

**Coordinated Utility
Retro-Commissioning Program
FINAL**

**Energy Efficiency/Demand Response Plan:
Electricity Plan Year 7 / Gas Plan Year 4
(6/1/2014-5/31/2015)**

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

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Table of Contents

- E. Executive Summary 1**
 - E.1. Program Savings 1
 - E.2. Program Savings by Utility and Program Channel 2
 - E.3. Impact Estimate Parameters for Future Use 3
 - E.4. Program Volumetric Detail 3
 - E.5. Results Summary 4
 - E.6. Findings and Recommendations 5
- 1 Introduction 7**
 - 1.1 Program Description 7
 - 1.2 Evaluation Objectives 8
 - 1.2.1 Impact Questions 8
 - 1.2.2 Process Questions 8
- 2 Evaluation Approach 10**
 - 2.1 Overview of Data Collection Activities 10
 - 2.2 Verified Savings Parameters 10
 - 2.2.1 Verified Gross Program Savings Analysis Approach 11
 - 2.2.2 Verified Net Program Savings Analysis Approach 12
 - 2.3 Process Evaluation 12
- 3 Gross Impact Evaluation 13**
 - 3.1 Tracking System Review 13
 - 3.2 Program Volumetric Findings 14
 - 3.3 Gross Program Impact Parameter Estimates 16
 - 3.4 Verified Gross Program Impact Results 16
- 4 Net Impact Evaluation 18**
- 5 Process Evaluation 20**
 - 5.1 Program Awareness and Marketing 20
 - 5.2 Program Attributes 21
 - 5.3 Program Satisfaction 22
 - 5.4 Program Benefits 23
 - 5.5 Program Barriers 24
 - 5.6 Recommendations for Improvement 24
 - 5.7 Process Evaluation Findings and Recommendations 24
- 6 Findings and Recommendations 26**
- 7 Appendix 29**

| | | |
|-------|--|----|
| 7.1 | Evaluation Research Impact Approaches and Findings | 29 |
| 7.1.1 | Evaluation Research Gross Impact Findings..... | 30 |
| 7.1.2 | Evaluation Research Net Impact Findings | 34 |
| 7.1.3 | Channeling..... | 35 |
| 7.2 | Detailed Process Findings | 35 |
| 7.2.1 | Data Tracking | 35 |
| 7.2.2 | Program Service Providers | 35 |
| 7.3 | Survey Instruments..... | 37 |
| 7.3.1 | Participant Survey..... | 37 |
| 7.3.2 | Service Provider Survey | 45 |

List of Figures and Tables

Figures

| | | |
|-------------|---|----|
| Figure 3-1. | Electricity Savings by Project and Program Channel..... | 15 |
| Figure 3-2. | Natural Gas Therm Savings by Project and Utility | 15 |
| Figure 3-3. | Number of Measures and Savings Installed by Type | 16 |
| Figure 5-1. | Deliverable Quality (>7 on 0-10 scale)..... | 21 |
| Figure 5-2. | Participant Satisfaction (>7 on 0-10 scale) with Program Elements | 22 |
| Figure 7-1. | Electricity Savings by Project and Program Channel..... | 29 |
| Figure 7-2. | Natural Gas Therm Savings by Project and Utility | 30 |
| Figure 7.3. | <i>Ex Ante</i> Electric Savings (kWh) by End-Use Category | 31 |
| Figure 7.4. | <i>Ex Ante</i> Energy Savings (kWh and therm) by Measure Type | 32 |

Tables

| | | |
|------------|--|----|
| Table E-1. | EPY7/GPY4 Total Program Electric Savings..... | 1 |
| Table E-2. | EPY7/GPY4 Total Program Natural Gas Savings | 1 |
| Table E-3. | EPY7/GPY4 Program Results by Utility | 2 |
| Table E-4. | EPY7/GPY4 Program Results by Program Channel | 3 |
| Table E-5. | EPY7/GPY4 Volumetric Findings: Participants and Measures Installed | 3 |
| Table E-6. | EPY7/GPY4 Volumetric Findings Detail: Measure Type | 4 |
| Table E-7. | EPY7 Electric Results Summary | 4 |
| Table 1-1. | Program Attributes – by Participation Channel | 7 |
| Table 2-1. | Primary Data Collection Activities..... | 10 |
| Table 2-2. | EPY7/GPY4 NTG Parameter Estimates | 12 |
| Table 3-1. | EPY7/GPY4 Volumetric Findings Detail | 14 |
| Table 3-2. | EPY7/GPY4 Volumetric Findings Detail | 14 |
| Table 3-3. | Verified Gross Savings Realization | 17 |
| Table 4-1. | EPY7/GPY4 Deemed Net to Gross Ratio Values Estimates | 18 |
| Table 4-2. | EPY7/GPY4 Program Results by Utility | 18 |
| Table 4-3. | EPY7/GPY4 Verified Net Impact Savings Estimates by Program Channel | 19 |
| Table 7-1. | Project Level Realization Rates | 33 |

E. Executive Summary

This report presents a summary of the findings and results from the impact and process evaluation of the EPY7/GPY4¹ Coordinated Utility Retro-Commissioning Program. The Northern Illinois Coordinated Utility Retro-Commissioning (Retro-Commissioning) program is offered in partnership between ComEd, 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. EPY7/GPY4 continues the offerings from recent years and adds the following program channels for ComEd customers:

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

E.1. Program Savings

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

Table E-1. EPY7/GPY4 Total Program Electric Savings

| Savings Category | Energy Savings (MWh) | Demand Savings (MW) | Peak Demand Savings (MW) |
|------------------------|----------------------|---------------------|--------------------------|
| Ex Ante Gross Savings | 21,578 | 1.411 | 1.411 |
| Verified Gross Savings | 20,868 | 2.164 | 2.164 |
| Verified Net Savings | 21,703 | 2.250 | 2.250 |

Source: ComEd tracking data and Navigant team analysis.

Table E-1. summarizes the natural gas savings from the Retro-Commissioning program. North Shore Gas did not have any coordinated participants in GPY4.

Table E-2. EPY7/GPY4 Total Program Natural Gas Savings

| Savings Category | Nicor Gas (therms) | Peoples Gas (therms) | North Shore Gas (therms) |
|------------------------|--------------------|----------------------|--------------------------|
| Ex Ante Gross Savings | 43,807 | 518,659 | 0 |
| Verified Gross Savings | 63,936 | 504,341 | 0 |
| Verified Net Savings | 65,215 | 514,428 | 0 |

Source: Nexant tracking data and Navigant team analysis.

¹ The EPY7/GPY4 program year began June 1, 2014 and ended May 31, 2015.

E.2. Program Savings by Utility and Program Channel

Table E.3 details electricity and natural gas *ex ante* gross, verified and net savings by utility. Since there were no gas customer participants in the North Shore Gas service territory in EPY7/GPY4, there are no gas savings shown. Electric savings for the gas utilities reflect savings from coordinated projects only, thus, there might have been electric savings for ComEd participants that are located in the North Shore Gas service territory, but they were electric-only participants. The electric savings are counted with ComEd and not North Shore Gas.

Table E-3. EPY7/GPY4 Program Results by Utility

| Savings Category | ComEd | Nicor Gas | Peoples Gas | North Shore Gas ² |
|---|-----------------------|-----------|-------------|------------------------------|
| <i>Ex Ante</i> Gross Savings (therms) | NA | 43,807 | 518,659 | 0 |
| <i>Ex Ante</i> Gross Savings (MWh) * | 16,572 | 641 | 4,366 | 0 |
| <i>Ex Ante</i> Gross Peak Demand Reduction (MW) | 1.193 | 0.042 | 0.175 | 0 |
| Verified Gross Savings (therms) ‡ | NA | 63,936 | 504,341 | 0 |
| Verified Gross Savings (MWh) ‡* | 16,026 | 620 | 4,222 | 0 |
| Verified Gross Peak Demand Reduction (MW) ‡* | 1.830 | 0.064 | 0.269 | 0 |
| Verified Gross Realization Rate (therms) ‡ | NA | 146% | 97% | NA |
| Verified Gross Realization Rate (MWh) ‡* | | 97% | | |
| Verified Gross Realization Rate (MW) ‡* | | 153% | | |
| Net to Gross Ratio (NTGR) | Electricity 1.04 † | | Gas 1.02 † | |
| Verified Net Savings (therms) | NA | 65,215 | 514,428 | 0 |
| Verified Net Savings (MWh)* | 16,667 | 645 | 4,391 | 0 |
| Verified Net Demand Reduction (MW)* | 1.904 | 0.067 | 0.280 | 0 |

Source: ComEd tracking data and Navigant team analysis.

* Program-wide electric savings is summed across all utilities. Thus, *ex ante* gross kWh savings for the program in Table E-3 is 21,578 MWh

† A deemed value. Source: ComEd_NTG_History_and_PY7_Recommendation_2014-02-28_Final_EMV_Recommendations.xlsx, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>

‡ Based on evaluation research findings.

² There were no North Shore Gas customers in the program in GPY4.

Table E-4. EPY7/GPY4 Program Results by Program Channel

| Savings Category | Legacy RCx Channels | RCXpress | Building Tune-Up | Grocery RCx |
|---|--------------------------|----------|------------------|-------------|
| Ex Ante Gross Savings (MWh) | 16,150 | 3,821 | 1,167 | 439 |
| Ex Ante Gross Peak Demand Reduction (MW) | 1.113 | 0.251 | 0.010 | 0.038 |
| Ex Ante Gross Savings (therms) | 562,466 | 0 | 0 | 0 |
| Verified Gross Savings (MWh) | 16,233 | 3,002 | 1,194 | 439 |
| Verified Gross Peak Demand Reduction (MW) | 1.931 | 0.195 | - | 0.038 |
| Verified Gross Savings (therms) | 565,628 | 49,598 | 46,198 | - |
| Verified Gross Realization Rate (kWh) | 101% ‡ | 79% ‡ | 102% ‡ | 100% ‡ |
| Net to Gross Ratio (NTGR) | 1.04 Electric† 1.02 gas† | | | |
| Verified Net Savings (MWh) | 16,882 | 3,122 | 1,242 | 457 |
| Verified Net Demand Reduction (MW) | 2.008 | 0.203 | - | 0.039 |
| Verified Net Savings (therms) | 576,941 | 50,590 | 47,122 | - |

Source: ComEd tracking data and Navigant team analysis.

† Source: ComEd_NTG_History_and_PY7_Recommendation_2014-02-28_Final_EMV_Recommendations.xlsx, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>

‡ Based on evaluation research findings.

E.3. Impact Estimate Parameters for Future Use

In EPY7/GPY4 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 64 participants in EPY7/GPY4. Among these participants all receive electricity service from ComEd, 12 are joint utility projects and they receive natural gas service from Nicor Gas or Peoples Gas. *There were no North Shore Gas customers in the program in GPY4.* Fifty-two participants have installed electric-only projects. These include 27 participants in the new program channels which are not coordinated channels.

Table E-5. EPY7/GPY4 Volumetric Findings: Participants and Measures Installed

| Participation | ComEd Only | Nicor Gas | Peoples Gas | North Shore Gas |
|--------------------------|------------|-----------|-------------|-----------------|
| Participants | 54 | 1 | 9 | 0 |
| Electric measures | 221 | 6 | 51 | NA |
| Gas Measures | 0 | 4 | 30 | NA |
| Total Installed Measures | 221 | 8 | 70 | NA |
| Measures/Project | 4.1 | 8 | 7.8 | NA |

Source: ComEd tracking data and Navigant team analysis.

Table E-6 shows participation by program channel. RCXpress, RCx Building Tune-Up and Grocery Retro-Commissioning are ComEd Only offerings.

Table E-6. EPY7/GPY4 Volumetric Findings Detail: Measure Type

| Participation | Traditional RCx | MBRCx | RCxpress | RCx Building Tune-up | Grocery RCx |
|----------------------|-----------------|-------|----------|----------------------|-------------|
| Participants | 32 | 5 | 15 | 10 | 2 |
| Total Measures | 174 | 18 | 84 | 22 | 3 |
| Measures/Participant | 5.4 | 3.6 | 5.6 | 2.2 | 1.5 |

Source: ComEd tracking data and Navigant team analysis.

E.5. Results Summary

The following table summarizes the key metrics from EPY7/GPY4.

Table E-7. EPY7 Electric Results Summary

| Participation | Legacy Channels | RCXpress | Building Tune-Up | Grocery RCx | ComEd |
|------------------------------------|-----------------|----------|------------------|-------------|--------|
| Net Ex Ante Savings (MWh) | 16,796 | 3,974 | 1,214 | 457 | 22,441 |
| Net Ex Ante Demand Reduction (MW) | 1.157 | 0.261 | 0.010 | 0.039 | 1.467 |
| Verified Net Savings (MWh) | 16,604 | 2,688 | 1,242 | 457 | 21,703 |
| Verified Net Demand Reduction (MW) | 2.008 | 0.203 | - | 0.039 | 2.250 |
| Program Energy Realization Rate | 99% | 68% | 102% | 100% | 97% |
| Program Demand Realization Rate | 174% | 78% | 0% | 100% | 153% |
| Program NTG Ratio † | 1.04 | 1.04 | 1.04 | 1.04 | 1.04 |
| Customers Touched | 37 | 15 | 10 | 2 | 64 |

Source: ComEd tracking data and Navigant team analysis.

† Source: ComEd_NTG_History_and_PY7_Recommendation_2014-02-28_Final_EMV_Recommendations.xlsx, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>

Table E-8. GPY4 Natural Gas Results Summary

| Participation | Nicor Gas | Peoples Gas | North Shore Gas |
|---------------------------------|-----------|-------------|-----------------|
| Net Ex Ante Savings (therms) | 44,683 | 529,032 | 0 |
| Verified Net Savings (therms) | 65,215 | 514,428 | 0 |
| Program Energy Realization Rate | 143% | 95% | NA |
| Program NTG Ratio † | 1.02 | 1.02 | 1.02 |
| Customers Touched | 1 | 9 | 0 |

Source: ComEd tracking data and Navigant team analysis.

† Source: ComEd_NTG_History_and_PY7_Recommendation_2014-02-28_Final_EMV_Recommendations.xlsx, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>

E.6. Findings and Recommendations

In general, the EPY7/GPY4 evaluation team reviewed a mature program that has adjusted to the market over the years to include customers³ that would benefit from the program, when they might otherwise not participate. Recent program changes that have been added to appeal to smaller facilities and grocers appear to position the program for sustained participation and savings in coming years. Participants and service providers are generally satisfied with the program. The following provides insight into key program findings and recommendations.⁴ The process evaluation focused on the new program channels in EPY7/GPY4. All program channels will be addressed in EPY8/GPY5.

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

Program Participation

Finding 1. Program participation has fallen in the legacy program channels (37 projects in EPY7/GPY4 versus 49 in EPY6/GPY3), but remains strong overall with the addition of participation channels for smaller customers 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 RSPs see diminished returns with marketing heavily to smaller customers.

Recommendation 1. Work to identify groups and associations that might have an affinity with the smaller customers who are targets of the new program channels. These might include smaller building/real estate management companies, big-box retailers, chambers of commerce, suburban/rural business park associations, *etc.* Revisit participants from early years of the program as they become eligible for the program again.

Program Energy Impacts

Finding 2. Gas savings are under-reported in the new program channels. These channels are electric-only, but significant gas savings are achieved due to complementary savings. The ex post analysis includes three Nicor Gas customers who achieved savings due to complementary effects of the program when only electric savings were tracked for the new channels. Based upon this, the Nicor Gas saving realization rate is enhanced with verified gas savings from these projects.

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

Finding 5. Review of energy savings estimates appear to be less rigorous with the RCxpress and RCx Building Tune-Up channels. Whether by design with lower-cost services or through a change in procedures, there seem to be more cases exhibiting lack of quality control in engineering. At the same time, many final calculations seem to be scrubbed of review comments from the IC, or not added at all. The history of the measure review informs the evaluation with measure details and nuances and should be used going forward.

³ Examples of program adjustments include introduction of RCxpress, RCx Building Tune-Up and Grocery RCx.

⁴ 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.

Recommendation 8. Maintain rigorous Implementation Contractor review – even for the smaller buildings. Leave as much as possible of the idea exchange included in the calculation reviews in the electronic spreadsheets. Alternatively, convert all appropriate measure saving estimates to vetted program standard calculators when RSPs submit alternative calculations.

Process Evaluation.

Finding 6. RSPs generally praise the expansion of the program with RCxpress and RCx Building Tune-Up. The participants and the RSPs understand the benefits to the customers and program. A few weaknesses in the new channels were identified:

- RSPs lament the smaller fees they receive with the new channels. A couple of RSPs expressed that they would not continue with these projects due to low fees;
- RSPs need to modify their service delivery in response to lower fees. Marketing costs can drive a project into the red; and
- A couple of customers wished for more investigation time, thinking more savings might have been identified.

Recommendation 9. Consider revising the pricing structure of the RCxpress and RCx Building Tune-Up channels to encourage a large and diverse group of registered providers.

Recommendation 11. Reduce the marketing risk to service providers by providing a stipend or nominal bonus for developing applications even if the customer ultimately does not participate in the program, or ComEd could shoulder all marketing efforts for these channels.

1 Introduction

1.1 Program Description

The Northern Illinois Coordinated Utility Retro-Commissioning (Retro-Commissioning) program has been offered each of the seven electric program years. Electric Program Year 7 (EPY7) also marked the fourth natural gas program year (GPY4) where the program was coordinated with the gas utilities where service areas overlap ComEd’s. Retro-Commissioning was previously a jointly managed program, but is now coordinated between ComEd and Nicor and there are no shared management costs or cost allocations. ComEd manages the program and ComEd covers the 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. In EPY7 ComEd completed projects in new program channels: RCXpress, Building Tune-Up and Grocery Retro-Commissioning. Each of these channels focuses on electricity savings, but some projects do result in gas savings due to combined impacts from measures.

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% 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 payback of 18 months or less. RCx Building Tune-Up and Grocery RCx channel include implementing common retro-commissioning measures immediately by the RSP (direct implementation) without prior detailed research and analysis.

Table 1-1. Program Attributes – by Participation Channel

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

The program is managed by ComEd and the gas utilities monitor the program and contribute, as needed. For all but the Grocery RCx channel, Nexant Inc. (Nexant) is the implementation contractor (IC). The IC manages the day-to-day operation of the program including marketing, interacting with customers, working with program-approved retro-commissioning service providers (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 Nexant (for Nicor Gas), participate in bi-weekly program operation calls and work with their respective customers. ComEd manages day-to-day operations of the Grocery RCx channel with select service providers.

In addition to the channel 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;
- Be served under a ComEd commercial rate schedule;
- Applicants must be part of a non-public organization⁵;
- Applicants must agree to use a pre-approved Retro-Commissioning Service Provider (RSP);
- For participants in all but Grocery and Building Tune-up channels, 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; and
- The facility owner must implement Recommended Conservation Measures (RCMs) according to the scope and outlined procedures within six months of being accepted into the program.

During EPY7/GPY4, 54 facilities participated in the Retro-Commissioning program: including: 32 traditional RCx sites and 5 MBCx sites, fifteen RCxpress, ten RCx Building Tune-Up and two pilot sites for Grocery RCx. Among all projects, more than 300 retro-commissioning measures (RCMs) were implemented and verified. The participants were led through the program steps by ten different RSPs.

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 EPY7/GPY4.

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?

1.2.2 Process Questions

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

1. Effectiveness of program implementation:
 - a. What steps have been taken to enroll projects across the entire ComEd service territory?

⁵ 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)

- b. How have the new program channels affected the program? Have those changes been advantageous?
 - i. How successful was the roll-out of RCx Building Tune-ups, RCxpress and Grocery RCx?
 - ii. What challenges occurred in implementation? How were they overcome?
- 2. How well is (are) the tracking database(s) serving the needs of the program and the utilities?
 - a. Do tracking system(s) capture sufficient data to support evaluation activities?
 - b. Do coordinating gas utilities have sufficient access to program data for their needs?
- 3. Effectiveness of program design and processes
 - a. Have the participation process and program requirements been clearly explained to customers and RSPs that serve each program channel?
 - b. How effectively are participants enrolled in appropriate program channels?
 - c. Have the program processes changed? If so how and why? Have those changes addressed the challenges they were intended to address? Probe for
 - i. Customer financial commitment changes,
 - ii. Alternative delivery modes (MBRCx, RCxpress and Grocery RCx),
 - iii. Marketing efforts and materials, incentive structure,
 - iv. Program deliverable changes – scope, content, frequency
 - d. What suggestions do the RSPs have about the current program and do they have any recommendations for improvement?
- 4. Program Satisfaction
 - a. Are customers satisfied with the program?
 - b. What do customers see as the major non-energy benefits?
 - c. Do customers value the Building Operator Certification Training?
 - d. Are RSPs satisfied with the aspects of program implementation in which they have been involved?
 - e. What program processes work well?

2 Evaluation Approach

This evaluation of the Retro-Commissioning program reflects the seventh year ComEd has offered the program and the fourth year of its coordinated offering with the gas utilities. The impact evaluation undertook file reviews of a representative sample of projects and onsite verification at nine sites. The process evaluation interviewed key program staff, service providers and participants to gather feedback for the program.

2.1 Overview of Data Collection Activities

The full set of data collection activities is shown in the following tables. Participant and service provider telephone surveys only targeted the RCxpress and RCx Building Tune-up channels.

Table 2-1. Primary Data Collection Activities

| What | Who | Target Completes | Completes Achieved | When |
|---------------------------|-----------------------------------|------------------|--------------------|---------------|
| Program Tracking Database | Participants | 64 | 64 | Sept. 2015 |
| In Depth Interviews | Program Manager/Implementer Staff | 4 | 4 | Sept. 2015 |
| Onsite M&V Audit | Participants | 10 | 9 | Oct 2015 |
| Telephone Survey | Participants | 22 (census) | 10 | Sept-Oct 2015 |
| Telephone Survey | Service Provider | 6 (census) | 6 | Sept. 2015 |

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

- Program guidelines⁶ 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; and
- Electronic versions of reports, invoices, submittals and savings calculations.

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

2.2 Verified Savings Parameters

Research findings gross savings (*energy and coincident peak electric demand*) resulting from the EPY7/GPY4 Retro-Commissioning program were calculated using custom algorithms based on engineering principles and extrapolated to “typical” full-year savings with TMY3 weather data sets. Each measure type will have its own inputs. Many measures will have multiple aspects of savings. For example, reducing the hours of operation for an air handler will save fan power and heating and cooling for outdoor air introduced to the building system.

⁶ Smart Ideas for Your Business Commercial Retro-Commissioning Calculation and M&V Guidelines.

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

Where:

The calculation can be 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

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

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_{OA} = Outdoor air temperature
- T_{EA} = Exhaust air temperature
- Fan energy ultimately becomes heat in the building system, thus this energy is accounted for in the fan savings.
- The calculation is summed hourly or based on bins of climate conditions

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

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

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_{OA} = Outdoor air enthalpy (Btu/lb air)
- h_{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 calculation is summed hourly or based on bins of climate conditions

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 data to understand operations and limitations of measures and their implementation. Navigant then reviewed calculations to ensure the savings are accurately estimated and include reasonable assumptions, as required. In many cases this review involves analysis of time-series trend and measured data, 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

Verified net energy and demand (*coincident peak and overall*) savings were calculated by multiplying the verified gross savings estimates by a net-to-gross ratio (NTGR). In EPY7/GPY4, 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 spreadsheet.⁷

Verified net savings utilize deemed net-to-gross ratios depending on fuel type.

Table 2-2. EPY7/GPY4 NTG Parameter Estimates

| Parameter | Electricity | Natural Gas |
|----------------------|---------------|---------------|
| Net-to-Gross Ratio ‡ | 1.04 | 1.02 |
| Source | EPY4 research | GPY1 research |

Source: *ComEd_NTG_History_and_PY7_Recommendation_2014-02-28_Final_EMV_Recommendations.xlsx*, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>

‡ Deemed values

2.3 Process Evaluation

The process evaluation included in-depth interviews with key actors in the program including ComEd, Nicor Gas, Peoples Gas, and North Shore Gas program managers, the ICs, program-approved RSPs and telephone surveys of program 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 process evaluation also reviewed documents related to the program such as program application forms.

⁷ Source: *ComEd_NTG_History_and_PY7_Recommendation_2014-02-28_Final_EMV_Recommendations.xlsx*, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>

3 Gross Impact Evaluation

The EPY7/GPY4 impact evaluation included verifying gross savings and a review of 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. Measured and assumed calculation inputs were evaluated for reasonableness. If inputs were not reasonable (*for example, including the incorrect units*) we made adjustments to the calculation or confirmed inputs with the participant or RSP staff. Savings were further researched with on-site inspection on a sub-set 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 the systems are performing well for the program overall.

3.1 Tracking System Review

The EPY7/GPY4 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. 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; and
- 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.

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. Two projects are follow-on retro-commissioning measures for projects submitted in prior years. The latitude to submit savings for measures in separate years was made in order to accommodate the long implementation cycle of some measures. Note that the new program channels, RCxpress, RCx Building Tune-Up and Grocery RCx are not coordinated gas offerings. Gas measures are not tracked for those channels.

Table 3-1. EPY7/GPY4 Volumetric Findings Detail

| Participation | ComEd Only | Nicor Gas | Peoples Gas | North Shore Gas |
|--------------------------|------------|-----------|-------------|-----------------|
| Participants | 54 | 1 | 9 | 0 |
| Electric measures | 221 | 6 | 51 | NA |
| Gas Measures | 0 | 4 | 30 | NA |
| Total Installed Measures | 221 | 10 | 70 | NA |
| Measures/Project | 4.1 | 8 | 7.8 | NA |

Source: ComEd tracking data and Navigant team analysis.

Among 301 measures implemented, 279 had electricity saving for the program, including eight with both electricity and natural gas savings. Twenty-four measures only saved natural gas for the program.

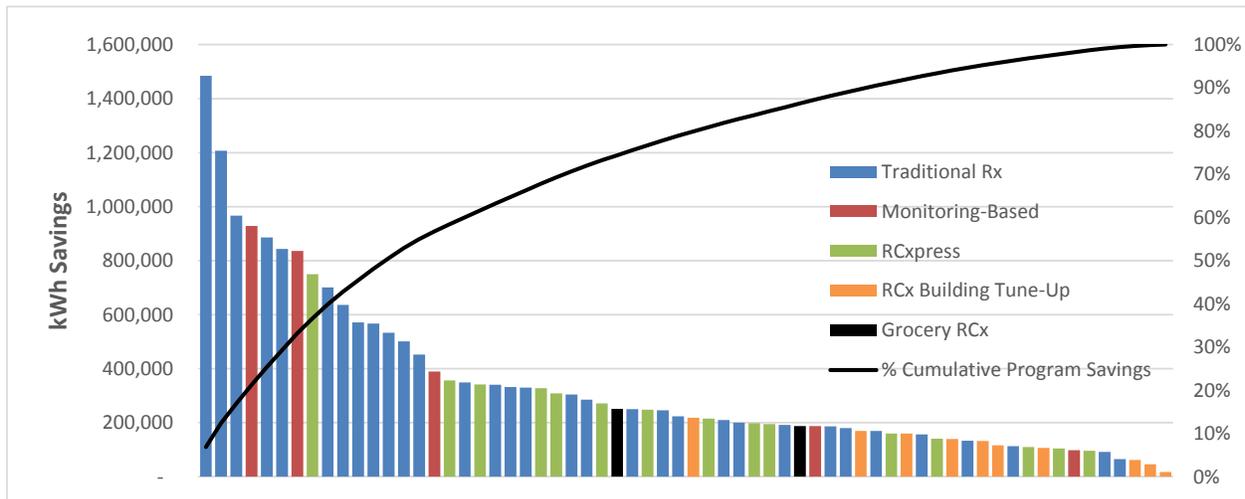
Table 3-2. EPY7/GPY4 Volumetric Findings Detail

| Participation | Traditional RCx | MBRCx | RCxpress | RCx Building Tune-up | Grocery RCx |
|----------------------|-----------------|-------|----------|----------------------|-------------|
| Participants | 32 | 5 | 15 | 10 | 2 |
| Total Measures | 172 | 18 | 86 | 22 | 3 |
| Measures/Participant | 5.4 | 3.6 | 5.7 | 2.2 | 1.5 |

Source: ComEd tracking data and Navigant team analysis.

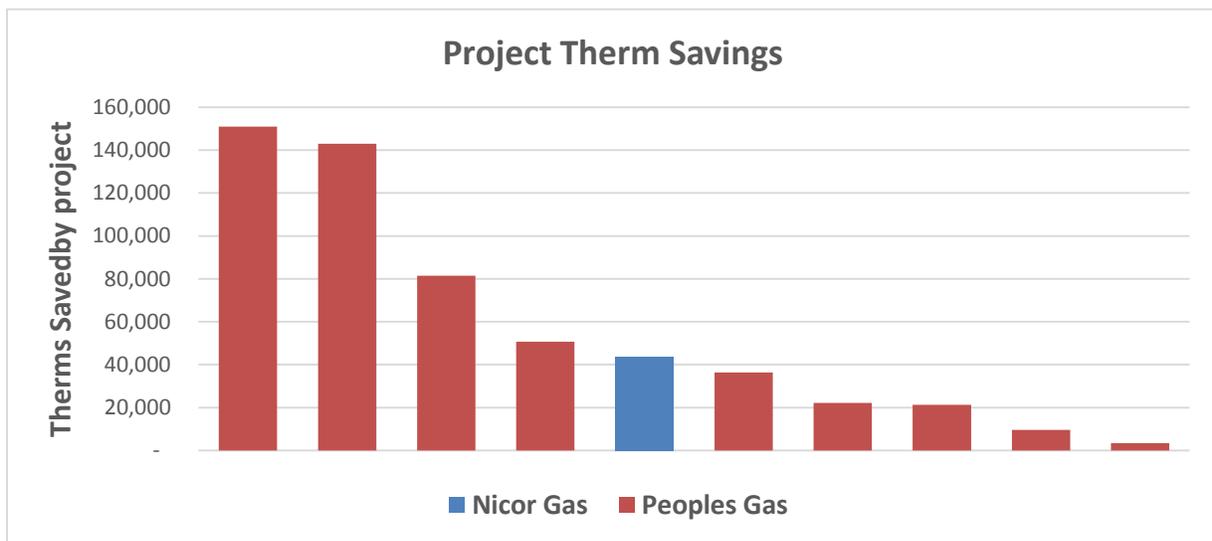
Figure 3-1 and Figure 3-2 show the distribution of savings by project and channel. All gas savings are through the Traditional RCx channel with the exception of the Nicor Gas project, which participated through Monitoring-Based RCx.

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



Source: Evaluation Analysis

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

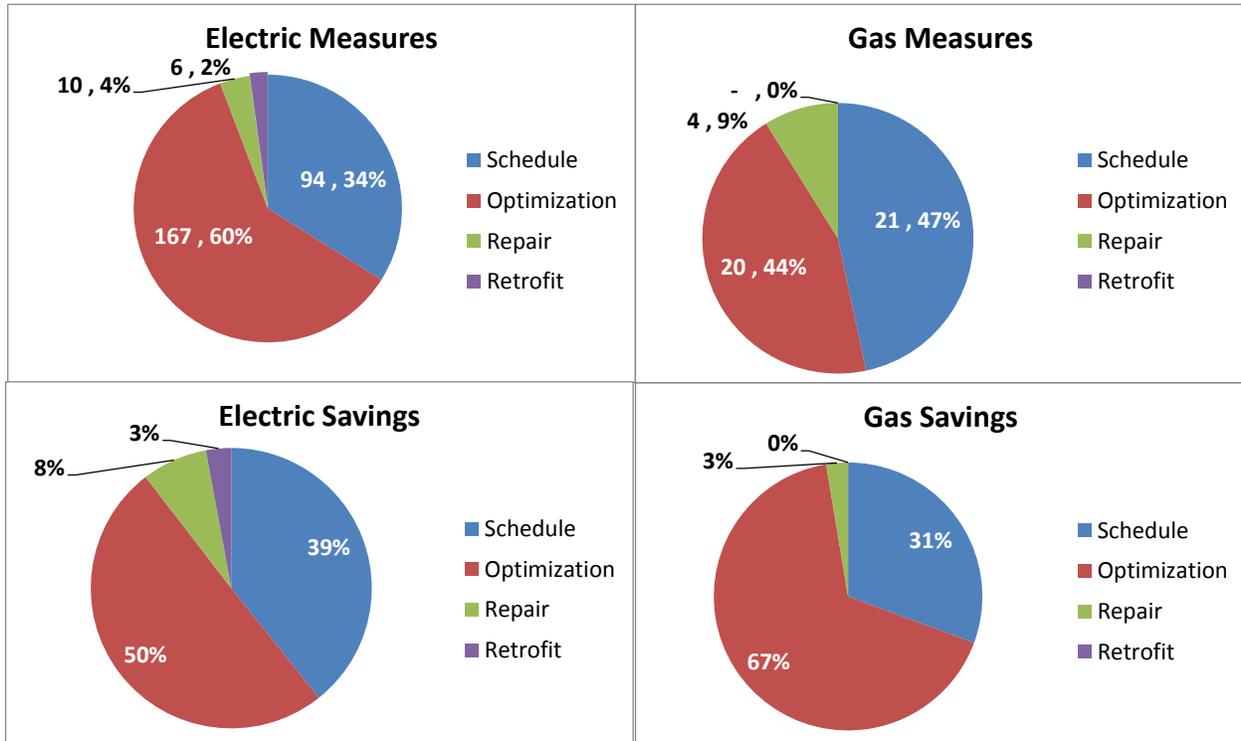


Source: Evaluation Analysis

As in prior years the majority of measures and savings can be categorized as optimization through set-point changes that allow the building to meet comfort conditions with less energy consumption. Schedule changes, where equipment is operated fewer hours based on the time of day or day of the week, comprise most of the other measures and savings⁸.

⁸ Repair measures fix broken equipment, such as a stuck damper or valve, or replace a relatively inexpensive actuator. Low-cost retrofit measures include using alternate filter media or notched belts.

Figure 3-3. Number of Measures and Savings Installed by Type



Source: Evaluation Analysis

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, energy and electric demand savings are estimated 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

Among the sampled projects, Navigant compared *ex ante* savings to annual energy consumption prior to program participation. For electricity the program implemented 1-16 percent annual savings at each site, *ex ante*, with an average of about 4 percent. For natural gas implemented savings were between 0 and 26 percent with an average of 5 percent. The total program verified gross savings is shown in Table 3-3. The table presents savings at the customer-level. Realization rates are the results of analyzing 28 projects including more than 180 measures.

Table 3-3. Verified Gross Savings Realization

| Savings Category | ComEd MWh | ComEd MW | Nicor Gas (therms) | Peoples Gas (therms) | North Shore Gas (therms) |
|-------------------------------------|--------------|-------------|-----------------------|-------------------------|-----------------------------|
| Ex Ante Gross Savings ¹ | 21,578 | 1.411 | 43,807 | 518,659 | 0 |
| Verified Gross Realization Rate | 0.967 | 1.534 | 1.459 | 0.972 | 0 |
| Verified Gross Savings ² | 20,868 | 2.164 | 63,936 | 504,341 | 0 |

¹ Source Tracking systems

² Source: Evaluation

There are a couple reasons why realization rates are other than 1.0.

- Due to on-site verification steps that determined the measures have been implemented somewhat differently than reported. This might entail modified schedules or set points. Changes in schedule or setpoint were mostly due to operator adjustment in order to maintain occupant comfort.
- Some projects in the new all-electric program channels (RCxpress and RCx Building Tune-up) did generate gas savings, but the program does not track gas savings for these channels and thus verified gas savings will increase the realizations rates. Gas savings were allocated to Nicor Gas upon determining the service territory of those savings. The ex post analysis includes three Nicor Gas customers who achieved savings due to complementary effects of the program. Some measures did not include demand savings.
- Occasional calculation or engineering errors also affected the realization rates. Two types of calculation errors were more common this year:
 - Night set-back calculations did not follow any common methodology. The best estimates used metered data from electrical panels. Other estimates neglect internal gains, thermal mass or morning recovery hours, and
 - Supply fan static reset is a common measure. Some RSP estimates are based on the affinity law relating fan speed (proportional to flow) and power. This method is not valid since flow is unchanged for this measures (except for minimal reduced duct leakage). The pressure vs. power relationships are required to estimate savings for this measure. Furthermore, return fans are frequently ignored for this measure and the return fan impacts can either increase or decrease savings.
- Other engineering errors affected verified savings, but these instances were not systematic. However, the engineering review did note more errors of this type that might have been caught in prior evaluations.

4 Net Impact Evaluation

The net-to-gross (NTG) values that the EM&V team used to calculate verified net savings were deemed for prospective use through the SAG.⁹ Table 4-1 below shows the deemed NTG values and the EPY7/GPY4 verified net savings.

Table 4-1. EPY7/GPY4 Deemed Net to Gross Ratio Values Estimates

| Parameter | Electricity | Natural Gas |
|--------------------|---------------|---------------|
| Net-to-Gross Ratio | 1.04 | 1.02 |
| Source | EPY4 research | GPY1 research |

Source: ComEd_NTG_History_and_PY7_Recommendation_2014-02-28_Final_EMV_Recommendations.xlsx, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>

The NTGR values used for all the utilities were determined in the EPY4/GPY1 evaluation by self-report interviews with program participants and RSPs. Updated NTGR research was conducted in EPY6/GPY3 and will be applied in EPY8/GPY5. Verified net savings, calculated with NTG values in Table 4-1 are shown in Table 4-2.

Table 4-2. EPY7/GPY4 Program Results by Utility

| Savings Category | ComEd MWh | ComEd MW | Nicor Gas Therms | Peoples Gas (Therms) | North Shore Gas (Therms) |
|-------------------------------------|-----------|----------|------------------|----------------------|--------------------------|
| Ex Ante Gross Savings ¹⁰ | 21,578 | 1.411 | 43,807 | 518,659 | 0 |
| Verified Gross Realization Rate‡ | 0.97 | 1.534 | 1.46 | 0.929 | NA |
| Verified Gross Savings | 20,868 | 2.164 | 63,936 | 504,341 | 0 |
| Net to gross ratio (NTG) † | 1.04 | 1.04 | 1.02 | 1.02 | 1.02 |
| Verified Net Savings ‡ | 21,703 | 2.250 | 65,215 | 514,428 | 0 |

Source: Utility tracking data and Navigant analysis.

† A deemed value.

‡ Based on evaluation research findings.

⁹ Source: ComEd_NTG_History_and_PY7_Recommendation_2014-02-28_Final_EMV_Recommendations.xlsx, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>

¹⁰ From the Tracking System

Table 4-3. EPY7/GPY4 Verified Net Impact Savings Estimates by Program Channel

| | Sample Size | Energy Savings (MWh) | 90/10 Significance | Coincident Peak Demand Savings (MW) | 90/10 Significance |
|---|-------------|----------------------|--------------------|-------------------------------------|--------------------|
| Legacy Channels (Traditional and Monitoring-Based) | 14 | | | | |
| Ex-Ante EPY7/GPY4 Gross MWh Savings | | 16,150 | | 1,113 | |
| Realization Rate | | 101% | No | 174% | No |
| Verified Gross MWh Savings | | 16,233 | | 1,931 | |
| Free Ridership | | 0.10 | | 0.10 | |
| Spillover | | 0.14 | | 0.14 | |
| NTG | | 1.04 | | 1.04 | |
| Verified Net Savings | | 16,882 | | 2,008 | |
| RCxpress | 5 | | | | |
| Ex-Ante EPY7/GPY4 Gross Savings | | 3,821 | | 251 | |
| Realization Rate | | 79% | No | 78% | No |
| Verified Gross Savings | | 3,002 | | 195 | |
| Free Ridership | | 0.10 | | 0.10 | |
| Spillover | | 0.14 | | 0.14 | |
| NTG | | 1.04 | | 1.04 | |
| Verified Net Savings | | 3,122 | | 203 | |
| RCx Building Tune-up | 6 | | | | |
| Ex-Ante EPY7/GPY4 Gross Savings | | 1,167 | | 10 | |
| Realization Rate | | 102% | No | NA | No |
| Verified Gross Savings | | 1,194 | | 10 | |
| Free Ridership | | 0.10 | | 0.10 | |
| Spillover | | 0.14 | | 0.14 | |
| NTG | | 1.04 | | 1.04 | |
| Verified Net Savings | | 1,242 | | 10 | |
| Grocery RCx | 2 | | | | |
| Ex-Ante EPY7/GPY4 Gross Savings | | 439 | | 38 | |
| Realization Rate | | 100% | Yes | 100% | Yes |
| Verified Gross Savings | | 439 | | 38 | |
| Free Ridership | | 0.10 | | 0.10 | |
| Spillover | | 0.14 | | 0.14 | |
| NTG | | 1.04 | | 1.04 | |
| Verified Net Savings | | 457 | Yes | 39 | Yes |
| Total | 27 | | | | |
| Ex-Ante EPY7/GPY4 Gross Savings | | 21,578 | | 1,411 | |
| Realization Rate | | 97% | Yes | 153% | Yes |
| Verified Gross Savings | | 20,868 | | 2,164 | |
| Free Ridership | | 0.10 | | 0.10 | |
| Spillover | | 0.14 | | 0.14 | |
| NTG | | 1.04 | | 1.04 | |
| Verified Net Savings | | 21,703 | Yes | 2,250 | Yes |

Source: Evaluation Team analysis.

5 Process Evaluation

The process component of the Retro-Commissioning program evaluation focused on the new participant channels – RCxpress and RCx Building Tune-up. The legacy participation tracks – Traditional and Monitoring- Based RCx were researched last year, and the EPY6/GPY3 process evaluation results indicated a stable program. The Grocery RCx Pilot channel had only two participants; therefore, any insights this year would have limited value. Process research in EPY8/GPY5 will cover all participation channels on the established alternate-year schedule.

The process research in EPY7/GPY5 addressed program design and implementation, program processes, marketing and outreach, and participant satisfaction for the new program channels. The primary data sources for the process evaluation were a review of program materials and interviews with program and implementation staff and RSPs, as well as a survey of participating service providers and customers.

Navigant attempted interviews with a census of the 23 unique customer contacts. We were successful interviewing ten, comprising twelve projects and 44 percent of channel savings. Participant interview contacts were split between property managers and chief operating engineers. Similarly, we were able to interview all six RSPs participating with RCxpress and RCx Building Tune-up, comprising 25 projects and 100 percent of electric savings. In general, the process results are consistent with findings from the legacy channels from prior evaluations.

5.1 Program Awareness and Marketing

The RCxpress and RCx Building Tune-up participants represent smaller sites than the legacy channels, thus many sites can be overlooked by the RSPs who are marketing the legacy program channels to their customers. Customer contacts also report slightly less awareness of retro-commissioning than counterparts in the legacy programs. While virtually all interview subjects for large buildings last year were aware of retro-commissioning and the program, 75 percent of current respondents were not aware of retro-commissioning services and 83 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 service providers, ComEd account managers and website and outreach presentations at industry events. ComEd was most often noted for introducing the program to this group of participants. Proactive outreach, such as direct mail, email, phone calls and bill inserts were cited by 40 percent of participants and 75 percent of these participants thought the marketing material was useful and effective. One participant said that email marketing was specifically not effective.

RSPs generally had positive feedback about the marketing of RCxpress and RCx Building Tune-up channels. RSPs commend the program for effectively reaching the smaller commercial market. RSPs also appreciate that ComEd and Nexant are leading the marketing effort as these customers normally would not be targets of the RSPs due to their size. The RSPs credit the program with generating all of their business among the smaller buildings. The Tune-up channel garnered some complaints about the different participation options that confused customers.

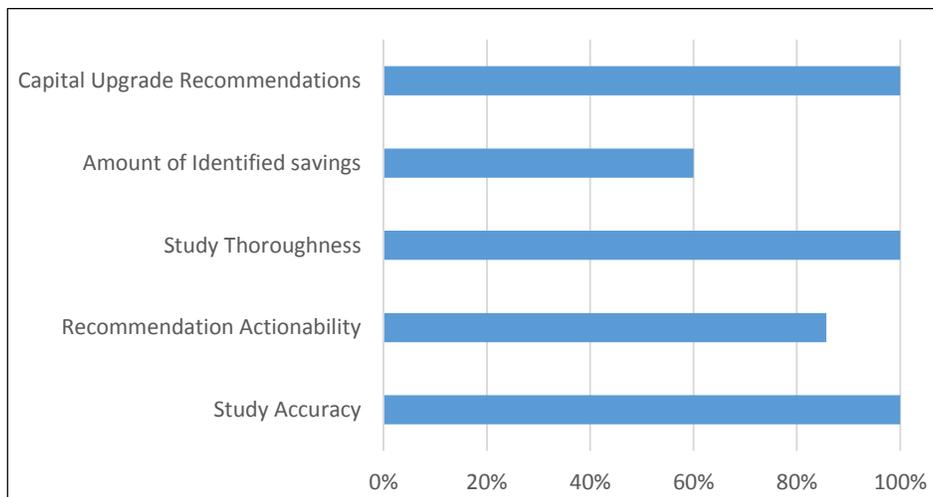
Unlike the legacy channels, where RSPs have worked long and hard to develop relationships with retro-commissioning customers, RSPs report that at least 50 percent of RCxpress and RCx Building Tune-Up customers are new. “Customers appreciate what the service providers do. Market outreach, awareness, education are all benefits.” One RSP mentioned that customers now approach his company about the RCx Building Tune-Up channel independently.

5.2 Program Attributes

Navigant asked participants to rank various attributes on a scale of 0-10 with 0 = “Not at all important” and 10 = “Extremely important.” The program attributes discussed include: the free study, the recommendation of those marketing the program and the marketing materials provided and the technical assistance of the RSPs. All of these attributes ranked high importance (greater than 7 on the 0-10 score) for 80 percent or more of participants. Rare mid-range scores correspond to situations where the participant did not have meaningful contact with ComEd or the RSPs, thus the importance score was non-committal for those program attributes.

The program deliverable – the study and implemented measures – also rated high among participants. Forty percent of participants were somewhat satisfied (score 6-7) on the amount of savings identified through the project. One fourth of respondents reported that they were aware of all identified opportunities, though on follow-up they could not name those recommendations.

Figure 5-1. Deliverable Quality (>7 on 0-10 scale)



Source: participant survey

RSP opinions were also generally favorable toward the program, though their perspective behind the scenes reveals some rough edges to the new channels. For example:

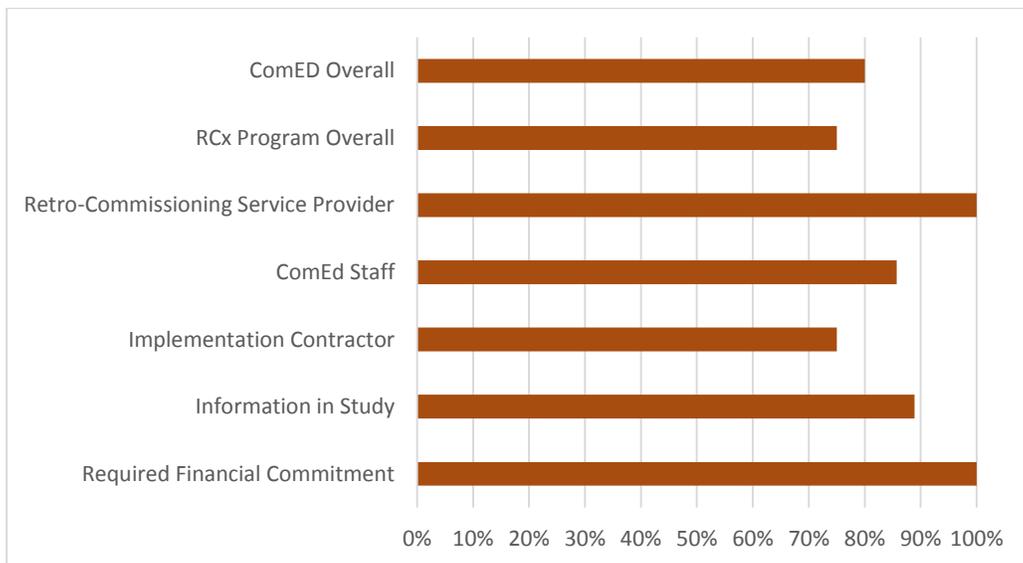
- “Working with Nexant has been smooth, but sometimes it has been hard to get clear and concise direction from them.”

- “Tune-up was pitched as an easy option with less red tape, but there are more meetings and forms to fill out than ever before. If the intent was to make it more clear-cut and less cumbersome on the clients and consultants, I’d say it failed.”
- Channel strengths included: “Quicker schedule with less financial commitment.” Elimination of the investigation report is a noted strength, and the program still delivers “a decent amount of savings.”
- One RSP noted that the preference for customers with a BAS for RCx Building Tune-Up is problematic. Even if a BAS is present it can be inadequate to perform retro-commissioning and some hopeful customers are turned away due to inadequate BAS capabilities¹¹. A couple of RSPs would like to see a more definitive BAS requirement which applied earlier in the process to exclude sites with inadequate controls.
- “Customers appreciate what the service providers do. Market outreach, awareness, education are all benefits.”

5.3 Program Satisfaction

In general, participants were very satisfied with the program. On a scale of 0-10 with 0 = “Not at all satisfied” and 10 = “Extremely satisfied,” all key program elements scored 8 or higher for a sizable majority of respondents. All recorded scores were 7 or higher. The high score for financial commitment is driven by the low commitments required for these channels, but it mirrors the generally high satisfaction with the financial commitment for the legacy program channels.

Figure 5-2. Participant Satisfaction (>7 on 0-10 scale) with Program Elements



Source: participant survey

¹¹ A BAS is not a requirement for Building Tune-Ups, but RSPs reported there is a perception of a BAS requirement – perhaps to achieve adequate savings within the budget of the project.

Participants reported that the program strengths were the free study, the energy savings and the quality of their RSP. Seventy-five percent of respondents would definitely recommend the program to peers, and 13 percent might recommend the program.

RSP satisfaction with the new channels were mixed and sometimes contradictory:

- Some felt customers were confused by the new options, others complimented the program “fact sheet that clears up all confusion.”
- Several RSPs were less impressed by the fees they receive:
 - Two of six said that they would likely not perform more of the RCxpress or Tune-Up projects or they would shift their focus to larger projects again, and
 - One RSP mentioned losing money on the new channels. They thought they would make it profitable by honing their delivery of the channels over the first couple projects, but they are not profitable yet.
- Some RSPs feel the 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 fast.

5.4 Program Benefits

All interview subjects consistently identified energy and/or cost savings as the primary program benefits. One other attribute of the Retro-Commissioning Program is its association with Building Operator Training and Certification curriculum offered by MEEA. For the legacy channels and RCxpress, completion of Level 1 Building Operator Certification is a program requirement. For RCx Building Tune-Up the training is recommended. Among the eight interviewed participants who knew about this requirement/recommendation gave responses to this line of questioning, two had completed the training, one did not know about it (RCx Building Tune-Up), two were not planning on attending (one RCxpress) and the others had not scheduled the training.

One of the participants who had staff complete the training clearly saw the training as a benefit of the program and was all raves about the training – both for experienced and new staff. That participant is sending multiple staff to the training and will send multiple staff to Level 2 training.

A general perspective from RSPs is that the greatest benefit of the new channels is the outreach to a new cohort of customers that were not eligible for the legacy program channels. 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: fees were too low and they needed to change their process to serve the new channels. The limited one-day walk-through was sometimes inadequate for the potential savings.

Program participants also agreed that various program attributes were benefits, when listed by the interviewer. Fifty percent cited the cost and energy benefits of the program or the overall payback. Twenty to thirty-five percent cited the free study, the training aspect for staff or improved equipment performance as benefits. Combined, these non-fiscal/non-energy benefits were cited by 72% of respondents, indicating additional program value for the customer.

5.5 Program Barriers

The participants identified barriers to the program, but there was not consistency or an over-arching answer. Participants saw time commitment, a too-complicated program and internal staff hurdles as program barriers.

The RSPs commended the new channels for reducing prior program barriers: participant size requirements, data collection and reporting. Project and deliverable complexity is aligned with the project size, but they thought there was still too much paperwork and some RSPs worried that they could not make money on the new channels. RSPs thought that participant expertise was a program barrier. Program paperwork was not always completed by the customer, and the RSP took a risk pursuing projects by helping with the application paperwork on the day of the walk-through. It was reported by some RSPs that two trips to the client site would make the project a financial loss; therefore, they had to take the risk going on-site with incomplete paperwork.

RSPs also see awareness of retro-commissioning benefits for the smaller customers as a barrier to participation. RSPs think many customers are skeptical of “free money” and do not believe savings projections.

5.6 Recommendations for Improvement

For these new program channels there were notably few suggestions for improvement. Recommendations for improvement include:

- Two participants would like to see a longer engagement and more detail on the reports and recommendations;
- Two participants also wanted an additional, less-technical deliverable for management and decision-makers about the program and site participation; and
- RSPs would like to see their fees increased to make the new channels more attractive business services.

5.7 Process Evaluation Findings and Recommendations

While generally satisfied with the program and its expansion, some common themes emerged about the program processes.

Process Evaluation.

Finding 6. RSPs generally praise the expansion of the program with RCxpress and RCx Building Tune-Up. The participants and the RSPs understand the benefits to the customers and program. That said a couple weaknesses in the new channels were identified:

- RSPs lament the smaller fees they receive with the new channels. A couple RSPs expressed that they would not continue with these projects due to low fees.
- RSPs need to modify their service delivery in response to much lower fees. Marketing costs can drive a project into the red.
- A couple of customers wished for more investigation time, thinking more savings might be identified.

Recommendation 9. Consider revising the pricing structure of the RCxpress and RCx Building Tune-Up channels to encourage a large and diverse group of registered providers.

Recommendation 10. Reduce the marketing risk to service providers by providing a stipend or nominal bonus for developing applications even if the customer ultimately does not participate in the program, or ComEd could shoulder all marketing efforts for these channels – including application assistance.

Recommendation 11. Consider developing a process where customers can upgrade their participation channel mid-process to investigate and implement more savings opportunities.

6 Findings and Recommendations

This section summarizes the key impact and process findings and recommendations. In general, the EPY7/GPY4 evaluation team finds a mature program that has adjusted to the market over the years to include customers¹² (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 service providers are generally satisfied with the program. The following provides insight into key program findings and recommendations.¹³ The process evaluation focused on the new program channels in EPY7/GPY3. All program channels will be addressed in EPY8/GPY5.

Program Participation

Finding 1. Program participation has fallen for the legacy program channels (37 projects in EPY7/GPY4 versus 49 in EPY6/GPY3), but remains strong overall with the addition of participation channels for smaller customers 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 RSPs see diminished returns with marketing heavily to smaller customers.

Recommendation 1. Work to identify groups and associations that might have an affinity with the smaller customers who are targets of the new program channels. These might include smaller building/real estate management companies, big-box retailers, chambers of commerce, suburban business park associations, *etc.*

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

Program Energy Impacts

Finding 2. Gas savings are under-reported in the new program channels. These channels are electric-only, but significant gas savings are achieved due to complementary savings. The ex post analysis includes three Nicor Gas customers who achieved savings due to complementary effects of the program when only electric savings were tracked for the new channels. Based upon this, the Nicor Gas saving realization rate is enhanced with verified gas savings from these projects.

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

Finding 3. Demand savings estimates continue to be a challenge. Peak demand savings are estimated when none is warranted. Inappropriate peak conditions are used in estimates.

¹² Examples of program adjustments include introduction of RCxpress, RCx Building Tune-Up and Grocery RCx.

¹³ 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.

Recommendation 4. Standardize and enforce estimation methods for total and peak demand savings. Proscribe peak demand saving for certain measures (*e.g., economizers*). 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.

Finding 4. Energy realization rates continue to be relatively high. There are three types of measures that appear to cause problems for RSPs and reviewers to accurately estimate: static pressure reset, night set-back and return fan power.

Recommendation 5. Static pressure reset measures should not use the “Cube-law” that shows a relationship between fan rotational speed and power. This relationship is not appropriate for this measure. Measured fan power pre and post-implementation is the preferred data for estimating savings. Pressure versus power relationships are the best alternative to measured power.

Recommendation 6. Night set-back savings calculations are being submitted with a mix of empirical data, engineering-based estimates and rules-of-thumb. The engineering assumptions vary from site to site and among RSPs. The rules-of-thumb are not documented for commercial buildings. The implementation contractor should develop a consensus methodology or template calculator for this measure. Measured and documented savings are preferred above other methods.

Recommendation 7. Return fan power is not always handled accurately in some measures. Sometimes return fan power is not included in measures such as static pressure reset and turning off air handlers at night.

Finding 5. Review of energy savings estimates appear to be somewhat less rigorous with the newer RCxpress and RCx Building Tune-Up channels. Whether by design with lower-cost services or through a change in procedures, there seem to be more cases of lack of quality control in engineering. At the same time many final calculations 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.

Recommendation 8. Maintain rigorous Implementation Contractor review – even for the smaller buildings for all channels. Leave as much of the idea exchange as possible included in the calculation reviews in the electronic spreadsheets. Alternatively, convert all appropriate measure saving estimates to program standard calculators when RSPs submit alternative calculations.

Process Evaluation.

Finding 6. RSPs generally praise the expansion of the program with RCxpress and RCx Building Tune-Up. The participants and the RSPs understand the benefits to the customers and program. That said a couple weaknesses in the new channels were identified:

- RSPs lament the smaller fees they receive with the new channels. A couple RSPs expressed that they would not continue with these projects due to low fees.
- RSPs need to modify their service delivery in response to much lower fees. Marketing costs can drive a project into the red.

- A couple customers wished for more investigation time, thinking more savings might be identified.

Recommendation 9. Consider revising the pricing structure of the RCxpress and RCx Building Tune-Up channels to encourage a large and diverse group of registered providers.

Recommendation 10. Consider implementing a transition period with different fees so that RSPs can develop a service offering more commensurate with the long-term fee structure.

Recommendation 11. Reduce the marketing risk to service providers by providing a stipend or nominal bonus for developing applications even if the customer ultimately does not participate in the program, or ComEd could shoulder all marketing efforts for these channels.

Recommendation 12. Consider developing a process where customers can upgrade their participation channel mid-process to investigate and implement more savings opportunities.

7 Appendix

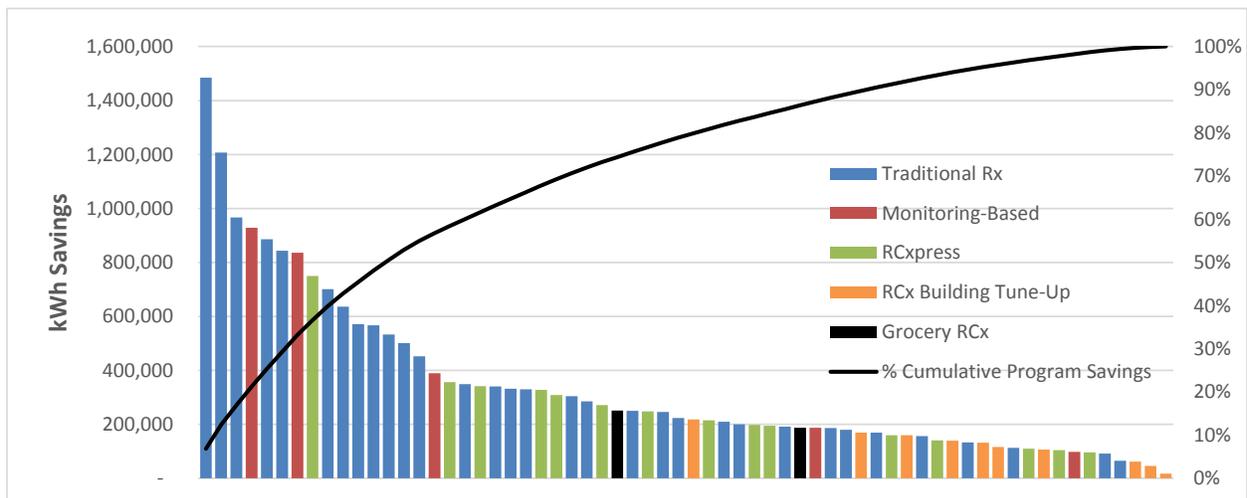
7.1 Evaluation Research Impact Approaches and Findings

Program impacts are tracked through the several phases of the program with the IC giving feedback and requiring changes along the way. Thus, the evaluator’s task is to check a sample of measures verified by the 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 nine projects within the impact sample for on-site verification.¹⁴ Evaluators visited all nine of these sites in October 2014 and verified implementation and observed actual operation of measures. In most cases measure implementation persists. In a couple cases, setpoints and schedules were modified due to comfort or occupancy requirements of the buildings.

Figure 7-1 and Figure 7-2 show the distribution of savings by project and channel. Fifty percent of program savings comes from thirteen projects; 75 percent of program electric savings comes from 29 projects or fewer than half of all participants. All gas savings is through the Traditional RCx channel with the exception of the largest Nicor Gas project, which participated though monitoring-based RCx.

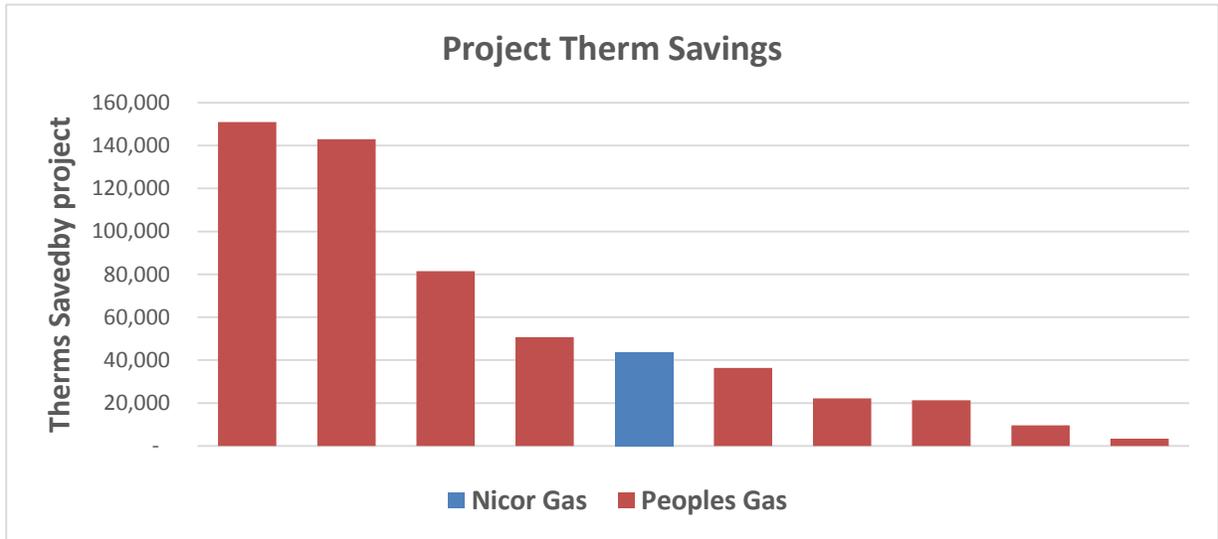
Figure 7-1. Electricity Savings by Project and Program Channel



Source: Evaluation Analysis

¹⁴ 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 28 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 transparent in spreadsheet form. In a few 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.

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 EPY6/GPY3, 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.

Two measure types stood out as problematic in several cases: night set-back and fan static pressure resets.

- In several cases static pressure savings was estimated using the fan rotational speed and the “Cube-Law” that relates fan speed and volume with power. This relationship is not accurate with this measure and estimates based on break horse-power or pressure versus power relationships should be used instead. Return fan effects should also be considered for this measure, when appropriate, and
- Night set-back calculations also proved problematic. Incorrect engineering relationships were sometimes used and in some other cases undocumented rules-of-thumb were used without explanation.

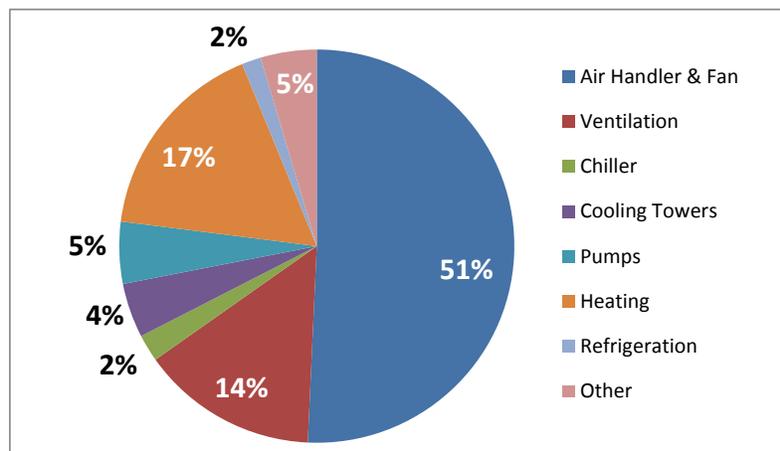
In these cases Navigant re-estimated saving with available data, additional data requested from the participant or RSP and/or program guideline inputs. Navigant recommends greater scrutiny of these

measures in the future to ensure consistent and accurate savings estimation methods are used by all RSPs.

As part of the impact analysis, Navigant grouped the retro-commissioning measures into broad end-use categories that include most types of measures included in retro-commissioning. Figure 7.3 shows the distribution of *ex ante* savings among measure end-uses. Secondary effects, such as heating savings from reduced ventilation when an air-handler is turned off, count in the primary end-use category.

- **Air-handler & Fan** includes measures that change the schedule of fan operation and fan control setpoints such as air temperatures, minimum airflows and/or static pressure setpoints.
- **Ventilation Controls** include economizer repair and optimization and ventilation control based on CO₂ levels in return air.
- **Chiller** includes such measures as chilled water temperature reset, compressor staging, and water-side economizers.
- **Cooling towers** includes fan and cell staging and condenser water temperature control.
- **Pumps** includes scheduling and pressure setpoints for variable pumping systems.
- **Heating** includes measures like boiler fans or terminal box setpoints and/or control and setbacks.
- **Refrigeration** measures are compressor or display case optimizations (non-lighting) for groceries.
- **Other** measures include lighting, domestic hot water and miscellaneous measures.

Figure 7.3. Ex Ante Electric Savings (kWh) by End-Use Category



Source: Utility tracking data and Navigant analysis.

In addition to analyzing measures by end-use, Navigant grouped the measures according to their upgrade type. Figure 7.4 shows the distribution of *ex ante* savings among measure types.

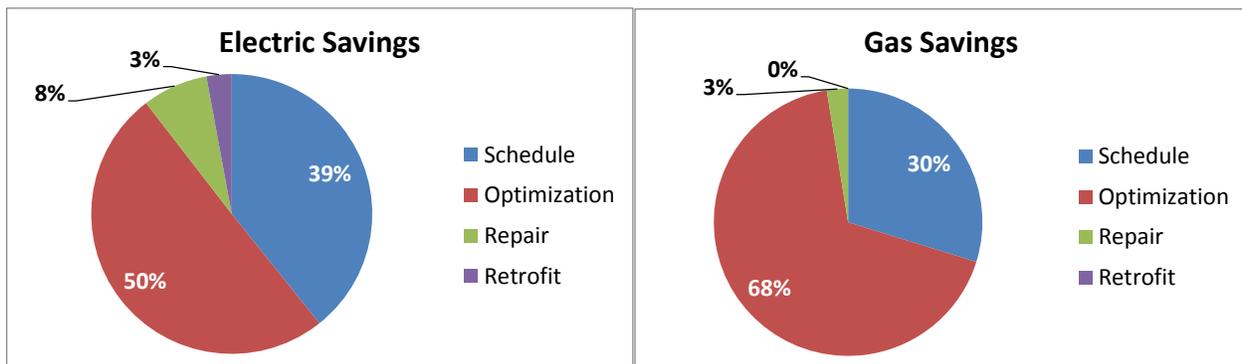
- **Scheduling** measures are those that merely turn off equipment (HVAC and lighting) when their service is not required for occupants.
- **Optimization** includes measures that improve control algorithms, or setpoints.
- **Repairs** are measures that address broken equipment such as failed actuators or sensors.

- **Retrofit** measures in retro-commissioning are relatively few and generally fairly inexpensive for retrofit measures. In EPY7/GPY4 equipment retrofit measures included new filter media, added sensors for CO or CO2 ventilation control and wet-bulb temperature sensors for cooling tower controls.

Among the RCMs implemented at the EPY7/GPY4 sites, air handlers and ventilation control and heating are the largest electric energy savers by end-use - 82 percent of savings combined. For gas savings, almost 88 percent of savings was due to air handler measures, such as reduced run-time, discharge air temperature resets and minimizing simultaneous heating and cooling.

Optimization measures dominate the electricity and gas savings by measure type, and most of the optimization measures involve air-handler control algorithms and set-point optimization. A relatively small portion of the identified savings relates to the cooling systems.

Figure 7.4. Ex Ante Energy Savings (kWh and therm) by Measure Type



Source: Utility tracking data and Navigant analysis.

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 significantly different from 1.0 are due to reasons noted.

Table 7-1. Project Level Realization Rates

| Facility Type | Realization Rates | | | Notes on <i>ex ante</i> Estimates |
|---------------|-------------------|------|------------------|---|
| | kWh | kW | Utility & Therms | |
| Health Care 2 | 138% | 767% | PG 92% | Estimates for fan savings do not accurately calculate fan power at part loads or include internal gains for gas savings. Chiller COP inconsistent among measures. Reduced airflow in operating rooms during daytime hours creates demand savings. |
| Office 2 | 88% | 100% | | Data for condenser water reset demonstrates additional cooling tower fan operation. This factor is not included in <i>ex ante</i> estimates. Conversion from brake HP to kW and motor and drive efficiency omitted for one measure. Static pressure reduction measure mistakenly uses affinity speed (flow) vs. power relationship even though airflow volumes should not change. |
| Office 10 | 100% | | | |
| Office 5 | 100% | 100% | | |
| Lodging 2 | 79% | 100% | | The HVAC system includes a heat recovery loop. On-site interview confirms operation of this equipment, but savings estimates do not adequately include heat recovery. |
| Office 6 | 74% | 39% | | Several calculation errors: 1) Condenser water reset efficiency and cooling tower fan relationships were flawed, 2) Night set-back Fan-Powered Box utilization used observed FPB kW as the denominator rather than connected kW 3) Interaction among independent heating systems is not addressed. Reducing AHU heating does not address heat from baseboard systems. |
| Health Care 1 | 104% | 100% | | |
| Education 2 | 79% | 72% | NG 98% | Night set-back measure analysis excludes morning recovery hours. Incorrect use of speed vs. power relationship for pressure reset measure. |
| Office 3 | 105% | | | |
| Office 9 | 49% | 85% | | Multiple estimate flaws. Demand controlled ventilation controls save minimal heating energy as minimum ventilation is required to meet mixed and discharge air temperature setpoints. Cooling tower fan savings is based on observed display amps while assuming 460V (input). Observed Amps are actually <i>VFD-Output</i> and output voltage = 62V. Condenser water temperature reset affects chiller and cooling tower operation and no other auxiliary loads. |
| Office 7 | 85% | 96% | | A measure estimate confuses diversity with loading and assumes motors operate at their nameplate load rather than the program-stipulated 75% loading. |
| Office 8 | 84% | 44% | | On-site observations for static pressure and equipment enabling set-points do not agree with inputs used for calculations. |
| Grocery 1 | 100% | 100% | | |
| Office 14 | 120% | | | Air handler inputs do not follow program guidelines and mistakenly omit some hours of savings. |
| Industrial 1 | 94% | 79% | | Measure calculation assumptions do not promote adequate indoor comfort and are not supported by data. Estimated condenser water temperatures are lower than achievable when wet-bulb temperatures are high. |
| Education 3 | 100% | | | |
| Lodging 1 | 98% | | | |
| Grocery 2 | 100% | 100% | | |
| Education 1 | 95% | 36% | | Some calculation inputs are inconsistent with reported values, program defaults & observed data. |
| Office 4 | 102% | | PG 100% | |
| Office 16 | 143% | | | Calculations omitted return fan savings, over-estimated cooling efficiency and applied a very conservative adjustment factor. |
| Office 1 | 155% | | | Baseline fan power estimate did not correctly factor in variable airflow. Night cooling setpoints did not change per measure description, therefore, only the night heating hours generate savings. Conduction loss equation was wrong. Weather data set was not program-specified TMY3. |
| Office 15 | 84% | | | Constant volume fan power estimates applied a temperature-dependent load factor in error. Heating saving were not included. |
| Office 12 | 57% | | | A single assumed loading profile was applied to constant volume fans, heating and cooling without justification. |
| Office 11 | 88% | | | On-site inspection determined that economizer high limit was not raised to 65F, as proposed. |
| Education 4 | 84% | 58% | | Fan power calculations were incorrect and TMY3 data used the wrong weather station. |
| Office 13 | 78% | | | The program calculator appears to be flawed. The measure saves some fan energy at a cost of higher cooling energy, therefore, net savings is smaller than claimed. |

Source: Evaluation research

7.1.2 Evaluation Research Net Impact Findings

Net impacts were determined with deemed net-to-gross ratios determined in EPY4/GPY1 for prospective application in EPY6/GPY3 and EPY7/GPY4. Once gross program impacts have been estimated, research findings net program impacts are calculated by multiplying the research findings gross impact estimate by the NTG ratio, which combined free-ridership (FR) and spillover (SO). Navigant included equally weighted participant and service provider NTG estimates in the final program NTG ratio.

$$\begin{aligned} \text{Site NTG} &= \text{NTG}_{\text{site}} = 1 - \text{FR}_{\text{site}} + \text{SO}_{\text{site}} \\ \text{RSP NTG} &= \text{NTG}_{\text{RSP}} = 1 - \text{FR}_{\text{RSP}} + \text{SO}_{\text{RSP}} \end{aligned}$$

Among participants interviewed for the process evaluation, Navigant determined site-level and RSP-weighted NTG. The overall program NTG is a saved kWh-weighted average of the NTG of the sites and RSPs interviewed.

$$\text{NTG}_{\text{overall}} = \left(\sum \text{NTG}_{\text{site}} \times \text{kWh}_{\text{site}} / \sum \text{kWh}_{\text{site}} + \text{NTG}_{\text{RSP}} \times \text{kWh}_{\text{RSP}} / \sum \text{kWh}_{\text{RSP}} \right) / 2$$

7.1.2.1 Free-Ridership

Free-ridership determination is a combination of three attributes investigated during the participant survey, combined with two parallel aspects investigated with the service provider survey. The service provider survey does not address the timing question, since that is solely participant-driven.

1. The influence of various program factors in the customer’s decision to conduct the study and commit the funding to perform retro-commissioning activities;
2. What would have been the timing for addressing those issues, absent the program; and
3. Whether the participant would have addressed the issues identified in the retro-commissioning study of which they were aware, absent the program.

7.1.2.2 Spillover

Navigant also researched the question of program spillover. Our EPY4/GPY1 participant survey asked about 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.

RSPs were also asked about spillover, both their own activities and observations of the regional retro-commissioning market. Three RSPs reported they completed more projects without incentives than they would have without the program. The projects were generally smaller, with RSPs saying their work was for facilities that fell below the program size guideline or had insufficient automation capabilities for the program. Nonetheless, the *additional* retro-commissioning work was attributed to capacity and awareness built by the program. The RSP results are weighted by their projects contribution to the overall program savings.

Overall the EPY4/GPY1 research estimated a net-to-gross ratio of 1.04 for electric savings and 1.02 for gas savings. Similar research conducted in EPY6/GPY3 will be applied to verified gross savings in EPY8/GPY5 and EPY9/GPY6.

7.1.3 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. Half of EPY7/GPY4 RSPs report guiding their customers to install energy efficient equipment upgrades within one year of completing studies.

The amount of channeling due to the program is ultimately indeterminate, as we do not know which of these measures would have been installed without the awareness brought by retro-commissioning.

7.2 Detailed Process Findings

7.2.1 Data Tracking

The EPY7/GPY4 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 retro-commissioning service providers (RSPs) may participate in the program. The service providers are active 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 EPY7/GPY4 there were 22 registered service providers for the legacy channels, RCxpress and RCx Building Tune-up. Two service providers with specialized refrigeration expertise are pre-qualified for the Grocery RCx channel. Among the pre-qualified RSPs fourteen submitted at least one project in EPY7/GPY4. Two RSPs combined to submit almost 60 percent of projects and 68 percent of program kWh savings.

Among the new channels, six RSPs were active with RCxpress, three were active with RCx Building Tune-up and one was active with Grocery RCx.

7.3 *Survey Instruments*

7.3.1 Participant Survey

ComEd / Coordinated Utility C&I Retro-Commissioning Program

RCx Participant Survey

September 28, 2015

Introduction

Hello, this is _____ from Navigant calling on behalf of ComEd [if natural gas = 1 “and <gas utility>] regarding your company’s participation in the Retro-Commissioning 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 [if natural gas = 1 “and <gas utility>] , and we are calling to conduct a follow-up study about your firm’s participation in this program. I was told you’re the person most knowledgeable and the 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

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

A1 First, according to our records, you participated in the Smart Ideas for Your Business Retro-Commissioning Program run by ComEd [if natural gas = 1 “and <gas utility>] between June 1, 2014 and May 31, 2015. [IF NEEDED: The Retro-Commissioning Program promotes energy efficiency improvements in commercial facilities. The program offers three services:

1. Technical assessments to identify applicable, mostly low-cost savings measures
2. Analysis to quantify energy and cost savings of recommended measures
3. Incentives to help cover the cost of the assessment and analysis.]

Do you recall participating in the Smart Ideas for Your Business Retro-Commissioning Program?

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

[ASK IF A1=1]

A2 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 in about <DATE> by <CXAGENT> and you implemented about <NO OF MEASURES> measures. Does that sound right?

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

A3 Also, the program has several tracks for participating, Traditional Retro-commissioning, Retro-Commissioning Express and Building Tune-up. Our records show that your facility participate through the <PROGRAM TRACK> offering of the program targeted to medium-sized and smaller buildings. Does that sound right?

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

Interview Subject Background

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

S2. How many years have you worked at < FACILITY >?

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

Project Background

B1. Before I ask you specific questions about your decision, please tell me why you decided to retro-commission this facility?

- 00. (RECORD VERBATIM) _____: Were there any other reasons?
- 98. (Don't know)
- 99. (Refused)

B2A. Before learning about the ComEd [if natural gas = 1 "and <gas utility>] 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
- 98. (Don't know)
- 99. (Refused)

[SKIP TO B2BB IF B2A=4. SKIP to B5 if B2A= 98, 99]

B2B. 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

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

IF B2A=4, THEN ASK. ELSE N2.

- B2BB. What were the main factors that kept you from performing retro-commissioning in prior years? [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
00. (Other, specify)
 98. (Don't know)
 99. (Refused)

Decision Influences

- N2 Did you learn about your organization's eligibility for the Retro-Commissioning Program BEFORE or AFTER you decided to complete retro-commissioning at this facility?
- 1 Before
 - 2 After
 - 88 (Don't know)
 - 99 (Refused)
- N4. Now I'm going to ask you to rate the importance of several factors that might have influenced your decision to conduct the study and commit the funding to perform retro-commissioning at your facility. On a scale from 0 to 10, where 0 means 'not at all important' and 10 means 'extremely important', how important were the following in your decision to conduct the study and commit the funding for retro-commissioning. [FOR N4a-e, 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 [if natural gas = 1 "and <gas utility>"] sponsored retro-commissioning was...]

[ROTATE N4A-N4E]

- N4A. The free retro-commissioning study
 - N4B. The recommendation from the retro-commissioning service provider
 - N4C. The information from the Retro-Commissioning Program
 - N4D. The recommendation from your ComEd [if natural gas = 1 "or <gas utility>"] Account Manager
 - N4E. The technical assistance to address the opportunity offered by the retro-commissioning service provider <CXAGENT> and implement recommendations [IF NEEDED EXPLAIN THE RSP IS THE FIRM THEY WORKED WITH ON THE RETRO-COMMISSIONING STUDY]
- N4F. Were there any other factors that we haven't discussed that were influential in your decision to conduct the retro-commissioning study? [OPEN END; 96=Nothing else influential, 98=don't know, 99=Refused]

Process Module

Marketing and Outreach

MK1. How did you first hear about the Retro-Commissioning Program? (DO NOT READ)

1. Retro-commissioning service provider, "RSP"
2. Nexant - the program implementer
3. ComEd Account manager
4. [if natural gas = 1] <gas utility> "Account Manager"
5. ComEd Website
6. [if natural gas = 1] <gas utility> "Website"
7. Friend, colleague, or word of mouth
8. Contractor
9. Utility marketing material– case studies overview sheets, marketing video
10. Industry event or presentation
11. Utility outreach (marketing) staff.
00. (Other, specify)
98. (Don't know)
99. (Refused)

MK2. [Ask If MK1=10] Who gave you this marketing material?

1. ComEd
2. [if natural gas = 1], <gas utility>
3. both ComEd and <gas utility>
4. Other [SPECIFY]
98. (Don't know)
99. (Refused)

MK3. [ASK IF MK1<>10] Do you recall seeing or receiving any marketing materials or other information for the Retro-Commissioning Program?

1. Yes, ComEd materials
2. [if natural gas = 1] "Yes, <gas utility> materials"
3. Yes, both ComEd and <gas utility> materials
4. No
98. (Don't know)
99. (Refused)

[ASK IF (MK3 or MK2) =1, 2 or 3 ELSE SKIP TO MK6]

MK4. What types of materials do you remember? [MULTIPLE RESPONSE, UP TO 4][DO NOT READ]

1. Presentation or workshop
2. Program overview sheet
3. Case Study
4. Utility website(s)
5. Direct Mail
6. Fact sheets
7. Program Forms
00. (Other, please specify)
98. (Don't know)
99. (Refused)

- MK5. On a scale of 0 to 10, where 0 means “Not at all useful” and 10 means “Extremely Useful”, how useful were these materials in providing information about the program? [SCALE 0-10; 98=don’t know, 99=Refused]
- MK6. What are the best ways of reaching companies like yours to provide information about retro-commissioning opportunities? [DO NOT READ?] [MULTIPLE RESPONSE, UP TO 3]
1. Bill inserts
 2. Flyers or mailings
 3. E-mail
 4. Telephone
 5. Key Account Executive
 6. Ads
 7. Industry events or shows
 00. Other, specify
 98. (Don’t know)
 99. (Refused)

Program Satisfaction

- PS3. On a scale of 0 to 10, where 0 is very dissatisfied and 10 is very satisfied, how would you rate your satisfaction with...? [SCALE 0-10; 96=not applicable, 98= Don’t know, 99=Refused]
- a. The level of your financial commitment required to receive the free study [if needed, note the required commitment was \$5,000 - \$8,000 if <PROJECT TRACK>= RCXpress and \$0 if <PROJECT TRACK>=Building tune-up]
 - b. The information provided in the retro-commissioning study
 - c. The program administrator - Nexant
 - d. The Smart Ideas for Your Business Program (ComEd) staff
 - e. [if natural gas = 1], <gas utility> program representative or staff
 - f. Your Retro-Commissioning Service Provider
 - g. The Retro-Commissioning program overall
 - h. ComEd overall
 - i. [if natural gas = 1], <gas utility> overall

[ASK IF PS3a, b, c, d, e, f, g, h, i <4 or PS3a, b, c, d, e, f, g, h, i >7]

- PS4. Why did you rate it this way? [OPEN END; 98=DK; 99=REF]

- PS5. 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]
- a. The accuracy of study, with respect to how your facilities were described
 - b. The action-ability of the study recommendations
 - c. The study thoroughness or depth of the energy savings investigation
 - d. The amount of low-cost savings identified
 - e. The recommendations for capital upgrades

[ASK IF PS5a, b, c, d or e <4 or PS5a, b, c, d or e >7]

- PS6. Why did you rate it this way? [OPEN END; 98=DK; 99=REF]

- B5. My next questions are about your awareness of the energy efficiency opportunities identified through your retro-commissioning study PRIOR to conducting it. Would you say you were aware of all, some, or none of the energy efficiency savings opportunities before the study?
1. All

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

[SKIP TO B6ab IF B5=1, 3, 98, 99].

- B6. Which of the following energy efficiency opportunities were you previously aware of? Were you aware of the opportunities with your... (1=Yes, 2=No, 98=Don't know, 99=Refused) Multiple OK
- a. Air handler [ASK IF AIRHAND=1]
 - b. Boiler [ASK IF BOILER=1]
 - c. Chiller [ASK IF CHILL=1]
 - e. Cooling tower [ASK IF CTOWER=1]
 - f. Economizer [ASK IF ECON=1]
 - g. Fans [ASK IF FAN=1]
 - h. Heating system [ASK IF HEAT=1]
 - i. Lighting system [ASK IF LIGHT=1]
 - j. Pumps [ASK IF PUMP=1]
 - k. [Ask if Natural Gas = 1] Other Gas-related opportunities

- B6ab What were the main factors that kept you from addressing the opportunities in prior years? [DO NOT READ]
- 1. Was not aware of the savings opportunity
 - 2. The complexity of addressing the opportunity
 - 3. Did not understand benefits of addressing the opportunity
 - 4. The cost of addressing the opportunity was too high
 - 5. Had insufficient in-house staffing to address the opportunity
 - 6. Had inadequate in-house expertise to address the opportunity
 - 7. Not aware of qualified contractors
 - 8. Management was against making changes
 - 00. (Other, specify)
 - 98. (Don't know)
 - 99. (Refused)

Benefits and Barriers

- B1. What do you see as the main strengths of the Retro-Commissioning Program? [DO NOT READ; MULTIPLE RESPONSE, UP TO 3]
- 1. Helps reduce the company's energy bills
 - 2. Saves energy
 - 3. Free study
 - 4. Improves the performance of equipment
 - 5. Prolongs equipment life / service-ability
 - 6. Trains facility staff on efficient building operations
 - 7. Helps building staff learn about building
 - 00. (Other, specify)
 - 98. (Don't know)
 - 99. (Refused)
- B2. [IF <PROGRAM TRACK> = RCXpress Ask: "The program requires that one or more building operators attend Building Operator Certification. To your knowledge, have your operators fulfilled this requirement?"]

[IF <PROGRAM TRACK> = Building Tune-up Ask: “The program encourages building operators attend Building Operator Certification. To your knowledge, have your operators attended this training?”]

1. Yes, Completed
2. Yes, in process of completion
3. No, scheduled
4. No, not scheduled
5. No, not planning to attend certification program
6. Unaware of the training
98. Don't know
99. Refused

If B2 = 1 or 2, ask B3. Else skip to B4.

B3. On a scale of 0 to 10, where 0 is not-at-all- and 10 is extremely-, how would you rate ...? [SCALE 0-10; 96=not applicable, 98=Don't know, 99=Refused]

- a. The usefulness of the curriculum for the Building Operator Certification training?
- b. The value of the training to the Operating Engineering staff at your facility.
- c. The influence of the training requirement on your decision to participate in the program
- d. The influence of the training on the long-term savings potential at your facility.
- e. The likelihood of sending additional staff to training without utility incentives.

B4. What the main barriers to participating in the program? [DO NOT READ; MULTIPLE RESPONSE, UP TO 3]

1. Paperwork too burdensome
2. Incentives or free study not worth the effort or required financial commitment
3. Program is too complicated
4. Retro-commissioning is too complicated
5. Staff did not understand the importance of RCX.
6. Time commitment is too great
00. (Other, specify)
96. (No barriers or concerns)
98. (Don't know)
99. (Refused)

Feedback and Recommendations

R1. Based on your experience, 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)

R2. Do you have any suggestions for ways to improve the program, and if so, what are they? [DO NOT READ; MULTIPLE RESPONSE, UP TO 4]

1. More flexibility on study costs
2. Reduce the required financial commitment to implement measures
3. Greater publicity
- 4.
5. Longer engagement with RSP to implement more measures

- 6. Key Account Executives provide more information
- 7. More Operator training
- 8. Less Operator training
- 96. No recommendations
- 00. Other, specify
- 98. (Don't know)
- 99. (Refused)

Firmographics

I only have a few general questions left.

F2 Does your company own, rent or manage this facility?

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

F3 How many full-time-equivalent maintenance staff work at this building – excluding house-keeping staff?
[NUMBER]

F5. Which of the following best describes your facility? This facility is...

- 1. My company's only location
- 2. One of several locations owned or operated by my company
- 3. The headquarters location of a company with several locations
- 8. (Don't know)
- 9. (Refused)

F6. In comparison to other companies in your industry, would you describe your company as...

- 1. A small company
- 2. A medium-sized company
- 3. A large company
- 4. (Not applicable)
- 8. (Don't know)
- 9. (Refused)

Those are all of the questions I have. Thank you very much for your participation!



7.3.2 Service Provider Survey

ComEd C&I Retro-Commissioning Program –RSP Interview Guide
September 23, 2015

DRAFT
Service Provider Guide PY7

Name of Interviewee: _____ Date: _____

Title: _____ Company: _____

[Note to Reviewer] The Interview Guide is a tool to guide process evaluation interviews with utility staff and implementation contractors. 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 and Nicor Gas and Peoples and North Shore Gas. We’re talking to **contractors who are currently service providers** for the ComEd Smart Ideas for your Business Retro-Commissioning Program that is led by ComEd and offers gas savings analysis supported by Nicor Gas and Peoples and North Shore Gas. **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 is a refresh of that prior survey.

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 and the Gas Utilities plan 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.

I. Interview Subject Background

- S1. Would you please tell me your title at <COMPANY>?
- S2. How many years have you worked at <COMPANY>?
- S3. What are your roles at <COMPANY> with respect to the Retro-commissioning Program?

II. Program Processes

1. In the recent Program Year, the program expanded scope to include additional program tracks – Retro-Commissioning Express and Building Tune-up to enroll medium-sized and smaller facilities. Our records show that <COMPANY> completed <COUNT EXPRESS> RCXpress project and <COUNT TUNE_UP> Building Tune-up projects during the recently ended program year (PY7).
 - i. 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, willingness of customers to enroll in a higher-saving option rather than least-cost commitment.]
 - ii. What are the strengths of the new program tracks? [PROBE FOR: Program marketability, sales/revenue impacts, implementation incentives, program deliverables, confusion among potential clients, market barriers]
 - iii. What could be done to improve the program with respect to these new program tracks?
2. Has this expansion been a benefit or a detriment to the program, overall? Explain.
3. In general how satisfied have you been with the program participation process for RCXpress and Building Tune-up? [PROBE FOR: participant enrollment, identification of measures, implementation, verification, project close-out] Are there aspects of the program that you think work particularly well? Please explain.
 - 3a. 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 program milestone (*probe for timeline, required information, budget constraints*)? If so, please explain.

III. Effects of Program on Business Practices

6. Of the <PROJECT COUNT> customers with whom you completed utility-sponsored retro-commissioning projects in Electric Program Year 7 / Gas Program Year 4 (June 2014 to May 2015), approximately how many did you have a prior working relationship with?

[IF Answer #6 equals <PROJECT COUNT>, SKIP to #8]
7. Among the [TRACK COUNT] Electric Program Year 7 / Gas Program Year 4 participants you worked with as part of the new program tracks, approximately how many did you have a prior working relationship with?
8. Have you made any changes to your business as a result of your participation in the RCx program? [PROBE: hired more staff, opened up new offices, changed marketing, changed approach to retro-commissioning investigations.]

III. Marketing and Outreach

- 11. How do customers typically learn about the Retro-Commissioning Program? *[Probe with: Do you tell them about it? Colleagues? Marketing materials from ComEd or gas utilities? Are they already aware of the program?]*

- 12. Do you feel the program provides sufficient support to you to promote the program?
 - 12a. Do you use the fact sheets and case studies that the utilities provide? If so, how effective do you think they are?

 - 12b. Is there anything that the program administrator (Nexant) or the utilities could do to help you promote this program to your customers?

- 13. Absent the Retro-Commissioning Program, approximately what percent of your Illinois customers, which participated in the Retro-Commissioning program, would have contracted with your company for retro-commissioning services **within the last year?** [0-100%]

IV. Channeling into Other C&I Programs

- 14. Is your firm currently registered as a service provider or trade ally for other Commercial & Industrial program offerings from ComEd or the Gas utilities? [Yes / No]

- 15. On a scale of 0-10 with 0 meaning “never” and 10 meaning “always,” approximately how often are equipment upgrade recommendations from the retro-commissioning study implemented **within a year?**
[SCALE 0-10, Don’t Know=888, Refused=999]

- 16. On a scale of 0-10 with 0 meaning “never” and 10 meaning “always,” approximately how often are equipment upgrade recommendations from the retro-commissioning study implemented **within 2 years?**
[SCALE 0-10, Don’t Know=888, Refused=999]

V. RSP Training

- 17. In the recent Program Year that began June 1, 2014 (PY7), the utilities introduced additional program tracks – Retro-Commissioning Express and Building Tune-up in addition to the Traditional and Monitoring Based options. Has the training offered by the program adequately prepared you to help customers enroll in the most appropriate program track? Explain

- 18. Did you participate in any other RSP training offered by the program this past year?
 - 1. Yes
 - 2. No
 - 888. Don’t Know
 - 999. Refused

[IF NO TRAINING, GO TO Question 19.]

18a. What training did you participate in? *[Probe for implementation training, safety training.]*
How helpful was the training? *[Probe by class.]* Please explain.

18b Did you make any changes in your practices as a result of the training? Did the training provide

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

18c. Overall, how would you rank the value of the training you received on a scale of 0 to 10 where 0 is not at all valuable and 10 is highly valuable?

[SCALE 0-10, Don't Know=888, Refused=999]

19. Are there any technical issues or barriers that you have experienced in your participation in the program that could be overcome with more training or guidance from the program?

20. What additional training would you like to have offered [PROBE for technical/engineering, program marketing, project management]?

VI. Participation Barriers

21. What do you view as the main barriers to retro-commissioning for your customers?

22. Does the program design address these barriers now?

23. What additional things could be done to overcome these barriers?

VII. Program Feedback and Recommendations

24. Have you received any other feedback from customers on the participation process and/or results of their project? If so can you please share?

25. In general, how satisfied are you with the Retro-Commissioning program? Has it met your expectations? Please explain.

26. 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?*