

COMMISSIONING GUIDANCE FOR ESPCs

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INTRODUCTION

Federal facility managers are challenged daily with maintaining federal buildings that are not energy efficient, require increasing expenditures for operations and maintenance (O&M), and often do not provide occupants with the comfort needed to maintain their productivity. Federal facility managers are also faced with increasingly ambitious federal energy and sustainability goals. Energy savings performance contracts (ESPCs) provide a procurement mechanism to allow agencies to improve their facilities and reduce energy and O&M costs, through projects designed, installed, and financed by Energy Service Companies (ESCOs). In federal ESPCs, the ESCO must guarantee a level of cost savings that is sufficient to pay for the project.

ESPC projects have focused primarily on the cost savings benefits from retrofitting facilities with energy efficient equipment and systems. However, an equally important goal of facility managers is for the project to result in improved (or ideally, optimized) building operations to enhance occupant comfort (and reduce service calls and complaints) and to provide conditions that promote worker productivity. Federal ESPCs are required to guarantee: (1) cost savings from reduced energy/water use and related O&M expenses, and (2) that facility performance requirements and standards, such as lighting levels and space temperatures, will be maintained. Commissioning (Cx) focuses primarily on the performance guarantee.

The U.S. Department of Energy indefinite-delivery, indefinite-quantity (IDIQ) ESPCs require commissioning of the installed energy- and water-saving equipment and systems. (See IDIQ Section C.5.4.) This guidance provides a description of how commissioning in ESPC projects can achieve the objective of meeting or exceeding facility performance requirements by optimizing the operation and efficiency of building systems and equipment.

Commissioning of existing buildings, when done properly, goes beyond quick-fix solutions (such as replacing an inefficient piece of equipment with a more efficient equivalent) by systematically optimizing

building systems. Commissioning of new equipment can also be defined as the process of ensuring that systems are designed, installed, functionally tested, and capable of being operated and maintained to perform in conformity with the project intent.

OVERVIEW OF COMMISSIONING IN THE ESPC PROCESS

The steps of planning, conducting, and reporting on commissioning are summarized below.

Phase 1 – Acquisition Planning

A brief introduction to commissioning is provided by the FEMP Federal Project Executive during an initial ESPC briefing for the agency.

Phase 2 – ESCO Selection and Preliminary Assessment

During ESCO selection and as the preliminary assessment proceeds, the ESCO and agency will begin addressing Cx approaches and expectations.

In preparing for ESCO selection the agency will define project requirements (in very broad strokes). Project goals and priorities will evolve through the process, along with the correlated *project intent*, which will define the performance criteria detailed in the commissioning plan.

The preliminary assessment will include an outline of a proposed Cx plan, and the agency comments will address areas in the Cx plan that need to be addressed in the investment-grade audit (IGA). The agency team also includes Cx specifics, requirements, and commitment in the draft TO-RFP.

Phase 3 – Project Development: Investment-Grade Audit, Proposal Development, Negotiation and Award of Task Order

During project development, as proposed ECMs are defined, the preliminary commissioning approach can be filled in with generic commissioning activities for each energy/water conservation measure (ECM) and included as the commissioning approach in the proposal. During project development in Phase 3 is the time to ensure that performance requirements are clearly defined in the contract – through the task order RFP (TO-RFP), the *Risk, Responsibility, and Performance Matrix*, and the Cx plan.

Phase 4 – Implementation: Final Design, Construction, M&V and Commissioning, Project Acceptance

The majority of actual commissioning activities occurs during Phase 4.

Final commissioning plan. After the ESCO has completed and agency has approved final designs, drawings, and equipment specifications, the detailed commissioning plan can be developed, along with commissioning instructions, methods, and checklists for design verification, operational acceptance tests, equipment start sequence, functional acceptance, and shakedown methods.

Inspections and operational acceptance tests. As construction proceeds, the ESCO and contractors validate the readiness of equipment, systems, and controls for equipment start.

Functional acceptance tests comprise testing and evaluation of ECM performance under operating conditions for compliance with project intent, with the government witnessing the testing.

SUMMARY OF ROLES AND RESPONSIBILITIES IN ESPC PROJECT COMMISSIONING

Activity	Agency	DOE/PF	ESCO
Phase 2			
Preliminary Assessment (PA) kickoff meeting	Participates in initial Cx discussions.	Introduces Cx as part of the kickoff agenda, including agency and ESCO roles.	Provides agency with Cx philosophy during meeting.
PA prepared and submitted			Submits Cx plan outline in PA.
PA review	Reviews PA; sends consolidated comments to ESCO. Identifies areas in Cx Plan that need to be addressed in proposal.	Reviews PA; identifies areas in Cx plan to be addressed in proposal. Consolidates comments to send to ESCO.	Responds to comments. (Typically the PA is not reissued; comments are addressed in IGA and proposal).
Notice of Intent to Award/TO-RFP issued along with PA comments.	Forms Cx team. Agency adds Cx specifics, requirements, and commitment to draft TO-RFP.	DOE/PF provides input to agency on Cx for TO-RFP; guides project intent (PI) discussions.	Reviews TO-RFP, provides comments. Leads PI discussions. Forms Cx Team.

Activity	Agency	DOE/PF	ESCO
Phase 3			
IGA kickoff meeting	Participates in discussions of IGA Cx and development of need statement.	Consults with agency on Cx goals as needed.	Provides agency with Cx summary approach for ECMs and leads PI workshop.
Proposal preparation	Reviews PI document and provides comments to ESCO.	Reviews PI and consolidates comments.	Drafts PI document; reviews with agency and uses PI for IGA ECM development.
IGA completed, proposal prepared and issued	Agency witnesses baseline measurements and provides input to ESCO.	Provides support to agency on Cx questions.	Prepares and submits proposal, with PI revised based on IGA results, and outline of Cx plan.
IGA & proposal review	Reviews proposal/Cx plan using PI document as guide; provides comments to ESCO.	Reviews proposal; consolidates comments.	Responds to comments and revises proposal.

Activity	Agency	DOE/PF	ESCO
Phase 4			
Construction kickoff meeting	Hosts meeting, assigns Cx representative, reviews Cx activities for construction.	Participates in kickoff; provides draft agenda if requested.	Reviews Cx activities and assigns Cx agent for project.
Design	Reviews design against PI and provides comments/ approves design package.	Participates in design review if part of statement of work.	ESCO integrates Cx process and PI with design.
Equipment Submittals	Reviews submittals against PI; provides comments/ approves.	Reviews equipment if part of statement of work.	ESCO integrates Cx process and PI requirements with suppliers.
Installation	Coordinates access and outages; inspects installations and witnesses performance testing.	Participates in installation activities if part of statement of work.	ESCO integrates Cx process and PI requirements with construction contractors.
Training	Reviews, provides	Reviews training plan	Issues training plans as outlined

	comments, and participates in training sessions.	and provides comments to agency.	in proposal, schedules training and provides training aids.
Commissioning (Cx)	Reviews and approves Cx plan; participates in Cx; witnesses Cx.	Participates in Cx if part of statement of work.	Cx agent provides and executes Cx plan, coordinates agency activities.
Post-installation M&V	Agency witnesses; reviews and approves report.	PF reviews and provides comments to agency.	Conducts M&V activities; provides report.
Project acceptance	Agency accepts project according to acceptance plan.	PF reviews acceptance plan and provides comments to agency.	ESCO provides acceptance plan, incorporates agency comments and executes.
Phase 5			
Post-acceptance performance	Participates in any needed seasonal testing; reviews/approves final Cx report.	Reviews and provides comments to agency.	Conducts seasonal testing; submits final Cx report incorporating agency comments.

KEY ELEMENTS OF COMMISSIONING

Project Intent

Early in the project, when the agency acquisition team and facility managers focus on defining the needs and priorities for the project, they can also begin defining *project intent* (PI) in terms of operational improvements needed in the facility — in other words, how the facility manager would define the energy project’s success in improving building conditions and reducing needs for maintenance or troubleshooting of energy systems.

The project intent is a living document which clearly defines the agency’s expectations and goals for the project. The project intent should be written with non-technical language and should be understandable by everyone involved in the project, including the owner, maintenance staff, construction workers, architect, engineers, and equipment manufacturers.

The project intent helps the ESCO target energy efficiency opportunities, and also helps to focus the IGA on capturing existing building operating conditions and establishing baselines from which to measure the opportunities for integrated energy savings and improved building operational conditions.

When project development begins in Phase 3, the ESCO can further refine the goals of the project and produce a draft of the project intent document. A PI workshop, either in conjunction with a kickoff meeting or a stand-alone meeting, with participation of the ESCO commissioning team, project facilitator, and agency, will facilitate this effort. Agency personnel who should be included are the same as those who would be involved in the IGA kickoff meeting: Contracting Officer (CO), contracting officer’s technical representative, energy/facility managers, construction manager, and others — all of those who can affect or will be affected by the project.

The PI will continue to be refined throughout IGA development as changes in ECM definitions arise. A PI and preliminary commissioning approach will be included with the proposal. The anticipated Cx activities, roles, and responsibilities for Phase 4 will be identified at this time.

Documented project intent also may guide the ESCO’s development of a design intent document, which can be useful in guiding design of the ECMs but is not always required.

Commissioning Plan

The ESCO submits the commissioning plan with the completed design and construction package, and the agency reviews for compliance with project intent. The final Cx plan specifies activities to verify that the ECMs meet the project intent.

The commissioning plan will define how the proposed ECMs should operate, guide the design and installation review and resulting requirements, and specify functional testing of the installed equipment/systems. Tests include measurement of ECM performance to document energy savings potential (supporting M&V of energy savings), and to demonstrate the ECMs' improvement in building system operations or discover operating deficiencies to be corrected in the ECM or interfacing facility equipment.

As construction begins, the agency and ESCO will review the commissioning plan and all commissioning activities that will take place during construction. The agency should review with the ESCO their requirements for notification of testing and inform the ESCO of their desire to witness all testing to be performed as a part of the Commissioning Plan.

The final commissioning plan should have the following contents:

Overview

- Abbreviations and definitions
- Purpose of the Cx plan
- Cx scope / objectives
- Commissioned systems

Commissioning Team: Roles & Responsibilities

- List Cx team members & contact information
- Description of roles

Commissioning Process

- Final commissioning plan
- Commissioning kick-off meeting, other meetings
- Management protocols
- Submittals, documentation, and written work products
- Pre-functional checklists, tests, and startup
- Functional tests and verification procedures
- O&M manuals and warranties
- Training
- Schedule
- Seasonal testing

ECM Installation And Functional Performance Tests

The ESCO installs the ECMs per agency-approved design and installation plans, and uses commissioning-related logs, checklists, and records required to document installation.

After installation, functional and operational performance tests are conducted to demonstrate the ECMs' performance in compliance with the project intent, and to measure how the ECMs interact with existing

facility equipment and achieve required building operating conditions. Any operating deficiencies are documented and resolved.

Operational acceptance tests comprise the validation of components of equipment, systems, and controls for readiness at equipment start. Test documents for mechanical, electrical, instrumentation and controls, life safety, and telecom are included. The individual contractors complete all these tests, which may or may not be witnessed.

Functional acceptance tests comprise testing and evaluation of ECM performance under operating conditions for compliance with project intent. Warranties typically become active at this point.

Shakedown testing addresses inter-system dependencies and intra-system components to verify safety, standby start, soft start and other performance functions that require multi-system interaction.

The agency should witness tests and ensure that all documentation has been submitted as described in the commissioning plan and that all punch list items are complete.

Commissioning Report

After construction is complete but before acceptance, the ESCO submits the commissioning report.

The commissioning report summarizes for each ECM the intended operational performance, equipment installation, testing equipment and specifications, results of functional performance tests, any operational deficiencies and course of action for their remediation, and compliance with project intent. Any seasonal testing requirements are identified and scheduled. After agency review and written comments and any required revisions, the final report is submitted for approval.

An “interim” Cx Report is submitted if there are commissioning activities that must occur after acceptance to cover functional and operations testing of seasonally operated equipment. (See “Commissioning and Project Acceptance” below.)

Cx Report & Record Book Outline

The Cx Report contains two major documents: The Commissioning Record Book and the Commissioning Summary Report.

Cx Record Book is documentation of the executed Cx plan. The Cx Record Book includes:

- Completed pre-functional checklists
- Completed functional tests
- Monitoring reports
- Additional information and documentation added as required (such as completed manufacturer’s checklists and documentation of manufacturer start-up).

Cx Summary Report

Project overview:

- Executive summary
- List of participants & roles
- Brief project description
- Overview of commissioning scope
- General description of testing & verification methods

For each piece of equipment or system, report on:

- Equipment meeting specifications
- Equipment installation
- Functional performance and efficiency
- Brief description of verification & testing methods used and observation & conclusions from the tests
- Equipment documentation & design intent
- Operator training

Appendix materials:

- Detailed list of all outstanding or non-compliance issues, including reference to the specific test, inspection, trend log, etc., where the deficiency is documented.
- Unresolved issues
- Summary of any design changes and location of additional information
- Cx meeting minutes
- Cx progress reports
- Site visit reports
- Findings
- Communications
- Etc.

Commissioning and Project Acceptance

Project acceptance marks the point when the ECMs and the project are turned over to the agency and payments to the ESCO begin.

Some requirements for ESPC project acceptance may be particular to the agency, but they will always include commissioning and M&V. The ESCO and agency will follow an agreed-upon acceptance plan and checklist, which will require the ESCO to (among other things) submit the following before acceptance:

- Punch list items
- O&M manuals (system manuals) and assurance that O&M training is complete
- As-built drawings
- Post-Installation M&V report confirming ECMs' cost savings potential
- Interim or final Cx report

Frequently an interim Cx report will be submitted before acceptance because seasonal testing of some ECMs is required by the Cx or M&V plan. Season testing entails, for example, commissioning of chillers during the summer months and boilers during the winter months.

In this case the agency would conditionally accept the project pending final commissioning or M&V, and payments to the ESCO would begin. After all post-acceptance commissioning and M&V activities are completed, the ESCO would submit the final Cx report for review and approval by the agency.