



**Commercial**  
**Retro-Commissioning**  
**Full Program**  
**Manual for 2012**



## **Introduction**

The Commercial Retro-Commissioning Full Program (RCx-Full) is designed to achieve demand and energy savings in commercial facilities. Peak demand period is from June 1 to September 30 during the week days between the hours of 1:00 PM and 7:00 PM excluding public holidays. Savings are realized through the systematic evaluation of facility systems and implementation of low-cost measures targeted to improve HVAC system operation and, in many cases, improve occupant comfort. This Program is offered to customers in the CenterPoint Energy Service Territory to enhance their facilities' comfort, productivity, and environment, while reducing energy costs by implementing low cost measures. This Program Manual includes detailed information about the RCx Full Program and guidelines for project implementation under this program. Nexant, Inc. is the Program Administrator (PA) for this program offered by CenterPoint Energy.

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## **Appendix A – ELIGIBLE AREA**

## **Appendix B – Preliminary Assessment Phase Materials**

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## 1 Introduction

RCx- Full is a program for implementing low cost /no cost measures to optimize and enhance existing facility systems to improve performance, reduce peak demand (kW) and save energy (kWh). The program caters to facilities with significant savings potential, and typically a minimum of 400,000 sq ft of conditioned space.

### 1.1 Customer Eligibility

Eligible customers must be in the CenterPoint Energy service territory. Although most facilities can benefit from retro-commissioning services, sites having the following characteristics are preferred:

- Based on our interpretation of laws passed in 2007 (HB 3693), “transmission class industrials” are excluded from this program. However, “educational, government and not-for profit facilities” that are transmission class customers are not excluded and can participate. Based on final rulings by the Public Utility Commission (PUC), this interpretation is subject to change.
- Existing facilities should generally be a minimum of 400,000 square feet of conditioned space. Multiple smaller facilities (which have the same Owner and are similar in size and nature) can be combined as one project. [For example, 4 or more “big-box” retail department stores that are 100,000 square feet each can be combined to form one project]. The Program Administrator (PA), Nexant, may choose to combine several buildings to achieve a minimum square footage and/or baseline power and energy consumption.
- Facilities must have a motivated in-house operations and maintenance staff that are available to support the project.
- The facility is equipped with an Energy Management Control System (EMCS) that has a substantial number of monitoring and control points.
- The system is free of major problems requiring costly repairs or replacements.
- All pertinent engineering mechanical systems design documentation is accessible.
- The facility has a high Energy Utilization Index (EUI). This includes Watts/sq ft and kwh/sq ft.
- The facility owner must be willing to commit to a minimum implementation budget for Energy Conservation Measures (ECMs).
- All projects must be implemented and verified within the agreed upon project schedule. The Owner and RCx agent will propose a schedule for each project at project kick-off. The schedule must be reviewed and approved by the PA and CenterPoint. Typical project durations will be between 6 – 12 months, but shall not exceed 14 months from the project kick-off date, which is established by the PA and CenterPoint.

Based on considerations such as those listed above, the PA and CenterPoint Energy will identify applicant facilities that have the highest perceived opportunity for savings to participate in the program and then will prioritize potential participants.

### 1.2 Retro-Commissioning Agents

Qualified RCx Agents are selected through a request-for-qualification process. Firms selected for the program are chosen based on a best-value ranking for performing retro-commissioning services that follow the program protocols. As part of the terms of the agreement, the RCx Agents agree to follow the guidelines set out in this program manual.

## 1.3 Peak Demand Definition and Calculation Methodology

### 1.3.1 Definition

Peak Demand (kW) reduction for the RCx Program is defined as the demand reduction that occurs between June 1 to September 30 during the week days between the hours of 1:00 and 7:00 PM, excluding Independence Day and Labor Day, resulting in a total of 504 hours.

Program Year 2012			
Month	Number of days	Peak Period : M:F 1:00 PM to 7:00 PM (hrs per day)	Peak Period Hours
June	21	6	126
July	21	6	126
August	23	6	138
September	19	6	114
<b>Total</b>	<b>84</b>		<b>504</b>

Table 1. 2012 Peak Hour Period

### 1.3.2 Calculation Methodology

The following equation and example illustrates the calculation methodology that should be followed for calculating the peak period demand reduction for the program:

$$\text{Peak Demand Reduction (kW)} = \frac{\text{Energy Savings during the "peak period" (kWh)}}{\text{Peak period hours}}$$

#### Example

A building has 1 Large Outside-Air Handling unit, with a 100 HP fan motor. The systems in the building are turned on between 6:00 AM – 9:00 PM Sunday through Saturday, all-year-round. The proposed measure will be to turn off the Outside-Air Handling Unit at 6:00 PM, to coincide with the occupancy in the building. This will result in a total reduction of 3 hours per day annually, and 1 hour per day during the peak period. The motor load factor is 80%.

$$\text{Annual Energy Savings} = \frac{\text{Fan horsepower} * 0.746 \text{ kW/hp} * \text{Load Factor} * \text{Total Hours/ Day}}{\text{Number of Days}}$$

$$100 \text{ hp} * 0.746 * 0.8 * 365 = 65,350 \text{ kWh}$$

$$\text{Energy Savings during Peak period} = \frac{\text{Fan horsepower} * 0.746 \text{ kW/hp} * \text{Load Factor} * \text{Hours/Day}}{\text{Number of Days in the Peak Period}}$$

$$100 \text{ hp} * 0.746 * 0.8 * 1 * 84 = 5,013.1 \text{ kWh}$$

$$\text{Peak Demand Reduction due to the Fan} = \frac{\text{Energy Savings during Peak period}}{\text{Total Hours in Peak Period}} = \frac{5,013.1 \text{ kWh}}{504 \text{ hrs}} = 9.94 \text{ kW}$$

## 1.4 Project Deliverables

Each RCx project includes three reports to be delivered to the PA – the Preliminary Assessment Summary, Investigation Phase Report, and final Verification Phase Report. These reports define and

document the retro-commissioning activities for the project. The PA must review and accept each deliverable before the project may proceed to the next program phase.

In addition to the reports completed by the RCx Agent, the building owner must submit an Implementation Plan along with a schedule after the Investigation Phase.

Microsoft Word is the preferred format for the reports. Microsoft Excel is the preferred format for spreadsheets.

## 1.5 Incentive for On-time Project Completion

Projects that are completed on time and have the minimum required demand and energy savings, as established by the PA in the Owner Selection Table are eligible to receive an incentive. The owner's rebate amount will be \$25/kW and \$0.01/kWh of verified annual energy savings, up to either \$10,000 (\$5,000 for kW and \$5,000 for kWh) or 100% of the owner's allowable implementation cost of ECMs, whichever is less. Examples of allowable owner implementation costs include material purchases to upgrade or enhance existing equipment, additional labor required for implementations, overtime for owner's employees, etc. Examples of owner implementation costs that are not allowed include capital expenditures/ equipment replacements (i.e., chiller replacement, lighting retrofit, etc.), regular time for owner's employees, etc.

## 1.6 Contact Information

The RCx Program Administrator (Nexant, Inc.) can address questions not answered in this program manual or discuss program components in more detail. Contact information for the administrator is provided below.

Richard Rusk, P.E., CEM  
Nexant, Inc.  
1331 Lamar Street, Suite 1575  
Houston, TX 77010  
Phone: (713) 982-5547  
Fax: (713) 739-0741  
Email: [rrusk@nexant.com](mailto:rrusk@nexant.com)

Or contact CenterPoint Energy:

Calvin Burnham, P.E., CEM  
CenterPoint Energy  
1111 Louisiana Street, 9<sup>th</sup> Floor  
Houston, TX 77002  
Phone: (713) 207-3423  
Email: [calvin.burnham@centerpointenergy.com](mailto:calvin.burnham@centerpointenergy.com)

## 2 Program Process

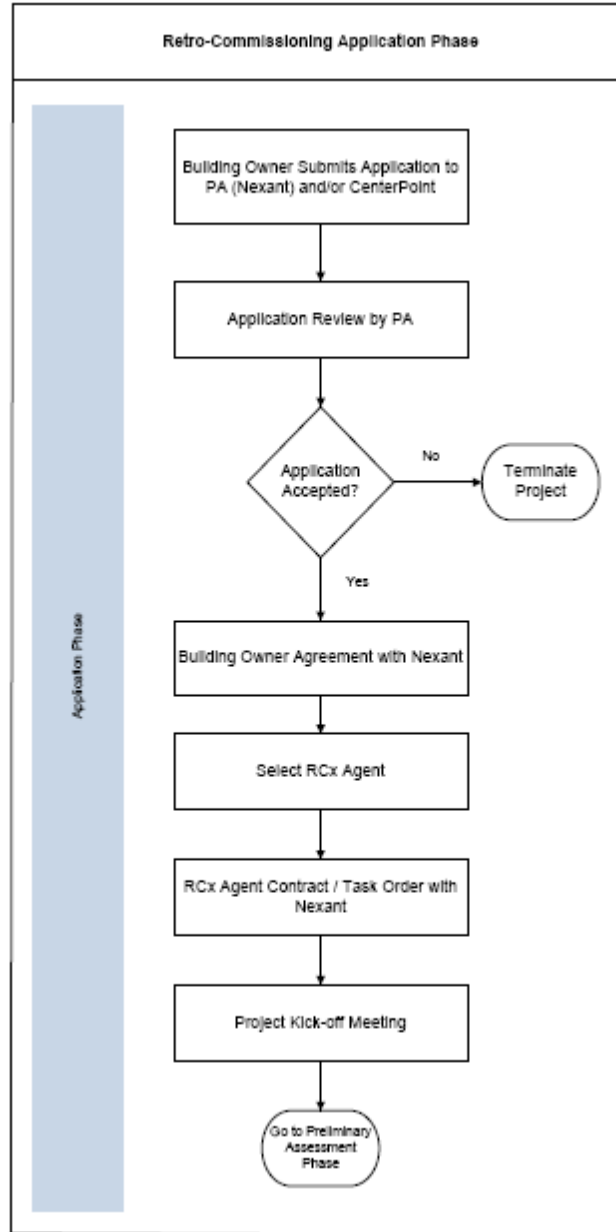
The program administrative process for each Retro-Commissioning-Full project follows the basic program phases, which are based upon industry-standardized retro-commissioning procedures:

- Application Screening Phase
- Preliminary Assessment Phase

- Investigation Phase
- Implementation Phase
- Verification Phase

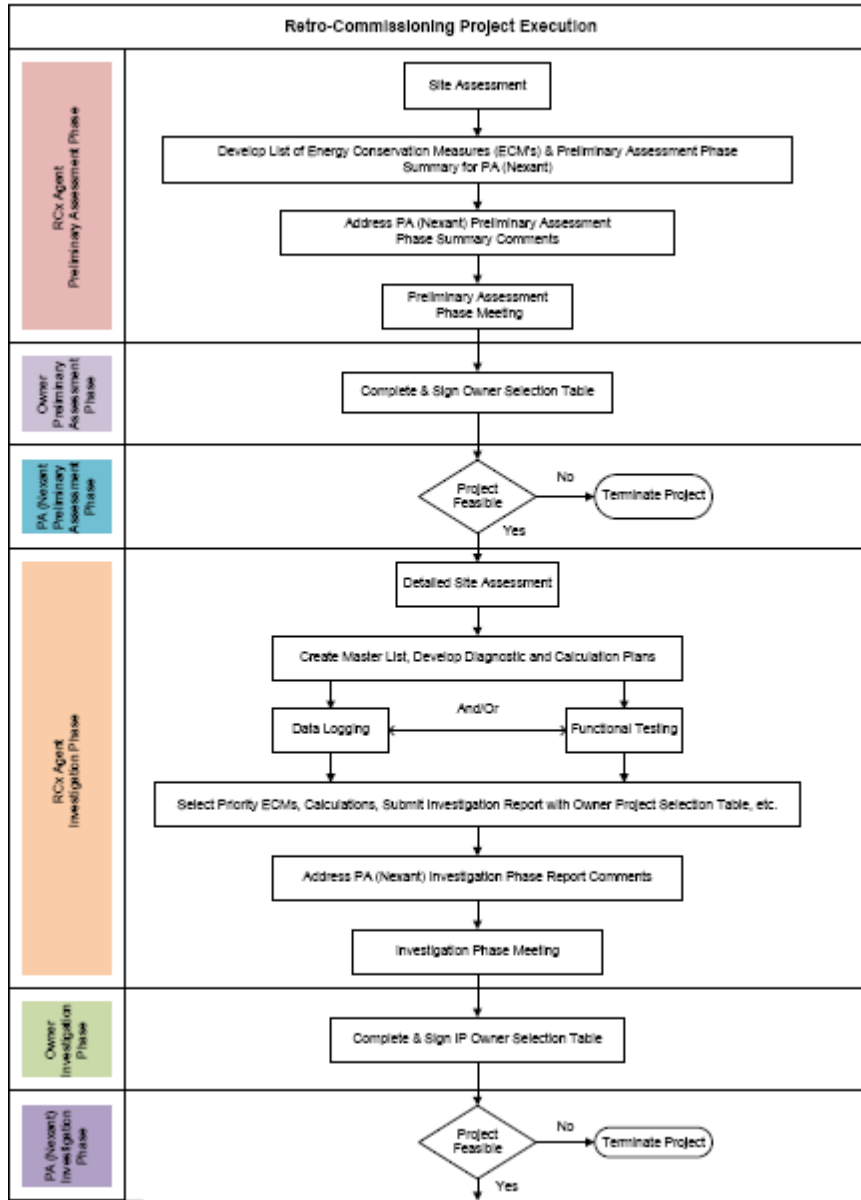
## 2.1 Process Flow Chart

### 2.1.1 Application Screening Phase

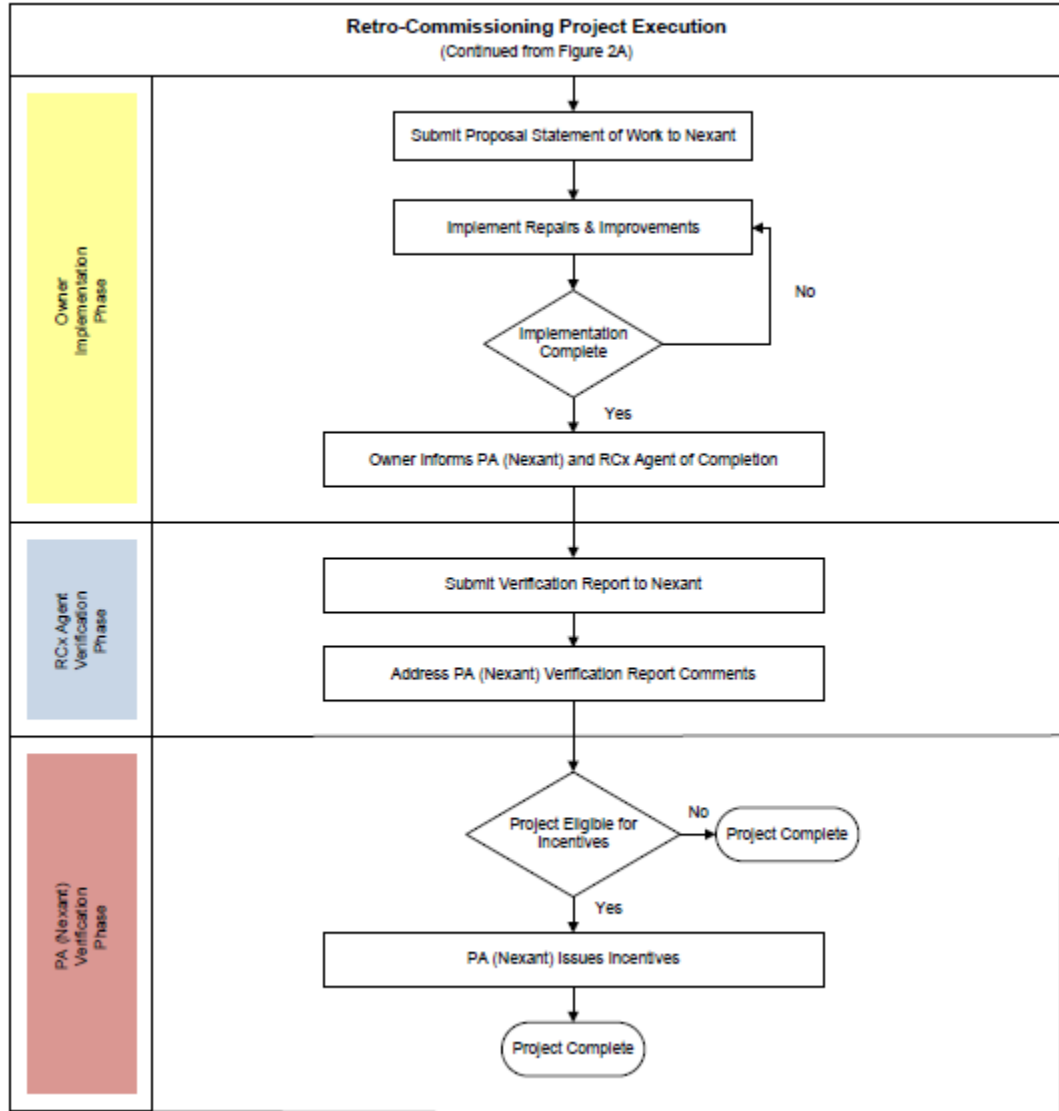


**Figure 1. Application Phase Process Flow Chart**

### 2.1.2 Project Execution



Continue to Figure 2B

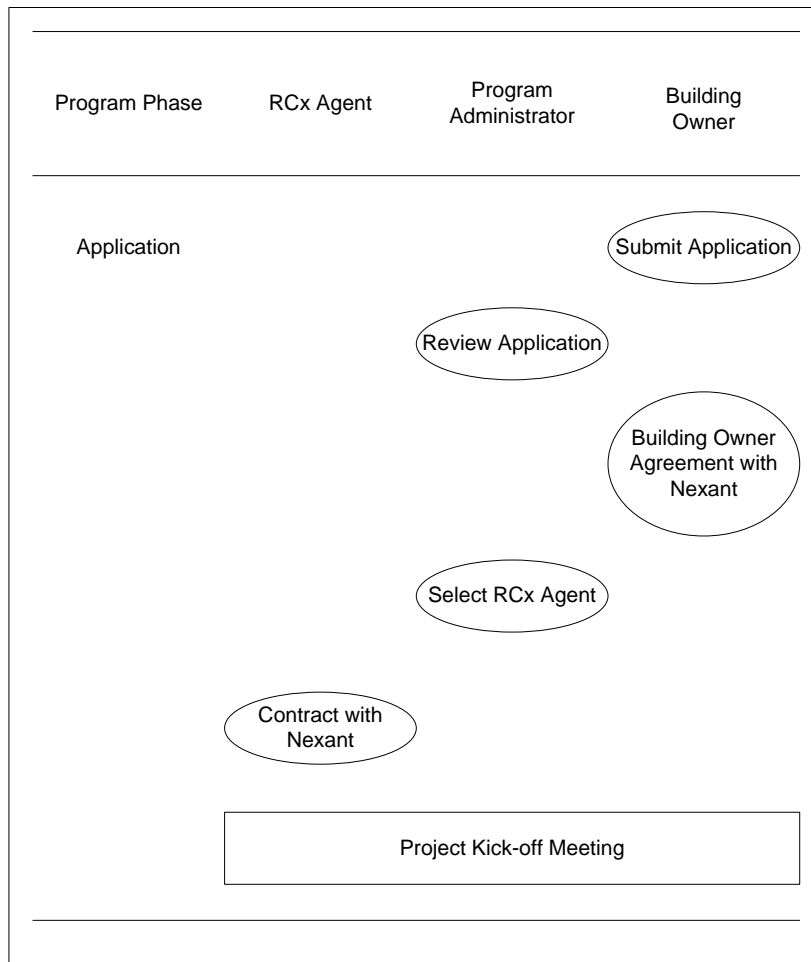


**Figure 2. Project Execution Flowchart**

## 2.2 Application Screening Phase

### 2.2.1 Overview

The program begins with the Application Screening Phase. The steps comprising this phase are outlined in Figure 3. Applications are completed by the facility representative and submitted to the PA or CenterPoint Energy. Once a program application is received, the PA reviews it and evaluates if the facility is a good candidate for participation. If an application is accepted, the facility owner is required to sign a Building Owner Agreement with Nexant, Inc. The PA will select and assign an RCx agent based on Owner preference, or on the experience and skills of the RCx Agent. The facility representative may request an RCx Agent of their choice, if any. Once the RCx Agent is selected, the Agent will enter into a contract (Task Order) with Nexant, Inc. to complete services. Soon after the contracts are signed, a project kick-off meeting will be scheduled. Attendees may include representatives from CenterPoint Energy, the PA, the assigned RCx Agent, and the owner or facility representative.



**Figure 3. Application Phase Administration**

## **2.2.2 Deliverables for Application Screening Phase**

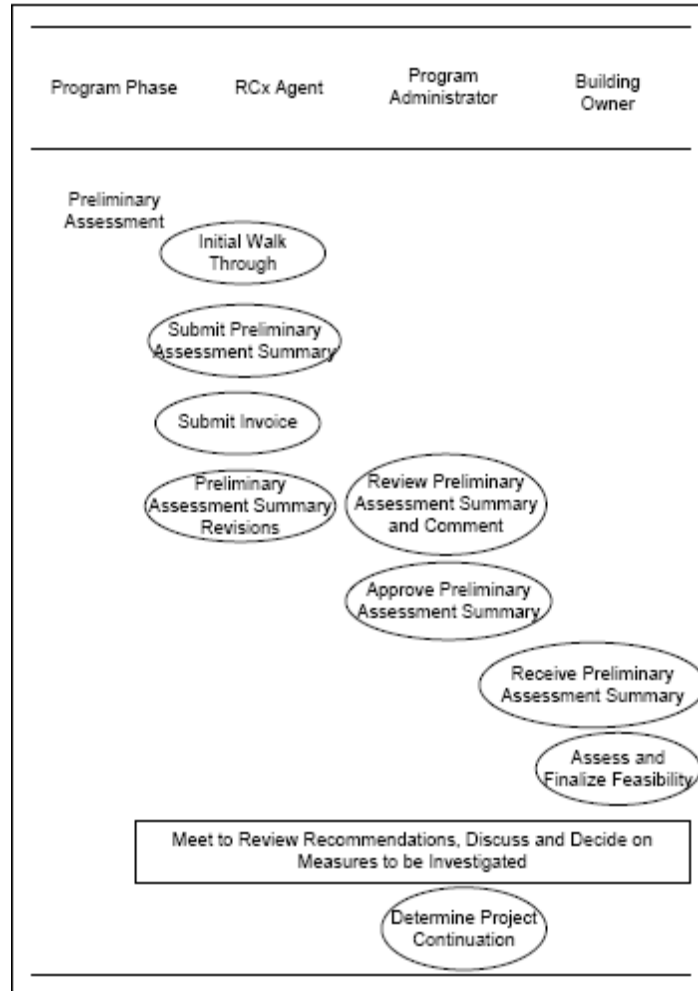
- Application submitted to the PA or CenterPoint Energy by the owner or representative
- Building Owner Agreement signed by the owner or owner representative
- Project Contract (Task Order) signed by RCx Agent to commence work
- Fourteen months of utility (Electricity and Natural Gas) bills in Microsoft Excel format (Owner to provide ESI ID # in the project application, for use in obtaining the utility information.)

## **2.3 Preliminary Assessment Phase**

### **2.3.1 Overview**

Following the kick-off meeting, the RCx Agent begins the Preliminary Assessment Phase. The program administrative steps that occur during this phase are shown in Figure 4. Following a project feasibility assessment walkthrough, the RCx Agent submits a Retro-Commissioning Preliminary Assessment Summary to the PA for review. The survey will have a basic description of the facility and its systems, the initial list of energy conservation measures and the owner selection table. The PA will review the Preliminary Assessment summary submittal and accept it or recommend refinements. Once an acceptable Preliminary Assessment survey has been submitted to the PA, the invoice may be submitted.

The Preliminary Assessment Phase needs to demonstrate that opportunities for low-cost performance improvements exist. The Plan must identify significant peak demand and annual energy savings (kW and kWh) in order for the project to continue to the Investigation Phase. Measures with long payback (>3 years) will not be considered in most instances. In certain cases, when the energy savings are below expectations, the PA may renegotiate a reduced scope of work and fee for the Investigation Phase. If the RCx Agent is not able to demonstrate project feasibility, the project may be dropped from the program. If this is the case, no additional work will be performed and the Owner will not be eligible for any incentives.



**Figure 4. Preliminary Assessment Phase Administration**

### 2.3.2 Preliminary Assessment Phase Execution

After being assigned a project by the PA, the RCx Agent begins the Preliminary Assessment Phase. This phase involves the RCx Agent performing a basic one day walkthrough which includes, but not limited to consulting with the facility's personnel, reviewing the facility mechanical and electrical systems and utility bill analysis. Basic description of the facility, baseline operating hours, list of major operating equipments are also to be reviewed and documented in the short summary.

From the information gathered, the RCx Agent develops a basic two page Preliminary Assessment Phase summary that briefly explains the building energy systems and identifies preliminary measures. The Report also outlines basic assessment tasks that will guide the investigation phase and must include the following components:

- A brief facility description that includes: list of energy-consuming equipments and system operating hours.
- Identification of List of potential Energy Conservation Measures (ECMs) .
- Basic estimated savings calculations One of the key goals of the RCx Program is to implement measures that will sustain the efficiency projections for 4-10 years, depending on the measure. This is a function of the measure's complexity, the building staff skill and motivation, and the

nature of the measure, whether it is a mechanical repair, software modification, or set point change.

In some cases a measure may show a high kW and/or kWh reduction potential, but technically it may not be a feasible project to implement. The focus of the program is low-cost measures, and these will be given priority over measures with higher cost and/or longer anticipated simple payback period.

### **Energy Conservation Measures (ECM) List**

The observations made during the preliminary site assessment form the basis for the ECM List. The list includes all recommended RCx qualified improvements that can potentially be investigated further.

### **Preliminary Assessment Phase Meeting**

After the Preliminary Assessment Phase Summary is approved, the RCx Agent coordinates the Preliminary Assessment Phase Meeting with the owner, CenterPoint Energy and the PA. The purpose of the Preliminary Assessment Phase Meeting is to discuss the Preliminary Assessment Phase findings and opportunities outlined in the report. The Preliminary Assessment Phase Meeting also gives the owner an opportunity to give valuable input concerning the Preliminary Assessment Phase findings and if the opportunities uncovered merit further investigation.

### **2.3.3 Deliverables for Preliminary Assessment Phase**

The Preliminary Assessment Phase Summary is the guiding document for the retro-commissioning process. It also serves to document a project's suitability for continued involvement in the RCx Program. It acts as a project summary for all parties involved. The outline to use for this summary is provided in Appendix B. The outline contains the details of documentation to be used in this report. The RCx Agent must use this outline unless the PA gives authorization to modify or substitute sections. It is recommended that the electronic version (MS Word) of the outline be used. Italicized text in the outline is provided as guidance regarding the content of the report sections and is not to be included in the submitted report. The RCx Agent shall also include in the summary, a Preliminary Assessment Phase Owner Selection Table (OST) containing the recommended energy conservation measure with their corresponding savings, cost and payback calculations. The RCx Agent submits an electronic copy of the summary to the PA. Upon approval of the summary, the RCx Agent will forward the Report to the facility owner and schedule the Preliminary Assessment Phase Meeting.

### **2.3.4 Preliminary Assessment Phase Timeline**

The Preliminary Assessment Phase Summary must be submitted by the RCx Agent to the PA within a timely manner after the kick off meeting, per the approved project timeline.

### **2.3.5 Preliminary Assessment Phase Owner Selection Table**

The Preliminary Assessment Phase Owner Selection Table (OST) will be reviewed with the Owner during the Preliminary Assessment Phase meeting. The Owner shall designate on the OST which measures they are interested in investigating further for implementation at their facility. The Owner shall sign this OST and return it to the PA and/or RCx Agent. The PA shall use this OST to determine whether the project has the potential for sufficient savings to proceed to the Investigation Phase. The RCx Agent shall use this OST to determine which measures will be examined further during the Investigation Phase.

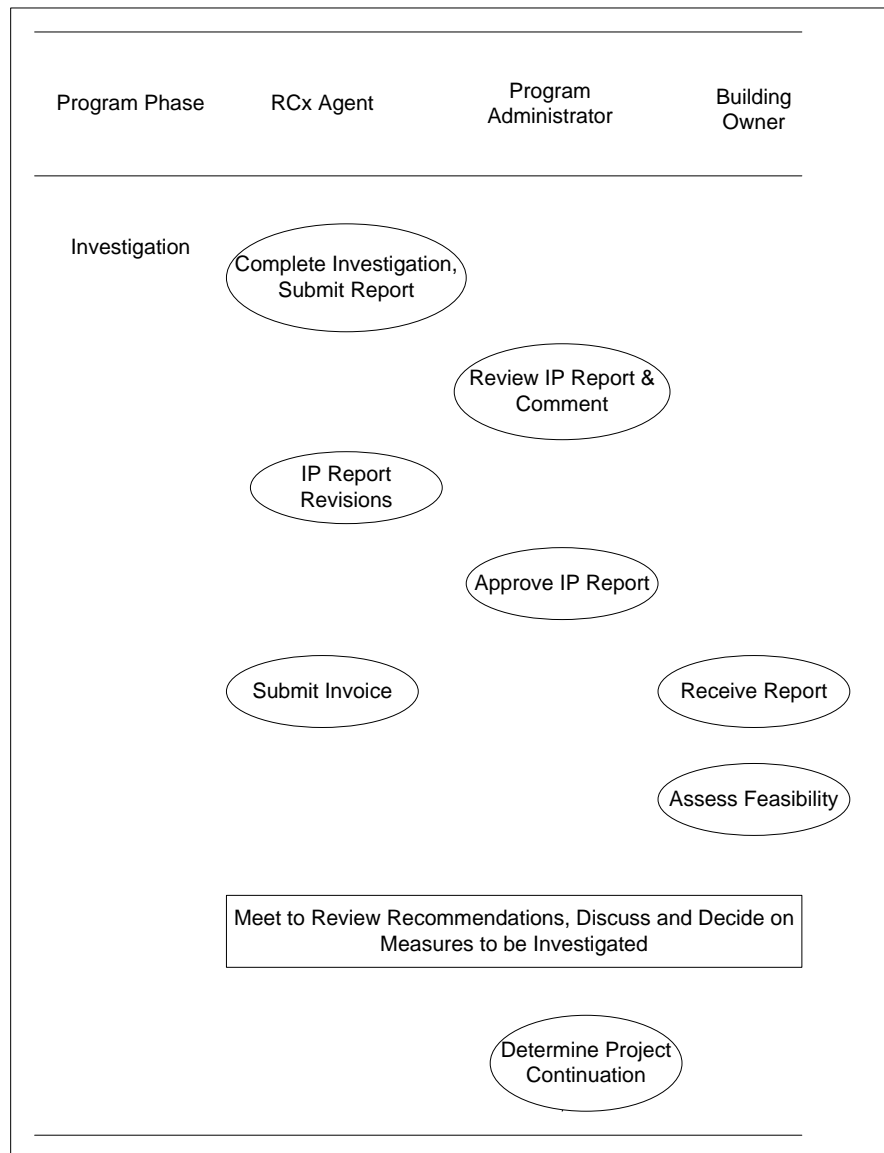
## **2.4 Investigation Phase**

### **2.4.1 Overview**

During this phase, the RCx Agent conducts detailed site-audits to validate measures identified in the Preliminary Assessment Phase Summary. In addition, the RCx Agents are expected to identify

ECMs, which were not noted during the Preliminary Assessment Phase, if applicable. The program administrative steps that occur during this phase are shown in Figure 5.

The Investigation Phase Report includes a detailed description of recommended improvements, energy savings projections, equipment data, assumptions and calculations, implementation cost estimates and a simple payback calculation. It may include one-line diagrams and written and graphical sequences of operations for affected equipment, and verification procedures for each recommended measure. The Investigation Report must be submitted to the PA for review and acceptance. The PA will review the Investigation Phase Report submittal and accept it or make recommendations for refinement.



**Figure 5. Investigation Phase Administration**

### 2.4.2 Investigation Phase Execution

During the investigation phase, the RCx Agent, with assistance from the building facility staff, will conduct a site assessment to develop an in-depth understanding of the building systems. The key investigation phase activities to be documented and included in the Investigation Report are (as applicable):

- Gathering data to assess equipment operation, including operational hours, building equipment data, current control sequences, etc.
- 
- Estimating the potential peak period demand reduction (kW) and energy savings (kWh) from identified RCx Energy Conservation Measures (ECMs) Assessing the cost to implement the identified RCx ECMs and calculating the corresponding savings to generate a simple payback period.
- The Master Findings List, including both low cost RCx-type ECMs and capital expenditure type ECMs.
- Written sequence of operation or detailed description for any control changes ECMs recommended (see Appendix C for example)
- One-line schematic of any major equipment (e.g. AHU, Central Plant) for which ECMs are recommended (see Appendix C for example) as applicable.

The owner may implement low-cost, no-cost measures only after sufficient information is collected to document the baseline and estimate the measure's energy savings potential. The PA, RCx Agent and the owner are all to agree before an ECM is implemented during the investigation phase. This action is to be documented in the Investigation Report.

Information and test results gathered during this phase are to be included in the Investigation Report. A template for the Investigation Report is provided in Appendix C.

### **Facility and System Equipment Assessment**

At the facility level, the following information is collected:

- Systems with highest energy use and demand
- Significant control, operational, and maintenance problems
- Comfort problems
- Operations and maintenance (O&M) practices
- Facility operation and occupancy schedules

The facility assessment expands on the general site assessment done in the Preliminary Assessment Phase by focusing on areas identified for potential savings.

System assessment occurs at the equipment level and involves collecting nameplate information and conducting a minimum standard set of diagnostic tests for each system and piece of equipment included in the ECM Master Findings List. Forms for reporting the equipment nameplate information are provided in Appendix C. The system and equipment assessments generally include collecting the following information:

- Nameplate data (with efficiency)
- Design and operational intent
- Actual operation
- Operating parameters
- General Conditions

### **Master Findings List**

The observations made during the site assessment and detailed facility assessment form the basis for the Master Findings List. The Master Findings List identifies savings opportunities (or performance deficiencies) and recommended improvements. It summarizes all of the findings of the investigation phase, including the adjustments and repairs made during the course of investigation. The list includes all recommended low-cost and capital improvements. The format for the Master Findings

List List is provided in the Investigation Report outline in Appendix C. The RCx Agent is required to use the Master Findings List List format provided, unless explicit written authorization is given by the PA to do otherwise.

The Master Findings List List includes the name of the system or equipment, a description of the problem or deficiency, recommended solutions, and savings category. Savings categories classify measures by the time period during which savings are anticipated. Categories include program peak-period demand savings and annual energy savings. The program peak period savings indicate the project's impact on the utility peak demand. The facility annual energy savings are to be calculated to determine the cost savings associated with each RCx measure.

For the measures identified by the RCx Agent, the estimated annual electricity savings are calculated, implementation costs are estimated, and a simple payback period is calculated. All calculations must be submitted in detail in the Investigation Report, as well as any data used in support of the calculations. The PA has compiled Typical Meteorological Year (TMY3) weather data for Houston, TX and it is available for the RCx Agents to develop their calculation templates. The RCx Agent may develop their own bin weather data base using bin weather software or Houston TMY data. Note that the bin data must be formatted to allow isolation of the applicable energy savings for each measure and each time period (i.e., peak period, annual, etc.).

### **Typical ECMs**

- Turn-off unnecessary systems
- Revise equipment operating schedules
- Optimize outdoor air ventilation
- Reset supply air temperature
- Automatic reset of static pressure set-point
- Minimize simultaneous heating and cooling
- Reset chilled water supply temperature
- Air balancing
- Water balancing
- Implement chiller plant optimization
- Use Variable Speed Drives in fans and pumps
- Eliminate leakage in air and water distribution systems
- Improve air-side economizer operation

### **Unacceptable ECM Characteristics**

- Compromise occupant comfort
- Compromise safety
- Violates building code
- Unacceptable to owner/staff
- Behavioral changes
- Manual operational changes
- Persistence of less than 4-10 years, depending on the measure

### **ECMs outside RCx Program Scope**

- Major equipment replacements or additions
- Lighting retrofits

While capital-intensive measures are outside the scope of this program, it is recommended that the RCx agent include these measures in the Master Findings List. The RCx Agent shall also identify in the Master Findings List the measures which may be applicable for other CenterPoint programs, such as Commercial & Industrial Standard Offer Program.

### **RCx Survey Elements**

The survey tasks noted in this manual are intended to provide quality assurance, streamline the RCx process, and standardize the services provided by the RCx Agents. As part of the process, the RCx Agent is requested to adhere to the RCx Survey Elements Summaries outlined below as a minimum.

RCx procedures are provided in Appendix C. The procedures should be utilized by the RCx Agent on all CenterPoint Energy RCx Program projects. Because the recommended procedures are minimum standards, they are not intended to be used exclusively. If the RCx Agent deems additional or alternative tests necessary, forms should be added to the recommended procedures to collect the additional information. Documentation of completed functional tests should also be included in the Investigation Report.

The survey list is organized by system and equipment type and covers the major mechanical components typically found in commercial facilities. Table 2 provides a summary of the minimum requirements of the survey tasks.

The RCx Agent should include a simple system schematic, record a minimum set of operating parameters, and include templates for conducting functional tests to verify proper component, equipment, or system operation, as necessary. The required fields in the forms are marked by an asterisk (\*). The functional tests outlined in the forms are recommendations only, and may be revised or rewritten based on the RCx Agents judgment. The functional tests may be carried out manually by forcing system variables, or automatically by trending variables in the Energy Management and Control System (EMCS) or stand-alone logging device. It is up to the RCx Agent to determine the best method that will meet the needs for testing and be acceptable to the owner.

System or Equipment	Typical Survey Requirements
Chilled Water System (Chiller and pumps)	Document sequence of operations (SeqOp)* Verify / Justify SeqOp Document actual schematic* Spot measure actual performance (kW/ton) Document setpoints* Verify temperature and pressure sensor calibration Verify thermostat calibration Document operations and maintenance (O&M) procedures
Air Handling Unit	Document SeqOp* Verify / Justify SeqOp Document system type* Document nameplate ratings* Document actual schematic Document temperature, pressure at control points* Verify economizer operation (if present) Verify damper operation and sealing Verify temperature and pressure sensor calibration Verify proper chilled water, hot water, and/or steam valve operation Measure motor/fan load, flow, pressure Identify operating point on fan curve Verify inlet guide vane / discharge damper / VFD operation (if present) Document O&M procedures
Cooling Tower	Document SeqOp* Verify / Justify SeqOp Document system type* Document nameplate ratings* Document temperature, flow at control points* Document O&M procedures
Control System	Document SeqOp for the HVAC system, integrating the equipment SeqOp s* Verify / Justify SeqOp Verify and sketch system schematic

**Table 2. RCx Survey Elements Summaries**

### **Diagnostic Monitoring**

During the RCx process, the Agent may identify problems that require short-term monitoring to understand how equipment is operating under a range of conditions or to prove the existence of suspected problems. A summary of the diagnostic monitoring activities should be submitted as part of the Investigation Report. Diagnostic monitoring should be performed using existing building control system, existing sensors, etc. Additional monitoring may be performed, but it will not be considered part of this program, and additional fees for this will not be included in this program.

The diagnostic monitoring plan typically lists the systems to be investigated, any simulation activity to create a desired condition, variables to be monitored, location of existing or proposed sensors (identified on associated schematic), data collection equipment, monitoring time period, sampling frequency, storage frequency, and parameter engineering units. The monitoring period must be appropriately chosen (at most hourly intervals) to capture the desired operational characteristics.

### **Investigation Phase Meeting (ECM Selection)**

Following delivery of the Investigation Phase Report to the owner, a meeting is to be held with the owner, the RCx Agent, the PA and CenterPoint Energy to review the project recommendations. The bundle of measures to be implemented is agreed upon by all parties, taking into consideration factors such as comfort, safety, or liability as input by the participants in the meeting.

### **Owner Selection Table (OST)**

After the Investigation Phase Meeting, the owner is expected to review and complete the OST. The owner will designate in the Investigation Phase OST the measures they have implemented or intend to implement during this project. The owner will sign the completed OST and return it to the PA and/or the RCx Agent. A sample OST is shown in Appendix E.

## **2.4.3 Deliverables for Investigation Phase**

The Investigation Phase Report provides a summary of the investigation phase activities. An outline for the report is provided in Appendix C. The RCx Agent must use this outline unless the PA gives authorization to modify or substitute sections. It is recommended that the electronic version of the outline be used, but note that italicized text in the outline is provided as guidance regarding the content of the report sections and is not to be included in the submitted report. Likewise, the retro-commissioning procedure forms provided in Appendix C are recommended to be used by the RCx Agent, unless authorization is given by the PA to modify them.

Key elements to be included in the Investigation Report as appendices if applicable are as follows:

- Diagnostic tests and calculation plans
- Verification plans
- Survey forms
- Schematics of affected systems
- Written sequence of operation for affected systems or equipment
- Graphical sequence of Central Plant operation

### **Diagnostic Tests and Calculation Plans**

During the investigation process, the RCx Agent is to further investigate the ECMs in which the owner designated their interest in the Preliminary Assessment Phase OST. For each of the measures that meet these criteria, the RCx Agent completes a Diagnostic Tests and Calculation Plan form. A sample form is provided in Appendix C.

**2.4.4 Investigation Phase Timeline**

The Investigation Phase Report must be submitted by the RCx Agent to the PA in a timely manner, in accordance with the approved project timeline.

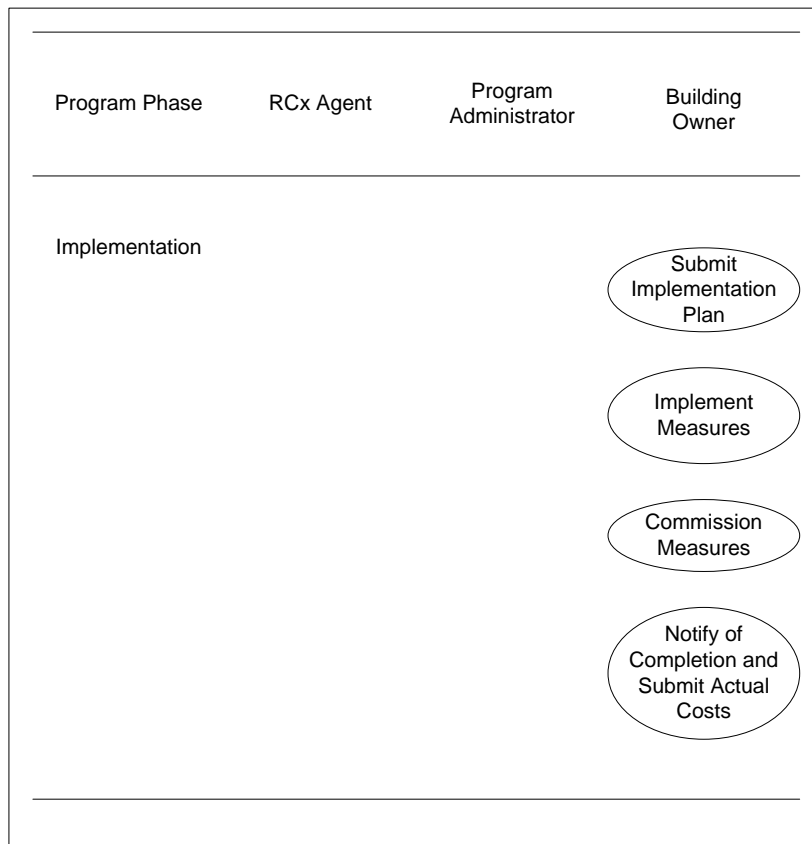
**2.5 Implementation Phase**

Completing the implementation phase of the project is the responsibility of the building owner/facility representative. The steps comprising the Implementation Phase are shown in Figure 6. The facility owner may choose to implement the measures using in-house staff, or contractors.

The facility owner submits an Implementation Plan to the PA that includes the following:

- Scope of work to be reviewed/verified by the PA and the RCx Agent before implementation begins
- Timeline for completion

At the completion of implementation, the owner must submit an accounting of actual cost of the RCx project to the RCx Agent for inclusion in the Verification Report.



**Figure 6. Implementation Phase Administration**

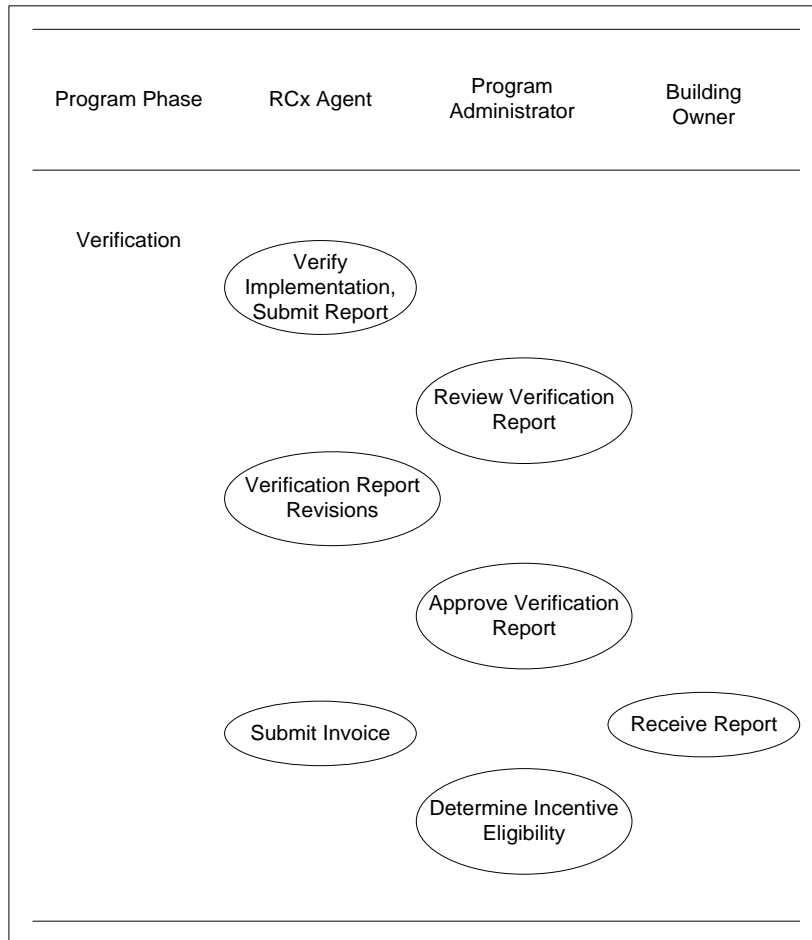
**Owner Implementation Confirmation**

After implementation is complete, it is the facility owner’s responsibility to confirm that the recommended energy conservation measures have been implemented as per the signed Investigation Phase Owner Selection Table. The RCx Agent is not responsible for making the system work if it fails the construction-commissioning phase. The Owner shall promptly notify the RCx Agent upon completion of implementation, so that the RCx Agent may begin the Verification process.

## 2.6 Verification Phase

### 2.6.1 Overview

During the Verification Phase, the RCx Agent visits the site to verify that measures have been properly installed and functioning, new control strategies are in place, repairs have been made, etc. The program steps comprising this phase are shown in Figure 7. The RCx Agent submits the Verification (Final) Report that summarizes its findings, and includes revised savings estimates. The PA will review the verification report. If a Verification Report is completed and approved on time, and the minimum savings have been achieved, the building owner will be eligible for a monetary bonus (see Section 1.5).



**Figure 7. Verification Phase Administration**

### 2.6.2 Verification Phase Execution

To confirm that the recommended energy conservation measures were properly implemented, the RCx Agent is required to prepare and submit a Verification Plan to the PA for approval. After implementation, the RCx Agent shall perform the verification activities as outlined in the approved Verification Plan. After the owner has completed their selected implementation, the RCx Agent shall document the verified savings in the Verification Report, which will be reviewed and approved by the PA.

### **Verification Plan Development**

For each of the owner selected measures, the RCx Agent is to develop a Verification Plan. The verification may consist of data trending, spot measurements, visual checks, and/or interviews with the party responsible for implementation. This plan is followed after implementation of the completed project with the goal of verifying that implementation was done correctly and the potential to reduce demand and energy usage exists.

In deciding the appropriate level of effort for verifying savings, the following measure characteristics should be considered:

- Estimated peak period demand and annual energy savings
- Measure complexity

The PA, as part of the verification plan review, will assess the suitability of the verification tasks for each ECM.

### **Deliverable for Verification Phase**

The Verification Report is prepared by the RCx Agent, and submitted to the PA after implementation verification is completed. The purpose of this report is to verify that the measures were properly implemented, provide justification for measures that were recommended but not implemented, and document verified project demand and energy savings. It shall also include a concise document clearly stating the RCx changes made to the systems and the reasons those changes were made, which may be posted on-site for the facility staff's reference. The RCx agent is expected to brief the facility operators on the changes made to the systems and emphasize the importance of persistence with these changes. It is essential that documented data be included in the report to support the final savings calculations because measures may not always be implemented exactly as recommended by the RCx Agent. A template for this report is provided in Appendix D. The RCx Agent must use this outline unless the PA gives authorization to modify or substitute sections. It is recommended that the electronic version of the outline be used, but note that italicized text in the outline is provided as guidance regarding the content of the report sections and is not to be included in the submitted report.

Key elements to be included in the Verification Report if applicable are as follows:

- Final Owner Selection Table
- Description of each implemented ECM
- Savings calculations
- Written sequence of operation for affected systems or equipment
- Graphical sequence of Central Plant operation
- Facility staff RCx reference document
- Owner's receipts/invoices for project costs