

Recommissioning (RCx) Process for EISA Compliance

Final (22 September 2017)

GUIDANCE & INSTRUCTIONS FOR RECOMMISSIONING STATEMENT OF WORK (SOW) TEMPLATES

Focus is on the main phases of Assessment, Investigation and Implementation

Army RCx Process

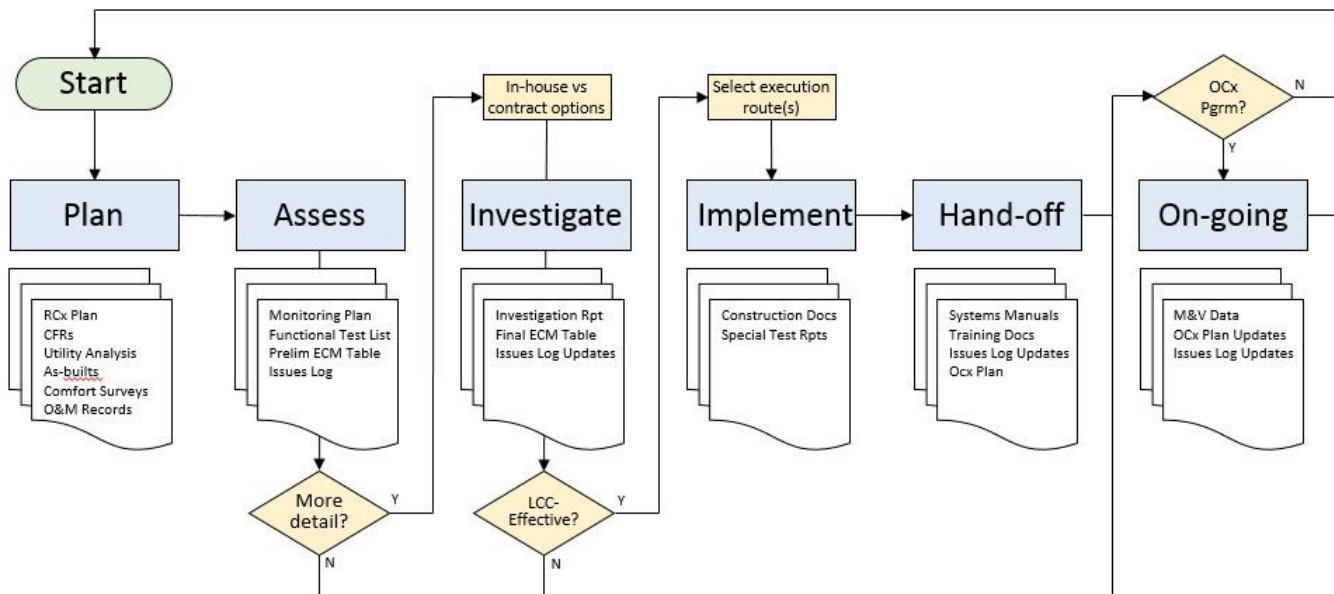


Table 1 Phase Descriptions

Table 2 Submittal Summary

Table 3 SAMPLE Roles and Responsibilities Matrix

Attachment 1 General Contract Requirements Template

Attachment 2 Assessment Phase SOW template

Attachment 3 Investigation Phase SOW template

Attachment 4 RCx Provider Experience Form

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INSTRUCTIONS FOR RECOMMISSIONING

Energy Independence and Security Act (EISA 2007) contains recommissioning (RCx) requirements for buildings greater than 50,000 SF. However the Army currently has little technical guidance to accomplish effective RCx work which will result in substantial energy savings and comfort improvements. New Army policy, a training curriculum, and engineering tools have been developed using a phased and deliverables-based approach that provides contracting flexibility and fits well with Army requirements and installation disparities in skillsets and staffing.

EISA requires that Recommissioning assessment and identification of potential improvements be performed for buildings greater than 50,000 sf along with the Energy and Water Conservation Assessments. This document was prepared to assist in compliance with EISA section 432 and focuses on the assessment, investigation and implementation phases of recommissioning process.

SOW Templates BLUF

This document contains three Statement of Work (SOW) templates: 1) General recommissioning requirements, 2) Assessment SOW, and 3) Investigation SOW. Depending on funding and maturity of the project and staff capacity, the general requirements can be combined with the Assessment SOW alone or with both the Assessment and Investigation SOW. However, it is recommended to complete one phase prior to the next as will be explained in these instructions. The Three SOW are located in Attachment 1, 2, and 3 of this document and contain the general and specific requirements of recommissioning.

The templates require tailoring to include specific information related to the particular scope of work and establishment of roles and responsibilities of contractors, users, or contracted RCx provider. The SOWs contain editor's notes to explain what should be considered in developing the specific scope. If there are any questions, you can reach a subject matter expert at commissioning@usace.army.mil.

Commissioning Processes

The building commissioning process is a sequential process, where total building commissioning occurs during the planning, design and construction and occupancy phases. Recommissioning and on-going commissioning can occur during the operations phase. While you can do one of the three below commissioning processes without the others, the best management practice is to perform them in order. Some of the differentiating commissioning tasks during the varying phases of a project are:

1. Total Building Commissioning **Cx-** for **new construction-** is a quality assurance process from design, construction to building turnover phases. Primarily occurs in the construction phase inclusive of installation verification and performance testing of equipment.
2. Retro Commissioning/Recommissioning **RCx-** reaffirms that **building systems are operating** as they were intended in the "as-built" plans. If building function has changed, or if original design never met operational desires, it may be necessary to reset operational set points and sequence(s) of operation. These system changes require performance testing.

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3. On-going commissioning **OCx**: Define Key performance index, use daily/weekly data to ensure that building **operations are optimized** and within the objectives defined during benchmarking.

This guidance document has been developed to provide contract language for the recommissioning process and guidance for use of the contract documents (Attachments).

RCx Definition

Retro-commissioning and recommissioning (or RCx) can be defined as a process of optimizing existing building systems. While this process requires similar knowledge and testing procedures to new building commissioning (or Cx), the goal of RCx is to maximize energy efficiency and occupant comfort. More emphasis is on building operation as opposed to installation verification typically performed in new construction. Through the RCx process of testing and analyzing system performance data, the user has the potential to return building operations to designed or commissioned conditions or even improve operations beyond what was initially required or delivered.

While the facilities management industry has variations on some RCx terminology and tasks, the approach is the same: apply knowledge of building systems to assess, test, analyze, and optimize the operation of HVAC, lighting, and other energy or water-using processes. Industry studies report energy savings at a 16% median (but often exceeding 33%) with 1.1 year payback (Lawrence Berkeley National Laboratory’s 2009 “Building Commissioning - A Golden Opportunity for Reducing Energy Costs and Greenhouse Gas Emissions”). With additional non-energy related benefits cited for improved O&M (14%), increased productivity/safety (19%), and enhanced thermal comfort (79%). RCx is also often generalized as a process of simply “operating the building well”. These results suggest RCx is a vital tool to capture “low-hanging fruit” energy savings.

RCx Approach



The Energy Independence and Security Act of 2007 requires RCx assessments to be done every four years for larger or energy intensive facilities (EISA 2007 Section 432), with more detailed investigation called for where viable opportunities are identified by energy management staff. The Assessment and Investigation commissioning phases, as described in Table 1-DESCRIPTION OF PHASES OF RECOMMISSIONING, fulfill the above noted EISA requirement. ASHRAE Guideline 0.2-2015 similarly recognizes a phased approach to the RCx process and allows utilization of in-house and/or contracted support for different types of RCx work.

Sample roles and responsibilities are provided in Table 3. Each project is different and roles and responsibilities should be defined by the project delivery team (PDT) based on capabilities and capacity.

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It is not advisable or cost-effective to contract all six RCx phases together. Instead, use of a hybridized approach is preferred, wherever possible, supplementing in-house skills with contracted services. Consider the following task order groupings:

1. The Planning phase may be contracted separately as a campus, installation or facility level RCx Plan or completed with in-house resources (optional).
2. The Assessment phase may be contracted as a scoping audit to support investigation phase bidding. However, where simple, obvious solutions can be executed by in-house staff or on-call contractors, it is recommended to pursue their implementation immediately without requiring them to wait for the investigation phase.
3. The Investigation phase may be bid using RCx documents developed in-house (e.g., by DPW) or from deliverable from an Assessment phase contract.
4. The Implementation phase may use the most appropriate execution options based on investigation results: you can either use existing O&M resources, in house staff, or you can develop a contract for maintenance and repair or replacement of equipment as needed. In some cases, the installation may have an existing maintenance contract and a simple work order can be developed. In other cases, there may be sufficient work to benefit from an economy of scale that an independent contract for the work should be prepared.
5. The Hand-off phase should always be contracted with implementation work as it will define the deliverables expected to manage the systems.
6. On-going (OCx) is an optional phase and may be performed in-house or through a multi-year service contract.

As a phased process, the RCx process intent is to capture initial information in each preceding phase as input to the succeeding phase. Therefore adjustments and potential contract modifications may occur as successive phases are executed and more detailed information is obtained.

(Consideration is required on contracting acquisition strategies when single vs. multiple contract awards are employed when executing single phase or multi-phase contracts or single phase with contract options.)

RCx Qualifications, Experience, and Certifications

Commissioning providers require a unique combination of engineering, design fundamentals and building operations knowledge including: energy systems design, installation and operation, commissioning planning and process management, hands-on field experience with energy systems performance, interaction, start-up, balancing, testing, troubleshooting, operation and maintenance procedures, and building automation systems (BAS) control knowledge.

Certification, Education and, most importantly, experience are indicators of qualified providers. Commissioning Provider Certification is one indicator of a commissioning provider's proficiency. However, depending on the size and complexity of a project, certification is not a hard and fast

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requirement. More than likely, a project will be by a combination of in-house staff, O&M contractor, and hired consultants. As long as at least one team member from the user (in-house), the O&M contractor or proposed commissioning provider has a certification that should be sufficient on smaller less complex projects. If it is a larger or more complex project, the SOW should contain the specific expectation for certification or experience on similar projects.

Certified or not, education, professional experience, and examples of past work are key indicators of an individuals' commissioning skills and ability and their appropriateness for a particular commissioning project. Attachment 4 has been developed for the contractor to complete and submit with the proposal for use in selecting the best fit for the project.

Certifications are available from industry organizations in two categories, 1) Process for oversight or project management functions typically used for Commissioning authority type of roles and 2) commissioning for the trades or those employees that perform the functional testing and adjusting and balancing. This type of certification is typically tied to a contracting/commissioning firm and the certification provides accompanying standards and template checklists and functional test forms.

The process type of certifications are the:

- a) Certified Building Commissioning Professional (CBCP) from the Association of Energy Engineers (AEE).
- b) Certified Process Management Professional (CPMP) from the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE).
- c) Certified Commissioning Professional (CCP) from the Building Commissioning Association (BCA).
- d) Accredited Commissioning Process Authority Professional (CxAP) and the Accredited Commissioning Process Manager (CxM) from University Of Wisconsin.

Commissioning Firm's qualifications (or trades certification) are provided from:

- a) Certified Commissioning Authority (CxA) or the Certified Commissioning Technician (CxT) from the Associated Air Balance Council Commissioning Group (ACG) Commissioning Guideline.
- b) Building Systems Commissioning Certification (BSC) or the Retro-commissioning
- c) Certification (RCx) from the National Environmental Balancing Bureau (NEBB) Commissioning Standard.
- d) Certified Commissioning Supervisor (CCS) or Certified Commissioning Contractor (CCC) from the Testing, Adjusting and Balancing Bureau (TABB).

The industry certifications have different level of efforts, but all have some experience, education and testing requirements. It is up to the user to decide which certification they desire or are willing to accept. For more specific information on criteria for certification see the California Collaborative Commissioning comparative summary of the certifications:

https://www.cacx.org/resources/provider_cert.html.

RCx Team Roles

Ideally, all RCx work could be performed by in-house government staff familiar with the

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building and with the skillsets and tools to properly measure, change, and monitor system operations. In practice, however, most Army DPWs will not have adequate capacity and may instead focus on phases like Planning and Assessment that most benefit from in-house direction. Refer to Table 3 for SAMPLE Roles and Responsibilities Matrix, edit this table to suite the requirement of the specific project.

The suitability of any Cx provided for any given project varies with specific project requirements, one of which is requisite experience. The Cx provider must complete and submit the RCx Firm Experience Form (Attachment 4) in response to a project’s Request for Proposal (RFP).

Army guidelines, currently in development, along with references from ASHRAE Guideline 0.2-2015 will elaborate on tasks and reporting requirements associated with each phase. The tables below illustrate tasks and submittals expected in each phase of recommissioning. Phase 1 and phase 6 (installation-level RCx planning and on-going commissioning) are not required for effective recommissioning, however, they are considered best management practice and requirements are outlined in tables 1 & 2 below. This document also provide an overview of how to proceed with the optional planning and ongoing commissioning phases.

Technical guidance, and example reports are in development for the assessment, investigation, and implementation/hand-off phases. Template scopes of work have been developed for the General Requirements, Assessments and Investigation phases and are located as Attachment 1, 2 & 3 of this document.

RCx Phases

Recommissioning is performed in phases. While there are six RCx phases described in ASHRAE 0.2 – 2015, the Assessment Phase, the Investigation Phase and the Implementation phase are the main phases for most RCx endeavors.

An overview of guidance on the process for each of the 6 phases is provided below. The Assessment and Investigation phases are provided with template SOW in attachments 2 and 3. Tables 1 & 2 summarize the phase descriptions/tasks and the expected submittals/deliverables for each phase of recommissioning. Edit Table 2 for project specific requirements.



The Planning Phase: This phase can consist of a combination of installation-level planning and facility-specific planning. The goal of installation-level planning is to establish and prioritize a set of candidate buildings for RCx Assessments. The goal of facility-specific planning is to compile and evaluate facility documentation in preparation for an RCx Assessment.

In-house completion of planning phase tasks is preferable, however limited DPW staffing may necessitate external contracted support or focusing on key planning steps only. Table 3 has been prepared as a sample of roles and responsibilities that may be assigned to a recommissioning team. It is up to the user to determine the level of effort for each team member based on funding, capability and capacity.

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A. Installation-Level Planning: The following should be considered as part installation-level planning and **documented as part of an RCx Plan**:

1. Developing a list of RCx candidates by selecting buildings greater than 50 KSF (or greater than 25 KSF if energy intensive) from the installation's top 75% of covered facilities.
2. Prioritizing RCx candidates based on energy intensity, size, BAS capabilities, known comfort/O&M/efficiency issues, or energy costs.
3. Establishing target years for performing RCx assessments of each facility (or representative facility for groups of identical facilities) such that all RCx candidates will be assessed in a 4 year cycle.
4. Determining to what degree RCx assessments (or follow-on investigations) will be done in-house, contracted, or through some other means of government support.
5. Specifying roles, responsibilities, and staffing/competency gaps for tasks such as RCx reporting, BAS operation, O&M coordination, RCx tool utilization, etc.
6. Outlining additional RCx approaches that may include standardization of benchmarking, Energy Conservation Measure (ECM) lists, occupant/operations and maintenance (O&M) surveys, or Measurement and Verification (M&V) processes.

B. Facility-Specific Planning: The following should be considered as part facility-specific planning immediately prior to an RCx assessment:

1. Evaluate utility billing information and perform some form of benchmarking to establish facility Energy Use Intensity (EUI), peer group EUI, and EUI changes over time.
2. Utilize as-built documentation to determine likely energy drivers and possible ECMs to assess.
3. Recognize how specific climate factors may also drive performance in your systems.
4. If available, review interval energy metering data to determine how base loads vary at start-up, during peak periods, at off-hours, and over time to identify any likely ECMs to additionally assess. If desired, strategize on how to improve energy metering and/or building automation infrastructure.

If available, use O&M records or occupant thermal comfort surveys to establish additional RCx assessment criteria and goals.

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Assessment Phase: This phase is an initial walk through of the facilities to be recommissioned.

2. Assessment

To create scope of work documents to award and execute the Assessment Phase, refer to Attachments 1 & 2.

Some of the tasks are:

- review system configuration (see Fig 1), equipment data, and overall facility conditions
- identify obvious indicators of poor performance
- flag items for further investigation
- list maintenance or occupant issues
- create preliminary list of potential RCx opportunities
- create monitoring plan (see Fig 2) and specific functional tests needed to drive investigation phase activities.

For a list of deliverables and expected submittals see Table 1 & 2. Edit Table 2 for project specifics.

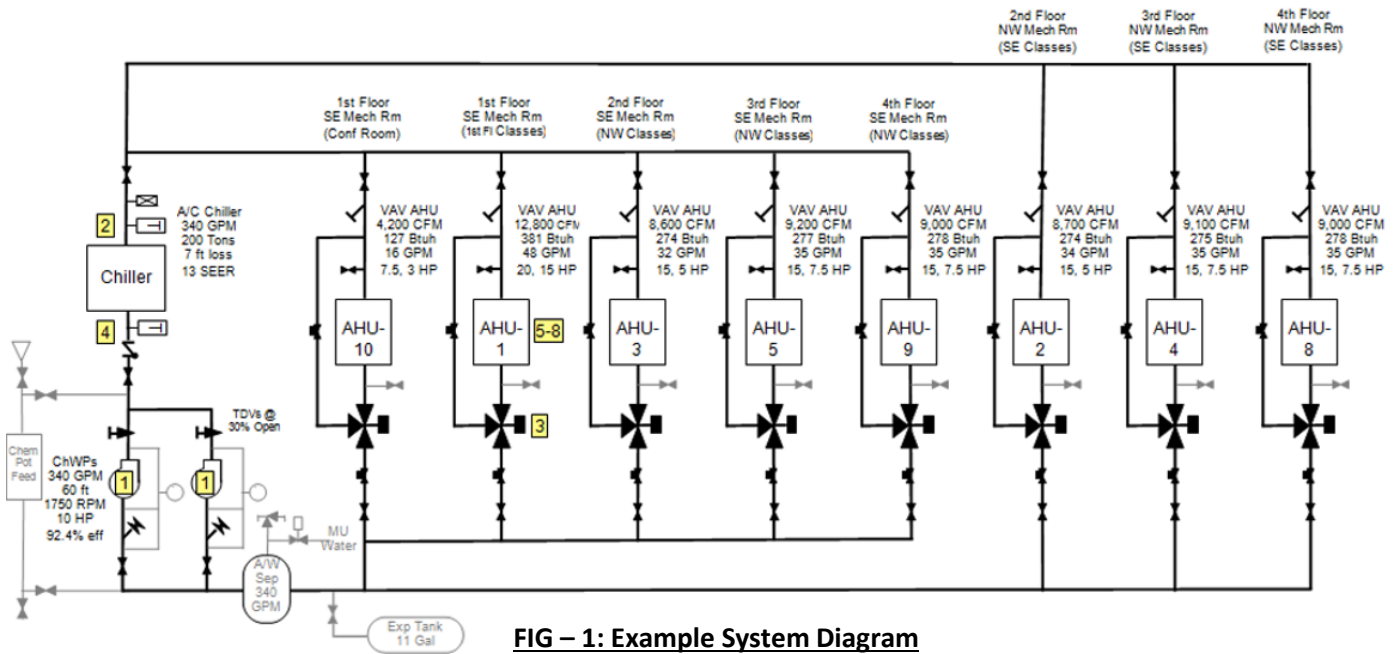


FIG – 1: Example System Diagram

ECM	System	Location	Type	Point Name or Logger ID	Trend Interval	Trend Length	Dates		Notes
							Launch	Read	
8	AHU-5	160 Occ/light	Occ/lt Logger		COV	4 wks			measure auditorium <u>occ</u>
15	AHU-5	MAT filter face 2	Temp Logger		15 sec	1.5 wk			4-channel + temp probe
12	AHU-5	Preheat discharge	Temp Logger		1 min	4 wks			<u>sensor/simult</u> issues?
15	AHU-2	<u>econo</u> temps	BAS	MAT	5 min	4 wks			
7	AHU-5	160A temp SP	BAS	160A temp SP	5 min	4 wks			to check averaging
17	HWS	boiler status	Amp Logger		5 sec	4 dys			4-channel + 20 amp CT
11	AHU-1	AHU start time	BAS	SF-S	COV	4 wks			start vs warm-up
8	AHU-5	160E min OA SP	BAS	160E min OA SP	5 min	4 wks			sensor checks
7	AHU-5	160A zone temp	BAS	160A zone temp	5 min	4 wks			to check averaging

FIG – 2: Example Monitoring Plan

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3. Investigation

Investigation Phase: During this phase, the in-depth testing and analysis will occur based on the preliminary list of potential RCx opportunities identified in the assessment phase and the recommissioning plan.

Some of the tasks are:

- perform detailed trending, functional tests, and engineering calculations.
- reveal operational characteristics
- verify the need for changes
- describe the recommended changes
- quantify the implementation needed and benefits expected.
- Create Scope of Work (SOW) documents to award and execute the Implementation Phase. Refer to Attachments 1 & 3.

Note: where Assessment and Investigation phases are to be contracted together, edit Attachments 1, 2 & 3 for a single contract.

4. Implementation

The Implementation Phase: For implementation, use the most appropriate execution options based on investigation results: you can either use existing O&M contract resources, in house staff, or develop a contract for maintenance and repair or replacement of equipment as needed. In some cases, the work may be limited and a simple work order can be developed.

The scope of the implementation phase may be as simple as repairing a broken damper, to reprogramming a sequence of operation or it might be a bigger project such as a chiller replacement ¹. The contract mechanism would have to be selected for the repair or replacement work after the assessment and investigation phase is completed.

Additionally, recommissioning implementation phase requires a verification process to confirm the completed recommendations meets the current facilities requirements (CFR). For more information on development of the CFR, see ASHRAE Guideline 0.2 paragraph 6.4.

Verification testing should be executed once implementation is complete as required in the updated RCx Plan. Document verification tests and physical inspections as outlined in the RCx Plan. Records shall include all tests and physical inspection data records, test data, observations, and M&V data. Data may be recorded on photographs, forms, or other means appropriate for each recommendation. Verify that the performance of the completed recommendations meets the CFR. Performance testing is used to quantify the benefits obtained from these recommendations. See ASHRAE Guideline 0.2 chapter 8 on implementation for further guidance.

¹ Capital projects were not included in the LBNL RCx payback analysis mentioned earlier.

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5. Hand-Off

Hand-Off Phase: During the Hand-Off phase, training and documentation is important. The user should be provided with a systems manual, TAB reports etc. There is also a benefit to establishing a period of time, similar to an extended warranty, where O&M technicians can reach back to the RCx team. This is to assure that if there are issues with the implementation, the system doesn't revert to the prior condition. Refer to Table 1 for expected deliverables and submittals. An ongoing commissioning plan may be developed in this phase.

6. On-Going Cx

On-Going Commissioning (OCx) Phase: This phase is a mix of technology and operational processes intended to continuously improve building energy consumption and optimize building performance during its entire lifecycle.

By continuously reviewing the selected data, performance patterns will appear. Deviations from the “normal” trends require investigation and action. This can identify out-of-tolerance equipment so it can be repaired or re-tuned to avoid further energy and cost. **Benchmarking** is used to compare the project to industry standards, like Energy Star scores or the Commercial Building Energy Consumption Survey (CBECS) data, or to compare the data to the expected building operations (as designed) as well as to the previous operational data. The data comparison is used to find variances from normal operations and identify maintenance problems in order to identify **proactive preventative maintenance**.

On-going (OCx) Commissioning Processes

Step 1: Benchmarking

Benchmark the building's actual performance and track the building's energy performance.

Step 2: Objectives

Establish a first set of objectives and pick the key performance indicators (KPIs) to monitor. Identify how often you plan to monitor the KPIs.

Step 3: Action

- a. Review detailed information about daily energy consumption.
- b. Track selected performance indicators.
- c. If faults are detected, take local action to improve mechanical system performance.
- d. Begin generating savings.

Step 4: Continuous improvement cycle

Continuous improvement of maintenance activities prevents breakdowns or malfunctions due to excessive wear of equipment. Implementing a robust preventive maintenance process saves energy.

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On-going (OCx) Commissioning Plan Outline

An on-going commissioning plan should be developed to identify: the who, what, where, when and how of facility operations, and the performance metrics to be tracked. This plan can be developed at any time, but it is particularly valuable following the recommissioning (RCx) implementation process. The plan outline should include the following:

1. Introduction: discussion of building systems
2. Understanding the RCx implemented measures
3. Performing O&M persistence activities
4. Tracking Building energy performed over time
 - a) Benchmarking
 - b) Energy use analysis
5. Review training needs
6. Appendices
 - a) Retro/recommissioning implementation summary report
 - b) Building sequence of operations.
 - c) Monitoring Action Plan- what to do if data is out of tolerance.
 - d) Sensor recalibration plan

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Table 1 – RCx Phase Description and Tasks

RCx Phase	Description	Primary Deliverable	Secondary / Optional
<p style="text-align: center;">1 Planning</p> <ul style="list-style-type: none"> • campus-level • best practice but optional 	<ul style="list-style-type: none"> • establish a set of buildings to assess • compile facility information • develop a Current Facilities Requirement (CFR) template and complete a CFR for each building • evaluate utility data • document desired RCx project tactics in an organizational RCx Plan 	RCx Plan	CFRs, utility analysis, comfort surveys, O&M data
<p style="text-align: center;">2. Assessment</p> <ul style="list-style-type: none"> • initial walk-thru • required 	<ul style="list-style-type: none"> • review system configuration, equipment data, and overall facility conditions • identify obvious indicators of poor performance • flag items for further investigation • list maintenance or occupant issues • create preliminary list of potential RCx opportunities • create monitoring plan and specific functional tests needed to drive investigation phase activities. 	Assessment Report, Monitoring Plan	Issues log, prelim ECM table, functional test sheets
<p style="text-align: center;">3. Investigation</p> <ul style="list-style-type: none"> • in-depth testing & analysis • as necessary 	<ul style="list-style-type: none"> • perform detailed trending, functional tests, and engineering calculations • reveal operational characteristics • verify the need for changes • describe the recommended changes • quantify the implementation needed and benefits expected 	Investigation Report (includes final ECM table)	Completed monitor data and functional tests, updated issues log
<p style="text-align: center;">4/5. Implementation/ Hand-off</p> <ul style="list-style-type: none"> • typical construction work with some specific follow-on testing . • as necessary 	<ul style="list-style-type: none"> • perform the actual changes to the building to realize CFR conformity and/or stated RCx benefits • may include BAS control changes, BAS retrofits, equipment replacements or tuning, and occupant outreach tasks • typical construction/service contracts are used, however specific testing or documentation may be added 	PVTs, System Manuals, Training	OCx Plan, TAB report (if used), other typical construction deliverables
<p style="text-align: center;">6 On-going Cx</p> <ul style="list-style-type: none"> • part of BAS service contract or separate data analytics service • optional 	<ul style="list-style-type: none"> • ensure that RCx benefits persist throughout building lifecycle by conducting periodic reviews of CFR changes, critical performance elements, and OCx reporting. • may be preferential to use separate service contracting or existing maintenance teams to perform OCx tasks 	Annual OCx Report	Updated CFR, utilities evaluation, or M&V data

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Table 2 – Submittal List Example

Phase	Part of Project	Submittal	Recipients	Format	Qty
Planning	X	Utilities Evaluation Report and Weather Bin Data	DPW, PM	.xlsx	1
		Occupant Thermal Comfort Survey Data	DPW, PM	.xlsx	1
	X	RCx Planning Workshop Agenda	RCx Team	.docx or .xlsx	1
		CFR Template	DPW, PM	.docx	1
	X	Completed CFR (for each building)	DPW, PM	.docx	1 ea
		RCx Team Roster	RCx Team	.xlsx or .docx	1
		RCx Plan	RCx Team	.docx	1
			DPW	8.5"x11" (color)	2
Assessment		Pre-Assessment Meeting Minutes	RCx Team	.docx or .pdf	1
	X	Equipment Inventory	DPW, PM	.xlsx	1
	X	System Diagrams (for each system)	DPW, PM	.pdf	1 ea
		Preliminary Opportunities List	RCx Team	.xlsx	1
	X	Monitoring Plan	DPW, PM	.xlsx	1
	X	Functional Test Templates (for each test)	DPW, PM	.docx or .pdf	1 ea
	X	Assessment Report	RCx Team	.docx or .pdf	1
			DPW	8.5"x11" (color)	2
Investigation		Issues & Resolution Log	RCx Team	.xlsx	1
		Pre-Investigation Meeting Minutes	RCx Team	.docx or .pdf	1
	X	Investigation Phase Training Agenda	RCx Team	.docx or .xlsx	1
	X	Functional Test Sheets (for each test)	DPW, PM	.docx or .pdf	1 ea
	X	Monitoring Plan Logger Data	DPW	CD	1
		ECM Table	RCx Team	.xlsx	1
	X	Investigation Report	RCx Team	.docx or .pdf	1
			DPW	8.5"x11" (color)	2
	X	M&V Monitoring Plan	DPW, PM	.xlsx	1
		Updated Issues & Resolution Log	RCx Team	.xlsx	1
Implementation		Environmental Protection Plan	DPW, PM	.docx or .pdf	1
		Safety and Accident Prevention Plan	DPW, PM	.docx or .pdf	1
		Security Training Certifications	DPW, PM	.docx or .pdf	1
		Quality Control Plan	DPW, PM	.docx or .pdf	1
		Equipment Submittals	DPW, PM	.docx or .pdf	1
		On-Site Progress Reports (for each week)	RCx Team	.docx or .pdf	1 ea
		Updated Issues & Resolution Log (as nec)	RCx Team	.xlsx	1 ea
		Equipment Start-Up Sheets (for each piece)	DPW, PM	.docx or .pdf	1 ea
	X	Preliminary TAB Report	DPW, PM	.docx or .pdf	1
		Final TAB Report	DPW, PM	.docx or .pdf	1
			DPW	8.5"x11" (color)	2
		PVT Sheets (for each system)	DPW, PM	.docx or .pdf	1 ea
		Rebate Application Copies (for each rebate)	DPW, PM	.docx or .pdf	1 ea
	Hand-Off		Endurance Test Data	DPW, PM	.xlsx
		FG Sheets (for each controller/system)	DPW	Laminated 11"x17"	1 ea
		Occupant Signage Sheets	DPW	Color printed labels	All
		Occupant Thermal Comfort Survey Data	DPW, PM	.xlsx	1
X		Hand-Off Phase Training Agenda	RCx Team	.docx or .xlsx	1
		Systems Manual (for each building)	DPW, PM	CD	2
			DPW	3-ring binder	1 ea
X		OCx Plan	RCx Team	.docx or .pdf	1
		Updated Issues & Resolution Log	RCx Team	.xlsx	1
X		Seasonal Testing Data and Report	DPW, PM	.xlsx and .docx	1
OCx	X	Utilities Evaluation Data	DPW, PM	.xlsx	1
		CFR and OCx Plan Meeting Minutes	RCx Team	.docx or .pdf	1
		M&V and Endurance Test Data	DPW, PM	.xlsx	1
		Occupant Thermal Comfort Survey Data	DPW, PM	.xlsx	1
	X	Energy Audit ECM Table	DPW, PM	.xlsx	1
	X	Annual OCx Report	RCx Team	.docx or .pdf	1
			DPW	8.5"x11" (color)	2
	Updated Issues & Resolution Log	RCx Team	.xlsx	1	

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Table 3 SAMPLE DPW Personnel Roles during Recommissioning

Role	Planning	Assessment	Investigation	Implementation	Hand Off	On-going Cx	Level of Effort:	
DPW Energy Manager	L/S	S	C	C	P	L	L	Lead
DPW BAS Operator		F			P		S	Support
DPW Engineering and O&M Chiefs	S			S	P	L	F	Facilitate
Facility Manager	S	S	S	S	P		C	Consult
IT Technician		C				C	P	Participate
Installation Safety Manager and Security Officer				C			O	Oversee

DPW Contractor Roles during Recommissioning

Role	Planning	Assessment	Investigation	Implementation	Hand Off	On-going Cx	Level of Effort:	
O&M Technician/Electrician	C	C	C	L/C	P		L	Lead
BAS Programmer		S	S			S	S	Support
Energy Consultant or RCx provider	L	L	O	O	O		F	Facilitate
Equipment Vendors			S	S	S		C	Consult
TAB Contractor		L*when req'd		S*when req'd			P	Participate
Mechanical/Electrical Contractor (if contracted)			L	L	L		O	Oversee

Other GOVT SUPPORT can fill in for DPW or contractor (Optional)

Role	Planning	Assessment	Investigation	Implementation	Hand Off	On going Cx	Level of Effort:	
USACE Commissioning Center of Expertise in Sustainability	L	L	S	S	S	L/S	L	Lead
USACE ERDC-CERL	L	L	S			L/S	S	Support
USACE -Huntsville			L/S/C	L/S/C			F	Facilitate
IMCOM REMs	L	L	L/S/O	F/S	O	L	C	Consult
PNNL	L	L	S	S		L	P	Participate
							O	Oversee

[TEMPLATE]
Statement of Work (SOW)
RCx General Contract Requirements
[Insert - Installation Name and location and date]

.....
Editor's Note: edit paragraph to include phases of the project required.

PART 1 GENERAL

1.1 PHASES

Retro/Recommissioning will be done in [3] [] phases:

- 1.1.1 [Planning phase]
- 1.1.2 [Assessment]
- 1.1.3 [Investigation]
- 1.1.4 [Implementation]
- 1.1.5 Hand-off phase (close out and testing, documentation submittals)]
- 1.1.6 [On-going Cx]

Editor's Note: Refer to Table 1 found in Guidance and Instructions to see the description of the phases and the anticipated tasks performed in each. Add requirements as necessary to each of the below phases.

1.2 PROJECT DESCRIPTION

- 1.2.1 [Insert description of project and its facilities]
- 1.2.2 The overall intent of RCx is to optimize facility system performance and solve O&M or occupancy comfort issues. General requirements for this RCx project by phase include:
 - 1.2.2.1 RCx Planning Phase: [Benchmark facilities, prioritize RCx candidates, and perform initial utility data analysis. Insert any available RCx Planning documentation.]
 - 1.2.2.2 RCx Assessment Phase: [Identify equipment in use, system configurations, and overall facility conditions. Develop system diagrams, monitoring plan, functional test list, and preliminary ECM table. Refer to Attachment 2.]
 - 1.2.2.3 RCx Investigation Phase: [Execute monitoring plan and functional testing, perform data analysis and energy calculations. Refer to Attachment 3.]
 - 1.2.2.4 RCx Implementation Phase: [Implement repairs or improvements as indicated or using criteria given.]
 - 1.2.2.5 RCx Hand-off Phase: Wherever RCx Implementation occurs, RCx Hand-off is be required with given documentation, testing, and training requirements.
 - 1.2.2.6 RCx On-going Cx Phase: [Insert information for On-going Cx Phase include periodic or continuous performance checks and data analytics functions required.]

1.3 RCx TEAM

1.3.1 Qualifications

Editors note: Both certification and experience are important indicators or qualified providers. However, depending on the size and complexity of a project, certification are not a hard and fast requirement. In any case, there should be someone on the team with some sort of certification to perform oversight. More than likely, a project will be by a combination of in-house staff, O&M contractor and hired consultants.

Commissioning providers require a unique combination of engineering, design fundamentals and building operations knowledge including: energy systems design, installation and operation, commissioning planning and process management, hands-on field experience with energy systems performance, interaction, start-up, balancing, testing, troubleshooting, operation, and maintenance procedures and energy systems automation control knowledge.

Commissioning Provider Certification is one indicator of a commissioning provider's proficiency. However, certified or not, education, professional experience, and examples of past work are key indicators of an individuals' commissioning skills and ability and their appropriateness for a particular commissioning project. Submit Attachment 4 RCx Firm Experience Form with the proposal.

1.3.2 RCx Team Roles and Responsibilities

Editor's Note: Keep RCx team members to the minimum needed to support the Assessment Phase. Both certification and experience are important factor in selecting RCx team members. The contractor shall complete an RCx Experience Evaluation Form and submit with bid.

Contractor shall provide all RCx team members needed to perform the scope requirements and shall at a minimum include:

1.3.2.1 Contractor's RCx Specialist (RCxC)

The RCxC shall be a Certified Commissioning Authority (CxA) of the Commissioning Firm. The RCxC shall be responsible for the following:

- 1.3.2.1.1 Coordination and execution of all RCx activities including development of all documentation.
- 1.3.2.1.2 Integration of all RCx activities into project schedule.
- 1.3.2.1.3 Updating the RCx Plan on a weekly basis.
- 1.3.2.1.4 Schedule and preside over RCx events, prepare minutes, and ensure execution of agenda items.
- 1.3.2.1.5 Witnessing of all RCx activities and verification of completion in accordance with RCx Plan.
- 1.3.2.1.6 Supervision of contractor members of RCx Team.

- 1.3.2.1.7 Ensuring documentation is complete, formatted properly, and distributed in accordance with this SOW.
- 1.3.2.1.8 Developing O&M Training materials and Training Plan.

 Editor's Note: Based on the results of the Assessment Phase for where complex design or system changes are expected, consider requiring a professional engineer as part of the RCx team.

1.3.2.2 [Registered Professional Engineer (PE)]

The Commissioning Firm shall provide a PE for the tasks defined in this section. The PE must be experienced in the design of facilities of similar scope and/or complexity and experienced in retro commissioning efforts. The PE may another engineer employed by the Commissioning firm, or a 1st tier subcontractor to the commissioning firm. Duties of the PE are as follows:

- 1.3.2.2.1 Responsible for engineering enhancements to SOOs.
- 1.3.2.2.2 Determining new flow rates for air and hydronic water.
- 1.3.2.2.3 Reviewing proposed control system changes.
- 1.3.2.2.4 Support RCx functions and review of final report
- 1.3.2.2.5 Assist RCxC in developing O&M Training materials.]

 Editor's Note: The government team may insert their local requirements regarding government participation and notification.

1.3.2.3 Government RCx Participation

The Contractor shall include government personnel as RCx team members and coordinate submittals and tasks per the submittal register.
 [Insert additional government requirements]

1.4 Submittals

 Editor's Note: edit Submittal Summary Table 2 found in the RCx guidance and instructions for requirements based on phases included and insert the table into this template.

See the Table 2 for submittal register summary. Contractor must submit and maintain the submittal register for the life of the project.

1.5 GOVERNMENT SUBMITTAL ROUTING AND POINTS OF CONTACT:

 Editor's Note: Edit contact information with names and phone numbers. Add additional personnel as required.

- 1.5.1 Project Manager (PM): [insert information with names and phone numbers]
- 1.5.2 Contracting Officer's Representative (COR): [insert information with names and phone numbers]
- 1.5.3 Using Agency's Representative (UA): [insert information with names and phone numbers]
- 1.5.4 Department of Public Works (DPW) Representative (DPW): [insert information with names and phone numbers]

1.6 SCHEDULE

Editor's Note: edit schedule for requirements based on phases included.

The Contractor shall perform the work in accordance with the timelines shown below. Following the completion of each Activity/Event, the Contractor shall submit findings to the Government for review and acceptance/rejection. The below list is not all-inclusive, refer to RCx Plan for complete Activity/Event list. Review conferences shall be held as shown below, with Contractor attendance required unless otherwise directed in writing from the Contracting Officer. All technical comments shall be incorporated into the submittal data prior to submission to the Government for review and approval/rejection prior to commencement of the next contract effort. Dates, times and locations of the review conferences shall be established by the Government.

Submittal/Event	Date (Calendar Days)
[Contract Award	N
Kickoff Meeting Conference	N + [# of days]
Submit Draft RCx Plan	N + [# of days]
Submit Final RCx Plan	N + [# of days]
Site Assessment	N + [# of days]
Submit Draft Site Assessment Report	N + [# of days]
Submit Final Site Assessment Report	N + [# of days]
Site Investigation	N + [# of days]
Submit Draft Site Investigation Report	N + [# of days]
Submit Final Site Investigation Report	N + [# of days]
RCx Implementation	N + [# of days]
Submit Draft OCx Plan	N + [# of days]
Submit Final OCx Plan	N + [# of days]

1.7 GOVERNMENT - FURNISHED INFORMATION

Editor's Note: edit supplemental information list and include other information as required. For more detailed list refer to ASHRAE 0.2-2015 Annex K.

- 1.7.1 Facility As-Builts
- 1.7.2 Utility Data (Utility bills (water and sewer, electric, gas, steam, etc.) or energy use records for the last two (2) years)
- 1.7.3 Thermal Comfort and/or Maintenance Logs (if available)
- 1.7.4 Current Facilities Requirements (CFR) (if completed)
- 1.7.5 Installation RCx Plan (if completed)
- 1.7.6 Construction Submittal Register at turn-over (if available)

1.8 SUBMITTAL LIST

Editor's Note: edit the submittal list to indicate which submittals are required for this project and include recipient, format, and quantity information. Add any additional deliverables desired per phase as necessary.

Phase	Part of Project	Submittal	Recipient(s)	Format	Qty
Planning	[X]	Utilities Evaluation Report and Weather Bin Data	[DPW, PM]	[.xlsx]	[#]
	[X]	Occupant Thermal Comfort Survey Data	[DPW, PM]	[xlsx]	[#]
	[X]	RCx Planning Workshop Agenda	[RCx Team]	[.docx] [.xlsx]	[#]
	[X]	CFR Template	[DPW, PM]	[.docx]	[#]
	[X]	Completed CFR (for each building)	[DPW, PM]	[.docx]	[# ea]
	[X]	RCx Team Roster	[RCx Team]	[.docx] [.xlsx]	[#]
	[X]	RCx Plan	[RCx Team]	[.docx]	[#]
Assessment	[X]	Pre-Assessment Meeting Minutes	[DPW]	[8.5"x11" (color)]	[#]
	[X]	Equipment Inventory	[RCx Team]	[.docx] [.pdf]	[#]
	[X]	System Diagrams (for each system)	[DPW, PM]	[xlsx]	[#]
	[X]	Preliminary Opportunities List	[DPW, PM]	[.pdf]	[# ea]
	[X]	Monitoring Plan	[RCx Team]	[xlsx]	[#]
	[X]	Functional Test Templates (for each test)	[DPW, PM]	[xlsx]	[#]
	[X]	Assessment Report	[DPW, PM]	[.docx] [.pdf]	[# ea]
Investigation	[X]	Assessment Report	[RCx Team]	[.docx] [.pdf]	[#]
	[X]	Issues & Resolution Log	[DPW]	[8.5"x11" (color)]	[#]
	[X]	Pre-Investigation Meeting Minutes	[RCx Team]	[xlsx]	[#]
	[X]	Investigation Phase Training Agenda	[RCx Team]	[.docx] [.xlsx]	[#]
	[X]	Functional Test Sheets (for each test)	[DPW, PM]	[.docx] [.pdf]	[# ea]
	[X]	Monitoring Plan Logger Data	[DPW]	[CD]	[#]
	[X]	ECM Table	[RCx Team]	[xlsx]	[#]
Implementation	[X]	Investigation Report	[RCx Team]	[.docx or .pdf]	[#]
	[X]	Investigation Report	[DPW]	[8.5"x11" (color)]	[#]
	[X]	M&V Monitoring Plan	[DPW, PM]	[xlsx]	[#]
	[X]	Updated Issues & Resolution Log	[RCx Team]	[xlsx]	[#]
	[X]	Environmental Protection Plan	[DPW, PM]	[.docx] [.pdf]	[#]
	[X]	Safety and Accident Prevention Plan	[DPW, PM]	[.docx] [.pdf]	[#]
	[X]	Security Training Certifications	[DPW, PM]	[.docx] [.pdf]	[#]
	[X]	Quality Control Plan	[DPW, PM]	[.docx] [.pdf]	[#]
	[X]	Equipment Submittals	[DPW, PM]	[.docx] [.pdf]	[#]
	[X]	On-Site Progress Reports (for each week)	[RCx Team]	[.docx] [.pdf]	[# ea]
	[X]	Updated Issues & Resolution Log (as nec)	[RCx Team]	[xlsx]	[# ea]
	[X]	Equipment Start-Up Sheets (for each piece)	[DPW, PM]	[.docx] [.pdf]	[# ea]
	[X]	Preliminary TAB Report	[DPW, PM]	[.docx] [.pdf]	[#]
	[X]	Final TAB Report	[DPW, PM]	[.docx] [.pdf]	[#]
Hand-Off	[X]	Final TAB Report	[DPW]	[8.5"x11" (color)]	[#]
	[X]	PVT Sheets (for each system)	[DPW, PM]	[.docx] [.pdf]	[# ea]
	[X]	Rebate Application Copies (for each rebate)	[DPW, PM]	[.docx] [.pdf]	[# ea]
	[X]	Endurance Test Data	[DPW, PM]	[xlsx]	[#]
	[X]	FG Sheets (for each controller/system)	[DPW]	[Laminated]	[# ea]
	[X]	Occupant Signage Sheets	[DPW]	[Color printed]	All
	[X]	Occupant Thermal Comfort Survey Data	[DPW, PM]	[xlsx]	[#]
	[X]	Hand-Off Phase Training Agenda	[RCx Team]	[.docx] [.xlsx]	[#]
	[X]	Systems Manual (for each building)	[DPW, PM]	[CD]	[#]
	[X]	Systems Manual (for each building)	[DPW]	[3-ring binder]	[# ea]
	[X]	OCx Plan	[RCx Team]	[.docx] [.pdf]	[#]
	[X]	Updated Issues & Resolution Log	[RCx Team]	[xlsx]	[#]
	[X]	Seasonal Testing Data and Report	[DPW, PM]	[.xlsx and .docx]	[#]
	OCx	[X]	Utilities Evaluation Data	[DPW, PM]	[xlsx]
[X]		CFR and OCx Plan Meeting Minutes	[RCx Team]	[.docx] [.pdf]	[#]
[X]		M&V and Endurance Test Data	[DPW, PM]	[xlsx]	[#]
[X]		Occupant Thermal Comfort Survey Data	[DPW, PM]	[xlsx]	[#]
[X]		Energy Audit ECM Table	[DPW, PM]	[xlsx]	[#]
[X]		Annual OCx Report	[RCx Team]	[.docx] [.pdf]	[#]
[X]		Annual OCx Report	[DPW]	[8.5"x11" (color)]	[#]
[X]	Updated Issues & Resolution Log	[RCx Team]	[xlsx]	[#]	

1.9 ROLES & RESPONSIBILITIES

Editor’s Note: indicate specific roles and responsibilities for different government and non-government personnel. Where known, indicate names and contact info for each role.

For each of the below roles, responsibility during the project is indicated with L (lead), S (support), F (facilitate), C (consult), P (participate), O (oversee), some combination of the above, or blank (no responsibility). These notations are provided as a summary of roles and responsibilities for the project for clarification purposes. Where a conflict with specific tasks exists, specific task language will be the requirement.

DPW Personnel Roles during Recommissioning

Role/Contact	Plan-ning	Assess-ment	Invest-igation	Implem-entation	Hand Off	Ongoing Cx
DPW Energy Manager	[L/S]	[S]	[C]	[C]	[P]	[L]
DPW BAS Operator	[]	[F]	[]	[]	[P]	[]
DPW Engineering and O&M Chiefs	[S]	[]	[]	[S]	[P]	[L]
Facility Manager	[S]	[S]	[S]	[S]	[P]	[]
IT Technician	[]	[C]	[]	[]	[]	[C]
Installation Safety Manager and Security Officer	[]	[]	[]	[C]	[]	[]

2.

DPW Contractor Roles during Recommissioning

Role/Contact	Plan-ning	Assess-ment	Invest-igation	Implem-entation	Hand Off	Ongoing Cx
O&M Technician/Electrician	[C]	[C]	[C]	[L/C]	[P]	[]
BAS Programmer	[]	[S]	[S]	[]	[]	[S]
Energy Consultant or RCx provider	[L]	[L]	[O]	[O]	[O]	[]
Equipment Vendors	[]	[]	[S]	[S]	[S]	[]
TAB Contractor	[]	[L*when req’d]	[]	[S*when req’d]	[]	[]
Mechanical/Electrical Contractor (if contracted)	[]	[]	[L]	[L]	[L]	[]

4.

Other Government Support

Role/Contact	Plan-ning	Assess-ment	Invest-igation	Implem-entation	Hand Off	Ongoing Cx
USACE Commissioning Center of Expertise in Sustainability	[L]	[L]	[S]	[S]	[S]	[L/S]
USACE ERDC-CERL	[L]	[L]	[S]	[]	[]	[L/S]
USACE -Huntsville	[]	[]	[L/S/C]	[L/S/C]	[]	[]
IMCOM REMs	[L]	[L]	[L/S/O]	[F/S]	[O]	[L]

4.1 ATTACHMENTS

Editor's Note: edit relevant attachments as required by the RCx project.
Include any information already gathered include as-builts, equipment data,
energy data, or previously developed RCx documents.

- 4.1.1 [Attachment 2 Assessment Phase SOW]
- 4.1.2 [Attachment 3 Investigation Phase SOW]
- 4.1.3 [Attachment 4 Implementation Phase SOW]
- 4.1.4 [facility as-builts]
- 4.1.5 [equipment inventory data, e.g., BUILDER attributes]
- 4.1.6 [energy data available]
- 4.1.7 [Any RCx deliverables already developed from a previous phase,
including RCx Plan, Monitoring Plan, Preliminary ECM List, etc]

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

[TEMPLATE]
Statement of Work (SOW)
RCx Assessment Phase

[Insert - Installation Name and location and date]

Editor's Note: edit to include requisite phase information. Refer to RCx
Guidance Instructions or ASHRAE Guideline 0.2 for additional guidance.

PART 1 GENERAL

1.1 PHASES

[Insert appropriate information determined from Planning Phase]

The intent of RCx Assessment Phase is to determine:

- 1.1.1 system configuration, equipment data, and overall facility conditions
- 1.1.2 obvious indicators of poor performance
- 1.1.3 items to flag for further investigation
- 1.1.4 maintenance or occupant issues
- 1.1.5 preliminary list of potential RCx opportunities
- 1.1.6 monitoring plan and specific functional tests needed to drive investigation phase activities.
- 1.1.7 Original design intent and basis of design for existing equipment (As-Builts)
- 1.1.8 Current design intent
- 1.1.9 RCx Team [insert team members]

[Include reference to other phase description as applicable for contract]

1.2 PROJECT DESCRIPTION

1.2.1 Building list (either as table with facility info or simple list):

Editor's Note: Define the hours of normal building operation and the hours
during which an assessment can be conducted.

1.2.2 Hours of normal occupied period building operation: [insert hours of operation]. The work hours to conduct the assessment tasks are [during normal the occupied period] [insert other time period]

1.2.3 Systems to be assessed: All energy-using building systems shall be part of the scope of this assessment. For equipment or systems to be exempted from assessment, contractor shall use utilities evaluation and/or preliminary energy calculation to justify to the RCx team during the pre-assessment meeting that there is low potential for energy

savings, comfort improvement, or O&M improvement and no expected opportunity for no-cost/low-cost measures. Systems to be assessed include but are not limited to:

Editor's Note: list is not all inclusive for every project, edit paragraph to identify the systems for assessment of the project. All buildings particularly older buildings with return air plenums may be good candidates for some combination of air barrier tests, thermography, physical examination, etc. as part of the Assessment. One potential goal would be to assess all energy-using systems in order to narrow the scope to systems which suspected opportunities for the RCx Investigation or Implementation Phase.

- 1.2.3.1 Air handling systems (AHUs, RTUs, MAUs, DOAUs, furnaces, ventilators, economizers, terminal boxes, and related equipment).
- 1.2.3.2 Steam and hot water hydronic systems (boilers, hot water primary and secondary pumps, condensate pumps, steam traps, heating coils, converters, control and balance valves, and related equipment)
- 1.2.3.3 Air and water-cooled hydronic systems (chillers, chilled water primary and secondary pumps, condenser pumps, cooling towers and fans, cooling coils, storage tanks, control and balance valves, and related equipment)
- 1.2.3.4 BAS systems (centralized EMCS or UMCS, local front-end systems, zone/plant/supervisory controllers, electric control modules, pneumatic control devices)
- 1.2.3.5 Local heating and cooling systems (DX split A/C units, unitary heaters, PTAC units, CRAC units, and similar equipment)
- 1.2.3.6 Domestic hot water systems (hot water heaters, booster or on-demand heaters, storage tanks, mixing valves, recirculation pumps, end-use fixtures, and related equipment)
- 1.2.3.7 Lighting Systems (all interior and exterior lighting systems and lighting control systems)
- 1.2.3.8 Other Equipment (kitchen equipment or appliances, medical equipment, industrial or manufacturing equipment, process refrigeration or conditioners, office electronics, and similar equipment)
- 1.2.3.9 Other automation systems
- 1.2.3.10 Solar hot water systems
- 1.2.3.11 Renewable Energy Generation Systems (e.g. Solar PV, Wind, etc.)
- 1.2.3.12 Fire/life safety systems

Editor's Note: Test, Adjust, and Balance (TAB) requirements should be tailored to the specific project. TAB should be limited to known problem areas based on occupant complaints, thermal performance, and experience. A complete building rebalance should not be required, but selective air traverses or total pump flow readings may be appropriate. The extent of TAB should be based on building age, completeness of existing TAB data.

1.2.4 Assessment Strategies: Contractor shall employ a strategic method of assessment that attempts to identify indicators of poor performance and opportunities for improved building system optimization. Contractor shall utilize assessment strategies outlined in the RCx Plan.

Editor's Note: include in the SOW if RCx Plan has been completed or directly required by the Current Facility Requirement (CFR) include in the SOW if CFR has been completed. Add or edit assessment strategies as necessary to cover desired approaches to the RCx process.

Where no RCx Plan has been developed, assessment strategies shall include but are not limited to identifying signs for the following possible opportunities:

- 1.2.4.1 Trimming hours of operation for HVAC, lighting, and electrical systems with tighter plant or zone scheduling, start-up or shut-down optimization, and holiday or training day schedule exemptions
- 1.2.4.2 Adjusting zone lighting, temperature, humidity, or ventilation levels to achieve compliance with the most stringent Current Facility Requirements (CFR) or applicable ASHRAE and IESNA standards
- 1.2.4.3 On-demand zone HVAC strategies in partially occupied spaces to include demand-controlled ventilation, outside air resets, and standby zone temperature set points based on known schedule, CO2, motion, or thermostat override proxies as allowed by code
- 1.2.4.4 On-demand plant HVAC strategies for low or no load conditions to include time- delayed demand-based hot or chilled water pump enables, set point deviation- based boiler or chiller enables with anti-cycling, and time or temp-based DHW recirculation pump enables as allowed by equipment manufacturer
- 1.2.4.5 Automatic demand-based reset of plant set points: duct static, coil discharge temperature, mixed air temperature, and hydronic loop and supply temperature, storage tank temperature, and economizer outside air flow
- 1.2.4.6 Mitigation of over-sized HVAC equipment through restaging heating or cooling equipment, thermal flywheel cycles, pump impeller trims or VFDs, or rebalancing/resheaving of fan systems
- 1.2.4.7 Load reduction in hydronic systems through removal of unnecessary pressure drops and decommission of unneeded, parasitic, or partially used electrical equipment that can be replaced with more efficient, on-demand, or better sized units
- 1.2.4.8 Conversion of constant volume air-side or hydronic systems to variable flow type through damper, valve, VFD, and/or BAS programming changes or improvement to existing variable flow sequences such as return fan tracking, relief fan space pressure control, VFD PI tuning, reprogramming of VFD output for CFM corrections, and staging of related interdependent resets
- 1.2.4.9 Eliminating or minimizing instances of simultaneous heating and cooling in air handlers, within zones, and for adjacent zones

- 1.2.4.10 BAS repairs that may address communication failures, interoperability issues, outdated software problems, logic errors or mistakes, sensor faults, output hunting, PID loop tuning, or point-to-point checks needed
- 1.2.4.11 Maximizing use of efficient equipment or stages including optimization of condensing mode in new or existing boiler systems, reduction of the need for chiller hot gas bypass, and reliance on standalone HVAC or lighting in critical zone that would otherwise increase centralized system runtimes or set points
- 1.2.4.12 Economizer improvements to address stuck or leaky dampers, inappropriate changeover or high-limit set points, stratified air, poor outside or mixed air sensor location, excess minimum or total outside air flow, control type changes (e.g., fixed dry, differential dry, or wet bulb control), different mixed vs preheat discharge vs supply air temperature set point, mixed air temperature and economizer flow reset potential, removal of unnecessary preheat coils, damper hunting, unoccupied or warm-mode damper closures
- 1.2.4.13 Maintenance program improvements addressing issues such as air filter selection and replacement optimization, hydronic chemical treatment procedures, cooling tower and boiler blowdown reductions, equipment cleaning and tuning schedules, how system malfunctions or occupant complaints are handled, misuse of hand-off-auto switches or BAS overrides, or gaps in training required for proper system operation and maintenance
- 1.2.4.14 Human behavior issues such as inadequate signage or instruction, occupant requirements for control of energy systems, awareness of thermostat features, procedures for end-of-day system shutdowns (HVAC, lights, equipment), conflicts with night cleaning crews, procedures for reporting maintenance issues or occupant complaints, and incentivizing energy conservation.
- 1.2.4.15 Bundling of ECM's are allowed to achieve Sustainable Performance Targets (e.g. deep energy retro-fits 40% savings).

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 MEETINGS, REPORTS, and DELIVERABLES

- 3.1.1 Contractor shall setup and host a preparatory meeting no less than 5 business days prior to the start of the scheduled assessment. The agenda of this pre-assessment meeting shall be to determine which RCx members are required to support the assessment, which outstanding documents need to be provided by RCx team members, and what the access needs will be during the assessment. Contractor shall also review assessment strategies and deliverables during the meeting. Contractor shall send meeting minutes with imbedded RCx team roster to the RCx team.
- 3.1.2 Equipment Inventories: Contractor shall provide completed digital spreadsheets (hand-written not acceptable) of equipment inventories. This includes but is not limited to equipment nameplate makes, models,

serial numbers, capacities, efficiencies, flows, and manufactured year as well as quantity, location, zone served, and condition comments. All plant and zone HVAC, lighting, appliances, and process equipment shall be addressed unless otherwise stated. Contractor may reuse existing inventories or as-built documentation may so long as system data is field verified by contractor and all above data is represented (assume none available unless provided in attachments). Field photographs are required for Assessment Report opportunity descriptions but not for each piece of equipment inventoried.

- 3.1.3 System Diagrams: Contractor shall provide separate computer-generated field verified system diagrams (scanned field notes not acceptable) for each distinct air-side (AHU and distribution) and water-side (chilled, hot and domestic water) HVAC system. The diagrams shall be schematic representations of all plant, distribution, zone, and return components with related auxiliary elements shown (tees, hydraulic decoupling and bypasses, unusual fittings, control/isolation/balance/mixing dampers and valves, sensor locations, expansion and air-water separator tanks, buffer/storage systems, chemical feed systems, envelope penetrations).
- 3.1.4 Issues and Resolution Log: Contractor shall develop an Issues and Resolution Log during the assessment that represents in tabular form the following information in order of most to least recent: operational issue identified, date identified, action required to resolve, RCx team lead on action, suspense date for action, and date resolved.
- 3.1.5 Preliminary Opportunities List: Contractor shall develop a spreadsheet table of preliminary findings that represent potential opportunities inclusive of utility incentives. This table shall be numbered and shall include a priority label (e.g., "low", "medium", or "high") brief description of the opportunity, location information (building, piece of equipment, zone, etc.), preliminary savings and cost savings estimates, demand savings estimates, water savings estimates, O&M saving estimates, preliminary implementation costs, simple payback period expected, whether recommended, and next steps required. Do not display any total, subtotal, or summary text in the spreadsheet.
- 3.1.6 Monitoring Plan: Contractor shall develop a Monitoring Plan spreadsheet that details the trending requirements to support performance testing and data collection for recommended opportunity regardless of whether the investigation phase is not part of the contract. Performance trending may be performed with portable data loggers or BAS, however if BAS data is used contractor shall perform field verify acceptable location, condition, and accuracy of input sensors. Each spreadsheet row in the Monitoring Plan shall indicate the system name, BAS name or data logger type, trend location, sampling time, trend length, and instructive notes for the trends needed. Contractor shall develop a Monitoring Plan unique to the RCx effort)
- 3.1.7 Functional Test Templates: Contractor shall develop or compile Functional Test sheets needed during the Investigation phase to capture system performance or response characteristics as part of validating or quantifying opportunity savings potential. Contractor shall provide these templates for every functional test required in the investigation phase for support of recommended opportunities whether the investigation phase is part of the contract or not. Functional Tests templates shall include the following sections: test purpose, tester info, equipment or references needed, acceptance criteria, precautions, pre-functional checks (include maintenance and facility manager preapproval of tests

requiring forced operation of equipment), test procedure steps, return to normal steps, and dated sign off. Functional tests actions must describe specific sequences that capture data needed to evaluate or quantify system performance. Stock forms from public or proprietary functional test databases may only be used if the above requirements are met.

3.1.8 Assessment Report: Contractor shall develop an Assessment Report that compiles and details the assessment process and above documentation. Sections and requirements for the report include:

3.1.8.1 Executive Summary Narrative: provide overall description on the potential for energy savings and benefits expected from investigation and implementation of opportunities found. Provide total facility reduction percentages for each utility type. Explain main energy drivers and the need for further investigation prior to implementation.

Editor's Note: Indicate Sustainable Performance Targets (e.g. deep energy retro-fits 40% savings) and whether or not bundling of ECM's are allowed.

3.1.8.2 Executive Summary Table: display Preliminary Opportunities List in a single table order from high to low priority with total savings, costs, and payback in the bottom row. Opportunities that were identified but not recommended may be removed, however contractor shall retain the opportunity number system from the original spreadsheet. Add table description for methodology used to recommend or not recommend opportunities found. All opportunities deemed economically viable or operationally critical per the RCx Plan must be listed as recommended. Additional opportunities may be listed so long as the overall group of opportunities remain economically viable.

3.1.8.3 CFR Summary: display or summarize each CFR section. If summarized, display any critical CFR information that was utilized in during the assessment phase and provide the entire CFR as a report attachment. If CFR document has not been provided by the government, summarize facility space functions observed or reported using quantitative descriptions (e.g., hours of operation, SF of different facility functions, estimated occupancies, zone temp set points, etc.)

3.1.8.4 Utilities Evaluation Summary: display charts, performance benchmarking results, and energy driver speculations from the utilities evaluation summary. Contractor may reuse data from the planning phase Utilities Evaluation Report If available. If utility rates being used for calculations are other than those provided in the CFR, state their source and reason used.

3.1.8.5 Pre-Assessment Meeting Summary: list final RCx team members and provide a brief explanation of meeting discussion and strategies reviewed and employed for the assessment.

3.1.8.6 Assessment Activities Summary: provide a description of assessment activities. For each facility energy system that as recommended opportunities, provide a description of the system type, configuration, and condition as well as any finalized system diagrams.

3.1.8.7 Individual Opportunity Descriptions: present separate descriptions that detail how each opportunity was identified, assumptions made in each calculation, methodology or equations used, and degree of uncertainty for estimates. Each description shall include color

photographs that help explain the nature of the opportunity. For equations used, describe the value and source for each variable. For cost estimates, describe sources uses and implementation assumptions. Discuss general next steps for each opportunity.

3.1.8.8 Investigation Phase Summary: outline the steps recommended for the investigation phase. Reference the Monitoring Plan developed and Functional Test templates compiled. Indicate time estimates for the investigation phase as well as any challenges or additional opportunities expected.

3.1.8.9 Systems Manual Outline: list the documents already assembled and those needed to develop a complete Systems Manual including CFR, operational sequences and set points, equipment inventories and cut sheets, performance curves, warranties, O&M maintenance schedules, training material, Issues and Resolutions Log, and RCx close-out documents.

3.1.8.10 Appendix Documents: Include any documents referenced in the report including the CFR, Utilities Evaluation, Pre-Assessment Meeting Minutes (with RCx team roster/attendees), Equipment Inventory, Issues and Resolutions Log, Labor Rate table (if applicable), Example Monitoring Plan, and Functional Test Template Examples.

3.2 REVIEW PERIOD

Contractor shall allow for 10 business days of review time for all RCx team members. Contractor shall use the Issues and Resolutions Log to document and address comments and update the final Assessment Report appendix with the up to date Issues and Resolution Log showing these comments.

-- End of Section --

[TEMPLATE]
Statement of Work (SOW)
RCx Investigation Phase
[Insert - Installation Name and location and date]

Editor's Note: edit to include requisite phase information. Refer to RCx
Guidance Instructions or ASHRAE Guideline 0.2 for additional guidance.

PART 1 GENERAL

1.1 PHASES

[Insert appropriate information determined from Planning and Assessment Phases]

The intent of RCx Investigation Phase is to determine:

- 1.1.1 perform detailed trending per the monitoring plan, functional tests, and engineering calculations.
- 1.1.2 reveal operational characteristics
- 1.1.3 verify the need for changes
- 1.1.4 describe the recommended changes
- 1.1.5 quantify the implementation needed and benefits expected.
- 1.1.6 Create Scope of Work (SOW) documents to award and execute the 1.1.7 Implementation Phase. Refer to Attachments 1 & 3.

The contractor shall provide all labor, supervision, transportation, supplies, vehicles, tools, materials, facilities, equipment, permits, taxes, submittals and incidentals necessary to perform the SOW.

Editor's Note: This template is intended to be edited for the projects' specific requirements. Under this type of contract, multiple contractors may receive a SOW from the Government. Each contractor forms a team that includes the Contractor's RCx Specialist, Mechanical Subcontractor, Electrical Subcontractor, Testing and Balancing Specialist, and Controls Subcontractor. Each contractor submits a proposal that includes technical qualifications and a firm fixed price to perform the investigations. The Government selects a contractor based on best value technically acceptable.

Editor's Note: If there is an intent to have the contractor produce detailed statements of work and/or engineering drawings for use in implementation phase, identify the requirements for construction SOW tailored to each installation depending on what access they have to other engineering support (contract, USACE district, etc.) and planned acquisition strategy for implementing measures (Design-Build or Design-Bid-Build SOW, task-order for O&M contract).

1.2 PROJECT DESCRIPTION

1.2.1 Building list [insert either as table with facility info or simple list]:

Editor's Note: Provide an overall description of which facilities will have RCx. Provide for each facility the following information: location map; current function; square footage; number of stories; date constructed; usage schedule; access requirements; access days/times for RCx activities; special hazards; etc. This scope assumes installation RCx Planning and Assessment phases have been performed.

1.2.2 Systems to be tested: All energy-using building systems shall be part of the scope, unless exempted from assessment phase using utilities evaluation and/or preliminary energy calculation to justify to the RCx team during the pre-assessment meeting that there is low potential for energy savings, comfort improvement, or O&M improvement and no expected opportunity for no-cost/low-cost measures. Systems to be tested include but are not limited to:

Editor's Note: Delete or add systems as applicable along with a brief description of each one. Ideally, the Assessment Phase has limited the scope to specific systems or subsystems with suspected opportunities.

- 1.2.2.1 Air handling systems (AHUs, RTUs, MAUs, DOAUs, furnaces, ventilators, economizers, terminal boxes, and related equipment)
- 1.2.2.2 Steam and hot water hydronic systems (boilers, hot water primary and secondary pumps, condensate pumps, steam traps, heating coils, converters, control and balance valves, and related equipment)
- 1.2.2.3 Air and water-cooled hydronic systems (chillers, chilled water primary and secondary pumps, condenser pumps, cooling towers and fans, cooling coils, storage tanks, control and balance valves, and related equipment)
- 1.2.2.4 BAS systems (centralized EMCS or UMCS, local front-end systems, zone/plant/supervisory controllers, electric control modules, pneumatic control devices)
- 1.2.2.5 Local heating and cooling systems (DX split A/C units, unitary heaters, PTAC units, CRAC units, and similar equipment)
- 1.2.2.6 Domestic hot water systems (hot water heaters, booster or on-demand heaters, storage tanks, mixing valves, recirculation pumps, end-use fixtures, and related equipment)
- 1.2.2.7 Lighting Systems (all interior and exterior lighting systems and lighting control systems)
- 1.2.2.8 Other Equipment (kitchen equipment or appliances, medical equipment, industrial or manufacturing equipment, process refrigeration or conditioners, office electronics, and similar equipment)
- 1.2.2.9 Other automation systems
- 1.2.2.10 Solar hot water systems

1.2.2.11 Renewable Energy Generating systems (e.g. Solar PV, Wind, etc.)

1.2.2.12 Fire/life safety systems.

1.3 EXISTING CONDITIONS

Government furnished information will be the latest information available and will be provided via [FTP site]. This information is being provided for information only. The contractor shall bear the responsibility of verifying the accuracy of Government furnished information. If Government furnished information is determined to be inaccurate by the Contractor, the Contractor shall notify the Government in writing of the specific areas where it is inaccurate as soon as it is discovered and the Government will attempt to provide data that is more accurate within [14] calendar days. Full and current documentation may not available.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 TASKS, REPORTS, and DELIVERABLES

3.1.1 Contractor shall setup and host a preparatory meeting no less than 5 business days prior to the start of the scheduled investigation phase. Where assessment and investigation are being performed consecutively as part of the same contract, a single meeting prior to the assessment phase shall be sufficient for these planning purposes. If more than 60 calendar days have passed since the start of the assessment, CFR sections shall be reviewed and updated. Contractor shall also review investigation strategies and deliverables during the meeting. Contractor shall send meeting minutes with imbedded RCx team roster to the RCx team.

Editor's Note: Include in this contract as an appendix the assessment phase monitoring plan.

3.1.2 Monitoring Plan Implementation: Contractor shall use the assessment phase Monitoring Plan [insert as appendix] as the minimum basis for all trending requirements and logger tracking. The monitoring plan shall be maintained and updated throughout the investigation. Contractor is responsible for providing all equipment and labor associated with acquiring, launching, installing, collecting, and reading portable data loggers and other monitoring equipment. Each data point trend listed in the Monitoring Plan represents a requirement for the contractor to conduct this trending for the listed location, sample length, and interval. Contractor shall use the Monitoring Plan to add and track any additional trends required. Contractor shall provide raw data from these trends on a request basis for any RCx team member and provide a CD of all trend files by the completion of the investigation phase.

Editor's Note: where functional test templates have not been provided, add a submittal register requirement for the contractor to submit

proposed functional test sheets as part of the investigation phase deliverable.

3.1.3 Functional Test Results: Contractor shall perform and record each functional test required in the Assessment Report using the provided Functional Test template sheets or contractor-written sheets that record equivalent procedures and data. Additional functional tests required but not included in the Assessment Report shall be conducted and recorded by the contractor using functional test sheets provided by the contractor that use the same section structure and formatting as Assessment Report functional test templates. Where functional tests templates have not been provided, refer to (www.ftguide.org). Submit to government for approval proposed templates to be used.

Editor's Note: provide an appendix for instrumentation requirements when the RCx Plan does not identify instrumentation requirements.

3.1.4 Instrumentation Requirements: Contractor shall provide all tools and instrumentation required to perform the investigation work specified in this SOW and defined in earlier RCx phases. Contractor shall adhere to the instrumentation range, accuracy, resolution, and calibration requirements in the manufacturer's instructions and provide calibration records. Contractor shall verify in the Investigation Report that all tools used on-site meet these requirements, list tool make/models of instruments used, and provide cut sheets of each instrument to RCx team members on an on-demand basis. RCx Plan contains instrumentation requirements for tool range, accuracy, resolution, and calibration.

3.1.5 Data Analysis: Contractor shall perform all data analysis of performance monitoring and functional test data necessary to validate opportunities and obtain values for energy savings calculations. (Examples of data analysis include but not limited to: scatter plots, time series graphs, economizer analysis, etc.)

Energy Calculations: Contractor shall perform all calculations necessary to determine the savings expectations associated with each opportunity. Equations shall be standard engineering energy equations with measured or known data used and engineering judgment applied only where it is not possible to use data logging and functional testing methods. In order to limit interactive effects, contractor shall prioritize opportunities by expected complexity of implementation and perform calculations for each opportunity that account for proposed operational changes from the previous calculations. Before opportunities can be determined cost prohibitive, all interrelated energy savings must be accounted for (e.g., labor purchase savings, water treatment savings, demand savings, standby or cycling savings, etc.).

Editor's Note: the Analysis period for LCCA will be left to the discretion of the SOW preparer and RCx team, but fallback position will be 40 year per EISA which represents the typical life of the building envelope.

3.1.6 Financial Calculations: Contractor shall perform cost savings, implementation cost estimate, and return on investment calculations for each opportunity. Blended utility rates shall be calculated for use in energy cost savings. Cost estimates shall be based on actual labor,

materials, and equipment required and available to the local area and not rule of thumbs or past job data, utilize standards for LCCA's, such as NIST or OMB guidelines. Contractor shall refer to the RCx Plan or DPW guidance on return on investment criteria for economic viability (e.g. simple payback or SIR for each opportunity or total project). Contractor shall perform research on applicable rebates for each opportunity (reference the DSIRE database) and account for available incentives in payback calculations.

- 3.1.7 ECM Table: Contractor shall update the Preliminary Opportunities List (see appendix) the final list of recommended changes to facility operations in an Energy Conservation Measure (ECM) spreadsheet table. Contractor shall list each ECM in its own row with restated and/or updated information from the assessment phase's Opportunities List. Add financial data for each ECM on available rebates and instruction on implementation vehicles where known or recommended execution services exist.
- 3.1.8 M&V Plan: Contractor shall develop a Measurement & Verification (M&V) Plan that specifies project and ECM M&V goals and includes the following information:
 - 3.1.8.1 M&V Guidelines: reference the set of M&V guidelines being used (ASHRAE Guideline 14, IMPVP, FEMP M&V Guidelines, or other equivalently official source.
 - 3.1.8.2 Baseline: Provide a narrative summary to explain how baselines were determined for each M&V option selected. For ECM isolations, perform data logging or BAS trending to identify parameters needed. For whole building approach, baseline may be restated from utility data provided in the planning phase's Utilities Evaluation Report unless any CFR operational parameters have changes or the investigation phase occurs beyond the four year RCx cycle defined in the RCx Plan. For energy modeling option, use CFR information (including weather data), additional inspection, and engineering judgment to complete eQUEST or Energy Plus modeling that falls within ASHRAE 14 baseline calibration requirement: no more than 10% deviation for total electric or gas usage and no more than 20% deviation for any individual month. Provide baseline calculations, raw trend data, and modeling files to RCx team members on an on-demand basis.
 - 3.1.8.3 Monitoring Plan: provide an updated assessment phase Monitoring Plan that indicates M&V approach (key or total parameter isolation, whole building, or energy modeling) recommended for each ECM as well as specific DDC point, portable logger type/location, and utility meter information needed to perform each M&V procedure. The same degree of mitigation for interactive effects must be present in the M&V Monitoring Plan as compared to the ECM savings table.
 - 3.1.8.4 Energy Savings Calculations: for each system type, describe how data collected from specific M&V procedures will be used in energy savings calculations and comparisons.
 - 3.1.8.5 Schedule: provide a schedule of M&V tasks required once the RCx hand-off phase is complete.
 - 3.1.8.6 Implementation Issue Resolution Process: Where M&V goals are not met, establish a process for the implementation contractor(s) to update the RCx issues and resolution log and propose a corrective action.
- 3.1.9 Presentation of Investigation Results: Contractor shall prepare a half-

day presentation (in person or web conference acceptable) to present the above findings and deliverables to the RCx team. Contractor shall record RCx team members present and feedback given in meeting minutes.

1.4 INVESTIGATION REPORT CONTENT

- 3.3.1 Executive Summary Narrative: provide overall description on the energy savings and benefits expected from implementation of opportunities found. Provide total facility reduction percentages for each utility type.
- 3.3.2 Executive Summary Table: display Preliminary Opportunities List in a single table ordered from high to low priority with total savings, costs, and payback in the bottom row. Opportunities that were identified but not recommended may be removed, however contractor shall retain the opportunity number system from the original spreadsheet. Add table description for methodology used to recommend or not recommend opportunities found and describe how new opportunities being recommended that were not including in the Assessment Report meet CFR needs. All opportunities deemed economically viable or operationally critical per the RCx Plan must be listed as recommended. Additional opportunities may be listed so long as the overall group of opportunities remain economically viable.
- 3.3.3 Implementation Schedule: provide a Gantt chart constructed in MS Project or equivalent software that indicates NTP target, periods of on-site work, government review times, submittals suspense's, equipment testing/configuration, work completion, training dates, and other RCx implementation milestones. In the event that implementation work is not in scope and start dates are unknown, format the implementation schedule in terms of estimated number of days for each chart entry starting with contract award rather than date ranges.
- 3.3.4 Utilities Summary: display utilities chart that show existing and recommended building performance after implementation as well as calculation steps to obtain utility rates specific to the building(s) investigated. Describe any site support, rebate incentives, or participation programs (e.g., demand response) available and applicable to this project.
- 3.3.5 Pre-Investigation Meeting Summary: list final RCx team members and provide a brief explanation of meeting discussion and strategies reviewed and employed for the investigation.
- 3.3.6 Investigation Activities Summary: provide a description of investigation activities including maintenance/occupant coordination performed, systems monitored, functional tests conducted, list of tools used, on-site ECM validation process employed.
- 3.3.7 Individual Opportunity Descriptions: present separate descriptions that detail how each opportunity was validated or identified, assumptions made in each calculation, methodology or equations used, and set points for any new sequence recommended (or explanation of how to determine set point during implementation). Each description shall include color photographs that help explain the nature of the opportunity. For equations used, describe the value and source for each variable. For cost estimates, list rebates available, implementation cost breakdowns, new equipment needed, and labor data estimates for the specific vehicle recommended. List any functional test needed, special testing or tuning, and follow-up needed immediately after implementation of each opportunity. Approach to minimizing interactive effects between ECMs and degree of uncertainty remaining should be detailed. These sections should

be specific enough to instruct subcontractors how to implement recommendations.

- 3.3.8 M&V Summary: provide an overview of approved M&V Plan strategies including updated M&V Monitoring Plan table and related recommendations.
- 3.3.9 Systems Manual Outline: list the documents already assembled and those needed to develop a complete Systems Manual including CFR, operational sequences and set points, equipment inventories and cut sheets, warranties, O&M maintenance schedules, training material, Issues and Resolutions Log, and RCx close-out documents)
- 3.3.10 Appendix Documents: Include the full Implementation Rates table as an appendix document. Also include any referenced or updated documents including the CFR, Utilities Evaluation, Pre-Investigation Meeting Minutes (with RCx team roster/attendees), Equipment Inventory, updated Issues and Resolutions Log, trend data for Monitoring Plan points, completed function test sheets, functional test sheet templates for implementation testing required, Environmental Review Checklist, and draft M&V Plan.
- 3.3.11 [Draft Implementation Phase SOW: Prepare a draft SOW or task-order for review and/or utilization in the implementation phase.]

3.4 REVIEW PERIOD

Contractor shall allow for 10 business days of review time for all RCx team members. Contractor shall use the Issues and Resolutions Log to document and address comments and update the final Investigation Report appendix with the up to date Issues and Resolution Log showing these comments.

-- End of Section --

RCx Firm Experience Form

FILL OUT A SEPARATE FORM FOR EACH FIRM ON THE TEAM

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

Validation of Requirements:

The below bullets represent eligibility requirements for competing on RCx work where this form is referenced. Validate that your firm meets the below requirements with the check-boxes next to each bullet:

- Continuous operation for the past 36 months with full-time employees as an engineering firm engaged in building commissioning? YES NO
- Availability of RCx tools/skills needed to complete all scope of work tasks including performance trending and functional testing? YES NO
- Familiarity with facility HVAC systems (equipment type, distribution configuration, and system size) included in RCx scope of work? YES NO
- Possesses RCx or Cx-related certification for the firm or designated contact person (certification must specify "commissioning")? YES NO

List Certification(s): _____

Additional Business Description:

Answer the below questions to provide additional info about your firm's qualifications (RCx includes recommissioning and retro-commissioning):

- | | <u>RCx</u> | <u>Cx</u> |
|--|----------------|----------------|
| • How long has the firm offered commissioning-related services? | _____ years | _____ years |
| • Average number of commissioning-related projects per year: | _____ projects | _____ projects |
| • Number of employees devoted to commissioning-related services? | _____ persons | _____ persons |
| • Percentage of overall revenue devoted to commissioning? | _____ % | _____ % |

Project History:

Describe at least 3 (and up to 10) RCx or Cx projects completed by your firm. For each project, give project details including owner contact information, tasks performed by your firm, and facility systems included as part of the scope of work executed by your firm. Use "X"s to denote tasks performed and systems included and note additional tasks and systems in the "Other" column that are pertinent to qualifying RCx experience.

Project Details							Tasks Performed								Systems Included						
							Utilities Evaluation	RCx Scoping	System Diagrams	Trending	Functional Tests	Data Analysis	Energy Calculations	Design Review	Training	Other	Cooling Systems	Heating Systems	Pumping Systems	Air-Side Systems	Automation Systems
Project Name	Cx or RCx	Facility Type	SF	City, State	Date Finished	Owner Contact															