NAVIGANT

Coordinated Utility Retro-Commissioning Combined Evaluation Report

Energy Efficiency / Demand Response Plan: Plan Year 9 (PY9)

Presented to
ComEd

February 14, 2019

Prepared by:

Navigant

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Coordinated Utility Retro-Commissioning Combined Evaluation Report

Submitted to:

ComEd
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Oakbrook Terrace, IL 60181

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1. INTRODUCTION

This report combines the key deliverables from the evaluation of the Coordinated UJtility Retro-Commissioning Program for PY9. Each of these deliverables were drafted, reviewed and finalized during the course of the PY9 evaluation.

APPENDIX A. RCx MEASURE PERSISTENCE COORDINATION MEMO 2017-04-17

NAVIGANT

Memorandum

To: Erin Daughton, ComEd

cc: Randy Gunn, Rob Neumann, Jeff Erickson, Emily Cross, Deborah Swarts, Navigant
Jennifer Morris, ICC

From: Roger Hill

Date: April 17, 2017

Re: PY9 Retro-Commissioning (RCx) Measure Persistence Research

Erin,

The Navigant Retro-Commissioning team was pleased to participate in the meeting last week to help scope Seventhwave's research for the persistence of RCx measures. While considering the work, it became clear that we need coordination with the core evaluation activities to help ensure smooth data collection, manage customer relations and facilitate defensible results. The coordination points include the following:

1. Seventhwave and Navigant should coordinate contact lists to minimize excessive customer touches and evaluation fatigue.

   Customers, who perennially participate in utility programs, frequently complain about the amount of evaluation touches they receive, whether on-site work or interviews. RCx participants may currently participate or have recently participated in other Smart Ideas for Your Business® (SIFYB) programs. To avoid evaluation fatigue we request that Seventhwave submit their target sample list to Navigant so that we can cross-reference the site with our current PY9 research and research touches - across all C&I programs - from recent years.

   Expected outcomes: In rare cases we might recommend removing a customer from the Persistence Study sample. More likely, we will remove a site from other PY9 program research samples or convey to Seventhwave specific insights about the customer's recent program participation and/or evaluation touches.

   Screen all pertinent SIFYB programs Navigant requests at least 10 business days to review the sample prior to Seventhwave contacting customers.

2. Coordinate Navigant data requests to minimize adverse schedule impacts on core evaluation activities.

   This thought is coupled with the first. Navigant is beginning its deep dive into the PY9 project files, in order to finish reports on schedule in early 2018. When Seventhwave has requests for Navigant staff we request a 12-business day turn-around to ensure we get the required data in a form that is useful to Seventhwave.

   Furthermore, Navigant would request that Seventhwave analyze project files and reports *prior to* requesting additional information from Navigant. A remarkable amount of detail is contained in the reports and calculations that does not need further clarification. Key pertinent information is contained in the planning/investigation reports (equipment lists, system descriptions and sequences of operation). Final measure implementation status is described with 99% accuracy in the verification reports. The calculations accurately track attribution of savings to specific equipment, thus if one measure includes changing the schedules for six air handers, a persistence study-verified change in one air handler's schedule can be accurately

weighted by using the information in the calculation files to infer how the savings persistence scales up to the site level for all six air handlers.

3. Constrain the Persistence Study sample frame to PY3 and PY6 participants as described on the call.

   Effective useful life research is part of the evaluation order from the ICC. As such, we expect that there will be continued research for RCx measure persistence. An un-tapped sample frame for other program years is crucial to developing un-biased research in the future. We fear that if the Seventhwave sample frame includes other program years, customers from those other program years will either refuse future research or will have significantly altered the awareness and persistence of RCx measures when their participation year constitutes the sample frame for persistence research.

   This constraint will require that Seventhwave to try to maximize the given sample frame with a strong value-proposition to persuade PY3 and PY6 customers to participate in the study.

4. Minimize sampling bias by including *all* PY3 and PY6 participants in the sample frame.

   Participants who were touched by prior evaluation, especially on-site verification, may be particularly sensitized to measure persistence. If Seventhwave were to prioritize sampling prior on-site verification participants, the results may be biased. By Navigant's estimate the sample frame commercial participant population would include 30 participants in PY3 and 50 participants in PY6, as shown in Table 1.

Table 1 – Commercial Participant Population and Evaluation Sample Size for PY3 and PY6

	PY3	PY6
Commercial Participants	30	50
Engineering review	16	23
On-site verification	9	8

5. Minimize the appearance of *post-hoc* sampling bias by documenting, *a priori*, a written plan for handling predictable and exceptional circumstances such as:

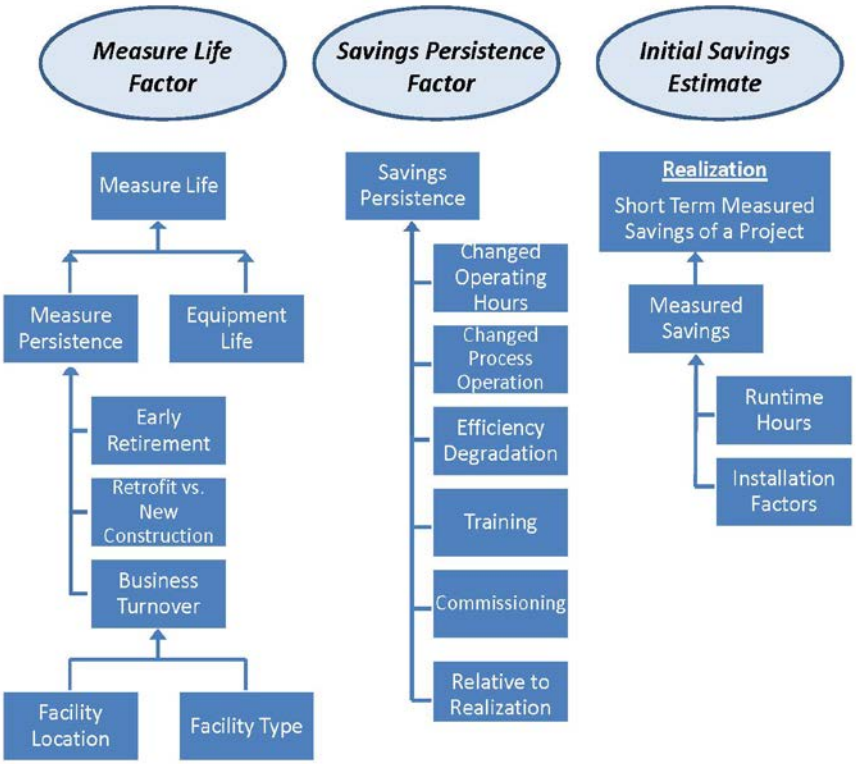
   - Personnel turnover that inhibits verification
   - Management company turnover – no institutional memory
   - Closed site
   - Vacated (or re-occupied) areas / floors
   - New equipment that replaces RCx-impacted equipment
   - New controls that cancelled all / some RCx measures
   - New controls that extensively improve on optimization
   - Is it spillover if a measure is applied to equipment that previously could not be implemented?
   - How will blended measure life be calculated for premise-level aggregate savings, where applicable, to be consistent with other programs?
   - Will the Seventhwave study address all measures, or only the most important (highest savings, highest participation) measures in Plan 3? What criteria will Seventhwave use to determine which measure will be addressed in the study?

6. Clarify the goals of the study by stating how the primary data gathered for the Seventhwave study will be utilized:

   - For TRM updates, to inform cost-benefit calculations for key measures
   - To determine reasonable re-participation timeframes for future RCx program participants
   - Other goals as required by ComEd

7. The Seventhwave research should follow the measure persistence framework outlined in the Uniform Methods Project (UMP) *Chapter 13: Assessing Persistence and Other Evaluation Issues Cross-Cutting Protocols.* This protocol will form the basis of other ComEd evaluation research and its use for RCx measures will be consistent with other ComEd programs.

    - *Measure Life Factor*
      Duration of an energy-consuming measure, taking into account business turnover, early retirement of installed equipment, and other reasons for removal or discontinuation.
    - *Savings Persistence Factor*
      Factor reflecting changes in impacts over time (either retention or degradation of measure savings)



Source: Uniform Methods Project: Methods for Determining Energy Efficiency Savings for Specific Measures. *Ch. 13: Assessing Persistence and Other Evaluation Issues Cross-Cutting Protocols. Daniel M. Violette, Navigant Consulting, April 2013.*

APPENDIX B. COMED RCX EPY9 GPY6 IMPACT EVALUATION REPORT 2018-04-19 FINAL

NAVIGANT

Coordinated Utility Retro-Commissioning Program Impact Evaluation Report

Energy Efficiency / Demand Response Plan: Plan Year 9 (EPY9) / Gas Plan Year 6 (GPY6) (6/1/2016-12/31/2017)

Presented to
Commonwealth Edison Company
Nicor Gas
Peoples Gas
North Shore Gas

FINAL

April 19, 2018

Prepared by:

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Deborah Swarts – INCA Energy Efficiency

Emily Cross - Navigant

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1. INTRODUCTION

This report presents the results of the impact evaluation of the EPY9/GPY6 Coordinated Utility Retro-Commissioning Program. It contains a summary of the energy and demand impacts for the total program broken out by relevant measure and program structure details. The appendix presents the impact analysis methodology and detailed results by program offering. EPY9/GPY6 covers June 1, 2016 through December 31, 2017.

2. PROGRAM DESCRIPTION

The Northern Illinois Coordinated Utility Retro-Commissioning (Retro-Commissioning) Program has been operating each of the nine electric program years. Electric program year 9 (EPY9) also marked the sixth natural gas program year (GPY6) where the program was coordinated with the gas utilities where service areas overlap ComEd's service area. Retro-Commissioning was previously a jointly managed program, but is now coordinated between ComEd and gas utilities serving ComEd customers with ComEd managing the program and paying all management costs. The gas utilities have the option to purchase verified saved therms from the program, in effect sharing costs. The overlapping gas territories include Nicor Gas, Peoples Gas, and North Shore Gas. The Retro-Commissioning Program offering is a natural fit for coordinated delivery with the gas providers due to the intensive investigation and analysis of heating, ventilation, and air-conditioning (HVAC) systems. Individual measures often save both electricity and natural gas so that analyzing one energy source, while neglecting the other, would fail to document all energy savings.

The program helps commercial and industrial customers improve the performance and reduce energy consumption of their facilities through the systematic analysis of *existing* building systems. Generally, the program pays for 100% of a detailed study, contingent upon a participant's commitment to spend a defined amount of their own money implementing a bundle of study recommendations having a simple payback of 18 months or less. The program consists of five offerings, with three targeted to medium to large office buildings: traditional retro-commissioning (RCx), monitoring-based retro-commissioning (MBCx) and RCxpress.

- RCx projects typically require more than one year and result in a single comprehensive deliverable.
- MBCx projects are based on a multi-year agreement between the building owner and the Retro-Commissioning Service Provider (RSP). This comprehensive approach identifies, analyzes, implements and verifies measures on a rolling basis with the RSP monitoring BAS data periodically to ensure on-going savings.
- RCxpress engagements last less than one year and typically have a more limited scope than RCx.

The RCx Building Tune-Up (Tune-up) and Grocery RCx offerings include direct implementation of common Retro-Commissioning measures by the customer and the RSP without prior detailed research and analysis.

- RCx Building Tune-up is more focused on the most common RCx measures in smaller commercial buildings and results in a briefer deliverable on a faster timeline.
- Grocery RCx focuses on the most common measures affecting refrigeration systems and equipment scheduling in full-service groceries and convenience stores.

The Grocery RCx offering is currently being merged into RCx Building Tune-up. Additional offering attributes are shown in Table 2-3, below..

The program had 124 projects, including 42 gas projects, in EPY9/GPY6 and implemented 423 measures as shown in Table 2-1 and Table 2-2 and the following graphs.

Table 2-1. EPY9/GPY6 Volumetric Findings Detail by Utility*

Participation	Electric Only	Nicor Gas	Peoples Gas	North Shore Gas	Total
Total Projects	82	15	25	2	124
Electric Measures	225	73	106	6	410
Gas Measures	0	36	55	2	93
Total Measures*	225	78	114	6	423
Measures/Project	2.7	5.2	4.6	3.0	3.4

*Project counts include six coordinated gas projects that did not report any gas savings in GPY6.
†Totals include some measures with both electric and gas savings.
Source: ComEd tracking data and Navigant team analysis.

Table 2-2. EPY9/GPY6 Volumetric Findings Detail by Offering

Participation	MBCx	RCx	RCxpress	Tune-Up	Grocery	Total
Total Projects	10	16	30	65	3	124
Electric Measures	29	69	128	179	5	410
Gas Measures	3	16	34	40	0	93
Total Measures*	30	70	136	182	5	423
Measures/Project	3.0	4.4	4.5	2.8	1.7	3.4

*Totals include some measures with both electric and gas savings.
Source: ComEd tracking data and Navigant team analysis.

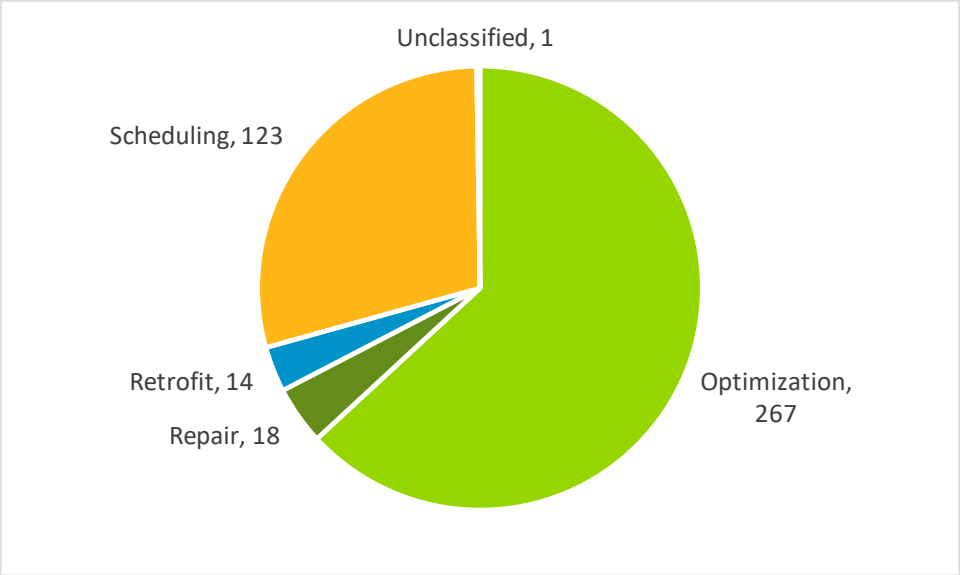
Table 2-3. Program Attributes – by Participation Offering

Program Offering	Target Facility Size	Incentives	Customer Commitment
Retro-Commissioning (RCx)	>500,000 ft^2 >10 GWh	100% Study with caps	$25,000
Monitoring Based (MBCx)	>150,000 ft^2 >3 GWh	Monitoring integration and $0.07/kWh and $1/therm	18-month monitoring contract
RCxpress	150,000 – 450,000 ft^2	100% Study with caps	$5,000 or $10,000
RCx Building Tune-Up	<150,000 ft^2 0.5-3.0 GWh	$15,000 max study $0.03/kWh with caps	Coordination
Grocery RCx	Same as RCx Building Tune-Up		

Source: ComEd program fact sheets

Figure 2-1, Figure 2-2, and Figure 2-3 categorize implemented electric and gas measures by type: scheduling, system optimization, equipment repair, and equipment retrofit. Categorization by type may be useful for determining cumulative persistent annual savings (CPAS) as reporting metrics. As seen in Figure 2-1, most of the measures in the Retro-Commissioning Program are categorized as optimization.

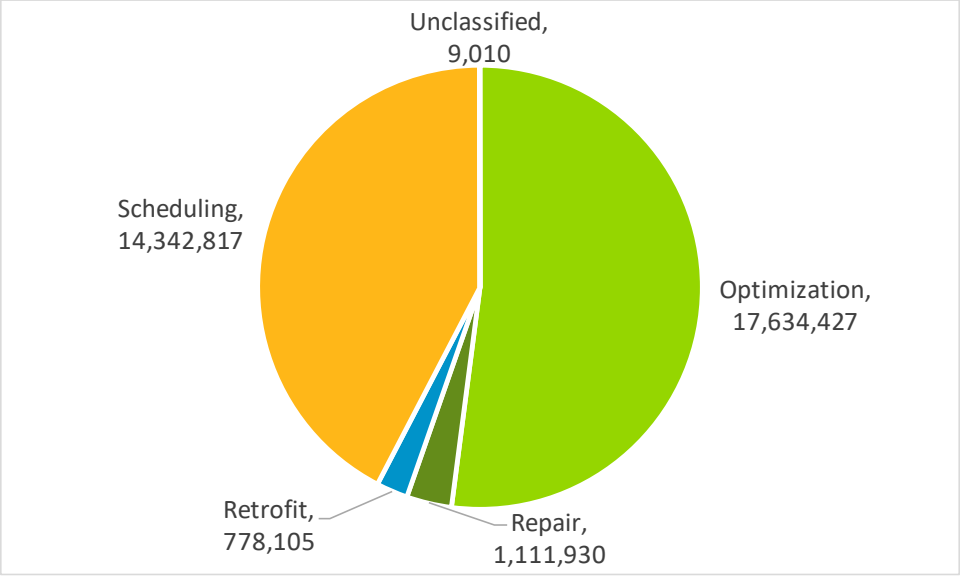
Figure 2-1. EPY9/GPY6 Number of Measures Installed by Type



Source: Program database

Figure 2-2 shows the breakdown of electric savings by measure type. Savings for optimization measures make up slightly more than half of the program's electric savings. Scheduling measures make up much of the remaining electric energy savings because the average measure savings are larger than the other measure types.

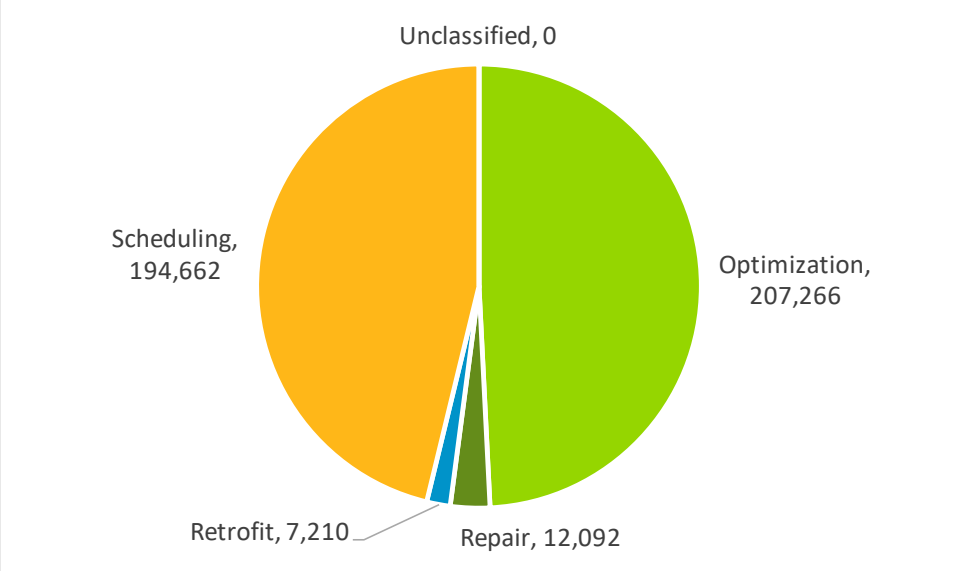
Figure 2-2. EPY9/GPY6 Electric Energy Savings in kWh Installed by Measure Type



Source: Program database

Figure 2-3 shows program gas savings by measure type. As with electric savings, scheduling and optimization together account for more than 90% of gas savings. Repair and retrofit measures make up only a small portion of energy savings in the program.

Figure 2-3. EPY9/GPY6 Gas Energy Savings in Therms Installed by Measure Type



Source: Program database

3. Program Savings

Table 3-1 summarizes the incremental energy and demand savings the Retro-Commissioning Program achieved in EPY9/GPY6. Overall, Navigant found the evaluated program savings to be higher than the reported ex ante values. This was more notable in demand and gas savings, in part due to under-reporting of demand and gas results in the Tune-Up offering. However, the Tune-Up offering has more recently been making efforts to report all types of savings. Utility-specific results for natural gas savings are presented in Section 5 and Section 6.

Table 3-1. EPY9/GPY6 Total Annual Incremental Savings

Savings Category	Energy Savings (kWh)	Demand Savings (kW)	Peak Demand Savings (kW)	Gas Savings (Therms)
Ex Ante Gross Savings	33,876,288	1,683	1,683	421,230
Program Gross Realization Rate	1.04	1.38	1.38	1.08
Verified Gross Savings	35,156,156	2,318	2,318	454,223
Program Net-to-Gross Ratio (NTGR)	0.95	0.95	0.95	1.02
Verified Net Savings	33,398,349	2,202	2,202	463,307

Source: ComEd tracking data and Navigant team analysis.

4. Program Savings by Measure

The Retro-Commissioning Program is evaluated by offering instead of by measure. Details of savings by offering are provided in Appendix 1, Program Savings by Offering.

5. Impact Analysis Findings and Recommendations

5.1 Impact Parameter Estimates

There are few program-level impact parameter estimates for the Retro-Commissioning Program. All analysis is rolled-up to realization rate impact parameter estimates for electric energy, electric demand, and natural gas energy savings. Service providers estimate energy and demand savings with custom algorithms, frequently using hourly weather data and time-series trend data. As such, the Navigant team conducted research to validate the savings individually for all measures in the evaluation sample.

The lifetime energy and demand savings are estimated by multiplying the verified savings by the effective useful life for each measure. The Navigant team conducted research to validate the parameters that were not specified in the TRM.

Table 5-1. Verified Gross Savings Parameters

Gross Savings Input Parameters	Value	Deemed* or Evaluated?
Quantity	124	Evaluated
Offerings	5	Evaluated
Gross Savings (kWh), Sampled Measures	19,552,601	Evaluated
Gross Savings (Therms), Sampled All Measures	292,750	Evaluated
Verified Realization Rate on Ex-Ante Gross Savings (Electric)	1.04	Evaluated
Verified Realization Rate on Ex-Ante Gross Savings (Gas)	1.08	Evaluated

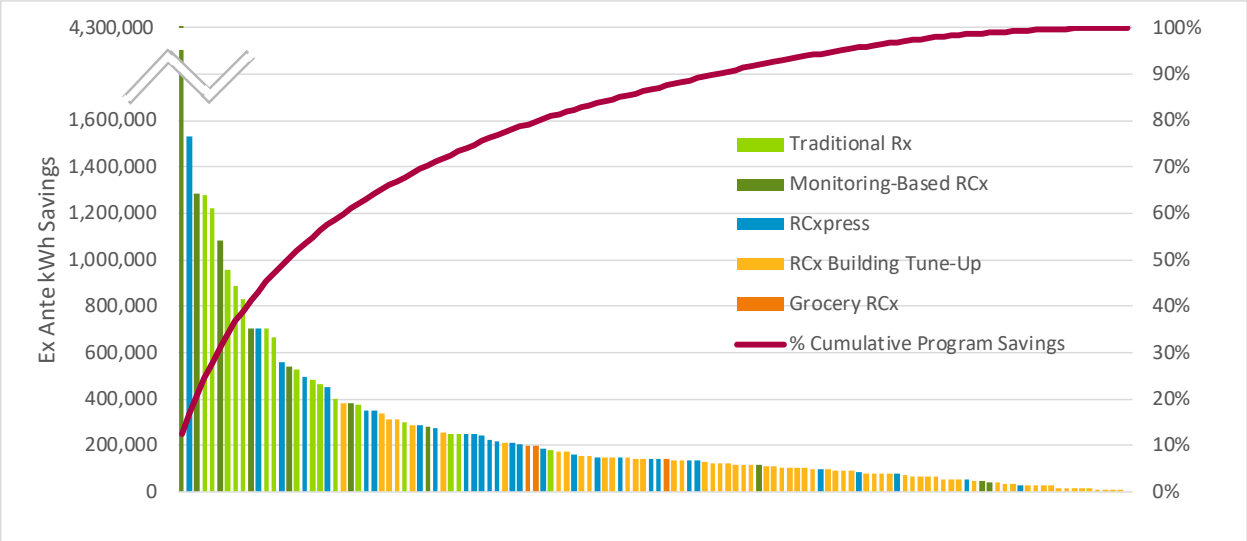
* State of Illinois Technical Reference Manual version 5.0 from http://www.ilsag.info/technical-reference-manual.html.
Source: ComEd tracking data and Navigant team analysis

5.2 Other Impact Findings and Recommendations

Navigant reviewed the overall program population from the program tracking data and performed a detailed analysis of a representative sample of projects.

Figure 5-1 shows the breakdown of electric savings in the program by project and offering. One project had more than twice the savings of any others and made up over 12% of program savings. As expected, larger projects are generally in the MBCx and RCx offerings, but some RCxpress projects are also quite large. For electricity, project savings ranged from over 4,200,000 kWh to 3,000 kWh, ex ante, with the largest 15 projects making up slightly over half of program savings.

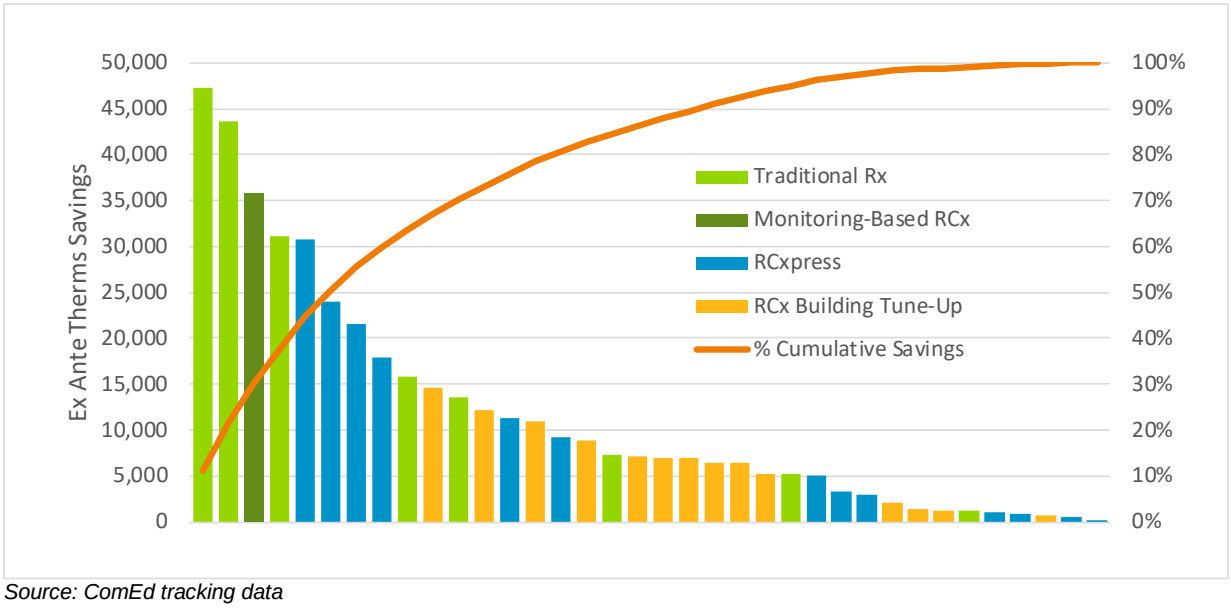
Figure 5-1. EPY9/GPY6 Ex Ante Electric Energy Savings by Project



Source: ComEd tracking data and Navigant team analysis

Figure 5-2 shows ex ante gas savings by project. As with electric savings, larger projects are generally in the RCx and MBCx offerings. For natural gas, implemented savings ranged from over 47,000 therms to 237 therms annually, with the largest project comprising slightly over a tenth of program savings, and the six largest accounting for over half of program savings.

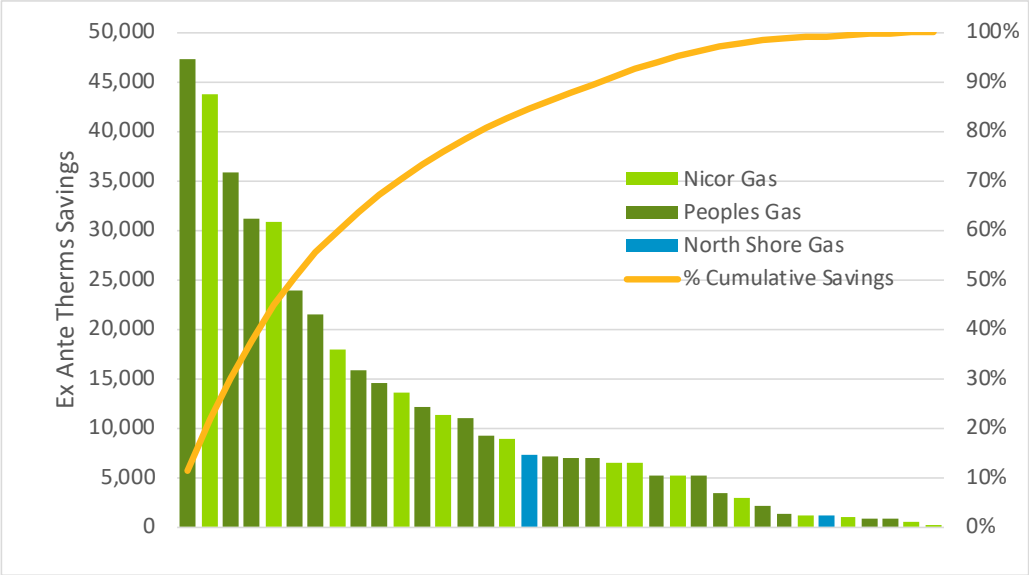
Figure 5-2. EPY9/GPY6 Gas Energy Savings by Offering



Source: ComEd tracking data

Figure 5-3 shows ex ante gas savings by utility. Most savings are from Nicor Gas and Peoples Gas customers, with only two participants in the North Shore Gas territory.

Figure 5-3. EPY9/GPY6 Gas Energy Savings by Utility



Source: ComEd tracking data and Navigant team analysis

The total program verified gross savings are in Table 5-3. The table presents savings at the customer-level. Realization rates are the results of analyzing 39 projects, made up of 156 measures.

Table 5-2. Verified Gross Savings Realization*

Savings Category	ComEd	ComEd Demand	Nicor Gas	Peoples Gas	North Shore Gas
Ex Ante Project Counts	124	55	14	20	2
Ex Ante Gross Savings*	33,876,288	1,683	150,269	262,506	8,455
Verified Gross Realization Rate	1.04	1.38	1.13	1.05	1.00
Verified Gross Savings*	35,156,156	2,318	170,246	275,521	8,455

*Electric energy in kWh, electric demand in kW, gas in therms
Source: ComEd tracking data and Navigant team analysis

There are several reasons why realization rates are other than 1.0, including:

- On-site verification determined measures were implemented differently than reported. This can include modified schedules or set points. Changes in schedules or set points were mostly due to operator adjustments to maintain occupant comfort.
- Some projects continued to implement additional recommended measures or finish implementing measures after they were verified and closed by the service provider and implementation contractor.
- Some projects generated gas savings that the program did not track accurately.
- Some measures did not include demand savings even when warranted and others claimed demand savings not found during verification. Demand calculations also used a variety of conditions that did not conform to the PJM WTHI[1] method of using savings at 81.6 °F outdoor air temperature.
- Occasional calculation or engineering errors also affected realization rates. Several types of calculation errors were encountered this year:

[1] Weighted temperature-humidity index. Each PJM-member utility is assigned a temperature representative of the average conditions in the utility service territory for PJM summer demand hours.

  - Saving analysis sometimes used poorly-chosen data sets for verifying savings. In one significant case, the post-installation data set predated complete installation of the measure, resulting in low ex ante savings.
  - Reducing simultaneous heating and cooling measures did not always quantify the cooling savings.
  - Floating head and suction savings were overly optimistic given the design and condition of refrigeration equipment included in the Grocery RCx projects.
  - Weather datasets were not consistently applied. Some projects used different weather data for different measures. One project used a Detroit weather dataset.
  - Discrepancies in set points or hours of operation between reported conditions and those used in calculations resulted in numerous, but generally small, changes in savings.
  - A few calculations included apparent typos, including copying cells without locking references.
- Other engineering or calculation errors affected verified savings, but these instances were not systematic.

5.2.1 Findings and Recommendations

Though the process for estimating savings has evolved and become more consistent since the program was launched in PY1, there is still room for improvement, as detailed in the following list of findings and recommendations.

Finding 1: Two projects reported savings using "post-implementation" meter data that included partial implementation periods, resulting in an under-estimate of savings.
Recommendation 1: Ensure that ex ante estimates use post-installation data collected after the measures are fully implemented.

Finding 2: Some projects use different weather datasets for different measures at the same location, including one that used all three Chicago area weather stations for measures at the same location. One evaluated project used Detroit weather data. A project in Rockford used O'Hare airport data when there is a Rockford weather station.
Recommendation 2: Give explicit recommendations for preferred weather datasets. Include weather dataset selection in QC steps for ex ante savings. Add the Rockford weather station to the program calculators.

Finding 3: Several MBCx projects relied on stand-alone data loggers for ex ante verification. A core precept of the MBCx offering is controls integration and monitoring that facilitates reliable and less-intrusive investigation and verification. Use of data loggers to verify savings seems contrary to the program.
Recommendation 3: The program should require verification use facility Building Automation Systems (BAS) trend data or interval meter data to non-intrusively identify opportunities and verify savings.

Finding 4: Some descriptions of measure verification do not clarify whether a measure is physically observed or whether the verification is only from the BAS screen.
Recommendation 4: Where physical adjustments are integral to the measure implementation, e.g. damper adjustment for minimum outdoor air, require physical verification and unambiguous description in the report.

Finding 5: For one project in the sample, the distinction between the Retro-Commissioning and Custom Program became blurred. Typically, retro-commissioning measures do not include large equipment costs. This measure retrofitted four fans with new variable speed drives (VSDs) at a cost exceeding $150,000. Retrofits of this nature are usually processed through the Custom or Standard-Offer Program. Depending on the project, the participant

incentives might be very different, program goal achievement might be distorted, and RSP service scopes might become biased.

Recommendation 5: Establish clear rules for situations where a measure might be implemented through different energy efficiency programs. Ensure that incentives to participants and fees to service providers do not distort the focus of the Retro-Commissioning Program.

6. Appendix 1: Program Savings by Offering

The Retro-Commissioning Program implements multiple measures that affect different building systems and end uses in each project. The program analyzes all identified measures but reports savings at the project level. Each project has enrolled in the program through one of the offerings described in Table 5-2, above. Electric savings by program offering are summarized in Table 6-1 and Table 6-2, and natural gas savings by utility in Table 6-3. Though RCx Building Tune-up (Tune-Up) has the highest participant volume, the traditional retro-commissioning (RCx) and monitoring-based (MBCx) offerings have the greatest savings, due to the larger facility sizes and greater equipment control capabilities among these participants.

Technical measure life is the technical life of the existing control system by which the measure has been implemented. Since most measures are implemented via existing Building Automation Systems (BAS), the evaluation considers the technical life is about 50% of a new BAS. At this juncture, the evaluation is using a 9-year technical measure life for retro-commissioning measures. Measure persistence is currently being researched, and would be applied during the life of a measure to reflect the rate that implemented optimization or scheduling measures might change over time.

Overall, the program had an electric energy savings realization rate of slightly over unity. Grocery RCx had the lowest realization rate of the offerings, largely because one of the three projects had reversed the implemented setpoint changes, greatly reducing savings. Table 6-1 shows electric energy savings by RCx offering.

Table 6-1. EPY9 Electric Energy Savings by Offering

Offering	Ex Ante Gross Savings (kWh)	Verified Gross Realization Rate	Verified Gross Savings (kWh)	NTGR *	Verified Net Savings (kWh)	Technical Measure Life	Persistence	Effective Useful Life (EUL)†
MBCx	8,721,825	1.06	9,248,519	0.95	8,786,093	9	TBD	TBD
RCx	9,778,667	1.06	10,369,182	0.95	9,850,722	9	TBD	TBD
RCxpress	8,128,479	1.06	8,619,342	0.95	8,188,375	9	TBD	TBD
Tune-Up	6,929,611	0.96	6,671,114	0.95	6,337,558	9	TBD	TBD
Grocery	317,706	0.78	248,000	0.95	235,600	9	TBD	TBD
All	33,876,288	1.04	35,156,156	0.95	33,398,349	9	TBD	TBD

Source: ComEd tracking data and Navigant team analysis.

* A deemed value. Source: ComEd_NTG_History_and_PY9_Recommendations_2016-02-26_Final.xlsx, which is to be found on the IL SAG web site here: http://ilsag.info/net-to-gross-framework.html.

† EUL is a combination of technical measure life and persistence.

Demand savings exceeded the ex ante values for the MBCx, RCx, and RCxpress offerings, largely due to omission of some measure-level demand savings. Table 6-2 shows electric PY9 peak demand savings by offering.

Table 6-2. EPY9 Peak Demand Savings by Offering

Enduse Type	Ex-Ante Gross Demand Reduction (kW)	Verified Gross Realization Rate	Verified Gross Demand Reduction (kW)	NTGR*	Verified Net Demand Reduction (kW)
MBCx	475	1.52	720	0.95	684
RCx	460	1.52	699	0.95	664
RCxpress	306	1.52	465	0.95	442
Tune-Up	441	0.98	435	0.95	413
Grocery	0	NA	0	0.95	0
All	1,683	1.38	2,318	0.95	2,202

Source: ComEd tracking data and Navigant team analysis

Gas energy savings were above the ex ante values, in part due to under reporting in the Tune-Up offering. Table 6-3 shows natural gas GPY6 therm savings by utility.

Table 6-3. GPY6 Natural Gas Therms by Utility

Utility	Ex Ante Gross Savings (Therms)	Verified Gross Realization Rate	Verified Gross Savings (Therms)	NTGR *	Verified Net Savings (Therms)	Technical Measure Life	Persistence	Effective Useful Life (EUL)†
Nicor Gas	150,269	1.13	170,246	1.02	173,651	9	TBD	TBD
Peoples Gas	262,506	1.05	275,521	1.02	281,032	9	TBD	TBD
North Shore Gas	8,455	1.00	8,455	1.02	8,624	9	TBD	TBD
All	421,230	1.08	454,223	1.02	463,307	9	TBD	TBD

* A deemed value. Source: PG-NSG_GPY6_NTG_Values_2016-02-29_Final.xlsx and Nicor_Gas_GPY6_NTG_Values_2016-02-29_Final.xlsx, which are to be found on the IL SAG web site here: http://ilsag.info/net-to-gross-framework.html.

Source: ComEd tracking data and Navigant team analysis

7. Appendix 2: Impact Analysis Methodology

This evaluation of the Retro-Commissioning Program reviews the ninth year ComEd has offered the program and the sixth year of its coordinated offering with the gas utilities. In general, the Electric Program Year 9 (EPY9) / Gas Program Year 6 (GPY6) impact evaluation paralleled prior impact evaluations for the program.

7.1 Methodology Overview

The impact evaluation consists of a review of a representative sample of projects: both an engineering desk-review and on-site verification for a sub-set of projects. Evaluators review gross program impacts with a project-by-project and measure-by-measure approach. Savings calculation reviews ensure the savings estimates are accurately modeled and include reasonable assumptions, as required. In some cases, evaluators acquired additional trend data or interval meter data to verify savings with both more data and data concurrent with expected savings, e.g. winter data for night set-back measures. In most cases, the impact evaluation involves analysis of time-series trend and measured data, both pre- and post- implementation.

For a nested sample of projects (selected from projects sampled for engineering review), Navigant performed on-site inspections of projects to determine whether implemented measures were still operating as described in project documentation (set points, affected equipment, hours of operation, etc.). Where we found differences, our research findings savings estimates reflect those new inputs.

Due to the number of projects and the compressed schedule between program year-end and reporting, Navigant began project reviews in waves. We constructed an impact sample in early May 2017 based on projects complete to-date and expected to be completed prior to year-end. ComEd and Nexant provided project files in waves as they were completed: end of July 2017, end of October, mid-December and January 2018.

Results from the impact evaluation were rolled up by sampling strata and extrapolated to the participant population to determine gross researched impacts. Deemed net-to-gross (NTG) ratios were applied to gross results to arrive at net researched impacts.

7.2 Sampling Methodology

The sample draw for EPY9/GPY6 gross impact evaluation was done in two waves roughly proportional to the populations they represented. The first wave of sampling was conducted on projects with a planned completion during EPY9/GPY6 based on the Nexant Operations Report in May 2016, when the program had completed almost half of the EPY9/GPY6 participation target. The second and final wave of sampled projects adjusted the first wave sample based on projects completed as of the final EPY9/GPY6 Operations Report. The Table 7-1 is the population of projects completed in the EPY9/GPY6 program.

Table 7-1. Sampling Population of PY9/GPY6 RCx Projects

Offering	ComEd	Nicor Gas	Peoples Gas	North Shore Gas
Monitoring-based (MBCx)	10	0	1	0
Traditional Retro-commissioning (RCx)	16	3	3	2
RCxpress	30	7	6	0
RCx Building Tune-Up (Tune-Up)	65	4	10	0
Total	121	14	20	2

Source: ComEd tracking data and Navigant team analysis.

The sample design considered the RCx, RCxpress, and MBCx projects as one component, and the Tune-Up projects as a separate component. Strata were defined by project size (separately for RCx, RCxpress, MBCx, and Tune-Up projects) based on ex ante gross energy savings boundaries that placed about one-third of program-level savings into each stratum. Sampling involved a combination of random and targeted sampling approaches to select a majority of the ComEd program large savers and a balanced number of projects in the medium and small savers strata, while capturing the gas utility projects along with electric savings. Sampling was targeted to provide a 90/10 level confidence and relative precision for gross impact realization rate results for the ComEd and gas utility overall programs. However, 90/10 could not be achieved for the gas projects, as the adjustments between the projected completion as of May 2017 and the final completed projects reduced the ex ante gas savings of the sample and the available replacement options.

Table 7-2 below provides the ComEd sample selection by program path and stratification. Overall the sample represented 30 percent of the project count and 57 percent (19,234,895 kWh) of the population ex ante savings of 33,558,582 kWh. A total of 36 projects were selected from the population of 121 completes (excluding Grocery projects), including 19 RCx, RCxpress, MBCx projects, and 17 Tune-Up projects.

Table 7-2. Profile of the ComEd EPY9 Gross Savings Verification Sample by Path Strata

		Population Summary		Sample Summary		
Population Group	Sampling Strata	Number of Projects (N)*	Ex Ante kWh	Number of Projects (n)	Ex Ante kWh	Sampled % of Population
RCx+RCxpr+MBCx Waves 1&2	1	5	9,559,372	5	9,559,372	100%
	2	11	8,166,138	6	5,004,156	61%
	3	40	8,903,461	8	2,113,959	24%
Subtotal		56	26,628,971	19	16,677,487	63%
Tune-Up Waves 1&2	1	10	2,602,588	5	1,324,516	51%
	2	16	2,122,111	5	697,817	33%
	3	39	2,204,912	7	535,075	24%
Subtotal		65	6,929,611	17	2,557,408	37%
Program Total		121	33,558,582	36	19,234,895	57%

* A total of 124 projects were completed in PY9. Population used for sampling excludes three grocery projects and savings.
Source: ComEd tracking data and Navigant team analysis.

Table 7-3 provides the breakdown of the sample selection for the gas programs. Neither of the two North Shore Gas projects were selected.

Table 7-3. Profile of the Gas GPY6 Gross Savings Verification Sample by Strata

		Population Summary		Sample Summary		
Population Group	Sampling Strata	Number of Projects (N)	Ex Ante Therms	Number of Projects (n)	Ex Ante Therms	Sampled % of Population
Nicor Gas Waves 1&2	1	1	43,699	1	43,699	100%
	2	2	48,666	2	48,666	100%
	3	11	57,904	3	25,207	44%
Nicor Total		14	150,269	6	117,572	78%
Peoples Gas Waves 1&2	1	2	83,156	2	83,156	100%
	2	4	92,408	3	61,268	66%
	3	14	86,942	3	30,754	35%
Peoples Gas Total		20	262,506	8	175,178	67%

Source: ComEd tracking data and Navigant team analysis.

For each sampled project, Navigant reviewed all measures. All measure savings for a project were rolled-up into project-level realization rates. Navigant subsequently rolled-up project-level results by stratum - weighted on savings - for strata-level realization rates. These rates were then applied to the population of projects in each stratum to determine research findings gross realization rates for the program.

In addition to the stratified random sampling discussed here, evaluators reviewed three grocery projects which were census sampled.

8. Appendix 3. Impact Analysis Detail

Program impacts are tracked through the several phases of the program with the implementation contractor (IC) giving feedback and requiring changes along the way. Thus, the evaluator's task is to check a sample of measures verified by the Retro-Commissioning Service Providers (RSPs) and IC and ensure that measures are indeed complete and savings are accurately estimated.

The evaluators conclude that the investigation, reports, verification reports, supporting data, and calculations provided sufficient confirmation that the measures were installed as described. Navigant identified 16 projects, comprising 11,000 MWh and 250,000 therms, within the impact sample for on-site verification.[2] Evaluators visited all 16 of these sites between August 2017and January 2018 and verified implementation and observed actual operation of measures. In most cases, measure implementation persists. In some cases, the facility had modified set points and schedules due to facility requirements, including adjustments to refrigeration systems at a grocery site. In a couple cases, evaluators learned that the participating site was continuing to make recommended improvements after the project was formally verified and closed.

The evaluation team reviewed 58% of electric energy savings and 71% of gas savings. Table 8-1 details the evaluation by offering.

Table 8-1. Savings Evaluated by Offering

	MBCx	RCx	RCxpress	RCx Building Tune-Up	Grocery	Total
Total Number of Projects	10	16	30	65	3	124
Evaluated Projects	4	10	5	17	3	39
Population kWh Ex Ante Savings	8,721,825	9,778,667	8,128,479	6,929,611	317,706	33,876,288
Sample kWh Ex Ante Savings	7,317,693	6,729,723	2,630,071	2,557,408	317,706	19,552,601
Evaluated Percent of kWh	84%	69%	32%	37%	100%	58%
Population Therms Ex Ante Savings	35,877	165,124	128,729	91,500	0	421,230
Sample Therms Ex Ante Savings	35,877	125,529	103,236	28,108	0	292,750
Evaluated Percent of Therms	100%	76%	80%	31%	NA	69%

Source: ComEd tracking data and Navigant team analysis

8.1 Evaluation Research Gross Impact Findings

For all 39 sites in the sample, Navigant reviewed measure implementation plans, assumptions and calculations in detail. In general, Navigant found the calculations accurately constructed, based on clearly measured data rather than rules-of-thumb, and reasonably transparent in spreadsheet form. In some instances, we found calculation errors due to spreadsheet equation errors, erroneous inputs, omissions of relevant impacts and inconsistencies in assumptions from measure-to-measure on the same system, but most of these errors resulted in only minor changes to overall savings. Some of the spreadsheets contained hard-coded input values but these were generally based on trend data files and standard TMY3[3] data.

[2] On-site verification projects were selected based on project savings size, measure type and facility type. Large projects were selected because of their impact on program goals. Diverse facility types were selected to capture a range of operating strategies and participant requirements (for example year-round cooling for equipment intensive sites or 24-hour operation for hospitals).

[3] TMY3 is the most recent version of the Typical Meteorological Year weather data sets.

Savings estimation approaches among RSPs were mostly consistent. Most calculation spreadsheets were comprehensive, though some were excessively complex and others overly simple. Despite the range of approaches in EPY9/GPY6, there were very few lapses in engineering methods. When faced with the need to make engineering assumptions, RSPs are often more conservative than the program guidelines. Where there was no further justification for overly conservative estimates, the evaluation team restored guideline defaults and/or supplemented estimated savings with secondary effects of the measures as could be determined with available data.

Navigant cautions that Grocery RCx projects may be at risk of low realization rates due to the inability of systems to reach the aggressive set points used by the program. Retrofitting valves to allow floating head set points and compressor staging would ensure significantly higher savings for the program. One project reverted to old setpoints due to equipment limitations during this program year.

In cases where inputs were inconsistent with reported data, such as set points or operational hours, Navigant re-estimated savings with available data, additional data requested from the participant or RSP and/or program guideline inputs. Research findings gross realization rates are the result of analysis of individual measures for each project in the impact sample. Table 8-2 details the realization rates by sampled project. Realization rates for energy varying by more than 10 percent from 1.0 are due to reasons noted. The wide variation in demand realization rates is caused by inconsistent ex ante calculation methodologies and is not discussed in detail in the table.

Table 8-2. Project Level Realization Rates

Project	Realization Rates			
	kWh	kW	Therms	Notes on ex ante estimates
14-109	99%	NA	NA	
14-110	85%	NA	NA	Simultaneous heating and cooling measure only estimated heating savings. EM&V added cooling and analyzed additional interval data. Minor calculation errors in discharge air temperature and outdoor air damper measures
15-005	72%	NA	376%	Changes made based on on-site observations and some errors in the calculations. Estimated fan BHP exceeded nameplate HP in some cases.
15-009	147%	NA	104%	Motor loading double counted in kW calculations, resulting in undercount of fan power savings.
15-017	160%	156%	NA	Simultaneous heating and cooling measure only estimated heating savings. EM&V added cooling and analyzed additional interval data
15-022	98%	103%	317%	Changed district steam eff from 100% to 80% efficiency; fixed errors that did not carry setback hours through all calculations.
15-023	105%	NA	NA	Minor correction to hours for one AHU, chiller size, and outside air minimum.
15-029	97%	7%	100%	
15-035	86%	93%	NA	Changes made based on on-site observations.
15-108	101%	97%	100%	
15-110	90%	100%	NA	
15-456	95%	NA	NA	
15-550	97%	95%	NA	
15-557	204%	NA	NA	
15-558	68%	97%	NA	
15-561	113%	NA	NA	Ex ante BIN hours were less than 8760. Using Midway TMY3 data gave increased cooling and decreased heating hours.

Project	Realization Rates			Notes on ex ante estimates
	kWh	kW	Therms	
15-562	76%	NA	NA	Inputs to standard calculators were wrong or were determined to have changed based on on-site inspection. Over-ventilation measure was zeroed out because EM&V determined that 30-50% outside air is appropriate for concurrent outdoor air temperatures.
15-563	36%	70%	NA	Inputs to standard calculators were wrong or were determined to have changed based on on-site inspection.
15-569	80%	NA	NA	Implementer calculated post period usage based on November data, but notes that mid-November to December has abnormal hours. Recalculated post period usage based on 10 months from January-October in 2017.
15-570	60%	NA	NA	Implementer calculated post period usage based on November data, but notes that mid-November to December has abnormal hours. Recalculated post period usage based on 10 months from January-October in 2017.
16-004	83%	NA	100%	Reduction in hours of operation on ECM5.
16-007	104%	117%	101%	Standard Nexant calculator set to Detroit for weather. Changed to Waukegan.
16-010	299%	100%	NA	Minor changes based on on-site observations. Analysis of additional interval data for night-time heating reduction.
16-017	98%	NA	NA	Minor adjustments to setpoints for cooling water temperature and static pressure setpoints based on screenshots and data in ex ante investigation and verification reports.
16-031	98%	40%	96%	
16-034	99%	33%	102%	Minor changes, but mixes TMY3 data for Rockford and O'Hare. VFD spot measurements of power do not agree with speed trends.
16-035	59%	74%	52%	On-site EM&V determined that night-set-back was not occurring any longer. Chiller sizes incorrect in standard calculator and custom estimate for condenser water reset over-estimated savings versus manufacturer documentation (1.25%/°F vs 0.5%/°F). Other small calculation discrepancies
16-039	90%	88%	93%	
16-400	97%	89%	NA	
16-403	112%	100%	NA	Changed weather station from O'Hare to Waukegan, removed Saturday hours, reduced baseline DAT to match report, matched start time in ECM2 to ECM1.
16-413	120%	NA	25%	ECMs 2&5 calculated independent of ex ante calculator, which was very convoluted.
16-416	100%	NA	78%	Conversion from steam to gas energy issues.
17-410	110%	NA	NA	
17-424	95%	NA	NA	
17-428	102%	100%	NA	
17-482	97%	111%	100%	
Grocery 1	81%	NA	NA	Restrict savings to expected temperature ranges for savings. More post-install data used.
Grocery 2	53%	NA	NA	Measure mostly reversed according to the report. Restrict savings to expected range. New EM&V data.
Grocery 3	100%	NA	NA	Restrict savings to expected temperature ranges for savings. More post-install data used.

Source: Evaluation research

8.2 Evaluation Research Net Impact Findings

After gross program impacts have been assessed, net program impacts are derived by applying the deemed net-to-gross ratio (NTGR) that quantifies the percentage of the gross program impacts that can be reliably attributed to the program. Currently, deemed NTGRs for electric savings is 0.95 for all electric program offerings and 1.02 for all gas savings.

The EM&V team is conducting free ridership and spillover research among participants in all program offerings in EPY9/GPY6. Results of this research may be considered for deeming in CY2019 and beyond.

9. APPENDIX 4. TRC DETAIL

The following data is for the calculation of the Total Resource Cost test benefit/cost ratios.

Table 9-1 TRC Test Inputs*

Projects	Units	Quantity	Measure Life	Ex Ante kWh	Ex Ante kW	Ex Ante Therms	Verified Gross kWh Savings	Verified Gross kW Savings	Verified Gross Therms Savings
ComEd	Project	124	9	33,876,288	1,683	NA	35,156,156	2,318	NA
Nicor Gas	Project	14	9	NA	NA	150,269	NA	NA	170,246
Peoples Gas	Project	20	9	NA	NA	262,506	NA	NA	275,521
North Shore Gas	Project	2	9	NA	NA	8,455	NA	NA	8,455
All	Project	124*	9	33,876,288	1,683	421,230	35,156,156	2,318	454,223

* The Total Resource Cost (TRC) variable table only includes cost-effectiveness analysis inputs available at the time of finalizing this PY9 impact evaluation report. Additional required cost data (e.g., measure costs, program level incentive and non-incentive costs) are not included in this table and will be provided to evaluation at a later date. Further, detail in this table (e.g., EULs) other than final PY9 savings and program data are subject to change and are not final.

APPENDIX C. COORDINATED UTILITIES PUBLIC SECTOR BRIDGE EPY9-GPY6 IMPACT EVALUATION RCX REPORT 2018-08-09 FINAL

NAVIGANT

Coordinated Utility Public Sector Retro-Commissioning Program Bridge Period Impact Evaluation Report

Energy Efficiency / Demand Response Plan: Electric Plan Year 9 (EPY9) / Gas Plan Year 6 (GPY6) - Bridge Period (June 2, 2017 to December 31, 2017)

Presented to
Commonwealth Edison Company
Nicor Gas
Peoples Gas
North Shore Gas

FINAL

August 9 2018

Prepared by:

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1. Introduction

This report presents the results of the impact evaluation of the coordinated utility Public Sector Retro-Commissioning (RCx) Program for the EPY9/GPY6 bridge period, June 2, 2017 through December 31, 2017. It presents a summary of the energy and demand impacts for the public sector program broken out by relevant measure and program structure details. The appendix presents the impact analysis methodology. The applicable technical reference manual (TRM) for this report is IL TRM version 5.0.

2. Program Description

The Public Sector Retro-Commissioning Program is operated through the Smart Energy Design Assistance Center (SEDAC) and managed by staff at the 360 Energy Group (360 Energy). The program helps customers improve the performance and reduce energy consumption of their facilities through the systematic analysis of *existing* building systems. Generally, the program pays for 100% of a retro-commissioning study, contingent upon a participant's commitment to spend $10,000 implementing a bundle of study recommendations having a simple payback of 18 months or less. The program does not provide incentives to the participant to implement the measures.

2.1 Eligibility

The RCx Program is available to public sector facilities that receive electrical service from Ameren Illinois or ComEd or natural gas service from Ameren Illinois, Nicor Gas, North Shore Gas, or Peoples Gas. In general, facilities must comprise at least 150,000 ft^2 of conditioned space and be at least five years old. However, newer and smaller buildings with an energy use profile suggesting a large potential for savings are also eligible for the program on a case-by-case basis. In addition to size and age criteria, buildings must have a functioning building automation system (BAS). Buildings with select characteristics are given preference for program: buildings direct-digital control BAS, absence of major planned system renovations or retrofits; and motivated and committed building owners and operators.

2.2 Bridge Period Program Activity

Two public sector retro-commissioning projects were completed during the bridge period and files were submitted to evaluators for review. All gas savings originates from Nicor Gas customers.

The volumetric findings are shown in the following table.

Table 2-1. EPY9/GPY6 Volumetric Findings Detail

Participation	DCEO
Participants	2
Electric Measures*	10
Gas Measures*	7
Total Measures*	11
Number of Measures/Projects	5.5

* Total measures include some with both gas and electric savings.
Source: SEDAC tracking data and Navigant team analysis.

3. Program Savings

Table 3-1 summarizes the incremental energy and demand savings the Public Sector RCx Program achieved in the bridge period. The net-to-gross ratio is established by the Illinois Stakeholder Advisory Group (SAG) and NTG values are deemed on a regular basis by the SAG. All gas savings originate from Nicor Gas customers.

Table 3-1. Bridge Period Total Annual Incremental Savings

Savings Category	Energy Savings (kWh)	Demand Savings (kW)	Peak Demand Savings (kW)	Gas Savings (Therms)
Ex Ante Gross Savings	245,937	22	22	22,355
Program Gross Realization Rate	0.82	0.50	0.50	0.80
Verified Gross Savings	200,539	11	11	17,888
Program Net-to-Gross Ratio (NTGR)	0.95	0.95	0.95	1.02
Verified Net Savings	190,512	10	10	18,246

Source: ComEd tracking data and Navigant team analysis.

4. Program Savings by Measure

During the bridge period the program completed two projects that encompass 11 custom, and mostly unique, measures. Measure-level savings for this small population have limited value summarized. Project savings are discussed in Section 7 (Appendix 1).

Table 4-1. Bridge Period Energy Savings by Measure‡

Measure Type	Research Category	Ex Ante Gross Savings (kWh)	Verified Gross Realization Rate	Verified Gross Savings (kWh)	NTGR *	Verified Net Savings (kWh)	Effective Useful Life (EUL)†
Optimization	Optimization	24,335	76%	18,564	0.95	17,636	7
Repair	Repair	53,007	107%	56,759	0.95	53,921	7
Retrofit	Retrofit	836	83%	694	0.95	659	7
Scheduling	Scheduling	167,759	74%	124,522	0.95	118,296	7
Total		245,937	82%	200,539	0.95	190,512	

* A deemed value. Source: ComEd_NTG_History_and_PY9_Recommendations_2016-02-26_Final.xlsx, which is to be found on the IL SAG web site here: http://ilsag.info/net-to-gross-framework.html.

† EUL is a combination of technical measure life and persistence. There is currently no prior established EUL for RCx measures. The EUL value in this table is a project-level value based on established secondary research as described in the ComEd EUL research memo dated May 2018.

‡ Values may not sum due to rounding.

Source: ComEd tracking data and Navigant team analysis

Table 4-2. Bridge Period Demand Savings by Measure‡

Measure Type	Research Category	Ex Ante Gross Savings (kW)	Verified Gross Realization Rate	Verified Gross Savings (kW)	NTGR *	Verified Net Savings (kW)	Effective Useful Life (EUL)†
Optimization	Optimization	14	79%	11	0.95	10	7
Repair	Repair	8	0%	0	0.95	0	7
Retrofit	Retrofit	0	NA	0	0.95	0	7
Scheduling	Scheduling	0	NA	0	0.95	0	7
Total		22	50%	11		10	

* A deemed value. Source: ComEd_NTG_History_and_PY9_Recommendations_2016-02-26_Final.xlsx, which is to be found on the IL SAG web site here: http://ilsag.info/net-to-gross-framework.html.

† EUL is a combination of technical measure life and persistence. There is currently no prior established EUL for RCx measures. The EUL value in this table is a project-level value based on established secondary research as described in the ComEd EUL research memo dated May 2018.

‡ Values may not sum due to rounding.

Source: ComEd tracking data and Navigant team analysis

Table 4-3. Bridge Period Therm Savings by Measure‡

Measure Type	Research Category	Ex Ante Gross Savings (Therms)	Verified Gross Realization Rate	Verified Gross Savings (Therms)	NTGR *	Verified Net Savings (Therms)	Effective Useful Life (EUL)†
Optimization	Optimization	5,277	100%	5,277	1.02	5,383	7
Repair	Repair	0	NA	0	1.02	0	7
Retrofit	Retrofit	5,743	72%	4,132	1.02	4,215	7
Scheduling	Scheduling	11,334	75%	8,479	1.02	8,649	7
Total		22,354	80%	17,888		18,246	

* A deemed value. Source: Nicor_Gas_GPY6_NTG_Values_2016-02-29_Final.xlsx, which is to be found on the IL SAG web site here: http://ilsag.info/net-to-gross-framework.html.

† EUL is a combination of technical measure life and persistence. There is currently no prior established EUL for RCx measures. The EUL value in this table is a project-level value based on established secondary research as described in the ComEd EUL research memo dated May 2018.

‡ Values may not sum due to rounding.

Source: ComEd tracking data and Navigant team analysis.

5. Impact Analysis Detail

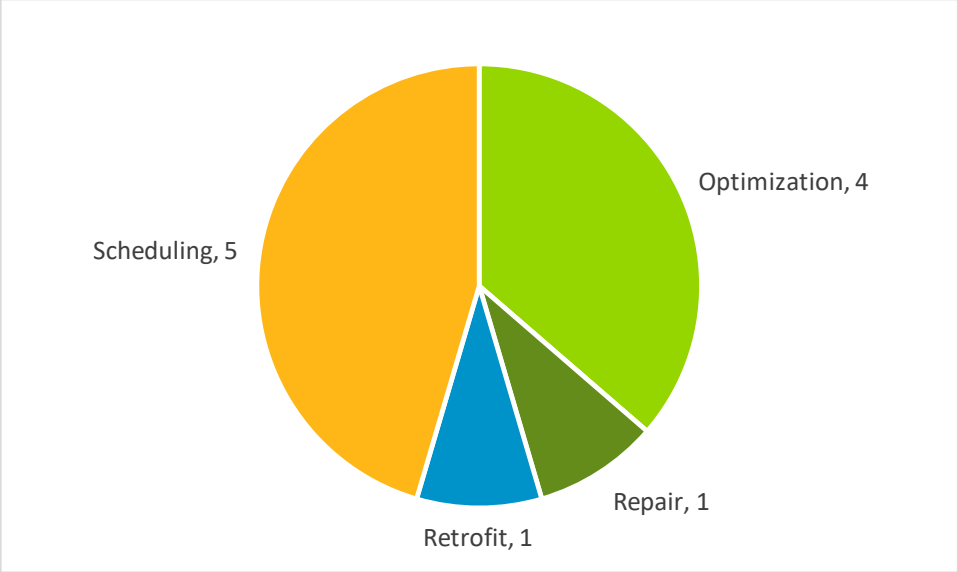
Navigant conducted an engineering review of reported impacts for both projects submitted during the bridge period. Each of the 11 reported measures were supported by custom calculations. The impact analysis included measure-by-measure calculation reviews to determine the accuracy of the methodology, analysis of data, and reasonableness of engineering assumptions.

Generally, retro-commissioning measures can be grouped into four broad categories.

- Scheduling measures are those based on improving energy consumption based on the time-of-day or year.
- Optimization measures utilize controls that monitor physical parameters for feedback to adjust operations to reduce energy use, such as duct pressure or outdoor conditions.
- Repair measures address missed or deferred maintenance of damaged or broken components, such as damper linkages.
- Retrofit and replacement measures include lower-cost equipment such as higher-quality filter media or broken occupancy sensors.

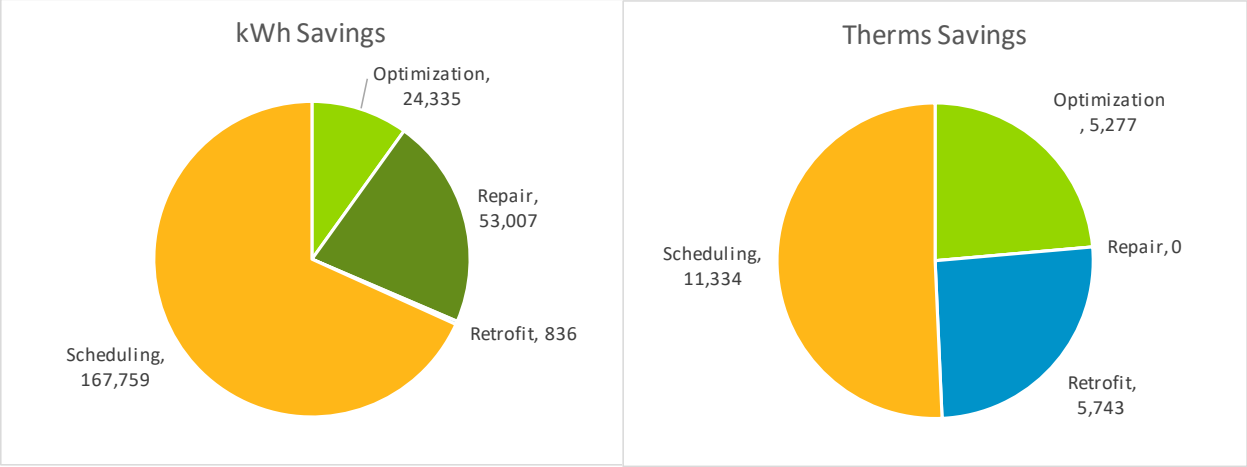
The public sector participation and measures are shown in the following tables and graphs. All gas savings originate from Nicor Gas customers. Figures summarize bridge period measures according to the categorization described here.

Figure 5-1. Number of Measures Installed by Type



Source: Evaluation Analysis

Figure 5-2. Savings by Type



Source: Evaluation Analysis

6. Program Impact Analysis Findings and Recommendations

The following sections present program energy and demand savings.

6.1 Impact Parameter Estimates

The RCx Program uses custom calculations. There are no individual universal parameters to evaluate.

6.2 Other Impact Findings and Recommendations

Finding 1: Reported savings often did not match calculations submitted for evaluation and verification review.
Recommendation 1: Implement quality control protocols to ensure that reported savings match project documentation.

Finding 2: Savings rely heavily on assumptions and rules-of-thumb. These assumptions are inconsistently applied. For example, the calculations might include 70%, 85% or 100% motor loading at design conditions. Different values are used within measures and projects and between projects with no justification for differences.
Recommendation 2: Encourage more measurement of parameters rather than relying on rules-of-thumb and assumptions. Measured parameters and functional tests are the crux of retro-commissioning. Without measurements and tests, the program deliverable is only an energy study.
Recommendation 3: Choose and enforce consistent and conservative assumptions when measurements are not included. For example, research has shown average motor loading between 60% and 70% over many studies and situations. Other assumptions for fan, pump, motor and drive efficiency should also be based on research and tilt toward underestimating savings (conservative) when there is uncertainty. The Nexant M&V Guidelines for RCx programs encode best practice research findings and should be leveraged whenever site-specific measurements are not available.

Finding 3: Demand savings of 8.3 kW were reported for a variable frequency drive (VFD) repair measure, however there are no demand savings for this measure because the motor is expected to be running at maximum design speed during peak demand hours.
Recommendation 4: Demand savings will generally be low or zero for weather dependent control measures in summer peak periods, since equipment is expected to be running at full design operating points during peak weather conditions. In cases where demand savings are expected, provide clear backup measurements and calculations supporting the reported demand savings.

7. Appendix 1. Impact Analysis Methodology

7.1 Verified Gross Program Savings Analysis Approach

For the EPY9/GPY6 bridge period, the Public Sector RCx Program impact evaluation included review of a census of two completed projects. Due to the limited results for the program during the bridge period, the evaluation consisted only of an engineering desk-review and no on-site verification. Evaluators reviewed gross program impacts with a project-by-project and measure-by-measure approach. Savings calculation reviews ensure the savings estimates are accurately modeled and include reasonable assumptions, as required. For projects where operating data are available, the impact evaluation includes analysis of time-

series trend and measured data, both pre- and post- implementation. The completed public sector projects were notable for their lack of measured or trended data.

All analysis is rolled-up to realization rate impact parameter estimates for electric energy, electric demand, and natural gas energy savings. Service providers estimate energy and demand savings with custom algorithms, frequently using hourly weather data and time-series trend data. As such, the Navigant team conducted research to validate the savings individually for all measures in the evaluation sample.

For the Public Sector RCx Program, Navigant reviewed a census of the two completed projects and associated measures. Navigant reviewed savings estimates to ensure calculations were accurate and based on data or reasonable assumptions, when necessary. No on-site verification was attempted with these projects. The lifetime energy and demand savings are estimated by multiplying the verified savings by the effective useful life for each measure. The Navigant team conducted research to validate the parameters that were not specified in the TRM.

7.2 Verified Net Program Savings Analysis Approach

Because the sample included a census of program savings, measure and project level evaluation results were summed and reported as gross savings without further adjustment. Deemed net-to-gross (NTG) ratios were applied to verified gross results to arrive at net impacts.

8. Appendix 2. Impact Analysis Detail

For both public sector projects, Navigant reviewed measure implementation plans, assumptions and calculations in detail. In general, Navigant found the calculations accurately constructed and reasonably transparent in spreadsheet form, but based on rules-of-thumb and assumptions more than measured data. In some instances, we found calculation errors due to spreadsheet equation errors, erroneous inputs, and inconsistencies in assumptions. Documentation for both projects did not match reported savings for most measures. As a result, the evaluation worked with the documented estimates rather than the reported values.

Research findings gross realization rates are the result of analysis of individual measures for each project in the impact sample. Table 8-1 details the realization rates by project. Realization rates for energy varying by more than 10 percent from 1.0 are due to reasons noted. The wide variation in demand realization rates is caused by inconsistent ex ante calculation methodologies and is not discussed in detail in the table.

Both projects were submitted by the same service provider so ex ante methods were similar.

Table 8-1. Project Level Realization Rates

Project	Realization Rates			
	kWh	kW	Therms	Notes on ex ante estimates
School 1	76%	50%	75%	Reported savings for most measures did not agree with documentation. Motor loading estimates were high without supporting documentation. Demand savings were not fully coincident with summer peak hours.
School 2	103%	NA	122%	Reported savings for most measures did not agree with documentation. Motor loading estimates were high without supporting documentation.

9. APPENDIX 3. TRC DETAIL

The following data is for the calculation of the Total Resource Cost test benefit/cost ratios. Table 9-1 shows the total resource cost savings summary for the Public Sector RCx Program.

Table 9-1. Total Resource Cost Savings Summary

Projects	Units	Quantity	Effective Useful Life	Ex Ante kWh	Ex Ante kW	Ex Ante Therms	Verified kWh Savings	Verified kW Savings	Verified Therms Savings
ComEd	Project	2	9	245,937	22	NA	200,539	11	NA
Nicor Gas	Project	2	9	NA	NA	22,355	NA	NA	17,888

The Total Resource Cost (TRC) variable table only includes cost-effectiveness analysis inputs available at the time of finalizing this PY9 impact evaluation report. Additional required cost data (e.g., measure costs, program level incentive and non-incentive costs) are not included in this table and will be provided to evaluation later. Further, detail in this table (e.g., EULs) other than final PY9 savings and program data are subject to change and are not final.

APPENDIX D. COORDINATED UTILITIES RCX EPY9-GPY6 NTG MEMO 2018-10-17

NAVIGANT

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To: Erin Daughton, Rick Tonielli, ComEd; Randy Opdyke, Bruce Liu, Anthony Lopez, Scott Dimetrosky, Katie Parkinson, Nicor Gas; Christina Pagnusat, Omy Garcia, Heidi Gorrill, Katie Baehring, Richard Boehnke, Erin Stitz, PGL/NSG

CC: Jennifer Morris, ICC Staff; Randy Gunn, Jeff Erickson, Rob Neumann

From: Sharon Mullen, Roger Hill, Kevin Grabner

Date: August 25, 2018 (Interim Update September 14, 2018)

Re: Net-to-Gross Research Results from EPY9/GPY6 for the Coordinated Utility Retro-Commissioning Program

Introduction

This memo presents our free ridership and spillover research results for the EPY9/GPY6 Coordinated Utility Retro-Commissioning Program (Retro-Commissioning) among ComEd, Nicor Gas, Peoples Gas (PGL) and North Shore Gas (NSG) using the Illinois TRM version 6.0 methodologies.[1] The net-to-gross (NTG) research was conducted by surveying EPY9/GPY6 participants in November 2017 and February 2018 and interviewing participating service providers in March and April 2018. The focus of the research was to capture a representative sample of traditional RCx, RCxpress and Tune-Up participants and a representative sample of participating service providers. The participant and service provider free ridership and spillover results combined provide new findings to inform the CY2019 NTG discussions in September 2018.

Table 1 below provides a summary of the participant free ridership and spillover research findings for the two different algorithm options included in the NTG TRM. Overall, 19 participant surveys were completed, including two Traditional RCx, five RCxpress and 12 Tune-Up participants. Navigant completed 11 service provider interviews.

[1] Illinois Statewide Technical Reference Manual for Energy Efficiency, Version 6.0, Volume 4: Cross-Cutting Measures and Attachments, effective January 1st, 2018.

Table 1. Participant Free Ridership and Spillover Results

NTG Option	Program Path	Participant Free Ridership, (Weighted)	Participant Spillover	Sample (n)	Relative Precision @90% CI
Option 1	Traditional RCx*	0.24	0	2	25.9%
	RCXpress	0.09	0	5	4.8%
	Tune-Up	0.14	0	12	6.2%
	Population Roll-up	**0.13**	**0**	**19**	**1.6%**
Option 2	Traditional RCx*	0.31	0	2	20.7%
	RCXpress	0.10	0	5	4.4%
	Tune-Up	0.15	0	12	6.3%
	Population Roll-up	**0.14**	**0**	**19**	**2.0%**

* Free ridership results are not statistically significant due to the small number of responses.
Source: Navigant analysis of data from a telephone survey conducted by Navigant with EPY9/GPY6 Retro-Commissioning Program participants. MBCx was not evaluated for this program year.

Free Ridership and Spillover Research Data Collection

Navigant conducted the free ridership and spillover research following a self-report approach with program participants and with participating service providers. The participant research involved a telephone survey with an attempted census of 78 unique EPY9/GPY6 participants. We achieved a response rate of 28 percent by count across the three paths, while experiencing 17 percent unreturned voice mail messages, 13 percent refusal to participate in the survey, and 12 percent inaccurate contact information. The service provider research involved telephone interviews with 11 program service providers from an attempted census of 25 partner companies. Although the service provider response rate was 44 percent by count, the respondents were responsible for 71 percent of the savings generated through the program. The counts for the completed participant survey, service provider interviews, and sample design are outlined in Table 2.

Table 2. Free Ridership and Spillover Research Survey and Interview Disposition

Respondents	Unique Contacts	Target Completes	Actual Completes	Free Ridership Sample (n)	Percent Savings Represented
Participant Decision Makers	78	Census	19	19	12%
Electric					12%
Gas					4.5%
Service Providers	25	Census	11	11	71%

Source: Coordinated Retro-Commissioning EPY9/GPY6 Participant Survey responses.

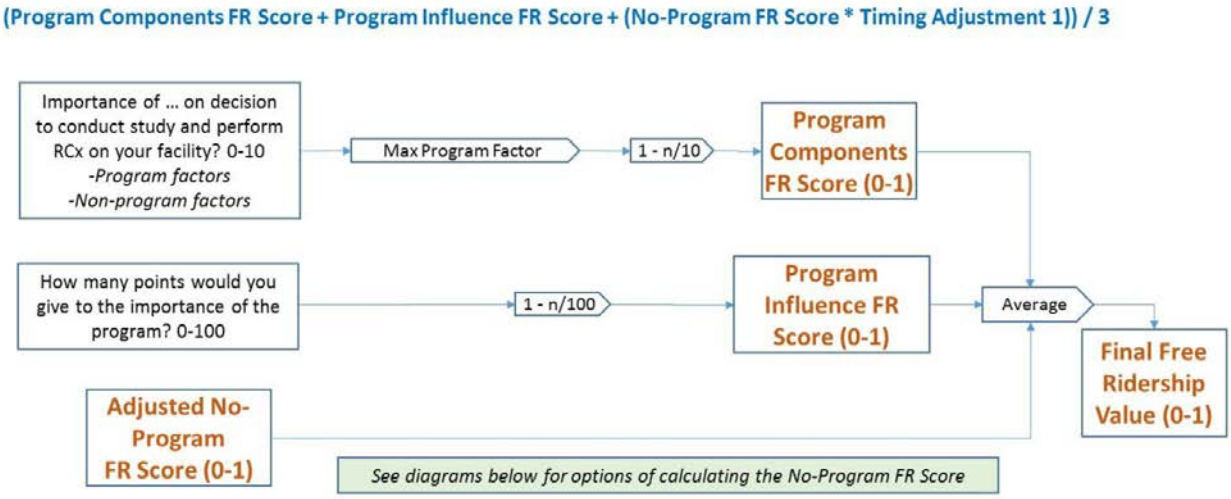
Following a low response rate to our participant survey in EPY8/GPY5, we took steps to improve the response this year. These steps include having the implementer email participants to take the survey before fielding the survey for both Waves and having a call center available to accept return-calls to take the survey during extended business hours. Participants from the Wave 1 sample who had fewer than two voice mail messages were contacted again with Wave 2. All participants were contacted up to five times or until they participated in the survey, refused to participate, or we discovered incorrect contact

information. We will take additional steps in the future, including advanced email scheduling of appointments to conduct the survey.

Free Ridership Estimates

The following diagrams describe the TRM participant free ridership algorithms for commercial and industrial study-based programs. Figure 1 shows an overview of the framework which allows for two options for computing score 3. These two variants are shown graphically in Figure 2 and Figure 3 below.

Figure 1 Study-Based Free Ridership Overview



Source: Illinois TRM Version 6, Volume 4. Cross-Cutting Measures and Attachments, final February 8, 2017, effective January 1st, 2018.

Figure 2. Study-Based Free Ridership – No-Program FR Score Option #1

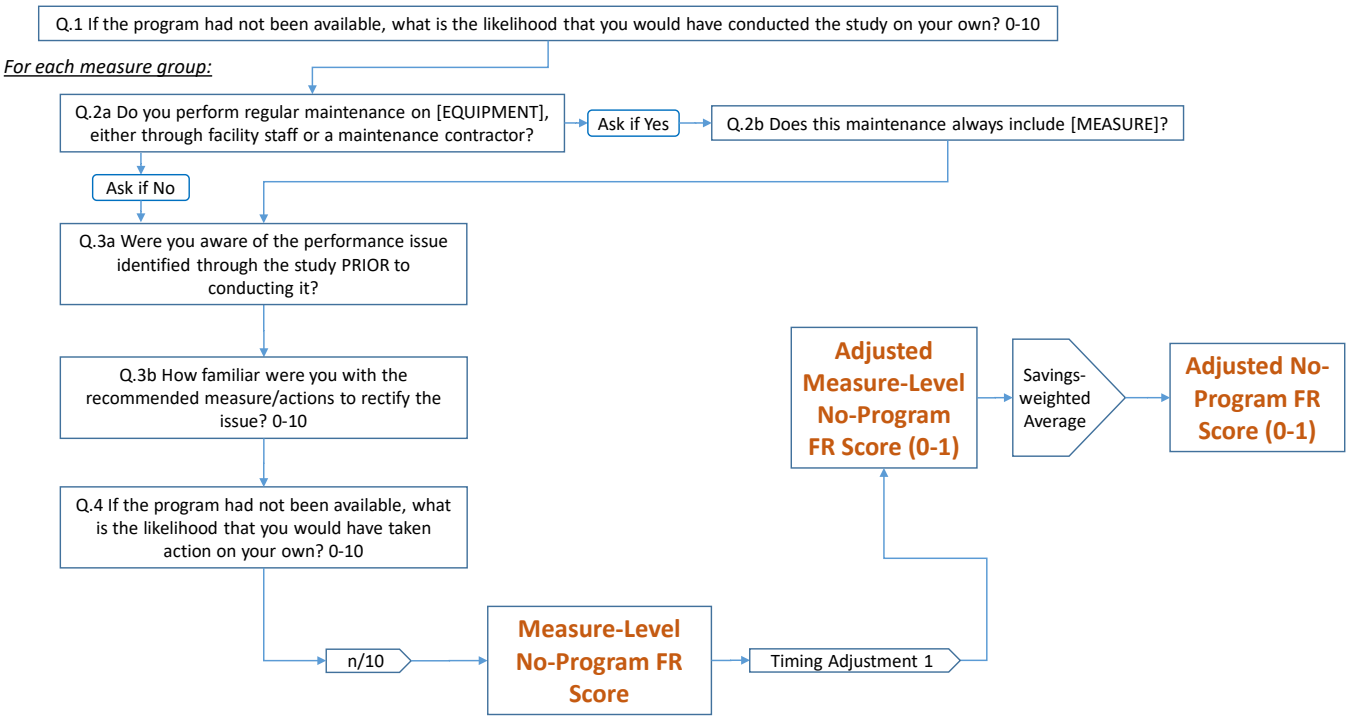
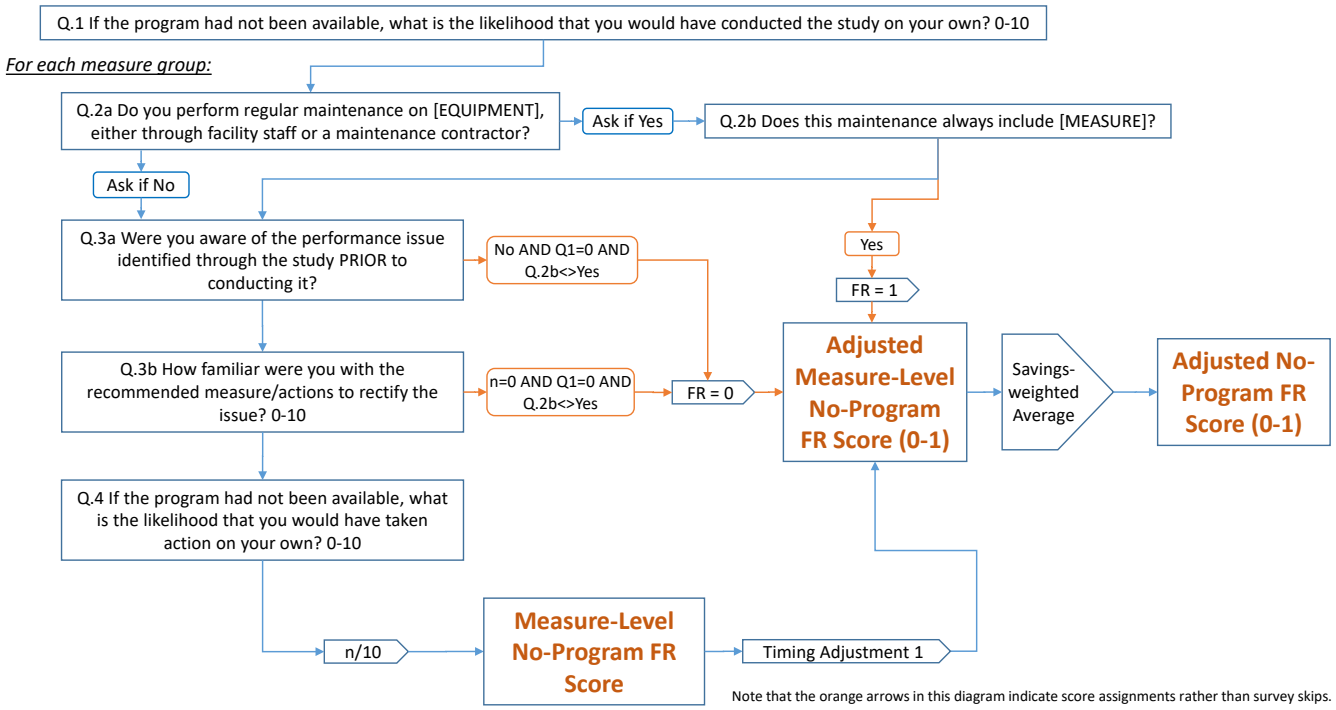


Figure 3. Study-Based Free Ridership – No Program FR Score Option #2



For the participant research, Navigant applied the algorithms indicated by the TRM version 6.0 to the data we collected from the EPY9/GPY6 Retro-Commissioning Program participants. To achieve the Program Influence score, we expanded the program factor/non-program factor rating questions with follow up questions to determine if this Retro-Commissioning Program was influential when considering, for example, previous experience with retro-commissioning, peer recommendations or trade organizations. We then prompted respondents with their three highest rated program factors when assigning points to the importance of the program and non-program factors.

The TRM protocol requires the free ridership analysis to include an adjusted no-program free ridership score. This adjustment is determined by querying the decision maker about 1) the likelihood of conducting the study on their own had the program not been available and 2) how they addressed various implemented measures or actions prior to participating in the program. Results of our free ridership calculations using the two options are shown in Table 1.

Table 3 below shows the average for each component free ridership score by program path. The free ridership algorithm is applied to individual respondents, and then those respondent free ridership values are savings weighted for the final free ridership.

Table 3. Free Ridership Component

Program Path	Program Component FR Score	Program Influence FR Score	Adjusted No-Program Score (Weighted):
Traditional RCx (n=2)	10%	40%	9%
RCXpress (n=5)	0%	20%	1%
Tune-Up (n=12)	8%	35%	1%

Navigant recommends the results from Option #1 because that option yields a more balanced representation of free ridership in that it considers the full body of evidence regarding no-program behavior in computing the No-Program FR Score. In contrast, Option #2 goes straight to a FR value of 0 (NTGR of 1.0) solely based on the decisionmaker self-reported responses that their routine maintenance excludes the incented equipment. This option does not consider other no-program evidence when computing the No-Program FR score. This essentially ignores the effect of the other no-program actions for such answer combinations, which in our view is inappropriate. This option also violates the general principal in the TRM that the NTG value should not be dependent on a single question.

For the service provider research, Navigant interviewed service providers on participant free ridership, asking the following questions:

> According to program records, you completed Retro-Commissioning studies between June 2016 and December 2017. If the program did not exist this year, how many studies do you think you would have completed in the same period?
>
> Again, thinking about the program studies that you completed between June 2016 and December 2017, if the program did not exist this year, how many studies *of comparable breadth and depth* do you think you would have completed in the same period?
>
> According to program records, between June 2016 and December 2017 your program participants went on to achieve [RSPSAVINGS] from implementing recommended energy efficiency improvements. What percent of these savings do you think those customers would have achieved if the program did not exist this year?

Navigant found that the free ridership as reported by service providers was 0.025, while the free ridership as reported by participants was 0.13.

Combining Participant and Service Provider Results. Navigant calculated a weighted average of the participant and service provider free ridership utilizing the proposed triangulation approach[2] shown in Table 4 to arrive at one recommended free ridership score. Navigant rated the survey data on three aspects: accuracy, validity, and representativeness, using a scale of 0 to 10 where 10 means “extremely so” and 0 means “not at all”.

[2] The triangulation approach is presented in TRM version 6.0 for residential rebate programs and is proposed for all sectors as an update to TRM version 7.0.

Table 4. Triangulation Weighting Approach

NTG Triangulation Data and Analysis	Participants	Service Providers
How likely is this approach to provide an accurate estimate of free ridership?	6	8
How valid is the data collected/analysis?	5	5
How representative is the sample for Electric?	1.2	7.1
How representative is the sample for Gas?	0.1	7.1
Electric		
Average Score	4.1	6.7
Sum of Averages	10.8	10.8
Weight	**0.38**	**0.62**
Gas		
Average Score	3.7	6.7
Sum of Averages	10.4	10.4
Weight	**0.36**	**0.64**

Source: Coordinated Retro-Commissioning EPY9/GPY6 Participant and Service Provider survey responses.

Navigant arrived at the value for accuracy based on our understanding of the difference between participant and service provider understanding of the marketplace and likelihood of customers engaging in the study and recommended improvements without the program: we rate the trade ally data as more accurate than the participant data. Validity of the data is consistent for both populations. The representativeness was based on the savings the respondents contributed to the program, calculated at 100 * XX% of savings delivered by the respondents (i.e., electric participants at [100 * 12%], service providers at [100 * 71%]. The weights were determined by [(average score) / (sum of averages)]. These weights were subsequently applied to the researched NTG value for the participants and service providers, then added together:

Free Ridership = ((Participant FR) * (Participant Weight)) +
((Service Provider FR) * (Service Provider Weight))
Free Ridership = 13.0% * 0.36 + 2.5% * 0.64 = 6%

Navigant recommends using the weighted free ridership estimate of 6% achieved through this triangulation of 13 percent reported by the participants and 2.5 percent reported by service providers. The triangulation weighting reflects the service providers' greater understanding of the market and higher representation of the energy savings achieved through the program.

Participant Spillover

Navigant asked the participants if they had implemented or installed additional energy savings measures to reduce consumption at their facility since participating in the Retro-Commissioning Program. Navigant included questions to identify spillover candidates and measures, paraphrased below:

- Since completing your project, have you adopted any additional energy efficient operational improvements? What did you implement?

- How important was your experience in the Retro-Commissioning Program in your decision to make these additional changes? Please use a 0-10 scale, where 0 means 'not at all important', and 10 means 'extremely important'?

Participants did not report having implemented or installed additional operations or measures to save energy at their facilities since participating in the program. As a result, Navigant estimated participant spillover at zero.

Trade Ally Spillover

From interviews with the 11 service providers, Navigant identified none who responded with any percentage of their sales that were potential spillover. To determine whether the sales were spillover, Navigant analyzed responses from questions including:

- Have you conducted any studies with ComEd-territory customers without program rebates?
- How influential do you think the program was on these additional studies conducted without program rebates?
- Thinking about the savings that those non-rebated studies achieved, how would you describe those savings in terms of the savings that your studies achieved through the program?

Navigant determined that none of the 11 service providers reported any potential spillover.

NTG Results

The NTG research results for the two fuel types represented in the Coordinated Retro-Commissioning Program are summarized in Table 5.

Table 5. Summary of Free Ridership, Spillover and NTGR Research Results for the Coordinated Utility Retro-Commissioning Program

Fuel Type	Free Ridership	Participant Spillover	Trade Ally Spillover	Non-participant Spillover	NTGR
Electric	0.06	0.00	0.00	0.00	0.94
Gas	0.06	0.00	0.00	0.00	0.94

NTGR = 1 – FR + PSO + TSO + NPSO
FR = Participant Free Ridership; PSO = Participant Spillover; TSO = Trade Ally Spillover; NPSO = Non-Participant Spillover
Source: Navigant analysis of data from telephone surveys conducted by Navigant with EPY9/GPY6 Retro-Commissioning Program participants and service providers. MBCx was not evaluated for this program year.

NTG Comparison with Previous Research

For comparison, the NTG results we reported previously[3] using EPY6 and GPY1 program participants and participating service providers are presented below.

[3] Evaluation Report: Northern Illinois Joint Utility Retro-Commissioning Program Report, January 14, 2013.

Table 6. Participant NTG Estimates (EPY6 and GPY1 Participants)

	Participant		Service Provider		Overall	
	Electricity	Gas	Electricity	Gas	Electricity	Gas
Net-of-Free-riders	0.91	0.82	0.90	0.998	0.91	0.91
Spillover	<0.01	<0.01	0.04	0.11	0.04	0.11
Overall NTG	**0.91**	**0.82**	**0.94**	**1.10**	**0.95**	**1.025**

Source: Navigant analysis of EPY6 and GPY1 Participant and Service Provider responses.

The overall electricity NTG value was updated to 0.95 by combining participant and service provider survey research results from EPY6[4]: electric free ridership (nine percent) and spillover (four percent).

[4]Joint Utility Retro-Commissioning Program EPY6/GPY3 Evaluation Report, March 24, 2015.

Appendix 1: ComEd Retro-Commissioning Program NTG History

	Retro-Commissioning
EPY1	**NTG** 0.8 **Free-Ridership** 0% **Spillover** 0% **Method**: Program *ex ante* assumption. Customer self-report. Two completed surveys from a population of four participants bracketed the assumed NTG. Basic method.
EPY2	**NTG** 0.916 **Free-Ridership** 8.4% **Spillover** 0% **Method**: Customer self-report. Five surveys completed from an attempted census of a population of thirteen. Basic method.
EPY3	**NTG** 0.71 **Free-Ridership** 28.7% **Spillover** 0% **Method**: Customer self-report. Eight surveys completed from an attempted census of a population of 34 participants. Basic method.
EPY4	**Deemed NTG of 0.916 from EPY2** **Research NTG** 1.04 **Free-Ridership 0.097** **Spillover 0.136** **Method**: Program *ex ante* assumption and stipulated for EPY4. NTG based on EPY2 research. EPY3 research rejected due to small ratio of completed surveys.
EPY5	SAG Consensus: • 0.71
EPY6	SAG Consensus: • 1.04
EPY7	**NTG: 1.04** There was no new NTG research in EPY5. The most recent NTG research is from PY4. **Free-Ridership: 0.10.** The PY4 Free-Ridership ratio is an equally weighted average of savings-weighted participant and service provider Free-Ridership scores. **Participant spillover: 0.14.** Source: Participant and trade ally surveys. (Includes spillover from trade allies that account for 94% of program participation) **Nonparticipant spillover: Negligible.** There is no evidence of non-participant spillover. Service providers are dropped from the program if they are not generating projects. If they are not generating projects in the program, they are probably not generating them outside the program.
EPY8	**Recommendation (based upon PY6 research):** **NTG: 0.95 (electric)** **Free Ridership: 0.09 (electric)** **Spillover: 0.04 (electric)** Spillover and Free-Ridership were calculated from self-report interviews with participants and service providers (n=18). The final EPY6 Free-Ridership ratio is an equally weighted average of savings-weighted participant and RSP Free-Ridership. Interviewed service providers account for 92% of electric savings.

	Retro-Commissioning
	NTG research was not conducted for the gas companies.
EPY9	**NTG: 0.95 (electric)** **Free Ridership: 0.09 (electric)** **Spillover: 0.04 (electric)** **NTG Source:** Free-Ridership and Spillover: PY6 NTG Research
EPY10	**NTG: 0.95 (electric)** **Free Ridership: 0.09 (electric)** **Spillover: 0.04 (electric)** **NTG Source:** Free-Ridership and Spillover: PY6 NTG Research Due to limited sample size of PY8 NTG research, EPY8 results will be included in EPY9 research and analysis.

Source: http://ilsagfiles.org/SAG_files/NTG/2017_NTG_Meetings/Final/ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.pdf

Appendix 2: People Gas (PGL) and North Shore Gas (NSG) Retro-Commissioning Program NTG History

	Retro-Commissioning
GPY1	**NTG** 1.02 **Free ridership** 0.09 **Participant Spillover** 0.11 **Method and Source**: Evaluation research consisting of GPY1 participating customer and Retro-Commissioning Service Provider self-reports. Interviews conducted with 9 of 15 participants from Peoples Gas and North Shore Gas and eight of nine Service Providers. Participant and Service Provider spillover researched. **Peoples Gas: Verified Gross Realization Rate:** 1.06 **North Shore Gas: Verified Gross Realization Rate:** 1.20
GPY2	**Peoples Gas: Deemed NTG** 1.02; **Free ridership** 0.09; **Participant Spillover:** 0.11 **North Shore Gas: Deemed NTG** 1.02; **Free ridership** 0.09; **Participant Spillover:** 0.11 **Method and Source**: Deemed by SAG consensus from GPY1 evaluation research. **Peoples Gas: Verified Gross Realization Rate:** 1.04 **North Shore Gas: Verified Gross Realization Rate:** no savings installed
GPY3	**Peoples Gas: Deemed NTG** 1.02; **Free ridership** 0.09; **Participant Spillover:** 0.11 **North Shore Gas: Deemed NTG** 1.02; **Free ridership** 0.09; **Participant Spillover:** 0.11 **Method and Source**: Deemed by SAG consensus from GPY1 evaluation research. **Peoples Gas: Verified Gross Realization Rate:** 1.00 **North Shore Gas: Verified Gross Realization Rate:** 1.00
GPY4	**NTG** 1.02; **Free ridership** 0.09; **Participant Spillover:** 0.11 **Method and Source**: Deemed by SAG consensus. Values based on GPY1 evaluation research.
GPY5	**NTG** 1.02; **Free ridership** 0.09; **Participant Spillover:** 0.11 **Method and Source**: No new research. Values based on GPY1 evaluation research.
GPY6	**NTG** 1.02; **Free ridership** 0.09; **Participant Spillover:** 0.11 **Method and Source**: No new research. Values based on GPY1 evaluation research.
GPY7	**NTG:** 1.02 **Method**: No new research. Retained GPY6 final value.

Source: http://ilsagfiles.org/SAG_files/NTG/2017_NTG_Meetings/Final/PGL_and_NSG_NTG_Summary_GPY1-7_2017-03-01_Final.pdf

Appendix 3: Nicor Gas Retro-Commissioning Program NTG History

	Retro-Commissioning
GPY1	**NTG** 1.02 **Free ridership** 9% **Spillover** 11% **Method**: Customer and service provider self-report. NTG based on GPY1 research – 11 participants with gas savings and eight of nine service providers surveyed. Enhanced method. Participant and Service Provider spillover researched.
GPY2	**NTG** 1.02 **Free ridership** 9% **Spillover** 11% **Method**: SAG deemed NTG ratio based on GPY1 evaluation research.
GPY3	**NTG** 1.02 **Free ridership** 9% **Spillover** 11% **Method**: SAG deemed NTG ratio based on GPY1 evaluation research.
GPY4	**NTG** 1.02 **Free ridership** 9% **Spillover** 11% **Method**: NTG values for GPY4 were deemed using values from GPY3, and reported in Table 14 of the Nicor Gas filed Energy Efficiency Plan for GPY4-GPY6.
GPY5	**NTG** 1.02 **Free ridership** 9% **Spillover** 11% **Method**: No new research. Values based on GPY1 evaluation research.
GPY6	**NTG** 1.02 **Free ridership** 9% **Spillover** 11% **Method**: No new research. Values based on GPY1 evaluation research.
GPY7	**NTG:** 1.02 **Method**: No new research. Retained GPY6 final value.

Source: http://ilsagfiles.org/SAG_files/NTG/2017_NTG_Meetings/Final/Nicor_Gas_NTG_Summary_GPY1-7_2017-03-01_Final.pdf

Appendix 4: Survey Instruments

ComEd C&I Retro-Commissioning Program
RCx Participant Survey
August 8, 2017

	Topics	Questions
Background	Subject background	B1-B3
	Project background	B4-B5B
Marketing and Outreach	Program awareness, best methods to reach customer, most persuasive content	MK1-MK7
Free Ridership Program Factors	Program factors, including the free study, incentive, assistance, program-affiliated recommendations	FR1-FR1G, FR2
	Potential Program factors, including previous experience, organizational policy.	FR1H-FR1M
	Counterfactual	INC1-FR3
Spillover & Channeling	Incentive-eligible measures installed without applying for incentives	SO1-SO2B
	Participation in additional programs; additional facilities participating in RCx	CH1-CH2B
Program Design	Building Operator Training	PD4-PD5A
	Program elements, energy benefits, non-energy benefits	PS1-PS2
Program Satisfaction	Recommendations and Feedback	PS3-PS4
	Ownership, FTE, business size	F1-F2
Firmographics	Incentive-eligible measures installed without applying for incentives	SO1-SO2B

Note: The survey questions and measure loops will allow data collection to estimate free ridership and spillover for the gas utility program partners (Nicor Gas, Peoples Gas, and North Shore Gas).

Sample Fields

ODCID
PHONE
CALLCENTER
CONTACTNAME
PATH
FACILITY
ADDRESS
DATE
CXAGENT
MEASNUM
NSAME
ESO
SPR
ESP
SCHEDUELING_MEASURE
OPTIMIZATION_MEASURE1
OPTIMIZATION_MEASURE2
MEASURE_LIST
STUDY_VALUE
PATH

Introduction
Hello, this is _____ from <**CALLCENTER**> calling on behalf of ComEd regarding your company's participation in the Retro-Commissioning Building **<PATH>** Program. May I please speak with <**CONTACTNAME**>?

Our records show that <**FACILITY**> participated in the ComEd Energy Efficiency Retro-Commissioning Program. I am calling to conduct a follow-up study about your firm's participation. I was told you're the person most knowledgeable and most involved with the retro-commissioning process. Is this correct? [IF NOT, ASK TO BE TRANSFERRED TO DECISION MAKER OR SOMEONE FAMILIAR WITH THE BASIS FOR THE DECISION TO PARTICIPATE. RECORD NAME & NUMBER.]

[IF NEITHER DECISION MAKER OR SOMEONE FAMILIAR WITH THE BASIS FOR THE DECISION TO PARTICIPATE, TERMINATE AND CALL REFERRAL]

This survey will take about 25 minutes. To thank you for your time, we would like to send you a $50 VISA gift card for completing this survey. Is now a good time? [If no, schedule call-back]

(IF NEEDED: Is it possible that someone else dealt with the retro-commissioning project?)

Retro-Commissioning Background

Qualifiers

I would like to ask you a few questions about your company's decision to perform retro-commissioning at your facility.

Q1 First, according to our records, you participated in the <PATH> Program run by ComEd.
[IF NEEDED: (All but MBCx) The Program promotes energy efficiency improvements in commercial facilities. The program offers fully-funded technical assessments to identify and implement applicable, low-cost savings measures. (For MBCx) The program promotes energy efficiency improvements in commercial facilities. It offers $0.07 per kWh of verified savings.]
Do you recall participating in this Program?
1. Yes
2. No
98. (Don't know)
99. (Refused)

[ASK IF Q1=1]
Q2. Next, I'd like to confirm the following information regarding your participation in the Program. I understand that you retro-commissioned <**FACILITY**> at <**ADDRESS**>. The retro-commissioning study was completed by <**CXAGENT**> and you implemented about <**MEASNUM**> improvement/improvements. Does that sound right?
1. Yes
2. No
00. Mostly correct (RECORD INCONSISTENCY)
98. (Don't know)
99. (Refused)

[ASK IF Q1=2,98,99 OR Q2=02,98,99]

INT70. (Thank respondent and ask if there is another person who might be familiar with the company's retro-commissioning experience. GATHER INFO THEN TERMINATE)

Name
Position
Phone
Email

Background

Interview Subject Background

B1. What is your role at <**FACILITY**> with respect to the Retro-commissioning Program?

1. Owner
2. Building or Facilities Manager
3. Building for Facility Engineer
0. Other [Detail]
98. (Don't know)
99. (Refused)

Project Background

B3. Please tell me why you decided to retro-commission this facility? [INTERVIEWER NOTE: Probe for additional reasons beyond that first offered.]

00. (RECORD VERBATIM) _____
98. (Don't know)
99. (Refused)

B4. What, if anything, were the main factors that kept you from performing retro-commissioning before this project? [PROGRAMMING NOTE: Multiple Response. Record first 4 responses. 98=Don't know, 99=Refused] [DO NOT READ.]

1. (Was not aware of retro-commissioning services)
2. (Did not understand the procedures and benefits of retro-commissioning)
3. (The cost of having a retro-commissioning study and report prepared was too high)
4. (Had inadequate in-house expertise to perform retro-commissioning)
5. (Had insufficient in-house staffing to carry out recommendations made in retro-commissioning report)
6.
7. (Not aware of qualified providers)
8. (Management was opposed to retro-commissioning)
9. (New facility and did not need recommissioning until now)

00. (Other, specify)
98. (Don't know)
99. (Refused)

Marketing and Outreach

MK1. How did you first hear about the <**PATH**>? [PROGRAMMING NOTE: Multiple Response. Record first 4 responses. 98=Don't know, 99=Refused] [DO NOT READ.]

1. Calling campaign by utility/implementer
2. Retro-commissioning service provider (RSP)
3. Trade Ally (TA) for another Energy Efficiency program
4. Nexant - the program implementer
5. ComEd Account manager
6. ComEd Website
7. Friend, colleague, or word of mouth
8. Contractor
9. ComEd's marketing material – case studies, fact sheets, marketing video
10. Nicor's marketing material – case studies, fact sheets, marketing video
11. People's Gas/North Shore Gas' marketing material – case studies, fact sheets, marketing video
12. Industry event or presentation
13. ComEd Energy Efficiency Program outreach staff
14. Email
15. E-Newsletters

00. (Other, specify)
98. (Don't know)
99. (Refused)

MK2. What source of information was most persuasive in convincing your company to participate in retro-commissioning?
[PROGRAMMING NOTE. Multiple Response. Record up to 3 responses. DO NOT READ.]

1. Presentation or workshop
2. Program overview sheet
3. Case Study
4. Utility website(s)
5. Direct Mail
6. Fact sheets
7. Program Forms

00. Other, please specify
98. (Don't know)
99. (Refused)

MK3. I'm going to list some information sources and I'd like you to tell me how useful you would find each option when you consider participating in a retro-commissioning program. Please rate the usefulness to you on a scale of 0 to 10, where 0 means 'Not at all useful' and 10 means 'Extremely useful'? [SCALE 0-10; 98=don't know, 99=Refused]

A. Case studies from businesses in your industry
B. Case studies from businesses that are approximately the same size as your business
C. Fact sheets detailing the program or retro-commissioning, in general

MK3AA. What other information would you find useful to in order to make a decision about participating in the program?

00. (OPEN END)
96. No other materials
98. (Don't know)

99. (Refused)

NTG Module

Free Ridership Program Factors

FR1. Now, I'm going to ask you to rate the importance of several factors that might have influenced your decision to conduct the retro-commissioning study and implement energy-saving improvements at your facility. Using a scale from 0 to 10, where 0 means 'not at all important' and 10 means 'extremely important', how important in your decision to conduct the study and commit the funding for retro-commissioning was… [FOR FR1A-N, RECORD 0 to 10; 96=Not Applicable; 98=Don't Know; 99=Refused.][If needed: How important in your DECISION to conduct the study and commit the funding to perform the ComEd sponsored retro-commissioning was…]

Program Factors [ROTATE FR1A-G]

FR1A. [Ask if Path <> MBCx] The free retro-commissioning study worth **<STUDY_VALUE>**

FR1Aa. [Ask if Path = MBCx] The retro-commissioning program incentives worth **<STUDY_VALUE>**

FR1B. The recommendation from **<CXAGENT>**

FR1C. The information from the Retro-Commissioning Program

FR1D. The recommendation from your ComEd Account Manager

FR1E. The technical assistance from <**CXAGENT**> to support recommendations

FR1F ComEd marketing materials or presentation

FR1G Information about the program from your gas utility

Potential Program Factors [ROTATE FR1H-L, End with FR1N]

FR1H. A recommendation from your company's management

FR1J. Previous experience with retro-commissioning

FR1Ja [Ask if FR1J >7, Otherwise, Skip] Did you receive a free retro-commissioning study from ComEd on your previous project?

1. Yes, we received a free study from ComEd
2. No free study from ComEd
98. Don't Know
99. Refused

FR1K. A recommendation from your peers – either internal or external

FR1Ka [Ask if FR1K >7, Otherwise, Skip] Did your peer specifically mention the retro-commissioning program from ComEd?

1. Yes
2. No
98. Don't Know
99. Refused

[*NOTE: FR1Ka=2 is a Non-Program Factor*]

FR1Kb [Ask if FR1K >7 and FR1Ka=1, Otherwise, Skip] Do you know if your peer received a free study or an incentive for retro-commissioning from ComEd?

1. Yes, a free study or incentive from ComEd
2. No incentive from ComEd
98. Don't Know
99. Refused

[*NOTE: FR1Kb=1, exclude, FR1Kb=2 is a Program Factor*]

FR1L. Trade organization publication or presentation

FR1La [Ask if FR1L >7, Otherwise, Skip] Did the article or presentation specifically mention ComEd or your gas company?

1. It specifically mentioned ComEd

2. It specifically mentioned my gas company
3. It was about retro-commissioning and did not specifically mention ComEd
98. Don't Know
99. Refused

[*NOTE: FR1La = 1 is a Program Factor*]

FR1M. Were there any other factors that we haven't discussed that were influential in your decision to perform the retro-commissioning?
00. Yes (please describe:)
96. No
98. (Don't know)
99. (Refused)

FR1Ma [Ask if FR1M = 00, Otherwise, Skip] How would you rate the influence of that factor, using the same 0-10 scale? [RECORD 0 to 10; 98=Don't Know; 99=Refused.]

FR1N. [Ask if FR1B, FR1C, FR1D, or FR1F is >7, Otherwise, Skip] What specific benefits of retro-commissioning did you learn from ComEd or your Service Provider that were important in your decision to conduct the study? [Open Ended, 98-Don't Know, 99-Refused]

FR2. If you were given a TOTAL of 100 points that reflect the importance in your decision to participate in this retro-commissioning project, and you had to divide those 100 points between 1) the program and 2) any other factors,

A. How many points would you give to the program? Program factors include [READ IN FIRST THREE HIGHEST FROM FR1A-G IF > 7].
Count of Program factor points _____ [Record 0-100, 998=Don't know, 999=Refused]

B. And how many of those same 100 points would you give to the importance of other factors, such as [READ IN FR1H, FR1j if FR1Ja = 2, FR1K if FR1Ka = 2, FR1L if FR1La = 2,]? [PROGRAMMING
Count of Non-Program factor points _____ [Record 0-100, 998=Don't know, 999=Refused]

NOTE: Responses should sum to 100.]

[SKIP IF OTHERPTS==FR2B OR FR2A=998,999 OR FR2B=998,999]

INC1. The last question asked you to divide a TOTAL of 100 points between the program and other factors. You just noted that you would give <QFR2A> points to factors like [READ IN FIRST THREE HIGHEST FROM FR1A-G IF > 7]. Does that mean you would give <OTHERPTS> points to other factors such as [READ IN FR1J if *FR1Ja=2, FR1K if FR1Ka=2,*]?
1. Yes
2. No [SKIP TO FR3]
98. (Don't know)
99. (Refused)

If (FR2A is >70 AND all FR1A-F are <3) OR (FR2B is <30 AND any FR1H-L is >7), then ask:

FR3. Could you tell me more about the importance of these factors in your decision to participate in the <**PATH**>?

Free Ridership Non-Program Factors

FR4. If the program had not been available, what is the likelihood that you would have conducted the study on your own? Please rate the likelihood on the 0-10 scale. [If necessary, "where 0 means extremely unlikely and 10 means extremely likely"] [SCALE 0-10, 98=Don't Know, 99=Refused]

NTG Measure Loops

<MEASURELOOP>

[PROGRAMMING NOTE: Sample data will include top two measure groups. Enter those two loops, disregarding the third, for each survey]

---BEGIN Scheduling and Optimization [Scheduling]---

Now I'm going to ask you a few questions about changes made through the program to your system schedules based on the time of day or year. An example would be adjusting air handler start times or implementing night set-backs. As you answer these questions, please think about the <SCHEDULING_MEASURE>.

FRML1_1. Prior to the retro-commissioning study, did you regularly modify the HVAC equipment scheduling, either with facility staff or a maintenance contractor?

1. Yes
2. No
98. (Don't know)
99. (Refused)

[Ask If FRML1_1=1, Else Skip]

FRML2_1. Do your equipment scheduling changes always follow recommendations from the retro-commissioning program?

1. Yes
2. No
98. (Don't know)
99. (Refused)

FRML3_1. Were you aware of the need to change equipment schedules using the building automation system prior to the retro-commissioning study?

1. Yes
2. No
98. (Don't know)
99. (Refused)

FRML4_1. How familiar were you with scheduling changes recommended through the retro-commissioning study? Please rate your familiarity on a scale of 0-10, where 0 means 'not at all familiar' and 10 means 'extremely familiar'.

[SCALE 0-10, 98=Don't Know, 99=Refused]

FRML5_1. How likely would you have been to implement the same recommended schedule without the Retro-commissioning Program? Please use a 0-10 scale, where 0 means 'not at all likely' and 10 means 'extremely likely'.

[SCALE 0-10, 98=Don't Know, 99=Refused]

FRML6_1. If the Retro-commissioning program had not existed, and you had not received the information and assistance from the program, do you think it's likely that you would have done all, some, or none of the recommended scheduling changes without the program?

1. All
2. Some
3. None
98. (Don't know)
99. (Refused)

[Ask If FRML6_1=1, 2 or 98, Else Skip]

FRML7_1. And, if the retro-commissioning program did not exist, when would your own scheduling project have taken place? Would it have been at the same time, within 1 year, 1-2 years later, 2-3 years later, 3-4 years later? Again, this is if the retro-commissioning program did not exist.

1. At the same time
2. Within 1 year
3. 1-2 years later
4. 2-3 years later
5. 3-4 years later
98. (Don't know)
99. (Refused)

---END Scheduling ---

<MEASURELOOP>

---BEGIN Optimization Measure 1 [**OPTIMIZATION_MEASURE1**]---

Now I'm going to ask you a few questions about systems optimized to respond to building loads or outdoor weather conditions. These measures might include setpoint changes in response to outdoor temperatures or economizer control. As you answer these questions, please think about the <OPTIMIZATION_MEASURE1>

FRML1_2. Prior to the retro-commissioning study, did you regularly check the equipment to find the optimal settings?

1. Yes
2. No
98. (Don't know)
99. (Refused)

[Ask If FRML1_2 =1, Else Skip to FR3_2]

FRML2_2. When you make changes to optimize settings on your own, do you always make these changes with the Building Automation System so those changes endure or persist?

1. Yes
2. No
98. (Don't know)
99. (Refused)

FRML3_2. Were you at all aware of the need to optimize settings prior to the retro-commissioning study?

1. Yes
2. No
98. (Don't know)
99. (Refused)

FRML4_2. How familiar were you with the task of optimizing the equipment settings as recommended through the retro-commissioning study? Please rate your familiarity on a scale of 0-10, where 0 means 'not at all familiar' and 10 means 'extremely familiar'. [SCALE 0-10, 98=Don't Know, 99=Refused]

FRML5_2. How likely would you have been to reset the equipment to save energy without the Retro-commissioning Program? Please use a 0-10 scale, where 0 means 'not at all likely' and 10 means 'extremely likely'. [SCALE 0-10, 98=Don't Know, 99=Refused]

FRML6_2. If the Retro-commissioning program had not existed, and you had not received the information and assistance from the program, do you think it's likely that you would have done all, some, or none of the same equipment optimization without the program?

1. All
2. Some
3. None
98. (Don't know)
99. (Refused)

[Ask If FRML6_2=1, 2 or 98, Else Skip]

FRML7_2. Would your own equipment setpoint optimization – without the Retro-commissioning Program -- have taken place at the same time, within 1 year, 1-2 years later, 2-3 years later, 3-4 years later? Again, this is without the retro-commissioning program.

1. At the same time
2. Within 1 year
3. 1-2 years later
4. 2-3 years later
5. 3-4 years later

---END <Optimization_Measure1> ---

<MEASURELOOP>

---BEGIN Optimization Measure 2 [<OPTIMIZATION_MEASURE2>]---

Now I'm going to ask you a few questions about systems optimized to respond to building loads or outdoor weather conditions. As you answer these questions, please think about the <OPTIMIZATION_MEASURE2>

FRML1_3. Prior to the retro-commissioning study, did you regularly check the equipment to find the optimal settings?

1. Yes
2. No
98. (Don't know)
99. (Refused)

[Ask If FRML1_3 =1, Else Skip]

FRML2_3. When you make changes to optimize settings on your own, do you always make these changes with the Building Automation System so those changes endure or persist?

1. Yes
2. No
98. (Don't know)
99. (Refused)

FRML3_3. Were you at all aware of the need to optimize settings prior to the retro-commissioning study?

1. Yes
2. No
98. (Don't know)
99. (Refused)

FRML4_3. How familiar were you with the task of optimizing the equipment settings as recommended through the retro-commissioning study? Please rate your familiarity on a scale of 0-10, where 0 means 'not at all familiar' and 10 means 'extremely familiar'. [SCALE 0-10, 98=Don't Know, 99=Refused]

FRML5_3. How likely would you have been to optimize the equipment to save energy without the Retro-commissioning Program? Please use a 0-10 scale, where 0 means 'not at all likely' and 10 means 'extremely likely'. [SCALE 0-10, 98=Don't Know, 99=Refused]

FRML6_3. If the Retro-commissioning program had not existed, and you had not received the information and assistance from the program, do you think it's likely that you would have done all, some, or none of the same equipment optimization without the program?

1. All
2. Some
3. None
98. (Don't know)
99. (Refused)

[Ask If FR6_3=1, 2 or 98, Else Skip]

FRML7_3. Would your own equipment setpoint optimization – without the Retro-commissioning Program -- have taken place at the same time, within 1 year, 1-2 years later, 2-3 years later, 3-4 years later? Again, this is without the retro-commissioning program.

1. At the same time
2. Within 1 year
3. 1-2 years later
4. 2-3 years later
5. 3-4 years later

Spillover & Channeling

- SO1. Our records show that you installed:

- <Optimization 1>
- <Optimization 2>
- <Scheduling>
- <Other 1>
- <Other 2>

- through your **<PATH>** project. Since completing your project, have you adopted any additional energy efficient **operational improvements**? This does not include any equipment you've installed. We're only asking about improvements made not through a ComEd program.

1. Yes
2. No
98. (Don't know)
99 (Refused)

- [If SO1=1, Ask SO1A, Else Skip to SO1C]
- SO1A. How important was your experience in the retro-commissioning program in your decision to make these additional changes? Please use a 0-10 scale, where 0 means 'not at all important', and 10 means 'extremely important'
- [SCALE 0-10, 96=Not Applicable, 98=Don't Know, 99=Refused]
- SO1B. Can you explain how your experience with **<PATH>** influenced your decision to adopt the additional improvements? [OPEN ENDED, 98=Don't know, 99=Refused]

- SO1C Have you installed any other energy efficient improvements that we haven't talked about? (if needed: "I am asking about actual equipment you might have installed")
    - 1. Yes
    - 2. No

    98. (Don't know)
    99 (Refused)

- [If SO1C=1, Ask SO1D, Else Skip]
- SO1D What did you install? [OPEN ENDED, 98=Don't know, 99=Refused]

- SO1E. How important was your experience in the retro-commissioning program in your decision to make these additional changes? Please use a 0-10 scale, where 0 means 'not at all important', and 10 means 'extremely important'
- [SCALE 0-10, 96=Not Applicable, 98=Don't Know, 99=Refused]

- SO1F. Can you explain how your experience with **<PATH>** influenced your decision to adopt the additional improvements? [OPEN ENDED, 98=Don't know, 99=Refused]

- **Channeling**
- CH1. Have you installed any improvements that were part of another ComEd or gas utility program since completing your retro-commissioning project?

1. Yes
2. No
98. (Don't know)
99. (Refused)

- [If CH1=1, Ask CH1A, Else Skip to CH2]

CH1A. If so, what did you install? [PROGRAMMING NOTE: Multiple Response. Record all responses. 98=Don't know, 99=Refused] [Do not read.]

1. Lighting
2. Cooling
3. Motors
4. Refrigeration
5. Compressed Air
6. Fans
7. Controls
8. Heating
    - 00. Other, please specify
    - 98. Don't Know
    - 99. Refused

CH2. Has your participation in the Retro-commissioning Program motivated you to consider participating in other ComEd or gas utility energy efficiency programs?

1. Yes
2. No
98. (Don't know)
99. (Refused)

[ASK IF CH2=1, Else Skip to CH2B]

CH2A. Which programs you are considering? [DO NOT READ. MULTIPLE RESPONSE, ACCEPT ALL ANSWERS]

1. Standard
2. Custom
00. Other, please specify
98. (Don't know)
99. (Refused)

[ASK IF CH2=2 OR 8, Else Skip to PD1]

- CH2B Could you tell me what barriers, if any, are preventing you from considering other programs?

[PROGRAMMING NOTE. Multiple Response. Record first 4 responses. 98=Don't know, 99=Refused] [DO NOT READ]

1. Timing within the budget year
2. Timing will disrupt our operations
3. Not convinced of the benefits
4. Not aware of qualified providers
5. Management is opposed
6. Cost/lack of financial resources
7. Lack of staff/personnel resources
00. Other, please specify
98. (Don't know)
99. (Refused)

Process Module

Program Design

PD1. What do you see as the main strengths of the Retro-Commissioning Program? [PROGRAMMING NOTE. Multiple Response. Record first 4 responses. 98=Don't know, 99=Refused] [DO NOT READ.]

1. Helps reduce the company's energy bills
2. Saves energy
3. Free study
4. Improves the performance of equipment
5. Prolongs equipment life / service-ability
6. Trains facility staff on efficient building operations
7. Helps building staff learn about building
8. Turnkey operation
00. Other, please specify
98. (Don't know)
99. (Refused)

PD2. What do you think are the main barriers to participating in the program? [PROGRAMMING NOTE. Multiple Response. Record first 4 responses. 98=Don't know, 99=Refused] [Do not read.]

1. Paperwork too burdensome
2. Application too onerous
3. Incentives or free study not worth the effort or required financial commitment
4. Program is too complicated
5. Retro-commissioning is too complicated
6. Staff did not understand the importance of RCX.
7. Staff's time commitment is too great
8. Timing is inconvenient to the business cycle
9. No barriers or concerns
00. (Other, please specify)

98. (Don't know)
99. (Refused)

PD3. What could the program do to encourage more enduring changes in your maintenance and operations? [OPEN END. 98=Don't know, 99=Refused]

PD4. [Ask if <PATH> = Tune-Up, Grocery, RCxpress] Would you be interested in any type of building operator training to improve your ability to maintain the energy efficiency improvements from retro-commissioning?

1. Yes
2. No
98. (Don't know)
99. (Refused)

[Ask if PD4=1 or 98, Else Skip to PD5]
PD4A. Can you describe what the ideal training would look like? (Probe for length, topics covered)
[OPEN END. 98=Don't know, 99=Refused]

PD5. [Ask if <PATH> = Tune-Up, Grocery, RCxpress] Are you interested in any materials or resources that can be available after the project to help you maintain the energy efficiency improvements from retro-commissioning?

1. Yes
2. No
98. (Don't know)
99. (Refused)

[Ask if PD5=1 or 98, Else Skip to PS1]
PD5A. What should be included in this material? (Probe for topics covered, amount of detail)
[OPEN END. 98=Don't know, 99=Refused]

Program Satisfaction

PS1. Now I'd like to ask you to rate your satisfaction with various elements of the program on a scale of 0 to 10, where 0 is 'not at all satisfied' and 10 is 'extremely satisfied'. How would you rate your satisfaction with…? [SCALE 0-10; 96=not applicable, 98= Don't know, 99=Refused] [Rotate order] [INTERVIEWER NOTE: Ask "Why did you rate it that way" for comments on any response <6]

A. The information provided in the retro-commissioning study
B. The program administrator - Nexant
C. The ComEd Energy Efficiency Program (ComEd) staff
D. Your gas utility Energy Efficiency Program staff [Nicor or Peoples' Gas/North Shore Gas]
E. Your Service Provider, <CXAGENT>
F. The Retro-Commissioning program overall
G. Anticipated energy benefits
H. Realized energy benefits
I. Anticipated non-energy benefits, such as increased comfort or lowered maintenance costs
J. Realized non-energy benefits
K. ComEd overall

PS2. Now I'd like to focus more deeply on your satisfaction with the program as you experienced it at your facility. Again, I welcome any comments, but need you to rate your satisfaction on a scale of 0 to 10, [IF NEEDED: where 0 is 'not at all satisfied' and 10 is 'extremely satisfied']. How would you rate your satisfaction with…?

[SCALE 0-10; 96=not applicable, 98=Don't know, 99=Refused] [Rotate order] [INTERVIEWER NOTE: Ask "Why did you rate it that way" for comments on any response <6]

A. The accuracy of the study, with respect to how your facility was described
B. The accuracy of price estimates listed in the study to have the work done
C. Any assistance in finding a contractor to perform the work recommended through the study
D. Your ability to act on recommendations from the study
E. The implementation steps completed by the service provider
F. The study thoroughness or depth of the energy savings investigation
G. The amount of low-cost savings identified
H. The application process
I. The number of required meetings
J. The amount of your staff's time required
K. [Ask if MBCx, Otherwise Skip] The security of your data while sharing access to the building automation system
L. The number of evaluation and measurement checks during and following your project
M. Your ability, with current staff, to maintain the savings through the Study

PS3. I only have a few questions left. Based on your overall experience, what would you tell a friend or peer about the Retro-Commissioning program?
[OPEN END Record verbatim. 98=Don't know, 99=Refused]

PS3A Would you recommend the Retro-Commissioning program to your peers inside or outside of your organization?

1. Yes
2. No
3. Maybe
98. (Don't know)
99. (Refused)

PS4. How do you think this program could be improved? [PROGRAMMING NOTE. Multiple Response. Record first 4 responses. 98=Don't know, 99=Refused] [DO NOT READ.]

1. Greater publicity
2. Longer engagement with RSP to implement more measures
3. Key Account Executives provide more information
00. Other, please specify
96. No recommendations
98. (Don't know)
99. (Refused)

Firmographics

F1. Does your company own, rent or manage this facility?

1. Own
2. Rent
3. Manage
00. Other, please specify
98. (Don't know)
99. (Refused)

F2. Does your company own the HVAC equipment?
1. Own
2. Lease as part of the facility contract
00. Other, please specify
98. (Don't know)
99. (Refused)

Closing

C1. Those are all of the questions I have. Is there anything you would like to add, anything that I forgot to ask about?

- [CREATE FOLLOWUP=1 IF SO1A >4 and/or SO1E>4, ELSE 0]

C2. May we contact you if we have any additional questions or to clarify any of your answers?
1. Yes
2. No

C3. [Ask if C2 = 1, Else Skip] What is the best way to reach you? [Read back responses to confirm spelling or phone number]
1. Phone
2. Email
00. Other

[ASK IF FOLLOWUP = 0]
C4 Would you like us to email a $50 VISA electronic gift card, or mail you a traditional gift card? [NOTE: we can make a donation in the respondent's name to the charity of their choice if they do not want the incentive.]
1. Email
2. Mail
3. Donate to a charity

[Ask if C4=1]
C4A What address should we email the gift card to?
1. [Email]

[Ask if C4=2, 3]
C4B What address should we mail the gift card to?
1. Street
2. City
3. State
4. Zip code

- [If SO1A >4 and/or SO1E>4, Ask]
- SO1G I would like to have another person follow up with a few brief questions about these additional improvements. When would be the best time for him to call you?
1. [date]
2. [time]
- 98. Don't Know

- 99. Refused

[ASK IF FOLLOWUP = 1]

C5 We will phone you on <SO1G: 1> at <SO1G: 2> with those few follow-up questions. The person who calls you back will ask you where you would like us to send your $50 VISA gift card. [Follow-up will ask C4-C4B]

Thank you very much for your time today. The information you shared is very valuable!

RSP Survey Instrument

ComEd C&I Retro-Commissioning Program –RSP Interview Guide
Retro-commissioning
August 25, 2017
DRAFT
Service Provider Guide PY9

Interviewee: _____ Date: _____

Title: _____ Company: _____

Interviewer: _____

[Note to Reviewer] The Interview Guide is a tool to guide process evaluation interviews of service providers. The guide helps to ensure the interviews include questions concerning the most important issues being investigated in this study. Follow-up questions are a normal part of these types of interviews. Therefore, there will be sets of questions that will be more fully explored with some individuals than with others. The interviews will be audio taped.

The respondents may have different exposure to different aspects of the program. Customization of questions will be required.

When "retro-commissioning" is written out, it refers to all four offerings. Each offering, when referenced specifically, is abbreviated (RCx, RCxpress, Tune-Up, MBCx).

Introduction
Hi, may I please speak with [name from list]?
My name is ___ and I'm calling from Navigant Consulting, an independent research firm, on behalf of ComEd. We're talking to **contractors who are currently service providers** for the ComEd Energy Efficiency Retro-Commissioning Program. **We may have spoken with you or someone from your firm in past years as a part of the process evaluation** completed at that time.
We are interested in any feedback you may have regarding your firm's involvement in this program and any feedback you have received about the program from your customers. ComEd plans to use this information to continue to improve the energy efficiency programs and services it offers to business customers.
Would you be willing to speak with me for about 30 minutes? Your responses will be kept strictly confidential.

Interview Subject Background

S1. Would you please tell me your title at <COMPANY>?

S2. How many years have you worked there?

S3. What are your roles at <COMPANY> with respect to the Retro-commissioning Program?

S4. Is your firm currently registered as a service provider or trade ally for other Commercial &Industrial program offerings from ComEd?

1. Yes [Probe for which programs, why they find this beneficial]

2. No [Probe for why not, what might entice them to expanding the programs they work with]
98. Don't Know
99. Refused

Program Processes

1. Our records show that <COMPANY> completed [<COUNT RCx> RCx, <COUNT RCxpress> RCxpress, <COUNT Tune-Up> Tune-Up] [[<COUNT MBCx> MBCx] project(s) during the current extended program year (PY9). Does that sound right?

[Ask if performed RCxpress]

X1. How have customers responded to changes in RCxpress? [Probe for change to 5 phase, potentially pulling some RCx customers into RCxpress]

X2. Did the changes to RCxpress impact your business? If so, how?

X3. If MBCx was available to your customers, would you recommend it to them? [Probe for the benefits to customers, impact on the RSP's business, if they would offer the service, if MBCx would impact their ability to return to a customer to perform RCx services in the future.]

[Ask if performed Tune-Up]

T1. Are customers challenged at all in offering the financial and staffing resources required to engage in the Tune-Up projects? [Probe for challenges, ways to address them]

T2. What training would be appropriate to increase the satisfaction and persistence of savings at smaller facilities? [Probe: training for the staff responsible for energy management, in house or contract.]

T3. What materials might increase persistence at facilities that do not have staff dedicated to energy management. [Probe: what materials could be offered to help contracted engineering vendors maintain the desired settings]

[Ask if performed MBCx]

M1. How do you expect your customers in midsized facilities would respond to the opportunity to engage in MBCx?

M2. How have customers responded to the possibility of extending their MBCx for another year or more? [Probe for impact on customer's savings, engagement, potential to involve in other projects. Impact on RSP(?) of extended involvement.]

M3. Have you noticed any relationship between the size of the customer's facility staff and the benefit they see from MBCx?

2. How could customers be encouraged to engage in more of no-cost/low-cost measures projects recommended through the study but not implemented?

3. How can customers be encouraged to participate in other ComEd programs, such as Standard or Custom? [Probe: mechanics of this encouragement, impact on the RSP, RSP awareness of the available measures]

4. What would encourage RSPs like you to recommend more measures incented through other ComEd programs? [Probe: awareness measures and incentives, program eligibility and procedures, incenting the RSP, referral bonuses, challenges working with different ICs or program structures]

5. Do you see a benefit to keeping projects open for future development? [Probe: Why, why not. If yes, how would the RSP like to see the extension work, is this a mid-point between closing the project and MBCx, kept open for future development if initial recommended improvements aren't adopted, what impact might it have on their margins?]

[Ask 6-8 of all <>MBCx]

6. When would be optimal to return to RCx after the initial RCx? [Probe for measure-specific or category-specific information]

7. Do you see a benefit to MBCx for your RCx customers? [Probe: Why, why not. If yes, how would they recommend that the transition work, is their firm considering offering MBCx?]

8. Would your customers be interested in on-going data access to monitor persistence of savings? [Probe for advantage of building operating data or utility data on persistence and ability to impact savings.]

[Ask All]

9. In general, how satisfied have you been with the program participation process? *[PROBE FOR: participant enrollment, identification of measures, implementation, verification, project close-out]*

    9A. Are there aspects of the program that you think work particularly well? Please explain.

    9B. Are there aspects of the program that could be improved? Please explain.

10. Did you have any difficulty meeting the required deliverables for each project milestone *(PROBE FOR: timeline, required information, budget constraints)*? If so, please explain.

11. Of the <PROJECT COUNT> customers with whom you completed utility-sponsored retro-commissioning projects from June 2016 to December 2017, approximately how many did you have a prior working relationship with? [Probe: How many of these new clients do they expect to continue working with, and doing what.]

12. Have you made any changes to your business as a result of your participation in the retro-commissioning program? *[PROBE: hired more staff, opened up new offices, changed marketing, changed approach to retro-commissioning investigations.]*

NTG Section

Program Influence on Service Provider

- PISP1. Have you participated in any program webinars, meetings, or training sessions, or received any educational materials from the program?
    - 1 YES
    - 2 NO
    - 98 Don't Know

- PISP2. Have you ever brought a utility or Nexant program staff member to customer sites with you?
    - 1 YES
    - 2 NO
    - 98 Don't Know

- [IF PISP2=1, ASK PISP2a and b, ELSE SKIP TO PISP3]

- PISP2a. About how many times have you brought a utility or Nexant program staff member with you?
- [NUMERIC OPEN ENDED]
- 98 Don't know

- PISP2b. How helpful are those joint visits with program staff in promoting a study or energy efficiency improvements?
- [0-10 scale, endpoints 0 "Not at all helpful" and 10 "Extremely helpful"]
- 98 Don't Know

- PISP3. Have you received any marketing materials from the program for you to pass along to your customers?
  - 1 YES
  - 2 NO
  - 98 Don't Know

- [IF PISP3=1, ASK PISP3a, ELSE SKIP TO PISP4]
- PISP3a. How much influence have those marketing materials had on your ability to promote studies to your customers?
  - [0-10 scale, endpoints 0 "Not at all influential" and 10 "Extremely influential"]
  - 98 Don't Know

-
- PISP4. If the program did not exist this year, how would your business be different, if at all?
  - [OPEN ENDED]
  - 98 Don't Know

- PISP5. If the program did not exist this year, what would be different about the services you provide to customers?
  - [OPEN ENDED]
  - 98 Don't Know

No Program

NP1. According to program records, you completed [NUMSTUDIES] retro-commissioning studies between June 2016 and December 2017. If the program did not exist this year, how many studies do you think you would have completed in the same period?

[numeric answer]
98. Don't Know

NP2. Again, thinking about the [NUMSTUDIES] program studies that you completed between June 2016 and December 2017, if the program did not exist this year, how many studies *of comparable breadth and depth* do you think you would have completed in the same period?

[numeric answer]
98. Don't Know

Direct Free Ridership

FR1. According to program records, between June 2016 and December 2017 your [NUMPARTICIPANTS] program participants went on to achieve [RSPSAVINGS] from implementing recommended energy efficiency improvements. What percent of these savings do you think those customers would have achieved if the program did not exist this year?

[numeric answer]
98. Don't Know

Consistency Checks

IF ONE OF THE FOLLOWING CASES IS TRUE

NP1 >= .7* NUMSTUDIES	AND	FR1 < .5
NP1 <= .3* NUMSTUDIES	AND	FR1 > .5
NP2 >= .7* NUMSTUDIES	AND	FR1 < .5
NP2 <= .3* NUMSTUDIES	AND	FR1 > .5

THEN ASK CC1. ELSE SKIP.

CC1. Could you tell me more about the impact the program has had on the total savings your customers have achieved from your studies between June 2016 and December 2017.

- [OPEN ENDED]
  98. Don't Know

Spillover

LSO1. Our records indicate that you conducted [STUDYTYPE1QTY] [STUDYTYPE1] and [STUDYTYPE1QTY] [STUDYTYPE1] since June 1, 2016. Since then, have you conducted any studies with ComEd customers *without* program rebates?

1. Yes
2. No [SKIP TO XYZ]

98. Don't Know [SKIP TO XYZ]

LSOA1. [ASK IF LSO1 = 1, ELSE, SKIP TO XYZ]
How influential do you think the program was on these additional studies conducted without program rebates?

- [0-10 scale, endpoints 0 "Not at all influential" and 10 "Extremely influential"]
- 98 Don't Know

LSOA2. [ASK IF LSO1 = 1, ELSE, SKIP TO XYZ]
If the program did not exist this year, how likely is it that your organization would still have conducted these non-rebated studies for ComEd customers?

- [0-10 scale, endpoints 0 "definitely WOULD NOT have conducted these studies" and 10 "definitely WOULD have conducted these studies"]
- 98 Don't Know

LSO2a. [ASK a and b IF AVERAGE (LSOA1, LSOA2) > 5.0, ELSE, SKIP TO LSO3]
Thinking about the savings that those non-rebated studies achieved, how would you describe those savings in terms of the [RSPSAVINGS] kWh that your studies achieved through the program. [IF NEEDED PROMPT FOR EITHER A PERCENTAGE OR MULTIPLIER OF RSPSAVINGS]

- [OPEN ENDED]
- 98 Don't Know

LSO2b. Please briefly describe where most of the savings from those non-rebated studies came from.

- [OPEN ENDED]
- 98 Don't Know

LSO3. [ASK IF LSO1 = 1, (AND ANY VALUE FOR LSOA1 and LSOA2), ELSE, SKIP TO ULSO1]

- Why did these studies not receive program rebates?

ULSO1. Since June 1, 2016. have you sold any other energy efficiency improvements to ComEd customers *without* ComEd rebates?

1. Yes
2. No [SKIP TO 14]

98. Don't Know [SKIP TO 14]

ULSOA1. [ASK IF ULSO1 = 1, ELSE, SKIP TO 14]
How influential do you think the program was on these energy efficiency sales without ComEd rebates?

- [0-10 scale, endpoints 0 “Not at all influential” and 10 “Extremely influential”]
- 98 Don’t Know

ULSOA2. [ASK IF ULSO1 = 1, ELSE, SKIP TO 14]
If the program did not exist this year, how likely is it that your organization would still have sold these non-rebated energy efficiency improvements for ComEd customers?

- [0-10 scale, endpoints 0 “definitely WOULD NOT have made these sales” and 10 “definitely WOULD have made these sales”]
- 98 Don’t Know

ULSO2a. [ASK a and b IF AVERAGE (ULSOA1, ULSOA2) > 5.0, ELSE, SKIP TO ULSO3]
Thinking about the savings that those non-rebated sales achieved, how would you describe those savings in terms of the [RSPSAVINGS] kWh that your studies achieved through the program. [IF NEEDED PROMPT FOR EITHER A PERCENTAGE OR MULTIPLIER OF RSPSAVINGS]

[OPEN ENDED]
98 Don’t Know

ULSO2b. Please briefly describe where most of the savings from those non-rebated sales of energy efficiency improvements came from.

[OPEN ENDED]
98 Don’t Know

ULSO3. [ASK IF ULSO1 = 1, (AND ANY VALUE FOR ULSOA1 and ULSOA2), ELSE, SKIP TO 14]
Why did these sales of energy efficiency improvements not receive program rebates?

[OPEN ENDED]
98 Don’t Know

Program Feedback & Recommendations

13. Would your answer have been different for the different offerings (RCx, RCxpress, Tune-Up)? [Probe for how any of the offerings may differ from others.]

14. Have you received any other feedback from customers on the program? If so, can you please share an anecdote or two? [Probe: participation process and/or results of their project]

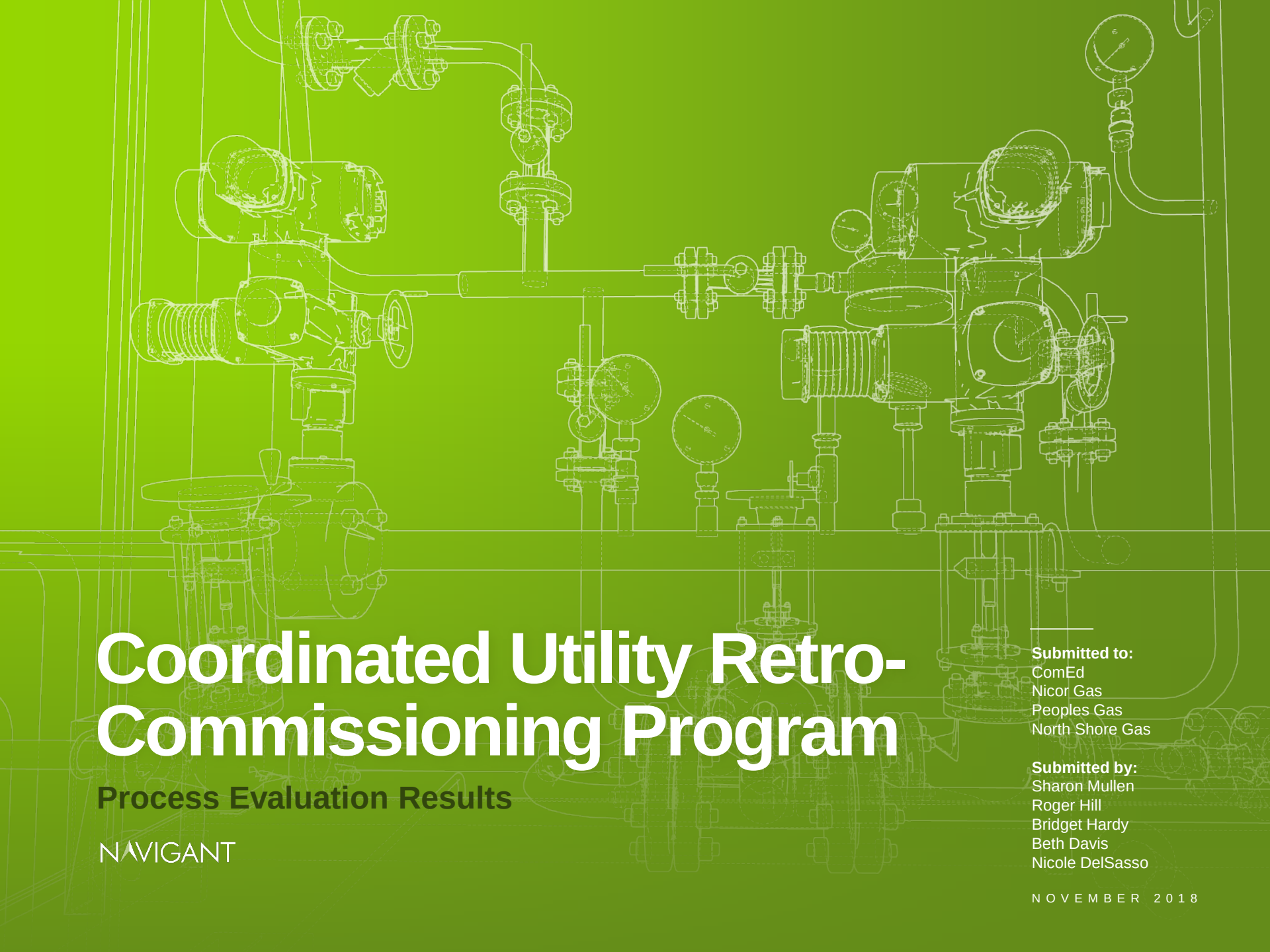
15. Are there adequate communication mechanisms in place to channel capital investment opportunities found during retro-commissioning programs to other ComEd programs? What might entice you to forward these opportunities to ComEd?

16. Do you have thoughts on how to help retro-commissioning customers improve persistence and their understanding of energy efficiency operations?

17. In general, how satisfied are you with the retro-commissioning program? Has it met your expectations? Please explain.

18. Do you have any additional recommendations or feedback for the evaluation?

APPENDIX E. COORDINATED UTILITIES RCX EPY9 GPY6 PROCESS RESULTS 2018-11-21



Coordinated Utility Retro-Commissioning Program

Process Evaluation Results

NAVIGANT

Submitted to:
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Nicor Gas
Peoples Gas
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NOVEMBER 2018

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01

Findings and Recommendations

Findings and Recommendations

The following provides insight into key program findings and recommendations.

FINDING 1

Satisfaction among participants is high, and highest surrounding areas most influential in their participation in the program, specifically the investigative report and work with the Retro-commissioning Service Providers (RSPs).

RECOMMENDATION 1

Emphasize the benefits of the investigative report and RSP expertise in program materials.

FINDING 2

RSPs are satisfied with their experience; most of their businesses enjoyed growth as a result of their partnering with ComEd on retro-commissioning. RSPs recommended operational improvements to the program.

RECOMMENDATION 2

ComEd may consider methods to expedite the application and technical review cycles for the traditional Retro-commissioning path (RCx) and RCxpress, as well as offering educational and leave-behind materials for all paths.

FINDING 3

All RSPs with RCx and RCxpress projects report that transitioning their customers to Monitoring Based Commissioning (MBCx) would drive energy savings and better serve their customers.

RECOMMENDATION 3

ComEd may consider introducing the concept of MBCx when selling RCx and RCxpress projects as a method to uncover additional savings and increase persistence.

FINDING 4

Satisfaction with anticipated energy savings remains higher among participants than their satisfaction with actual energy savings. Conversely, satisfaction with experienced non-energy benefits remains higher than the satisfaction with anticipated NEBs.

RECOMMENDATION 4

Source the discrepancy in anticipated and realized energy savings and align the participant's expectations by savings and return on investment (ROI) to more closely approximate their real-world experience. Promote the non-energy impacts of RCx when marketing, citing prior participants' savings enjoyed through reduced maintenance and operations costs or improved productivity. As feasible, NEBs may be offered in the investigation reports to support recommended actions, adding to the ROI data.

FINDING 5

Overall, most RSPs agree that keeping projects open for future development can benefit customers financially. They believe most customers would be very interested in on-going data monitoring access to monitor persistence for savings.

RECOMMENDATION 5

ComEd may consider keeping projects open during a potential transition to MBCx. RCx and RCxpress participants would benefit from educational and leave-behind materials to aid in maintaining persistence.

FINDING 6

Almost half (43%) of Tune-Up program RSPs suggest implementing remotely accessible building management systems for their customers to increase persistence at facilities that do not have staff dedicated to energy management.

RECOMMENDATION 6

ComEd should continue looking at monitoring options for Tune-Up participants available through AMI data. Tune-Up participants would benefit from educational and leave-behind materials to aid in increased persistence.

FINDING 7

Tune-up participants and RSPs report that training and leave-behind materials would improve savings persistence.

RECOMMENDATION 7

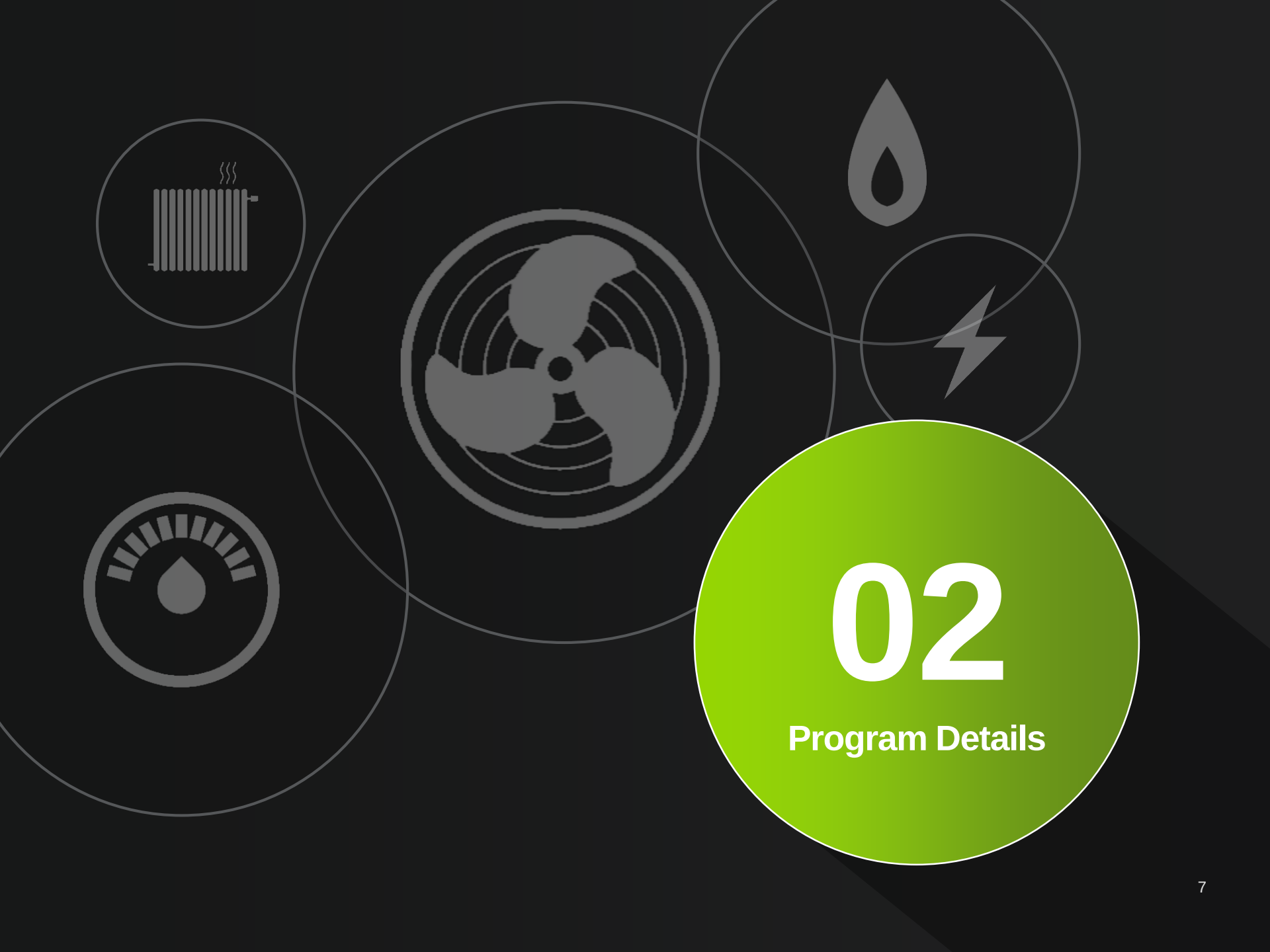
Develop a series of industry- or system-specific materials to leave behind to aid persistence at facilities with smaller or changing staff.

FINDING 8

Where lack of satisfaction was found among Tune-Up participants, it was due to an expectation that the recommended improvements would be more customized to the facility and less prescriptive in nature.

RECOMMENDATION 8

Consider adjusting the marketing and promotional material to better describe the Tune-Up offering, and include typical savings experienced by participants as a result of the comparatively prescriptive recommendations for improvements.



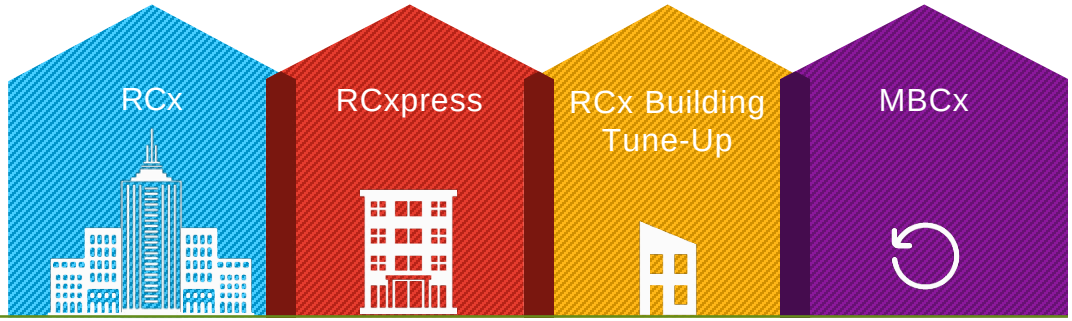
02

Program Details

The RCx program helps customers improve building performance and reduce energy consumption.

ComEd has been operating the Northern Illinois Coordinated Utility Retro-Commissioning (Retro-Commissioning) program for nine program years. Electric Program Year 9 (EPY9) also marked the sixth program year (GPY6) ComEd coordinated program operations with the gas utilities that have service areas which overlap ComEd's service area. The program helps commercial and industrial customers improve performance and reduce energy consumption of their facilities through the systematic evaluation of existing building systems and the implementation of low- and no-cost energy efficiency solutions.

There are four paths in the program:

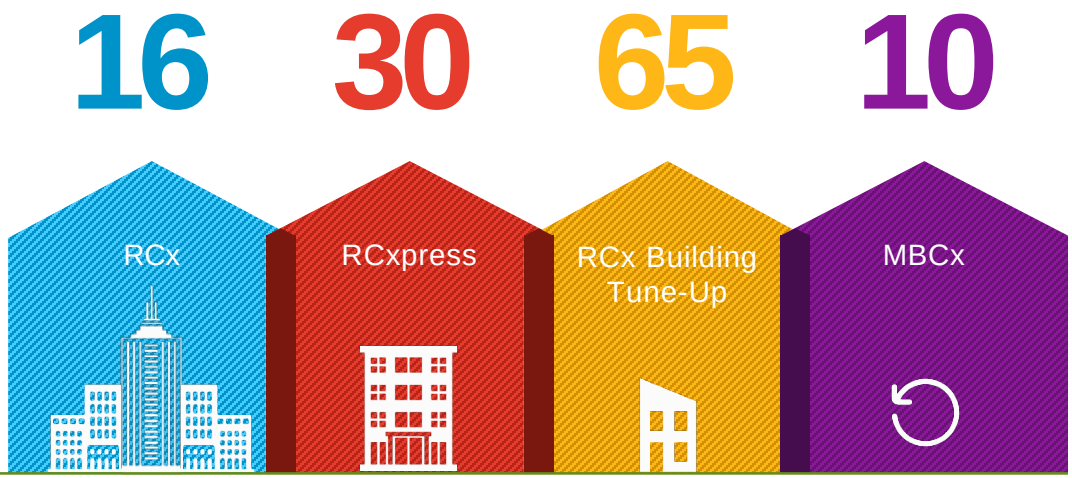


Generally, the program pays for 100% of a detailed study, contingent upon a participant's commitment to spend a defined amount of their own money implementing a bundle of improvements recommended through the study with a simple payback of 18 months or less.

The RCx Building Tune-Up path features the option to immediately implement some common measures during the investigation visit by the RSP in addition to a cash incentive for implementing savings following receipt of the investigation report.

Program Participation

During EPY9/GPY6, the Retro-Commissioning program completed 121 projects, including:



RSPs, participants and their contractors implemented 423 retro-commissioning measures (RCMs).

03

Primary Data Collection Results

Evaluation Questions

The Process research addressed program participant satisfaction and program processes including marketing, training, and market potential for retro-commissioning services. The research questions included:

A What drives program participant and RSP satisfaction?

B What are program strengths and barriers?

C What are recommended program improvements?

D What is the potential for keeping projects open longer and how will this affect RSPs?

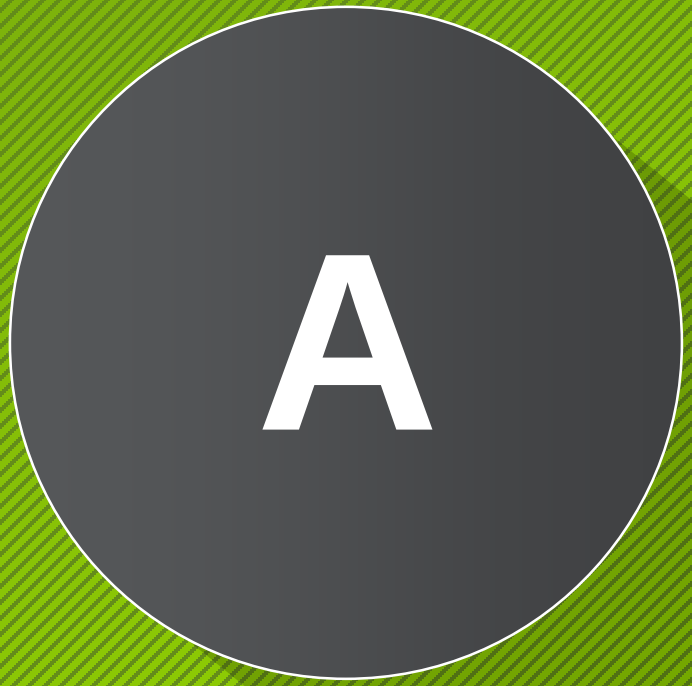
E What is the viability of shifting customers to MBCx?

The team answered these questions by surveying program participants and interviewing RSPs.

- We utilized a census approach with a computer-assisted telephone interview (CATI) **survey** of 78 unique customer contacts among RCx projects, and achieved a response rate of 24%, surveying 2 RCx, and 5 RCxpress, and 12 Tune-Up participants cumulatively representing 12% of the electric savings and 4.5% of the gas savings. An effort will be made to increase future response rates, particularly from dual fuel (electric and gas) participants, including advanced email scheduling of appointments to conduct the survey.

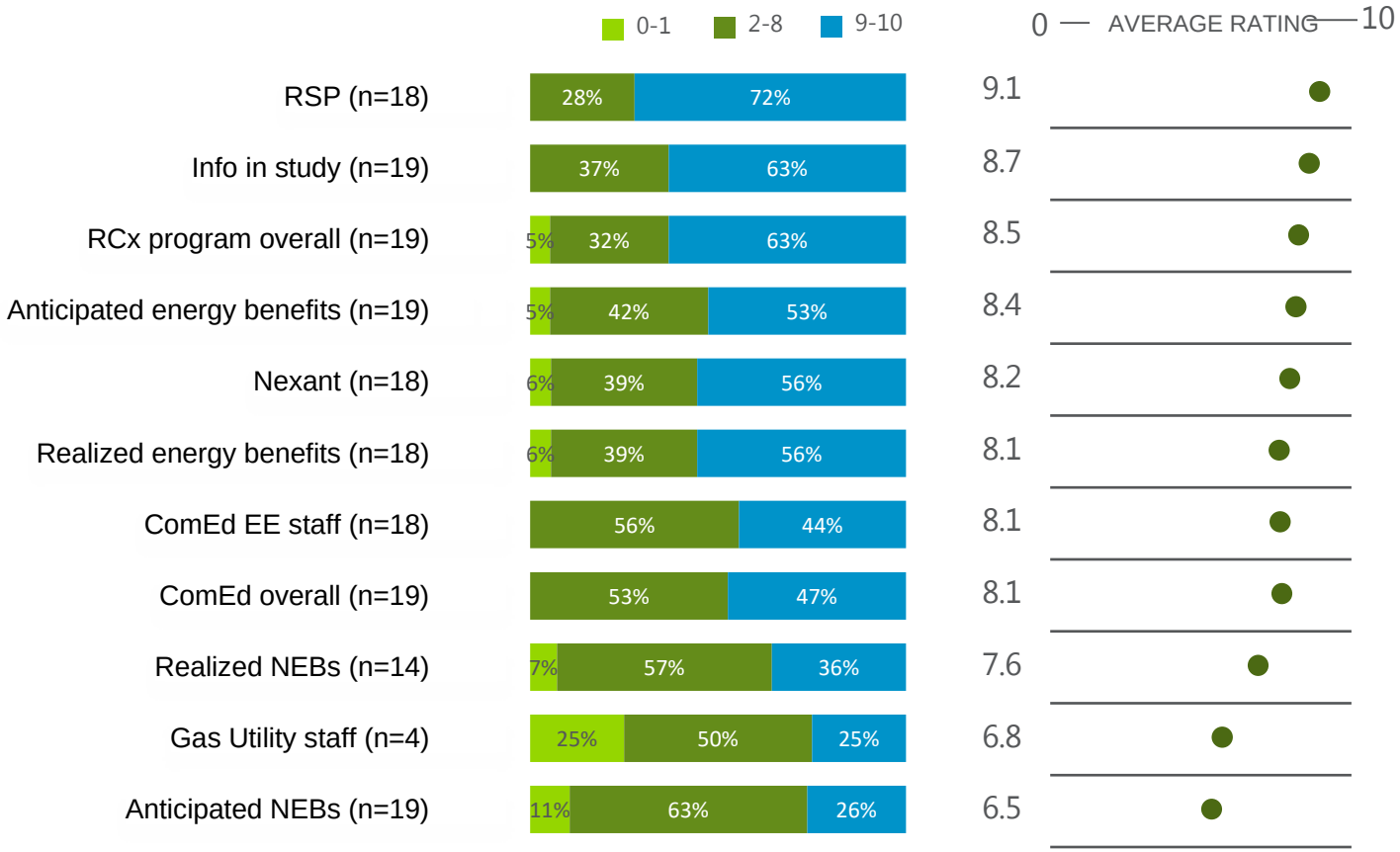
- We conducted in-depth **interviews** with 11 of 25 RSPs, representing 71% of the program generated savings.

What drives program participant and RSP satisfaction?



General Program Satisfaction

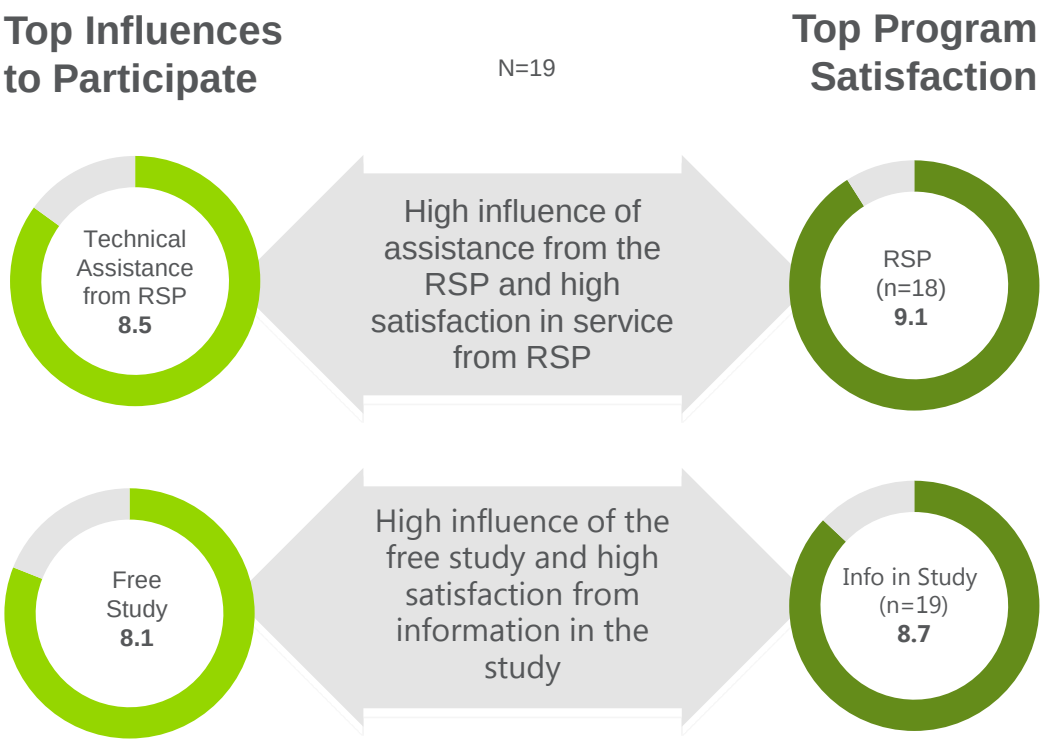
Navigant asked participants to rank their satisfaction with various program attributes on a scale of 0-10, where 0 means “not at all satisfied” and 10 means “extremely satisfied.” Participants were very satisfied with the program overall, and particularly satisfied with their RSPs and the information provided by the retro-commissioning study.



Source: Navigant analysis of EPY9/GPY6 RCx participant Process survey data.

Greatest Satisfaction is with the Program Elements Most Influential in Driving Participation

The two most influential factors motivating customers' enrollment were support from RSPs and the free retro-commissioning study. These were also the elements of the program that participants were most satisfied with.



Source: Navigant analysis of EPY9/GPY6 RCx Participant Process Survey

Non-Energy Benefits are Important

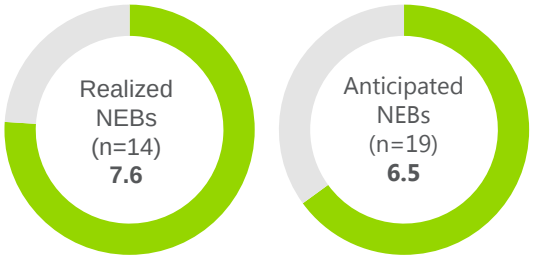
Some participants recognize the potential Non-Energy Benefits (NEBs) offer their organization, while others do not.

INTERESTED IN NEBs

"It is all about saving money, being energy efficient, and saving on wear and tear on equipment."
RCxpress Participant

UNCONCERNED WITH NEBs

"[We don't care about NEBs] because comfort is not a consideration and maintenance does not calculate."
RCxpress Participant



Participants are more satisfied with their realized non-energy benefits than they had anticipated. The NEBs achieved through retro-commissioning measures include impacts that may improve operations or productivity by, for example, improving a facility's comfort, lighting and air quality, or reducing maintenance costs by properly scheduling and using HVAC equipment.

Program documents, shown on the next slide, specifically promote NEBs. Although the program promotes NEBs, RSPs do not consistently rely on the program's promotional material when they market retro-commissioning to customers, with only 55% of RSPs reporting that they print the available documents to present to customers. Of those RSPs who print and use the program's materials, 60% find them influential because they legitimize the RCx project.

Source: Navigant analysis of EPY9/GPY6 RCx participant Process survey data.

Program Documents Support Non-Energy Benefits

ComEd. Energy Efficiency Program

FACT SHEET

Retro-Commissioning (RCx)

Optimize Energy Performance

Receive a fully-funded study performed by a ComEd-approved service provider. Services valued at up to $100,000 are provided to identify no- and low-cost operational improvements to your energy-using systems. You may also qualify for an incentive based on the energy savings

- Improve and maintain occupant comfort and productivity.
- Increase property value.
- Reduce maintenance needs and extend equipment life.
- Gain deeper understanding of building systems and controls.

- Gain deeper understa… building systems and controls.
- Improve energy perfo… nd energy benchmarking scores

To receive the study, pa… s must commit to spending $5,000 to $2… no- and low-cost energy-saving improve… e commitment level depends on your p… e.

Implementing an RCx project can help you save an average of five percent on annual electric bills with an average simple payback of less than 1.5 years for implemented energy improvements.

- Improve and maintain occupant comfort and productivity.
- Increase property value.
- Reduce maintenance needs and extend equipment life.
- Gain deeper understanding of building systems and controls.

ComEd. Energy Efficiency Program

FACT SHEET

AirCare Plus: The Next Level of HVAC Efficiency

The ComEd Energy Efficiency Program offers low-cost comprehensive AirCare Plus tune-ups of HVAC packaged rooftop units and split systems to eligible commercial and industrial customers. Our tune-ups are proven to help businesses save money and energy on their electric bills, improve HVAC system performance and enhance indoor air quality and occupant comfort. Each tune-up, conducted by a trained ComEd Energy Efficiency Program Trade Ally, includes a thorough inspection and adjustment of the HVAC unit's thermostat, economizer, refrigerant charge, coils and belts for optimal performance.

WHAT'S IN A TUNE-UP?

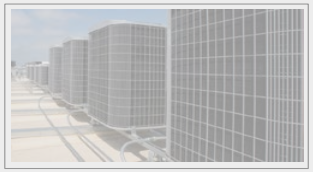
Our tune-ups address major components of your HVAC unit. A trade ally will thoroughly inspect and adjust the following for optimal performance:

» **Programmable thermostat**
Fan settings are evaluated to ensure proper settings based on the occupancy schedule, guaranteeing that the unit is running only when it needs to be. Manual thermostats are replaced with programmable thermostats at a low cost to you.

» **Refrigerant charge and coil cleaning**
The trade ally will assess your unit's refrigerant charge and airflow. Proper charge will extend the compressor's life and reduce energy consumption. Depending on the as-found condition of the HVAC unit, the trade ally may clean the evaporator and condenser coils.

» **Cogged v-belts**
Replacing smooth belts with cogged v-belts can help your HVAC blower motor run more efficiently and use less energy.

» **Economizer**
Using our tools, your trade ally will diagnose the current operating condition of the economizer and, in most cases, repair or adjust it to provide as much "free cooling" from fresh outdoor air as possible.



DOES THE TUNE-UP INCLUDE REPAIRS?

No. The tune-up is intended to complement your regularly scheduled HVAC maintenance visits, not replace them. Your trade ally will advise you if your HVAC unit needs repairs that fall outside of the scope of the tune-up services.

ELIGIBILITY REQUIREMENTS

In order to qualify for our service, your building must have:

» Packaged HVAC or qualifying split systems
» Rooftop units in operating condition

Businesses that participate in the program are responsible for a payment equal to total contractor costs minus program incentives. Your trade ally will inform you of any required amount prior to service.

…nation about the ComEd Energy Efficiency Program, visit ComEd.com/BizIncentives, …700 or email us at BusinessEE@ComEd.com.

…ly. Company, 2018. …ency Program is funded in compliance with state law.

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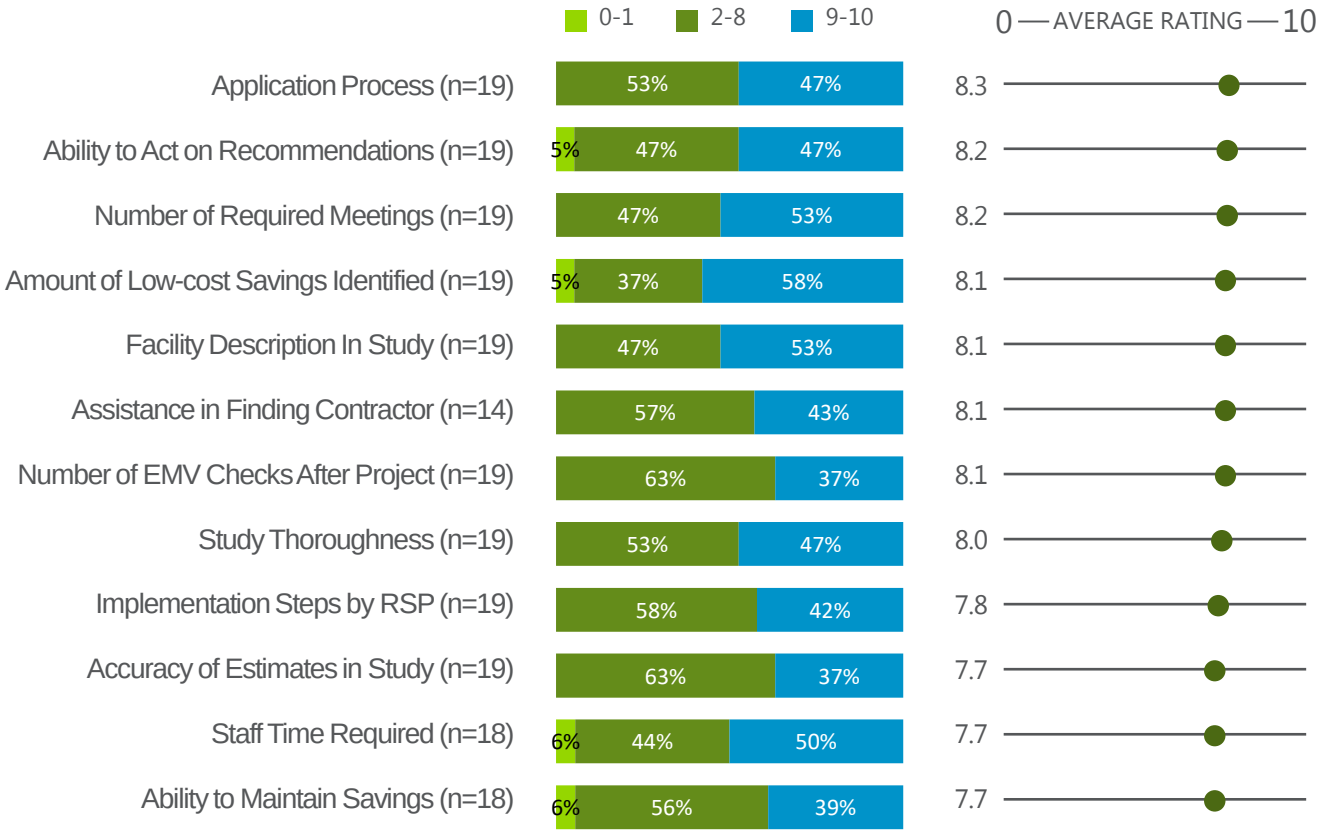
Satisfaction with Projects Elements

Participants indicated they were most satisfied with the amount of low-cost savings identified, the facility description in the study, and the number of required meetings. Participants were less satisfied with the staff time required and ability to maintain the savings they achieved through the program. The accuracy of estimates in the study impact the financial decisions involved in determining which and how many measures to implement.

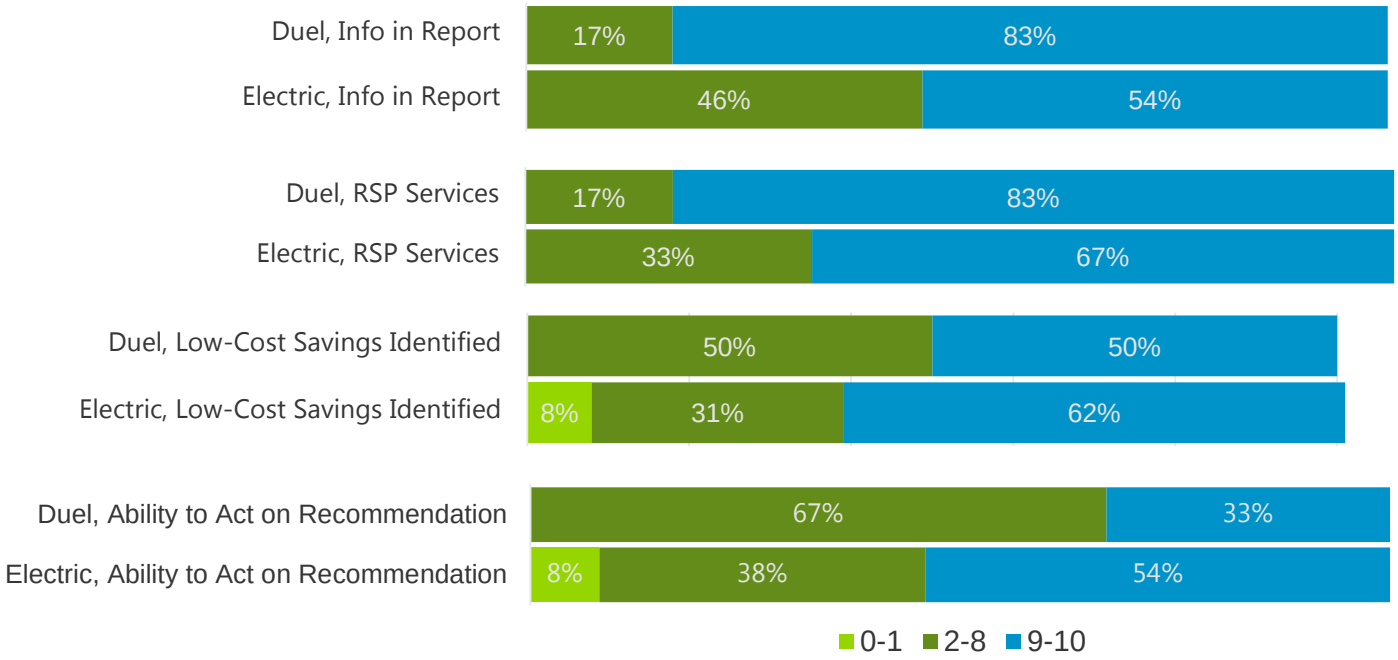


Source: Navigant analysis of EPY9/GPY6 RCx participant Process survey data.

Satisfaction by Fuel Type

Electric only and duel fuel (electric and gas) participants were similarly satisfied with many components of the RCx Program. However, the duel fuel respondents indicated both higher satisfaction with the information offered in the investigative report and services from the RSPs, as well as lower satisfaction with the low-cost savings identified and their ability to act on the recommendations. This suggests that duel fuel participants may be more reliant on the program to generate savings and maintain persistence than the electric-only participants.

Duel Fuel and Electric-Only Participant Satisfaction with Select Elements of the Program



Source: Navigant analysis of EPY9/GPY6 RCx participant Process survey data.

Participants Would Recommend the Program to a Peer

The clear majority (84%) of RCx participants would recommend the program to a peer, with a typical participant reporting:

> "I would tell them to do it. **It is easy**, and the results are what they said it was going to be."

RSPs report that their customers expressed high satisfaction and benefited from the program, with one RCxpress RSP reporting:

> "The property manager was **really happy** with the heat maps and shared them with rest of the organization."

Source: Navigant analysis of EPY9/GPY6 RCx RSP Process interview data; n=11 RSPs interviewed.

RSPs Were Very Satisfied with their Participation in the Program

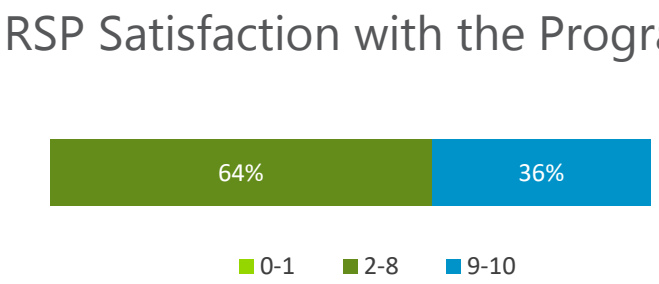
Seventy percent of RSPs indicated they were very satisfied with participation in the program. When asked to rate the program, RSPs offered an average satisfaction rating of 8.2 on a 0-10 scale, with over a third offering a high rating of 9 or 10. Principle drivers of the RSPs satisfaction surround the Nexant staff, services and program administration.

SATISFACTION WITH STAFF AND SERVICES

"The people that we work with at Nexant are efficient and diligent."

"The RCx calculator is great. The fact that it spits out the report is great. The 60 day deadline gets the project done, it's very impactful."

"The review process definitely has helped us out understanding what we need to be doing to span the bridges there."



Source: Navigant analysis of EPY9/GPY6 RCx RSP Process interview data; n=11 RSPs interviewed.

RSPs Grew Their Businesses Because of the Program

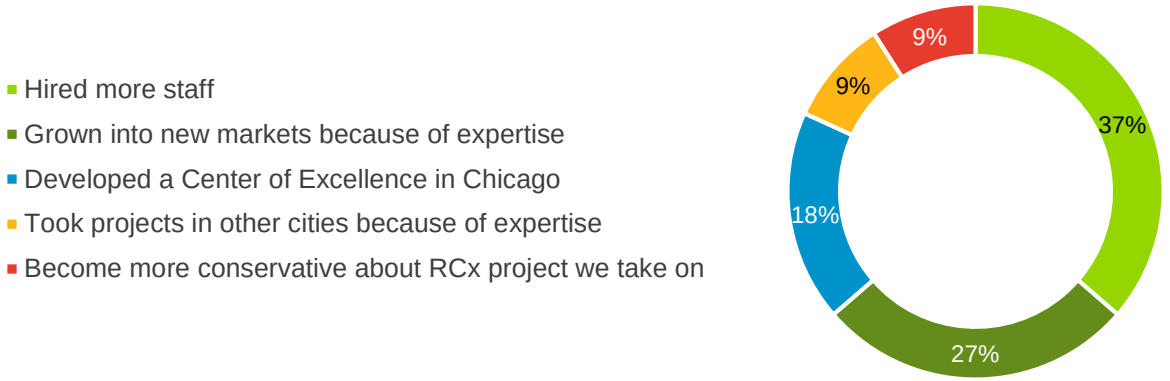
Most (92%) of RSPs reported growth to their business resulting from their participation in the RCx Program.

RSPs EXPANDED THEIR BUSINESS FOCUS AND REACH

> "Before I was doing all new building commissioning, and now I pursue existing building commissioning.
>
> "We've essentially adopted monitoring-based commissioning as an independent service."
>
> "We've been able to hire energy experts because of the program… It's afforded us to develop a center of excellence in Chicago. We're now doing projects in LA, Minneapolis, and Omaha because we've built expertise in Illinois."

RSPs ADDED STAFF

> "Our department grew from about 2 to 10 people."
>
> "One new 1099 keeps pretty busy. Also hired a national program incentive manager to manage [the Tune-Up program]."



Source: Navigant analysis of EPY9/GPY6 RCx RSP Process interview data; n=11 RSPs interviewed.

What are program strengths and barriers?

Technical & Financial Support and the Ability to Save Money are the Greatest Strengths

Main Strengths of RCx Programs

Most respondents agree that three program services—technical support, equipment optimization, and enforced deadlines—were the greatest strengths of the program (47%). RCx and RCxpress participants listed saving energy and saving money as the greatest program strength 80% of the time.

TECHNICAL SUPPORT

"Third party non-biased opinion on building settings helps compare and contrast against existing operators and contractors."
Tune-Up Participant

EQUIPMENT OPTIMIZATION

"[The main program strength was the] realization of areas that need attention and the resulting optimization of equipment."
Tune-Up Participant

ENFORCED DEADLINES

"Involvement of engineers or project manager; having a deadline."
Tune-Up Participant

SAVING MONEY

"[The greatest strengths of the program were the] motivation to get something done and [resulting] reduced costs.
RCxpress Participant

Source: Navigant analysis of EPY9/GPY6 RCx participant Process survey data.

Financial Uncertainty and Cost are the Top Barriers

Financial uncertainty, primarily the required financial commitment to participate and ROI or payback for the implemented projects, was the main barrier to participating in the program according to 42% of respondents. Most of these participants (88%) were highly satisfied with the information provided in the study, but some would appreciate more data collection and cost information that directly informs their financial decisions.

MORE DATA TO SUPPORT ROI DECISIONS

"Talk to us more often and get our input and [offer] better data so we can make ROI decisions."

RCxpress Participant

MORE DATA TO SUPPORT PAYBACK DECISIONS

"[I need to be] informed of the payback and information. As long as the information is good and the payback is good then the barriers are minimized."

RCxpress Participant

CLEAR DETERMINATION OF INCENTED MEASURES

"It's a little confusing understanding what's free and what's not."

Tune-Up Participant

Source: Navigant analysis of EPY9/GPY6 RCx participant Process survey data.

What are recommended program improvements?

Participant Recommendations to Improve the RCx and RCxpress Programs

RCx and RCxpress participants offered suggestions to improve the program. They suggested communicating concepts for a financial, in addition to the technical, audience to make it easier to fund the recommended improvements.

MORE FINANCIAL DATA DIRECTLY TRANSFERABLE TO DECISION MAKERS

“ If they could group capital improvement and new equipment together, I think it could provide better improvements.”

“BETTER COMMUNICATION

“[Require fewer] meetings, and [make it] easier to understand.”

Source: Navigant analysis of EPY9/GPY6 RCx participant Process survey data; n= 2 RCx respondents and n=5 RCxpress respondents.

RSPs Detail Administrative Confusion about the RCx and RCxpress Path

RSPs delivering RCx and RCxpress services offered few recommendations to improve the program. They did offer some areas of concern surrounding administration of the program and confusion about program requirements.

CUSTOMER CONFUSION ABOUT PROGRAM REQUIREMENTS

"Some very big buildings have been very concerned about the minimum spending requirements. When they hear "required spending" they get nervous. …. "if you can't find improvements for $5,000, might we be locked into spending $30,000?"

SALES CYCLE

"The sales cycle is very long. Anything Nexant can do to assist in shortening the sales cycle [would be appreciated]."

TECHNICAL REVIEW CYCLE

"The technical review process gets very challenging. It gets time consuming with the whole back and forth process."

APPLICATION CYCLE

"The application phase should be accelerated. Reviews of service provider deliverables should be completed faster."

REPORT FORMATTING

"The one issue we've had is the formatting of the reports. We typically have to go in and fix a lot of the reports so the fonts match."

Source: Navigant analysis of EPY9/GPY6 RCx RSP Process interview data; n= 2 RCx respondents and n=5 RCxpress respondents.

Participant Recommendations to Improve the Building Tune-Up Path

Unlike the RCx and RCxpress participants, Tune-Up participants were looking for additional contact, greater depth and customized reports.

MORE TIME AT THE FACILITY AND CONTACT WITH BUILDING STAFF

"To improve the program, I'd recommend better enhancement of the initial scope, options for vendor selection, and more follow up meetings and staff."

"Greater understanding of the building in order to provide better recommendations, and more time spent at the buildings."

CUSTOMIZE REPORTS TO HIGHLIGHT FINANCIAL METRICS TO FACILITATE FUNDING DECISIONS

"[Tailor solutions to specific facilities by providing a] percentage as opposed to [a] standard amount."

Source: Navigant analysis of EPY9/GPY6 RCx participant Process survey data; n=12 Tune-Up respondents.

RSP Recommendations to Improve the Building Tune-Up Path

The Tune-Up RSPs also offered recommendations to improve the program that address the special concerns of smaller facilities with less staff dedicated to energy efficiency and building operations. They share concerns regarding the project cycle to improve the program.

ENHANCE CUSTOMER SERVICE WITH EDUCATIONAL AND LEAVE-BEHIND INFORMATION TO IMPROVE SATISFACTION AND PERSISTENCE:

"Usually the people that are running the building don't know where the information is. There should be a user guide."

"A quick video about the top ten (energy efficiency) measures to send to the building manager… would be helpful."

ADDRESS PROJECT CYCLES CHALLENGED BY REMOTE MANAGERIAL CONTROL

"My experience is it's hard getting customers into the program. Once they're in the program everything goes well. I had one project where getting the signature on the application from the owner who is all the way across the country is just excruciating."

AVOID CONFUSION WITH CUSTOMER COMMUNICATIONS FROM NEXANT

"The official communications to the customers need improvement. The official emails go out at the wrong time or with an internal projects name that neither the customer or myself understands. They seem autogenerated and often just create confusion."

Source: Navigant analysis of EPY9/GPY6 RCx RSP Process interview data; n=12 Tune-Up respondents.

What is the potential for keeping projects open longer and how will this affect RSPs?

Participants and RSPs Recognize the Need to Expand Savings and Persistence for the RCx and RCxpress Paths

The Challenge

Participants desire expanded savings and persistence through retro-commissioning, but recognize the challenges, even with dedicated staff. Both participants and RSPs echoed the need for a better understanding of the facilities, systems and operations to maintain savings:

PARTICIPANT

" We learned that our building engineers made a system change to rectify immediate problems which in turn made problems later."

RSP

" Sometimes if it's not working exactly right, the customer goes and throws the whole thing away, when they could just go in and tweak it and have a little less savings, but better than throwing it away."

Source: Navigant analysis of EPY9/GPY6 RCx participant Process survey data; n=2 RCx respondents and n=5 RCxpress respondents.

Participant Recommendations to Expand Savings and Persistence for the RCx and RCxpress Paths

Participants' Solutions:
To address the desire for better savings and persistence, RCx and RCxpress participants recommended greater communication and guidance over time:

OFFER GUIDANCE

"Provide more information and suggestions. Basically, offer us more guidance."

COMMUNICATE WITH DECISION MAKERS

"Talk to us more often and get our input and better [cost/benefit and financial] data so we can make ROI decisions."

COMMUNICATE WITH FACILITY ENGINEERS

"[Offer more] communication with the engineers."

Source: Navigant analysis of EPY9/GPY6 RCx participant Process survey data; n=2 RCx respondents and n=5 RCxpress respondents.

Participants Request Additional Training for the RCx and RCxpress Paths

In addition to the building operator certification (BOC) training required of RCx and RCxpress participants, survey respondents requested additional training.

FACILITY-SPECIFIC

"At my site [and] using my systems, not in a classroom or a seminar."

"Hands on, something that's related to what we do."

APPROPRIATE TO FUNCTION AT THE FACILITY

"The difference between training our contractors and our staff at different levels with twenty hours of training."

REMOTE, INSTRUCTOR-LED SEMINARS

"Online training with questions and answers. The teaching would need to pertain to my building. You could … have the teachings small enough that you don't get lost. We could do an hour a week at work [over 10 weeks]."

RSPs CONCUR

In addition to offering MBCx to improve persistence, RSPs recommend leaving materials behind to help guide the facility staff in maintaining the improvements implemented through the program, with one suggesting that these materials would help to

"avoid the pitfalls of resorting back to [their] same ways."

Source: Navigant analysis of EPY9/GPY6 RCx participant Process survey data; n=2 RCx respondents and n=5 RCxpress respondents.

RSPs Recommend Keeping Projects Open in RCx and RCxpress Paths

While all RSPs recommend MBCx for eligible facilities, most (75%) state that keeping projects open to uncover additional savings opportunities is beneficial to their customers.

A typical response from a RSP addresses both the benefit to their business of continued engagement as well as to the customer with increased savings:

BENEFITTING RSP BUSINESSES

"[Keeping projects open] is one of the ideas that goes into the on-going engagement."

BENEFITTING PARTICIPANTS

"That would provide an incentive to maintain a relationship with those customers and see how the measure is performing."

Source: Navigant analysis of EPY9/GPY6 RCx RSP Process interview data; n=2 RCx respondents and n=5 RCxpress respondents.

Participant Suggestions to Expand Savings and Persistence for the Building Tune-Up Path

Tune-Up customers, with few if any dedicated staff and smaller facilities, face different challenges when they seek additional savings and persistence compared to RCx and RCxpress customers. They have lower savings potential at smaller facilities, and RSPs receive lower incentives due to the limited savings anticipated.

The result is a more prescriptive program with less follow-up, leading to some dissatisfaction with the program and the potential for lower persistence. In addition to the request for leave-behind materials mentioned above, participants are eager for broader engagement with the program.

CONTINUED MONITORING

"More follow up, six months to a year later, just to continuously press the facilities to check what's going on. Maybe do some data analysis to check if things have slacked or dropped off."

ADDITIONAL SAVINGS OPPORTUNITIES

"Identification of additional opportunities to reduce energy costs through equipment optimization."

ADDITIONAL INCENTIVES THROUGH CHANNELING

"More incentives… offer a system for the whole facility."

Source: Navigant analysis of EPY9/GPY6 RCx participant Process survey data; n=12 Tune-Up respondents.

Participant Interest in Training and Leave-Behind to Expand Savings and Persistence for the Building Tune-Up path

- Most Tune-Up participants are interested in building operator training.
- Most of those were interested in on-site training specific to their equipment that ranged in length from two hours to a full day. One participant requested training for seasonal adjustments.
- Those Tune-Up participants interested in training are equally interested in leave-behind materials that include:
  - Instruction on how to use the data left behind and generated by their systems
  - Reminder of actions taken and additional steps
  - Check list to maintain their optimization

Source: Navigant analysis of EPY9/GPY6 RCx participant Process survey data; n=12 Tune-Up respondents.

RSP Suggestions to Expand Savings and Persistence for the Building Tune-Up path

Though the responding RSPs had in prior years experienced low margins with Tune-Up due to comparatively lengthy investigations yielding limited savings, they are interested in expanding their services to offer follow-up monitoring to improve persistence and potentially uncover additional savings opportunities. RSP interest includes monitoring and training.

SCHEDULED FOLLOW-UPS

"Having a remotely accessible building management system is pretty important. Also, check-ins maybe twice a year or something."

RSP INCENTED MONITORING

"There should be actual budgets for the service providers to monitor. Really monitoring is the answer."

REMOTE MONITORING

"Remote access to the building automation system. That way, somebody else can monitor the building like an energy manager or an outside contractor."

BUILDING OPERATOR TRAINING

"[Provide] additional training of the staff so they're aware of the impact of not turning off the lights or not setting equipment back."

"Helpful to have whoever is in charge of the building to get training on the equipment they have there and how it best runs, what needs to happen as the seasons change."

Source: Navigant analysis of EPY9/GPY6 RCx RSP Process interview data; n=12 Tune-Up respondents.

What is the viability of shifting customers to MBCx?

RSPs Recommend MBCx as an Option to Address Business Issues and Encourage Persistence

Where feasible, RSPs recommend MBCx as an option to uncover additional savings and encourage persistence. All RSPs who work with RCx and RCxpress participants would recommend MBCx to address business development issues in a saturated market and their customers' concerns with cost effectiveness and persistence.

MBCx Addresses RSP Business Issues

MARKETING SATURATION

"The retro-commissioning market in Chicago is pretty saturated, but there's room to grow in monitoring based commissioning."

MBCx Addresses Participants' Concerns

COST EFFECTIVENESS

"It's much more cost effective for the program and the service providers and for the customers to do MBCx."

PERSISTENCE

"There's no persistence [with RCx]. You have no idea to know if savings persist years down the line. The only real way to apply persistence is to do MBCx."

Source: Navigant analysis of EPY9/GPY6 RCx RSP Process interview data; n=11 RSPs interviewed.

RSPs Report High Customer Interest in MBCx to Uncover Additional Savings and Encourage Persistence

RSPs report high customer interest in MBCx when there are savings to be uncovered. Facility size has not been an issue, with RSPs reporting that their customers with mid-sized facilities are equally interested in MBCx as those with large facilities.

INTEREST IN ON-GOING MBCx

"[Customer reactions are] positive, [depending on] how we frame it. What they ask for is an indefinite program, as long as savings are available."

NO RELATIONSHIP BETWEEN FACILITY SIZE AND INTEREST IN MBCx

"No direct relation between size and benefit [was] noticed. Some large facility customers are more engaged, but it's customer to customer."

NO RELATIONSHIP BETWEEN CUSTOMER TYPE AND INTEREST IN MBCx

"It's been a broad spectrum [of interest by customer sophistication and facility size]. Clients vary from the very sophisticated LEED Platinum building that just wants to do a little better to schools with not very sophisticated projects. We give them issues lists to not get them overwhelmed on a weekly or monthly basis."

Source: Navigant analysis of EPY9/GPY6 RCx RSP Process interview data; n-11 RSPs interviewed.

RSPs Recommend Improvements to the MBCx Path

RSPs made recommendations to improve and expand MBCx and focus on the challenges of introducing a new product to customers.

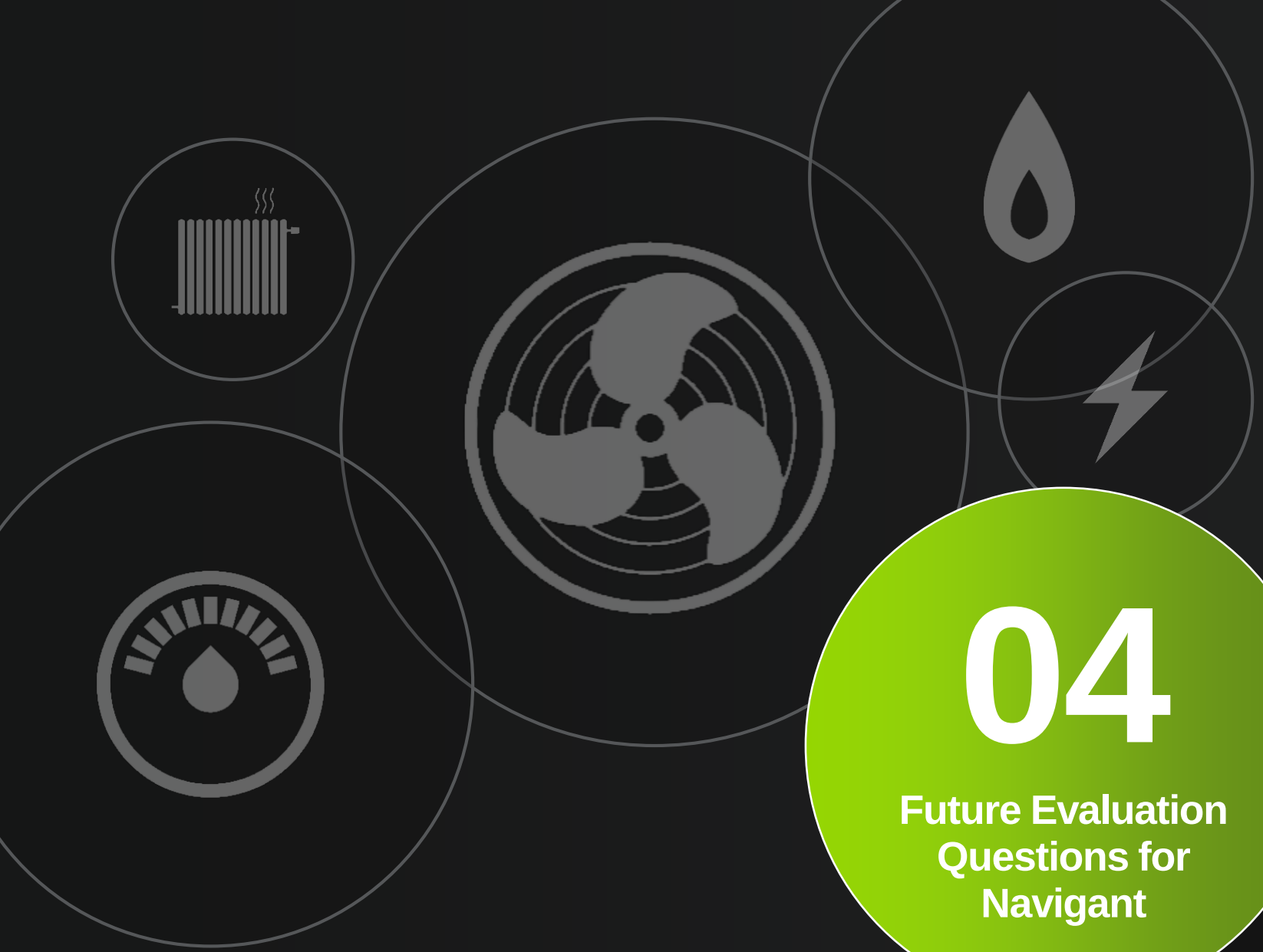
NEW PRODUCT REQUIRING IT INVOLVEMENT

"Lots of customers are learning all of this for the first time, and when software gets introduced IT gets involved and if they could provide more clarity to that."

INCENTIVES

"It's my opinion that RCx is more lucrative [for RSPs] and it is not as clear where the MBCx savings will come from, so the subsidy should be more focused on MBCx."

Source: Navigant analysis of EPY9/GPY6 RCx RSP Process interview data; n=11 RSPs interviewed.



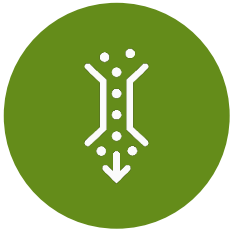
04

Future Evaluation Questions for Navigant

Future Evaluation Questions

Why are Tune-Up participants dropping out of the program?

How can the investigation reports encourage the adoption of additional recommended measures as well as channeling to other programs?



How can the controls contractor bottleneck be alleviated?

What is the role of Non-Energy Impacts in RCx?