COMMISSIONING for LEED
New and Existing Buildings
What is Commissioning?

The Commissioning Process is Quality Assurance in Building Construction
Why Commissioning Now?

- High Performance Buildings
  - Sealed, Energy Efficient (by Code), Secure
- Cutting Edge Equipment
  - Microprocessor Controlled
- Intermixing Systems
Changing Roles in Construction

- Buildings Built 95% Complete
- O&M Staff Fixes the Rest
- Engineers Rely on Sales Reps
- Sales Reps Rely on the Factory
- Factories are “Beta-Testing Equipment”
Will Occupants Commission Your Building?

- Low Productivity
- Poor Morale
- Absenteeism
- Sick Leave
- Medical Claims
- Litigation
Managing the Cx Project 3 Stages

- Design
- Construction
- Occupancy
Cx is Not a Punchlist
ASHRAE Cx During Planning/Design

- Design Intent
- Commissioning Plan
- Drawing Reviews
- Commissioning Specifications
- Pre-Bid Conference
Cx During Construction

- Contractor Kick-off Meeting
- Submittal Review
- Static Inspection / Start-up
- Functional Testing
- O&M Manuals
- Training—Videotaped by CxA
Cx During Occupancy

- The Commissioning Report
- Trend-logging
- Off-season Testing
- Warranty Review
Commissioning Benefits
Berkeley National Laboratory Study

- 224 Buildings
- 30 million sf Floor Area
- 21 States
- 6800 Deficiencies Found and Corrected
NEEA Building Study

- 13 New Commissioning projects
- 1.4 million square feet
- Offices, schools, hospitals, prisons
- 5 states, 1998-2003
- 5.6 year payback not including productivity, sick leave or liability
Leadership in Energy and Environmental Design

• Current Programs:
  LEED-NC  LEED-EB
  LEED-CI
  LEED-CS
  LEED for Schools

• Pilot Phase or Public Comment programs:
  – LEED for Retail—New Construction
  – LEED for Retail—Commercial Interiors
  – LEED for Healthcare
  – LEED for Homes (No Cx)
  – LEED for Neighborhood Development (No Cx)
The LEED Rating Systems

- Sustainable Sites
- Water Efficiency
- Energy & Atmosphere
  - Pre-1-Fundamental Systems Cx
  - Cre-3-Additional Cx
- Materials & Resources
- Indoor Environmental Quality
- Innovation & Design Process
Pre-1-Fundamental Systems Cx
New Construction

1. Designate a CxA to lead the Cx process

2. Owner documents the Owner’s Project Requirements (OPR), design team develops the Basis of Design (BOD), CxA reviews

3. Develop and incorporate Cx specifications

4. Develop and implement Cx plan.

5. Verify the installation and performance (training moved)

6. Complete a summary commissioning report.
## Primary Responsibility

<table>
<thead>
<tr>
<th>Task</th>
<th>Responsible Parties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Designate a CxA to lead the Cx process</td>
<td>Owner and Design Team</td>
</tr>
<tr>
<td>Owner’s Project Requirements (OPR)</td>
<td>Owner, Design Team, CxA</td>
</tr>
<tr>
<td>Basis of Design (BOD)</td>
<td>Design Team</td>
</tr>
<tr>
<td>Develop and incorporate Cx specifications</td>
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</tr>
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</tr>
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<td>CxA, Contractors</td>
</tr>
<tr>
<td>Complete a summary commissioning report</td>
<td>CxA</td>
</tr>
<tr>
<td>Focused design review prior to CD phase</td>
<td>CxA, Design Team</td>
</tr>
<tr>
<td>Review the CDs before completion</td>
<td>CxA, Design Team</td>
</tr>
<tr>
<td>Selective review of submittals</td>
<td>CxA, Contractors</td>
</tr>
<tr>
<td>Develop a Re-commissioning manual</td>
<td>CxA, Contractors</td>
</tr>
<tr>
<td>Contract for post occupancy review</td>
<td>CxA, Owner</td>
</tr>
</tbody>
</table>
Designate the CA

1. Designate an individual as the Commissioning Authority (CxA) to lead, review and oversee the completion of the commissioning process activities.

As early as possible, ideally during pre-design.

Experience with two other projects of similar managerial and technical complexity. CxA responsible for:

- directing the commissioning team and process in the completion of the commissioning requirements
- coordinating, overseeing, and/or performing the commissioning testing and
- reviewing the results of the systems performance verification
The Owner shall document the Owner’s Project Requirements.

The design team shall develop the Basis of Design.

The CxA shall review these documents for clarity and completeness.

The Owner and design team shall be responsible for updates to their respective documents.
Develop and incorporate commissioning requirements into the construction documents. Typically the project specifications are used to inform the contractor(s) of their responsibilities in the commissioning process.

- Avoid telling the contractor the work of others
- Includes Divisions 1, 15, 16 and 17
- Reference each section with commissioned equipment
Prepare a Cx Plan

Overview of Cx as Quality Assurance

Systems to be Commissioned

Team Members

Commissioning Activities
Verify Installation and Performance

- Installation Checklists
- Installation Back-checks
- Pre-Start Checks
- Start-up
- Functional Checks
Summary Cx Report

• Executive summary of the process
• A history of any system deficiencies
• Systems performance test results and evaluation
• Supporting information

In addition, for projects pursuing EA Credit 3

• A summary of the design review process
• A summary of the submittal review process
• A summary of the O&M documentation and training process
Credit 3—Enhanced Commissioning

1. Designate an Independent CxA
2. Review Construction Documents
3. Review Contractor Submittals
4. Develop a Systems Manual
5. Verify Training of O&M Personnel
6. Post Occupancy Review and Plan
Designate the CxA

Prior CD phase, designate an independent CxA

• The CxA shall have documented CxA experience in at least two building projects
• The individual serving as the CxA shall be independent
• The CxA shall report directly to the Owner.
• This requirement has no deviation for project size
• CxA shall perform Tasks 2, 3 and 6. Other team members may perform Tasks 4 and 5
Review Construction Documents

Review specifications and plans prior to “CD” phase
Back-check prior to completion of design
Review contractor submittals applicable to systems being commissioned for compliance with the OPR and BOD.

- Meeting the OPR and BOD
- Operation and maintenance requirements
- Facilitating performance testing

The CxA review of contractor submittals does not, typically, substitute or alter the scope or responsibility of the design team's obligations to approve or reject submittals. Not for any other design team responsibilities, either!
Systems Manual

Develop a systems manual that provides future operating staff the information needed to understand and optimally operate the commissioned systems.

In addition to the O&M Manuals submitted by the Contractor Focuses on operating, rather than maintaining the equipment Particularly interactions between equipment.

System single line diagrams

Operating instructions for integrated building systems
Verify Training

Verify that the requirements for training operating personnel and building occupants are completed.

Based on the particular project, establish and document training expectations and needs with the Owner. Ensure that operations staff and occupants receive this training and orientation.

Pay particular attention to new or uncommon sustainable design features that may have a potential to be over-ridden or removed because of a lack of understanding. Document that the training was completed according to the contract documents.
Post Occupancy Review

Assure the involvement by the CxA in reviewing building operation within 10 months

Interview with O&M staff and occupants

Plan for resolution of outstanding issues
LEED for Existing Buildings
Operations and Maintenance

- Passed by vote of members, January, 2008
- EA Credit 2.1—Investigation and Analysis
- EA Credit 2.2---Implementation
- EA Credit 2.3---Ongoing Commissioning
- Pre-1, Pre-2, credits 1, 3.1, 3.2, 3.3 (M&V), 4.1-4.4 (Renewable) & IEQ Credits also require Cx
**LEED EB: O&M**

**EA Credit 2.1— Investigation and Analysis**

Intent—Develop an understanding of the building’s systems

**Option A:**
- EB Cx plan and conduct investigation and analysis
- Breakdown energy use from Pre-Req 1, ASHRAE Level I Energy Audit
- List occupant problems and capital improvements

**Option B:**
- Conduct an ASHRAE Level II Energy Audit
- Savings and cost analysis of all practical measures—fit owner’s programs
- List capital improvements that provide cost-effective savings
LEED EB: O&M
EA Credit 2.2—Implementation

• Implement low-cost/no-cost projects from Credit 2.1
• Provide staff training
• Demonstrate savings from measures
• Update the building operating plan
LEED EB: O&M
EA Credit 2.3—Ongoing Commissioning

• Implement a continuous commissioning program
• Cycle less than 24 months
• Complete at least half of work before applying for LEED-EB
• Update the building operating plan
LEED EB: O&M
Plus Other Credits Requiring Cx

- Pre-1, Pre-2
- Credit 1 (energy)
- Credits 3.1, 3.2, 3.3 (M&V)
- Credits 4.1-4.4 (Renewable)
- IEQ Credits
Thank You For Coming!

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