



An Introduction to The Commissioning Process

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TOTAL BUILDING COMMISSIONING

**An owner's quality process
for delivering better buildings
at lower cost.**



The Five Basic Questions About Commissioning

Who, What, When, Where, Why



Brief History of Commissioning (Cx)

- 1977 – Public Works Canada begins using Cx**
- 1981 – Disney includes Cx for the Epcot Center**
- 1984 – ASHRAE forms Cx Guideline Committee**
- 1989 – ASHRAE publishes HVAC Cx Guideline**
- 1993 – 1st National Conference on Building Cx**
- 1996 – ASHRAE Guideline 1 – HVAC Cx Process**
- 1998 – Building Commissioning Assoc. formed**
 - USGBC includes Cx as basic requirement**
- 2009 – Green Energy Code in development**
 - (ASHRAE Standard 189.1 – Requires Cx)**



Who

A Team Effort

- The Cx team includes the Commissioning Authority (CxA), owner, design team & contractor at a minimum, plus other parties as needed.
- The CxA should be independent of the design and construction team.
- The CxA should work directly for the owner.
- The CxA is the owner's advocate.



Commissioning Authority Definition

An entity identified by the Owner who leads, plans, schedules and coordinates the commissioning team to implement the Commissioning Process.

Ref.: ASHRAE Guideline



What Is Commissioning?

Commissioning Process Definition

A quality-focused process for enhancing the delivery of a project. The process focuses upon verifying and documenting that the facility and all of its systems and assemblies are planned, designed, installed, tested, operated, and maintained to meet the Owner's Project Requirements.

Ref: ASHRAE Guideline 0-2005



What is Commissioning?

Commissioning is a quality-assurance process that can be incorporated into building design and construction to meet the following objectives:

1. Verify that design intent is accomplished
2. Assure that systems operate as intended
3. Validate system performance
4. Document decisions and basis of design
5. Calibrate baseline measurement of system performance
6. Train operations staff



Commissioning vs. Testing, Adjusting and Balancing (TAB)

- Building Commissioning goes beyond TAB and traditional inspections
- In the case of direct digital controls (DDC), it usually includes point-to-point (PTP) testing over and above normal testing
- Functional Performance Testing (FPT) is normally included for all operating systems to determine how well mechanical and electrical systems work together.
- These non-TAB activities are not, as many owners and managers believe, part of the typical design and construction process or part of standard O&M service contracts.



What

Communication, Documentation, Verification

- Define owners project requirements (OPR) or design intent
- Document basis of design
- Review of design documents
- Construction verification and testing
- Systems (O&M) manual
- Re-commissioning manual
- Comprehensive training review and coordination
- Warranty review and lessons learned
- Continuous commissioning



Different Types of Commissioning

- Functional Performance Testing
- Total Building Commissioning
- HVAC System Commissioning
- Re-Commissioning
- Continuous Commissioning
- Existing Building Commissioning (also known as Retro-Commissioning)



Typical Systems/Equipment to be Commissioned

Mechanical Systems

- HVAC (Heating, Air Conditioning, Ventilation, Ducting & Accessories)
- Piping Systems (Pipe, Valves, instrumentation, etc.)
- Plumbing (Energy using equipment, critical systems)
- DDC Controls (Software programming and Hardware)

Electrical Systems

- Switchgear/Transformers
- Grounding/Bonding
- Circuiting
- Lighting and lighting control

Specialty Systems

- Security Systems and Fire Alarm
- Voice/Data Systems
- Building Envelope
- Special process systems



When

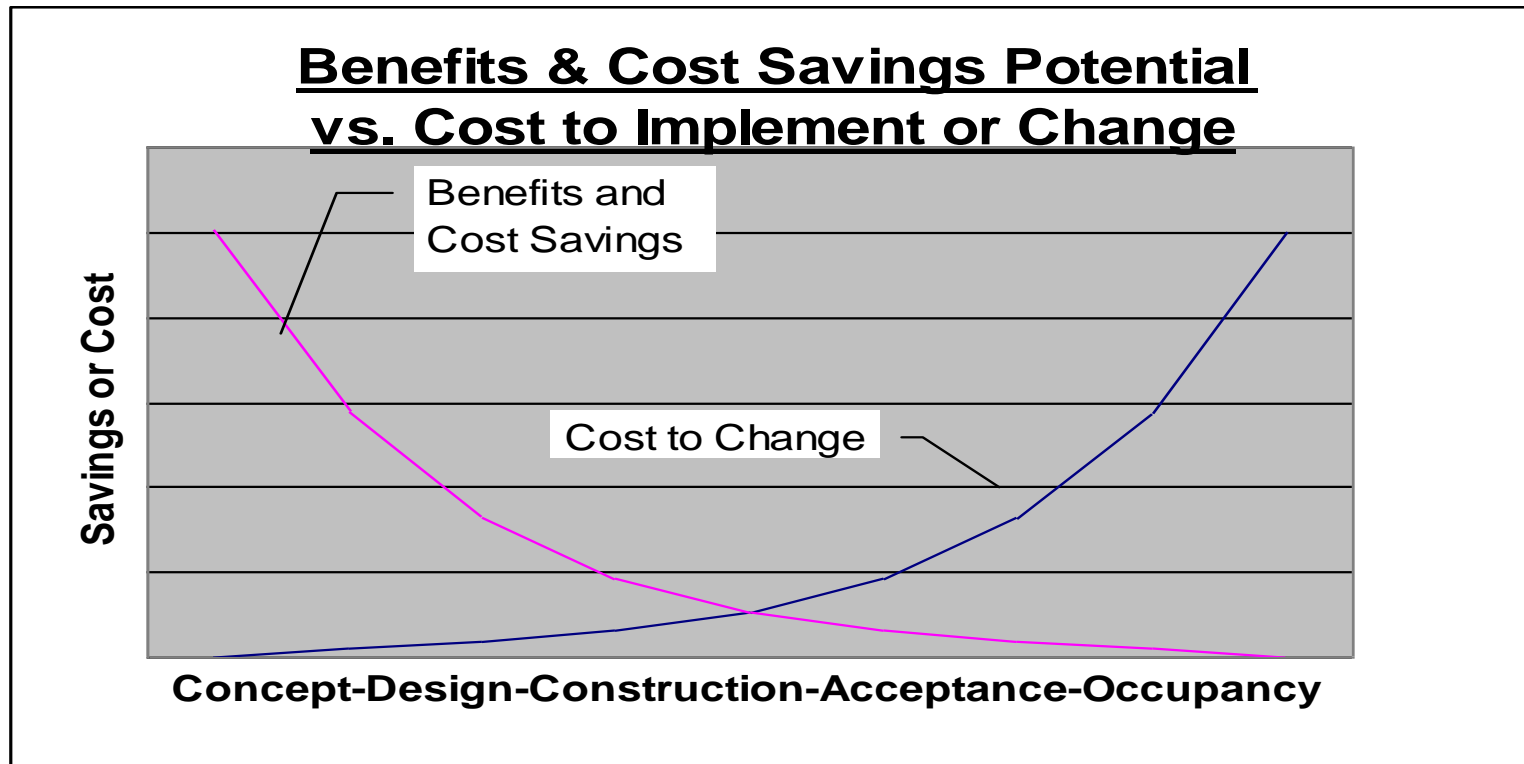
Is It Time To Do Commissioning?

Beginning To End

- Planning
- Design
- Construction
- Turnover
- Occupancy



When





LEED Green Building Cx

<u>Standard Design Phases</u>	<u>Recommended Commissioning Process Item</u>	<u>LEED Fundamental Commissioning</u>	<u>LEED Additional Commissioning</u>	<u>Who Develops?</u>
Pre-Design	Prepare Owner's Project Requirements Document (Design Intent)	CxA Reviews		Owner CxA may help
Planning	Preliminary Cx Plan	Required at some point		CxA prepares



LEED Green Building Cx

<u>Standard Design Phases</u>	<u>Recommended Commissioning Process Item</u>	<u>LEED Fundamental Commissioning</u>	<u>LEED Additional Commissioning</u>	<u>Who Develops?</u>
Design Phase	Design Checklists			A/E & CxA
	Basis of Design	Required CxA reviews		A/E prepares
	Design Review		Required	CxA, 2 reviews
	Cx Input into Specifications	Required		A/E & CxA
	Specification Review		Required	CxA, 2 reviews
	Update OPR	Required		CxA & Owner
	Update Cx Plan	Required		CxA



LEED Green Building Cx

<u>Standard Design Phases</u>	<u>Recommended Commissioning Process Item</u>	<u>LEED Fundamental Commissioning</u>	<u>LEED Additional Commissioning</u>	<u>Who Develops?</u>
Construction Phase	Construction Checklists			Not defined
	Periodic Site Visits			Not defined
	Submittal Review		CxA Reviews	For identified systems
	Installation Quality Verification	CxA verify		CxA verify thru sampling
	Update OPR	Required		CxA & Owner
	Update Cx Plan	Required		CxA
	Functional Testing	CxA verify		Cx Team



LEED Green Building Cx

<u>Standard Design Phases</u>	<u>Recommended Commissioning Process Item</u>	<u>LEED Fundamental Commissioning</u>	<u>LEED Additional Commissioning</u>	<u>Who Develops?</u>
Turnover (part of Construction Phase in ASHRAE/NIBS Guideline 0)	Systems Manual (O&M) Review	CxA verify		Contractor CxA may help
	Systems Training	CxA verify		Contractor CxA may help
	Cx Report	Required		CxA
	Re-commissioning Manual		Required	CxA
	Issues Resolution Plan		Required	CxA



LEED Green Building Cx

<u>Standard Design Phases</u>	<u>Recommended Commissioning Process Item</u>	<u>LEED Fundamental Commissioning</u>	<u>LEED Additional Commissioning</u>	<u>Who Develops?</u>
Occupancy Phase	Seasonal Testing			Not defined
	Follow-up Site visits and Training			Not defined
	10 month Warranty Review		Required	CxA
	Lessons Learned Workshop			Not defined
	Energy Performance Verification			Not defined



Where

Is The Place For Commissioning?

All Building Systems And Components That Make Up The Systems

Typically HVAC systems are the first systems that are thought of when the commissioning process is discussed.

In reality, every system is a candidate for commissioning..

- >Site work
 - >Roofs
 - >LEED Cx – HVAC, Lighting Controls & Plumbing Systems
 - >Elevators
 - >Structure
- >Building Envelope
 - >Electrical Systems



Where

Industry Guidelines Define Locations

- ASHRAE/NIBS Guideline 0-2005 – The Commissioning Process
- ASHRAE Guideline 1-2007 – Commissioning HVAC Systems
- NIBS Guideline 3-2006 – Commissioning Building Envelope Systems
- More to come (Roofs, Elevators, Plumbing, Electrical, etc.)



Why

Benefits For The Building Owner


- More complete design documents
- Fewer RFI's and Change Orders
- Fewer call backs, systems operate as intended
- Satisfied occupants
- More efficient operation
- Easier to maintain systems
- Fewer problems all through the process
- Increase profits for everyone
- Better information for the life of the building



Why should we consider Commissioning for our Project?

Commissioning enhances building performance by:

1. Minimizing energy consumption by ensuring that all systems function in accordance with the design intent
2. Minimizing environmental impacts associated with faulty construction
3. Maximizing occupant healthy and comfort by optimizing system performance
4. Optimizing life-cycle costs by maximizing system performance
5. Improving project delivery and reducing overall cost.



“Commissioning benefits owners’ through improved energy efficiency, improved workplace performance due to higher quality environments, reduced risk from threats, and prevention of business losses. Organizations that have researched commissioning claim that owners can achieve savings in operations of \$4 over the first five years of occupancy as a direct result of every \$1 invested in commissioning—an excellent return on investment. Meanwhile, the cost of not commissioning is equal to the costs of correcting deficiencies plus the costs of inefficient operations. For mission-critical facilities, the cost of not commissioning can be measured by the cost of downtime, which reaches an average of \$26 thousand per hour for the package shipping industry, \$89.5 thousand per hour for airline reservation operations, and \$6.45 million per hour for brokerage operations, according to the research firm Dataquest.”



How

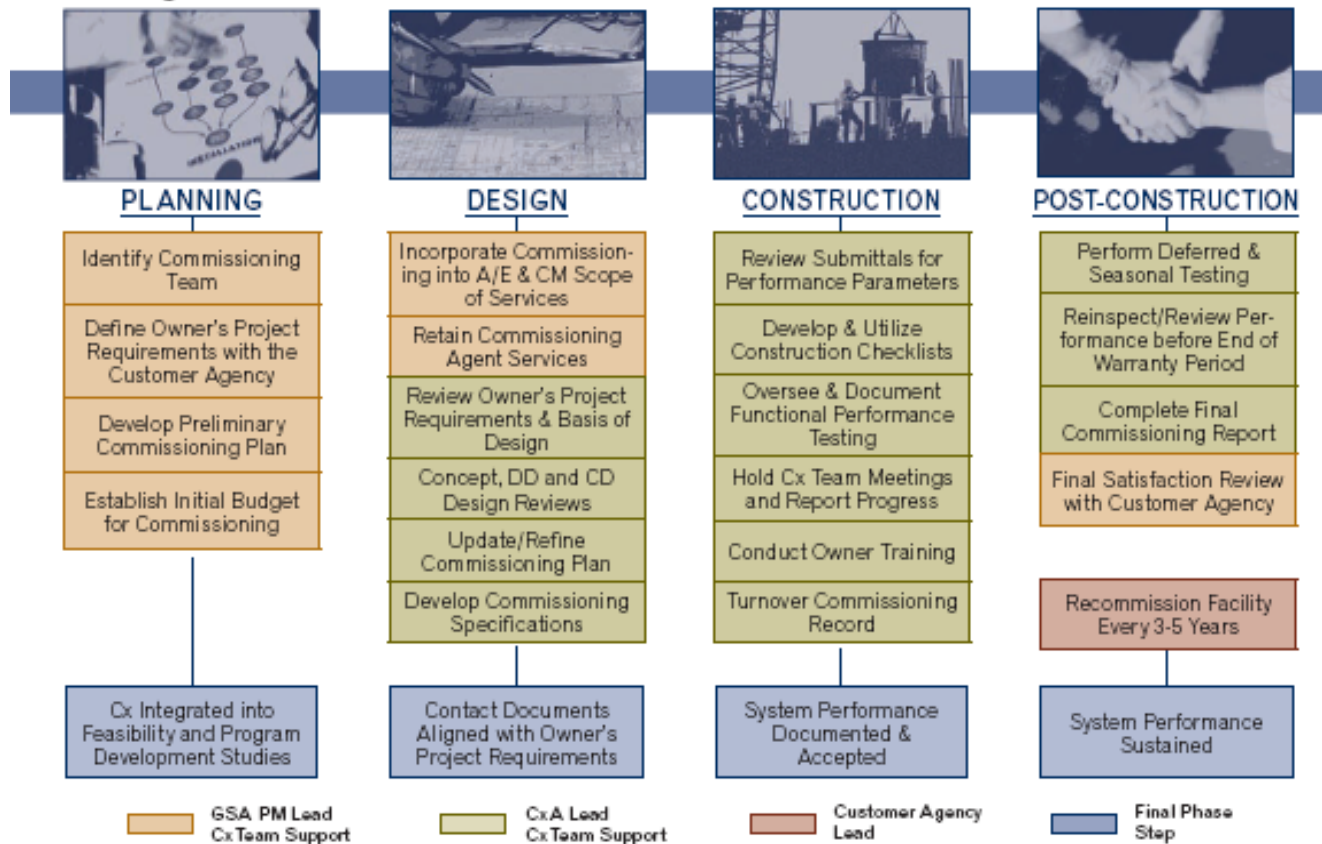
Is Commissioning Done?

ASHRAE Guideline 0

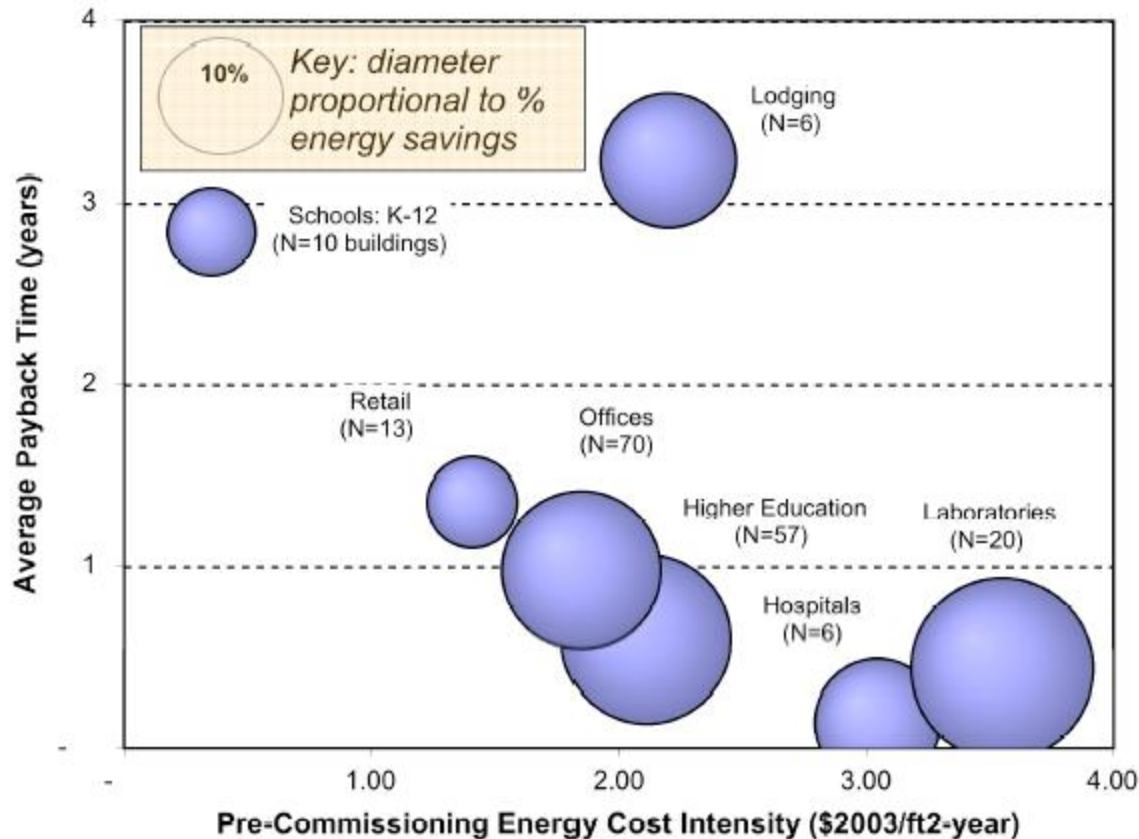
The purpose of this Guideline is to describe the Commissioning Process capable of verifying that a facility and its systems meet the Owner's Project Requirements.



Building Commission Process



From *The Cost-Effectiveness of Commissioning New and Existing Commercial Buildings: Lessons from 224 Buildings* – 2005 National Conference on Building Commissioning





Estimated Commissioning Authority Costs to Owner for Construction and Occupancy / Operation Phases

Commissioned Systems

HVAC and Controls^a

Electrical System^b

HVAC, Controls and Light Electrical

Total Commissioning Cost

2.0 to 3.0% of mechanical

1.0 to 2.0% of electrical

0.5 to 1.5% of construction

^aSource: Wilkinson, R. (2000) Establishing Commissioning Fees, ASHRAE Journal 42 (4):41-47

^bSource: PECl.2000. The National Conference on Building Commissioning Proceedings, Portland Energy Conservation Inc. OR.



The CxE Group LLC Team

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CxE Group LLC brings together a small group of engineers committed to the goal of helping buildings work better through the process now commonly referred to as building commissioning.

Combining years of mechanical and electrical design experience with a special emphasis on energy efficient operation for both new and existing buildings, CxE has focused on refining the methods that ensure successful design, construction and operation of our client's buildings.

CxE Group is a member of the Building Commissioning Association, the ASHRAE Technical Committee on Commissioning, and the U. S. Green Building Council.

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Questions?

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