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Evaluation Plan for Ameren Illinois Company Energy Efficiency Programs

Transition Period

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December 1, 2017

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1. Executive Summary

Ameren Illinois Company (AIC) hired the team of Opinion Dynamics, The Cadmus Group, Navigant Consulting, and Michaels Energy to perform impact and process evaluations for AIC's portfolio of energy efficiency programs implemented between June 1, 2017 and December 31, 2017 (the Transition Period). This seven-month Transition Period bridges the period between AIC's Plan 3 energy efficiency programs and the 2018 Plan established by Senate Bill 2814 (the Future Energy Jobs Bill), which begins on January 1, 2018.

The overarching evaluation objective for the Transition Period is to determine gross and net energy and demand impacts associated with the AIC energy efficiency portfolio. In addition, the evaluation team will conduct research to inform improvements to the design and implementation of new and existing programs. As part of the Transition Period evaluation effort, the team will assess the following programs:

- Residential
  - Lighting
  - Heating and Cooling (HVAC)
  - Behavioral Modification
  - Multifamily
  - Home Efficiency Income Qualified (HEIQ)
  - School Kits
- Commercial and Industrial (C&I)[1]
  - Standard
  - Custom
  - Retro-Commissioning (RCx)

The evaluation team, in coordination with AIC, will use the Transition Period as to prepare for the execution of evaluation activities and reporting on results within the timelines stipulated for the 2018 Plan. Key milestones include: (1) final program tracking data from AIC within 30 days of the end of the program year, (2) draft evaluation reports within 60 days of the end of the program year, and (3) 15-day review periods for evaluation reports.

[1] Beginning in the Transition Period, public sector energy efficiency projects (formerly under DCEO) are included in the C&I programs.

1.1 Overall Evaluation Approach

The Transition Period evaluation approach includes both program- and non-program-specific activities (as outlined in Table 1) with the goal of providing gross and net energy and demand impacts, as well as information on program performance that can be used to inform the 2018 Plan period.

Table 1. Transition Period Evaluation Activities

Evaluation Activity	Residential						C&I		
	Behavioral Modification	HVAC	Multifamily	Lighting	HEIQ	School Kits	Standard	Custom	RCx
Program Material & Data Review	✓All programs								
Program Manager and Implementer Interviews	✓ All programs								
Market Actor Interviews[a]									
Participant/Non-Participant In-Depth Interviews							✓	✓	✓
Participant Survey					✓		✓		
Non-Participant Survey					✓				
Literature Review								✓	
Ex Post Gross Impact Analysis									
Application of the IL-TRM V5.0		✓	✓	✓	✓	✓	✓		
M&V Site Visits								✓	✓
Consumption Analysis	✓								
Ex Post Net Impact Analysis									
Application of SAG-Approved NTGR	✓All programs								
Retrospective Application of Researched NTGR								✓	
Performed NTGR Research for Prospective Use									

[a] Program allies, retailers, or other market actors.

In addition to the activities outlined above, the evaluation team will conduct non-program specific research activities to help inform program design and execution moving forward. We provide an overview of each activity below.

- **Sector- and Program-Specific Cross-Cutting Research**: The evaluation team will conduct targeted research related to the income qualified and public sector customer segments, as well as targeted research related to specific AIC program offerings (for example, the Strategic Energy Management [SEM] program). This research is designed to gather insights that AIC and its implementation team can use as they ramp up new and modified program offerings in 2018.

- **IL-TRM Update Efforts:** The evaluation team will participate in the Technical Advisory Committee (TAC) process as needed throughout the Transition Period to ensure that data gathered as part of the evaluation is submitted for inclusion in the Illinois Statewide Technical Reference Manual (IL-TRM) V7.0. In addition, we will participate in other meetings of the Stakeholder Advisory Group (SAG) as needed in advance of the 2018 Plan.

- **Coordination with Illinois Utilities:** Consistent with all prior evaluation periods, the evaluation team will consult with their counterparts supporting evaluation efforts for other utilities in the state on an ongoing basis to ensure the consistency of evaluation approach where appropriate.

- **Cost-Effectiveness Analysis:** The team will prepare model inputs of evaluated program savings as determined through the evaluation effort. As needed, the team will also audit AIC's cost-effectiveness analysis based on the study period's program results. This may include a review of AIC's assumptions for avoided costs, discount rates, measure cost information, administrative costs, and other relevant data.

2. Impact Evaluation Activities

This section outlines the impact evaluation activities for each of the Transition Period programs. The Transition Period evaluation will include the calculation of gross and net impact estimates associated with each program. For the majority of programs, the impact evaluation will consist of applying savings algorithms from the IL-TRM V5.0 to final program tracking databases to estimate ex post gross savings. However, we will employ a combination of on-site visits, engineering analysis, and consumption analysis to select programs (i.e., Behavioral Modification, C&I Custom, and C&I RCx).

2.1 Research Objectives

The overarching research objectives for the impact evaluation of AIC's Transition Period programs are as follows:

1. What were the estimated gross energy and demand impacts from this program?
2. What were the estimated net energy and demand impacts from this program?

The evaluation team plans to meet these objectives by conducting the impact evaluation activities outlined in Table 2. As noted previously, the evaluation approaches outlined here are consistent with the PY9 evaluation efforts.

Table 2. Transition Period Impact Evaluation Activities

Program	Gross Impacts				Net Impacts
	IL-TRM V5.0 Application	M&V Site Visits	Consumption Analysis	REM/Rate Simulation	Application of SAG-Approved NTGR
Residential Lighting	✓				✓
HVAC	✓				✓
Behavioral Modification			✓		✓
Multifamily In-Unit	✓				✓
HEIQ	✓				✓
School Kits	✓				✓
C&I Standard	✓				✓[a]
C&I Custom		✓			✓[a]
C&I RCx		✓			✓[a]

[a] Consistent with prior years, we will also conduct project-specific NTGR research for projects completed as part of the Custom Large Incentive Program (CLIP) offering and Staffing Grant offering if warranted.

Within each of the following sections we provide detailed information on the gross and net impact evaluation activities.

2.2 Gross Impacts

2.2.1 Application of IL-TRM V5.0

To determine gross impacts associated the majority of AIC's programs (see Table 2), we plan to review the content of program tracking databases to identify database errors and duplicate records, and to ensure that the implementer correctly applied savings algorithms and assumptions stated in the IL-TRM V5.0. As part of this process, we will also verify measure installation analysis of program tracking databases, as well as the review of supporting project documentation for a sample of projects per program. We will resolve any discrepancies found in the databases, report on findings, and provide details related to any gross savings adjustments. We will apply the algorithms and assumptions provided in the IL-TRM V5.0 while using the actual data from the database. We will also provide detailed algorithms and assumptions used to calculate ex post gross energy and demand impacts by measure type.

2.2.2 Application of Custom Impact Methods

Two of AIC's Transition Period programs—C&I Custom and C&I RCx—require custom energy savings calculations for gross impacts. We outline the methodology for each program in the following sections.

C&I Custom

We will conduct onsite data collection for a sample projects to review and verify savings assumptions. Based on our review of initial program tracking data received in November 2017, we plan to attempt a census of on-site visits for all projects completed through the Custom Program during the Transition Period.[2] This may include an examination of existing equipment and/or program M&V measurements. At a minimum, the review engineer will perform the following actions during the site visits:

- Verify that the installed measure(s), for which the program participants received an incentive payment, is/are still installed and functioning, and that the quantity is consistent with the number of measures the program rebated.
- Collect additional physical data to further analyze and determine the energy savings resulting from the incented measure(s). The pertinent data collected from each site will be determined based on an in-depth review of the site's project files and will be unique to each installed measure.

In addition, the team will submit formal M&V plans and reports for up to five of the largest Custom Program projects. No other M&V sites will have a written site-specific plan or report.

Some sites may require an additional level of effort, which could include monitoring of equipment to gather both real-time data at the time of inspection and trend data over a period of several weeks, if necessary. The team will share the site visit results with AIC and ICC staff in advance of submitting the draft annual report. The Excel file and Custom Program project site reports provided for review and discussion will feature the ex ante and ex post savings for each project, the resulting realization rate, and the reasons for the realization

[2] Historically, we have conducted on-site review of a sample of Custom projects. However, given the expected population of projects completed through the Program in the Transition Period (<50), the new inclusion of public sector projects, and the additional rigor required to conduct sampling in a short time period, we believe that attempting a census of all projects will provide AIC with the most accurate and actionable results.

rate. We will also hold a meeting with AIC and Leidos, as well as with ICC staff, to discuss the findings and answer any questions.

Sampling

We expect to conduct site visits at a census of projects completed in the Transition Period. Therefore, there will be no need to conduct sampling activities and stratification, and there will be no sampling error around our gross impact estimates for the Custom Program in the Transition Period.

Analysis Plan

Consistent with prior years, the gross impact analysis for the Custom Program in the Transition Period is based on site-specific M&V results, which we will use to verify measure installation and savings through the Custom Program. The team will develop a site-specific M&V plan for each site based on project complexity, savings magnitude, and access to critical parameter measurements. Critical parameters include a combination of those that have a significant impact on the savings and/or have a high level of uncertainty. These plans will provide for internal quality assurance and control by senior staff, who are licensed professional engineers.

Within each of the M&V plans, we will describe the International Performance Measurement and Verification Protocol (IPMVP) option that we will use to verify the savings estimates. The IPMVP approach is typically chosen based on the type of project that was completed (new construction or replacement), the technology implemented, the level of savings relative to the customer's billing/usage history, and the information provided in the project documentation. For example, Option A, retrofit isolation with parameter measurement, may be used for a specific measure, but if the impacts are significant enough such that results should be apparent on billing/usage data, analysis of billing data (Option C) will also be conducted as a cross-check. Similarly, if Option C, whole-building energy billing analysis, is the primary means of M&V, Option A or B may be used as a cross-check to verify savings from specific measures with a significant impact on the total project savings.

Once onsite, each visit will include a physical inspection of measures and a customer interview to gather information about the project for verification purposes. We will use a standard inspection and interview format so that information gathered from various projects is consistent. The team will use the site-specific M&V plan to guide the collection of these data, including any monitoring data.

For projects that operate mainly at a steady state (i.e., constant load), we will typically record spot measurements of critical parameters, such as amps, kW, temperatures, and flow rates. For projects that operate with significant load fluctuations, to the extent possible, we will use data logging over a period of 1–2 weeks. Data may be logged to determine run times or it may include "interval metering," where the loads are recorded at specific intervals as they vary throughout the day or week.

Based on the results from the onsite visits, we will calculate the gross impacts for each site and roll these impact estimates up to a population total to determine total program ex post savings estimates.

We will report savings by energy source using the following criteria. For single-fuel customers receiving an incentive through the program, we will report the savings associated with the fuel type they receive from AIC. For example, the team will count gas savings associated with any gas incentive paid to a gas-only customer by AIC. For dual-fuel customers, we will report both the gas and electric savings associated with measures installed through the program, regardless of whether the customer received a gas or electric incentive.

C&I RCx

The impact analysis for the Transition Period RCx Program will employ a bottom-up approach to estimating gross savings based on site-specific M&V results, which we will use to verify savings through the RCx Program. We will determine realization rates from sampled sites for each impact metric—kWh, kW, and therms—individually at the project level. Retro-commissioning projects can have large variability in savings among participants. Sources of variability include the physical size of the participant site, the systems installed, the condition of systems prior to retro-commissioning, the extent of control capabilities, the scope and quality of the retro-commissioning study itself, and the willingness of customers to implement recommendations.

Based on the expected participation level for the RCx Program in the Transition Period, we expect to complete desk reviews and onsite verification for a census of RCx projects in the Transition Period. In some cases, these activities will entail monitoring over several weeks and/or taking other measurements. In other cases, simple visual verification will suffice. Because we expect to complete desk reviews and onsite verification for a census of RCx projects, no sampling activities need to occur, and there will be no sampling error surrounding our ex post savings estimates for the program.

Based on the results from both activities, we will calculate the gross impacts for each site and roll these impact estimates up to a population total to determine total program ex post savings estimates.

2.3 Net Impacts

To determine net savings for Transition Period programs, the evaluation team will apply SAG-approved NTGRs, to ex post gross savings for almost all programs.[3] An exception to this approach is made for the Behavioral Modification Program, which is evaluated using a consumption analysis approach, which yields net impact results. We describe our approach to the Behavioral Modification Program below.

2.3.1 Behavioral Modification Consumption Analysis

The primary method used to determine program impacts for the Behavior Modification Program is a consumption analysis. Given the experimental design, the estimated savings are considered net savings. We will utilize treatment and control group monthly billing data to estimate net savings per household over the program period.

The evaluation team will conduct an equivalency analysis to ensure that the treatment and control groups are comparable.[4] This review will strengthen the internal validity and defensibility of the research design. No new customers were added to the program after August 2016. As a result, we will assess equivalency based on prior energy consumption. Finally, we will conduct a review and comparison of Oracle's data cleaning and modeling methods to our data cleaning and modeling methods to understand why the two sets of billing results may differ.

[3] EPY9/GPY6 NTG Recommendations (http://www.ilsag.info/ntg_2016.html)

[4] We will not assess Expansion Cohort 8 for equivalency in PY9 because this cohort will not be included in the impact analysis due to insufficient post-period billing data to model savings.

Data sources for the Transition Period impact evaluation include:

- For all customer treatment and control groups, gas consumption/billing data from July 2009 to December 2017;
- AIC program tracking database for all residential programs from June 2011 to December 2017; and
- Data from Oracle to conduct exploratory analysis, including raw data files, any code used for data cleaning and analysis, final data files and model outputs.

Sampling

The billing analysis will include all cohorts. For the cohorts previously evaluated—Original Cohort, Expansion Cohort 1 through 7—some attrition might have occurred. Therefore, we will compare the treatment and control groups on pre-period usage only to ensure continued equivalence. If we find that the populations are equivalent on energy consumption, no sampling will occur for the billing analysis, and we will include all available data in our analysis. However, if the treatment and control groups are found to be dissimilar, we will select two matched samples from the population of treatment and control group members for this analysis.

Equivalency Analysis

We will compare all cohort treatment customers to controls on pre-period energy consumption. This will ensure that the random assignment of customers to treatment and control groups led to relatively comparable groups.

Below we detail some sample data points that we will use for the equivalency check.

The evaluation team will use a consumption analysis approach for PY9 that augments the PY8 approach. Specifically, based on conversations with program implementers, we will conduct an intent to treat (ITT) approach rather than an average treatment effect on the treated (ATT) approach. In implementing this approach, we will estimate savings using a difference-in-differences (DID) approach. The DID refers to the model's implicit comparison of consumption before and after treatment of both treatment and control group customers. The model includes customer-specific intercepts (i.e., fixed effects) to capture unobserved differences between customers that do not change over time and which affect customers' energy use.

We will report savings from three different models to aid comparisons to previous evaluations:

1. A simple overall model, as described in Equation 1, which is consistent with previous years' evaluations
2. An overall model with the addition of weather adjustments, which allows year to year savings comparison
3. An overall model that incorporates post period only (consistent with vendor modeling)

All of these models will use an ITT approach. We will provide impact estimates for the program using the first model. The second model will be used to assess savings year over year. The third model is the model that the program implementer uses to estimate program impacts, as a result, we will run this model to ascertain whether there are any variations in savings due to model specifications.

Model 1: Overall Model

Equation 1. Overall Model Estimating Equation

$$ADC_{it} = \alpha_i + \beta_1 Post_{it} + \beta_2 Treatment_i \cdot Post_{it} + \varepsilon_{it}$$

Where:

ADC_{it}= Average daily consumption (therms) for household i at time t

α_i= Household-specific intercept

β_1= Coefficient for the change in consumption between pre- and post-periods

β_2= Coefficient for the change in consumption for the treatment group in the post-period compared to the pre-period, and to the control group. This is the basis for the net savings estimate.

Treatment = Variable to represent treatment and control groups (0 = control group, 1 = treatment group)

Post = Variable to represent the pre- and post-periods (0 = pre-period, 1 = post-period)

Model 2: Weather Adjusted Model

To enable accurate comparisons across program years, we will incorporate weather terms. These weather terms also improve the precision in the modeled results by accounting for possible differences in weather experienced by the analyzed population. Specifically, we will control for weather by entering heating degree days (HDD) and cooling degree days (CDD), using a base of 65 degrees Fahrenheit for HDD and 75 degrees Fahrenheit for CDD.

Equation 2. Weather Adjusted Model Estimating Equation

$$ADC_{it} = \alpha_i + \beta_1 Post_t + \beta_2 Treatment_i \cdot Post_t + \beta_3 HDD_{it} + \beta_4 CDD_{it} + \varepsilon_{it}$$

Where:

ADC_{it}= Average daily consumption (therms) for household i at time t

α_i= Household-specific intercept

β_1= Coefficient for the change in consumption between pre and post periods

β_2= Coefficient for the change in consumption for the treatment group in the post period compared to the pre period and to the control group. This is the basis for the net savings estimate.

β_3= Coefficient for HDD

β_4= Coefficient for CDD

Post = Dummy variable for pre (Post=0) and post (Post=1), marked by receipt of the first report

Treatment = Dummy variable for treatment (Treatment=1) and control (Treatment=0)

HDD_{it}= Sum of heating degree days (base 65 degrees Fahrenheit)

CDD_{it}= Sum of cooling degree days (base 75 degrees Fahrenheit)

ε_{it} = Error

Model 3: Post Only Model

To enable comparisons to vendor supported models, we will employ the following estimating equation. This model can also be used for year to year comparison.

Equation 3. Post-Only Model Estimating Equation

$$ADC_{it} = \alpha_i + \beta_1 Treatment_i + \beta_2 PreUsage_i + \beta_3 PreWinter_t + \beta_4 PreSummer_i + \beta_5 MonthYear_t + \beta_6 PreUsage_i \cdot MonthYear_t + \beta_7 PreWinter_i \cdot MonthYear_t + \beta_8 PreSummer_i \cdot MonthYear_t + \varepsilon_{it}$$

Where:

ADC_{it}= Average daily consumption (therms) for household i at time t

α_i= Household-specific intercept

β_1= Coefficient for the change in consumption for the treatment group

β_2= Coefficient for the average daily usage across household *i* available pre-treatment meter reads

β_3= Coefficient for the average daily usage over the months of December, January, February, and March across household *i* available pre-treatment meter reads

β_4= Coefficient for the average daily usage over the months of June, July, August, and September across household *i* available pre-treatment meter reads

β_5= Vector of coefficients for month- year dummies

β_6= Vector of coefficients for month- year dummies by average daily pre-treatment usage

β_7= Vector of coefficients for month- year dummies by average daily winter pre-treatment usage

β_8= Vector of coefficients for month- year dummies by average daily summer pre-treatment usage

$Treatment_i$ = Dummy variable for treatment (Treatment=1) and control (Treatment=0)

$MonthYear_t$= Vector of month-year dummies

$PreWinter_i$ = Average daily usage for household i over the pre-participation months of December, January, February, and March

$PreSummer_i$ = Average daily usage for household i over the pre-participation months of June, July, August, and September

ε_{it} = Error

Results of the billing analyses conducted by Oracle and Opinion Dynamics have been discrepant in previous evaluations. As such, if we find differences in the vendor and evaluated impact estimates, we will conduct

additional review of data cleaning approaches to identify the source (or sources) of these differences. To do this, we will request raw and cleaned billing analysis data files from Oracle, as well as the corresponding code and model outputs for PY9. These items will be carefully compared to our data cleaning code and model outputs to determine where our processes are differing, and how these differences affect billing analysis results.

We will calculate a savings adjustment to account for the portion of net savings estimated from the billing analysis that has been claimed by other AIC programs. Savings from the Behavioral Modification Program reflect both non-purchase behavioral changes, such as turning off lights in unoccupied rooms and adjusting thermostat settings, and investments in energy-saving equipment, such as high-efficiency furnaces and compact fluorescent lamps (CFLs), or other purchase behaviors. Savings from measures that were rebated through AIC's energy efficiency programs appear in both the Behavioral Modification Program and the rebate programs, and thus would be double-counted if an adjustment were not made.

This piece of the savings will be subtracted from the savings estimated by billing analysis. Customers in the treatment and control groups are assumed to receive the same treatment from the utility for the program promoting Measure A (i.e., they face the same marketing and incentives). Because customers were randomly assigned to the treatment and control groups, any difference between the groups in the installation of Measure A can be attributed to the Behavioral Modification Program. We will base the savings associated with participation in other AIC programs on the deemed savings values associated with the measures other programs have claimed in the Transition Period. As such, we will conduct a participation lift and channeling analysis (incorporating historical trend analysis) to assess trends in program participation over time and adjusted net savings estimates. This analysis will also account for and remove channeling savings for current participants from prior program years (PY3 – the Transition Period).

3. Process Evaluation Activities

Starting in January 2018, AIC will implement energy efficiency programs for the tenth consecutive year. As a result of the Illinois Future Energy Jobs Bill (SB 2814), which was enacted in 2017, and the start of new energy efficiency plan cycle, AIC plans to enhance existing energy efficiency offerings, as well as add new ones. As such, our Transition Period research activities focus on conducting research to inform the optimization of current programs, as well as new program offerings.

Table 3. Process Evaluation Research Overview

Sector	Task	Target Completed Interviews
All	Program Material & Data Review	N/A
All	Program Manager and Implementer Interviews	~2 per program
Business	Online Store Participant Survey	Census Attempt
	Top 500 Customer Interviews	50
	Strategic Energy Management Literature Review	N/A
	Strategic Energy Management Evaluability Assessment	N/A
	Public Sector Customer Interviews	15
Residential	Low Income Population Characterization	N/A
	Low Income Population Survey	1,200

3.1 C&I Research

The evaluation team plans to conduct cross-cutting process research with AIC's C&I and public sector customers to provide AIC and their implementation team with information that will help them tailor the 2018 programs to key customer segments. In particular, we plan to conduct research with small, medium, and large C&I customers, as well as public sector customers engaging in AIC programs for the first time.

We detail the research planned for each customer segment in the sections below.

3.1.1 Small and Medium C&I Customer Research

Online Store Participant Survey

AIC has offered its business customers the ability to purchase energy efficiency equipment through its Online Store since PY2. Serving first as a channel to engage smaller, harder to reach customers, the Online Store has expanded over the years to serve all C&I customers, but has largely remained a conduit for discounted energy efficient lighting equipment. Further, Online Store participants have historically been less likely to participate in multiple AIC programs. As a result, the evaluation team plans to conduct research with AIC customers to understand: (1) the characteristics of Online Store participants, (2) the potential of current and past participants to take additional energy savings actions through other AIC programs, (3) interest in current and additional Online Store offerings.

To meet these research objectives, the evaluation team will conduct an internet survey with a census of recent participants in the Online Store offering. The evaluation team will leverage findings from the survey to provide insight into the potential for increased savings among Online Store participants, as well as how AIC and their implementation team might encourage Online Store participants to engage in other C&I programs.

Deliverables: Draft and final survey instrument *Deliverable Date: December 2017*

Evaluation Budget and Timeline

Table 7 outlines the schedule and budget associated with the small and medium C&I research activities.

Table 4. Small and Medium C&I Research Timeline and Budget

Associated Program	Activity	Deliverable Date	Budget
C&I Standard	Online Store Participant Survey	December 2017	$37,000
	Total Budget		$37,000

3.1.2 Large C&I Customer Research

In-Depth Interviews with AIC's Top 500 C&I Customers

As AIC and their implementation team plan for the 2018-2021 cycle in which large industrial customers[5] are no longer eligible to participate in electric energy efficiency programs, the utility needs additional insight into their largest remaining eligible business customers. As such, the evaluation team plans to explore the needs of these customers, as well as the challenges that these customers may have encountered in participating in AIC's past programs. The goal of these interviews is to determine what holistic improvements AIC can make to better serve this group and therefore, continue to foster participation in energy efficiency programs from this customer group.

As part of this task, we will conduct in-depth telephone interviews with a random sample of up to 40 of AIC's top 500 commercial customers. If feasible based on a review of tracking data, we will stratify our sample based on past participation and conduct half of the interviews with past participants and half with non-participants. As noted above, this cross-cutting research activity will explore large commercial and industrial

[5] Customers with demand of 10+ MW.

customer's satisfaction with their overall AIC program experience, challenges to program participation, and suggestions for overall program improvement. These interviews will also focus on specifically on techniques for improving cross-program participation processes.

Deliverables: Draft and final in-depth interview guide *Deliverable Date: January 2018*

Deliverables: Key findings memo *Deliverable Date: March 2018*

Strategic Energy Management Research

The evaluation team will conduct two distinct research tasks to support the AIC Strategic Energy Management (SEM) offering, a literature review and a program-specific evaluability assessment. Each activity is detailed below.

Literature Review

First, the evaluation team will conduct a literature review of best practice reports on the implementation of SEM programs for commercial customers to gather ideas for components that AIC could incorporate into its SEM offering. This literature review will include a focus on SEM programs that incorporate new and innovative program designs, as well as a review of best practice methodology for claiming savings from SEM programs. The evaluation team will review industry white papers, conference presentations, and evaluation reports from across the country. Results from this review will be summarized in a memo, and include:

- A detailed summary of various program elements included in SEM programs nationwide, with an assessment of the relevance of these program elements for the AIC SEM offering;
- A list of best practices and lessons learned from other SEM programs that could be applied to the AIC offering 's design and implementation;
- A high level summary of information evaluators need to most easily assess savings from SEM programs; and
- Recommendations for specific program elements and implementation changes AIC could make to the SEM offering.

Deliverable: Literature review and best practices memo *Deliverable Date: January 2018*

Program Material Review and Evaluability Assessment

Building upon findings from the literature review, and in concert with impact evaluation activities being conducted for the AIC SEM offering, the evaluation will conduct a detailed review of supporting project documentation provided for SEM projects in AIC territory, with a focus on the following research objectives: (1) identification of opportunities to claim savings that are not currently being claimed by the offering, and (2) recommendations for additional data the offering could capture to increase evaluability of future projects from an impact evaluation perspective. The findings from this assessment will be summarized in a memo to AIC and ICC staff.

Deliverable: Evaluability memo *Deliverable Date: March 2018*

Evaluation Budget and Timeline

Table 7 outlines the schedule and budget associated with each of the large C&I research activities.

Table 5. Large C&I Research Timeline and Budget

Associated Program	Activity	Deliverable Date	Budget
C&I Standard C&I Custom C&I RCx	Top 500 Interviews	January 2018	$62,000
	SEM Literature Review	January 2018	$23,800
	SEM Evaluability Assessment	March 2018	$24,500
	Total Budget		**$110,300**

3.1.3 Public Sector Customer Research

Beginning in the Transition Period and continuing into 2018, AIC programs are serving public sector customers. As such, the evaluation team will conduct research with this sector to explore how AIC can best support these customers with its offerings moving forward.

Establish Background Context

The evaluation team will review all available DCEO evaluation reports, AIC customer data, as well as any other available documentation on the energy efficiency needs of public sector customers in Illinois to identify:

- The mix of public sector customers in AIC territory, and
- The historical energy efficiency offerings provided to these customers and the measures they have installed in the past.

In addition, the evaluation team will review available historical process research to understand any challenges program administrators in Illinois have faced in implementing programs for public sector customers.

In-Depth Interviews with Public Sector Customers

Utilizing the results from the materials review as an initial guide, the evaluation team will develop an in-depth interview guide and conduct 15 interviews with AIC public sector customers to better understand their unique characteristics and needs related to energy efficiency. The interviews will focus on:

- The current practices and specific needs of public sector customers with regards to energy efficiency
  - Whether the needs of public sector customers differ by customer type (e.g. large/small, segment, etc.)
- How the challenges faced by public sector customers compare with challenges faced by customers in other sectors
- If relevant, how public sector customers have engaged with energy efficiency programs in Illinois in the past

The evaluation team will summarize its findings from the aforementioned research in a comprehensive memo to support future program implementation with public sector customers. In particular, the memo will identify

the unique needs of public sector customers, and discuss how these unique needs can be incorporated into program design processes.

Deliverable: Draft and final in-depth interview guide *Deliverable Date: January 2018*

Deliverable: Findings Memo *Deliverable: March 2018*

Evaluation Budget and Timeline

Table 7 outlines the schedule and budget associated with each of the public sector research activities.

Table 6. Public Sector Research Timeline and Budget

Associated Program	Activity	Deliverable Date	Budget
C&I Standard C&I Custom C&I RCx	Public Sector Background Context Review	March 2018	$26,700
	Public Sector Customer Interviews	January 2018 March 2018	
	Total Budget		**$26,700**

3.2 Residential Research

The evaluation team's research within the residential sector will focus on customers targeted by AIC's income qualified program offerings given the large role that the Income Qualified Program will play in AIC's next energy efficiency plan.

3.2.1 Low Income Customer Needs Assessment

In 2018, AIC plans to increase the annual budget for programs targeting low-income customers by approximately 50% compared to the PY9 Home Efficiency Income Qualified (HEIQ) Program budget. To help AIC meet the increased goals associated with these budgets, we propose research on AIC low-income customers to better understand their unique energy efficiency needs and barriers to action. Transition Period research activities in this area will include two tasks: (1) a low-income population characterization, and (2) a survey with low-income customers. Together, the results of these tasks will provide AIC with a profile of low-income customers for use in future program design, marketing, and customer targeting. We describe the objectives and methodological approach for each task below.

Low Income Population Characterization

The evaluation team will build on work we performed in PY8 and PY9, as well as on AIC's 2016 Potential Study, to give AIC a more precise estimate of the number customers eligible for the HEIQ program, and the percentage of customers already served by the program. We have designed this research to answer the following questions:

- How many AIC residential customers eligible for the HEIQ program? How does this vary using different income program eligibility requirements?
- What percentage of eligible AIC customers have participated in the HEIQ program in the past five years? How many remain to be served?

- What percentage of eligible AIC customers live in single family versus multifamily homes? What percentage of multifamily homes are good targets for HEIQ versus the Multifamily Program?

- What communities and specific neighborhoods have the greatest need due to their income levels or past participation rates? Which have the greatest energy savings potential?

AIC's current HEIQ Program targets customers with household incomes below 300% of the Federal Poverty Guidelines. Because the federal poverty threshold varies by household size, the program has only a rough estimate of the number of AIC customers that are eligible. Our PY8 and PY9 analyses relied on aggregate Census block group level estimates in which we assumed an average of 2.3 people per household so that all households with incomes under $50,000 a year were eligible, and all with incomes over this amount were ineligible using 2017 Poverty Guidelines. This definition allowed us to identify communities with a high concentration of low-income customers, but it did not provide an accurate estimate of the number of eligible customers using household size. Based on this analysis, we estimate that 50% of AIC's residential customers are eligible for HEIQ. Based on AIC's 2016 Potential Study, 41% of residential customers are "low-income", of which 69% live in single family homes. This is likely an underestimate of program eligibility because the Potential Study made use of an internet survey that would have excluded customers without internet access, who tend to be poorer and older.

For this analysis, we will analyze Census Public Use Microdata Area (PUMAs) datafiles to produce a more accurate estimate of the number of HEIQ eligible customers based on income and household size. We will break these results down by housing characteristics, and integrate customer usage and past participation data to provide AIC with street-level data and targets for the HEIQ Program. This analysis will identify customer types that have been underserved by the program and have the greatest energy savings potential.

Low Income Population Survey

To better understand the needs and barriers to energy efficiency action for low-income customers, we will conduct a survey of AIC residential customers that includes an oversample of low-income customers. We will complete 1,200 interviews, half with low-income customers. This oversample will large enough that we can compare low-income customers to moderate and higher income customers and whether the current HEIQ program design addresses the needs of low-income customers. Key research questions for this survey include:

- How do the needs of low-income customers differ from market-rate program participants? How do the needs of different subgroups of low-income customers vary? What measures would be most beneficial to low-income customers based on their self-reports of energy using equipment and home weatherization? How does this compare to their actual usage?

- How do low-income customers think about their energy use compared to moderate or higher income customers? Do they attempt to manage their use on a day-to-day basis through their purchases or behaviors? Do they feel it is something outside of their control or something they cannot afford?

- What is the energy burden of low-income customers (i.e. ratio of energy expenditures to income)? How is energy burden correlated with energy insecurity (challenges paying energy bills and presence of health conditions requiring energy use)? What subgroups are most in need of program assistance? How do these needs align with current program eligibility requirements?

- What access do low-income customers have to information and technology? What are the informational and technological barriers to energy efficient action among low-income customers? What are low-income customers trusted sources of information? What program outreach strategies would be most effective at reaching different low-income customer subgroups?

We often talk about low-income customers as if they are a homogenous group with the same needs and barriers, but this is unlikely to be true. For example, low-income owners versus renters are likely to face different barriers. Low-income owners may not have the financial resources to make energy efficient improvements to their home, but compared to renters, they are the decision maker responsible for those changes. It is also possible that low-income rural customers face different challenges than urban or suburban customers. The same is likely true of low-income customers with children or older customers. The oversample for this survey will be large enough that we will be able to examine different subgroups of low-income customers.

We will use a mail-push-to-web (MPTW) approach to conduct this survey. As outbound telephone survey response rates have fallen, mail survey response rates have held steady making mail surveys an attractive, though expensive, option. A less expensive alternative is to mail invitations to potential respondents and encourage ("push") them to complete a survey online.[6] By providing incentives to complete the survey and sending reminders, Opinion Dynamics has found that this MPTW approach typically results in response rates at least four times greater than telephone surveys and at a much lower cost. Of course, to ensure that people without internet access are able to complete the survey as well, our survey invitation will also include a phone number that respondents can call to complete the survey with an interviewer.

Using the AIC customer database and Census data we assembled for the Low Income Population Characterization, we can oversample households based on census data and other geographic information, allowing us to target low-income communities. We will draw a stratified random sample of households, pulling disproportionately from Census Tracts with higher disadvantage levels.

Opinion Dynamics will print and mail invitations to complete the survey to sampled households. The survey invitations will contain a web address where the recipient can go to complete the survey, as well as a telephone number they can call if they prefer to take the survey over the phone. We will also provide a unique personal identification number (PIN) that the respondent will enter or give to the interviewer to identify their associated sample record. The PIN will prevent people from completing the survey more than once and also allow us to track survey completion.

Deliverables: Draft and final survey instrument *Deliverable Date: January 2018*

Deliverables: Needs Assessment Report *Deliverable: April 2018*

[6] Online surveys have some other desirable qualities such programmed "skips" so that can skip questions that are not appropriate based on previous answers. With mail surveys, respondents must navigate through the survey themselves by following question directions, which can result in error.

Evaluation Budget and Timeline

Table 7 outlines the schedule and budget associated with each of the Low Income Needs Assessment activities.

Table 7. Low Income Needs Assessment Timeline and Budget

Associated Program	Activity	Deliverable Date	Budget
HEIQ	Low Income Population Characterization	April 2018	$107,000
	Low Income Population Survey	January 2018	
	Needs Assessment Report	April 2018	
	Total Budget		**$107,000**

4. Cross-Cutting Evaluation Activities

4.1 Illinois Statewide Technical Reference Manual

The team will continue its involvement in the IL-TRM process, including participation in Technical Advisory Committee (TAC) meetings and NTGR Methodology Working Group meetings as needed. The former includes participation in weekly calls, as well as reviewing and commenting on IL-TRM update items presented to the TAC. The latter includes participation in periodic calls with working group members to discuss any pending issues.

4.2 Review of Cost Effectiveness Test Results

The evaluation team will work with AIC to audit the company's cost-effectiveness analysis based on Transition Period program results. As part of this process, we will prepare evaluation-based model inputs, which include evaluated program savings as determined through the Transition Period evaluation effort. Once AIC's contractor, AEG, has conducted the cost effectiveness analysis, we will review the results and the assumptions for avoided costs, discount rates, measure cost information, administrative costs, and other relevant data.

4.3 Quality Assurance and Control Process

Per our contract, the team must hire a separate entity for quality assurance/quality control (QA/QC) review, and work collaboratively with this entity to ensure the quality of our evaluation plans, analysis, and reporting. Since PY4, the team has worked with Dr. Richard Ridge, who has a long history in energy efficiency evaluation. In recent years, Dr. Ridge has used his expertise to help write evaluation protocols and oversee other firms in their evaluation efforts, as well as continuing to perform evaluations across the country. For several years, Dr. Ridge was a consultant to the California Public Utilities Commission (CPUC) evaluation staff, where he worked with them to understand evaluation needs, review contractor plans, and participate in many aspects of a multi-million-dollar evaluation effort. Since 2008, he has been providing similar support to the New York State Department of Public Service.

As part of the Transition Period evaluation effort, Dr. Ridge will continue to (1) discuss portfolio evaluation plans with the evaluation team, providing advice as needed; (2) participate in ongoing sampling and evaluation design efforts as requested; (3) review draft evaluation reports to ensure quality and accuracy; and (4) provide the ICC with a report on the efforts in which he was involved.

4.4 Reporting

The evaluation team will provide a single Transition Period integrated report with impact findings for all AIC programs. To the extent possible, we will include findings from process evaluation efforts.

5. Transition Period Evaluation Budget

The following table outlines the expected budget per program to execute the evaluation plans presented above.

Table 8. Transition Period Evaluation Budget

Program/Task	Estimated Budget
Program-Specific Activities	
Residential Lighting	$38,500
Residential Behavioral Modification	$91,000
Residential HVAC	$43,000
Residential Multifamily	$30,000
Residential Home Efficiency Income Qualified	$131,500
Residential School Kits	$18,500
C&I Standard	$80,700
C&I Custom	$205,900
C&I Retro-Commissioning	$38,900
Total Program-Specific Efforts	*$678,000*
Cross-Cutting C&I Research	$88,500
IL Statewide Technical Reference Manual	$10,000
Cost-Effectiveness Analysis	$35,000
QA/QC Coordination	$10,000
Other Non-Program Activities (i.e., SAG, Planning Integrated Reporting, etc.)	$205,175
Total Non-Program Efforts	*$348,675*
Total	*$1,026,675*

Appendix A. Transition Period Measure Level Net to Gross Ratios

The following table provides the SAG-approved NTGRs for AIC programs in the Transition Period. The evaluation team will also be utilizing the most recent available DCEO NTGRs for public sector projects.

Table 9. Transition Period Measure Level Electric NTGRs

Sector	Program	Measure	Recommended Value	FR	Part SO	Non-Part SO	Electric Source(s)
C&I	C&I Custom	All projects	74%	26%	0.1%	0.0%	PY5 Evaluation - Part Self-Report & PY7 Evaluation for NP Self-Report for NPSO
C&I	C&I Retro-Commissioning	All projects	91%	8.6%	0.0%	0.0%	PY6 Evaluation - Part Self-Report/RSP Interviews; PY7 NP Self-Report for NPSO
C&I	C&I Standard	Core Program Lighting	77.8%	22.3%	0.1%	0.0%	PY7 Evaluation - Part Self-Report & NP Self-Report for NPSO
C&I	C&I Standard	Core Program HVAC	55.7%	44.4%	0.1%	0.0%	PY7 Evaluation - Part Self-Report & NP Self-Report for NPSO
C&I	C&I Standard	Core Program Leak Survey	70.2%	29.9%	0.1%	0.0%	PY7 Evaluation - Part Self-Report & NP Self-Report for NPSO
C&I	C&I Standard	Core Program Specialty	84.9%	15.2%	0.1%	0.0%	PY7 Evaluation - Part Self-Report & NP Self-Report for NPSO
C&I	C&I Standard	Core Program Steam Trap	N/A	N/A	N/A	N/A	PY7 Evaluation - Part Self-Report & NP Self-Report for NPSO
C&I	C&I Standard	Core Program VFD	83.3%	16.8%	0.1%	0.0%	PY7 Evaluation - Part Self-Report & NP Self-Report for NPSO
C&I	C&I Standard	Online Store Measures	83%	36%	19.0%		PY4 Evaluation - Part Self-Report
C&I	C&I Standard	Green Nozzles	92%	17%	9.0%		PY4 Evaluation - Part Self-Report
C&I	C&I Standard	Midstream Lighting - CFLs	64%	46%	10.0%		ComEd PY7 BILD Evaluation
C&I	C&I Standard	Midstream Lighting - LEDs	78%	32%	10.0%		ComEd PY7 BILD Evaluation
C&I	CHP	All projects	N/A	N/A	N/A	N/A	Project specific NTG
Res	Behavior Modification	All measures	N/A	N/A	N/A	N/A	Consumption analysis
Res	HPwES	CFL	82%	19%	1.0%		PY6 Evaluation - Part Self-Report

Transition Period Measure Level Net to Gross Ratios

Sector	Program	Measure	Recommended Value	FR	Part SO	Non-Part SO	Electric Source(s)
Res	HPwES	Faucet Aerator	92%	9%	1.0%		PY6 Evaluation - Part Self-Report
Res	HPwES	Showerhead	86%	15%	1.0%		PY6 Evaluation - Part Self-Report
Res	HPwES	Air sealing	71%	30%	1.0%		PY6 Evaluation - Part Self-Report
Res	HPwES	Insulation	78%	23%	1.0%		PY6 Evaluation - Part Self-Report
Res	HPwES	Thermostat	87%	13%	0.0%		Deemed Value
Res	HVAC	<SEER 16 CAC/HP (RB)	60%	62%	0.1%	22.0%	PY5 (SO) and PY6 (FR) evaluations
Res	HVAC	SEER 16+ CAC/HP (RB)	64%	58%	0.1%	22.0%	PY5 (SO) and PY6 (FR) evaluations
Res	HVAC	<SEER 16 CAC/HP (ER)	63%	59%	0.1%	22.0%	PY5 (SO) and PY6 (FR) evaluations
Res	HVAC	SEER 16+ CAC/HP (ER)	76%	46%	0.1%	22.0%	PY5 (SO) and PY6 (FR) evaluations
Res	HVAC	Brushless Motors	76%	46%	0.1%	22.0%	PY5 (SO) and PY6 (FR) evaluations
Res	Moderate Income	All measures	100%	0%	0.0%		AIC and ICC staff consensus
Res	Multifamily In-unit	CFLs	95%	11%	6.0%		PY6 Evaluation - Part Self-Report
Res	Multifamily In-unit	Programmable Thermostat	104%	2%	6.0%		PY6 Evaluation - Part Self-Report
Res	Multifamily In-unit	Faucet Aerators	106%	0%	6.0%		PY6 Evaluation - Part Self-Report
Res	Multifamily In-unit	Showerheads	100%	6%	6.0%		PY6 Evaluation - Part Self-Report
Res	School Efficiency Kits	CFLs	83%	43%	26.0%		Avg. of Values from Similar Programs
Res	School Efficiency Kits	Showerheads	105%	15%	20%		Avg. of Values from Similar Programs
Res	School Efficiency Kits	Faucet Aerators	104%	13%	17%		Avg. of Values from Similar Programs
Res	School Efficiency Kits	Water Heater Setback	100%	0%	0%		Secondary research

Table 10. Transition Period Measure Level Gas NTGRs

Sector	Program	Measure	Recommended Value	FR	Part SO	Non-Part SO	Gas Source(s)
C&I	C&I Custom	All projects	83%	17%	0%	0%	PY6 Evaluation - Part Self-Report
C&I	C&I Retro-Commissioning	All projects	91%	9%	0%	0%	PY6 Evaluation - Part Self-Report & RSP Interviews
C&I	C&I Standard	Core Program Lighting	N/A	N/A	N/A	N/A	PY7 Evaluation - Part Self-Report & NP Self-Report for NPSO
C&I	C&I Standard	Core Program HVAC	49.4%	50.6%	0.0%	0.0%	PY7 Evaluation - Part Self-Report & NP Self-Report for NPSO
C&I	C&I Standard	Core Program Leak Survey	N/A	N/A	N/A	N/A	PY7 Evaluation - Part Self-Report & NP Self-Report for NPSO
C&I	C&I Standard	Core Program Specialty	67.5%	32.5%	0.0%	0.0%	PY7 Evaluation - Part Self-Report & NP Self-Report for NPSO
C&I	C&I Standard	Core Program Steam Trap	60.8%	39.2%	0.0%	0.0%	PY7 Evaluation - Part Self-Report & NP Self-Report for NPSO
C&I	C&I Standard	Core Program VFD	N/A	N/A	N/A	N/A	PY7 Evaluation - Part Self-Report & NP Self-Report for NPSO
C&I	C&I Standard	Online Store Measures	N/A	N/A	N/A	N/A	N/A
C&I	C&I Standard	Green Nozzles	89%	21%	10%	0%	PY4 Evaluation - Part Self-Report
C&I	C&I Standard	Midstream Lighting - CFLs	N/A	N/A	N/A	N/A	N/A
C&I	C&I Standard	Midstream Lighting - LEDs	N/A	N/A	N/A	N/A	N/A
C&I	CHP	All projects	N/A	N/A	N/A	N/A	Project specific NTG
Res	Behavior Modification	All measures	N/A	N/A	N/A	N/A	Consumption analysis
Res	HPwES	CFL	N/A	N/A	N/A	0%	N/A
Res	HPwES	Faucet Aerator	94%	8%	2%	0%	PY6 Evaluation - Part Self-Report
Res	HPwES	Showerhead	91%	11%	2%	0%	PY6 Evaluation - Part Self-Report
Res	HPwES	Air sealing	72%	30%	2%	0%	PY6 Evaluation - Part Self-Report
Res	HPwES	Insulation	78%	24%	2%	0%	PY6 Evaluation - Part Self-Report
Res	HPwES	Thermostat	87%	13%	0%	0%	Deemed Value
Res	HVAC	<SEER 16 CAC/HP (RB)	N/A	N/A	N/A	N/A	N/A
Res	HVAC	SEER 16+ CAC/HP (RB)	N/A	N/A	N/A	N/A	N/A
Res	HVAC	<SEER 16 CAC/HP (ER)	N/A	N/A	N/A	N/A	N/A
Res	HVAC	SEER 16+ CAC/HP (ER)	N/A	N/A	N/A	N/A	N/A
Res	HVAC	Brushless Motors	N/A	N/A	N/A	N/A	N/A
Res	Moderate Income	All measures	100%	0%	0%	0%	AIC and ICC staff consensus

Transition Period Measure Level Net to Gross Ratios

Sector	Program	Measure	Recommended Value	FR	Part SO	Non-Part SO	Gas Source(s)
Res	Multifamily In-unit	CFLs	N/A	N/A	N/A	N/A	N/A
Res	Multifamily In-unit	Programmable Thermostat	98%	2%	0%		PY6 Evaluation - Part Self-Report
Res	Multifamily In-unit	Faucet Aerators	100%	0%	0%		PY6 Evaluation - Part Self-Report
Res	Multifamily In-unit	Showerheads	94%	6%	0%		PY6 Evaluation - Part Self-Report
Res	School Efficiency Kits	CFLs	N/A				Based upon averaging NIPSCO, Nicor Rider 29, and Nicor Gas GPY1
Res	School Efficiency Kits	Showerheads	105%	15%	20%		Based upon averaging NIPSCO, Nicor Rider 29, and Nicor Gas GPY1
Res	School Efficiency Kits	Faucet Aerators	104%	13%	17%		Based upon averaging NIPSCO, Nicor Rider 29, and Nicor Gas GPY1
Res	School Efficiency Kits	Water Heater Setback	100%	0%	0%		Secondary research

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