

# Comissionamento

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Commtech Commissioning Services



# LEARNING OBJECTIVES

## Cx

- Commissioning definitions
- Benefits of New Construction/Major Renovation Commissioning Process
- Owner Project Requirements
- Testing vs Commissioning
- Commissioning opportunity for Existing Buildings
- Encourage the European Building Industry to benefit from commissioning





# ASHRAE POSITIONING DOCUMENTS



ASHRAE Guideline 0-2013  
(Supersedes ASHRAE Guideline 0-2005)

## The Commissioning Process

See Appendix C for approval data by the ASHRAE Standards Committee and the ASHRAE Board of Directors.

This guideline is under continuous maintenance by a Standing Guideline Project Committee (SGPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including provisions for timely, documented, consensus action on requests for change to any part of the guideline. The change addendum form, instructions, and deadlines may be obtained in electronic form from the ASHRAE website ([www.ashrae.org](http://www.ashrae.org)) or in paper form from the Manager of Standards. The latest edition of an ASHRAE Standard or Guideline may be purchased from the ASHRAE website ([www.ashrae.org](http://www.ashrae.org)) or from ASHRAE Customer Service, 1791 Tullie Circle, NE, Atlanta, GA 30329-2205. E-mail: [orders@ashrae.org](mailto:orders@ashrae.org). Fax: 404/835-2726. Telephone: 404/835-4800 (toll-free), or toll-free: 1-800-827-4772 (for orders in US and Canada). For reprint permission, go to [www.ashrae.org/permissions](http://www.ashrae.org/permissions).

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ASHRAE Guideline 6.2-2015

## Commissioning Process for Existing Systems and Assemblies

Approved by ASHRAE on August 31, 2015.

ASHRAE Guidelines are scheduled to be updated on a five-year cycle, the date following the guideline number is the year of ASHRAE approval. The latest edition of an ASHRAE Guideline may be purchased on the ASHRAE website ([www.ashrae.org](http://www.ashrae.org)) or from ASHRAE Customer Service, 1791 Tullie Circle, NE, Atlanta, GA 30329-2205. E-mail: [orders@ashrae.org](mailto:orders@ashrae.org). Fax: 404/835-2726. Telephone: 404/835-4800 (toll-free), or toll-free: 1-800-827-4772 (for orders in US and Canada). For reprint permission, go to [www.ashrae.org/permissions](http://www.ashrae.org/permissions).

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Includes real-world examples that illustrate applications of the Cx Process to various facility systems, or assembly types. Features "Targeted Read"!



ANSI/ASHRAE/IES Standard 202-2018  
(Supersedes ANSI/ASHRAE/IES Standard 202-2013)  
Includes ANSI/ASHRAE/IES addenda based on Appendix A

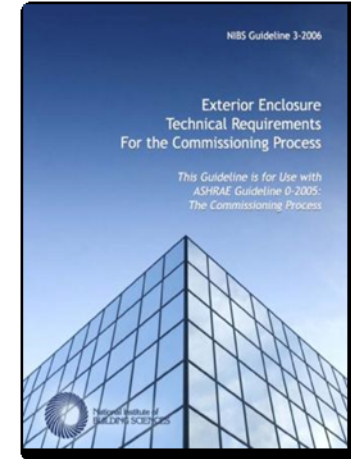
## Commissioning Process for Buildings and Systems

See Information Appendix K for ASHRAE, IES, and ANSI approval dates.

This Standard is under continuous maintenance by a Standing Standard Project Committee (SSPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including provisions for timely, documented, consensus action on requests for change to any part of the Standard. Instructions for how to submit a change can be found on the ASHRAE website ([www.ashrae.org](http://www.ashrae.org)) or on the Standards Committee website.

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NIBS Guideline 3-2006

## Exterior Enclosure Technical Requirements for the Commissioning Process

This Guideline is for use with ASHRAE Guideline 0-2005: The Commissioning Process



ASHRAE Guideline 1.3-2018

## Building Operations and Maintenance Training for the HVAC&R Commissioning Process

Approved by ASHRAE on April 1, 2018.

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ASHRAE Guideline 1.4-2014

## Procedures for Preparing Facility Systems Manuals

Approved by the ASHRAE Standards Committee on June 28, 2014, and by the ASHRAE Board of Directors on July 2, 2014.

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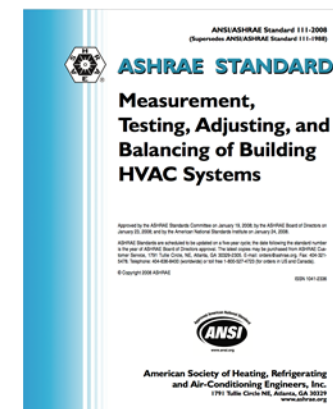
ASHRAE Guideline 1.1-2007  
(Supersedes ASHRAE Guideline 1.1-1998)

## HVAC&R Technical Requirements for the Commissioning Process

Approved by the ASHRAE Standards Committee on June 21, 2007, and by the ASHRAE Board of Directors on June 27, 2007.

ASHRAE Guidelines are scheduled to be updated on a five-year cycle, the date following the guideline number is the year of ASHRAE approval. The latest edition of an ASHRAE Guideline may be purchased on the ASHRAE website ([www.ashrae.org](http://www.ashrae.org)) or from ASHRAE Customer Service, 1791 Tullie Circle, NE, Atlanta, GA 30329-2205. E-mail: [orders@ashrae.org](mailto:orders@ashrae.org). Fax: 404/835-2726. Telephone: 404/835-4800 (toll-free), or toll-free: 1-800-827-4772 (for orders in US and Canada). For reprint permission, go to [www.ashrae.org/permissions](http://www.ashrae.org/permissions).

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ANSI/ASHRAE Standard 111-2008  
(Supersedes ANSI/ASHRAE Standard 111-1988)



## ASHRAE STANDARD

## Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems

Approved by the ASHRAE Standards Committee on January 16, 2008, by the ASHRAE Board of Directors on January 20, 2008, and by the American National Standards Institute on January 24, 2008.

ASHRAE Standards are scheduled to be updated on a five-year cycle, the date following the standard number is the year of ASHRAE approval. The latest edition of an ASHRAE Standard may be purchased from ASHRAE Customer Service, 1791 Tullie Circle, NE, Atlanta, GA 30329-2205. E-mail: [orders@ashrae.org](mailto:orders@ashrae.org). Fax: 404/835-2726. Telephone: 404/835-4800 (toll-free), or toll-free: 1-800-827-4772 (for orders in US and Canada).

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# HIGH-PERFORMANCE BUILDINGS

A high-performance building is a building designed, constructed, and capable of being operated in a manner that increases environmental performance and economic value over time, seeks to establish an indoor environment that supports the health of occupants, and enhances satisfaction and productivity of occupants through integration of environmentally preferable building materials and water-efficient and energy-efficient systems.

*ANSI/ASHRAE/USGBC/IES Standard 189.1-2014, Standard for the Design of High-Performance Green Buildings.*



ASHRAE Headquarters, Atlanta, US



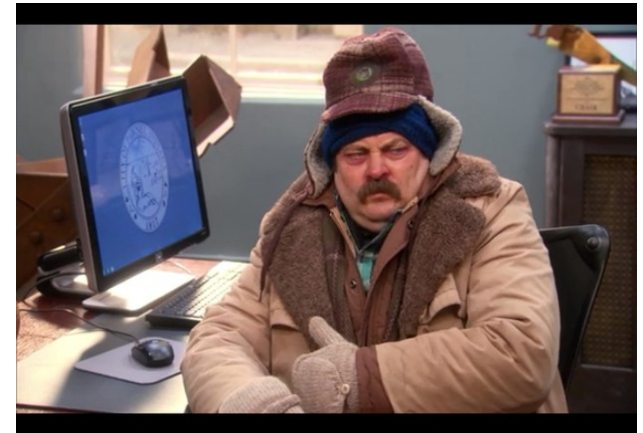
# OUTLINE

Everyone benefits from a well designed, operated and maintained building. There are good reasons for commissioning a building. The primary intention of the Commissioning Process is to ensure building systems provide efficient comfort, reliability, safety and security to occupants, guarantee the building is well-managed by a effectively trained staff and environmentally friendly



# COMMON ISSUES IN NEW CONSTRUCTED OR MAJOR RENOVATED BUILDINGS

- Owner Project Requirements-OPR-NOT well defined
- Gap between OPR vs Basis of Design, BOD
- Design solutions NOT well-communicated to contractors
- Poor construction/testing work
- Poor building performance
- O&M Staff NOT well-trained
- Equipment failure
- Complaints from occupants
- Poor available documentation



**Resulting into inefficient, uncomfortable, unreliable and unmanageable buildings**

# Cx INTERNATIONAL DEFINITIONS: VALUE FOR MONEY

- A quality-focused process focuses verifying and documenting that building and all of its system assemblies and equipment are planned, designed, installed, tested, operated and maintained to meet the Owner's Project Requirements.

**(ASHRAE Guideline 0-2013)**

- The advancement of the installation from the state of static completion to full working order to the specific requirements. It includes the setting up of an installation, the regulation of the system and the fine tuning of the system.

**(CIBSE Commissioning Code M: 200)**

- Cx let me get what I have paid for

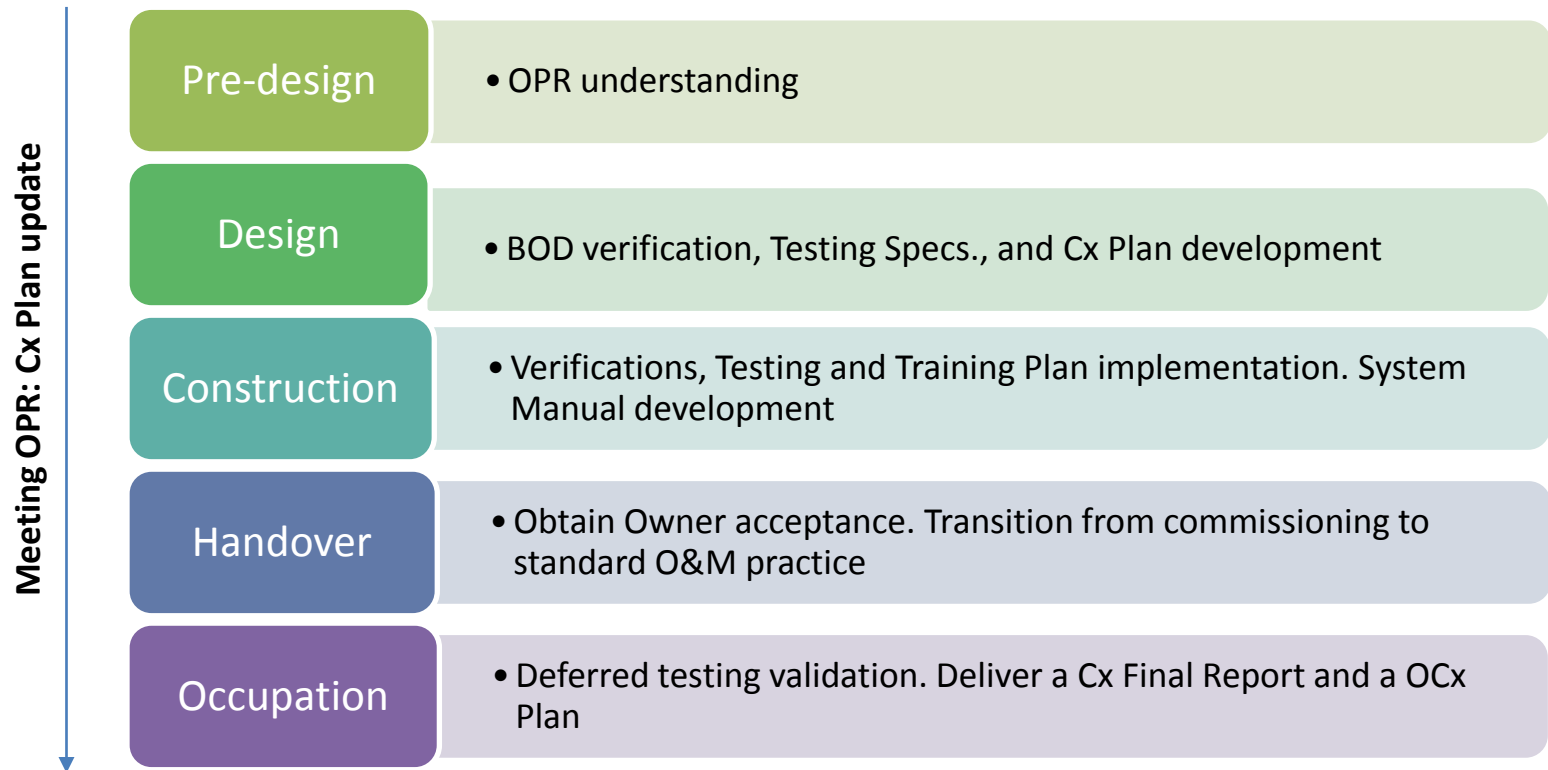


# BUILDING SYSTEMS TO BE COMMISSIONED: Cx ROADMAP

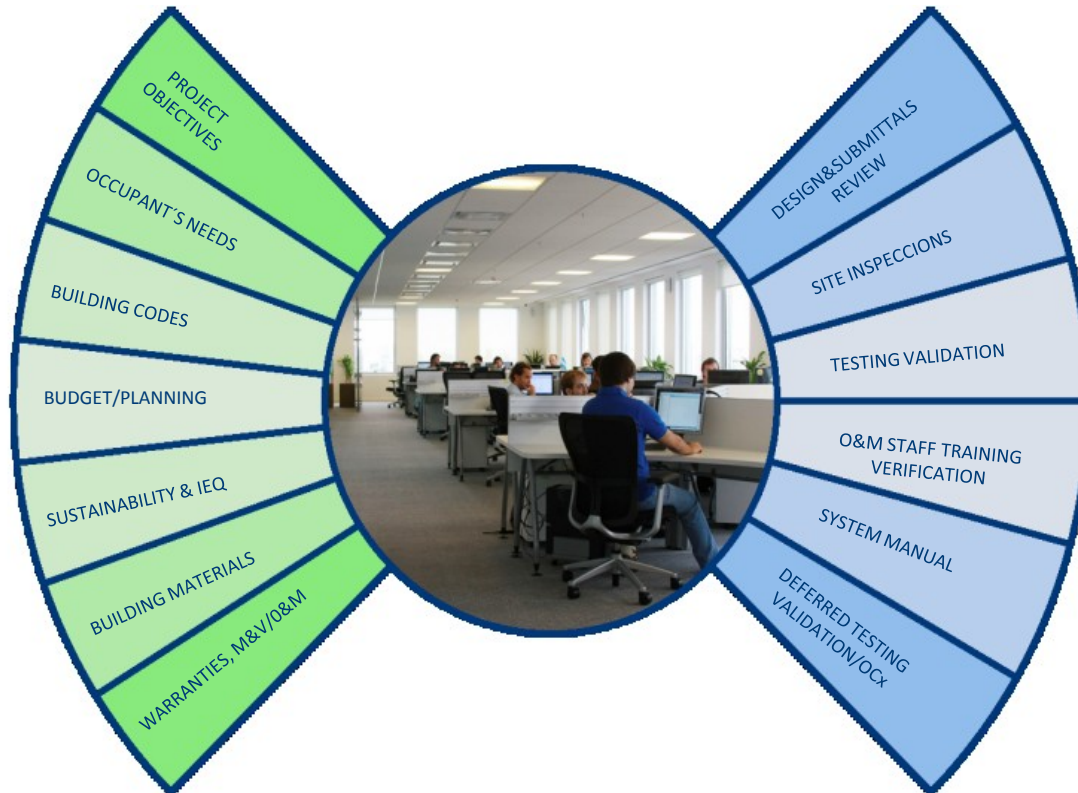
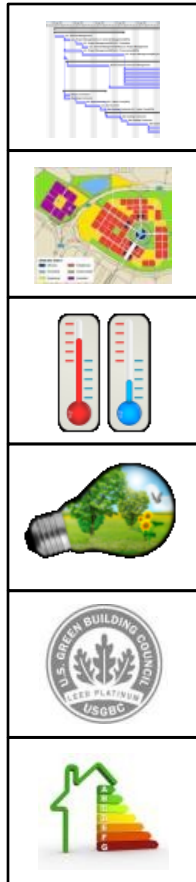




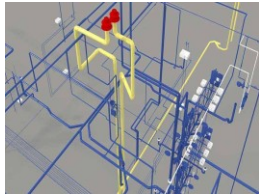
# Cx PROCESS IMPLEMENTATION IN NEW CONSTRUCTION/MAJOR RENOVATION



# OPR DEFINITION vs Cx OBJECTIVES



# COMMISSIONING vs TESTING



CxA role



Engineer's  
role



TAB role

PREDESIGN


DESIGN

CONSTRUCTION

OCCUPATION

# VERIFICATIONS AND TESTING



- Factory Testing, FT
  - Static Testing, ST
  - Pre-functional Verifications, PFV
  - Testing, Adjusting and Balancing, TAB
  - Load Testing, LT
  - Performance Demonstrations, PD
  - System Integration Testing, IST
-  Functional Performance Testing, FPT
- Seasonal Testing, ST

# CX BENEFITS: HIGHER ASSET VALUE

A successful and effective Cx Process delivers a project:

- That reflects the Owner's needs and desires
- That fully works from occupation day 1
- That is well-documented
- Managed by a well-trained O&M Building Staff
- With clear performance benchmarks

Then:

- Sustainability and well-being Certifications
- Smooth handover
- Fewer callbacks
- Improved building occupant comfort, health conditions and productivity
- Lower utility bills thank to energy savings
- Improved building systems reliability and extended LC





# Cx: KEY SUCCESS FACTORS

- Accredited and independent Cx Agent
- Reporting to the Owner
- Support from the Owner
- Cx strategy integration
- Sufficient budget/time to TAB
- Monitor OPR
- Cx Specs in the construction documents
- Design and Submittals review
- Test planning
- O&M Staff onboard previous to Static Completion
- Cooperation of stakeholders in the Cx Process



And document, communicate, document, communicate,...!!!

# COMMON ISSUES IN EXISTING BUILDINGS



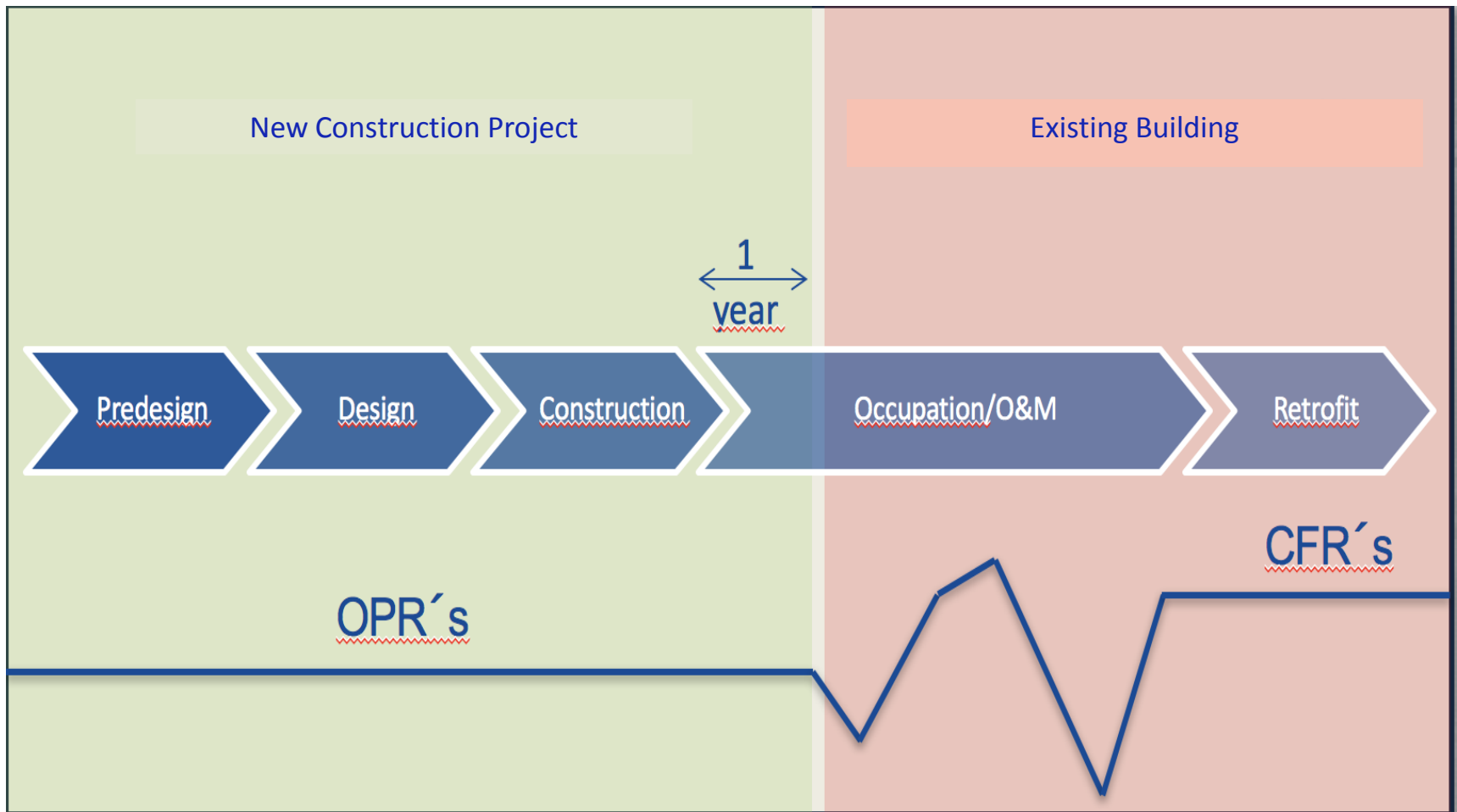
**Many existing buildings even those that were apparently well-built, share common patterns:**

- Wrong design specifications
- Faulty construction work
- Poor start-up
- Inefficient operation
- Ineffective maintenance
- Building performance deterioration
- Not well-trained O&M Staff

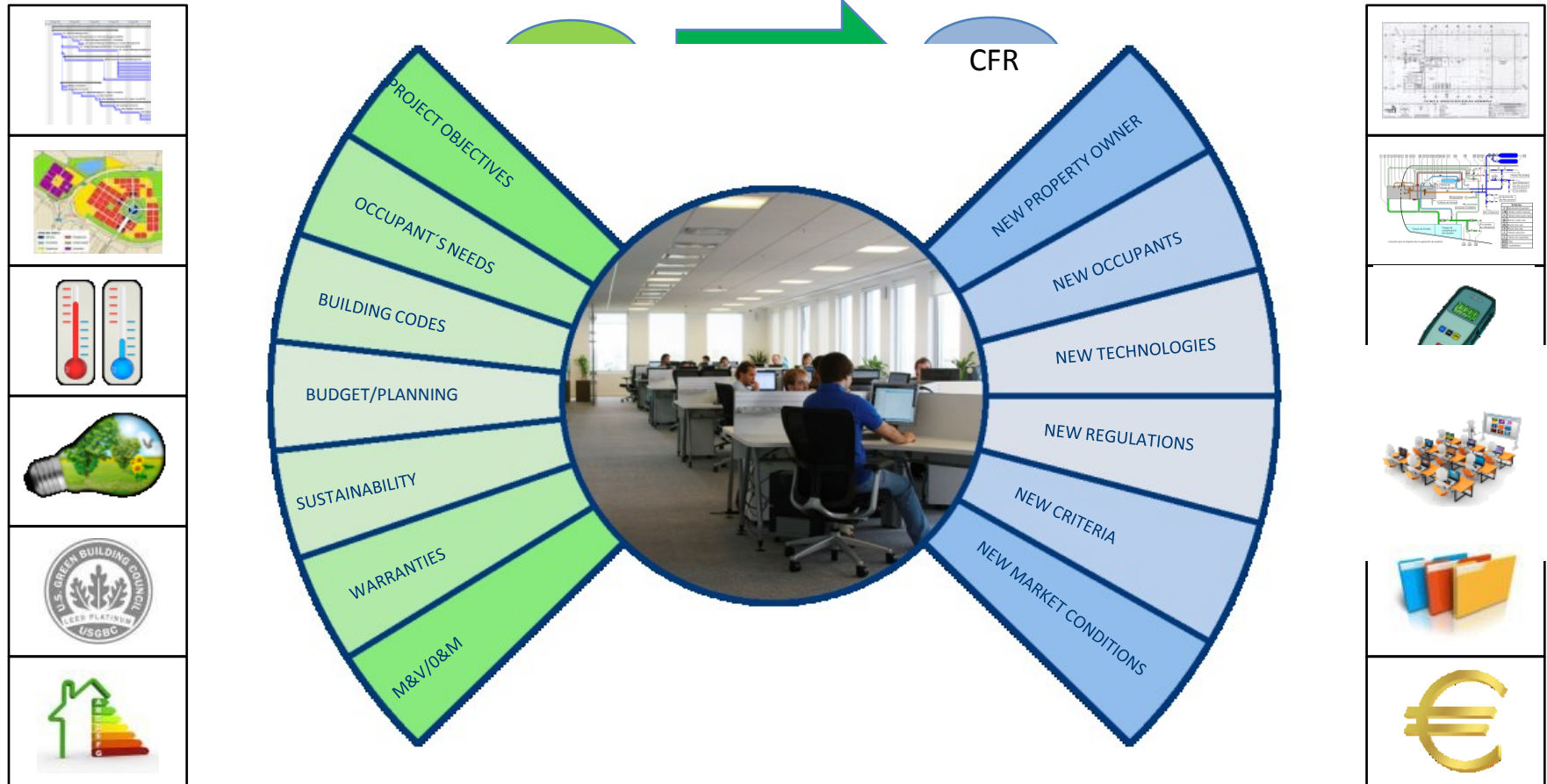
**Resulting into:**

- High operation costs
- Lot of equipment repairs and replacements
- Lot of occupant complains about comfort

# OPR's EVOLUTION: CFR's



# CFR DEFINITION: EVOLVING OPR



# EBCx: INTERNATIONAL DEFINITIONS

- **A** quality-focused process for attaining the Current Facility Requirements, CFR of an existing building and/or its systems and assemblies. The process focuses on planning, investigating, implementing, verifying, and documenting that the building and/or its systems and assemblies are operated and maintained to meet the CFR, with a program in place to maintain the enhancements for its remaining life.

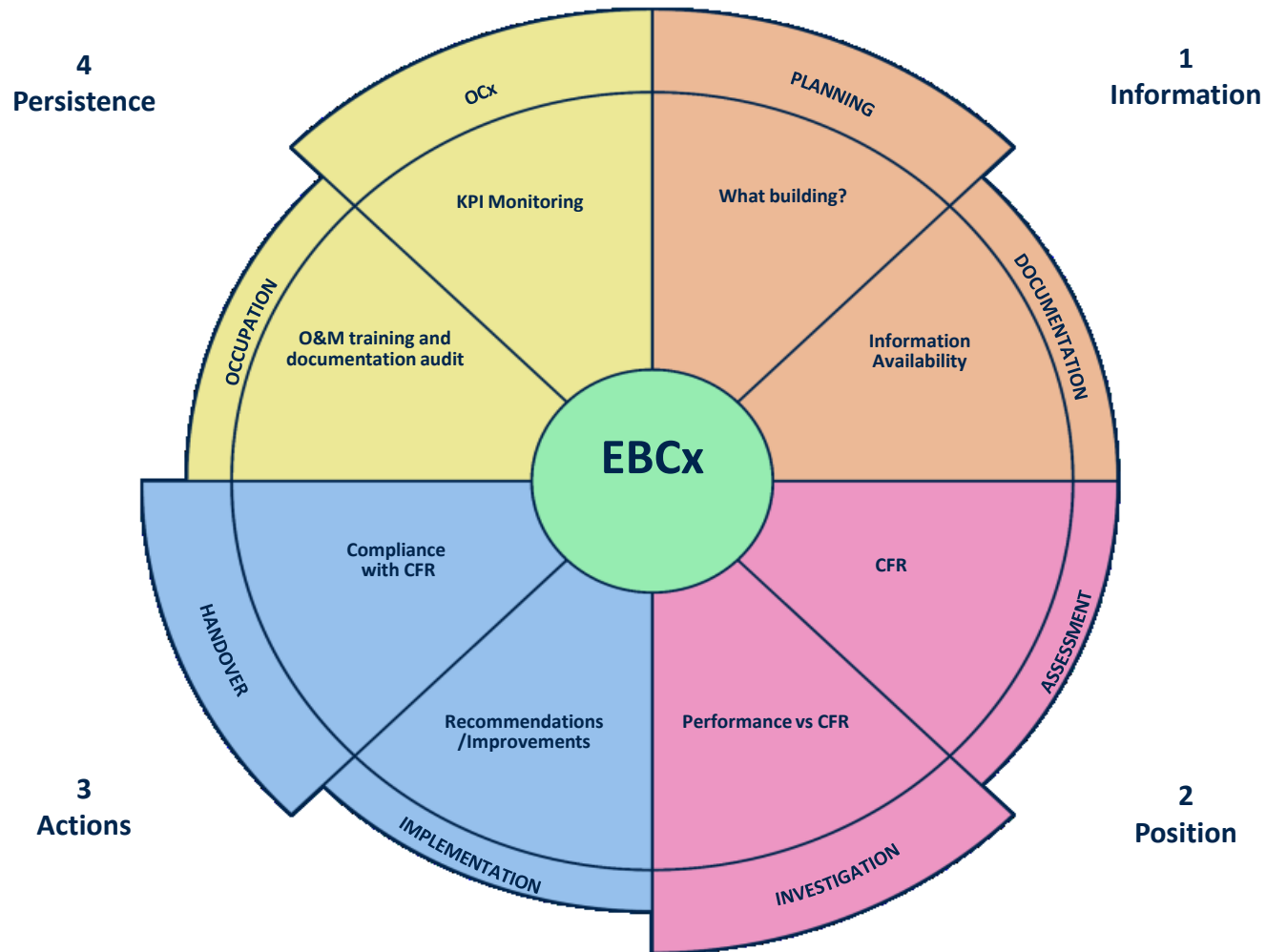
**(ASHRAE Guideline 0.2-2015)**

- **A** systematic process for investigating, analyzing, and optimizing the performance of existing buildings and/or their systems and assemblies through the identification and implementation of low/no-cost Energy Conservation Measures (ECMs) and capital intensive Facility Improvement Measures (FIMs) and ensuring their continued performance.

**(The BCxA Building Commissioning Handbook, 3rd Edition)**



# EBCx PROCESS PHASES



# EBCx: OBJECTIVES

- Verify that a building meets defined CFR
- Save energy and reduce demand
- Solve O&M and controls issues
- Reduce occupants/tenants complaints: improve comfort
- Improve maintenance programmes
- Identify O&M staff training needs
- Extend equipment life cycle
- Ensure persistence of implemented improvements



# EBCx: EXISTING BUILDING SELECTION CRITERIA

- Forget about a small building!!!
- Lot of complaints and frequent equipment breakdown
- BMS with adequate trending capacity
- Available time from O&M staff
- High motivation of the Owner/Manager
- Robust available documentation
- Availability of incentive programmes
- Strong interest in making it more efficient



# EBCx: TYPICAL FINDINGS. IMPROVEMENT OPPORTUNITIES



- Poor performance of critical equipment
- Equipment close to their final life cycle period
- Not well-defined sequence of operations. Building work schedules
- Not tight ductwork
- Pumps and fan oversized
- Unbalanced water and air distribution.
- C/H circuit water temperatures not optimized. Poor chiller/boiler performance
- Unbalanced pressure in the building
- Speed variators set at max. speed
- Poor IEQ
- Poor Maintenance Plan
- Not well-trained O&M Personnel



ORDEM  
DOS ENGENHEIROS  
BASTONÁRIO

20<sup>º</sup> ano OE  
das alterações  
climáticas

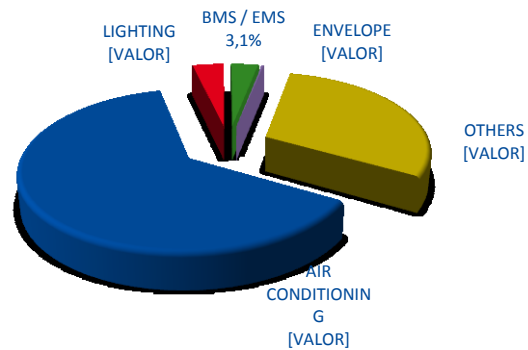


PORTUGAL CHAPTER

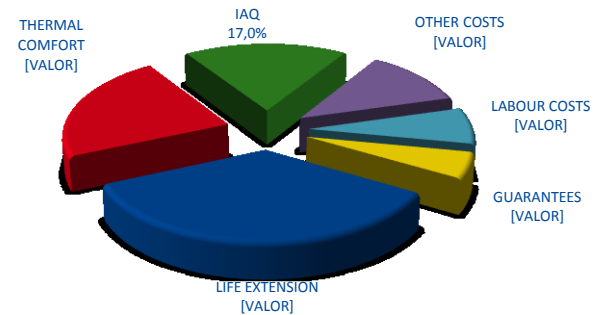


# EBCx: DEFICIENCIES / BENEFITS

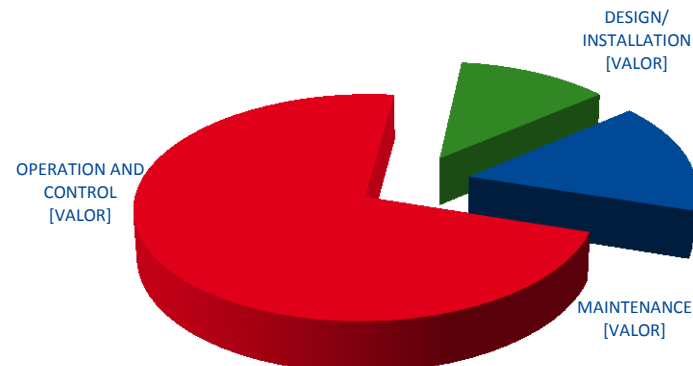
**EBCx: Deficiencies usually identified in Energy Systems**



**EBCx: Energy and non-energy benefits**



**EBCx: Nature of the identified deficiencies**



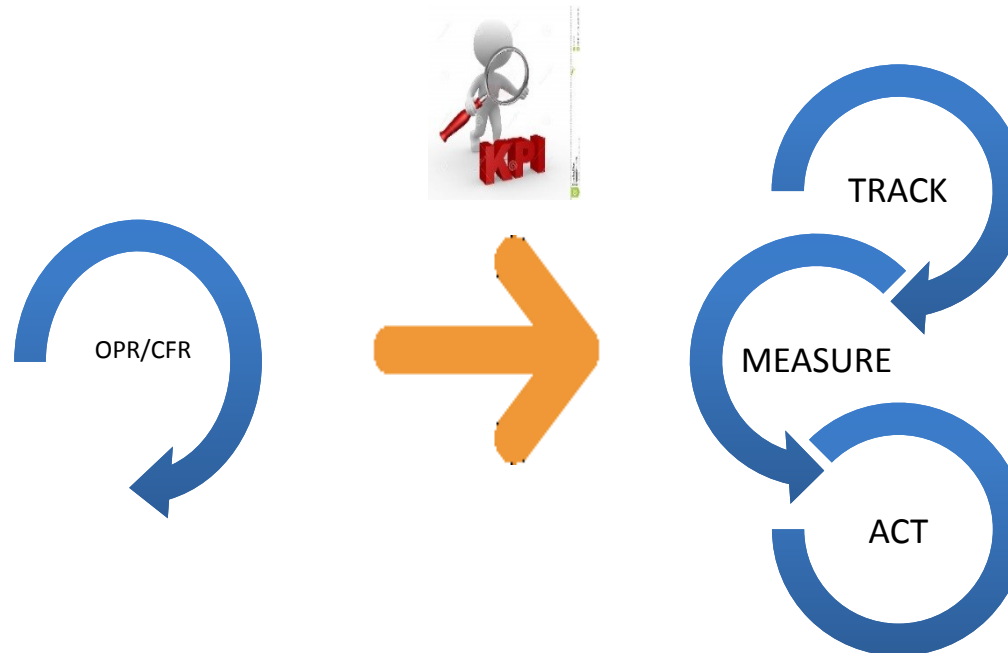
## **OCx: CONTINUOUS/ONGOING COMMISSIONING**

**MOST BUILDINGS WILL LOSE UP TO 30%  
OF THEIR ENERGY EFFICIENCY IN THE FIRST  
THREE YEARS OF OPERATION  
(Texas A&M)**

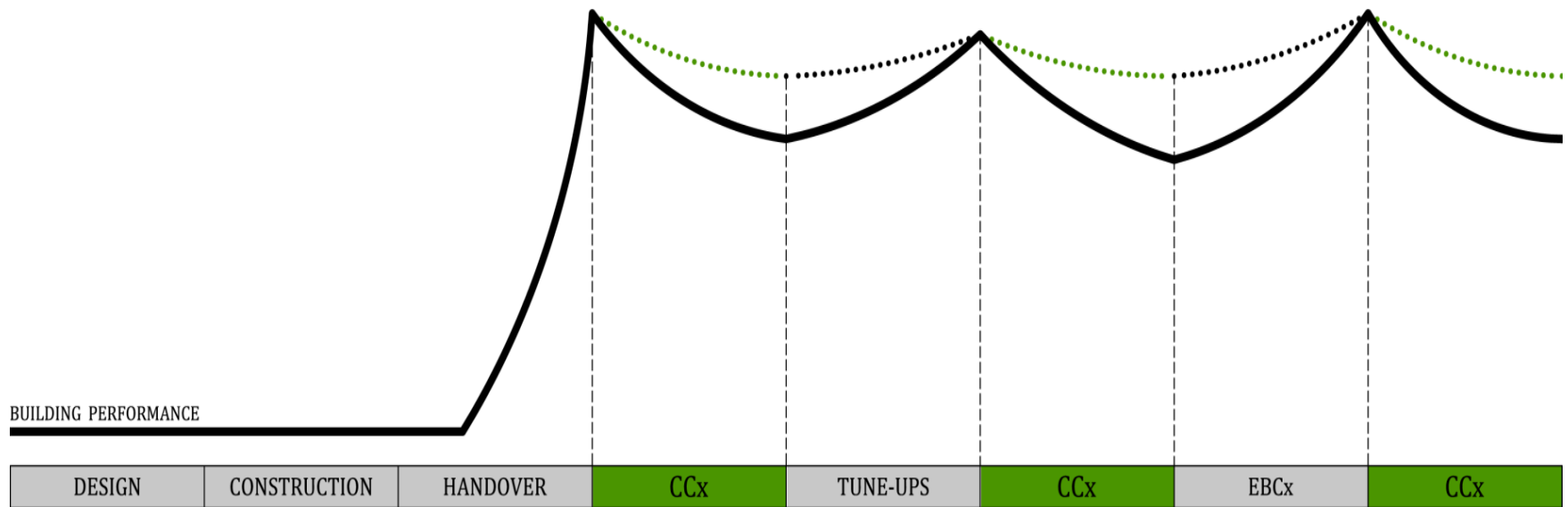
# OCx CONTINUOUS/ONGOING COMMISSIONING

A continuation of the Cx Process after the handover and well into the occupation and operation phase to verify that a building keeps meeting the OPR/CFR throughout its life cycle, resulting into continuous, scheduled or non scheduled activities.

**(ASHRAE Guideline 0.2-2015)**



# OCx IMPACT ON LC BUILDING PERFORMANCE

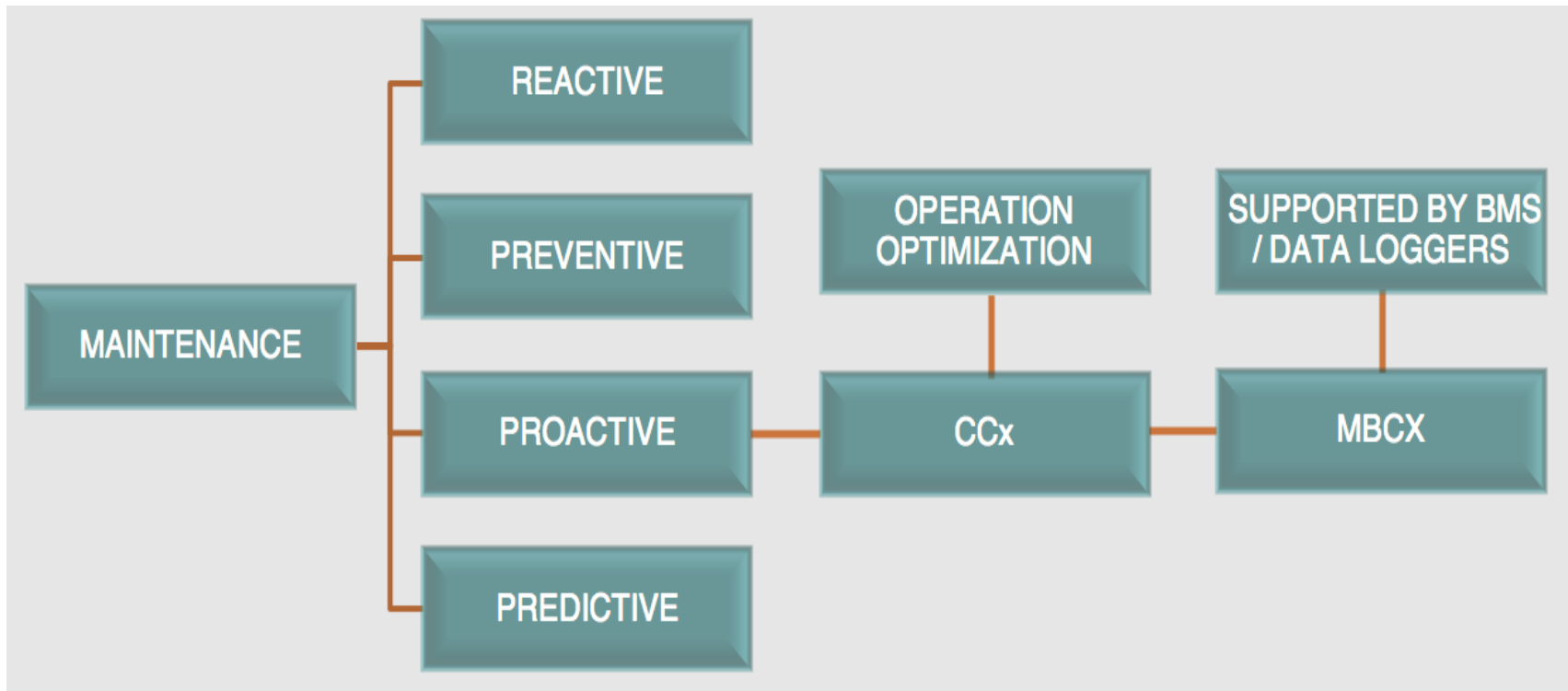


# OCx CONTINUOUS COMMISSIONING BENEFITS

- Maintain the CFR during LC
- Ensure efficient operation in compliance with BOD
- Improve performance by monitoring/optimization
- Reduce ongoing operational costs
- Poor building performance
- Identify O&M Staff training needs
- Identify deficiencies prior to impact occupants
- Improve systems reliability
- Extend system life cycle



# OCx: MONITORING BASED COMMISSIONING, MBCx





# WHAT TYPE OF COMMISSIONING SHOULD I CHOOSE?

MY BUILDING  
IS ...

CONSIDER...

...being designed and  
constructed or subjected to a  
major renovation

**Commissioning, NCx** – from building pre-design into the occupation and operation phase throughout all project phases.

...relatively new with high  
energy use, having being  
poorly commissioned when  
constructed

**Retro-commissioning, RCx** – to verify the building meets the Owner Project Requirements (OPR).

...existing, with high  
operational costs and a high  
number of equipment failure  
and comfort complains

**Re-Commissioning, ReCx** – ideal for existing buildings that were NEVER commissioned.

...existing, where the OPR  
have changed significantly:  
CFR

**Existing Building Commissioning, EBCx** – ideal for existing buildings that are NOT any longer meeting the Current Facility Requirements (CFR).

...just occupied, having being  
fully commissioned by a NCx  
or EECx Process

**Ongoing/Continuous Commissioning, OCx** – to verify meeting the Current Facility Requirements (CFR) continuously.

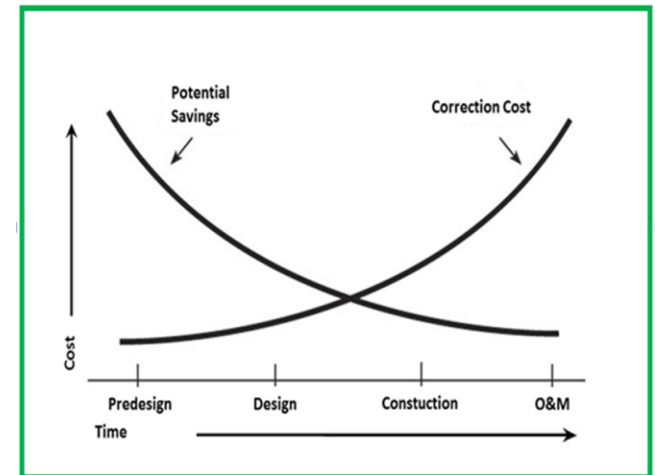
# FUTURE OF COMMISSIONING



- Waiting too long to contract commissioning in a project
- Chronicled experiences are leading to better estimates of costs and potential savings
- Statements of work are becoming more standardized
- New functional testing protocols have been developed and widely available and applied
- New automated diagnostic technologies are critical components in establishing continuous commissioning programs
- Need for certified and accredited commissioning providers
- Commissioning is not that widely used outside UK and US and influenced markets

# Cx MANAGEMENT FOR HIGH-PERFORMANCE BUILDINGS: CONCLUSIONS

- The Building Industry has not historically placed enough importance about addressing building performance early in the Project Development, fixing problems and delivering performance at the end of the Project instead of preventing them happening from the beginning.
- An effective and successful Cx Process engaged at a very early stage in a project can anticipate and address future building performance problems in a cost-efficient way.



## Cx. BIBLIOGRAPHY

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- **ASHRAE Guideline 1.4-2014**, *Procedures for Preparing Facility Systems Manuals*
- **ASHRAE Guideline 1.1-2007**, *HVAC&R Technical Requirements for the Commissioning Process*
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- **CIBSE Commissioning Codes (A, B, C, L, M, R and W)**, UK
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- **NIBS Guideline 3-2006**, *Exterior Enclosure Technical Requirements For the Commissioning Process*
- **The Building Commissioning Handbook**, BCxA, *third edition*, US



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