



# **Coordinated Utility Retro-Commissioning Program Evaluation Report**

**FINAL  
Energy Efficiency / Demand Response Plan:  
Electric Plan Year 8 (EPY8) / Gas Plan Year 5 (GPY5)  
(6/1/2015-5/31/2016)**

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

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## E. EXECUTIVE SUMMARY

This report presents a summary of the findings and results from the impact and process evaluations of the EPY8/GPY5<sup>1</sup> Coordinated Utility Retro-Commissioning program. The Northern Illinois Coordinated Utility Retro-Commissioning (Retro-Commissioning) program is offered in partnership between ComEd and Nicor Gas, Peoples Gas and North Shore Gas. The Retro-Commissioning program helps commercial and industrial customers improve the performance and reduce energy consumption of their facilities through the systematic evaluation of *existing* building systems. EPY8/GPY5 continues the offerings from previous years, including recent additions for ComEd customers:

- Retro-Commissioning Express
- Retro-Commissioning Building Tune-Up
- Grocery Retro-Commissioning

This report emphasizes research for the Retro-Commissioning Building Tune-Up (RCx Building Tune-Up) and Grocery Retro-Commissioning (Grocery RCx) offerings. EPY8 represents the first, non-pilot year of RCx Building Tune-Up as well as an additional pilot year of Grocery RCx. Traditional Retro-Commissioning (Traditional RCx), Monitoring-Based Retro-Commissioning (MBCx) and Retro-Commissioning Express<sup>2</sup> (RCxpress), are all delivered through processes in place for several years. Thus, this report only includes impact evaluations for these offerings and all are collectively called “Legacy” offerings. Legacy channel offerings include RCx, MBCx, and RCxpress projects.

### E.1. Program Savings

The electricity and natural gas savings shown this section and throughout this report exclude electric and gas interactive effects. The reported electricity savings are the result of electric measures only, and the reported natural gas savings are the result gas measures only. If a measure saves electricity and gas, the savings are reported without adverse interactive effects.

Table E-1. summarizes the electricity savings from the Retro-Commissioning program.

**Table E-1. EPY8/GPY5 Total Program Electric Savings**

Savings Category	Energy Savings (MWh)	Demand Savings (MW)
Ex Ante Gross Savings	25,595	1.33
Verified Gross Savings	25,215	0.500
Verified Net Savings	23,955	0.475

*Source: ComEd tracking data and Navigant team analysis.*

<sup>1</sup> The EPY8/GPY5 program year began June 1, 2015 and ended May 31, 2016.

<sup>2</sup> Though a recent addition to the program, RCxpress is more similar to the Traditional and Monitoring Based Retro-commissioning offerings; thus it is grouped with these legacy offerings throughout the report.

Table E-2 summarizes the natural gas savings from the Retro-Commissioning program.

**Table E-2. EPY8/GPY5 Total Program Natural Gas Savings**

Savings Category	Nicor Gas (therms)	Peoples Gas (therms)	North Shore Gas (therms)
Ex Ante Gross Savings	309,711	111,459	989
Verified Gross Savings	287,914	116,095	989
Verified Net Savings	293,672	118,417	1,009

Source: Nexant tracking data and Navigant team analysis.

## E.2. Program Savings by Utility and Program Offering

Table E-3 details electricity and natural gas ex ante gross, verified and net savings by utility. Electric savings for the gas utilities reflect savings from coordinated projects only; thus, there might have been electric savings for other ComEd participants that are located in the gas utility service territory, but they were electric-only participants. The electric savings count toward ComEd and not the gas utility.

**Table E-3. EPY8/GPY5 Program Results by Utility**

Savings Category	ComEd	Nicor Gas	Peoples Gas	North Shore Gas
Ex Ante Gross Savings (therms)	NA	309,711	111,459	989
Ex Ante Gross Savings (MWh) *	25,595	NA	NA	NA
Ex Ante Gross Peak Demand Reduction (MW)	1.33	NA	NA	NA
Verified Gross Savings (therms) ‡	NA	287,914	116,181	989
Verified Gross Savings (MWh) ‡*	25,215	NA	NA	NA
Verified Gross Peak Demand Reduction (MW) ‡*	0.500	NA	NA	NA
Verified Gross Realization Rate (therms) ‡	NA	93%	104%	100%
Verified Gross Realization Rate (MWh) ‡*	99%	NA	NA	NA
Verified Gross Realization Rate (MW) ‡*	38%	NA	NA	NA
Net to Gross Ratio (NTGR)	Electricity 0.95 †			Gas 1.02 †
Verified Net Savings (therms)	NA	293,672	118,417	1,009
Verified Net Savings (MWh)*	23,955	NA	NA	NA
Verified Net Demand Reduction (MW)*	0.475	NA	NA	NA

Source: ComEd tracking data and Navigant team analysis.

\* Program-wide electric savings are summarized across all utilities. Thus, ex ante gross kWh savings for the program in Table E-3 is 25,595 MWh

† Source: from documentation on the IL SAG web site: <http://ilsag.info/net-to-gross-framework.html>

[http://ilsagfiles.org/SAG\\_files/NTG/2015\\_NTG\\_Meetings/Final\\_2015\\_Documents/ComEd\\_NTG\\_History\\_and\\_PY8\\_Recommendations\\_2015-02-24\\_v2\\_clean.xlsx](http://ilsagfiles.org/SAG_files/NTG/2015_NTG_Meetings/Final_2015_Documents/ComEd_NTG_History_and_PY8_Recommendations_2015-02-24_v2_clean.xlsx)

‡ Based on evaluation research findings.

**Table E-4. EPY8/GPY5 Program Results by Program Offering**

Savings Category	Legacy RCx Offerings <sup>‡</sup>	Building Tune-Up	Grocery RCx
Ex Ante Gross Savings (MWh)	21,496	3,613	487
Ex Ante Gross Peak Demand Reduction (MW)	1.105	0.224	0
Ex Ante Gross Savings (therms)	422,159	NA	NA
Verified Gross Savings (MWh)	21,290	3,560	365
Verified Gross Peak Demand Reduction (MW)	0.437	0.063	0
Verified Gross Savings (therms)	404,998	NA	NA
Verified Gross Realization Rate (kWh)	99%	99%	75%
Net to Gross Ratio (NTGR) <sup>†</sup>	0.95 electric, 1.02 gas		
Verified Net Savings (MWh)	20,226	3,382	347
Verified Net Demand Reduction (MW)	0.415	0.060	0
Verified Net Savings (therms)	413,098	0	0

Source: ComEd tracking data and Navigant team analysis.

<sup>†</sup> Source: from documentation on the IL SAG web site: <http://ilsag.info/net-to-gross-framework.html>

[http://ilsagfiles.org/SAG\\_files/NTG/2015\\_NTG\\_Meetings/Final\\_2015\\_Documents/ComEd\\_NTG\\_History\\_and\\_PY8\\_Recommendations\\_2015-02-24\\_v2\\_clean.xlsx](http://ilsagfiles.org/SAG_files/NTG/2015_NTG_Meetings/Final_2015_Documents/ComEd_NTG_History_and_PY8_Recommendations_2015-02-24_v2_clean.xlsx)

<sup>‡</sup> Legacy channel offerings include RCx, MBCx, and RCxpress projects.

### E.3. Impact Estimate Parameters for Future Use

In EPY8/GPY5 the Retro-Commissioning program evaluation team did not conduct any new research on parameters used in the Illinois TRM.

### E.4. Program Volumetric Detail

The RCx program had 100 participating projects in EPY8/GPY5 including one project from EPY7/GPY4 that implemented a gas measure for GPY5. Among these participants all receive electricity service from ComEd, 20 are coordinated utility projects receiving natural gas service from Nicor Gas, Peoples Gas, or North Shore Gas. Seventy-nine projects claimed only electric savings and one claimed no savings. These include electric-only RCx Building Tune-Up and Grocery RCx offerings, with 52 and five projects respectively.

**Table E-5. EPY8/GPY5 Volumetric Findings: Participants and Measures Installed**

Participation	ComEd Only	Nicor Gas	Peoples Gas	North Shore Gas
Projects	80	10	9	1
Electric measures	231	38	51	8
Gas Measures	NA	29	21	1
Total Installed Measures*	244 <sup>†</sup>	45 <sup>‡</sup>	57 <sup>‡</sup>	8
Measures/Project	3.1	4.5	6.3	8

Source: ComEd tracking data and Navigant team analysis.

\*There were 10 gas-only measures. Fifteen measures with no savings are also included in this total. Measures with both electric and gas savings are counted in both electric and gas totals.

<sup>†</sup>Includes 13 measures with no savings.

<sup>‡</sup>Includes one measure with no savings and some measures with both gas and electric savings.

In total, the program installed 354 measures, of which some saved both gas and electricity. Table E-6 shows participation by program offering. RCx Building Tune-Up and Grocery RCx are ComEd Only offerings.

**Table E-6. EPY8/GPY5 Volumetric Findings Detail: Measure Type**

Participation	Traditional RCx	MBCx	RCxpress	RCx Building Tune-up	Grocery RCx
Projects	22	11	10	52	5
Total Measures	119	34	56	133	12
Measures/Project	5.5	3.1	5.6	2.6	2.4

Source: ComEd tracking data and Navigant team analysis.

## E.5. Results Summary

The following table summarizes the key metrics from EPY8/GPY5.

**Table E-7. EPY8 Electric Results Summary**

Participation	Legacy Offerings‡	Building Tune-Up	Grocery RCx	Total ComEd
Net Ex Ante Savings (MWh)	20,421	3,432	462	24,316*
Net Ex Ante Demand Reduction (MW)	1.150	0.213	0	1.263
Verified Net Savings (MWh)	20,226	3,382	0.347	23,955
Verified Net Demand Reduction (MW)	0.415	0.060	0	0.475
Program Energy Realization Rate	99%	99%	75%	99%
Program Demand Realization Rate	40%	28%	NA	38%
Program NTG Ratio †	0.95	0.95	0.95	0.95
Customers Touched	10	12	4	26

Source: ComEd tracking data and Navigant team analysis.

‡ Legacy channel offerings include RCx, MBCx, and RCxpress projects.

\*Values may not sum exactly due to rounding

† Source: from documentation on the IL SAG web site: <http://ilsag.info/net-to-gross-framework.html>

[http://ilsagfiles.org/SAG\\_files/NTG/2015\\_NTG\\_Meetings/Final\\_2015\\_Documents/ComEd\\_NTG\\_History\\_and\\_PY8\\_Recommendations\\_2015-02-24\\_v2\\_clean.xlsx](http://ilsagfiles.org/SAG_files/NTG/2015_NTG_Meetings/Final_2015_Documents/ComEd_NTG_History_and_PY8_Recommendations_2015-02-24_v2_clean.xlsx)

**Table E-8. GPY4 Natural Gas Results Summary**

Participation	Nicor Gas	Peoples Gas	North Shore Gas
Net Ex Ante Savings (therms)	309,711	113,688	1,009
Verified Net Savings (therms)	287,914	118,417	1,009
Program Energy Realization Rate	93%	104%	100%
Program NTG Ratio †	1.02	1.02	1.02
Customers Touched	4	2	0

Source: ComEd tracking data and Navigant team analysis.

† Source: from documentation on the IL SAG web site: <http://ilsag.info/net-to-gross-framework.html>

[http://ilsagfiles.org/SAG\\_files/NTG/2015\\_NTG\\_Meetings/Final\\_2015\\_Documents/ComEd\\_NTG\\_History\\_and\\_PY8\\_Recommendations\\_2015-02-24\\_v2\\_clean.xlsx](http://ilsagfiles.org/SAG_files/NTG/2015_NTG_Meetings/Final_2015_Documents/ComEd_NTG_History_and_PY8_Recommendations_2015-02-24_v2_clean.xlsx)

## E.6. Key Findings and Recommendations

In general, the EPY8/GPY5 evaluation team reviewed a mature program that has adjusted to the market over the years to include customers<sup>3</sup> that would benefit from the program, when they might otherwise not participate. Recent program changes added to appeal to smaller facilities and grocers should position the program for sustained participation and savings in coming years. Participants and RSPs are generally satisfied with the program. The following provides insight into key program findings and recommendations.<sup>4</sup> The process evaluation focused on the new program offerings in EPY8/GPY5. The EPY9/GPY6 evaluation will include a process evaluation for all program offerings.

See Section 6 of this report for the full list of Findings and Recommendations.

### Program Participation

**Finding 1.** Program participation has continued to fall for the RCx and MBCx program offerings (32 projects in EPY8/GPY5, down from 37 in EPY7/GPY4 and 49 in EPY6/GPY3), but increased overall with the addition of participation offerings for smaller facilities and groceries. Future program strength will require continued effort to broaden the program appeal. For smaller sites, this will require more effort from ComEd to market the program, as Retro-Commissioning Service Providers (RSPs) see diminished returns with marketing heavily to smaller customers.

**Recommendation 1.** As mentioned last year, continue to work to identify groups and associations that might have an affinity with the smaller facilities who are targets of the new program offerings. These might include smaller building/real estate management companies, big-box retailers, chambers of commerce, suburban business park associations, etc.

**Recommendation 2.** Continue to investigate marketing to legacy offering participants from the initial years of the program offering. These customers may benefit from refreshed inspections and analysis.

### Program Energy Impacts

**Finding 5.** There is a common issue of the calculators using limited pre and post data. Sites should collect as much pre and post data as possible and try to bin energy use against

<sup>3</sup> Examples of program adjustments include introduction of RCxpress, RCx Building Tune-Up and Grocery RCx and accommodation of district energy customers and campus projects.

<sup>4</sup> Numbered findings and recommendations in this section are the same as those found in the Findings and Recommendations section of the evaluation report for ease of reference between each section.

outside air temperature instead of creating trend lines. In many cases, only a few weeks of summer data form the basis of trend lines which are then used to represent winter operation. These linear extrapolations often do not represent the real operation of HVAC units.

**Recommendation 7.** Verify that calculations carry any verification data forward into all dependent measures in a project, and not just apply it to the primary measure for which it was implemented. Inspect extrapolations for reasonableness of application.

**Recommendation 8.** When half-hour set points need to be rounded to full-hour for use in the Tune-Up calculator, either choose a standard rounding direction (the same direction for both on and off times) or specify why another choice is being made.

**Finding 7.** Floating head and suction pressures in existing grocery systems is often not possible due to lack of relatively inexpensive hardware through retrofitting. Although set point adjustments occurred as a part of these RCx activities, many set points had to be readjusted and/or the set points were greatly limited due to system design.

**Recommendation 10.** The program should consider incentivizing minor retrofits of equipment to support the RCx activities on the refrigeration systems. Installation of balance port thermal expansion valves would allow these systems to float the head pressure by an additional 10 °F or more. These valves are fairly cheap and simple to install but greatly enhance a system's ability to float head pressure and could double site savings. In addition, installation of capacity controls on compressors, such as cylinder unloading valves would allow better staging of the equipment.

## Process Evaluation

**Finding 8.** RSP success in the performance-based program is based in part on pre-screening for suitable facilities and speedy processes.

**Recommendation 11.** Require stringent pre-screening of any leads generated through the program.

**Recommendation 12.** Continue to streamline the process to reduce RSP and participant frustration with bureaucratic procedures.

**Recommendation 13.** Offer training to RSP staff that will enable them to generate required materials more quickly with fewer errors to save additional overhead on each project.

**Finding 9.** Enhancing persistence of savings is likely by offering training to the maintenance and repair staff contracted by the facilities. These facilities frequently do not employ permanent engineers or energy managers. Both RSPs and participants report that the contracted maintenance staff reset optimized measures without understanding the change, or the impact of the changes.

**Recommendation 14.** Launch a training and certification program for maintenance and repair contractors similar to MEEA's HVAC SAVE<sup>5</sup>.

**Finding 10.** We experienced difficulty convincing RCx Building Tune-Up participants to participate in a survey, with only nine of 30 participants agreeing to take the survey and seven of 30 completing it.

**Recommendation 15.** Accelerate the survey schedule to approach participants throughout the year, shortly after the project is complete. This schedule would involve approving and fielding the survey prior to the PY9 Plan being complete, but should yield far better results.

**Recommendation 16.** RSPs and the implementer should remind participants about surveys of their experience with the Retro-Commissioning program, thereby encouraging them to participate in the survey process.

<sup>5</sup> More info can be found at: <http://hvacsave.com/what-hvac-save>

## 1. INTRODUCTION

### 1.1 Program Description

The Northern Illinois Coordinated Utility Retro-Commissioning (Retro-Commissioning) program has been operating each of the eight electric program years. Electric Program Year 8 (EPY8) also marked the fifth natural gas program year (GPY5) 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 no shared management costs or cost allocations. ComEd manages the program and ComEd covers the full costs; however, 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 due to the intensive investigation and analysis of heating, ventilation and air-conditioning (HVAC) systems. Individual measures often save both electricity and natural gas and analyzing one power source, while neglecting the other, would be a lost energy savings opportunity.

The program helps commercial and industrial customers improve the performance and reduce energy consumption of their facilities through the systematic evaluation of *existing* building systems. Generally, the program pays for 100 percent 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 that has a simple payback of 18 months or less. RCx Building Tune-Up and Grocery RCx offerings include implementing common Retro-Commissioning measures immediately by the customer with the RSP (direct implementation) without prior detailed research and analysis.

**Table 1-1. Program Attributes – by Participation Offering**

Program Offering	Target Facility Size	Study Incentive	Customer Commitment
Traditional and Monitoring Based	>250,000 ft <sup>2</sup> >500kW	100% with Caps	\$15,000-30,000
RCxpress	150,000 – 400,000 ft <sup>2</sup>	100%	\$5,000 or \$8,000
RCx Building Tune-Up	Less than 150,000 ft <sup>2</sup> >100kW	\$5000 maximum including implementation incentives	Direct Implementation changes
Grocery RCx	Full Service to Convenience	100%	Direct Implementation changes

Due to the similarity in program delivery and marketing, the utilities and evaluators refer to the Traditional, Monitoring-based, and RCxpress offerings collectively as “legacy” offerings and are evaluated together, even though RCxpress is a relatively recent addition to the program. Legacy channel offerings include RCx, MBCx, and RCxpress projects.

ComEd manages the program and the gas utilities monitor the program and contribute input, as needed. For all but the Grocery RCx offering, Nexant Inc. (Nexant) was the implementation contractor (IC) in EPY8/GPY5. The IC manages the day-to-day operation of the program including marketing, interacting with customers, working with program-approved RSPs and reporting progress and savings to the utilities. The gas utilities and their respective ICs, Franklin Energy (for Peoples Gas and North Shore Gas) and

CLEAResult and Nexant (for Nicor Gas), participate in bi-weekly program operation calls and work with their respective customers. In PY8 ComEd managed day-to-day operations of the Grocery RCx offering with select RSPs.

In addition to the offering attributes noted above, the program is open to all customers who meet the eligibility requirements:

- Facilities must receive electricity delivery service from ComEd (*regardless of energy supplier*), and, if participating in gas Retro-Commissioning, receive gas delivery from Peoples Gas, North Shore Gas or Nicor Gas.
- Service to facilities must be under a ComEd commercial rate schedule.
- Applicants must be part of a non-public organization<sup>6</sup>.
- Applicants must agree to use a pre-approved RSP.
- For participants in all but Grocery RCx and RCx Building Tune-Up offerings, the facility owner must send at least one staff member to Building Operator Certification™ (BOC) training. The staff member must receive BOC Level I Certification.
- The facility owner must provide access to the facility and time for the facility personnel to interface with the RSP, as well as assist with the reporting and collection of information pertaining to the operation of the facility during all phases of the project.
- The facility owner must implement Retro-Commissioning Measures (RCMs) according to the scope and outlined procedures within six months of acceptance into the program.

During EPY8/GPY5, the Retro-Commissioning program completed 100 projects including: 22 Traditional RCx sites<sup>7</sup>, 11 MBCx sites, 10 RCxpress, 52 RCx Building Tune-Up, and five sites for Grocery RCx. Participants and RSPs implemented and verified more than 300 RCMs. Three legacy channel steps are used by 17 different RSPs to progress participants through the program. The RCx Building Tune-Up projects employed nine RSPs, of whom six also worked as RSPs for the legacy channel programs. A single RSP completed all Grocery RCx projects.

## 1.2 Evaluation Objectives

The goal of the evaluation was to assess various impact and process questions specific to the Retro-Commissioning program. The evaluation team identified the following key researchable questions for EPY8/GPY5.

### 1.2.1 Impact Questions

1. What is the level of gross and net annual energy (kWh), total and peak demand (kW) and natural gas (therm) savings achieved by the program?
2. Did the program achieve its goals?
3. What is the free-ridership for the RCx Building Tune-Up and Grocery RCx offerings?

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<sup>6</sup> Public buildings such as government, municipal, and public schools are eligible for similar Retro-Commissioning incentives through the Illinois Department of Commerce and Economic Opportunity (DCEO)

<sup>7</sup> One of the traditional RCx projects completed gas savings measures in GPY5, but the other electric measures were completed and evaluated in EPY7/GPY4.

### **1.2.2 Process Questions**

The process evaluation will answer questions that are common among all program offerings and questions that are offering-specific.

1. How effective is the program implementation?
2. How effective are the program design and processes?
3. What is the program satisfaction for both participants and RSPs?

## 2. EVALUATION APPROACH

This evaluation of the Retro-Commissioning program reviews the eighth year ComEd has offered the program and the fifth year of its coordinated offering with the gas utilities. Navigant undertook file reviews of a representative sample of projects and onsite verification at 19 sites for the impact evaluation. During the process evaluation, Navigant interviewed key program staff, RSPs and RCx Building Tune-Up participants to gather feedback for the program.

### 2.1 Overview of Data Collection Activities

The following tables show the full set of data collection activities. Participant and RSP telephone process surveys only targeted the RCx Building Tune-Up offerings.

**Table 2-1. Primary Data Collection Activities**

What	Who	Target Completes	Completes Achieved	When
Program Tracking Database	Program Participants	Census	Census	September 2016
In Depth Interviews	Program Manager/Implementer Staff	2	2	August – September, 2016
Onsite M&V Audit	Program Participants	19	19	September – October, 2016
Telephone Survey	RCx Building Tune-Up Participants	13	7	October – November, 2016
Telephone Survey	Service Provider	4	5	November, 2016

The primary data for the impact evaluation came from the program implementation contractor, Nexant. Navigant reviewed the following data for the impact analysis:

- Program guidelines<sup>8</sup> that described expected savings estimation techniques and assumptions when site-specific data were not available.
- Exports from Nexant’s program tracking system in spreadsheet format including project-level and measure-level descriptions and savings.
- Electronic versions of reports, invoices, submittals and savings calculations.

To understand the measures, Navigant supplemented this data with on-site inspections at a sample of sites and requested supplemental data from participants and/or RSPs, as needed.

### 2.2 Verified Savings Parameters

The RSPs calculated research findings gross savings (*energy and coincident peak electric demand*) resulting from the EPY8/GPY5 Retro-Commissioning program with custom algorithms based on engineering principles and extrapolated to “typical” full-year savings with TMY3 weather data sets. Each measure type has its own unique inputs. Many measures will have multiple avenues of savings. For

<sup>8</sup> Smart Ideas for Your Business Commercial Retro-Commissioning Calculation and M&V Guidelines.

example, reducing the hours of operation for an air handler will save fan power and energy for heating and cooling the outdoor air introduced to the building system.

$$\text{Fan kWh savings} = \sum \text{Fan kW savings} * \text{HOU}$$

Where:

The calculation is summed hourly or based on bins of climate conditions

- Fan kW = constant, variable or discrete differences pre and post, depending on the application, climate and controls.
- HOU = Annual Hours of Use at each Fan kW savings level

$$\text{Heating savings} = \sum 1.08 * \text{CFM} * (T_{\text{OA}} - T_{\text{EA}}) - \text{fan energy savings}$$

Where:

The calculation is summed hourly or based on bins of climate conditions

- 1.08 = constant includes specific heat and density of air and time conversion.
- CFM = cubic feet per minute of outdoor air introduced to the building system – variable hourly or constant depending on the system and operating conditions
- $T_{\text{OA}}$  = Outdoor air temperature
- $T_{\text{EA}}$  = Exhaust air temperature
- Fan energy ultimately becomes heat in the building system, thus this energy is accounted in the fan savings.

Resulting savings, in BTU-required, is converted to input energy of the appropriate units.

$$\text{Cooling savings} = (\sum 4.5 * \text{CFM} * (h_{\text{OA}} - h_{\text{DA}}) + \text{fan energy savings (BTU)}) / 12,000 (\text{Btu/ton}) * \text{cooling system efficiency (kW/ton)}$$

Where:

The calculation is summed hourly or based on bins of climate conditions

- 4.5 = constant includes density of air and time conversion.
- CFM = cubic feet per minute of outdoor air introduced to the building system – variable hourly or constant depending on the system and operating conditions
- $h_{\text{OA}}$  = Outdoor air enthalpy (Btu/lb air)
- $h_{\text{EA}}$  = discharge air enthalpy (Btu/lb air)
- Cooling efficiency includes auxiliaries and performance at differing climate conditions
- Fan energy ultimately becomes heat in the building system, thus during the cooling season it is an additional load on the cooling system that is avoided

The electricity and natural gas savings presented throughout this report exclude electric and gas interactive effects. The reported electricity savings are the result of electric measures only, and the reported natural gas savings are the result gas measures only. If a measure saves electricity and gas, the savings are reported without adverse interactive effects.

### **2.2.1 Verified Gross Program Savings Analysis Approach**

Navigant selected a representative sample of projects for an engineering review of savings. Evaluation staff reviewed gross program impacts with a project-by-project and measure-by-measure approach. Evaluators reviewed submitted written materials and data to understand operations and limitations of measures and their implementation. Navigant reviews calculations to ensure savings estimates are accurate and include reasonable assumptions, as required. In many cases, this review 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 measures to determine whether they 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.

Navigant aggregated project-level savings with projects in the same sampling strata and determined strata-by-strata realization rates which we applied to the population strata for overall program savings estimates.

### 2.2.2 Verified Net Program Savings Analysis Approach

Navigant multiplied the verified gross savings estimates by a net-to-gross ratio (NTGR) to determine verified net energy and demand (*coincident peak and overall*) savings. In EPY8/GPY5, the NTGR estimates used to calculate the net verified savings were based on past evaluation research and defined through a consensus process through the Illinois Stakeholder Advisory Group (SAG) as documented in a publicly available spreadsheet.<sup>9</sup>

Deemed net-to-gross ratios differ depending on fuel type.

**Table 2-2. EPY8/GPY5 NTG Parameter Estimates**

Parameter	Electricity	Natural Gas
Net-to-Gross Ratio ‡	0.95	1.02
Source	EPY6 research	GPY1 research

Source: documentation on the IL SAG web site: <http://ilsag.info/net-to-gross-framework.html>  
[http://ilsagfiles.org/SAG\\_files/NTG/2015\\_NTG\\_Meetings/Final\\_2015\\_Documents/ComEd\\_NTG\\_History\\_and\\_PY8\\_Recommendations\\_2015-02-24\\_v2\\_clean.xlsx](http://ilsagfiles.org/SAG_files/NTG/2015_NTG_Meetings/Final_2015_Documents/ComEd_NTG_History_and_PY8_Recommendations_2015-02-24_v2_clean.xlsx)

‡ Deemed values

## 2.3 Process Evaluation

The process evaluation included in-depth interviews with key actors in the program including ComEd program managers, the implementers, program-approved Retro-Commissioning RSPs and telephone or in-person surveys of RCx Building Tune-Up and Grocery RCx participants. These interviews dealt with overarching satisfaction with the program and details about program operations, marketing, training, and market potential for Retro-Commissioning services. The interviews also addressed net-to-gross research for the RCx Building Tune-Up and Grocery RCx offerings applicable to EPY10 verified gross savings.

<sup>9</sup> Source: from reports on the IL SAG web site: <http://ilsag.info/net-to-gross-framework.html>  
[http://ilsagfiles.org/SAG\\_files/NTG/2015\\_NTG\\_Meetings/Final\\_2015\\_Documents/ComEd\\_NTG\\_History\\_and\\_PY8\\_Recommendations\\_2015-02-24\\_v2\\_clean.xlsx](http://ilsagfiles.org/SAG_files/NTG/2015_NTG_Meetings/Final_2015_Documents/ComEd_NTG_History_and_PY8_Recommendations_2015-02-24_v2_clean.xlsx)

### 3. GROSS IMPACT EVALUATION

The EPY8/GPY5 impact evaluation included verifying gross savings and reviewing the program tracking systems and files, reports and calculations related to the project. Our review of savings calculations examined the methodology and accuracy of the calculations. Navigant evaluated measured and assumed calculation inputs for reasonableness. If inputs were not reasonable (*for example, including the incorrect units or hours of operation*) we made adjustments to the calculation or confirmed inputs with the participant or RSP staff. Navigant confirmed savings at sampled projects with on-site inspection of a subset of the evaluation sample. If measures were not found during on-site verification as described in the ex ante reports, we asked the participant contact about operations and made necessary adjustments to savings estimates.

In general, we find the databases and savings estimates perform well for tracking program activity and recording accurate energy savings estimates. The relatively high realization rates for both electricity and gas energy savings indicates these system controls are performing well for the program overall. However, demand savings have a low realization rate due to inconsistent calculation methodology which should be standardized.

#### 3.1 Tracking System Review

The EPY8/GPY5 impact evaluation included verifying gross savings and a review of the program tracking systems. Data tracking for the Retro-Commissioning program is based on sequential databases – one populated with detailed data that are summarized and uploaded to utility-specific tracking systems. Summary fields in ComEd's, Nicor Gas' and Peoples Gas' and North Shore Gas' databases are populated with data from a TrakSmart database, which is maintained by the implementation contractor for detailed program tracking. Navigant reviewed the secondary database summary information and spreadsheet exports from the TrakSmart database.

In general, the databases accurately report project savings based on project reports. Navigant reviewed each of the measure-level details for the sampled projects. With a few exceptions, we find the tracking system adequate to the task, and utility program managers are satisfied with the data reporting.

- Projects are tracked from preliminary contact through internal implementation verification with appropriate intermediate updates.
- Key actors for each project are easily identified with contact information.
- Project savings are tracked from the point of original goals to planning savings based on observation to final verified savings.
- Measure history is complete: the fate of each measure is tracked with associated implementation costs and savings. It is possible to determine at what stage a measure is dropped from a project, and measures added at a later stage of analysis are picked up and included in project summaries.

In a few instances summed measure-level savings for a project did not reconcile with the program-level report based on reported program years for the measures, and evaluators had to manually add these measures to the PY8 savings. Additionally, the project-level data did not include demand savings, although they were shown in the measure-level reports.

Navigant has no recommendations for the tracking system at this time.

### 3.2 Program Volumetric Findings

Review of the database and project files determined the volumetric parameters for the program shown in Table 3-1. Note that RCx Building Tune-Up and Grocery RCx are not coordinated gas offerings. Gas-only measures and gas savings are not tracked for those offerings.

**Table 3-1. EPY8/GPY5 Volumetric Findings Detail**

Participation	ComEd Only	Nicor Gas	Peoples Gas	North Shore Gas
Projects	80	10	9	1
Electric measures	231	38	51	8
Gas Measures	NA	29	21	1
Total Installed Measures*	244†	45‡	57‡	8
<i>Measures/Project</i>	<i>3.1</i>	<i>4.5</i>	<i>6.3</i>	<i>8</i>

Source: ComEd tracking data and Navigant team analysis.

\*There were 11 gas-only measures. Fifteen measures with no savings are also included in this total. Measures with both electric and gas savings are counted in both electric and gas totals.

†Includes 13 measures with no savings.

‡Includes one measure with no savings and some measures with both gas and electric savings.

Among 354 measures implemented, 328 had electricity savings for the program, including 42 with both electricity and natural gas savings. Eleven measures only saved natural gas for the program. Fifteen measures tagged as verified in the database showed neither gas nor electric savings.

**Table 3-2. EPY8/GPY5 Volumetric Findings Detail**

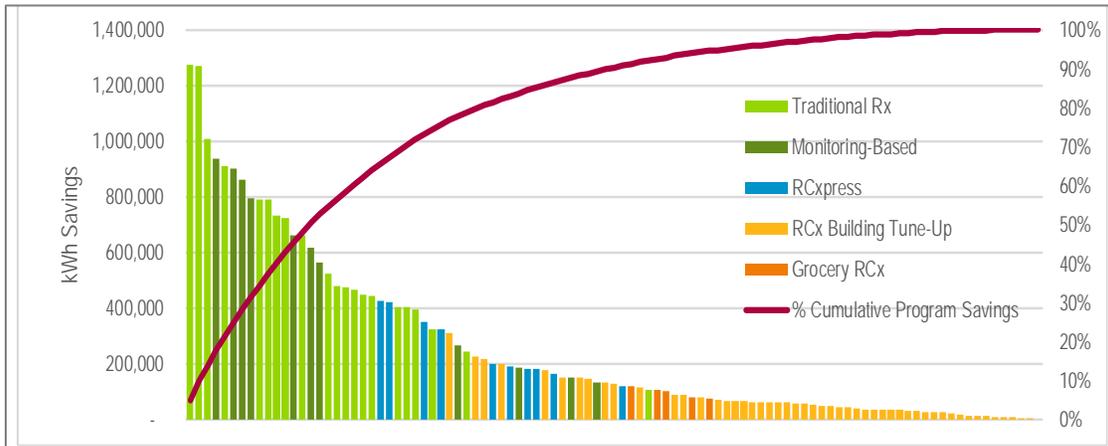
Participation	Traditional RCx*	MBRCx	RCxpress	RCx Building Tune-up	Grocery RCx
Participants	22	11	10	52	5
Total Measures	119	34	56	133	12
Measures/Participant	5.5	3.1	5.6	2.6	2.4

Source: ComEd tracking data and Navigant team analysis.

\* Includes one measure from a carryover gas project.

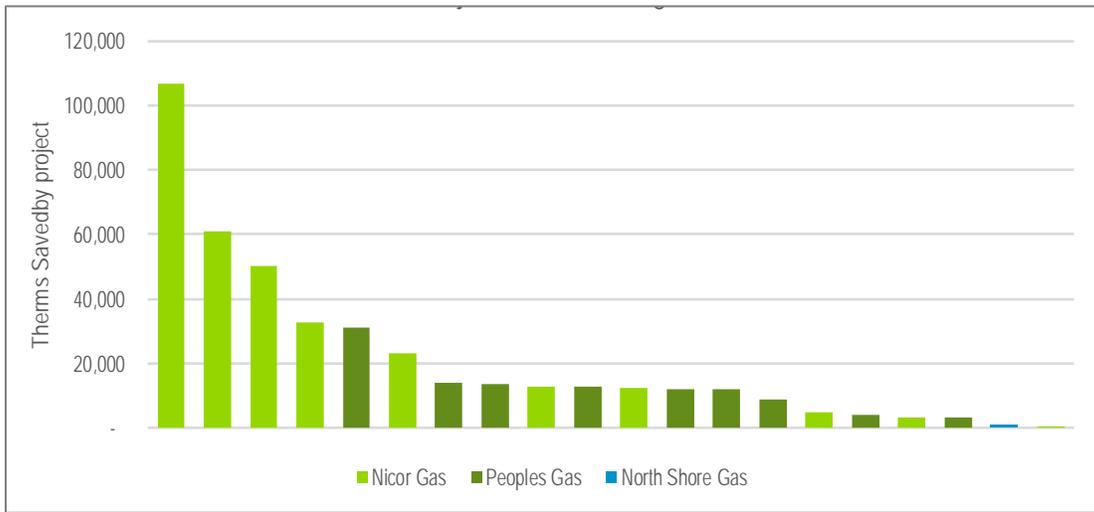
Figure 3-1 and Figure 3-2 show the distribution of savings by project and offering. All gas savings are through the Traditional RCx or RCxpress offerings.

Figure 3-1. Electricity Savings by Project and Program Offering



Source: Evaluation Analysis

Figure 3-2. Natural Gas Therm Savings by Project and Utility



Source: Evaluation Analysis

As in prior years, the majority of measures and savings are generally 1) optimization through set-point changes or resets that allow the building to meet comfort conditions with less energy consumption or, 2) schedule changes, where equipment is operated fewer hours based on the time of day or day of the week. Grocery RCx measures include adjustments to allow floating head and suction temperatures on refrigeration systems as well as anti-sweat heater and lighting controls. The remaining measures include minor repairs of broken equipment, such as stuck dampers and actuators, and low cost retrofits, such as using alternate filters or fan belts.

### 3.3 Gross Program 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. As explained in Section 2, service providers estimated energy and demand savings with custom algorithms, frequently using hourly weather data and time-series trend data. As such, the EM&V team conducted research to validate the savings individually for all measures in the evaluation sample.

### 3.4 Verified Gross Program Impact Results

Navigant selected a sample from the population with the goal of achieving 90 percent confidence and 10 percent precision on each of three segments of the program: combined RCx, MBCx, and RCxpress; Grocery RCx; and RCx Building Tune-Up. Since the Grocery RCx segment included only five projects; Navigant included all projects in the sample.

**Table 3-3. Impact Sample**

Program	Population Projects	Sample Projects	Population kWh	Sample kWh	Population Therms	Sample Therms
RCx, MBCx, and RCxpress*	43	19	21,496,061	11,984,647	422,159	355,184
Grocery RCx	5	5	486,803	486,803	NA	NA
RCx Building Tune-Up	52	15	3,612,627	2,000,286	NA	NA
<b>Total</b>	<b>99</b>	<b>39</b>	<b>25,595,491</b>	<b>14,471,736</b>	<b>422,159</b>	<b>355,184</b>

\*Includes one project with carry-over gas savings from previous year.

Source: ComEd tracking data and Navigant team analysis.

Overall, the sample included more than 50 percent of the gas and electric energy savings for each segment. Across all offerings, the sample included more than 56 percent of program electric energy savings and 83 percent of gas savings.

Among the sampled projects, Navigant compared ex ante savings to annual energy consumption prior to program participation. For electricity, project savings ranged from over 1.2 million kWh to 572 kWh, ex ante, with the largest 15 projects making up slightly over 50 percent of program savings. For natural gas, implemented savings ranged from over 100,000 therms to 402 therms annually, with the largest project comprising slightly over a quarter of program savings, and the three largest comprise over 50 percent of program savings. The total program verified gross savings is in Table 3-4. The table presents savings at the customer-level. Realization rates are the results of analyzing 38 projects including 167 measures. Because North Shore Gas had only one small project, that project was evaluated along with Peoples Gas.

**Table 3-4. Verified Gross Savings Realization<sup>10</sup>**

Savings Category	ComEd MWh	ComEd MW	Nicor Gas (therms)	Peoples Gas (therms)	North Shore Gas (therms)
Ex Ante Gross Savings <sup>1</sup>	25,595	1.33	309,711	111,459	989
Verified Gross Realization Rate	99%	38%	93%	104%	100%
Verified Gross Savings <sup>2</sup>	25,215	0.50	287,914	116,095	989

<sup>1</sup> Source Tracking systems

<sup>2</sup> Source: Evaluation

There are several reasons why realization rates are other than 1.0.

- On-site verification steps determined measures were implemented differently than reported. This might entail modified schedules or set points. Changes in schedules or set points were mostly due to operator adjustment in order to maintain occupant comfort.
- Some projects in the RCx Building Tune-Up offering did generate gas savings, but the program does not track gas savings for this offering whereas the program could increase gas savings if they were included, as they are in GPY6 and subsequent years.
- 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<sup>11</sup> method of using savings at 81.6 °F outdoor temperature.
- Occasional calculation or engineering errors also affected the realization rates. Two types of calculation errors were more common this year:
  - Floating head and suction savings were overly optimistic given the design and condition of refrigeration equipment included in the Grocery RCx projects.
  - 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.
- Other engineering errors affected verified savings, but these instances were not systematic.

<sup>10</sup> The electricity and natural gas savings presented throughout this report exclude electric and gas interactive effects.

<sup>11</sup> 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.

## 4. NET IMPACT EVALUATION

The EM&V team used net-to-gross (NTG) values, deemed for prospective use through the SAG,<sup>12</sup> to calculate verified net savings. Table 4-1 below shows the deemed NTG values and the EPY8/GPY5 verified net savings.

**Table 4-1. EPY8/GPY5 Deemed Net to Gross Ratio Values Estimates**

Parameter	Electricity	Natural Gas
Net-to-Gross Ratio	0.95	1.02
Source	EPY6 research	GPY1 research <sup>13</sup>

Source: from documents on the IL SAG web site: <http://ilsag.info/net-to-gross-framework.html>  
[http://ilsagfiles.org/SAG\\_files/NTG/2015\\_NTG\\_Meetings/Final\\_2015\\_Documents/ComEd\\_NTG\\_History\\_and\\_PY8\\_Recommendations\\_2015-02-24\\_v2\\_clean.xlsx](http://ilsagfiles.org/SAG_files/NTG/2015_NTG_Meetings/Final_2015_Documents/ComEd_NTG_History_and_PY8_Recommendations_2015-02-24_v2_clean.xlsx)

Self-report interviews with program participants and RSPs, conducted during the EPY4/GPY1 evaluation, were used to determine gas and electric NTGR values. Navigant updated NTGR research for electricity projects in EPY6 and applied those results to EPY8/GPY5 verified gross savings. Verified net savings, calculated with NTG values, are in Table 4-2.

**Table 4-2. EPY8/GPY5 Program Results by Utility<sup>14</sup>**

Savings Category	ComEd MWh	ComEd MW	Nicor Gas Therms	Peoples Gas (Therms)	North Shore Gas (Therms)
Ex Ante Gross Savings <sup>15</sup>	25,595	1.33	309,711	111,459	989
Verified Gross Realization Rate <sup>‡</sup>	99%	38%	93%	104%	100%
Verified Gross Savings	25,215	0.500	287,914	116,095	989
Net to gross ratio (NTG) <sup>†</sup>	0.95	0.95	1.02	1.02	1.02
Verified Net Savings <sup>‡</sup>	23,955	0.475	293,672	118,417	1,009

Source: Utility tracking data and Navigant analysis.

<sup>†</sup> A deemed value.

<sup>‡</sup> Based on evaluation research findings.

<sup>12</sup> Source: from reports on the IL SAG web site: <http://ilsag.info/net-to-gross-framework.html>  
[http://ilsagfiles.org/SAG\\_files/NTG/2015\\_NTG\\_Meetings/Final\\_2015\\_Documents/ComEd\\_NTG\\_History\\_and\\_PY8\\_Recommendations\\_2015-02-24\\_v2\\_clean.xlsx](http://ilsagfiles.org/SAG_files/NTG/2015_NTG_Meetings/Final_2015_Documents/ComEd_NTG_History_and_PY8_Recommendations_2015-02-24_v2_clean.xlsx)

<sup>13</sup> GPY1 was concurrent with EPY4

<sup>14</sup> The electricity and natural gas savings presented throughout this report exclude electric and gas interactive effects.

<sup>15</sup> From the Tracking System

**Table 4-3. EPY8/GPY5 Verified Electric Net Impact Savings Estimates by Program Offering**

	Sample Size	Energy Savings (MWh)	90/10 Significance	Coincident Peak Demand Savings (MW)	90/10 Significance
<b>RCx, MBCx, and RCxpress</b>	<b>18</b>				
Ex-Ante EPY8/GPY5 Gross MWh Savings		21,496		1.105	
Realization Rate		0.99	0.03	0.40	0.46
Verified Gross MWh Savings		21,290		0.437	
NTG		0.95		0.95	
Verified Net Savings		20,226		0.415	
<b>RCx Building Tune-up</b>	<b>15</b>				
Ex-Ante EPY8/GPY5 Gross Savings		3,613		0.224	
Realization Rate		0.99	0.02	0.28	0.38
Verified Gross Savings		3,560		0.063	
NTG		0.95		0.95	
Verified Net Savings		3,382		0.060	
<b>Grocery RCx</b>	<b>5</b>				
Ex-Ante EPY8/GPY5 Gross Savings		487		0	
Realization Rate		0.75	NA	NA	NA
Verified Gross Savings		365		0	
NTG		0.95		0.95	
Verified Net Savings		347		0	
<b>Total</b>	<b>38</b>				
Ex-Ante EPY8/GPY5 Gross Savings		25,595		1.330	
Realization Rate		0.99	0.03	0.38	0.48
Verified Gross Savings		25,215		0.500	
NTG		0.95		0.95	
Verified Net Savings		23,955		0.475	

Source: Evaluation Team analysis.

The electricity and natural gas savings presented throughout this report exclude electric and gas interactive effects.

## 5. PROCESS EVALUATION

The process component of the Retro-Commissioning program evaluation focused on two participant offerings: RCx Building Tune-Up and Grocery RCx. Both tracks are electric-only. Program evaluators researched the legacy participation tracks – Traditional RCx, Monitoring-Based RCx, and RCxpress -- in EPY6/GPY3, and those process evaluation results indicated a stable program. Process research in EPY9/GPY6 will cover all program offerings on the established alternate-year schedule.

The process research in EPY8 addressed program design and implementation, program processes, marketing and outreach, and participant satisfaction. The primary data sources for the process evaluation were a review of program materials, interviews with program and implementation staff, as well as a survey of participating RSPs and customers. The process interviews also included questions to quantify free-ridership and program spillover for these participants.

Navigant attempted interviews with a census of the 32 unique customer contacts among the 57 RCx Building Tune-Up and Grocery RCx projects. We were successful in interviewing nine, comprising 23 percent of RCx Building Tune-Up savings and 81 percent of Grocery RCx savings. Among the reasons for unsuccessful interviews: three had incorrect contact details, two refused the interview, two terminated the interview prior to completion, and the remaining were non-responsive to repeated email and telephone requests.

We exceeded our goal of interviewing four RSPs by talking with five of the 11 RSPs who participated in RCx Building Tune-up. These five delivered 50 percent of projects and 60 percent of electric savings in the offering. In general, the process results are consistent with findings from the legacy offerings from prior evaluations.

We attempted to mitigate any non-response or self-selection bias in the Building Tune-Up survey by contacting each potential interviewee multiple times via email and telephone, including telephone voice messages. We reached out to each contact a minimum of five times and left telephone messages where possible.

### 5.1 Program Awareness and Marketing

The RCx Building Tune-Up and Grocery RCx participants represent smaller facilities than the legacy offerings. Customer contacts also report less awareness of Retro-Commissioning than counterparts in the legacy programs. While virtually all interview subjects for large buildings in prior years were aware of Retro-Commissioning and the program, only 66 percent of current respondents were aware of Retro-Commissioning services and 100 percent decided to retro-commission their facilities only after hearing about the program.

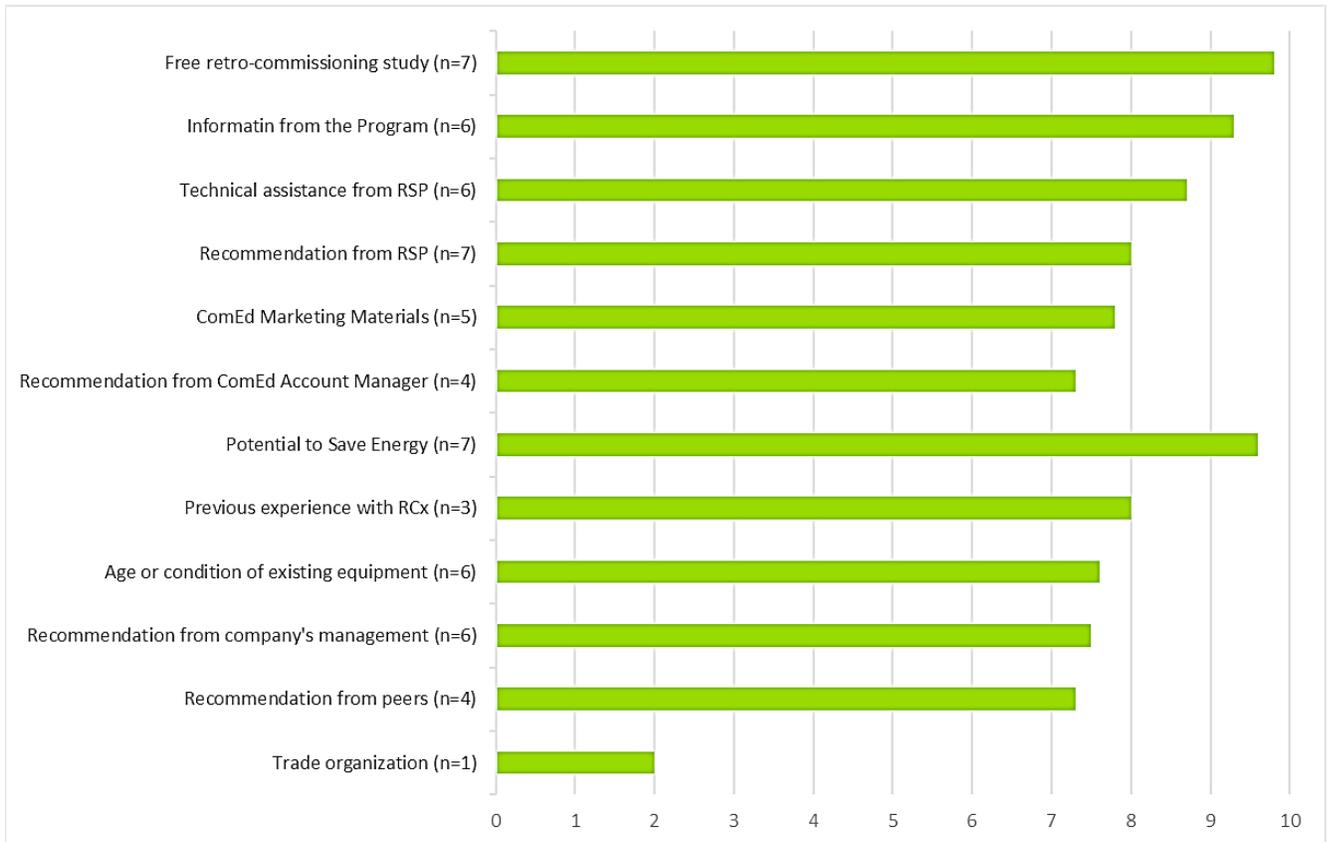
RSPs had prior relationships with 70 percent of their RCx Building Tune-Up customers. The RSP sample comprised both firms whose business model included servicing the smaller facilities that RCx Building Tune-Up addresses, and larger firms focusing on their large client needs. The remaining RSPs credited the program with increasing awareness of Retro-Commissioning among their customers.

The Tune-Up customers continue to lack awareness of the program, in part because they do not have staff dedicated to energy efficiency. As one RSP states, “[Clients with a portfolio of large and small buildings] know about the RCx Building Tune-Up opportunity because they’re actively trying to save energy. [The owners of predominantly smaller buildings], who don’t have [the expertise] mix, might not know anything.”

### 5.2 Program Attributes

Navigant asked participants to rank various attributes on a scale of 0-10, where 0 means “not at all important” and 10 means “extremely important.” As shown in Figure 5-1, the most important program attribute was the free Retro-Commissioning study, and the most important non-program attribute was the potential to save energy. The results show that the program attributes are very important to participants for addressing important non-program drivers.

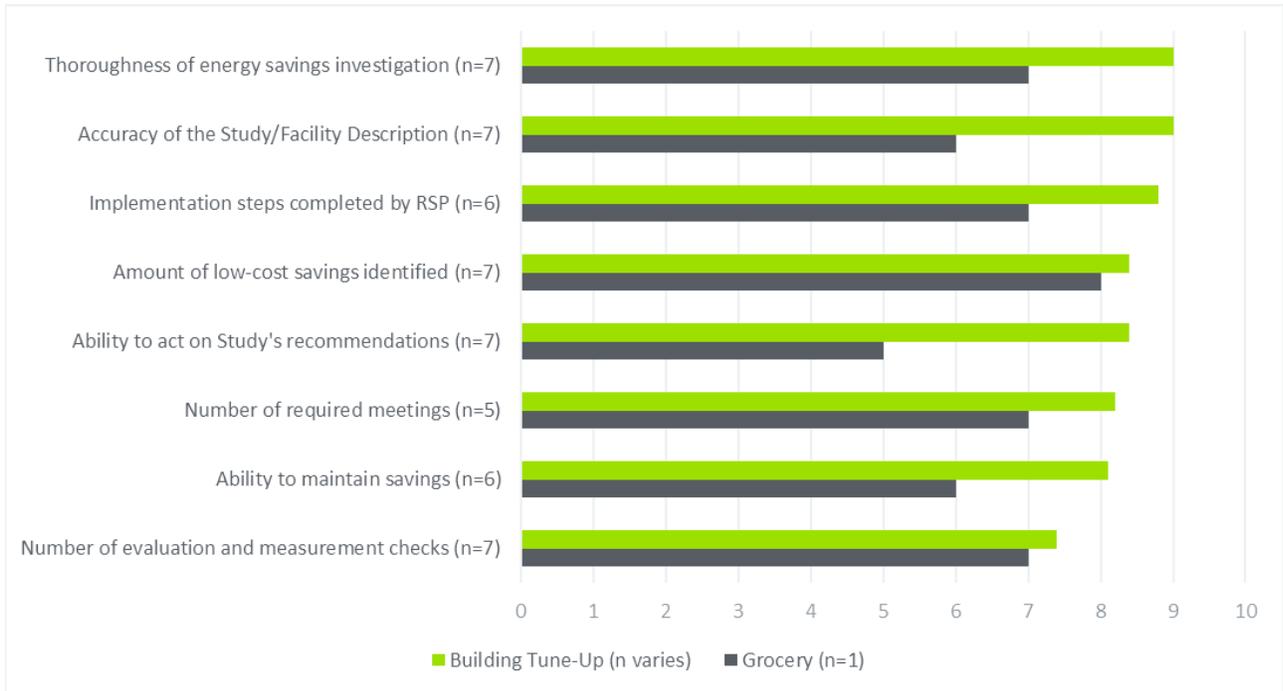
Figure 5-1. Importance of Program and Non-Program Attributes



Source: Navigant research

The program deliverables, including the energy savings investigation and amount of low-cost saving identified, exceeded a rating of 8 on a scale of 0-10, where 0 means “not at all satisfied” and 10 means “extremely satisfied.” As shown in Figure 5-2 the satisfaction level differed between the RCx Building Tune-Up participants and the Grocery RCx participants in large measure due to the Grocers’ reduced ability to act on the study’s recommendations and a lower satisfaction with the RSP. The Grocery RCx RSP reported that tight margins within the grocery field “leaves grocers cash strapped” and often unable to implement the recommended changes.

Figure 5-2. Participant Satisfaction with Deliverables



Source: Navigant research

RSPs had generally favorable feedback for the program, including:

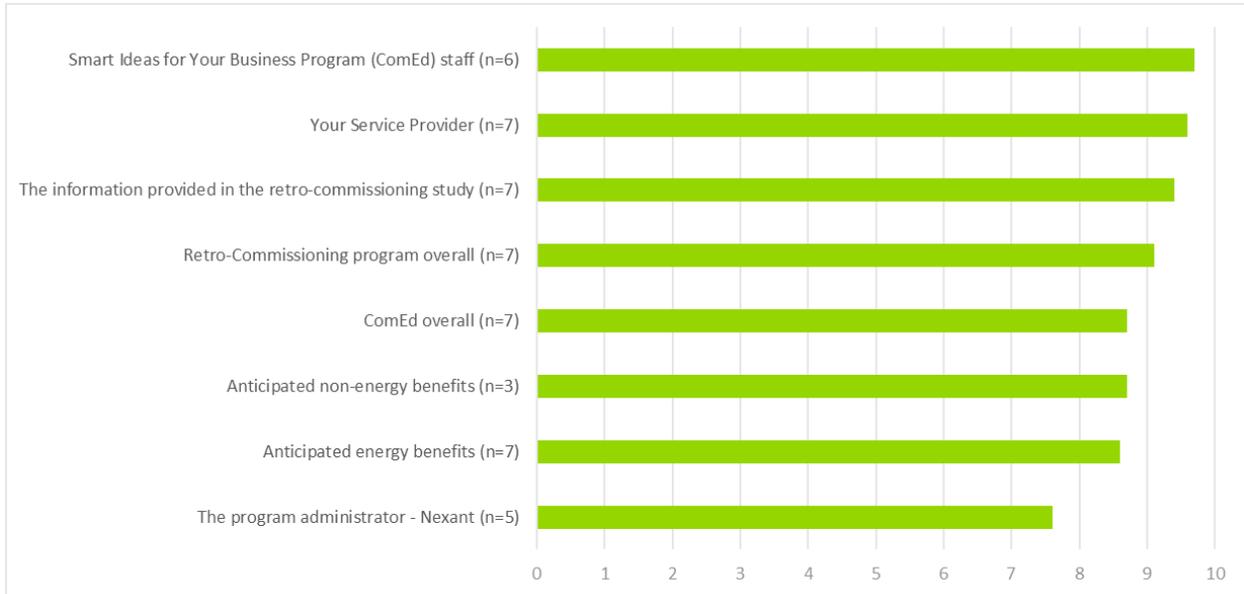
- “The calculator helps them find savings quickly for the small customers that otherwise aren’t worth it.”
- “They’ve put tighter constraints on the timeline for projects to limit RSP wasting their time on customer hold-ups. Customers can lose their money if they don’t move the project along fast enough.”
- “Nexant provides a list of top 10 measures to look for. It gets used for screening to limit facilities without sufficient controls and systems. That gives RSPs a guideline to help identify how they can find good projects.”

However, RSPs also report frustrations with the program including the guidelines. Some noted the guidelines limit persistence (“We would like to install what is practical so you know on paper we would be giving them less energy savings but, in our opinion, in the real world, we’d actually be giving them more energy savings because that implementation would have stayed implemented and not have been overridden when we walk out.”). Bureaucratic delays are noted too (“Coordinating the two engineers (IC’s and RSP’s”).

### 5.3 Program Satisfaction

Participants were very satisfied with the program, as shown in Figure 5-3. On a scale of 0-10, where zero means “not at all satisfied” and ten means “extremely satisfied,” all key program elements scored over an eight, with the exception of the program’s implementer. The majority of participants rated Nexant at a ten, but a minority rated it at a five or under. Grocery RCx participants rated all elements at an eight on the 0-10 scale.

Figure 5-3. RCx Building Tune-Up Participant Satisfaction with Program Elements



Source: Navigant research

RSP satisfaction was high, with 80 percent wishing to continue with the program. Half of those continuing will do so to enhance the service that they offer to their current, larger customers, while the other half is interested in the Tune-Up path to generate business and revenue.

### 5.4 Program Benefits

All interviewed participants consistently identified energy savings and/or cost savings as the primary program benefits.

Building Operator Training is not required for either the RCx Building Tune-Up or Grocery RCx paths, yet 43 percent of RCx Building Tune-Up participants would be interested in training for their staff. A Grocery RCx participant stated that training “would be beneficial,” while another would like to see training available to their contractors and maintenance or repair people, but not necessarily for the store’s staff.

A general perspective from RSPs was that the greatest benefit of the new offerings was the outreach to a new cohort of customers that were not eligible for the legacy program offerings. Customers appreciated the attention the program gave them and the reasonable amount of savings they achieved for limited or no financial commitment.

The RSPs were less enthusiastic about the benefits to their companies because the fees were too small to support larger companies with more overhead.

### 5.5 Program Barriers

Half the participants identified awareness of Retro-Commissioning as the main barrier to the program. Additional barriers included a concern that savings would not be realized, that costs associated with the program were difficult to plan, difficulty locating local resources to help with the low- and no-cost

recommendations, and frustration that the program budget cycle (June – May) runs counter the customer's budget cycle (January – December<sup>16</sup>).

The RSPs identified three main barriers to the program: time commitment, few qualifying opportunities, and a split incentive between property owners and lessees.

## 5.6 Channeling

Navigant also researched the question of channeling, including if participation in the RCx offerings helped to drive participation in other energy efficiency programs. Eighty-seven percent of the RCx Building Tune-Up and Grocery RCx customers expressed an intention to consider other ComEd programs since participation in RCx, specifically the Standard and Custom programs. Energy efficient equipment and additional Retro-Commissioning measures implemented at the facility that did not receive incentives through any utility or government program is classified as spillover and not channeling.

As part of the Retro-Commissioning study process, RSPs identify potential energy efficient equipment upgrades and list them in the study. Additionally, all RSPs promote ComEd, Nicor Gas, Peoples Gas and North Shore Gas Commercial and Industrial Prescriptive and Custom programs to participants as an opportunity to receive incentives for qualifying measures. RSPs often also continue to encourage participants to implement these measures after the Retro-Commissioning project concludes, although this appears to be stronger for RSPs with existing relationships with their clients.

## 5.7 Survey Respondent Recommendations for Improvement

Participants are motivated to improve persistence, and would like both additional contact with RSPs and training for their maintenance contractors. RSPs, too, are focused on persistence, and recommend incentivizing an alignment of building engineers or maintenance contractors with the RCx customer. To address project cost concerns, RSPs would like training on the administrative procedures required to complete RCx projects.

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<sup>16</sup> The program will run on a calendar year starting with PY10.

## 6. FINDINGS AND RECOMMENDATIONS

This section summarizes the key impact and process findings and recommendations. In general, the EPY8/GPY5 evaluation team finds a mature program that has adjusted to the market over the years to include customers<sup>17</sup> (that may not otherwise participate) that would benefit from the program. Recent program changes to appeal to smaller facilities and grocers appear to have positioned the program for sustained participation and savings. These are good additions and should continue to evolve and grow.

Program impacts and realization rates remain strong and indicative of adequate management and savings investigation. Participants and RSPs are generally satisfied with the program. The following provides insight into key program findings and recommendations.<sup>18</sup> Some of these recommendations carry-over from the EPY7/GPY4 evaluation, but they still hold true and are reinforced by the current evaluation research.

### Program Participation

**Finding 1.** Program participation has continued to fall for the RCx and MBCx program offerings (32 projects in EPY8/GPY5, down from 37 in EPY7/GPY4 and 49 in EPY6/GPY3), but increased overall with the addition of participation offerings for smaller facilities and groceries. Future program strength will require continued effort to broaden the program appeal. For smaller sites, this will require more effort from ComEd to market the program, as Retro-Commissioning Service Providers (RSPs) see diminished returns with marketing heavily to smaller customers.

**Recommendation 1.** As mentioned last year, continue to work to identify groups and associations that might have an affinity with the smaller facilities who are targets of the new program offerings. These might include smaller building/real estate management companies, big-box retailers, chambers of commerce, suburban business park associations, *etc.*

**Recommendation 2.** Continue to investigate marketing to legacy offering participants from the initial years of the program offering. These customers may benefit from refreshed inspections and analysis.

### Program Energy Impacts

**Finding 2.** As was true last year, gas savings are under-reported in the new program offerings. These offerings are electric-only, but significant gas savings are achieved due to complementary savings. This is being addressed in future program years.

**Recommendation 3.** Develop a consensus approach for handling the gas savings from the new offerings.

**Finding 3.** Demand savings estimates continue to be a challenge, and are only reported in the measure level database, not the project list. Peak demand savings are estimated when none is warranted. Inappropriate peak conditions are used in some estimates. Demand savings are not included for some projects where they exist. Smaller projects almost universally neglect demand savings estimates.

**Recommendation 4.** Standardize and enforce estimation methods for total and peak demand savings based on 81.6 °F as required by PJM, or the temperature bin containing that temperature. Track and report total demand savings in verification reports and in the tracking database. Ensure that transparent demand estimates in measure calculators are summarized parallel with energy savings estimates.

<sup>17</sup> Examples of program adjustments include introduction of RCxpress, RCx Building Tune-Up and Grocery RCx.

<sup>18</sup> Numbered findings and recommendations in this section are the same as those found in the Executive Summary section of the evaluation report for ease of reference between each section.

**Finding 4.** Energy realization rates continue to be relatively high. A large number of projects had minor issues due to baselines or new setpoints and a few still used a cube law instead of a factor of 2.5 in the affinity law. Errors in hours of operation also caused changes in realization rates for some sites. Some projects did not carry verification data for measures forward into other measures which were dependent upon those results.

**Recommendation 5.** All measures should use a factor of 2.5 with the affinity law relating fluid flow and power, unless measured data show otherwise. The “cube law” relationship is not appropriate for real-world conditions in these measures. As always, measured power, pre- and post-implementation, is the preferred data for estimating savings. Pressure versus power relationships are the best alternative to measured power for static pressure measures.

**Recommendation 6.** There is inconsistency in how savings are being calculated, project to project, and sometimes within a given project. If the provided program savings calculators are not flexible enough for some measures, enforcing program guidelines for assumptions and methods becomes more important.

## Program Energy Impacts

**Finding 5.** There is a common issue of the calculators using limited pre and post data. Sites should collect as much pre and post data as possible and try to bin energy use against outside air temperature instead of creating trend lines. In many cases, only a few weeks of summer data form the basis of trend lines which are then used to represent winter operation. These linear extrapolations often do not represent the real operation of HVAC units.

**Recommendation 7.** Verify that calculations carry any verification data forward into all dependent measures in a project, and not just apply it to the primary measure for which it was implemented. Inspect extrapolations for reasonableness of application.

**Recommendation 8.** When half-hour set points need to be rounded to full-hour for use in the Tune-Up calculator, either choose a standard rounding direction (the same direction for both on and off times) or specify why another choice is being made.

**Finding 6.** Calculators provided for review contain hard-coded values for many inputs, frequently without notes explaining their sources. At the same time many final calculations in the non-legacy offerings seem to be scrubbed of review comments from the IC, or they were not added in the first place. The history of the measure review informs the evaluation with measure details and nuances, and verifying inputs depends on being able to confirm their sources.

**Recommendation 9.** Maintain rigorous Implementation Contractor review – even for the smaller buildings for all offerings. Leave as much of the idea exchange as possible included in the calculation reviews in the electronic spreadsheets as well as actual formulas instead of hard coding values where notes claim the affinity law or other calculations are used. Also include notes on the source of data, including stations for TMY3 data. Alternatively, convert all appropriate measure saving estimates to program standard calculators when RSPs submit alternative calculations.

**Finding 7.** Floating head and suction pressures in existing grocery systems is often not possible due to lack of relatively inexpensive hardware through retrofitting. Although set point adjustments occurred as a part of these RCx activities, many set points had to be readjusted and/or the set points were greatly limited due to system design.

**Recommendation 10.** The program should consider incentivizing minor retrofits of equipment to support the RCx activities on the refrigeration systems. Installation of balance port thermal expansion valves would allow these systems to float the head pressure by an additional 10 °F or more. These valves are fairly cheap and simple to install but greatly enhance a system’s ability to float head pressure and could double site savings. In addition, installation of

capacity controls on compressors, such as cylinder unloading valves would allow better staging of the equipment.

### Process Evaluation

**Finding 8.** RSP success in the performance-based program is based in part on pre-screening for suitable facilities and speedy processes.

**Recommendation 11.** Require stringent pre-screening of any leads generated through the program.

**Recommendation 12.** Continue to streamline the process to reduce RSP and participant frustration with bureaucratic procedures.

**Recommendation 13.** Offer training to RSP staff that will enable them to generate required materials more quickly with fewer errors to save additional overhead on each project.

**Finding 9.** Enhancing persistence of savings is likely by offering training to the maintenance and repair staff contracted by the facilities. These facilities frequently do not employ permanent engineers or energy managers. Both RSPs and participants report that the contracted maintenance staff reset optimized measures without understanding the change, or the impact of the changes.

**Recommendation 14.** Launch a training and certification program for maintenance and repair contractors similar to MEEA's HVAC SAVE<sup>19</sup>.

**Finding 10.** We experienced difficulty convincing RCx Building Tune-Up participants to participate in a survey, with only nine of 30 participants agreeing to take the survey and seven of 30 completing it.

**Recommendation 15.** Accelerate the survey schedule to approach participants throughout the year, shortly after the project is complete. This schedule would involve approving and fielding the survey prior to the PY9 Plan being complete, but should yield far better results.

**Recommendation 16.** RSPs and the implementer should remind participants about surveys of their experience with the Retro-Commissioning program, thereby encouraging them to participate in the survey process.

**Finding 11.** The RCx program may be better leveraged to channel customers to other programs within the Smart Ideas for Your Business portfolio. Tracking of channeling and channeling opportunities should be improved to leverage the RCx program.

**Recommendation 17.** To further enhance channeling, Nexant should share specific, client-based capital improvements recommended by RCx RSPs with implementers across the C&I Portfolio if they are not already doing so.

**Recommendation 18.** A database should be created that includes fields for recommended capital improvements and the customer's budget cycle to facilitate promotional emails or contacts five, three and two months in advance of budget deadlines two through four years following the RCx. This will allow time for the RCx savings to be realized and place the capital improvement benefits in the budget discussion.

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<sup>19</sup> More info can be found at: <http://hvacsaves.com/what-hvac-save>

7. APPENDIX

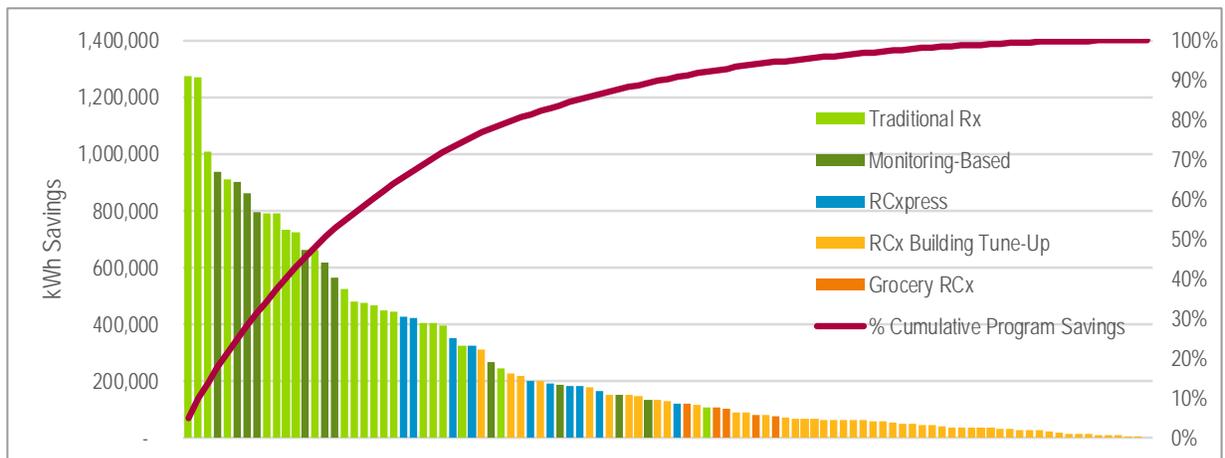
7.1 Evaluation Research Impact Approaches and Findings

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 Verification Reports and supporting data and calculations provided sufficient confirmation that the measures were installed as described. Navigant identified 19 projects within the impact sample for on-site verification.<sup>20</sup> Evaluators visited all 19 of these sites between August and October 2016 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 some grocery sites.

Figure 7-1 and Figure 7-2 show the distribution of savings by project and offering. Slightly over half of program savings comes from 15 projects; over 75 percent of program electric savings comes from 30 projects, significantly less than half of all participants. The majority of the gas savings is through the Traditional Retro-commissioning (RCx) offering with the exception of the largest Nicor Gas project, which participated through Monitoring-Based Retro-commissioning (MBRx).

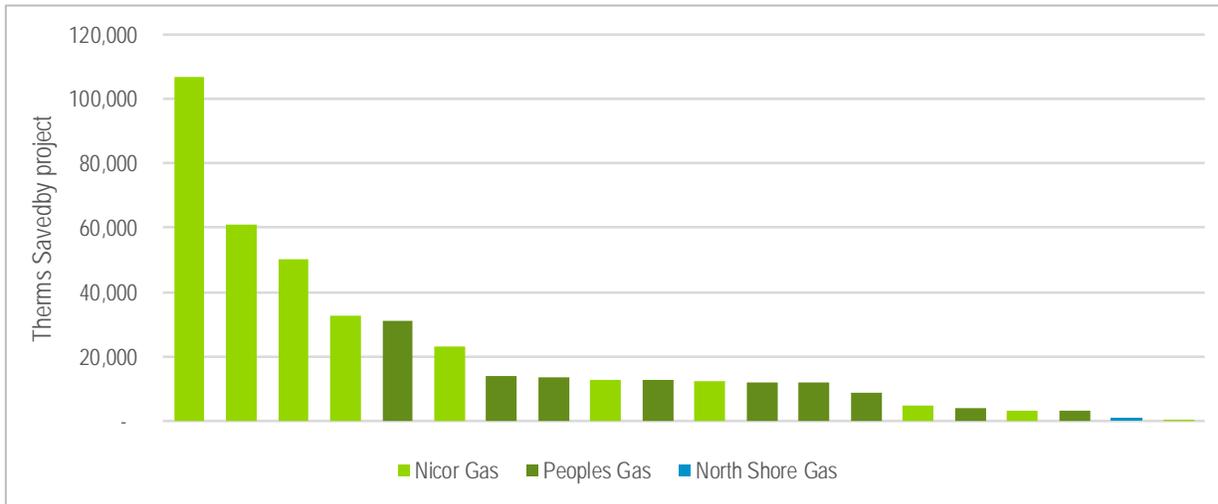
Figure 7-1. Electricity Savings by Project and Program Offering



Source: Evaluation Analysis

<sup>20</sup> 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. Projects with chilled water and cooling tower measures were selected because their full functionality would not necessarily have been verifiable before May 31. 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).

Figure 7-2. Natural Gas Therm Savings by Project and Utility



Source: Evaluation Analysis

**7.1.1 Evaluation Research Gross Impact Findings**

For all 38 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 resulting 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<sup>21</sup> data.

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 EPY8/GPY5, 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.

Grocery RCx measures saw low realization rates primarily due to the inability of systems to reach the aggressive set points used by the program with their current hardware. Retrofitting valves to allow floating head set points and compressor staging would provide significantly higher savings for the program.

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 7-1 details the realization rates by sampled projects. Realization rates for energy varying by more than 10 percent from 1.0 are due to reasons noted. The wide variation in demand

<sup>21</sup> TMY3 is the most recent version of the Typical Meteorological Year data sets.

realization rates is caused by inconsistent ex ante calculation methodologies and is not discussed in detail in the table.

**Table 7-1. Project Level Realization Rates**

Project	Realization Rates			Notes on ex ante Estimates
	kWh	kW	Therms	
12-040*			72%	Measure control strategy incorrectly entered into calculator.
13-103	82%	100%	43%	ECMs 4, 5: Site contact claims S1/S2 night setback schedules were never implemented; commented out of the control code. Ex ante claimed no electric savings for this, but gas savings were not removed. ECM #13: Post-project schedule was until 4PM not 1PM.
13-105	81%	253%		ECM6 was not completed according to onsite data (resumed baseline controls), ECM3 had incorrect demand conditions.
14-004	100%		100%	
14-004	92%			
14-005	72%			Incorrect entry of baseline set point temperatures in ex ante calculations
14-006	36%			Miscalculated temperature/pressure relationship in calculation; most racks did not change setpoint so no floating suction savings.
14-007	84%			Model had a base condenser temp of 85 °F but reported base was 83 °F.
14-007	100%			
14-017	109%			
14-043	103%		93%	
14-044	99%	96%	264%	Affinity law has wrong exponent in ECM1. Gas hours referenced wrong cells in ECM2; electric hours wrong in ECM13.
14-049	74%			Omitted conversion factor between HP and kW.
14-102	96%			
14-103	100%			
14-110	92%			
15-002	100%		100%	
15-011	111%		100%	Chiller COP of 5 is too high for air cooled equipment. Motor efficiencies incorrect for size.
15-015	98%	178%	98%	
15-016	90%	58%	54%	ECM3: Changed boiler plan on/off temperature back to 70 °F. ECM11 did not adjust for changes made in ECM6. ECM12 based on 100% outside air but should be 10% make up air.
15-017	91%			
15-027	143%	139%	190%	Cooling equipment shuts off at 60 °F; ex ante used 50 and 35 °F. DCV ex ante used minimum OSA as 5% but data show 0%. Cooling off below 60 °F, but 35 °F used in one place. Cooling tower staging OSA temp maximum too low. Maximum CFM inconsistent for same AHUs across calculations.
15-031	107%		105%	
15-034	100%		100%	
15-435	100%			
15-452	100%			
15-453	100%			

Project	Realization Rates			Notes on <i>ex ante</i> Estimates
	kWh	kW	Therms	
15-464	101%			
15-467	105%			
15-473	100%			
15-477	85%	75%		ECM1 uses the space temperature instead of the discharge air temperature to calculate cooling savings and neglects savings from latent cooling. Adjusted the ECM1 calculations to account for ECMs 2 and 3. Calculations for ECM3 did not match the measure described in the verification report. Ex ante analysis extrapolated temperature bins based on limited available data.
15-482	101%			
15-498	104%			
15-516	161%			Trending showed that hours were much higher than claimed in ex ante calculations. Initial investigation calculator was far more accurate—96% RR.
15-527	94%			
15-532	82%			Chilled water pump flows in ex ante calculations did not match data in files.
15-538	95%			
15-541	92%			
15-545	100%			

\*Project 12-040 claimed electric savings in EPY7 but gas savings in GPY5 so only gas savings are included here.  
Source: Evaluation research

### 7.1.2 Evaluation Research Net Impact Findings

The primary objective of the evaluation research net savings analysis for the Retro-commissioning Program was to determine the RCx Building Tune-Up and Grocery RCx's net effect on customers' electricity usage. After gross program impacts have been assessed, net program impacts are derived by estimating a net-to-gross ratio (NTGR) that quantifies the percentage of the gross program impacts that can be reliably attributed to the program.

For PY8, we conducted evaluation research to estimate the level of free ridership and spillover among participants and RSPs for the RCx Building Tune-Up and Grocery RCx offerings, interviewing seven participants and five RSPs from the RCx Building Tune-Up offering and two participants from Grocery RCx. Quantifying free ridership requires estimating what would have happened in the absence of the program. Navigant implemented a customer self-report method, based on data gathered during telephone interviews, to estimate the free ridership for this evaluation. The existence of spillover in PY8 was quantitatively examined by identifying spillover candidates through questions asked in the participant telephone interviews.

The EM&V team conducted free ridership and spillover research among RCx Building Tune-Up participants and RSPs for potential application in PY10. Overall the PY8 research estimated a NTGR for the RCx Building Tune-Up of 84 percent, with qualitative research supporting this estimate as a *lower* bound for NTGR. In other words, the research supports a NTGR of at least 84 percent. However, due to the limited sample size for Building Tune-Up, and limited sample size combined with corporate directives to engage in energy efficiency projects like RCx within Grocery, we recommend applying the current 95 percent NTGR moving forward.

### 7.1.2.1 Free-Ridership

Navigant estimated free ridership by quantifying three attributes investigated during the participant survey, combined with a qualitative analysis of the RSP survey results. The participant survey results in three equally weighted measures of free-ridership:

1. **Program Component Score:** the influence of various program components (e.g., free RCx study, available rebates, etc.) on the participant's decision to conduct the study and commit the funding to perform Retro-Commissioning activities.
2. **Program Influence Score:** the relative importance of program influences vs. non-program influences in the participant's decision-making.
3. **No-Program Score:** The likelihood that the participant would have addressed the issues identified in the Retro-Commissioning study of which they were aware if the program did not exist, and, if so, when they would have addressed the issues.

Navigant developed the free ridership estimates consistent with the TRM v5.0 Study-Based Protocol. The protocol provides two options for calculating a No-Program Score. Navigant estimated free ridership using both options. The resulting free ridership estimates were 19 percent following the Study-Based Free ridership No-Program Score Option 1, and 18 percent following Option 2. The difference between Option 1 and Option 2 was minimal because few respondents answered the additional questions used in Option 2 in such a way that the overall estimate was changed. We recommend using the estimate of 19 percent from Option 1 because the algorithm is simpler and allows respondents to speak for themselves more directly without layering in additional evaluator judgments. Table 7-2 presents detailed results of the free ridership estimation for the RCx Building Tune-up Program.

**Table 7-2. Detailed Free Ridership Results for Tune-up Program**

Score	Average Score*	Description
Program Component Score	1%	This score is based on a series of questions regarding the influence of various program components (e.g., free RCx study, available rebates, etc.) on the participant’s decision to conduct the study and commit the funding to perform Retro-Commissioning activities. This score is based on the most influential program component to capture the most important element in the participant’s decision-making.
Program Influence Score	39%	This score is based on a question in which respondents are asked to assign 100 points to program vs. non-program influences in their decision-making process.
Non-Program Score (Option 1)	5%	This score is based on a question regarding the likelihood that the participant would have implemented the same measures if the program did not exist. This measure of free ridership is adjusted downward if the program significantly accelerated the measure’s implementation.
Non-Program Score (Option 2)	5%	This score is based on a series of questions regarding the likelihood that the participant would have implemented the same measures if the program did not exist. Expanding on the algorithm used in Option 1, this score also incorporates responses to questions about the participant’s awareness and past experience with the measure. This measure of free ridership is adjusted downward if the program significantly accelerated the measure’s implementation.
Final Free ridership Score (Option 1)	<b>19%</b>	Each participant’s free ridership score is the average of their Program Component Score, Program Influence Score, and Non-Program Score. The individual participant scores are then rolled up to the program level through a kWh savings-weighted average.
Final Free ridership Score (Option 2)	<b>18%</b>	

\*Energy savings-weighted average of all respondents. Note that a high score indicates high free-ridership/low program influence and a low score indicates low free-ridership/high program influence.

Source: Evaluation research

The Grocery participant survey was completed with one major participant which comprised 80 percent of total program energy savings.

Four of the five RSPs interviewed said that they would *never* perform comparable Retro-Commissioning services without the program, and the one who said that they might went on to say that none of their participating customers would have performed any of the related projects within two years. Since the participants indicated that the RSPs exerted a very high influence on the decision to participate in the program (on a 0-10 scale, “recommendations from the RSP” received an average influence rating of 8.0, and “technical assistance from the RSP” rated an 8.7), and the RSPs indicated a very high program influence on their studies, Navigant concludes that a very high net-to-gross score is expected. Thus, Navigant recommends that the free ridership score of 19 percent be considered to be an upper boundary on free-ridership.

### 7.1.2.2 Spillover

Navigant also researched the question of program spillover, including any energy efficient equipment and additional Retro-Commissioning measures implemented at the facility that did not receive incentives through any utility or government program. Navigant also asked RSPs about spillover, both their own activities and observations of the regional Retro-Commissioning market.

Two Tune-up participants reported installing energy-efficient equipment without program rebates, but one of them did not attribute the project to the program’s influence. Two Tune-up participants reported implementing additional energy efficiency operational improvements after participating in the program. Thus, three participants reported program attributable spillover projects. In the absence of more detailed spillover project descriptions, Navigant assumed that each spillover project’s savings is equal to 25 percent of the program project’s savings. Navigant estimated the attribution factor (i.e., the share of spillover savings attributable to the program) in accordance with the TRM v5.0 Core Non-residential Spillover Protocol. For the RCx Building Tune-up Program, the resulting spillover estimate is 3 percent of program savings.

The Grocery participant survey did not identify any spillover.

### 7.1.2.3 Net-to-Gross Ratio (NTGR)

Table 7-3 summarizes the free-ridership, spillover, and resulting NTGR results for the RCx program. However, due to the limited sample size for Building Tune-Up, and limited sample size combined with corporate directives to engage in energy efficiency projects like RCx within Grocery, we recommend applying the current 95 percent NTGR moving forward.

**Table 7-3. Summary of FR, SO, and NTGR Results**

Program Component	Free ridership Estimate	Spillover Estimate	NTGR (1 – FR + SO)
Building Tune-up	19%	3%	84%
Grocery	47%	0%	53%

Source: Evaluation research

## 7.2 Detailed Process Findings

### 7.2.1 Data Tracking

The EPY8/GPY5 impact evaluation included verifying gross savings and a review of the program tracking systems. Data tracking for the Retro-Commissioning program is based on sequential databases – one populated with detailed data that are summarized and uploaded to utility-specific tracking systems. Summary fields in ComEd’s, Nicor Gas’ and Peoples Gas’ and North Shore Gas’ databases are populated with data from a TrakSmart database, which is maintained by the implementation contractor for detailed program tracking. Navigant reviewed the secondary database summary information and spreadsheet exports from the TrakSmart database.

In general, the databases accurately report project savings based on project reports. Navigant reviewed the measure-level details for the sampled projects. In general, we find the tracking system adequate to the task, and utility program managers are satisfied with the data reporting.

- Projects are tracked from preliminary contact through internal implementation verification with appropriate intermediate updates.
- Key actors for each project are easily identified with contact information.
- Project savings are tracked from the point of original goals to planning savings based on observation to final verified savings.
- Measure history is complete: the fate of each measure is tracked with associated implementation costs and savings. It is possible to determine at what stage a measure is dropped from a project, and measures added at a later stage of analysis are picked up and included in project summaries.

## 7.2.2 Program Service Providers

Only pre-qualified RSPs may participate in the program. The RSPs are active in recruiting participants to the program and conduct all phases of the program with the participants: application, planning, investigation, implementation and verification. RSPs must demonstrate their capability to serve the program before they are pre-qualified. RSPs are subject to periodic review of their performance which might require re-application to or termination from the program. Nexant and ComEd maintains this group of RSPs and they are listed on the ComEd website with contact information.

In EPY8/GPY5 there were 22 registered RSPs for the legacy offerings, RCxpress and RCx Building Tune-up. One RSP with specialized refrigeration expertise is pre-qualified for the Grocery RCx offering. Among the pre-qualified RSPs, 18 submitted at least one project in EPY8/GPY5. One RSP submitted 45 percent of the legacy program kWh savings and one submitted 47 percent of the RCx Building Tune-Up kWh savings.

Among the offerings, 15 RSPs were active with the legacy programs, 11 were active with RCx Building Tune-Up, and one was active with Grocery RCx.

## 7.2.3 Detailed Process Findings for RCx Building Tune-Up and Grocery RCx

The process component of the Retro-Commissioning program evaluation focused on two participant offerings: RCx Building Tune-Up and Grocery RCx. Both tracks are electric-only. Evaluators researched the legacy participation tracks – Traditional RCx and Monitoring-Based RCx -- in EPY6/GPY3, and the process evaluation results indicated a stable program so they were not researched this program year. Process research in EPY9/GPY6 will cover all program offerings on the established alternate-year schedule.

The process research in EPY8 addressed program design and implementation, program processes, marketing and outreach, and participant satisfaction. The primary data sources for the process evaluation were a review of program materials, interviews with program and implementation staff, as well as a survey of participating RSPs and customers. The process interviews also included questions to quantify free-ridership and program spillover for these participants.

Navigant attempted interviews with a census of the 32 unique customer contacts across 57 Building Tune-Up and Grocery RCx projects. We were successful in interviewing nine, comprising 23 percent of Tune-Up savings and 81 percent of Grocery RCx savings. Participant interview contacts represented property managers, data center engineers, facility owners and general managers. We were able to interview five of 11 RSPs participating in RCx Building Tune-up, comprising 50 percent of projects and 60 percent of electric savings. In general, the process results are consistent with findings from the legacy offerings from prior evaluations.

As part of the study, we conducted interviews with participants in the PY8 ComEd RCx Building Tune-Up program. The PY8 program had 48 unique projects, completed by 30 unique contacts, eight of whom completed two or more projects. We attempted to interview all 30 contacts, and completed seven comprehensive interviews.

- Three contacts could not be reached, with either invalid contact information (phone number and email address) or were no longer employed at the organization that participated in the program and an alternate contact was unavailable
- Three additional contacts provided hard initial refusals to participating in the interview
- Two contacts began the interview but did not complete
  - One terminated mid-interview and was unresponsive to further outreach
  - One refused to complete interview questions but did provide useful contextual information about their programmatic experience
- The remaining contacts were either completely nonresponsive to repeated outreach or failed to be available for scheduled interviews and then became nonresponsive

We attempted to mitigate any non-response or self-selection bias by contacting each potential interviewee multiple times via email and telephone, including telephone voice messages. We reached out to each contact a minimum of five times and left telephone messages when possible.

### *7.2.3.1 Program Awareness and Marketing*

The RCx Building Tune-Up and Grocery RCx participants represent smaller facilities than the legacy offerings. Customer contacts also report less awareness of Retro-Commissioning than counterparts in the legacy programs. While virtually all interview subjects for large buildings in prior years were aware of Retro-Commissioning and the program, only 66 percent of current respondents were aware of Retro-Commissioning services and 100 percent decided to retro-commission their facilities only after hearing about the program.

Customers report a variety of contact and marketing modes that reflect the breadth of the marketing campaign. Participants recall marketing from RSPs (44 percent), ComEd marketing material and outreach staff (33 percent), and Nexant and industry events (11 percent each). The most persuasive information in convincing participants to engage in Retro-Commissioning was evenly split, with 44 percent preferring financial metrics including savings and payback and 44 percent favoring specific information for their facility from a RSP. The remaining 12 percent favored direct contact from a program representative.

Participants rated the usefulness of marketing materials on a 0-10 scale, where 0 meant not at all useful and 10 meant extremely useful. On average, they rated case studies from businesses in their industry and case studies from businesses of their size at an 8, and fact sheets detailing the program or Retro-Commissioning in general at a 7.8.

Sixty-six percent of participants considered the Retro-Commissioning program to be offered by a combination of ComEd and their RSP, while 34 percent considered the program to be offered by ComEd alone. No participants considered the program to be offered by their RSP alone.

RSPs had prior relationships with 70 percent of their RCx Building Tune-Up customers. The RSP sample comprised both firms whose business model included servicing the smaller facilities that RCx Building Tune-Up addresses, and larger firms focusing on their large client needs. These large clients, including medical and university campuses, were already aware of the legacy offerings for larger buildings, but they also frequently had small, independent structures that fell within the RCx Building Tune-Up guidelines. The remaining RSPs credited the program with increasing awareness of Retro-Commissioning among their customers.

The RSPs who focus on serving the smaller facilities find the RCx Building Tune-Up path to be an “excellent revenue source,” while those who serve larger clients participate in this path “to maintain business relationships,” and “have a lot of face time with clients and improve our relationships with our clients.”

The Tune-Up customers continue to lack awareness of the program, in part because they do not have staff dedicated to energy efficiency. As one RSP states, “[Clients with a portfolio of large and small buildings] know about the RCx Building Tune-Up opportunity because they’re actively trying to save energy. [The owners of predominantly smaller buildings], who don’t have [the expertise] mix, might not know anything.”

### **7.2.3.2 Program Attributes**

As shown in Figure 5-1 and Figure 5-2 in Section 5.2 RCx Building Tune-up participants generally had positive feedback about program attributes. RSPs also had mostly favorable experiences with the program, including:

- “The calculator helps find savings quickly for the small customers that otherwise aren’t worth it.”
- “They’ve put tighter constraints on the timeline for projects to limit RSP wasting their time on customer hold-ups. Customers can lose their money if they don’t move the project along fast enough.”
- “Nexant provides a list of top 10 measures to look for. It gets used for screening to limit facilities without sufficient controls and systems. That gives RSPs a guideline to help identify how they can find good projects.”

However, RSPs also report frustrations with the program, including:

- “The guidelines can be frustrating. We would like to install what is practical, even though on paper we would be giving them less energy savings, but in our opinion, we’d actually be giving them more energy savings because that implementation would have stayed implemented and not have been overridden when we walk out.”
- “All we’re doing is making some simple control sequence changes that pretty much can get implemented in a day or two but these projects take weeks and months to get through because there is so much paperwork and reports and phone calls and conference calls and emails. Our frustration and our client’s frustration is these are simple things and seem like it’s over complicated.”

### **7.2.3.3 Program Satisfaction**

Participants were very satisfied with the program, as shown in Figure 5-3. On a scale of 0-10, where zero means “not at all satisfied” and ten means “extremely satisfied,” all key program elements scored over an eight, with the exception of the program’s implementer. A majority of participants rated Nexant at a ten, but a minority gave it a five or under. Grocery RCx participants rated all elements at an eight on the 0-10 scale.

Participants reported that the program strengths were the free study, the energy savings and the quality of their RSP. One hundred percent of respondents would definitely recommend the program to peers, citing the energy savings and low cost. One participant would tell peers that “you can get improvements

for little expense without involving staff at the facility level” while another would “tell [peers] to look into the program to save their complexes money [through] energy savings.”

RSP satisfaction was high, with 80 percent wishing to continue with the program. Half of those continuing will do so to enhance the service that they offer to their current, larger customers, while the other half is interested in the Tune-Up path to generate business and revenue. RSP comments include:

- The new, improved promotional material lets the RSP “explain [the program] to [the customer] and they get it, and now they understand what you’re going to do.”
- The training is very effective with “a good amount of peer learning and advice for handling common problems.”
- Some RSPs feel that budgets and timeline do not allow enough investigation to uncover more savings opportunity and the RSPs need to change their building energy audit process significantly to produce a deliverable quickly. These RSPs absorb the loss to enhance the service they offer to existing customers.

### 7.2.3.4 Program Benefits

All interviewed participants consistently identified energy savings and/or cost savings as the primary program benefits. Participants further commented on the program benefits, saying:

- Participation “didn’t require capital commitment, unlike programs for larger facilities, and was low risk.”
- Participation “did not involve local resources, but used external resources and at minimal cost”
- “Our experts at Corporate are busy. This program brings in third party experts who do the work and then leave. It is perfect.”

Building Operator Training is not required for either the RCx Building Tune-Up or Grocery RCx paths, yet 43 percent of RCx Building Tune-Up participants would be interested in training for their staff. A Grocery RCx participant stated that training “would be beneficial,” while another would like to see training available to their contractors and maintenance or repair people, but not necessarily for the store’s staff.

A general perspective from RSPs was that the greatest benefit of the new offerings was the outreach to a new cohort of customers that was not eligible for the legacy program offerings. Customers appreciated the attention the program gave them and the reasonable amount of savings they achieved for limited or no financial commitment. RSP comments include:

- “We’re better able to serve our customers and bring customers to the program and let them take advantage of incentives and rebates that were [previously unavailable to them].”
- “Now that the program is performance based, it encourages the RSP to find the most savings. Pre-screening makes it worthwhile. Without pre-screening it may not be worth it.”
- “The barrier to entry in the RCx and the Tune-Up is no different with small buildings. These people are even probably more conscious because the engineering study or service contractor fee is going to be \$5,000-10,000. That’s a lot of money for them. It’s absolutely a wonderful program for the clients, the building owners, because that barrier to entry is effectively eliminated.”

The RSPs were less enthusiastic about the benefits to their companies because the fees were too small to support larger companies with more overhead. RSP comments include:

- “The amount of money they give us for that initial report typically doesn’t come close to covering our costs to do the initial report.”

- “For us, it’s almost just like a sales tool that we can use in-house to try to get in front of clients to create new projects.”
- “I hope we break even. We don’t. Tune-Up is not something we do to make money on.”
- “There are a lot of buildings in this size segment and they need energy efficiency services, but it needs to be cost-effective, and for [us] it doesn’t make financial sense. Maybe the effort would make sense for the contractor who is servicing the building. Or perhaps smaller professional RSPs, like a two-person firm with low overhead. RCx Building Tune Up is too small an audience for [us].”

Time spent on a project is critical for the RSP to generate a profit. The limited one-day walk-through was sometimes inadequate for the potential savings. A RSP explained, “For the initial walk through and assessment to tee up projects and scope everything, we are more than double the \$2,000 for everyone. My point is we expect to spend \$25,000 to do the three projects, with incentives coming out at \$27,000, and little wiggle room in calculations.” Changes to the Tune-Up path elicited a compliment from one RSP: “We like the speed by which they can move through the phases of a project.”

#### **7.2.3.5 Program Barriers**

Half the participants identified awareness of Retro-Commissioning as the main barrier to the program. Additional barriers included a concern that savings would not be realized, that costs associated with the program were difficult to plan, and difficulty locating local resources to help with the low- and no-cost recommendations. A Grocery RCx participant expressed frustration that the program budget cycle (June – May) runs counter the customer’s budget cycle (January – December).

The RSPs identified three main barriers to the program:

1. Time commitment: “the customers still has to coordinate people coming into the building, and small building operators often don’t have the staff.”
2. Few qualifying opportunities: “[the facilities] lack sophisticated building controls that meet the criteria of the program.”
3. Split incentive: “70-80 percent of the buildings we’re talking about are going to be owned by one entity and you know leased out to another entity.”

#### **7.2.3.6 Respondent Recommendations for Improvement**

Service providers and participants suggested the following recommendations for program improvement.

- Participants would like additional contact with the RSP to understand how to maintain savings, and suggest a “formal 12-month follow-up, circling back to see that implementations are being maintained.”
- Participants hope for educational webinars and/or training for maintenance contractors to prevent changes to the optimizations.
- A RSP recommended delaying full payment or affecting a penalty for altering the optimizations, in part to address “in-house politics between the building manager and engineer, saying you need to understand the changes and agree with them, and to force the client to be a lot more responsible with what they’re willing to do and how they’re willing to do it.”
- Additional RSP training for office staff to “walk you through step by step the project and show you exactly what we expect out of you -- this formatting, presented this way. That would save a lot of time.”

## 7.2.4 Survey Instruments

### 7.2.4.1 Participant Survey

## ComEd C&I Retro-Commissioning Program RCx Building Tune-up Participant Survey October 4, 2016 FINAL

Section	Topics	Questions
<b>Background</b>	Subject background	B1-B3
	Project background	B4-B5B
<b>Free Ridership</b>	Program factors, including incentive, assistance, program-affiliated recommendations	FR1-FR2G
	Non-Program factors, including condition of existing equipment, previous experience, organizational policy. Awareness	FR2H-FR3 FR7-FR9
	Counterfactual, including implementation, scope and timing	FR5-FR7
	Measure loops	FR8-FR10
<b>Spillover &amp; Channeling</b>	Incentive-eligible measures installed without applying for incentives	SO1-SO6
	Participation in additional programs; additional facilities participating in RCx	CH1-CH3
<b>Marketing and Outreach</b>	Program awareness, best methods to reach customer, most persuasive content	MK1-MK7
<b>Program Design</b>	Barriers, benefits, encouraging persistence	PD1-PD5
	Building Operator Training	PS4
<b>Program Satisfaction</b>	Program elements, energy benefits, non-energy benefits	PS1-PS3
	Recommendations and Feedback	PS5-PS6
<b>Firmographics</b>	Ownership, FTE, business size	F1-F3

## SAMPLE FIELDS

ODCID  
 PHONE  
 CALLCENTER  
 CONTACTNAME  
 FACILITY  
 ADDRESS  
 DATE  
 CXAGENT  
 MEASNUM  
 NSAME  
 ESO  
 SPR  
 ESP

## INTRODUCTION

Hello, this is \_\_\_\_\_ from <CALLCENTER> calling on behalf of ComEd regarding your company’s participation in the Retro-Commissioning Building Tune-up Program. May I please speak with <CONTACTNAME>?

Our records show that <FACILITY> participated in the Smart Ideas for Your Business Retro-Commissioning Program run by ComEd. 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. 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

### A.1 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 Smart Ideas for Your Business Retro-Commissioning Building Tune-Up Program designed for small and medium sized businesses and run by ComEd. [IF NEEDED: The Retro-Commissioning Building Tune-up Program promotes energy efficiency improvements in commercial facilities. The program offers three services:
1. Fully-funded technical assessments to identify and implement applicable, low-cost savings measures
  2. Incentives to implement qualified low-cost measures.
  3. Assistance applying for other Smart Idea for your Business incentives for equipment upgrades.]

Do you recall participating in this Program?

1. Yes
2. No
8. (Don't know)
9. (Refused)

[ASK IF Q1=1]

- Q2. Next, I'd like to confirm the following information regarding your participation in the RCx Program. I understand that you retro-commissioned <FACILITY> at <ADDRESS>. The RCx study was completed by <CXAGENT> and you implemented about <MEASNUM> improvement/improvements. Does that sound right?
01. Yes
  02. No
  00. Mostly correct (RECORD INCONSISTENCY)

- 8. (Don't know)
- 9. (Refused)

[ASK IF Q1=2,8,9 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.)

- Name
- Position
- Phone
- Email

## BACKGROUND

### A.2 Interview Subject Background

- B1. Would you please tell me your title at <FACILITY>?
- B2. How many years have you worked there?
  - 1. Less than 1 year
  - 2. 1-3 years
  - 3. 4-10 years
  - 4. 11-20 years
  - 5. Over 21 years
- B3. What is your role at the facility with respect to the Retro-commissioning Program?
  - 1. Owner
  - 2. Building or Facilities Manager
  - 3. Other [Detail]

### A.3 Project Background

- B4. Before I ask you specific questions about your decision, 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)
- B5. Before learning about the ComEd Retro-Commissioning Program, had your company ever conducted retro-commissioning at this facility or any of your other facilities in Illinois?
  - 1. Yes, at this facility
  - 2. Yes, at other facilities
  - 3. Yes, at both this and other facilities
  - 4. No
  - 8. (Don't know)
  - 9. (Refused)

[ASK if B5=1, 2 or 3. SKIP TO B5B IF B5=4. SKIP to MK1 if B5= 98, 99]

B5A. Did you receive an incentive or another form of utility or government financial support for performing this previous retro-commissioning work?

1. Yes
2. No
8. (Don't know)
9. (Refused)

[IF B5=4, THEN ASK. ELSE Skip to MK1.]

B5B. What were the main factors that kept you from performing retro-commissioning in prior years? [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 audit 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. Not aware of qualified providers
7. Management was opposed to retro-commissioning
8. (Other, specify)
  - a. 98. (Don't know)
  - b. 99. (Refused)

## MARKETING AND OUTREACH

MK1. How did you first hear about the Retro-Commissioning Program? [PROGRAMMING NOTE: Multiple Response. Record first 4 responses. 98=Don't know, 99=Refused] [Do not read.]

01. Calling campaign by utility/implementer
02. Retro-commissioning service provider (RSP)
03. Nexant - the program implementer
04. ComEd Account manager
05. ComEd Website
06. Friend, colleague, or word of mouth
07. Contractor
08. Utility marketing material – case studies overview sheets, marketing video
09. Industry event or presentation
10. Utility outreach (marketing) staff
00. (Other, specify)
98. (Don't know)
99. (Refused)

[Ask If MK1=08, Else Skip to MK3]

MK2. Who gave you this marketing material?

01. ComEd
00. Other [SPECIFY]
98. (Don't know)
99. (Refused)

[ASK IF MK1<>08]

MK3. Do you recall seeing or receiving any marketing materials or other information for the Retro-Commissioning Program?

- 01. Yes, ComEd materials
- 00. Yes, Other [SPECIFY]
- 96. No
- 98. (Don't know)
- 99. (Refused)

[ASK IF MK2=01,00 OR MK3=01,00]

MK4. What types of materials do you remember? [PROGRAMMING NOTE. Multiple Response. Record first 3 responses. 98=Don't know, 99=Refused] [Do not read.]

- 01. Presentation or workshop
- 02. Program overview sheet
- 03. Case Study
- 04. Utility website(s)
- 05. Direct Mail
- 06. Fact sheets
- 07. Program Forms
- 00. (Other, please specify)
- 98. (Don't know)
- 99. (Refused)

MK5. On a scale of 0 to 10, where 0 means 'Not at all useful' and 10 means 'Extremely useful', how useful would the following materials be in providing you with information about the program? [SCALE 0-10; 98=don't know, 99=Refused]

- A. Case studies from businesses in your industry
- B. Case studies from businesses about your size
- C. Fact sheets detailing the program or retro-commissioning, in general

MK5F\_O. What other materials would be helpful in providing you with information about the program?

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

MK6. What information was most persuasive in convincing your company to participate in retro-commissioning? [PROGRAMMING NOTE. Multiple Response. Record up to 8 responses. DO NOT READ.]

- 01. Presentation or workshop
- 02. Program overview sheet
- 03. Case Study
- 04. Utility website(s)
- 05. Direct Mail
- 06. Fact sheets
- 07. Program Forms
- 00. (Other, please specify)
- 98. (Don't know)
- 99. (Refused)

MK7. Do you consider this retro-commissioning program to be offered by your contractor, your service provider, ComEd, or a combination?

(IF COMBINATION, PROMPT “WHO COMBINES TO OFFER THE PROGRAM?”)

[MULTIPLE RESPONSE]

- 02. (The service provider offers)
- 03. (ComEd offers)
- 00. (Other, please specify)
- 98. (Don't know)
- 99. (Refused)

## NTG MODULE

### A.4 Free Ridership

FR1. Did you decide to implement retro-commissioning at this facility BEFORE or AFTER you learned about your organization’s eligibility for the ComEd Program? [\[INTERVIEWER NOTE: “At about the same time,” or any response that is not “Before,” should be identified as “After.”\]](#)

- 1. Before
- 2. After
- 8. (Don't know)
- 9. (Refused)

FR2. 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... [\[FOR FR2A-N, RECORD 0 to 10; 96=Not Applicable; 98=Don’t Know; 99=Refused.\]\[If needed: How important in your DECISION to conduct the study and commit the funding to perform the ComEd sponsored retro-commissioning was...\]](#)

**Program Factors** [ROTATE FR2A-G]

- FR2A. The free retro-commissioning study
- FR2B. The recommendation from the retro-commissioning service provider **<CXAGENT>**
- FR2C. The information from the Retro-Commissioning Program
- FR2D. The recommendation from your ComEd Account Manager
- FR2E. The technical assistance from the Service Provider **<CXAGENT>** to implement recommendations
- FR2F. ComEd marketing materials or presentation

**Non-Program Factors** [ROTATE FR2H-N]

- FR2H. Potential to save energy
- FR2I. Age or condition of existing equipment
- FR2J. A recommendation from your company’s management
- FR2K. Previous experience with retro-commissioning
- FR2L. A recommendation from your peers – either internal or external
- FR2M. Trade organization publication or presentation

FR2O. 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)

FR3. This time I'd like you to use a scale from 0-100. How many of the 100 points would you give to the importance of the program as a whole in your decision to participate in this retro-commissioning project, such as [READ IN FR2A-G IF > 0], and how many of those same 100 points would you give to the importance of other factors, such as [READ IN FR2H-N IF > 0]? **[PROGRAMMING NOTE: Responses should sum to 100.]**

- A. Count of Program factor points \_\_\_\_\_
- B. Count of Non-Program factor points \_\_\_\_\_

**[SKIP IF OTHERPTS==QFR3B OR QFR3A=998,999 OR QFR3B=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 <QFR3A> points to the Program. Does that mean you would give <OTHERPTS> points to other factors?

- 1. Yes
- 2. No **[SKIP TO FR3]**
- 8. (Don't know)
- 9. (Refused)

**If (FR3A is >70 AND all FR2A-G are <3) OR (FR3B is <30 AND any FR2H-M is >7), then ask:FR4.** Could you tell me more about the importance of the program in your decision to participate in it recently?

## 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 Equipment and Scheduling Optimization [Scheduling Optimization]---**

Now I'm going to ask you a few questions specifically about equipment and scheduling optimization.

FR5\_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 same equipment and scheduling optimization without the program?

- 1. All
- 2. Some
- 3. None
- 8. (Don't know)
- 9. (Refused)

**[Ask If FR5\_1=1, 2 or 8, Else Skip to FR6A\_1]**

FR5A\_1. Would your own equipment and scheduling optimization project – 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
- 8. (Don't know)

9. (Refused)

FR6A\_1. Do you regularly modify HVAC equipment scheduling?

- 1. Yes
- 2. No
- 8. (Don't know)
- 9. (Refused)

[Ask If FR6A\_1=1, Else Skip to FR7\_1]

FR6B\_1. Do the equipment and scheduling changes always follow recommendations from the retro-commissioning program?

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

FR7\_1. Were you at all aware of the need to optimize HVAC equipment schedules using the building automation system prior to the retro-commissioning study?

- 1. Yes
- 2. No
- 8. (Don't know)
- 9. (Refused)

FR8\_1. How familiar were you with equipment and scheduling optimization 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 'completely familiar'.

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

FR9\_1. How likely would you have been to follow the same equipment and scheduling optimization 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]

---END Equipment and Scheduling Optimization---

<MEASURELOOP>

---BEGIN Static Pressure Reset [Pressure Reset]---

Now I'm going to ask you a few questions specifically about static pressure reset of the supply fan.

FR5\_2. If the Retro-commissioning program 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 static pressure reset of the supply fan without the program?

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

[Ask If FR5\_2=1, 2 or 98, Else Skip to FR6A\_2]

FR5A\_2. Would your own static pressure reset of the supply fan – 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

FR6A\_2. Do you regularly check the static pressure of the supply fan to find the optimal pressure setting without the Program?

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

[Ask If FR6A\_2 =1, Else Skip to FR7\_2]

FR6B\_2. Do the equipment changes always include using the building automation system to increase or decrease temperatures based on occupancy and use?

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

FR7\_2. Were you at all aware of the need to reset the static pressure of the supply fan prior to the retro-commissioning study?

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

FR8\_2. How familiar were you with the task of resetting the static pressure of the supply fan 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 'completely familiar'. [SCALE 0-10, 98=Don't Know, 99=Refused]

FR9\_2. How likely would you have been to reset the static pressure of the supply fan 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]

---END Static Pressure Reset ---

<MEASURELOOP>

---BEGIN Air Side Economizer Set Points [Economizer]---

Now I'm going to ask you a few questions specifically about the air-side economizer set points.

FR5\_3. If the Retro-commissioning program not existed, and you had not received the information and assistance from the program, do you think it's likely that you would have performed all, some, or none of the same air-side economizer set points without the program?

1. All
2. Some
3. None

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

[Ask If FR5\_3=1, 2 or 98, Else Skip to FR6A\_3]

FR5A\_3. Would your own air-side economizer set points adjustments – 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

FR6A\_3. Do you regularly adjust the air-side economizer to find the optimal setting based on indoor and outdoor weather conditions?

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

[Ask If FR6A\_3 =1, Else Skip to FR7\_3]

FR6B\_3. Do your air-side economizer setting changes always follow the settings recommended through the retro-commissioning program?

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

FR7\_3. Were you at all aware of the need to reset the air-side economizer set points based on outdoor air conditions prior to the retro-commissioning study?

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

FR8\_3. How familiar were you with the need to use the air-side economizer to bring outside air into the air handling unit 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 'completely familiar'.

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

FR9\_3. How likely would you have been to reset the air-side economizer based on indoor and outdoor temperatures 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]

---END Air Side Economizer Set Points---

[Ask if NSAME>0 Else skip to SO1]

FR10. I see that you were responsible for additional retro-commissioning projects during 2015-2016. Was your decision making process for the other projects the same as for this one?

- 1. Yes
- 2. No
- 8. Don't Know
- 9. Refused

## SPILOVER & CHANNELING

SO1. Since completing your retro-commissioning project, have you installed any other energy efficient equipment?

- 1. Yes
- 2. No
- 8. (Don't know)
- 9 (Refused)

[If SO1=1, Ask SO1A, Else Skip to SO2]

SO1A. How important was your experience in the retro-commissioning program in your decision to install this equipment? 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. Did it have a payback period longer than one year?

- 1. Yes
- 2. No
- 8. (Don't know)
- 9 (Refused)

SO1C. Did you receive a ComEd incentive or rebate for this equipment?

- 1. Yes
- 2. No
- 8. (Don't know)
- 9 (Refused)

SO1D. What did you install? [PROGRAMMING NOTE: Multiple Response. Record first 4 responses. 98=Don't know, 99=Refused] [Do not read.]

- 01. Lighting
- 02. Cooling
- 03. Motors
- 04. Refrigeration
- 05. Compressed Air
- 06. Fans
- 07. Controls
- 08. Heating
- 00. Other (detail)
- 98. Don't Know
- 99. Refused

SO1E. If you had not participated in the retro-commissioning program, how likely is it that you still would have installed the same equipment? Please use the 0-10 scale, where 0 means 'not at all likely', and 10 means 'extremely likely'.

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

SO2. Since completing your project, have you adopted any other energy efficient operations?

- 1. Yes
- 2. No
- 8. (Don't know)
- 9 (Refused)

[If SO2=1, Ask SO2A, Else Skip to SO3]

SO2A. How important was your experience in the retro-commissioning program in your decision to make these 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]

SO2B. What operations did you change? [PROGRAMMING NOTE: Multiple Response. Record all responses. 98=Don't know, 99=Refused] [Do not read.]

- 01. Equipment temperature set point optimization
- 02. Equipment scheduling optimization
- 00. Other (detail)
- 98. Don't Know
- 99. Refused

[ASK IF SO2B=01]

SO2B1. What did you do to optimize the temperature set point?

[OPEN END. 98=Don't know, 99=Refused]

[ASK IF SO2B=02]

SO2B2. What did you do to optimize equipment scheduling?

[OPEN END. 98=Don't know, 99=Refused]

SO2C. If you had not participated in the retro-commissioning program, how likely is it that you still would have made these adjustments? Please use the 0-10 scale, where 0 means 'not at all likely', and 10 means 'extremely likely'.

[SCALE 0-10, 96=Not Applicable, 98=Don't Know, 99=Refused]

SO3. Since completing your project, have you undertaken any other retro-commissioning projects that are not part of this program?

- 1. Yes
- 2. No
- 8. (Don't know)
- 9 (Refused)

[Ask if SO3=1, Else Skip to CH1]

SO3A. Was the project at a facility in ComEd's region?

- 1. Yes
- 2. No
- 8. (Don't know)
- 9 (Refused)

SO3B. What type of facility is it?

- 01. School
- 02. Hospital
- 03. Medical Facility
- 04. Office Building
- 00. Other; specify
- 98. (Don't know)
- 99. (Refused)

CH1. Have you installed any capital improvements that were part of another ComEd program since completing your retro-commissioning project?

- 1. Yes
- 2. No
- 8. (Don't know)
- 9. (Refused)

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

CH1A. If so, what did you install? [PROGRAMMING NOTE: Multiple Response. Record first 4 responses. 98=Don't know, 99=Refused] [Do not read.]

- 01. Lighting
- 02. Cooling
- 03. Motors
- 04. Refrigeration
- 05. Compressed Air
- 06. Fans
- 07. Controls
- 08. Heating
- 00. Other (detail)
- 98. Don't Know
- 99. Refused

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

- 1. Yes
- 2. No
- 8. (Don't know)
- 9. (Refused)

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

CH2A. Which programs you are considering? [MULTIPLE RESPONSE]

- 01. Standard
- 02. Custom
- 00. (Other, specify)
- 98. (Don't know)
- 99. (Refused)

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

- CH2B Could you tell me what barriers are preventing you from considering other programs? (DO NOT READ)
01. Timing within the budget year
  02. Timing will disrupt our operations
  03. Not convinced of the benefits
  04. Not aware of qualified providers
  05. Management is opposed
  00. (Other, specify)
  98. (Don't know)
  99. (Refused)

## PROCESS MODULE

### A.5 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.]

01. Helps reduce the company's energy bills
02. Saves energy
03. Free study
04. Improves the performance of equipment
05. Prolongs equipment life / service-ability
06. Trains facility staff on efficient building operations
07. Helps building staff learn about building
00. (Other, specify)
98. (Don't know)
99. (Refused)

PD2. What do you think are the main barriers to other organizations participating in the program?

[PROGRAMMING NOTE. Multiple Response. Record first 4 responses. 98=Don't know, 99=Refused] [Do not read.]

01. Paperwork too burdensome
02. Application too onerous
03. Incentives or free study not worth the effort or required financial commitment
04. Program is too complicated
05. Retro-commissioning is too complicated
06. Staff did not understand the importance of RCX.
07. Time commitment is too great
08. Timing is inconvenient to the business cycle
00. (Other, specify)
96. (No barriers or concerns)
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. Are you 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
- 8. (Don't know)
- 9 (Refused)

[Ask if PD4=1 or 8, Else Skip to PS1]

PD4A. Can you describe what the ideal training would look like? (Probe for length, time of day, topics covered, frequency of offering)

[OPEN END. 98=Don't know, 99=Refused]

## PROGRAM SATISFACTION

PS1. Now I'd like to ask you about your satisfaction with various elements of the program. While I'm very interested in your comments and anything you'd like to add, I need you to rate your satisfaction on a scale of 0 to 10, where 0 is 'extremely dissatisfied' 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 =<4]

- A. The information provided in the retro-commissioning study
- B. The program administrator - Nexant
- C. The Smart Ideas for Your Business Program (ComEd) staff
- D. Your Service Provider, <CXAGENT>
- E. The Retro-Commissioning program overall
- F. Anticipated energy benefits
- G. Anticipated non-energy benefits
- H. 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, where 0 is 'extremely dissatisfied' 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 =<4]

- A. The accuracy of the study, with respect to how your facility was described
- B. Your ability to act on recommendations from the study
- C. The implementation steps completed by the service provider
- D. The study thoroughness or depth of the energy savings investigation
- E. The amount of low-cost savings identified
- F. The application process
- G. The number of meetings required
- H. The number of evaluation and measurement checks
- I. Your ability, with current staff, to maintain the savings through the Study

PS5. 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]

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

- 1. Yes
- 2. No

- 3. Maybe
- 8. (Don't know)
- 9. (Refused)

PS6. 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.]

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

## FIRMOGRAPHICS

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

- 01. (Own)
- 02. (Rent)
- 03. (Manage)
- 00. (Other, specify)
- 98. (Don't know)
- 99. (Refused)

*Those are all of the questions I have.  
Is there anything you would like to add, anything that I forgot to ask about?  
Thank you very much for your participation!*

**7.2.4.2 Retro-Commissioning Service Provider Survey**

ComEd C&I Retro-Commissioning Program –RSP Interview Guide  
Tune-Up RCx  
October 19, 2016

**Service Provider Guide PY8**

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 have different exposure to different aspects of the program. Some may not be aware of the Tune-up track. Customization of questions will be required*

**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 Smart Ideas for your Business Retro-Commissioning Building Tune-Up. **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. This survey focuses on the Building Tune-Up RCx program track.

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 Building Tune-Up Program?

- S4. Is your firm currently registered as a service provider or trade ally for other Commercial & Industrial program offerings from ComEd?
1. Yes
  2. No
  98. Don't Know
  99. Refused

## PROGRAM PROCESSES

1. In the prior Program Year, the program expanded scope to include additional program tracks, including one targeted to smaller facilities through the Tune-Up program. Our records show that <COMPANY> completed <COUNT TUNE\_UP> project(s) during the recently ended program year (PY8).
  - A. How have customers responded to these new options compared to the older options? *[PROBE FOR: level of confusion with new tracks, customer receptiveness of new tracks, etc.]*
  - B. What are the strengths of the Tune-Up RCx track? *[PROBE FOR: Program marketability, sales/revenue impacts, implementation incentives, program deliverables, confusion among potential clients, market barriers]*
  - C. What could be done to improve the Tune-Up RCx program?
2. Has the expansion to include small building been a benefit or a detriment to the overall Retro-Commissioning program? Explain.
3. In general, how satisfied have you been with the program participation process for Tune-Up RCx? *[PROBE FOR: participant enrollment, identification of measures, implementation, verification, project close-out]*
  - 3A. Are there aspects of the program that you think work particularly well? Please explain.
  - 3B. Are there aspects of the program that could be improved? Please explain.
4. What are the strengths of the Service Provider participation process? *[PROBE FOR: Training, Market Awareness for retro-commissioning, calculation templates, support with customers, RSP review process,]*
5. Did you have any difficulty meeting the required deliverables for each project milestone *(PROBE FOR: timeline, required information, budget constraints)?* If so, please explain.

## RSP TRAINING

6. Has the training offered by the program during PY8 adequately prepared you to deliver services and still earn a respectable profit? Explain [\[PY8, not PY9 changes or Express\]](#)
7. Did you participate in any other RSP training offered by the program this past year?
  1. Yes
  2. No
  98. Don't Know
  99. Refused

[\[Ask if 7=1, Else Skip to 8\]](#)

7A. What training did you participate in? [\[PROBE FOR: implementation training, safety training.\]](#)

7B. Did you make any changes in your practices as a result of the training?

7C. Did the training provide ways or resources to help you market or deliver the Retro-Commissioning program to customers? If yes, please explain.

## EFFECTS OF PROGRAM ON BUSINESS PRACTICES

8. Of the <PROJECT COUNT> customers with whom you completed utility-sponsored Tune-Up RCx projects from June 2015 to May 2016, approximately how many did you have a prior working relationship with?
9. Have you made any changes to your business processes as a result of your participation in the Tune-Up RCx program? [\[PROBE: hired more staff, opened up new offices, changed marketing, changed approach to retro-commissioning investigations.\]](#)

## MARKETING AND OUTREACH

10. How do customers typically learn about the Tune-Up RCx Program? [\[PROBE WITH: Do you receive leads from Nexant? Tell customers about it? Colleagues? Marketing materials from ComEd? Are they already aware of the program?\]](#)
11. Do you feel the implementer adequately promotes the program?
  - 11a. What is your role in promoting the retro-commissioning program to customers?
  - 11b. What impact does the implementer's role in marketing and promotion have on your business? [\[PROBE FOR: impact on margins/profitability, interest in the program, increase/decrease in number of projects\]](#)
  - 11c. Has there been a change in your customer base as a result of this program? [\[PROBE FOR: change in geography, type of business\]](#)

## NTG & CHANNELING INTO OTHER C&I PROGRAMS

12. If this program did not exist, would you always, sometimes or never perform comparable retro-commissioning tune-up services to comparable businesses?
1. Always
  2. Sometimes
  3. Never
  98. Don't Know
  99. Refused

[Ask if 12 = 1 or 2]

12A. Without the program, do you think your average retro-commissioning Tune-Up services would save the same amount of energy, somewhat less, or significantly less?

1. Same Savings
2. Somewhat less savings
3. Significantly less savings
00. Other
98. Don't Know
99. Refused

[Ask if 12 = 1 or 2, Else Skip to 15]

13. Absent the Program, approximately what percent of your Illinois customers would have performed the Tune-Up retro-commissioning services of similar rigor to the ones completed through the program?

- A. within the last year? [0-100%]
- B. within the next year? [0-100%]
- C. within 1 to 2 years? [0-100%]
- D. more than 2 years or never? [0-100% – total of 14A-D may not exceed 100%]

14. What would be different about the services you provide if the program did not exist?

15. I'd like to offer you three scenarios about the program's influence on your typical retro-commissioning project. Could you please tell me which of these, if any, describes the program's influence on your typical project scope:
1. The program encouraged you to consider more energy saving measures than you would have otherwise done.
  2. You probably would have considered the same number of measures in the absence of the program.
  3. The program actually restricted the number of measures you were able to consider.
  00. Other[detail]
  98. Don't Know
  99. Refused

16. Do think that there should be an equipment replacement section within the report?

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

## PARTICIPATION BARRIERS

17. What do you view as the main barriers to retro-commissioning Tune-Up RCxs for your customers?
18. Does the program design address these barriers now?
19. What additional things could be done to overcome these barriers?

## PROGRAM FEEDBACK AND RECOMMENDATIONS

20. Have you received any other feedback from customers on the participation process and/or results of their project? If so, can you please share an anecdote or two?
21. Do you have thoughts on how to help Tune-Up customers improve persistence and understanding of energy efficiency operations?
22. In general, how satisfied are you with the Retro-Commissioning program? Has it met your expectations? Please explain.
23. Do you have any additional recommendations or feedback for the evaluation?

*Thank you for taking the time to discuss the Retro-commissioning Program.  
If we need follow-up on some of these questions, is it alright to call you again?*