing, and targeted sample sizes that will be used to answer the evaluation research questions.

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

Activity	Target	Target Completes CY2021	Timeline
Process Survey	Facility Representatives for 2020 IHWAP Participants	Approximately 5	Q2 2021
Gross Impact	Early Impact Review	Census (Deemed) Sample (Custom)	June 2021 – Oct 2021
Gross Impact	Measure-Level Deemed Savings Review	EOY data	Feb 2022 – April 2022
Gross Impact	Custom Analysis for non-TRM projects	All custom projects	Feb 2022 – April 2022

Gross Impact Evaluation

Savings verification will be based on using the applicable TRM v9.0, or secondary research for any measure with custom savings input. Gross savings will be evaluated primarily by: (1) reviewing the tracking system data to ensure that all fields are appropriately populated; (2) reviewing measure

algorithms and values in the tracking system to assure that they are appropriately applied; and (3) cross-checking totals. Guidehouse will perform a custom analysis for measures which are not included in the TRM.

Verified Net Impact Evaluation

The net impact evaluation will apply the net-to-gross (NTG) ratio deemed through the Illinois Stakeholders Advisory Group (SAG) consensus process. The deemed NTGs are provided below.

Table 3. Deemed NTG Values for CY2021

Program Measure	Deemed NTG Value
All measures	1.0

Source: https://www.ilsag.info/evaluator-ntg-recommendations-for-2021/

Use of Randomized Controlled Trial and Quasi-Experimental Design

Guidehouse is not evaluating the program via a randomized controlled trial because the program was not designed with randomly assigned treatment and control groups. Guidehouse is not using quasi-experimental consumption data because the savings are likely not large enough to achieve statistically significant estimates using this method.

Evaluation Schedule

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

Table 4. Schedule – Key Deadlines

Activity or Deliverable	Responsible Party	Date Delivered
Conduct Interviews with IHWAP Participants	Evaluation Team	Q2 2021
Summary Findings from IHWAP Participants	Evaluation Team	Q3 2021
CY2021 program tracking data for Wave 1	ComEd/Gas Utilities	July 15, 2021
Interim Impact Results	Evaluation	September 15, 2021
CY2021 EOY tracking data	ComEd/Gas Utilities	January 30, 2022
Draft Impact Report to Nicor Gas and SAG	Evaluation Team	April 15, 2022
Comments on Draft Report	Nicor Gas / SAG	May 6, 2022
Revised Draft Report	Evaluation Team	May 20, 2022
Comments on Revised Draft Report	Nicor Gas / SAG	May 27, 2022
Final Impact Report to Nicor Gas and SAG	Evaluation Team	June 3, 2022

Income Eligible Single-Family Retrofits Evaluation Plan

Introduction

The Income-Eligible Single-Family Retrofits (SFR) offerings provide retrofits to single-family households in ComEd and Nicor Gas service areas with incomes at or below 80% of the Area Median Income. The offerings provide assessments, direct installation of energy efficiency measures, replacement of inefficient equipment, technical assistance, and educational information to further save money on energy bills.

One program component is delivered leveraging the State of Illinois' Home Weatherization Assistance Program (IHWAP). The IHWAP portion is offered jointly with Peoples Gas, North Shore Gas, and Nicor Gas. The Nicor Gas (non-joint) Single-Family Income-Qualified Program offers free weatherization for income-qualified customers in the Nicor Gas service territory. The contractor channel included direct installation of water heating efficiency measures (faucet aerators, showerheads, gas water heaters); advanced and programmable thermostats; attic, wall, duct, and rim insulation; air leakage reduction; and high efficiency boilers and furnaces. The program also provided free energy savings kits of water efficiency or air sealant measures (reported as "Kit 2" and "Kit 4" in the Nicor Gas program tracking data). Kit 2 included low-flow showerheads (SH, 2 per kit), kitchen aerators (KA), shower timers (ST), and bathroom aerators (BA, 2 per kit). Kit 4 included 12 electrical switch/outlet gaskets, 1 door sweep, 30 linear feet of caulk, and 34 linear feet of weather stripping. The program provided one or two kits per customer depending on their request.

The following table shows the data collection and analysis activities for CY2021.

Table 1. Evaluation Approaches

Tasks	CY2021
Process – Survey of IHWAP Participants	X
Impact – Engineering Review	X
Impact – Verification & Gross Realization Rate	X

Coordination

The ComEd evaluation team will coordinate closely with the Peoples Gas evaluation team on issues common to the CBA component and with the Peoples Gas, North Shore Gas, and Nicor Gas evaluation teams on issues common to the IHWAP component. We expect to prepare joint impact reports for ComEd and the gas utilities for each of this program's joint delivery channels. The evaluation team will also coordinate with the Illinois Income Eligible Stakeholder Advisory Group (SAG) and as needed, with the Ameren Illinois evaluation team.

Evaluation Research Questions

The CY2021 evaluation will seek to answer the following key research questions:

Impact Evaluation

1. What are the program's annual total verified gross and net savings?
2. Are there any updates recommended for the Illinois Technical Reference Manual (TRM)?

Process Evaluation and Other Research Topics

Guidehouse will survey 2020 single-family participants in the IHWAP component through telephone interviews in the first half of 2021 as a gas only study. Interviews will focus on customer awareness, perspectives, and satisfaction. These results will be reported in 2021.

Evaluation Approach

The team will conduct the evaluation tasks in Table 2 for both components to answer the above evaluation questions.

Table 2. CY2021 Core Data Collection Activities, Sample, and Analysis

Activity	Target	Timeline
Process Survey	2020 IHWAP Customer Participants	Q2 2021
Gross Interim Impact Evaluation	Engineering Impact Review	June-August 2021*
Calculation of Annual Savings	Engineering Impact Review	Feb – April 2022

*Guidehouse will coordinate with ComEd and the gas utilities to determine appropriate dates to pull tracking data.

Gross Impact Evaluation

Since the SFR offerings derive savings from deemed values contained in the TRM[9], the evaluation team will continue to verify savings by reviewing:

- Tracking system data to ensure the accurate population of fields
- Algorithms and values in the tracking system to ensure accurate calculation of savings
- Totals to ensure accurate summation of savings

Verified Net Impact Evaluation

The net impact evaluation will apply the net-to-gross (NTG) ratio deemed through the Illinois Stakeholders Advisory Group (SAG) consensus process. The deemed NTGs are provided below.

[9] Illinois Statewide Technical Reference Manual for Energy Efficiency Version 9.0, http://www.ilsag.info/technical-reference-manual.html

Table 3. Deemed NTG Values for CY2021

Program Measure	Deemed NTG Value
All Measures	1.0

Source: https://www.ilsag.info/evaluator-ntg-recommendations-for-2021/

Use of Randomized Controlled Trial and Quasi-Experimental Design

Guidehouse is not evaluating the program via a randomized controlled trial because the program was not designed with randomly assigned treatment and control groups. Guidehouse is not using quasi-experimental consumption data because the savings are likely not large enough to achieve statistically significant estimates using this method.

Evaluation Schedule

Table 4 below provides the schedule for key deliverables and data transfer activities.

Table 4. Schedule – Key Deadlines

Activity or Deliverable	Responsible Party	Date Delivered
Conduct Interviews with IHWAP Participants	Evaluation Team	Q2 2021
Summary Findings from IHWAP Participants	Evaluation Team	Q3 2021
CY2021 Interim Program Tracking Data	Gas Utilities	July 15, 2021
Interim Impact Results	Evaluation	September 15, 2021
CY2021 Final End of Year Data	ComEd, Gas Utilities	January 30, 2022
Joint Program Offerings		
Draft Report to ComEd, Gas Utilities, and SAG	Evaluation	February 22, 2022
Comments on Draft Report	ComEd, Gas Utilities, and SAG	March 15, 2022
Revised Draft Report	Evaluation	March 29, 2022
Comments on Revised Draft Report	ComEd, Gas Utilities, and SAG	April 5, 2022
Final Impact Report to ComEd, Gas Utilities, and SAG	Evaluation	April 12, 2022
Non-Joint Offerings		
Draft Impact Report to Nicor Gas and SAG	Evaluation Team	April 15, 2022
Comments On Draft Report	Nicor Gas / SAG	May 6, 2022
Revised Draft Report	Evaluation Team	May 20, 2022
Comments on Revised Draft Report	Nicor Gas / SAG	May 27, 2022
Final Impact Report to Nicor Gas and SAG	Evaluation Team	June 3, 2022

Public Housing Energy Savings Program Evaluation Plan

Introduction

The Public Housing Retrofits Program provides standard and custom incentives for federally assisted low-income and public housing, residential and common areas. The purpose of this program is to work with 21 Illinois Public Housing Authorities (PHAs) and their portfolios of 51,693 housing units and other buildings to achieve energy savings. This market segment is considered underserved and is comprised of the extremely low to very low-income groups, including seniors, disabled, and households on federal assistance. The residents are renters with incomes at or below 30% to 80% of the area median income poverty levels. The jointly delivered program provides outreach, education, and incentives to management of eligible buildings to upgrade old, inefficient energy equipment in residential units, common areas, maintenance and community buildings, and any other buildings they own and manage in ComEd and gas utility service territories.

The evaluation of this program in CY2021 will include a variety of data collection and analysis activities, including those indicated in the following table.

Table 1. Evaluation Approaches – CY2021

Tasks	CY2021
Impact – Measure-Level Deemed Savings Review	X
Impact – Verification & Gross Realization Rate	X

Coordination

Guidehouse will coordinate with the evaluation teams for ComEd and the gas utilities on any issues relevant to this program. Guidehouse will coordinate impact research with the Ameren Illinois Public Housing Initiative evaluation team and ensure consistency where appropriate. Nicor Gas results will be based on Nicor Gas tracking data and reported separately.

Evaluation Research Topics

The CY2021 evaluation will seek to answer the following key researchable questions:

Impact Evaluation

1. What are the program's annual verified gross savings (energy, coincident peak demand)?
2. What are the program's annual verified net savings?
3. Are there any updates recommended for the Illinois Technical Reference Manual (TRM)

Process Evaluation and Other Research Topics

There will be no formal process evaluation of the program in CY2021.

Evaluation Approach

The table below summarizes the evaluation tasks for CY2021 including data collection methods, data sources, timing, and targeted sample sizes that will be used to answer the evaluation research questions.

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

Activity	Target	Notes
Gross Impact Evaluation	Engineering Impact Review of Installed Measures	Based on Nicor Gas Tracking System Data
Calculation of Annual Savings	Engineering Impact Review of Installed Measures	Based on Nicor Gas Tracking System Data

Gross Impact Evaluation

The measure type, deemed or non-deemed, will dictate the savings verification approach. For measures with per unit savings values deemed by the TRM, Guidehouse will calculate verified gross savings estimated by multiplying deemed per unit savings by the database-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. Measures with fully custom or partially-deemed ex ante savings will be subject to retrospective evaluation adjustments to gross savings on custom variables. For fully custom measures, Guidehouse will subject the algorithm and parameter values to evaluation adjustment, where necessary. For partially-deemed measures, TRM algorithms and deemed parameter values will be used where specified by the TRM, and evaluation research will be used to verify custom variables.

Verified Net Impact Evaluation

The net impact evaluation will apply the net-to-gross (NTG) ratio deemed through the Illinois Stakeholders Advisory Group (SAG) consensus process. The deemed NTGs are provided below.

Table 3. Deemed NTG Value for CY2021

Program Measures	Deemed NTG Value
All Measures	1.0

Source: https://www.ilsag.info/evaluator-ntg-recommendations-for-2021/

Use of Randomized Controlled Trial and Quasi-Experimental Design

Guidehouse is not evaluating the program via a randomized controlled trial because the program was not designed with randomly assigned treatment and control groups. Guidehouse is not using quasi-

experimental consumption data because the savings are likely not large enough to achieve statistically significant estimates using this method.

Evaluation Schedule

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

Nicor Gas results will be based on Nicor Gas tracking data and reported separately.

Table 4. Schedule – Key Deadlines

Activity or Deliverable	Responsible Party	Date Delivered
CY2021 Final End of Year Data	ComEd, Gas Utilities	January 30, 2022
Draft Impact Report to Nicor Gas and SAG	Evaluation Team	April 15, 2022
Comments on Draft Report	Nicor Gas / SAG	May 6, 2022
Revised Draft Report	Evaluation Team	May 20, 2022
Comments on Revised Draft Report	Nicor Gas / SAG	May 27, 2022
Final Impact Report to Nicor Gas and SAG	Evaluation Team	June 3, 2022

A.3 Business Programs (includes Public Sector)

Business Energy Efficiency Rebate Program Evaluation Plan

Introduction

The Business Energy Efficiency Rebates (BEER) program's goal is to produce natural gas energy savings in the Business Sector and Public Sector by promoting the purchase and installation of prescriptive energy efficiency measures. The energy efficiency rebate component influences the purchase and installation of high-efficiency space heating, water heating, and process heating technologies. Boiler measures are divided into hydronic, condensing, and steam boilers of varying size categories. Also included as prescriptive measures are boiler tune-ups, boiler reset controls, steam traps, thermostats, low-flow spray valves, infrared heaters, water heaters, unit heaters, pipe insulation and an assortment of food service equipment.

The BEER program offers technical assistance in the form of assessments, the direct installation of low-flow salon sprayers, faucet aerators, showerheads, and additional indoor pipe insulation for customer facilities. The assessments culminate in a customer-facing report which summarizes the findings from the assessment and makes recommendations for energy-saving projects for the customer. Prescriptive measures are marketed through a combination of market push and pull strategies as well as trade ally activities. These efforts stimulate demand, while simultaneously increasing market provider investment in stocking and promoting high efficiency products.

Guidehouse will produce a single report with separate reporting of impacts, research findings, and recommendations for the Business Sector and Public Sector.

We have prepared an evaluation plan summary to identify tasks by year. Final scope and timing of activities for each year will be refined as program circumstances are better known.

Table 1. Evaluation Plan Summary

Activity	2021
Gross Impact - Interim Impact Review	X
Gross Impact - End-of-Year TRM Savings Verification	X

Evaluation Research Topics

The evaluation team has identified the following key objectives for evaluation research for program year 2021:

Impact Evaluation

1. What are the Business Sector verified gross savings?
2. What are the Business Sector verified net savings?

3. What are the Public Sector verified gross savings?
4. What are the Public Sector verified net savings?
5. What caused gross realization rate (RR) adjustments and what corrective actions are recommended?

Other Evaluation Research

Guidehouse is not planning to conduct other evaluation research for this program in 2021.

Evaluation Approach

Gross Impact Evaluation

Guidehouse anticipates all measures offered through the BEER Program will be defined in the TRM. For measures covered by the TRM, the evaluation team will review the TRM measure characterizations and customer-specific data collected in the tracking system that substantiates the measures installed, and make adjustments as needed to calculate verified savings. The gross impact evaluation for TRM measures will include a mid-year review and end-of-year final verification. Midway through the program year, Guidehouse will review the program tracking data to determine the level of input completeness, flag outliers, and identify incorrect algorithms or input assumptions. If necessary, the Guidehouse team will make recommendations for modifications to the tracking data for use in the impact evaluation effort. After the program year ends, verified measure savings are estimated and summed across participants to calculate the total verified savings for the program. Guidehouse will produce separate reporting of impacts, research findings, and recommendations for the Business Sector and Public Sector.

Use of Randomized Controlled Trial and Quasi-Experimental Design

Guidehouse is not evaluating the BEER Program via a randomized controlled trial because the program was not designed with randomly assigned treatment and control groups. Guidehouse is not using quasi-experimental consumption data for the following reasons.

- It may not be possible to create a valid matched control group for the customers in this program.
- This method would estimate average savings across all program participants which is not the desired savings estimate for this program.
- This program contains many unique measures with significant cross-participation. In this case, quasi-experimental consumption data analysis would produce savings estimates for bundles of commonly-installed measures, rather than for each measure individually, which is not the desired output for all analysis.

Net Impact Evaluation

The net impact evaluation will apply the net-to-gross (NTG) ratio deemed through the Illinois Stakeholders Advisory Group (SAG) consensus process. The deemed NTGs are provided below.

Table 2. Deemed NTG for 2021

Program Path/Measure	Deemed NTG
BEER – Business Sector	0.86
BEER – Public Sector	0.86

Source: https://www.ilsag.info/evaluator-ntg-recommendations-for-2021/

Data Collection, Methods, and Sample Sizes

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

Table 3. Core Data Collection Activities

Activity	Target	Target Completes	Comments
Interim Impact Review	All Program TRM Measures	Census	Review program tracking data using the TRM measure characterizations
End-of-Year TRM Savings Verification	All Program TRM Measures	Census	Gross savings verification using the TRM and tracking system data

Evaluation Schedule

Table 4 below provides the schedule for evaluation of the BEER Program. Adjustments will be made as needed as program year evaluation activities begin.

Table 4. Evaluation Schedule

Activity/Deliverables	Responsible Party	Completion/Delivery
Interim Tracking Data Extract	Nicor Gas	July 15, 2021
Interim Impact Review and Findings	Evaluation Team	September 15, 2021
Final Tracking Data to Guidehouse	Nicor Gas	January 30, 2022
Draft Impact Report to Nicor Gas and SAG	Evaluation Team	April 15, 2022
Comments on Draft Report	Nicor Gas / SAG	May 6, 2022
Revised Draft Report	Evaluation Team	May 20, 2022
Comments on Revised Draft Report	Nicor Gas / SAG	May 27, 2022
Final Impact Report to Nicor Gas and SAG	Evaluation Team	June 3, 2022

Business and Public Sector Custom Incentives Program Evaluation Plan

Introduction

The purpose of the Custom Incentives (Custom) program is to assist medium to large commercial, multi-family non-prescriptive public sector and industrial customers in identifying and implementing cost-effective gas energy efficiency measures that are not otherwise addressed in Nicor Gas' BEER or Small Business Programs. Additionally, the Custom program will offer a Nicor Gas only Retro-Commissioning (RCx) offering, assisting participants with low-cost and no cost tune-ups and adjustments to the operating systems, building controls, energy management systems and HVAC systems of existing buildings. The program will also consider rebates for Combined Heat and Power (CHP) projects.

Custom projects involve unique or process-related equipment or multiple measures with interactive effects that are not well-suited for prescriptive programs. In this program, performance-based incentives are provided to customers working on larger-scale projects. Incentives are typically higher than prescriptive incentives and are based on an energy savings or engineering analysis. Technical assistance is provided to customers or their contractors to help quantify the energy savings opportunity and customize incentives for specific projects. The program also provides custom audits and engineering studies to assist customers in understanding their efficiency opportunities by quantifying the estimated project costs, energy savings, and forecasted incentives.

Guidehouse will produce a single report with separate reporting of impacts, research findings, and recommendations for the Business Sector and Public Sector. The Coordinated Retro-Commissioning Program evaluation is addressed in a separate plan. For 2021, we will evaluate and report impacts for the Nicor Gas only RCx program within the Custom Program.

We have prepared an evaluation plan summary to identify tasks by year. Final scope and timing of activities for each year will be refined as program circumstances are better known.

Table 1. Evaluation Plan Summary

Activity	2021
Gross Impact – Custom Project Savings Verification Waves and Large Project Pre-Installation Review	X
Gross Impact – End-of-Year Custom Project Savings Verification	X
Present NTG and Other Survey Research Results	Q3
CHP Project-Specific Process and NTG Research – Case-by-Case	X
Program Manager and Implementer Interviews/ Review Materials	X

Evaluation Research Topics

The evaluation team has identified the following key objectives for evaluation research for program year 2021:

Impact Evaluation

1. What are the Business Sector verified gross savings?
2. What are the Business Sector verified net savings?
3. What are the Public Sector verified gross savings?
4. What are the Public Sector verified net savings?
5. What caused gross realization rate (RR) adjustments and what corrective actions are recommended?
6. What are the effective useful lifetimes (EULs) of the non-TRM, custom measures?

NTG and Other Evaluation Research

During 2021, the evaluation team will conduct Net-to-Gross (NTG) research through interviews with 2020 participating Business Sector and Public Sector customers to determine free ridership and spillover to inform future NTG recommendations. Process research activities will include questions in the participant NTG surveys to assess program satisfaction, barriers to participation, and suggestions for improvement.

Evaluation Approach

Gross Impact Evaluation

The gross impact evaluation approach for Custom projects will be based on engineering analysis of a sample of projects to verify claimed savings or make retrospective adjustment to claimed gross savings. Projects will be sampled by size-based strata and analyzed together. All the sampled projects will be subject to engineering file review and a subset may receive on-site inspection and verification of installed measures. Gross impact estimates will mimic *ex ante* methods to the extent they are reasonable and accurate per data collected during verification steps. The evaluation team will modify calculations if methods are not reasonable or if verified operation differs from that which was reported.

Guidehouse will employ IPMVP protocols for on-site measurement and verification of custom projects. The impacts for some projects will be verified by engineering review of site-collected data and determined with regression analysis of utility billing data and weather and/or other independent variables that affect energy use (e.g., production data, days of operation), as appropriate. This approach parallels IPMVP option C. If implemented measures are not amenable to regression analysis, the evaluated savings will be determined by engineering review with site verified data, incorporating historical data when available.

The sampling plan for these projects will target overall 10 percent precision at 90 percent confidence using the stratified ratio estimation technique to optimize sample size and control evaluation costs. Due to tight end-of-year impact reporting timelines, Guidehouse will attempt to complete the majority of verification work prior to the end of the program year. The sampling for impact verification will occur in two to three waves – approximately July and/or December, and after the final program year projects are closed. Each sample will be based on lower precision targets for the wave, but when combined at the end of the year, the overall sample will meet targets. The Large Project Pre-Installation Review process provides evaluator feedback on savings methodology and baseline selection on large custom projects in pre-installation stages.

Use of Randomized Controlled Trial and Quasi-Experimental Design

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

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

Net Impact Evaluation

The net impact evaluation will apply the net-to-gross (NTG) ratio deemed through the Illinois Stakeholders Advisory Group (SAG) consensus process. The deemed NTGs are provided below.

Table 2. Deemed NTG for 2021

Program Path/Measure	Deemed NTG
Business Sector Custom	0.79
Public Sector Custom	0.79
Nicor Gas only Retro-Commissioning	0.94
CHP	Project-Specific

Source: https://www.ilsag.info/evaluator-ntg-recommendations-for-2021/

NTG and Process Evaluation

During 2021, the evaluation team will conduct Net-to-Gross (NTG) research through interviews with 2020 participating Business Sector and Public Sector customers to determine free ridership[10] and spillover to inform future NTG recommendations. Process research activities will include questions in

[10] The evaluation team may calculate free ridership using the new free ridership algorithm currently under development by the SAG NTG Working Group if indicated by a comparison of old algorithm and new algorithm results in our pilot of the new algorithm.

the participant NTG surveys to assess program satisfaction, barriers to participation, and suggestions for improvement.

Guidehouse's 2020 research activities will include review of program materials and in-depth qualitative interviews with program management and implementers. These interviews will be used to develop a complete understanding of the final design, procedures, and implementation strategies for the program, including specific marketing tactics and perceived results, to understand the current program performance and inform our evaluation efforts. We will note differences between Business Sector and Public Sector issues.

Data Collection, Methods, and Sample Sizes

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

Table 3. Core Data Collection Activities

Activity	Target	Target Completes	Comments
In Depth Interviews	Program Management	1-2	Interview program staff
NTG and process research	2020 participants and non-participants	TBD	Initiate survey development in 2020 for fielding and reporting in 2021
Project Savings Verification	Completed Business Sector and Public Sector Custom and Nicor Gas only RCx Projects		Two sampling waves, separate samples for Business and Public Sectors.
Large Project Parallel Path (Pre-Installation) Review	Business and Public Sector Projects in the Pre-Installation Phase		Evaluator feedback on savings methodology and baseline on large projects in pre-installation stages
End-of Year Project Savings Verification	Completed Business and Public Sector Custom and Nicor Gas only RCx Projects		Projects not previously sampled

Evaluation Schedule

Table 4 below provides the schedule for evaluation of the Custom Program. Adjustments will be made as needed as program year evaluation activities begin.

Table 4. Evaluation Schedule

Activity/Deliverables	Responsible Party	Completion/Delivery
Custom Project Savings Verification Waves	Evaluation Team	Q3 2021 to Q1 2022
Large Project Pre-Installation Review	Evaluation Team	Ten business days
Final Tracking Data to Guidehouse	Nicor Gas	January 30, 2022
Draft Impact Report to Nicor Gas and SAG	Evaluation Team	May 6, 2022
Comments on Draft Report	Nicor Gas / SAG	May 27, 2022
Revised Draft Report	Evaluation Team	June 10, 2022
Comments on Revised Draft Report	Nicor Gas / SAG	June 19, 2022
Final Impact Report to Nicor Gas and SAG	Evaluation Team	June 24, 2022
Conduct NTG and process surveys	Evaluation Team	Q1 2021
NTG Research Findings Memo	Evaluation Team	August 1, 2021
Process Research Findings	Evaluation Team	September 15, 2021

Small Business Program Evaluation Plan

Introduction

The Small Business Program's (SB) objective is to obtain long-term natural gas energy savings from small business gas customers with energy efficiency retrofit and financial incentives to influence the installation of high efficiency natural gas equipment. This program will provide small commercial gas customers with turn-key installation services and incentives to replace older, inefficient equipment and increase the overall efficiency of buildings.

The program offers a free energy assessment to introduce customers to energy efficiency and creates an Energy Assessment Report to help customers identify and prioritize energy efficient improvements for their business. During the assessment, Energy Advisors offer customers free energy efficient products and services including low-flow bathroom and kitchen aerators, low-flow pre-rinse spray valves, salon sprayers, low-flow showerheads, and pipe insulation. Customers are given recommendations to improve the efficiency of their business. Recommendations align with the rebates available for small business customers for energy efficiency improvements and additions (i.e. pipe insulation, ozone laundry, and boiler reset controls), space and water heating, commercial food service equipment, steam traps, and boiler tune-ups. Small business customers may also qualify for higher custom incentives for energy-saving projects. Small business customers may directly apply for a rebate for energy efficiency projects in their facility.

In 2020, Nicor Gas added a business and public sector optimization approach to their portfolio that will continue into 2021. The overall approach will target income-qualified zip codes and the public sector, with special focus on measures for small businesses and the public sector. Nicor Gas will fund an incentive account, allowing the trade ally to offer an instant rebate to the customer.

We have prepared an evaluation plan summary to identify tasks by year. Final scope and timing of activities for each year will be refined as program circumstances are better known.

Table 1. Evaluation Plan Summary

Activity	2021
Gross Impact - Interim Impact Review	X
Gross Impact - End-of-Year TRM Savings Verification	X
Gross Impact – Custom Project Savings Verification Waves	X
Gross Impact – End-of-Year Custom Project Savings Verification	X
Program Manager and Implementer Interviews/ Review Materials	Q1 2021
Survey Research – 2021 Participants and Trade Allies FR+SO plus Process Survey	Initiate Q2 2021

Evaluation Research Topics

The evaluation team has identified the following key objectives for evaluation research for program year 2021:

Impact Evaluation

1. What are the program's verified gross savings?
2. What are the program's verified net savings?
3. What caused gross realization rate (RR) adjustments and what corrective actions are recommended?

NTG and Other Evaluation Research

Guidehouse will conduct free ridership and spillover research in Q2 2021through a survey of 2020 and 2021 participants and trade allies. The survey will include a targeted set of process questions developed after input with program managers. The analysis will include a synthesis of both qualitative and quantitative data collected during the surveys and in-depth interviews with program management and implementers.

Evaluation Approach

Gross Impact Evaluation

For measures covered by the TRM, the evaluation team will review the TRM measure characterizations and customer-specific data collected in the tracking system that substantiates the measures installed and make adjustments as needed to calculate verified savings. The gross impact evaluation for TRM measures will include a mid-year review and end-of-year final verification. Midway through the program year, Guidehouse will review the program tracking data to determine the level of input completeness, flag outliers, and identify incorrect algorithms or input assumptions. If necessary, the Guidehouse team will make recommendations for modifications to the tracking data for use in the impact evaluation effort. After the program year ends, verified measure savings are estimated and summed across participants to calculate the total verified savings for the program.

The gross impact evaluation approach for custom projects will be based on engineering analysis of all or a sample of projects to verify claimed savings or make retrospective adjustment to claimed gross savings. Custom projects will be sampled by size-based strata and analyzed together. All the sampled projects will be subject to engineering file review and a subset may receive on-site inspection and verification of installed measures. Gross impact estimates will mimic *ex ante* methods to the extent they are reasonable and accurate per data collected during verification steps. The evaluation team will modify calculations if methods are not reasonable or if verified operation differs from that which was reported.

Guidehouse will employ IPMVP protocols for on-site measurement and verification of small business custom projects. The impacts for some projects will be verified by engineering review of site-collected

data and determined with regression analysis of utility billing data and weather and/or other independent variables that affect energy use (for example, days of operation), as appropriate. This approach parallels IPMVP option C. If implemented measures are not amenable to regression analysis, the evaluated savings will be determined by engineering review with site verified data, incorporating historical data when available.

The sampling plan for custom projects will target overall 10 percent precision at 90 percent confidence using the stratified ratio estimation technique to optimize sample size and control evaluation costs. Due to tight end-of-year impact reporting timelines, Guidehouse will sample for impacts in one or two waves – approximately July and/or December, and after the final program year projects are closed. Each sample will be based on lower precision targets for the wave, but when combined at the end of the year, the overall sample will meet targets.

Use of Randomized Controlled Trial and Quasi-Experimental Design

Guidehouse is not evaluating the Small Business Program via a randomized controlled trial because the program was not designed with randomly assigned treatment and control groups. Guidehouse is not using quasi-experimental consumption data for the following reasons.

- It would not be possible to create a valid matched control group for the customers in this program.
- This method would estimate average savings across all program participants which is not the desired savings estimate for this program.
- This program contains many unique measures with significant cross-participation. In this case, quasi-experimental consumption data analysis would produce savings estimates for bundles of commonly-installed measures, rather than for each measure individually, which is not the desired output for all analysis.

Net Impact Evaluation

The net impact evaluation will apply the net-to-gross (NTG) ratio deemed through the Illinois Stakeholders Advisory Group (SAG) consensus process. The deemed NTG ratios are provided below.

Table 2. Deemed NTG for 2021

Program Path/Measure	Deemed NTG
Direct Install (DI)	0.92
Prescriptive Rebates	0.91 Thermostats 0.83 All Other Measures
Custom Rebates	0.93
Business and Public Sector Optimization	0.92

Source: https://www.ilsag.info/evaluator-ntg-recommendations-for-2021/

NTG and Other Research

Guidehouse will conduct NTG research in Q2 2021 through surveys with 2020 and 2021 Small Business participating customers and trade allies. We will complete surveys with contacts who participated in the 2021 program to quantify free ridership[11] and in the 2020 program for participant spillover, and we will include questions on trade ally perspective of free ridership and non-participant spillover in trade ally interviews. The sample design will attempt to achieve a 90/10 confidence/precision level in each stratum.

The process analysis will include a synthesis of both qualitative and quantitative data collected during the review of program materials (including prior program process evaluations), and in-depth qualitative interviews with program management and implementers. Process research activities in 2021 will include reporting the results of 2021 participant and trade ally survey research conducted to assess program satisfaction, barriers to participation, and suggestions for improvement.

Data Collection, Methods, and Sample Sizes

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

Table 3. Core Data Collection Activities

Activity	Target	Target Completes	Comments
In Depth Interviews	Program Management	1-2	Interview program staff
Interim Impact Review	All Program TRM Measures		Review program tracking data using the TRM measure characterizations
Process and NTG Survey	2020-2021 Participants and Trade Allies	TBD	Survey Q2 2021
Custom Project Savings Verification	Completed Custom Projects		One or two sampling waves
End-of-Year TRM Savings Verification	All Participating Customers with TRM Measures		Gross savings verification using the TRM and customer-specific data collected in the tracking system
End-of Year Custom Project Savings Verification	Completed Custom Projects		Custom projects not previously sampled

[11] The evaluation team may calculate free ridership using the new free ridership algorithm currently under development by the SAG NTG Working Group if indicated by a comparison of old algorithm and new algorithm results in our pilot of the new algorithm.

Evaluation Schedule

Table 4 below provides the schedule for evaluation of the Small Business Program. Adjustments will be made as needed as program year evaluation activities begin.

Table 4. Evaluation Schedule

Activity/Deliverables	Responsible Party	Completion/Delivery
Interim Tracking Data Extract	Nicor Gas	July 15, 2021
Interim Impact Review and Findings	Evaluation Team	September 15, 2021
Custom Project Savings Verification Waves	Evaluation Team	Q3 2021 to Q1 2022
Final Tracking Data to Guidehouse	Nicor Gas	January 30, 2022
Draft Impact Report to Nicor Gas and SAG	Evaluation Team	May 6, 2022
Comments on Draft Report	Nicor Gas / SAG	May 27, 2022
Revised Draft Report	Evaluation Team	June 10, 2022
Comments on Revised Draft Report	Nicor Gas / SAG	June 17, 2022
Final Impact Report to Nicor Gas and SAG	Evaluation Team	June 24, 2022
NTG Research Findings Memo	Evaluation Team	August 1, 2021
Process Research Findings	Evaluation Team	September 15, 2021

Coordinated Non-Residential New Construction Program Evaluation Plan

Introduction

This plan covers CY2021 for the Non-Residential New Construction Program. CY2021 (January 1, 2021 to December 31, 2021) is the 13th program year of ComEd's energy efficiency savings portfolio and the 10th program year for energy efficiency gas savings. The Non-Residential New Construction Program is coordinated between ComEd, Nicor Gas, Peoples Gas and North Shore Gas Companies. Slipstream implements the program for ComEd, Nicor Gas, Peoples Gas, and North Shore Gas.

The CY2021 program has seen a few changes from previous years. The program has continued to develop and offer different program tracks to tailor program support to different types of participants and specific business segments. These include the Comprehensive Track, the Expedited Assistance Track, the Design Replication Track, and the Accelerate Performance Track. The tracks vary in the incentives and technical assistance offered by the program based on the type of project and the point at which the project enters the program. In addition to these tracks, the program also serves public sector projects. Beginning in CY2020, the program consolidated the participation tracks into a single Performance Path and introduced a new Best Practices Path.

1. **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 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.
2. **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 pre-determined lists of measures and incentives that are available for specific building types along with resources and guidelines for how to best implement those measures. 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 listed below:
    - Warehouse and Industrial
    - Multi-Family and Assisted Living
    - Office
    - Retail and Grocery
    - Parking Garage – being added in 2021

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

This evaluation plan reflects evaluation approaches designed for the unique characteristics of this program. The evaluation approaches have been developed through discussions between the implementation and evaluation teams, as well as ComEd, over the course of the past several years. The primary objectives of this evaluation are as follows:

- Provide adjusted gross impacts for all completed projects using a researched realization rate
- Provide verified net savings for all electric and gas projects completed in CY2021
- Use a rolling approach for the eventual derivation of net-to-gross (NTG), interviewing project representatives as they enter the reservation stage

The CY2021 gross impact evaluation will not vary substantially from the previous years and will be based on engineering desk reviews. The evaluation team will use the same general evaluation approach for all tracks of the program, including the public sector projects, but will account for the variations in the tracks (e.g., Expedited Assistance, Best Practices) and program offerings as needed. We will present results overall for the program by fuel type.

The CY2021 evaluation will include customer free ridership research. The findings from the research will inform recommended NTG values for the Illinois Stakeholder Advisory Group (SAG) approval and future program application. The CY2021 free ridership research will include in-depth interviews with participating customers to learn about how the program incentive and technical assistance may have influenced their project and to collect the data needed to calculate an NTG ratio.

Table 1. Evaluation Approaches

Tasks	CY2021
Program Tracking Data Review	X
Data Collection – Materials Review	X
Participant Interviews	X
Program Manager and Implementer Interviews	X
Impact – Engineering Review	X
Impact – Verification & Gross Realization Rate	X
Net-to-Gross – Free Ridership Self-Report Interviews	Results July 2021

Coordination

In this plan, Guidehouse outlines the evaluation objectives and activities for the program and how results pertain to each utility. The impact evaluation work will be fuel-specific: the electric impact evaluation will focus on a sample of projects with electric savings, while the gas impact evaluation will focus on a sample of projects claiming gas savings.

The evaluation activities and timing for each utility evaluation are the same, as this is one evaluation for all utilities. Guidehouse will also coordinate with Ameren evaluators on their evaluation approach. Participant interviews are done without respect to the associated gas utility. The team will work with the program implementer to determine if the differences in measures and buildings by gas service territory warrant updating the sampling strategy to support utility-specific realization rates. If not, sampling for desk reviews will be done without respect to the associated gas utility. NTG ratios are

deemed prospectively with separate NTG values for electric and for gas. Beyond these points, the ComEd evaluation team will coordinate with the gas utilities on any relevant evaluation issues as needed.

Evaluation Research Topics

The CY2021 evaluation will seek to answer the following key researchable questions:

Impact Evaluation

1. What are the program's verified gross savings?
2. What are the program's verified net savings (first year and lifetime)?
3. What are the free ridership values to be used prospectively in future program years?

Evaluation Approach

The table below summarizes the evaluation tasks for CY2021 including data collection methods, data sources, timing, and targeted sample sizes that will be used to answer the evaluation research questions.

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

Activity	Target	Target Completes CY2021	Notes
Program Tracking Data Review	Tracking System	Entire System	Completed by January 30, 2022
In-Depth Interviews	ComEd Staff and Implementers	2	Augment with monthly calls
Material Review	Literature review, secondary research, program materials	n/a	Inform primary data collection activities
Gross Impact Evaluation	Early Feedback File Review	5	Early Feedback for Large Projects, As Needed
Gross Impact Evaluation	Engineering Desk Review	30†	Two Waves*
Verified Net Impact Evaluation	Calculation using deemed NTG ratio	n/a	
NTG Research Interviews	Telephone Interview with Participating Customers	~30	FR, Targeting Projects Currently in Reservation Phase

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

Program Tracking Data Review

The program tracking data review serves two key purposes. Primarily, it ensures that the fields provided in the tracking data are sufficient for the evaluation team to calculate savings for the targeted measures. Additionally, this review helps guarantee that the tracking data is consistent with the program's data in eTRACK.

Guidehouse will perform program tracking data review and M&V project sampling in waves in CY2021. The first wave of M&V sampling is expected to cover about one-half of the projects.

Proposed gross impact sampling timelines are shown below.

CY2021 Gross Impact Sampling Waves

- First wave sample drawn in June 2021 and completed September 2021
- Final (second) wave by January 30, 2022 or upon the completion of all CY2021 projects

Gross Impact Evaluation

The evaluation team will conduct gross savings research using building energy simulation models on a sample of approximately 30 projects to determine CY2021 savings and calculate realization rates. This research will include an engineering desk review of each project in our sample. The evaluation team will also develop a summary sheet for each project reviewed that outlines the evaluation activities completed, any resulting changes to the building energy simulation model because of ex post review, and the net effect on the electric and therm savings relative to ex ante claimed savings.

Per the program design, the baseline for all projects typically will be based on the applicable Illinois Energy Conservation Code for Commercial Buildings. Determination of the applicable code version will be subject to requirements, if any, of the ICC approved version of the *Illinois Energy Efficiency Policy Manual* in place at the time of a project's application to the program. At the time of drafting this plan, the policy will likely be for evaluation to estimate savings using the code in effect at the time of the issuance of the construction permit.

All projects accepted under the guidance of *Illinois Energy Efficiency Policy Manual Version 1.1* (or earlier versions), will continue the practice of using a project's application date to determine which version of the Illinois Energy Conservation Code is the most appropriate to use as baseline. The Illinois Energy Conservation Code for Commercial Buildings references the *International Energy Conservation Code* (IECC), which also allows for use of *ASHRAE Standard 90.1* as an alternate compliance method.

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

Some new construction projects have high uncertainty surrounding the baseline selection (e.g., major renovations with HVAC reconfiguration), resulting in higher risk for downward evaluation savings adjustment if the evaluation determines that the appropriate baseline is more efficient than what was assumed in the ex-ante savings calculations. To anticipate and reduce the incidence of such cases, a review of the baseline by the evaluation team prior to incentive commitment may be appropriate. As a part of monthly evaluation update calls, there will be an opportunity for the program staff to identify projects where they perceive higher uncertainty. After discussion, the program staff and evaluation team may agree to have the evaluation team follow-up with a brief, but deeper review of project details and provide feedback on baseline selection within 10 days.

Sampling Approach

The evaluation team plans to create two sample frames, one focused on electric projects and the other focused on gas projects. These projects may or may not have gas savings and may or may not be in any of the participating gas utilities' service territories. The gas sample frame will consist of all gas projects with positive therm savings before interactive effects from electric measures, regardless of whether the project has electric savings or received a gas incentive.[12] Within each of the sample frames, we plan to use a stratified random sample design. Each sample will be designed to reach 90% confidence and 10% precision two tailed for MWh and therms, respectively. The overall sample will include 30 projects, approximately 12 of which will have received gas incentives. [13]

Table 3. Estimated Number of Projects in Sample

Fuel-Type	Estimate of Projects in Sample (Approximate)
Electric	18
Gas	12
Total	**30**

Guidehouse will perform program tracking data review and M&V project sampling in two waves in CY2021. The first wave of M&V sampling is expected to cover about one-half of projects completed in CY2021.

New Measure Calculation Review

Program managers are currently in the process of developing new energy efficiency measures to add to program offerings and may seek the input of the evaluation team on preliminary savings calculations before the measures are offered to participants. The evaluation team is available to support program managers and staff in this process, as needed, and will review spreadsheets and other preliminary calculations to provide any insight on how the new measures may be evaluated in subsequent projects.

Verified Net Impact Evaluation

The evaluation team will apply the NTG ratios approved by the SAG to the estimate of evaluation-verified gross savings to compute verified net savings. Separate estimates will be made for electric and gas savings.

[12] Similarly, when estimating verified savings, the evaluation will include all therm savings in the gas utilities' service territories with the interactive effects removed, whether the project received a gas incentive.

[13] The number of projects in the sample may change based on the final list of projects and their savings. Additional gas projects may be sampled if utility-specific realization rates are warranted.

Table 4. Deemed NTG Values for CY2021

Utility	Deemed NTG Value
ComEd (MW and MWh)	0.53
Gas Utilities (therms)	0.54

Source: https://ilsag.s3.amazonaws.com/ComEd-NTG-History-and-CY2021-Recs-2020-09-30-Final.xlsxhttps://ilsag.s3.amazonaws.com/Nicor_Gas_NTG_History_and_2021_Values_Final-9-30-20.xlsx

Program Management and Implementer Interviews

The evaluation team will interview program managers during monthly calls, or separately if more time is needed, to understand current program design and status as well as the program's plan for the future. This will be done so that the evaluation team can evaluate the program with a solid understanding of the program.

NTG Research: Participant Interviews

The team will implement a rolling approach for deriving the NTG estimates, where program attribution will be estimated through attempting to evaluate all projects currently in the reservation stage, regardless of program year, to best capture the program's early influence. We will apply an augmented participant self-report approach (SRA), where in-depth interviews will collect the primary data necessary to implement the C&I New Construction free ridership protocol (3.4) from the Illinois Technical Reference Manual, Version 9.0 and results will be internally reviewed for consistency with project materials and documentation[14]. Further, for projects accounting for the top 20% of captured savings the NTG analysis will necessarily include a detailed project documentation and material review ("Enhanced Rigor"). This methodology will include the following for each sampled project:

1) **Initial Project Documentation Review.** This includes:
    a. Measure Incentive Reservation. The evaluation team will begin by reviewing the measure incentive reservation for each sampled project. This document will inform the evaluation team's characterization of the decision-making processes for specific components of each project. The measure incentive reservation documents contain:
        i. Project description
        ii. Estimated savings by energy efficiency measures (baseline compared to proposed equipment)
        iii. Estimated incentive, by energy efficiency measures
    b. Project Narrative/Influence Tab. The evaluation team will also review project narrative files developed by the implementation contractor and Project Influence tabs. This information will allow the team to determine potential points of influence of the program.

2) **Post-Reservation Interview.** The evaluation team will seek to speak with key decision makers for each project in reservation phase. In most cases, the primary project contact will be the key decision maker, but we will verify this as part of the interview and ask to be

[14] The evaluation team may calculate free ridership using the new free ridership algorithm currently under development by the SAG NTG Working Group if indicated by a comparison of old algorithm and new algorithm results in our pilot of the new algorithm.

referred to the appropriate contact if necessary. If needed, the evaluation team will work with the implementer to identify alternate contacts. We will work with program managers and staff to update and refine the existing interview guide for use in these interviews. We will also incorporate customized questions for each project linked to the points of influence identified in the documentation review. All project-level results will also be reviewed for consistency with the findings of the initial project documentation review task. Because we will attempt to interview a census of projects in the reservation stage, no sampling of projects or differentiation between electric and gas savings is needed. We expect to complete about 30 interviews.

3) **Enhanced Rigor Project Documentation Review.** For projects accounting for the top 20% of electric savings from the pool of completed interviews, we will conduct a secondary documentation review of all relevant project materials, communications, email documentation of engagement history, and other project files to corroborate and support project-level NTG findings. We will develop a structured review protocol before conducting the analysis, rely on two qualified consultants working independently though all projects, and, if needed, adjust SRA results accordingly. The evaluation team will seek to speak with key decision makers for each project in reservation phase. In most cases, the primary project contact will be the key decision maker, but we will verify this as part of the interview and ask to be referred to the appropriate contact if necessary. If needed, the evaluation team will work with the implementer to identify alternate contacts. We will also incorporate customized questions for each project linked to the points of influence identified in the documentation review. Because we will attempt to interview a census of projects in the reservation stage, no sampling of projects or differentiation between electric and gas savings is needed. We expect to complete about 30 interviews.

Use of Randomized Controlled Trial and Quasi-Experimental Design

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

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

Evaluation Schedule

Table 5 below provides the schedule for key deliverables and data transfer activities. (See Table 2 for other schedule details.) Adjustments will be made, as needed, as evaluation activities progress.

Table 5. Schedule – Key Deadlines

Activity or Deliverable	Responsible Party	Date Delivered
Program tracking data for participant interviews	ComEd	April 1, 2021
Post-reservation phase participant interviews	Evaluation	April 1, 2021 through June 11, 2021
Program tracking data for sampling Wave 1	ComEd	June 3, 2021
NTG Results Memo	Evaluation	July 26, 2021
Wave 1 engineering desk reviews	Evaluation	September 30, 2021
Program tracking data for sampling Wave 2	ComEd, Gas Utilities	January 30, 2022
Wave 2 engineering desk reviews	Evaluation	February 28, 2022
Draft Report to ComEd, Gas Utilities, and SAG	Evaluation	March 11, 2022
Comments on Draft Report	ComEd, Gas Utilities, and SAG	March 18, 2022
Revised Draft Report	Evaluation	April 8, 2022
Comments on Revised Draft Report	ComEd, Gas Utilities, and SAG	April 15, 2022
Final Report to ComEd, Gas Utilities, and SAG	Evaluation	April 22, 2022

Coordinated Utility Retro-Commissioning Program Evaluation Plan

Introduction

The Coordinated Utility Retro-Commissioning (RCx) Program seeks to realize energy savings by restoring building HVAC systems and optimizing controls to meet the needs of the current building occupants. RCx is a study-based process that generates savings through improved understanding and operation of the existing equipment, rather than capital outlays to install new equipment.

The RCx Program is managed by ComEd. ComEd coordinates with Nicor Gas, Peoples Gas and North Shore Gas to account for gas savings generated through the program. The RCx Program continues to evolve to serve more diverse customer segments. To reach smaller customers and market segments, the utilities began expanding the program to support additional offerings in the fifth electric and second gas program years (PY5/GPY2) and in the seventh electric and fourth gas program years (PY7/GPY4). Beginning in CY2018, public sector customers could participate in any of the RCx offerings from the utilities.

Historically there have been four core RCx Program options to optimize energy performance. Virtual Commissioning (VCx) savings are reported by ComEd along with RCx savings but evaluated as a separate program. Starting in CY2021, these will be merged into two distinct options as follows:

- **Retro-Commissioning** includes the following historical program tracks:
  - Traditional RCx represents the original offering for large commercial buildings and completes a four-phase RCx process (Planning, Investigation, Implementation, and Verification). Projects are unique, and savings are determined using program standard and custom calculations developed by service providers and implementation contractors with input from the evaluators.
  - Retro-Commissioning Express (RCxpress) is an offering targeted to mid-sized commercial buildings or buildings interested in a shorter project timeline. RCxpress uses program-standard calculators in addition to custom calculations for savings estimates.
  - RCx Building Tune-Up (Tune-Up) is for customers less than about 150,000 ft^2 but with more than 100 kW of peak demand. This offering offers an implementation incentive in addition to the RCx study incentive provided in the other offerings.
- **Monitoring-Based Commissioning (MBCx)** is a long-term engagement between the Energy Efficiency Service Provider (EESP) and customer to identify, implement, and monitor measures over time. MBCx features the integration of monitoring software into the building automation system to assist in the identification and documentation of deeper energy saving opportunities than those found in traditional RCx. It can also be used as a process to continue and augment prior projects that will help ensure measure persistence and improve building operations over time.

Guidehouse anticipates that the evaluation will pursue the following research areas for CY2021.

Table 1. Evaluation Approach

Tasks	CY2021
Program Tracking Data Review	X
Data Collection – Program Manager and Implementer Interviews	X
Impact – Project-specific Billing Analysis	X
Impact – Engineering Review	X
Impact – Verification & Gross Realization Rate	X
NTG Research: Customer Self-Report Surveys	July 2021
NTG Research: Service Provider Interviews	July 2021

The evaluation team determined the evaluation approach for the CY2021 period based upon the needs of the program and program's prior history. The evaluation approach for this program is based on the following:

- RCx measures often use custom calculation tools to estimate savings. As a result, we will continue to review and estimate gross and net impacts each year over CY2021.
- NTG research with participants and EESPs will conform to statewide NTG methodologies described in the Illinois Technical Reference Manual (TRM).

Coordination

Guidehouse will coordinate with the Ameren Illinois (AIC) evaluation team on any issues relevant to this program. The teams have worked in parallel over many years and the methods used in both evaluations are specified by the TRM and are generally consistent. Depending on the number of completed projects the AIC impact analysis may include a sample or census of participants.

Gas savings. A memorandum of understanding between ComEd and the gas utilities promotes estimating complementary gas savings at ComEd customer sites for all RCx offerings, up to an amount of approximately 600,000 therms for CY2021. The RCx Program evaluation plan parallels the planned work for the AIC RCx Program.

Evaluation Research Topics

The CY2021 evaluation will seek to answer the following key researchable questions:

Impact Evaluation

1. What are the program's verified gross savings?
2. What are the program's verified net savings?
3. Should the program design be modified to reduce free ridership, and if so, how?

Process Evaluation and Other Research Topics

Guidehouse will undertake NTG research in CY2021. NTG was last researched for RCx using participants from PY9 and Guidehouse believes it is time to re-estimate the value.

Guidehouse will not conduct process research in CY2021.

Evaluation Approach

Guidehouse will use impact methodologies from the International Performance Measurement and Verification Protocols (IPMVP), as appropriate for the market segment we are researching. In some cases, Guidehouse may opt to use regression methods with meter data (IPMVP – Option C) for Tune-Ups or select measures in other offerings which would be apparent on meter data seasonally or during select hours of the day. Guidehouse will adjust ex post evaluated savings results where needed to represent a 'typical' year.

Table 2 below summarizes data collection methods, data sources, timing, and targeted sample sizes that will be used to answer the evaluation research questions for each program offering. For planning purposes, Guidehouse assumes CY2021 participation will be similar to CY2020 participation. Participation by gas utility customers is unknown at the time of this Plan.

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

Activity	Target	Target Completes CY2021	Notes
Tracking Data Review	Tracking System	Census	Fall/Winter
Service Provider NTG Interviews*	Active retro-commissioning service providers (EESP)	TBD	Census sample frame
Participant NTG Interviews	Program Participants	TBD	Census sample frame
Gross Impact Evaluation	Engineering File Review	50	March 31, June 30, Sept 30, Dec 31†
Gross Impact Evaluation	On-site M&V	TBD‡	
Verified Net Impact Evaluation	Calculation using deemed NTG ratio	Census	

* Service Provider surveys are triggered by high importance ratings by participating customers to the Service Provider or vendor. Therefore, the number of surveys is dependent on the results of the participating customer surveys.
† Guidehouse will draw an incremental sample each quarter based on completed projects at the time of the sample refresh.
‡ Guidehouse will limit on-site M&V to the extent we can and focus it on only the highest-impact projects. Guidehouse expects most or all of the projects to be verified using a combination of electric and gas billing data, additional trend data requested from the customer, and telephone verification of key inputs by the customer. This approach is not expected to impact the final realization rates, however it may limit the amount of site-specific feedback available to explain the realization rates.

Tracking Data Review

Guidehouse will perform program tracking data review and M&V project sampling approximately quarterly in 2021. Initial feedback on sampled project files will occur within 45 days of their posting as outlined in the "*CY2021 Gross Impact Research Waves"* section below. Guidehouse will report periodic preliminary evaluated impact findings.

The program tracking data review serves two key purposes. Primarily, it ensures that the fields provided in the tracking data are sufficient for the evaluation team to calculate savings for the targeted measures. Additionally, this review helps guarantee that the tracking data is consistent with the program's data in eTRACK. This latter task will become increasingly important as eTRACK undergoes development and more closely reflects the tracking data Guidehouse receives.

Gross Impact Evaluation

The CY2021 gross impact evaluation sampling plan may be adjusted to reflect ComEd's research goals.

Sampling Strategy

Our overarching goal is to research savings impacts sufficiently to report program-level savings at ±10% precision and 90% confidence. We will also accommodate secondary research objectives, as requested by ComEd, but with relaxed precision and confidence,[15] to fit research within budget constraints and as permitted by ComEd. The default strata will be defined by project size and 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 Guidehouse will adjust the sample to comply with sampling goals.

CY2021 Gross Impact Research Waves

Guidehouse will perform program tracking data review and M&V project review quarterly in CY2021.

All sampled projects will be subject to engineering file review. Gross impact estimates will mimic ex ante methods to the extent they are reasonable and accurate per data collected during verification steps. The evaluation team will modify calculations if methods are not reasonable or if verified operation differs from what was reported.

Wherever possible, ex post savings may be determined with regression analysis of trend or utility billing data and weather or other independent variables that affect energy use (for example, days of operation), as appropriate. If implemented measures are not amenable to regression analysis, the engineering review will form the basis of evaluated savings using IPMVP Option A. This review process may point to special needs of this market segment.

Proposed gross impact timeline:

a) Guidehouse will communicate preliminary realization rates within four weeks of receiving all necessary information including permission to contact participant customers for confirmation and clarification of key inputs to the savings algorithms. Necessary information includes

[15] Sampling in this manner for 85/15 confidence/precision is the approach used by Exelon-PECO for sub-program level research. When the subprograms are considered the overall research achieves 90/10 results for the program.

project folders, detailed measure summary, up-to-date customer contact information, and tracking data for projects sampled quarterly. This target assumes projects do not require a site visit to reduce uncertainty in key project variables such as equipment kW and operational hours.[16]

b) Guidehouse will communicate results for projects requiring a Guidehouse site visit as soon as the site visit is complete, and all data has been collected and analyzed.

c) Final analyses will be posted in March of 2022 or sooner.

Retro-commissioning program measures are not covered by the TRM and are all non-deemed measures subject to retrospective per unit savings adjustment of custom variables. Guidehouse performs an engineering analysis of savings using document review, telephone interview with participating customers, and supplemental data requests. Where appropriate, Guidehouse will use site-collected data as inputs to the analysis. The approach is further described below:

- Measures with fully custom or partially deemed ex ante savings will be subject to retrospective evaluation adjustments to gross savings on custom variables. For fully custom measures, Guidehouse will subject the algorithm and parameter values to evaluation adjustment, where necessary. For partially deemed measures, TRM algorithms and deemed parameter values will be used where specified by the TRM, and evaluation research will be used to verify custom variables.
- The evaluation may include an analysis of on-site collected verification data for a subset of projects. The engineering analysis methods and degree of monitoring will vary from project to project, depending on the complexity of the measures, the size of the associated savings, the potential to revise input assumptions, and the availability and reliability of existing data. The evaluators will contact the implementers prior to conducting site visits to ensure that the evaluation team has all correct and relevant information.

The measure-level realization rates will be extrapolated to the program population using a ratio estimation method to yield ex post evaluation-adjusted gross energy savings. Gross realization rates will be developed for energy and coincident peak demand savings. The sample design will provide 90/10 statistical validity for program savings overall.

Verified Net Impact Evaluation

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

[16] The data required to develop an ex post savings estimate depends on several factors including: measure seasonality; the size of the project savings; whether the project is selected for an on-site visit; whether there are both gas and electric savings; the availability of gas company billing data; and on the completeness of the data provided by the implementer. Where possible based on the data provided by the implementer, Guidehouse will provide a preliminary estimate of the ex post savings subject to final quality control checks. Where additional data or clarifications are needed, or a site visit is required, Guidehouse will request the additional information from the implementer and/or make initial contact with the participant within 45 days to schedule a site visit.

Table 3. Deemed NTG Values for CY2021

Component	Deemed NTG Value
RCx	0.94
Legacy RCx Legacy Tune-Up Legacy RCxpress	0.94
MBCx	0.94
All-Natural Gas	0.94

Source: https://www.ilsag.info/evaluator-ntg-recommendations-for-2021/

NTG Research: Customer Surveys

Guidehouse will conduct a participating customer NTG study in CY2021 to research free ridership and spillover for future evaluations. We will survey participants and interview active EESPs to research free ridership and spillover. We will triangulate their results to inform the final recommended NTG value, using methods defined in the Illinois TRM.

- **Net-to-gross research.** NTG research with participants and EESPs will conform to statewide NTG methodologies described in the Illinois Technical Reference Manual[17], and includes the following:
  - Target CY2020-2021 participant population for Free Ridership
  - Target CY2019-2020 participant population for Spillover
  - Online surveys
  - Report in Summer 2021

For natural gas NTG research, we will attempt a census of all gas projects. Each gas participant data point will also constitute an electric participant data point.

NTG Research: Service Provider Interviews

The evaluation team will conduct interviews with EESPs to inform NTG recommendations for each program offering. Interviews will address free-ridership and participant spillover using protocols developed by the Illinois EM&V NTG Working Group and incorporated into the TRM. We will sample a census of service providers participating in each offering.

We will target a 90/10 sample by program offering. For natural gas NTG research, we will attempt a census of all gas projects. Each gas participant data point will also constitute an electric participant data point.

[17] The evaluation team will calculate free ridership using the new free ridership algorithm currently under development by the SAG NTG Working Group. The participation population is small, and the free ridership battery for this program is long, therefore, using both the old free ridership questions and the new ones is not possible.

Use of Randomized Controlled Trial and Quasi-Experimental Design

We are not evaluating the RCx Program via a randomized controlled trial because the program was not designed with randomly assigned treatment and control groups. We are not using quasi-experimental consumption data because there are not enough participants in this program to achieve statistically significant savings estimates using this method and it would not be possible to create a valid matched control group for the customers in this program.

Program Management and Implementer Interviews

The evaluation team will interview ComEd staff to understand current program design and status as well as the program's plan for the future. This will be done so that the evaluation team can evaluate the program with a solid understanding of the new program structure.

Evaluation Schedule

Table 4 provides the schedule for key deliverables and data transfer activities.

Table 4. Schedule – Key Deadlines

Activity or Deliverable	Responsible Party	Date Delivered
Calculators/Ops Manual/Workpapers	ComEd	January 20, 2021
Program Tracking Data Review – tracking data for QA/QC	ComEd	April 1, July 1, Oct 1st of 2021
Program Tracking Data Review Feedback – Quarterly project documentation, engineering reviews	Evaluation	June 1, 2021, Oct. 1, 2021 Early feedback for on-site projects will be provide ongoing as results become available
ComEd Staff Interviews	Evaluation	December 15, 2021
NTG Surveys Fielded	Evaluation	March – May 2021
Program Tracking Data Review – data for final end of year sampling	ComEd	January 30, 2022
Final Project Documentation Feedback - engineering reviews	Evaluation	February 25, 2022
Draft Report to ComEd, Gas Utilities, and SAG	Evaluation	March 11, 2022
Comments on Draft	ComEd	April 1, 2022
Revised Draft	Evaluation	April 8, 2022
Comments on Revised Draft	ComEd	April 15, 2022
Final Report to ComEd, Gas Utilities, and SAG	Evaluation	April 22, 2022
NTG Research Memo	Evaluation	June 25, 2021

Strategic Energy Management Program Evaluation Plan

Introduction

The Strategic Energy Management (SEM) Program provides customers with high energy consumption training to holistically assess the energy use of their facilities and identify no/low cost opportunities to reduce their usage. Through the program, participants learn to apply principles and practices of continuous improvement to implement strategic energy management practices.

Currently the Strategic Energy Management (SEM) Program has two types of participants: (1) the new cohort made up of new participants, and (2) the alumni cohort for customers that continue to participate after their first year. Guidehouse's focus in CY2021 will be on new cohorts as that detail becomes available for evaluation. The evaluation of this program over the coming year will include a variety of data collection and analysis activities, including those indicated in Table 1.

Table 1. Evaluation Approaches

Tasks	CY2021
Program Tracking Data Review	X
Impact – Billing Analysis	X
Impact – Engineering Review	X
Impact – Modeling	X
Impact – Verification & Gross Realization Rate	X

The impact evaluation of this program focuses on the review of site level energy models and detailed site reports. As needed, calls with customers may be completed to verify information included in both the report and whole building models. Notable evaluation changes made from CY2020 to CY2021 include:

- Due to timing of data availability, the gas and electric reports will likely be separate for this program and not a joint report.
- A sample will be taken from all participants. In CY2020, new participants were more focused on than alumni. This year all customers will be considered equally in order to ensure that alumni customers are continuing to show accurately claimed savings.
- Program coordination will occur during monthly meetings. Guidehouse has not planned for separate implementer and utility surveys this year.

The evaluation approach for this program is based on the following principles:

- Gross and net impact analyses will be conducted each year
- The impact evaluation of the SEM Program will characterize and quantify:
    - Energy savings achieved through SEM improvements and behavior change beyond capital projects (prescriptive and custom)

Coordination

The SEM Program is jointly managed between ComEd, Nicor Gas, Peoples Gas Company and North Shore Gas Company. ComEd will coordinate with other Illinois utilities, as needed. The SEM evaluation report will be developed as separate ComEd and gas utilities evaluation reports. Guidehouse leads the evaluation and will work with each gas utility to finalize the report. There are special data collection issues with the SEM Program and Guidehouse will manage those data issues with ComEd and gas utilities.

Evaluation Research Topics

The CY2021 evaluation will seek to answer the following key researchable questions:

Impact Evaluation

1. What are the actual achieved energy behavior savings in this program?
2. What were the realization rates of the projects?
3. Are there any major changes occurring during or after program implementation (production, size, hours, etc.) which may have affected the results?

Process Evaluation and Other Research Topics

Guidehouse will not conduct formal process evaluation research in CY2021.

Evaluation Approach

Table 2 summarizes the evaluation tasks for CY2021, including data collection methods, data sources, timing, and targeted sample sizes that will be used to answer the evaluation research questions. Final activities will be determined as program circumstances are better understood.

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

Activity	Target	Target Completes CY2021	Notes
Program Tracking Data Review	Tracking System	Census	Guidehouse will coordinate with the electric and gas utilities to ensure tracking data is complete and accurate.
Gross Impact Evaluation	Engineering File Review	*	This is a review of multi-regression models based upon whole-building data, production data and other key variables.
Verified Net Impact Evaluation	Calculation Using Deemed NTG Ratio	NA	Deemed Value Electric (1.00) Gas (1.00)

*Sample size will be determined to achieve 90/10

Program Tracking Data Review

The program tracking data serves two key purposes. Primarily, it ensures that the fields provided in the tracking data are sufficient for the evaluation team to calculate savings for the targeted measures. Additionally, this review helps guarantee that the tracking data is consistent with the program's data in eTRACK. This latter task will become increasingly important as eTRACK undergoes development and more closely reflects the tracking data Guidehouse receives.

Gross Impact Evaluation

The impact evaluation will be grounded in site-specific data using engineering models and analysis.

1. A site-specific analysis approach will be implemented. Because this program primarily contains behavioral-based changes, International Performance Measurement and Verification Protocol (IPMVP) Option C (i.e., billing/metered data regression) will be the main method of impact evaluation.

2. The data collection will focus on verifying or updating the assumptions that feed into the implementer's energy model for each site. This data may include program tracking data and supporting documentation (project specifications, invoices, etc.), utility billing and interval data, Guidehouse-calibrated building automation system (BAS) trend logs, production data and telephone conversations with onsite staff.

ComEd or the gas utilities will provide energy models for all the sites within the SEM Program. The evaluation will use this data with other information from the site to identify operating characteristics of the site both pre-and post-program activities. If major changes have occurred at the site during or after the SEM activities, it is expected the model will need to be adjusted to account for these changes. The changes that could affect the model savings include but are not limited to:

- Changes in hours of operation
- Changes in employees
- Changes in production
- Various factors that affect the model savings
- Other measures installed at the site that were implemented through other utility energy efficiency or demand response programs or outside of the ComEd and Nicor Gas programs[18]

Guidehouse will sample projects from the sites and apply the sample realization rates to the entire population to calculate overall savings. Guidehouse will consider several ways to stratify the SEM projects to design a sample once initial program data is received. Guidehouse will use a stratified ratio estimation sampling design to develop an efficient sample achieving 90/10 confidence/precision on the program-level realization rate. Once all sampled sites are evaluated, the realization rate of each stratum will be calculated. This realization rate will be applied to the total claimed savings within each stratum to calculate the final program savings.

[18] These measures are rebated separately from SEM program and savings for these measures are not counted in the SEM savings

As participating sites complete their one year of activities within the SEM Program, Guidehouse will collect the information regarding these sites and begin the evaluation. Guidehouse expects that the timing of this information will be dependent on the timing of the cohort training.

Verified Net Impact Evaluation

The net impact evaluation will apply the net-to-gross (NTG) ratio deemed through the Illinois Stakeholders Advisory Group (SAG) consensus process. The deemed NTGs are provided below.

Table 3. Deemed NTG Values for CY2021

Program Measure	Deemed NTG Value
All-Electric	1.00
All-Natural Gas	1.00

Source: https://www.ilsag.info/evaluator-ntg-recommendations-for-2021/

Use of Randomized Controlled Trial and Quasi-Experimental Design

The evaluation team will not evaluate this program via a randomized controlled trial because the program was not designed with randomly assigned treatment and control groups. The evaluation will not use quasi-experimental design because there are not enough participants for individual measures in this program to achieve statistically significant savings estimates using this method.

Evaluation Schedule

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

Table 4. Evaluation Schedule – Key Deadlines

Activity/Deliverables	Responsible Party	Date Delivered
Calculators/Workpapers and Models	Nicor Gas	January 30, 2022
Draft Report to Nicor Gas and SAG	Evaluation	April 15, 2022
Comments on Draft Report	Nicor Gas and SAG	May 6, 2022
Revised Draft Report	Evaluation	May 20, 2022
Comments on Revised Draft Report	Nicor Gas and SAG	May 27, 2022
Final Report to Nicor Gas and SAG	Evaluation	June 3, 2022

A.4 Market Transformation Initiatives and Emerging Technologies Program (ETP)

Market Transformation Initiatives and Emerging Technology Program Evaluation Plan

Introduction

Energy legislation Section 8-104 affords program administrators up to 3 percent of the portfolio budget to be dedicated to breakthrough equipment and devices and up to 5 percent of the portfolio budget to be dedicated towards market transformation initiatives. The Nicor Gas Energy Efficiency Program will employ Emerging Technologies and Market Transformation tools and techniques to integrate innovation in energy efficiency programs. Nicor Gas expects these tools and techniques will play a critical role in identification and demonstration of innovative energy efficiency technologies and identification and alleviation of market barriers towards adoption and implementation of energy efficiency strategies and offerings.

Nicor Gas will operate several market transformation and research efforts during EEP 2020-2021, as well as the Emerging Technology Program, including:

- Gas Heat Pump Water Heaters
- Thin Triple Windows

If Nicor Gas claims savings during this period, Guidehouse will develop a plan and approach to verify the savings. Guidehouse will provide technical review to support Nicor Gas efforts to deem natural gas energy savings for these measures in the Illinois TRM.