

# CenterPoint Energy

## Building Retro-Commissioning Program

Commercial Demand-Side  
Management

## Request for Qualification

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# 1. Retro-commissioning Program Overview

CenterPoint Energy Retro-commissioning Program will provide assessments to owners and operators of commercial facilities and incentives, if needed, for implementing energy efficiency measures recommended to reduce peak demand and energy usage. To secure retro-commissioning agents (RCx Agents) for the program, Nexant, the program administrator (PA), is issuing this request for proposal (RFP).

The Retro-commissioning Program is intended to encourage and assist CenterPoint Energy customers in increasing the operating efficiency of their existing energy-consuming equipment and lowering peak, electric demand. Proposals are sought from qualified RCx Agents to identify demand savings opportunities for participating customers. Successful respondents will complete projects stemming from accepted customer applications. Successful respondents will contract with Nexant to provide services for the program.

The CenterPoint Energy Building Retro-commissioning Program is built upon the following premises.

1. Energy consuming equipments in buildings often use more energy than is necessary to perform their intended operation.
2. A systematic evaluation of building systems often identifies significant, otherwise undetected, opportunities to make existing equipment/systems operate more efficiently. These opportunities are typically implemented through no- or low-cost measures.
3. Many customers do not have the time or in-house expertise to perform the detailed energy-efficiency analysis required to undertake this important work. If provided with the technical expertise and financial assistance, they will implement the energy-saving measures.
4. The benefits to CenterPoint Energy justify their investment in the program.

## 1.1 Rules

Retro-commissioning agents (RCx Agent) responding to this RFQ should be able to identify demand savings opportunities and prioritize investigation of savings opportunities to control costs. RCx Agent should be familiar with the buildings and climate in CenterPoint Energy service territory. RCx Agents with experience will be graded higher than those without.

### 1.1.1 Retro-commissioning Service Provider Eligibility

Retro-commissioning service providers responding to this RFP should be national or local entities and have experience in providing quality retro-commissioning services, identifying demand savings opportunities, and prioritizing tasks to control costs and maximize demand savings. RCx Agents should be familiar with the buildings and climate in CenterPoint Energy's Service Territory.

## 1.2 Process

The RCx 2011 program has now been branched into two components.

- a) **RCx Full program** – for large facilities with a minimum of 400,000 square feet of conditioned space
- b) **RCx Fast Track Program** – for smaller facilities with a minimum of 150,000 square feet of conditioned space

In general, the program guidelines follow a standardized retro-commissioning process to assure that RCx Agents provide consistent and quality services. The work will be broken into the principal phases listed below. In accordance with the retro-commissioning work for Phases 1 (as applicable), 2, and 4, the RCx Agent will submit the following reports to Nexant Inc.

1. Planning (RCx Full program only)
2. Investigation (RCx Full and Fast Track)
3. Implementation (customer's responsibility)
4. Verification (RCx Full and Fast Track)

The PA will market the program through outreach to professional organizations and direct customer contact. If an approved RCx Agent is identified in an approved application, that RCx Agent will be assigned to that project. For projects that the customer does not indicate a preference, Nexant will assign the RCx Agent based on their qualifications, expertise, workload, etc.

### **Planning Phase (RCx Full Only)**

After being assigned to a project, the RCx Agent begins the retro-commissioning planning phase. This phase begins with a site-visit, consulting with the building facilities personnel, and reviewing the building system documentation, operating set points, equipment sequences of operation and state of repair, utility bills, etc. From the information gathered, the RCx Agent develops a preliminary list of improvements, performing basic calculations of the demand-saving potential of each. From this analysis, the RCx Agent generates a feasibility assessment of the project, which is included in the Retro-commissioning Plan and submits it as a program deliverable. After the Retro-Commissioning Plan is approved, the RCx Agent will be paid the agreed-upon fee. If the PA and RCx Agent conclude that the project is unlikely to result in sufficient savings to meet program cost-effectiveness targets, the RCx Agent will be paid the planning phase fee, and the project will be terminated.

### **Investigation Phase (RCx Full and Fast Track)**

The investigation phase continues the site assessment to develop an in-depth understanding of the building systems. Operational and functional data are collected to assess equipment operation and document baseline operating conditions. A master list is developed to augment the items found in the planning phase, and to identify additional deficiencies and potential improvements. Detailed calculations are completed to estimate the demand and energy impacts, and simple payback period of potential improvements. For recommended measures, an implementation verification procedure is defined. Information gathered and recommendations for implementation are presented in the Investigation Report. After the Investigation Report is approved, the RCx Agent will be paid the agreed-upon fee.

### **Implementation and Verification (RCx Full and Fast Track)**

Nexant and the customer agree upon a bundle of measures to be implemented and an incentive amount is established based on the simple payback and demand savings of the bundle. It is the responsibility of the

building owner to complete the implementation. In-house staff or subcontractors may do the work. Once the work is complete, the RCx Agent verifies that the measures have been implemented by carrying out the verification procedure. The final portion of the agreed upon fee will be paid when the Final Report is approved.

## 2. Proposal Process

This chapter presents the procedures for preparing and submitting a proposal. The Proposal Stipulations, which must be acknowledged, signed and included in the proposal, are presented in Appendix B. The Proposal Submittal Forms required for submission are presented in Appendix C.

### 2.1 Electronic Q&A

Questions regarding the RFQ may also be directed to the PA at the address listed in Section 2.2. Answers to questions directed to the PA and those raised at the pre-bid Q&A session will be responded to in writing. The PA response will be emailed to all Q&A attendees, those who submit questions to the PA, and others who request them. To request Q&A responses, contact the PA at the address listed in Section 2.2.

### 2.2 Submitting Proposals

Proposals can be sent any time throughout the year to the PA through email. The electronic version of the RFQ and proposal forms may be downloaded from the CenterPoint Energy website that describes the Retro-commissioning Program at [www.CenterPointEfficiency.com](http://www.CenterPointEfficiency.com). Program Administrator Contact Information:

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#### 2.2.1 Proposal Check List

The following list summarizes the information and documents that comprise the proposal. Review the list to ensure all required components are included and signed if necessary. The documents include:

1. Acceptance of Appendix B Proposal Stipulations
  - Acceptance and Rejection of Proposals
  - Interpretation of Scope of Work
  - Preparation Costs
  - Contract Award
  - Orientation Meeting
  - Contract Requirements

## 2. Completed Appendix C Proposal Submittal Forms

- General Information
- Technical Approach
- Relevant Work Experience
- Reference Projects

### **2.3 Proposal Review**

Proposals will be evaluated and successful respondents will be selected using the scoring criteria discussed below. Projects will be assigned to RCx Agents as they become available.

#### **2.3.1 Evaluation Criteria**

Proposals will be evaluated for inclusion in the program using a pre-determined, multi-faceted scoring system. The scoring system follows a “best-value” methodology and evaluates the respondents’ ability to provide the most comprehensive service in a cost-effective manner while meeting the basic requirements of the program, as described in this RFQ. The following criteria will be used to evaluate proposals.

1. The respondents’ ability to provide quality services consistent with the program goals.
  - a. Systematic approach to identifying O&M efficiency improvements
  - b. Ability to identify peak demand savings opportunities
  - c. Ability to control costs through task prioritization
  - d. The respondents’ ability to meet the requirements of the Scope of Work
2. The respondents’ ability to allocate resources to meet the deliverables schedule.
3. References

#### **2.3.2 Clarification of Proposals**

While evaluating a proposal, the PA may request clarification of or additional information about any item in the proposal. Requests will be made in writing. The respondents are required to provide a written response to the PA within 5 business days.

#### **2.3.3 Confidentiality**

Sensitive company and project information submitted by the respondents as part of its proposal or the program contract will be treated confidentially to the fullest extent possible, and will not be provided directly to outside parties. For purposes of program evaluation or review, information contained in program submittals may be aggregated with information provided by other program participants and presented to outside parties, including the Texas Public Utility Commission.

### **2.4 Proposal and Contract Conditions**

The terms the respondents must concur with in submitting the proposal application are outlined in Appendix B Proposal Stipulations. The respondents should read the conditions, sign a copy, and submit as part of the proposal.

As part of the Proposal Stipulations, the respondents must read the Retro-commissioning Service Contract that they are expected to sign in order to provide services for the program. The Contract is included in Appendix D. If the respondents anticipate exceptions to the contract terms, these should be noted in the Proposal Stipulations form in the space allocated.

### 3. Scope of Services

The RCx Agent will plan, manage, perform and report on the retro-commissioning activities, utilizing the reporting formats and standardized forms provided by CenterPoint Energy whenever required.

Compilation of an equipment inventory, system troubleshooting, data trends and analysis, demand and energy savings calculations, implementation cost estimates, etc. will be conducted by the RCx Agent, in association with the building operations staff (OS). The RCx Agent will submit deliverable reports to the PA according to the retro-commissioning schedule set by the RCx Agent and agreed upon by CenterPoint Energy, the PA, and the customer. It is extremely important that all retro-commissioning tasks be conducted in a sufficiently transparent manner that involves the building engineer and OS to the greatest degree. This assures that the recommendations made by the RCx Agent will be adopted by the OS, and that the resulting demand and energy savings will persist for an extended time period (approximately 4 years, on average).

The following sections describe the primary tasks that will be required of the RCx Agent in the retro-commissioning process.

#### 3.1 Scope of Analysis

Savings are realized through the systematic evaluation of building systems and implementation of low-cost and no-cost measures targeted to reduce the electrical peak demand of the facility. The scope and complexity of the analysis associated with identifying savings opportunities will vary depending on the building size, use, type of equipment, and other factors. Because the objective of this program is to achieve the highest level of demand and energy savings possible at the lowest possible implementation cost, the primary focus of the retro-commissioning effort is the principal electric energy consuming equipment in the facility, typically consisting of the systems and equipment listed in Table 1. Recommendations targeted solely at improving occupant comfort, reducing off-peak demand or energy savings, reducing maintenance costs, etc. are encouraged to be included in the Master List, but do not contribute to the programs objectives, and are therefore not the focus of the retro-commissioning effort.

A three-stage analysis approach is typically used to both rapidly identify problems, while avoiding unnecessarily allocating time and resources. The stages in the analysis listed below are intended both to maintain retro-commissioning product quality and to guide the RCx Agent in the analysis.

1. Collect operational data for each major equipment item using standard forms provided.
2. Analyze system sequence of operations and design intent.
3. Conduct functional testing and/or collect trend data to document and isolate problem.

Stage 1 above is a program requirement with associated deliverables described in Sections 3.1.1 and. Stages 2 and 3 are not explicitly required, but the program requirements in Sections 3.1.2 through □to demonstrate demand savings typically necessitate such an approach.

The activities in Table 1 marked with an asterisk are program requirements. The remaining diagnostic procedures may be warranted in isolating the cause and remedy of a system malfunction, though they may be neither sufficient nor necessary to do so, and it is the responsibility of the RCx Agent to determine whether additional tests or alternate analysis methodologies are required. The Program data collection forms for chillers are provided in Appendix E – Sample Procedure Forms. These forms provide a sample of the data collection and documentation requirements (or suggestion if the procedure is not specified as required) for the program. Forms for the other major equipment items listed in Table 1 follow a similar format and level of detail.

**Table 1. Typical retro-commissioning equipment scope and activities**

<b>System or Equipment</b>	<b>Procedures</b>
Chiller Plant (Includes associated equipment such as pumps, valves, flat plate HX, etc.)	Sketch <sup>‡</sup> system schematic and evaluate for given application* Document setpoints (e.g. chilled water supply temperature)* Measure supply, return chilled water & condenser water temperatures and flows* Measure actual performance (kW/Ton)* Document sequence of operations (SeqOp) Evaluate <sup>†</sup> SeqOp for the given application
Cooling Tower	Sketch system schematic (may be included in chiller plant schematic)* Document setpoints (e.g. condenser water leaving temperature)* Measure supply, return condenser water temperatures, flow* Document SeqOp Evaluate SeqOp for the given application
Air Distribution System (Includes air handling unit, ducting, related fans in zone, related terminal boxes, etc.)	Sketch system schematic and evaluate for given application* Document setpoints (e.g. supply air temperature)* Measure supply, return, mixed, outside air temperatures* Verify proper chilled water, hot water, and/or steam valve operation Verify proper economizer operation (if present) Document SeqOp Evaluate SeqOp for the given application
DX Air Conditioning System (Includes all items associated with packaged DX system, such as compressors, condenser fans, economizer, air distribution system, etc.)	Sketch system schematic and evaluate for given application* Document setpoints (e.g. supply air temperature)* Measure supply, return, mixed, outside air temperature* Verify proper economizer operation (if present)* Measure actual performance (kW/Ton) Document SeqOp Evaluate SeqOp for the given application
Control System	Review SeqOp for the HVAC system, integrating the equipment SeqOps Evaluate SeqOp for the given application Sketch system schematic and evaluate for given application

<sup>‡</sup> *Sketch* may consist of a simple, clear hand-drawn sketch showing major components and control points

<sup>†</sup> *Evaluation* in this context means identification of peak load reduction opportunities

\* Program requirement

### 3.1.1 Site Assessment Form

The standard site assessment form must be completed for the building. The site assessment form is a standardized questionnaire that provides a basic insight into the building’s operation and potential problems. The site assessment form is provided in Appendix E.

### 3.1.2 Retro-commissioning Procedure Forms

Following the stages in the retro-commissioning process outlined in Section 3.1, retro-commissioning procedure forms have been developed to provide a standardized documentation structure. The equipment specification forms apply to each major piece of equipment typically found in commercial building HVAC systems, such as chillers, DX units, cooling towers, air handling units, and pumps. The forms consist of required and optional sections. Data collection requirements include component specifications

(e.g. capacity, size), setpoints (e.g. temperature, pressure, flow), loading characteristics (e.g. tons, amps, flow) and current operating parameters (e.g. temperature, pressure, flow). After reviewing the information gathered in the equipment specifications forms, the RCx Agent should have a well-formed idea of where savings might be achievable. This should direct the RCx Agent where to target efforts in the next phase of the investigation process.

Following the equipment specifications for each piece of equipment are functional test procedures that may be used as a diagnostic tool to assist the RCx Agent to isolate operational problems. These sections are optional, and the RCx Agent may use proprietary or site-specific functional test forms if desired, but only with the consent of the PA. A sample retro-commissioning procedure form is provided in Appendix E.

### **3.1.3 Data Collection**

Data representative of actual building operating status are necessary both to provide insight into the operation of equipment and to support the engineering calculations that are the basis of the savings estimates. Collection of these operational parameters may be done using the existing building EMCS, with stand-alone datalogging equipment, by hand using handheld meters, by referring to existing written logs, or through a combination of these methods. The data collection requirements will vary depending on the types of savings measures pursued, the complexity of the systems, the savings potential of a given measure, and the transient or steady-state nature of the parameters being measured.

### **3.1.4 Master List**

The observations made during the site assessment form the basis for the Master List of findings. The Master List identifies performance deficiencies and recommended improvements. It summarizes all of the findings of the investigation phase, including all potential no-cost, low-cost, and capital improvements.

The Master List includes the name of the system or equipment, a description of the problem or deficiency, recommended solutions, and cost/savings category. This category represents a rough estimate of the relative ratio of implementation cost to potential peak demand savings. For example, an air-side economizer control sequence may be found to result in maximum outdoor airflow during peak cooling conditions in a large office building ventilation system. The cost to reprogram the controls is relatively small in comparison to the potential savings due to correcting this problem, thus this item would be classified as low cost with high savings. In contrast, investigation may determine that a large air handling unit originally designed as a 100% outdoor air system to serve a special-use space is now serving typical office space. A recommendation to upgrade the system to operate as a return-air system would potentially yield considerable savings, but at considerable cost, and be classified as high cost with high savings. A complete set of savings calculations would be warranted for the former example, but not for the latter, though both items would be included in the Master List.

### **3.1.5 Savings Calculations**

Calculations based on engineering principles and reliable field data are the foundation for the savings reported by the Program. While there are potential shortcomings to reliance on this approach, the cost to apply detailed measurement and verification procedures is prohibitive. Thus, the engineering calculations must be based on reliable data, sound principles, and good judgment in the use of assumptions.

Savings calculations are not required for every item on the Master List, but only for those, which in the judgment of the RCx Agent, have the potential for high savings at a low cost of implementation. This

judgment may be based on preliminary calculations or experience, but with the goal of achieving maximum demand savings for the project.

Three fundamental types of savings calculations, plus an implementation cost estimate and simple payback, as listed below, are required for each measure with significant savings and deemed feasible by the EESP and the building engineer/representative.

- Peak Demand Savings – Defined as the calculated demand savings (kW) that occur during peak building operating conditions. Peak conditions occur during the utility peak demand period defined as Monday through Friday, 1:00 pm to 7:00 pm, June through September, excluding federal holidays. Peak conditions typically occur concurrently with high outdoor air temperature and result in peak cooling load. The peak demand savings calculation uses actual field data to estimate the reduction in building electrical demand during peak operating conditions due to the implementation of a savings measure. The PA may supply calculation templates for selected measures to reduce calculation efforts.
- Annual Energy Savings – Using the peak demand savings calculation as a starting point, the energy savings calculation estimates the annual electrical energy (kWh) savings potential for a given savings measure. In many cases, this calculation is a function of the part-load operating characteristics of the affected equipment and may also require an independent variable as an input to the calculation.
- Annual Cost Savings – The cost savings calculation accounts for electrical energy and demand savings, and uses the electrical rate tariff to determine the dollar savings achievable due to implementation of a savings measure.
- Implementation Cost Estimate - For each Master List item for which savings calculations were completed, the cost to implement the measure must be determined. This cost includes the materials, equipment and labor to fully implement the measure, and must include the source of the estimate, which may consist of list pricing, an actual quotation, or a recognized cost estimation database. In-kind contributions of OS time and materials are eligible for inclusion in the cost estimate.
- Simple Payback – The simple payback is calculated as the Implementation Cost divided by the Annual Cost Savings. This value is used as the basis to determine whether the customer (building owner) will be paid an incentive to implement the package of recommended savings measures.

## **3.2 Deliverables**

Each retro-commissioning project includes three deliverable reports from the RCx Agent (the Planning Report (RCx Full only), the Investigation Report, and the Final Report). The purpose of these reports is to define the activities of the primary phases of retro-commissioning: planning, investigation, and implementation. CenterPoint Energy reviews each of these deliverables prior to the project proceeding to the next phase.

### **3.2.1 Planning Report (RCx full only)**

The planning phase report is the guiding document for the Retro-Commissioning Full process. It acts as a project summary for all parties involved, provides a feasibility assessment of the retro-commissioning project, defines the scope of the retro-commissioning effort, and outlines a time schedule and responsibilities for the various tasks. The RCx Agent submits copies of the report to Nexant Inc. and the building owner. Upon approval of the report, the RCx Agent will be authorized to proceed to the investigation phase of the project. If the PA and RCx Agent conclude that the project is unlikely to result in sufficient savings to meet program cost-effectiveness targets, the RCx Agent will be paid the planning phase fee, and the project will be terminated.

The planning report provides guidance for the remainder of the retro-commissioning process. This report includes the following components.

- Facility description and list of energy-consuming equipment.
- Outline of Investigation activities
- Potential savings measures and associated electric savings estimates in kWh and peak kW. These can consist of "back-of-the-envelope" style calculations, but must be based on generally accepted engineering equations and estimation techniques.

### **3.2.2 Investigation Report**

After completing the investigation phase of the project, the RCx Agent delivers to Nexant Inc. a report summarizing the investigation activities, findings, recommendations, and procedures for verifying implementation of recommended measures. The purpose of this report is to document what investigation activities were completed, present detailed engineering calculations and supporting data behind the savings estimates, and to demonstrate to CenterPoint Energy that quality retro-commissioning services have been provided.

The Investigation Report includes the following principal components.

- Master List of findings (must include all items identified, regardless of savings potential).
- Summary of functional test results, field observations, monitored data, etc. used to assess equipment operation and to support savings calculations.
- Engineering calculations estimating the potential peak electrical demand savings associated with each master list item having significant savings potential.
- Engineering calculations estimating the potential annual energy and demand cost savings associated with each master list item having reasonable simple payback (typically zero to four years).
- Estimated cost to correct identified opportunities and corresponding simple payback period based on annual electricity cost savings.
- Implementation verification procedures (e.g., visual inspections, spot measurements, trend logging) to be used to verify proper implementation of each recommended measure.

A sample Investigation Report is provided in Appendix F.

### **3.2.3 Final Report (RCx Full and Fast Track)**

The Final Report is prepared by the RCx Agent, and submitted to CenterPoint Energy and the building owner once implementation verification is completed.

This report summarizes the implemented measures, documents estimated project demand and energy savings, and verifies that the measures were properly implemented. The report lists the implemented measures and discusses any insufficiencies found. If implementation was not as outlined in the Investigation Report, the RCx Agent must provide updated savings estimates in the Final Report, based on the actual implementation.

### 3.3 Project Schedule and Budget

The schedule for retro-commissioning projects is anticipated to follow the timetable outlined in Table 3. The timetable indicates expected duration of project phases and not manpower requirements, which will be less.

It should be noted that portions of the investigation phase might need to coincide with the building peak-demand period (i.e. hot summer days). This should be kept in mind when scheduling project tasks. Also, the implementation of retro-commissioning measures is the duty of the building owner and not the RCx Agent. The duration noted in the table is only an estimate.

The RCx Agent will receive a fixed fee payment for RCx services, to be paid on a milestone schedule. This % payment breakdown presented in Table 2 below are subject to change at the sole discretion of Nexant and CenterPoint Energy.

**Table 2. Anticipated project timeline for RCx Full**

<b>Phase</b>	<b>Approximate Budget Allocation</b>
Planning	20%
Investigation	65%
Implementation	-
Verification	15%
Project Total	100%

**Table 3. Anticipated project timeline for RCx Fast Track**

<b>Phase</b>	<b>Approximate Budget Allocation</b>
Investigation	84%
Implementation	-
Verification	16%
Project Total	100%

**Sample Timeline- RCx Fast Track (Table 3)**

**SCREENING PHASE**

<b>Dates</b>	<b>Activity and/or Milestone</b>
4/8/11 – 4/15/11	Nexant analysis of Application & utility bills; Benchmarking
4/17/11 – 5/9/11	Application approval; Nexant issues Building Owner Document & Owner signs; Additional Nexant screening
<b>Week of 5/11/11</b>	<b>Kick-off Meeting; Notice to agent to proceed to Investigation Phase</b>

**INVESTIGATION/IMPLEMENTATION PHASE**

<b>Dates</b>	<b>Activity and/or Milestone</b>
5/12/11 – 6/13/11	On-site Interviews, Field Measurements; Data Logging Validation of ECMs; Calculate Savings; Prepare Report
<b>6/13/11</b>	<b>Issue Draft of Investigation Phase Report to Nexant</b>
6/15/11 – 6/29/11	Centerpoint/Nexant Review and Comment on Report
6/30/11 – 7/6/11	RCx Agent incorporates Review Comments
7/7/11 – 7/14/11	Nexant reviews & approves Investigation Phase Report
<b>7/15/11</b>	<b>Issue Final Investigation Phase Report</b>
Week of 7/18/11	Presentation to Client; Client agrees to implement identified ECMs
7/18/11 – 8/17/11	Client implements ECM's

**VERIFICATION PHASE**

<b>Dates</b>	<b>Activity and/or Milestone</b>
8/18/11 – 8/29/11	RCx Agent Site verification & Prepare report
<b>8/29/11</b>	<b>Issue Draft of Initial Verification Report</b>
8/30/11 – 9/9/11	Centerpoint/Nexant Review and Comment on Report
9/12/11 – 9/19/11	RCx Agent incorporates Review Comments
9/20/11 – 9/26/11	Nexant reviews & approves revised Verification Report
<b>9/27/11</b>	<b>Issue Final Verification Report</b>

**Sample Timeline- RCx Full (Table 3)**

**PLANNING PHASE**

<b>Dates</b>	<b>Activity and/or Milestone</b>
2/23/11 - 2/29/11	Benchmarking; review & analyze utility tariffs
3/2/11 – 3/9/11	Application approval; Nexant issues Building Owner Document & Owner signs
3/10/11- 4/11/11	On-site Interviews, Identification of ECMs; Estimate savings; Prepare report
<b>4/11/11</b>	<b>Issue Draft of Planning Phase Report</b>
4/12/11 – 4/19/11	Centerpoint/Nexant Review and Comment on Report
4/20/11 – 4/27/11	RCx Agent incorporates Review Comments
4/28/11 – 5/4/11	Nexant reviews & approves Planning Phase Report
<b>5/5/11</b>	<b>Issue Final Planning Phase Report</b>
Week of 5/9/11	Presentation to Client; Notice to Proceed to Investigation Phase

**INVESTIGATION PHASE**

<b>Dates</b>	<b>Activity and/or Milestone</b>
5/16/11-7/15/11	On-site Interviews, Field Measurements; Data Logging Validation of ECMs; Calculate Savings; Prepare Report
<b>7/18/11</b>	<b>Issue Draft of Investigation Phase Report</b>
7/18/11 – 7/25/11	Centerpoint/Nexant Review and Comment on Report
7/25/11 – 8/1/11	RCx Agent incorporates Review Comments
8/2/11 – 8/9/11	Nexant reviews & approves Investigation Phase Report
<b>8/10/11</b>	<b>Issue Final Investigation Phase Report</b>
Week of 8/15/11	Presentation to Client; Client agrees to implement identified ECMs

**IMPLEMENTATION PHASE: 8/16/11-10/16/11**

**VERIFICATION PHASE**

<b>Dates</b>	<b>Activity and/or Milestone</b>
10/17/11-10/27/11	Prepare Report
<b>10/28/11</b>	<b>Issue Draft of Final Verification Report</b>
10/31/11 - 11/4/11	Centerpoint/Nexant Review and Comment on Report
11/7/11 - 11/14/11	RCx Agent incorporates Review Comments
11/15/11 – 11/22/11	Nexant reviews & approves Verification Phase Report
<b>11/23/11</b>	<b>Issue Final Verification Report</b>

## **Appendix A – CenterPoint Energy Service Territory**

Applicable: Entire Service Area

AREAS SERVED

Counties Served

Austin Co.  
Brazoria Co.  
Chambers Co.  
Colorado Co.

Fort Bend Co.  
Galveston Co.  
Harris Co.  
Liberty Co.

Matagorda Co.  
Montgomery Co.  
Waller Co.  
Wharton Co.

Incorporated Communities Served

Arcola\*  
Bayou Vista, Village of\*  
Baytown  
Beach City  
Beasley\*  
Bellaire  
Bonney\*  
Brookshire\*  
Brookside Village  
Bunker Hill  
Clear Lake Shores  
Clute  
Cove\*  
Danbury  
Deer Park  
El Lago  
Fairchilds  
Freeport  
Fulshear  
Galena Park\*  
Galveston  
Hedwig Village  
Hillcrest Village\*  
Hilshire Village\*  
Hitchcock\*  
Houston  
Humble\*  
Hunters Creek  
Iowa Colony\*

Jacinto City\*  
Jamaica Beach Village\*  
Jersey Village  
Jones Creek  
Katy\*  
Kemah\*  
Kendleton\*  
Lake Jackson  
La Porte  
Liverpool\*  
Magnolia\*  
Marvel  
Meadows  
Missouri City  
Mont Belvieu\*  
Morgans Point\*  
Nassau Bay\*  
Needville\*  
Oak Ridge North  
Old River-Winfree\*  
Orchard\*  
Oyster Creek  
Pasadena  
Pattison\*  
Pearland  
Pine Island\*  
Piney Point Village\*  
Pleak

Prairie View\*  
Quintana  
Richmond  
Richwood  
Rosenberg  
San Felipe\*  
Santa Fe  
Seabrook  
Sealy\*  
Shoreacres  
Simonton  
South Houston  
Southside Place  
Spring Valley  
Stafford  
Stagecoach\*  
Sugar Land  
Surfside Beach Village  
Taylor Lake Village  
Thompsons  
Tiki Island  
Tomball\*  
Waller\*  
Wallis\*  
Webster  
West University Place  
Wharton

\*Relinquished original jurisdiction to the Public Utilities Commission of Texas.

Revision Number: 16th

Effective: 7-30-99

Applicable: Entire Service Area

In addition to the incorporated communities listed above, a minority of the customers in the incorporated areas of Alvin, La Marque, League City, Friendswood, Dickinson, Texas City and West Columbia are served.

Unincorporated Communities Served

Addicks	Cypress	Longpoint
Aldine	Damon	Magnet
Algoa	Danciger	McNair
Alta Loma	Decker Prairie	Mixville
Arcadia	Dewalt	Moonshine Hill
Bacliff	East Bernard	Newgulf
Bammel	Egypt	Peters
Barker	Foster	Pinehurst
Barrett	Fresno	Pledger
Big Creek	Frydek	Raccoon Bend
Blue Ridge	Genoa	Randon
Boling	Glen Flora	Retrieve
Bonus	Gulf Park	Rose Hill
Booth	Guy	Rosharon
Burleigh	Highlands	Sandy Point
Cedar Bayou	Hockley	San Leon
Channelview	Houston Point	Satsuma
Chenango	Huffman	Sheldon
Chesterville	Huffsmith	Spanish Camp
Clodine	Hungerford	Spring
Cloverleaf	Iago	Strang
Coady	Juliff	Tavener
Cochran	Lakewood	Virginia Point
Crabb	Lane City	Westfield
Crosby	Lissie	

## **Appendix B – Proposal Stipulations**

Review, sign, and submit Appendix B - Proposal Stipulations as part of the proposal.

## **Proposal Stipulations**

### **Acceptance and Rejection of Qualifications**

CenterPoint Energy reserves the right to open qualifications privately, unannounced and to reject any and all proposals and waive irregularities and informalities in any proposal that is submitted and to be the sole and final judge of all qualifications. CenterPoint Energy reserves the right to discontinue its evaluation of proposals from any respondents who submits false, misleading, or incorrect information.

### **Interpretation of Scope of Work**

It is the respondent's responsibility to advise Nexant, the program administrator, of conflicting requirements or omissions in the RFQ that describe proposal requirements or scope of work before submission. Nexant will resolve acknowledged omissions and questions through electronic correspondence. It is the respondent's responsibility to contact Nexant if they did not receive the anticipated electronic correspondence.

### **Preparation Costs**

The costs incurred by a respondent in the preparation of this proposal, attendance at information sessions, or in contract negotiation will not be reimbursed.

### **Contract Award**

This RFQ does not commit CenterPoint Energy to award a contract. CenterPoint Energy reserves the right to modify or withdraw this Request for Qualification. CenterPoint Energy also reserves the right to reject program applications.

### **Orientation Meeting**

Successful bidders will be required to meet with Nexant to cover program administration issues, provide an overview of the savings calculations, further describe required project deliverables, and answer any remaining questions that the approved RCx Agent may have.

### **Contract Requirements**

The Service Contract that will be used to secure services by Nexant is provided in Appendix D. As noted in the Service Contract, contractors of CenterPoint Energy and their subcontractors must meet minimum insurance requirements. The respondents must agree to abide these provisions to participate as an RCx Agent in the program.

### **Notice of Exceptions to the Service Contract**

List in this section exceptions the respondent has to accepting the terms of the Service Contract.

## Acceptance of Proposal Stipulations

Respondents' must sign in the space provided below to acknowledge acceptance of the proposal stipulations outlined above. In addition, the respondent, by signing below, acknowledges that they have read and understand all sections of this RFQ, including Section 3.1 through 3.3 of this RFQ. Please submit an original signed copy of this sheet with your proposal.

### CONTRACTOR

Signature: \_\_\_\_\_

Name: \_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_

Phone: \_\_\_\_\_

E-mail: \_\_\_\_\_

## **Appendix C – Proposal Submittal Forms**

The electronic version of the Appendix C - Proposal Submittal Forms may be downloaded from the CenterPoint Energy website that describes the CenterPoint Building Retro-commissioning Program at <http://www.CenterPointEfficiency.com/>. Please complete all sections. Expand the space provided to answer questions as needed.

## General Information

Company Name	Contact Person	Title	
Address	City	State/Prov	Zip/Postal Code
Telephone	Fax	E-Mail	

### Description of business

**Describe your Houston office, and staffing. If located out of the area, how does your firm propose to complete on-site retro-commissioning work over an extended period of time?**

### Affiliation with specific equipment suppliers, distributors and product brand names

#### Retro-commissioning Activities

Percentage of overall business devoted to retro-commissioning services \_\_\_\_\_%

How long has the firm offered retro-commissioning services \_\_\_\_\_years

Average number of retro-commissioning projects performed each year \_\_\_\_\_projects

Number of registered professional engineers on staff who have directed retro-commissioning projects \_\_\_\_\_engineers

Number of CenterPoint Energy Retro-commissioning Program projects firm would be available to complete in this program year \_\_\_\_\_projects

**Systems or technologies for which firm has provided retro-commissioning services (check all that apply)**

- |  |   |
|--|---|
| <input type="checkbox"/> Pkg. or split HVAC    | <input type="checkbox"/> Electrical, emerg. power |
| <input type="checkbox"/> Chiller system        | <input type="checkbox"/> Envelope                 |
| <input type="checkbox"/> Boiler system         | <input type="checkbox"/> Fire/Life Safety         |
| <input type="checkbox"/> Energy Mgmt. Sys.     | <input type="checkbox"/> Plumbing                 |
| <input type="checkbox"/> Variable Freq. Drives | <input type="checkbox"/> Commercial refrigeration |
| <input type="checkbox"/> Lighting Controls     | <input type="checkbox"/> Telecommunications       |
| <input type="checkbox"/> Daylighting           | <input type="checkbox"/> Thermal Energy Storage   |
| <input type="checkbox"/> Electrical, general   | <input type="checkbox"/> Labs & Clean Rooms       |
|  | <input type="checkbox"/> Other: _____             |

The firm has provided retro-commissioning services in the following: **(check all that apply)**

<b><u>Building Sector</u></b>	<b><u>New Construction/ Major Renovation</u></b>	<b><u>Existing Building Tune-up</u></b>	<b><u>Equipment Replacement</u></b>
Office or retail	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Grocery	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hospitals	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Laboratories	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Schools or universities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Industrial / Manufacturing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Special purpose—prisons, museums, libraries, etc.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## Technical Approach

Please complete the questions below, using additional space as required.

1. Describe your firms general approach to retro-commissioning.
2. Describe your firms approach to achieve maximum peak demand savings.
3. Describe your approach for prioritizing retro-commissioning services.
4. Indicate the data gathering methods and tools used to measure performance (i.e. field observations, spot measurements, EMS reports, trend logs, etc.).
5. List of datalogging equipment your firm uses.
6. List of EMCSs your firm is experienced with.
7. List of automated software tools your firm uses.
8. Describe methods used to calculate achieved savings.
9. Provide examples of checklists or special documentation used in your work.

## Relevant Work Experience

Please complete the questions below, using additional space as required.

10. List relevant projects, identify any demand-side management projects.
11. Provide examples of prior projects energy savings achieved (kW, kWh, CCF/MCF, BTUs, cost).
12. Provide a brief description of relevant experience and training of staff you would assign to the project, attach resumes of key personnel.
13. Identify optional services you offer beyond energy system retro-commissioning.
14. Provide an example of your work (i.e. report prepared for a client).

## Reference Projects

Please complete the table below and provide references and descriptions for three projects your firm has completed.

	Project 1	Project 2	Project 3
<b>Project</b> (Name, Date, Bldg Size, Type, new or existing)			
<b>Project Contact</b> (Title, City, State, and Phone)			
<b>Name &amp; Role of Persons(s)</b> <b>Assigned to Project by Firm</b> (identify any sub-consultants)			
<b>Systems Recommissioned</b> (Identify if tested by sub-consultants)			
(Enter "X" if by own firm, "S" if by sub-consultant)	<b>Retro-commissioning Tasks Performed</b> Wrote the retro-commissioning plan		
	Wrote functional test procedures		
	Calculated demand or energy savings		
	Witnessed and documented functional tests		
	Performed functional tests (hands-on)		
	Used data loggers or EMS trend logs for testing		

	Developed or approved staff training			
	Reviewed completed O&M manuals			
<b>Management</b>	Retro-commissioning service provider was part of the firm			
	Supervised a consultant retro-commissioning service provider to our firm.			
	Worked with a retro-commissioning service provider hired by others			

## Appendix D – Retro-commissioning Service Contract

### *Technical Services Agreement*

THIS AGREEMENT No. XXXX-NEX-XXX is effective \_\_\_\_\_ between Nexant, Inc. hereinafter referred to as Nexant, and \_\_\_\_\_, hereinafter referred to as Subcontractor. The parties agree as follows:

1. Subcontractor shall provide services as an independent contractor in a manner acceptable to Nexant to perform the required work of this Agreement as outlined in **Exhibit A**. Upon written request of Nexant, Subcontractor shall review such documents as may be submitted to it by Nexant and give Nexant in writing its professional opinions and suggestions regarding them; and shall be available for consultation with Nexant staff members.
2. Upon receipt of [bi-weekly/monthly] billings from Subcontractor and subject to the provisions of this Agreement, Nexant shall compensate the Subcontractor at the **firm fixed price of** \_\_\_\_\_ for work performed in response to Nexant's request and shall reimburse Subcontractor for such travel and other expenses as have been authorized by Nexant. Nexant may require periodic written reports from subcontractor as part of its contracting requirement.
3. All discoveries, improvements, works of authorship and inventions made or conceived by Subcontractor in the performance of his obligations under this Agreement (collectively "Inventions") shall be the sole property of Nexant. Subcontractor hereby assigns to Nexant, its successors and assigns all right, title and interest that Subcontractor has or may acquire in and to the Inventions. If in the course of performing under this Agreement, Subcontractor incorporates into any Invention any invention, improvement, development, concept, work of authorship or other proprietary information owned by Subcontractor or in which Subcontractor has an interest, Subcontractor hereby grants Nexant, its successors and assigns a nonexclusive, royalty-free, perpetual, irrevocable, transferable, sublicensable, worldwide license to make, have made, modify, create derivative works from, display, perform, distribute, use and sell such item as part of or in connection with such Invention. Subcontractor shall promptly disclose to Nexant all Inventions and shall execute all documents and perform all other acts as requested by Nexant to implement this paragraph at Nexant's expense.
4. All trade secrets and confidential information obtained by Subcontractor while in, by reason of, or in preparation for, performance of his obligations herein shall be regarded by Subcontractor as strictly confidential and shall be held by Subcontractor in trust solely for Nexant's benefit and use and shall not be used by Subcontractor for any other purpose. Subcontractor shall not publish nor make known to others any information obtained during the performance of this Agreement without first having obtained the written approval of an Officer of Nexant.
5. Nexant shall neither exercise nor have any control over Subcontractor as to the means by which Subcontractor is to accomplish work under this Agreement.
6. Subcontractor shall hold Nexant harmless from damages or obligation incurred by reason of conduct of Subcontractor while performing services hereunder, or otherwise. Subcontractor has no authority to and shall not incur any obligations on account of or in the name of Nexant, except after specific written authorization from Nexant.
7. In case of arbitration or litigation arising out of any terms of the Agreement or in the performance thereof, the prevailing party shall be entitled to reasonable attorney's fees, expert's fees and/or costs incurred.
8. The rights and obligations of the parties under Paragraphs 3 through 9 of this Agreement shall survive any termination of the Agreement.

9. This Agreement shall be governed by and construed in accordance with the applicable U.S. federal law and the laws of the State of Texas, without regard to conflicts of laws principles. The parties irrevocably consent to the exclusive jurisdiction and venue of the U.S. federal and Texas state courts located in the City and County of Houston in connection with all disputes arising in connection herewith.
10. Prior to commencing the Work, Subcontractor shall obtain, pay the applicable premium and maintain during the period of the Work the types of insurance satisfactory to Nexant. Subcontractor shall procure and maintain at all times during this Agreement and the Work, an Unemployment Insurance Tax Account in accord with applicable state laws. Subcontractor shall procure and maintain General Liability Insurance in the minimum amount of one million dollars (\$1,000,000) per incident and Automotive Liability Insurance in the minimum amount of three hundred thousand dollars (\$300,000) per incident. The comprehensive general liability insurance and the automobile liability insurance shall cover damages arising from injuries, including death, sustained by persons and damages to property arising from work done or services performed pursuant to the Work, including without limitation the operation of any vehicle or equipment controlled by Subcontractor. Subcontractor shall not commence the Work until Subcontractor has obtained the insurance required herein. Subcontractor shall furnish to Nexant certificates of insurance or certification of self-insurance as required herein, each policy to contain a provision requiring thirty (30) days' prior written notice of cancellation or material change to be given to Nexant's representative. Subcontractor shall require its general liability insurer to add Nexant as an additional insured. All insurance required shall contain provisions wherein all rights of subrogation or recovery of any kind against Nexant, its agents, employees, officers, successors and assigned are specifically waived by the insuring entity.
11. Unless either party gives the other party twenty-four (24) hours written notice of termination, this base Agreement shall be **effective through** \_\_\_\_\_, unless extended in writing by mutual agreement.

Nexant, Inc.

Subcontractor

By: \_\_\_\_\_

By: \_\_\_\_\_

Date: \_\_\_\_\_

Date: \_\_\_\_\_

Fed. Empl. ID No.: \_\_\_\_\_

**Exhibit A**  
**Technical Services Agreement Reference: No. XXXX-NEX-XXX**

**PART I: SCOPE OF SERVICES** (Attach additional sheets if required)

1. Period of performance for the requested services shall be for performance starting from \_\_\_\_\_, 2011.
2. Subcontractor shall provide the following Services in support of the CenterPoint Energy Retro-commissioning Program.

**Background:**

Nexant, Inc. is managing the CenterPoint Energy Building Retro-commissioning program. The program focuses on providing retro-commissioning services to participants and provides incentives for implementing the recommendations. During the program, pre-qualified firms are contracted to conduct the retro-commissioning work.

**Project Tasks**

The program follows standardized retro-commissioning procedures developed by Nexant and CenterPoint Energy to assure that retro-commissioning providers provide consistent and quality services. The retro-commissioning process generally consists of the following four phases, with associated tasks:

<b>Project Phase</b>	<b>Tasks</b>	<b>Deliverable</b>
Planning	Visit building, meet with owner to discuss project goals Collect building documentation Write site-specific Retro-commissioning Plan	Retro-commissioning Plan
Investigation	Perform detailed site assessment Compile list of deficiencies Develop diagnostic monitoring and test plan Conduct testing and monitoring Select measures for recommendation Estimate demand and energy savings, and implementation cost estimates for recommended measures Develop implementation verification procedures for recommended measures Write Investigation Report	Investigation Report
Implementation	n/a – Conducted by building owner or their subcontractor	None
Verification	Conduct on-site verification of measure implementation Write Final Report	Final Report

The tasks listed in the table above are to be completed by the Subcontractor.

**Project Timeline**

See attached sample project timelines in Table 3

**PART II: COMPENSATION FOR SERVICES** (Attach additional sheets if required. Terms: Net 30 unless otherwise specified.)

1. Subcontractor shall provide technical expertise for the firm fixed price of \_\_\_\_\_.
2. Subcontractor shall include its Tax Identification Number on each invoice
3. Payments shall be made to the Subcontractor no more frequently than Nexant is paid under its Prime Contract and within 30 days of receipt of payments by Nexant under its Prime Contract.

**PART III: STANDARD PROVISIONS**

All terms and conditions of the attached Technical Services Agreement shall apply and are incorporated herein by reference.

**MAILING ADDRESS**

Nexant, Inc.  
44 Montgomery, Suite 4100  
San Francisco, CA 94104-4814

## Appendix E – Retro-commissioning Procedure Forms

# STANDARD SITE-ASSESSMENT FORM

RETRO-COMMISSIONING PROVIDER: \_\_\_\_\_

PROJECT #: \_\_\_\_\_

BUILDING NAME: \_\_\_\_\_

BUILDING ADDRESS: \_\_\_\_\_  
 \_\_\_\_\_

## 4. Building Characteristics

Characteristic	Description	
1. Year of construction		
2. Gross area (gross square footage)*		
3. Percent of gross area designated as prime office space*		
4. Percent of gross area designated as computer data center space*		
5. Percentage and type of other secondary space uses (e.g. parking, clarify below if necessary)		
6. Building configuration (e.g. campus, towers)		
7. Building use (e.g. office, school, hospital)		
8. Number of occupants*		
9. Annual occupancy rate of primary space by year*	Year	Rate (% full)
10. Number of personal computers in operation (approx.)*		
11. Type of lighting equipment installed		
12. Weekly hours of operation by major space type*	Space Type	Hours

13. Building occupied for 11 or more of last 12 months?*	
14. Brief renovation history (clarify below if necessary)	
15. Brief description of building improvements planned.	

\*EPA Energy Star Buildings benchmarking data

ITEM NO. COMMENT


## 2. Building Equipment

Equipment	Description
1. Type of cooling system (e.g. district cooling, packaged A/C)	
2. Type of condenser (e.g. air or water, number of cells)	
3. HVAC distribution system (e.g. constant volume, variable volume, dual duct, multi-zone)	
4. Age of primary cooling system	
5. Heating system type	
6. HVAC control system type (e.g. pneumatic, DDC)	
7. Brief equipment replacement / renovation history (clarify below if necessary)	
8.	
9.	

ITEM NO. COMMENT


## 5. Building Control Strategies

Equipment	Description
1. Does facility use a zone temperature setback strategy?	
2. Is the central supply air temperature fixed or is a reset strategy used?	
3. Does central air system have preheat?	
4. Is free cooling used, i.e. with an air or water-side economizer?	
5. How is the outdoor air controlled? What is the design outdoor air fraction?	
6. For VAV systems, is supply static pressure reset used?	
7. Does system have automatic shutdown?	
8. Is an optimum start strategy used?	
9. Is system equipped with zone isolation devices for minimizing energy use in off-hour operation?	
10. Is there exhaust air heat recovery?	
11. What type of dehumidification strategy is used (e.g. desiccant, chilled water coil)?	
12. What is the energy source for reheat in the AHU (e.g. gas, electric).	

ITEM NO.      COMMENT

_____	
_____	
_____	
_____	
_____	

## 6. General O&M Questions

Has the heating system always met load?  Yes  No

Under what conditions has the heating system not met load?

What was the approach to solve this problem:

Has the cooling system always met load?  Yes  No

Under what conditions has your cooling system not met load?

What was the approach to solve this problem:

Is any free cooling used? If so, please describe.

Is there any HVAC equipment that is considered to be undersized?  Yes  No

If yes, explain:

What compensation is made for the under sizing?

Is there any HVAC equipment that is considered to be oversized?  Yes  No

If yes, explain:

What compensation is made for the over sizing?

Is the building mechanical equipment (fans, pumps, etc.) scheduled to start up simultaneously, or is the startup staged?

What HVAC adjustments are made to unoccupied areas or spaces (e.g., turn off HVAC, adjust thermostat to minimum heating and cooling, close off diffuser)?

Is the building HVAC system airflow correctly balanced?  Yes  No

If yes, when was it completed?

If no, explain:

Are there any problems with the humidification method (explain)?  Yes  No

If yes, explain:

Describe the method of humidification for the building:

Are there any problems with the dehumidification method (explain)?  Yes  No

If yes, explain:

Describe the method of dehumidification for the building:

From what areas in the building are the most complaints received (explain nature of complaints)?

What is the worst building problem and how is it managed?

Is there currently in place a procedure for systematically identifying areas of excessive energy usage?

Yes  No

If yes, describe:

Does the building facilities team have specific goals established for improving the building mechanical systems?  Yes  No

If yes, describe:

In the past year, have modifications been made to improve the building's energy efficiency?  Yes  No

If yes, describe:

Notes, comments, and observations from Building Manager

Additional notes, comments, and observations by retro-commissioning provider

# STANDARD RETRO-COMMISSIONING PROCEDURE FOR CHILLERS

CHILLER ID: \_\_\_\_\_

RETRO-COMMISSIONING PROVIDER: \_\_\_\_\_ PROJECT #: \_\_\_\_\_

BUILDING NAME: \_\_\_\_\_ DATE(S) OF TESTING: \_\_\_\_\_

## 1. Operator Interview

PROBLEM DESCRIPTION & EFFECT	PROPOSED SOLUTION

## 2. System Schematic

Date: \_\_\_\_\_ Time of Day: \_\_\_\_\_ Outside Air Temperature: \_\_\_\_\_ Sun  / Cloud

### 3. Nameplate and Operating Data (\* indicates required data)

DESCRIPTION	DATA	UNITS
1. Manufacturer		
2. Chiller Type (centrifugal, screw, recip, scroll)	*	
3. Chiller rated capacity (Tons)	*	
4. Condenser Type (water or air cooled)	*	
5. Refrigerant Type		
6. Chilled water (CHW) setpoint (panel readout)	*	
<b>NOTE:</b> Items 7, 10, 11, and 12 <b>must</b> be measured concurrently (as possible) and under steady-state conditions to allow calculation of chiller efficiency (kW/Ton).		
7. Chiller kW (indicated measured or from chiller panel)	*	
8. Leaving CHW temp, design		
9. Entering CHW temp, design		
10. CHW flow rate, design		
11. Leaving CHW temp, <b>measured</b>	*	
12. Entering CHW temp, <b>measured</b>	*	
13. CHW flow rate, <b>measured</b> (indicate method used)	*	
14. Leaving CW temp, design		
15. Entering CW temp, design		
16. CW flow rate, design		
17. Leaving CW temp, <b>measured</b>	*	
18. Entering CW temp, <b>measured</b>	*	

DESCRIPTION	DATA	UNITS
19.CW flow rate, <b>measured</b>	*	

COMMENTS ON NAMEPLATE AND OPERATING DATA:

ITEM # COMMENT

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## 4. Sensor Calibration

Date: \_\_\_\_\_ Time of Day: \_\_\_\_\_ Outside Air Temperature: \_\_\_\_\_ Sun  / Cloud

<u>Sensor</u>	<u>Recommended Tolerance (+/-)</u>
Cooling coil, chilled and condenser water temps	1.0 F deg
AHU wet bulb or dew point	2.0 F deg
Hot water coil and boiler water temp	2.0 F deg
Outside air temps	1.5 F deg
Relative humidity	4%
Space and coil air temps	2.0 F deg

<u>Sensor</u>	<u>Recommended Tolerance (+/-)</u>
Watt-hour, voltage & amperage	4% of scale
Flow rates, water	4% of scale
Oxygen or CO <sub>2</sub> monitor	1% of scale
Flow rates, air	10% of design
Building differential pressure	0.02 in. of water
Pressures, air, water and gas	2% of scale

CONTROL TYPE	SENSOR LOCATION	SENSOR LOCATION OK?	MEASURED VALUE	EMCS VALUE	ACCEPT-ABLE?
1. Outdoor air temp, global (EMCS)					
2. Evap. water temp. in (F)					
3. Evap. water temp. out (F)					
4. Evap. water flow (gpm)					
5. Cond. water temp. in (F)					
6. Cond. water temp. out (F)					
7. Cond. water flow (gpm)					

ITEM #    COMMENT

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## 5. Functional Performance Testing

Date: \_\_\_\_\_ Time of Day: \_\_\_\_\_ Outside Air Temperature: \_\_\_\_\_ Sun  / Cloud

DESCRIPTION	DATA
<b>Chiller System Controls Tests:</b>	
1. Document existing chiller sequence of operations (SeqOp), including unit staging and operating schedule, on an attached sheet	
2. Verify that the chiller system operates according to the existing SeqOp	
3. Evaluate existing SeqOp as appropriate for the application	
4. If chiller system does not operate according to the existing SeqOp, describe problem and note on Master List.	
5. Chiller appears to meet load (no complaints)	
6. Shut-down and start-up sequences stage multiple chillers & accessories properly	
7. Record & explain any diagnostic codes in control panel memory. Include explanation as necessary below. Note deficiencies on Master List.	
8. Compare schematic sketch in Section 2 with design documents. Note any differences below and any deficiencies on the Master List.	

COMMENTS ON FUNCTIONAL PERFORMANCE TESTS (add more sheets as needed):

ITEM # COMMENT

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## Appendix F – Sample Investigation Report