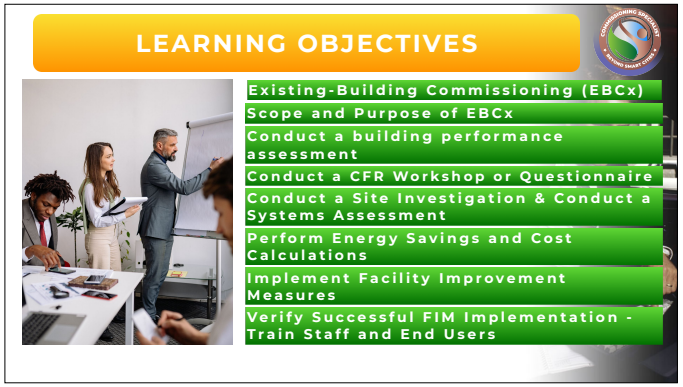

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GREEN BUILDING COMMISSIONING
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LEARNING OBJECTIVES
Existing-Building Commissioning (EBCx)
Scope and Purpose of EBCx
Conduct a building performance assessment
Conduct a CFR Workshop or Questionnaire
Conduct a Site Investigation & Conduct a Systems Assessment
Perform Energy Savings and Cost Calculations
Implement Facility Improvement Measures
Verify Successful FIM Implementation - Train Staff and End Users

SCOPE AND PURPOSE OF EBCX

Existing-Building Commissioning (EBCx) is similar in intent to new construction commissioning. Its purpose is to investigate, verify, improve, and optimize system performance. However, because Owners and project stakeholders are planning and executing the process within an operating—or even occupied—facility, the process differs in both scope and sequence.

Existing Building Commissioning (EBCx) is a systematic process for planning, assessing, investigating, analyzing, improving, optimizing and verifying the performance of building systems and assemblies.



The purpose of EBCx is most often to address facility conditions such as:

- ☑ A change in building use, ownership or functional requirements.
- ☑ The building uses more energy than it should or has in the past.
- ☑ The building has problems that impact the occupants or functional program.
- ☑ The systems and assembles are in poor condition, or don't perform properly.
- ☑ An addition or alteration to the building.

EBCX PROCESS DESCRIPTION

EBCx is generally conducted in six phases, described as follows. In small projects, Phase 2 Initial Assessment and Phase 3 Investigation often occur together:



- ☑ Planning. Initial project documentation gathering and assessment forms the basis for developing the EBCx goals, facility requirements, and Commissioning Plan.
- ☑ Initial Assessment. Initial walk-through of the building to note and confirm current condition of systems and equipment, document known issues, identify other potential issues, interview building staff and occupants, and prepare an initial EBCx Plan.
- ☑ Investigation. Field observation and testing of system operation, interviewing facility staff, reviewing equipment and building documentation, confirmation of adequate preventive maintenance plans,

EBCX PROCESS DESCRIPTION +



- ☑ Implementation: Initiation and completion of desired energy conservation measures (ECMs) and facility improvement measures (FIMs), and verification of results and performance.
- ☑ Hand-Off : Systematic transition from a commissioning activity and commissioning team to normal operating practice and the O&M team.
- ☑ Ongoing Commissioning (OCx): The continuous process that helps to monitor and ensure effective and efficient building performance over its lifecycle. Energy use, benchmarking, conformance to and continuous revision of the current facility requirements, automated fault detection and diagnostics, and training are all key parts of the ongoing commissioning process.

During the hand-off phase, a formal training session helps users to understand the EBCx findings, the how and why of implemented changes, as well as the methods to control and maintain integrated systems.

CONDUCT A CFR WORKSHOP OR QUESTIONNAIRE

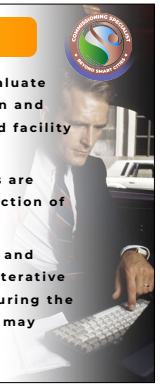


- The CFR workshop is typically facilitated by the Commissioning Provider (CxP), who determines the primary concerns of the project team.
- The workshop is organized to encourage identification of all requirements, interaction and discussion among all team members, and group consensus of priorities for the CFR.

The CFR typically includes:

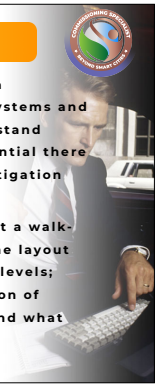
- User-Occupant,Owner-Directed ,Specific Facility and Sustainability Requirements.
- Equipment and System Maintainability Requirements
- Capabilities of Operators and Maintenance Team Regulatory Requirements
- Ongoing Commissioning (OCx) Requirements
- Financial Requirements and Investment Criteria
- Building-wide and zonal/space information

CONDUCT A SITE INVESTIGATION



- The objective of the investigation phase is to further evaluate systems and equipment in detail to verify proper operation and identify specific energy conservation measures (ECMs) and facility improvement measures (FIMs).
- The findings, recommendations, and subsequent analysis are presented to the Owner for further prioritization and selection of measures for implementation.
- The current operation and performance are documented and compared to the CFR. The EBCx process is intended to be iterative and flexible; therefore, some implementation may occur during the Investigation Phase and, conversely, further investigation may occur during the Implementation Phase.

CONDUCT A SYSTEMS ASSESSMENT



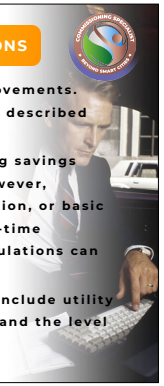
- The objective of the initial assessment phase is to gain a preliminary understanding of how and why the building systems and equipment are currently operated and maintained, understand areas of performance concerns, determine how much potential there might be for improvement, and where to focus later Investigation Phase efforts.
- The CxP and facility staff assigned to the project conduct a walk-through of all major spaces to gain an understanding of the layout of the building; types and condition of spaces; occupancy levels; lighting and controls; location of equipment rooms; location of documentation; the building automation system, its age and what it controls; and general condition of equipment.

CONDUCT DETAILED SITE SURVEY



- The site survey is based on a detailed assessment focusing on original areas of concern and items discovered during occupant interviews, drawing review, and review of additional building documentation.
- The detailed site review includes examination of physical condition and review of system performance. The condition review evaluates appearance, physical damage, whether equipment is in need of maintenance, new features, or changes of use. Performance based evaluation includes how system and components are operated compared to CFR requirements or expected or good practice.

PERFORM ENERGY SAVINGS AND COST CALCULATIONS



- Energy savings are estimated for potential facility improvements. Complete savings calculations as most appropriate and as described in the EBCx Plan.
- Best practice does not spend excessive time in improving savings accuracy at the expense of other important activities. However, custom weather bin spreadsheet, hourly computer simulation, or basic engineering calculations, local weather data, or even real-time weather data that coincides with trend data used for calculations can be helpful to ensure accuracy of calculation estimates.
- Factors that impact calculation methodology rigor may include utility program requirements if applicable, Owner expectations, and the level of investment required for measure implementation.

IMPLEMENT FACILITY IMPROVEMENT MEASURES



The objectives of the implementation phase are to implement the approved ECMs and FIMs and confirm they are operating correctly. Implementation Phase Cx tasks include these activities:

- Prepare an Implementation Plan
- Implement Selected FIMs
- Verify Successful FIM Implementation
- Adjust Energy Savings Estimates and Measure Costs
- Review and comment on remediation designs by a design professional
- Execute Measurement and Verification Plan and Metering (If in Scope)
- Update EBCx Documentation/Prepare Implementation Phase Summary Report
- Plan for Ongoing Commissioning
- Obtain Owner Acceptance and Written Decision to Proceed

IMPLEMENT PERFORMANCE TRACKING

The CxP shall work with the project team to document and record the results and outcome of the implemented ECMs and FIMS.

Verification of the implementation shall be done using a combination of methods including: Performing focused functional performance testing (FPT) of the implemented ECMs and FIMs, using a formal FPT procedure; analyzing utility bill data, analyzing BAS or data logger trend data or reports; or other data collected to demonstrate that the desired outcomes and improvements successfully achieve the anticipated outcomes.

If the verification analysis of testing or trending does not show that the improvements were successful, the CxP shall work with the project team to analyze the system/equipment and determine the cause for the discrepancy, document the deficiencies found, and prepare a corrective action plan.

TRAIN STAFF AND END USER

- ☑ Training should be pervasive throughout the commissioning process. At the hand-off phase, conduct formal training to ensure operations staff understand the EBCx findings and implemented changes.
- ☑ Training may also include the end users for ECMs and FIMs that impact or are directly controlled by the end user occupants, examples of these include upgraded thermostats or lighting controls in which the occupants will directly control and adjust.
- ☑ Verify Training Effectiveness. Ensure that operators have sufficient knowledge of the systems and EBCx changes to maintain optimum building operation. Verify that the training has accomplished these objectives through the use of quizzes, training evaluations by the trainees, or field observations of the training.

