DRAFT COMMISSIONING GUIDANCE DOCUMENT FOR DOE SUPER ESPC'S -10.19.04

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COMMISSIONING GUIDANCE DOCUMENT FOR SUPER ESPCS

INTRODUCTION

Federal facility managers are challenged daily with maintaining existing federal building stock that is energy inefficient, requires increasing O&M expenses, and often do not achieve the building occupant comfort needs to maintain worker productivity. Additionally, they are faced with congressionally mandated requirements to reduce energy use and O&M expenses, with little capital funding. The Super ESPC program provides a procurement mechanism to allow agencies to acquire performance based services to implement energy efficient equipment and systems that reduce energy use and O&M expenses through projects designed, installed, financed, and maintained by Energy Service Companies.

An ESPC project allows an agency to reallocate its utility and building O&M expenses to pay for energy system infrastructure improvements from resulting cost savings achieved. ESPC projects have focused primarily on the energy and related cost savings benefits of retrofitting facilities with higher energy efficient equipment and systems. However, an equally important goal of facility managers is the project results in improved or ideally optimized building operations to increase occupant comfort (fewer service calls or complaints) and conditions that may improve worker productivity. In ESPC's there are two principle contract requirements or goals: (1) reduced building energy use and related equipment O&M expenses, and (2) meet or exceed facility performance requirements, such as lighting levels and temperature levels, based on how the building is used and occupied. Commissioning (Cx) focuses primarily on the second building performance goal.

Since 2001, Super ESPC contracts have included a requirement for commissioning by the ESCOs installing energy savings equipment and systems. This guideline will provide a description of how the commissioning process in Super ESPC contracts can achieve the objective of meeting or exceeding facility performance requirements by improving the building's operational conditions.

Commissioning of existing buildings, when appropriately applied, go beyond quick-fix solutions (replace an inefficient piece of equipment with higher 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".

The Commissioning process begins early in the project development process by DOE FEMP technical staff (Project Facilitator) engaging the facility management staff to focus on building operational deficiencies that can help the ESCO and agency formulate and define the "project intent" of potential energy retrofits. In other words, how would the facility manager identify that the energy project was successful in improving building conditions and reduced maintenance or troubleshooting of energy systems, beyond the obvious objective of reducing building energy costs.

PROJECT INTENT

The project intent of the ESPC project not only helps the ESCO target energy efficiency opportunities, its helps focus facility survey activities to clearly capture the existing building operating conditions to establish a baseline from which to measure the opportunities for concurrent energy savings and improved building operational conditions. The project intent for the ESCO proposed energy project scope can be derived from the data and information collected in its investment grade facility audit, which in Super ESPC projects is called the Detailed Energy Survey and from customer requirements.

COMMISSIONING PLAN

Documented project intent provides the guide for ESCO development of a design intent that will guide the design of proposed Energy Conservation Measures (ECM), as well as define the Commissioning Plan for the testing of the installed systems and how they integrate with and affect the operation of existing building equipment. The Commissioning Plan will define how the proposed ECM should operate, guide the design and installation review and resulting requirements, and identify how the installed equipment/systems will be functionally tested. Tests include measurement of ECM performance to document energy savings potential (supporting M&V of energy savings) and demonstrate its improvement in building system operations or discover operating deficiencies to be corrected in the ECM or Government equipment with which it interfaces.

ECM INSTALLATION AND FUNCTION PERFORMANCE TESTS

The ESCO installs the ECM(s) per agency-approved design and ECM installation plans and documents commissioning related logs/records required during installation phase. After installation, functional and operational performance tests are conducted to demonstrate the ECM's performance in compliance with the design intent and measures how the ECM interfaces with Government equipment and achieves required building operating conditions. Any operating deficiencies are documented and resolved.

COMMISSIONING REPORT

An interim commissioning report is prepared for the agency summarizing for each ECM the intended operational performance, equipment installation, testing equipment and specifications, results of functional performance tests, any operational deficiencies identified and course of action to remedy and compliance with project intent. Any seasonal testing requirements are identified and scheduled. Upon agency review and written comments the final or interim (if seasonal testing required) commissioning report is prepared and submitted for approval.

AGENCY TRAINING ON COMMISSIONED ECM

ESCO will submit O&M manuals and provide training for agency O&M staff on operational system covering safety, startup, emergency shut down procedures and O&M procedures and checklist (if agency O&M to be provided in performance period.).

COMMISSIONING SCHEDULE

There are four phases associated with a SuperESPC Project:

Phase 1: Project Planning
Phase 2: Initial Project Development
Phase 3: Negotiate and Award Delivery Order
Phase 4: Implementing the Delivery Order

The commissioning process should begin with Phase 2 and continue through remaining phases. Following is an overview of the activities that are associated with each phase of the ESPC process. Roles and Responsibilities are outlined in Appendix 1.

PHASE 1: PROJECT PLANNING

An initial introduction is provided by the DOE-FEMP Alternative Financing Representative or Project Facilitator when appropriate. Only minimal Cx detail is discussed depending on project considerations.

PHASE 2: INITIAL PROJECT DEVELOPMENT

The commissioning process begins in the Project Development phase with the introduction of commissioning to the Agency. Although the commissioning process is becoming widely known and accepted, there are various nuances associated with the ESPC process that should be explained. A summary of commissioning activities throughout the ESPC process is available and may be provided to the Agency for reference.

Although the ESCO will be performing the majority of the work associated with the commissioning process, the Agency is still responsible for oversight and to see that the process is completed in a quality manner. With this in mind, if in-house resources are not available, the Agency may wish to consider obtaining the service of an experienced commissioning agent to guide them through the process.

Also in this phase, discussions begin for development of the Project Intent (PI). The PI will outline the goals of the project, articulating the wants and needs of the Agency, and will be developed by the ESCO in Phase 3. These wants and needs should be discussed in a general fashion during the Initial Proposal (IP) Kickoff meeting and in subsequent discussions during IP development. Project goals will shape the commissioning scope.

PHASE 3: NEGOTIATE AND AWARD DELIVERY ORDER

After the Notice to Proceed, the ESCO will refine the goals of the project and issue a draft of the PI. This will be accomplished by convening a Project Intent (PI) Workshop. Participants in the workshop will include representatives from the Agency, ESCO, and the Project Facilitator. Representatives of the Agency may include all personnel to be affected by the ESPC project including, but not limited to, the CO, COR, Energy Manager, Construction Manager, Engineering, O&M Representatives, Building Engineer, and Building Representatives of all buildings to be affected by the project.

The PI will continue to be refined throughout the Detailed Energy Survey as changes in project scope arise. A description of the Project Intent will be issued with the Final Proposal and will form the basis for the Design Intent Document (PID) to be developed by the ESCO during Phase 4. A Preliminary Commissioning Approach is submitted in this phase with the Final Proposal as described in the DO RFP or IDIQ. The anticipated Cx activities in Phase 4 and roles and responsibilities of the ESCO and the Agency will be identified at this time.

PHASE 4: IMPLEMENTING THE DELIVERY ORDER

After award of the Delivery Order, the ESCO will begin detailed design of the ECMs. Although not a requirement of the process, it is suggested that the ESCO develop a Design Intent Document, using the PI as guidance, for use in the detailed design process. The ESCO will then submit a Commissioning Plan, as described in this guidance, with the completed Design and Construction Package for approval by the Agency. The Agency should review the Commissioning Plan for compliance with the PID. After approval and issuance of the Notice to Proceed with Installation, construction begins.

During the construction kickoff meeting, the Agency and ESCO will review the Commissioning Plan and all commissioning activities that will take place during construction. The Agencies 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.

After construction is complete, but before acceptance, an interim Commissioning Report, as described in this guidance, shall be submitted by the ESCO. All documentation submitted during the construction process should be incorporated into the interim Commissioning Report. The Agency should witness any tests and assure that all documentation has been submitted as described in the Commissioning Plan. The Agency should also ensure that all punch list items are complete.

After conditional acceptance of the ECMs, project payments may begin. The ESCO will conduct seasonal testing as required in the Commissioning Plan. This will entail, for example, commissioning of chillers during the summer months and boilers during the winter months. After all commissioning has been completed, the ESCO submits a final Commissioning Report for review and approval by the Agency.

COMMISSIONING PROCESS FLOW

Activity	Commissioning Process (ESCO Example)
Commissioning (definition/philosophy)	The process by which equipment or systems are taken from concept through design, design intent, construction to completion of construction through energization and testing to sustaining operation by agency.
Phase Two:	
Commissioning Introduction	This section will address the broad approach for the project as it is seen at this preliminary stage of project development.
Phase Three:	
Project Intent	Detail is included in the Preliminary Cx approach. Generic functions can be highlighted for each ECM at this time.
Preliminary Commissioning Approach	This section of the final proposal will address the broad approach for each ECM as it is seen at this preliminary stage of project development.
Commissioning Team (prelim)	The preliminary team will be established as it relates to the ESCO, Agency, etc. More detail will be outlined in Phase 4.
Phase Four:	
Commissioning Team (final)	The final team will be established as it relates to the ESCO, Agency, design team, vendors, contractors, etc.
Commissioning Plan (detailed)	The ECM's have been determined and the detailed commissioning plan can be developed. Specific information can now be added for each of the systems and larger components in the systems.
Commissioning Sequence	The sequence of activities to commission equipment or systems—Design, Sequence Of Ops written, Develop Equipment List, Design Verification, Operational Acceptance Test, Equipment Start and Functional Acceptance Test and shakedown.

Activity	Commissioning Process (ESCO Example)
Construction / Installation	The work of the Project defined by the drawings and specifications. During construction all commissioning forms will be used by the contractors, vendors, ESCO and collected during this phase.
Commissioning Check Lists and Start up Procedures	The written documents covering general instructions and methods to commission equipment or systems. Typically they consist of Design Verification checklists, OAT checklists, Equipment Start sequence, FAT checklists, and Shakedown methods.
Design Verification	The validation of the completeness of construction in compliance with the drawings and specifications including approved changes. Various members of the design team complete this as construction moves forward but before any component testing is started.
Operational Acceptance Test (OAT)	The validation of components on equipment, system and controls for readiness at equipment start. Includes test documents for mechanical, electrical, instrumentation and controls, life safety, and telecom. The individual contractors complete all these tests and they may or may not be witnessed.
Construction Complete	The entire work in place to permit the start of Functional Acceptance Tests (FAT).
Functional Acceptance Test (FAT)	The equipment or system performance evaluation under operating conditions for compliance with the P&ID drawings, Sequences of Operation, and specifications including changes. It verifies equipment or system component performances, e.g., temperature, humidity, pressure, pH, particle counts, etc. Warranties become effective for operating equipment. A qualified agency representative should witness these tests.
Training	Any system training already performed will now be able to be enhanced with all systems operating.
Shakedown	The testing has inter-system dependencies and intra-system components to verify safety, standby start, soft start and other performance functions, which require system or multi system interaction.

PROJECT INTENT

The development of the Project Intent (PI) is critical to the Commissioning Process. This document details the owner's expectations and requirements for the building and its performance and serves as a basis for the project for everyone involved. The PI will be invaluable throughout the remaining phases of the Super ESPC process. Continuous evaluation and update of the PI is required and changes should be communicated to the project team. The purpose for the project intent, regardless of the stage or Phase of the project when starting commissioning, is that the project intent sets forth the goals and criteria against which the success of the project is measured. The PI is used by the ESCO to develop the Design Intent document that is used for the detailed ECM Design.

The project intent is a living document which defines in clear language the building owner's expectations and goals for the building. 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 requirements can cover a wide range of topics, such as comfort, productivity, and maintainability of equipment. The project intent also details the success criteria for the project. Criteria such as verifiable percentage change in: reduction in occupant comfort complaints, increase in productivity, sales, and reduction in operating costs should be identified. All criteria established should be well defined, clearly worded, and most importantly, verifiable.

Every project should have a project intent regardless of project status, when commissioning is started. Whether it is during pre-design, design, or later during construction, even turnover, a project intent is necessary for the process.

CX PLAN OUTLINE

The Final Commissioning Plan is a submittal that is due with the design & construction package. The Final Cx Plan should include verification that the various measures meet the Project Intent.

The Final Commissioning Plan should have the following contents:

Overview
- Abbreviations & 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 & written work products
- Prefunctional checklists, tests & startup
- Functional Tests & Verification Procedures
- O&M Manuals and Warranties
- Training
- Schedule
- Seasonal Testing

CX AND PROJECT ACCEPTANCE

The Acceptance phase of the Super ESPC occurs during *Phase 4: Implementing the Delivery Order* at the end of the Construction Period but before the start of the Performance Period. Acceptance marks the point when the ECMs and the Project are turned over to the Agency and payments begin. This is also the phase when the majority of the Cx activities have been completed.

M&V activities should not be confused with Cx activities. Cx ensures that the equipment functions well according to the design intent and has the potential to save energy. M&V seeks to quantify the savings of the installed equipment. Cx activities and M&V activities are detailed in the specific Cx and M&V plans.

Prior to Acceptance, the ESCO submits an acceptance plan to the Agency for comments, incorporates any changes and executes the Plan. The Acceptance Plan outlines the items that must be completed by the ESCO before Agency acceptance and can serve as the Agency's checklist for acceptance. A sample acceptance plan is shown in the Project Management Guide. Major activities in the acceptance plan include:

- ESCO submits punch list items
- ESCO submits O&M Manuals (System Manual) and conducts training
- ESCO submits As-builds
- ESCO submits Post-Installation M&V report confirming actual cost savings potential
- ESCO submits an Interim Cx Report

The Cx Report contains two major documents: The Commissioning Record Book and the Commissioning Summary Report. An outline for the Cx Report is provided here. The Cx Report is considered an Interim Cx Report to account for commissioning activities that must occur post acceptance to cover functional and operations testing of seasonally operated equipment.

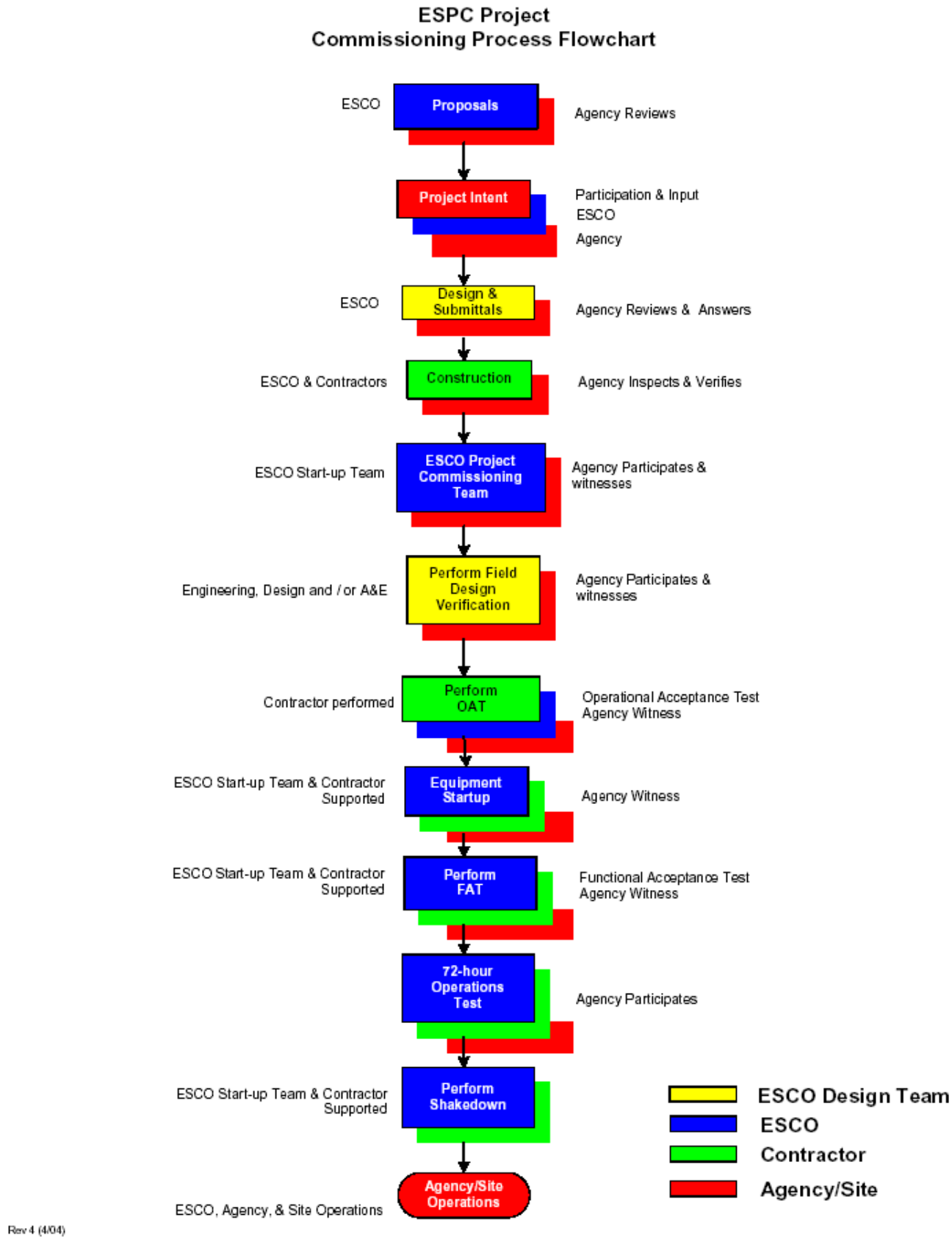
After Agency review of the Interim Cx Report, the Agency conditionally accepts the ECMs and project payments may begin. After all post-acceptance commissioning activities have been completed per the Cx Plan, the ESCO submits the final Cx Report for review and approval by the Agency.

CX REPORT & RECORD BOOK OUTLINE

Cx Record Book is documentation of the executed Cx plan maintained by the Commissioning Authority (CA).

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 (by CA):
- 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.


ESPC Project
Commissioning Process Flowchart
ESCO
Proposals
Agency Reviews
Project Intent
Participation & Input
ESCO
Agency
ESCO
Design & Submittals
Agency Reviews & Answers
ESCO & Contractors
Construction
Agency Inspects & Verifies
ESCO Start-up Team
ESCO Project Commissioning Team
Agency Participates & witnesses
Engineering, Design and / or A&E
Perform Field Design Verification
Agency Participates & witnesses
Contractor performed
Perform OAT
Operational Acceptance Test
Agency Witness
ESCO Start-up Team & Contractor Supported
Equipment Startup
Agency Witness
ESCO Start-up Team & Contractor Supported
Perform FAT
Functional Acceptance Test
Agency Witness
72-hour Operations Test
Agency Participates
ESCO Start-up Team & Contractor Supported
Perform Shakedown
ESCO, Agency, & Site Operations
Agency/Site Operations
ESCO Design Team
ESCO
Contractor
Agency/Site
Rev 4 (4/04)

Activity	Agency	DOE/PF	ESCO
Phase 2			
Initial Proposal (IP) Kickoff Meeting	Participates in Initial Cx discussions.	Introduces Cx as part of the Initial kickoff agenda, including Agency & ESCO roles	Provides customer with Cx philosophy during meeting
IP Prepared, Issued and Presented	Reviews proposal and identifies areas in Cx Plan that need to be addressed in Final Proposal.	Reviews proposal and identifies areas in Cx Plan that need to be addressed in Final Proposal.	Submits Cx Plan outline in IP.
IP Reviewed/Questions to ESCO	Agency Reviews and provides comments to PF and sends consolidated comments to ESCO.	PF Reviews provides comments to agency and coordinates comment consolidation.	Responds to comments. (Typically the IP is not reissued; comments are addressed in DES/FP).
Letter of Intent/DO-RFP prepared and issued along with IP comments.	Agency Team adds Cx specifics to Draft DO-RFP, including Cx Requirements and commitment. Forms Cx team	DOE/PF provides input to agency on Cx guides for DO-RFP and guides Project Intent discussions. Forms Cx team.	Reviews DO-RFP, provides comments and leads Project Intent discussions. Forms Cx Team.

Activity	Agency	DOE/PF	ESCO
Phase 3			
DES Kick-off Meeting	Participates in DES Cx discussions and in development of need statement	Cx goals are covered as part of the DES kickoff agenda	Provides customer with Cx summary approach for ECMs during meeting and leads Project Intent workshop.
Proposal Preparation Period	Reviews project intent document and provides comments to ESCO.	Reviews project intent document and provides comments to customer for transmittal to ESCO.	Drafts project intent document reviews with customer and uses PI for DES ECM development.
Complete DES, Final Proposal (FP) Prepared and Issued	Agency witnesses baseline measurements as required. Provides input to ESCO as necessary.	DOE/PF provides support to agency on Cx questions.	Prepares and issues FP. Project intent revised based on ECM selection and final DO guidance. Outline of Cx Plan provided with FP.
DES/FP Review	Reviews proposal using PI document as guide. Also reviews Cx plan and provides comments to ESCO. Agency witnesses baseline measurements as required.	PF reviews FP using tools and PI document, provides comments to agency and consolidates comments for agency as requested.	Responds to comments and revises final proposal.

Activity	Agency	DOE/PF	ESCO
Phase 4			
Post Award (Construction) Kickoff Meeting	Agency hosts meeting, assigns Cx representative, reviews Cx activities for construction.	PF participates. Provides draft agenda if requested.	Reviews Cx activities and assigns Cx agent for project.
Design	Agency reviews design against project intent and provides comments/approves design package.	PF participates in design review if part of statement of work.	ESCO integrates Cx process and project intent with Design.
Equipment Submittals	Agency reviews equipment submittals and provides comments/approves equipment submittals against PI.	PF participates in equipment review if part of statement of work.	ESCO integrates Cx process and PI requirements with suppliers.
Installation	Agency coordinates access and necessary outages – inspects installations and witnesses selected performance testing as required, provides punch list items to ESCO.	PF participates in installation activities if part of statement of work.	ESCO integrates Cx process and PI requirements with construction contractors.
Training	Reviews, provides comments and participates in training sessions.	Reviews training plan and provides comments to agency.	Issues training plans as outlined in FP, schedules training and provides training aids.
Commissioning (Cx)	Agency reviews and approves Cx plan and staff participates in performance and witness of activities.	PF participates in Cx if part of statement of work.	Cx agent provides and executes Cx plan, coordinates customer activities.
Project Acceptance	Agency accepts project according to acceptance plan.	PF reviews acceptance plan and provides comments to agency.	ESCO provides acceptance plan, incorporates customer comments and executes.
Post Installation O&M/M&V report.	Agency reviews and approves and payments begin. Measurements are witnessed as required.	PF reviews and provides comments to agency.	ESCO prepares, performs measurements and incorporates customer comments.
Post Install	Participates in seasonal testing – reviews and provides comments to final Cx report.	PF reviews and provides comments to agency.	Conducts seasonal testing – submits final Cx report and incorporate customer comments.
1st Year M&V Review	Agency Team reviews against final proposal and post installation report and provides comments to ESCO. Agency witnesses measurements as necessary.	PF reviews against final proposal and post installation report and reviews with customer prior to customer discussions with ESCO.	ESCO visits site, takes measurements, inspects equipment and records, issues report and responds to customer comments.