



# 18<sup>th</sup> National Conference on Building Commissioning

A PEGI EVENT



## Commissioning for Federal Buildings Guidebook and e-learning

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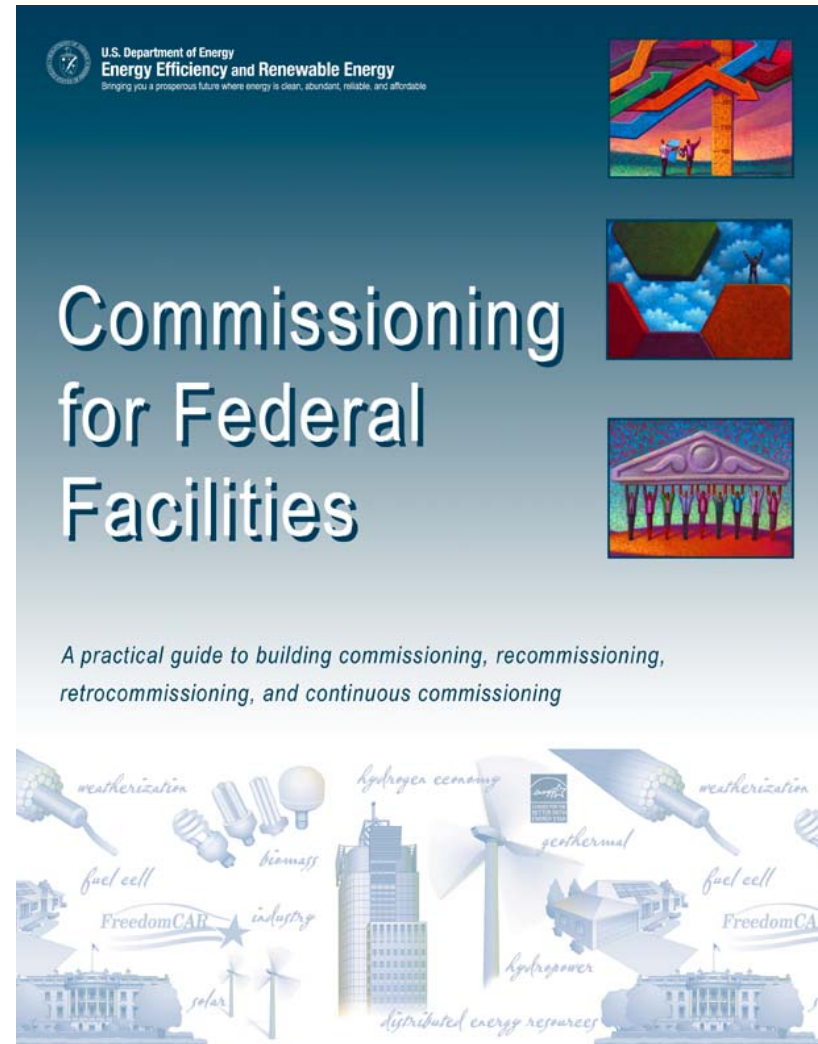


O&M First!

# Learning Objectives

## Learning Objectives

1. Familiarization with FEMP's Cx Guide
2. How to use the e-learning web-based training



# Guidebook Objectives

**Provide an introduction to commissioning approaches to a variety of professionals involved with the management, operation, and maintenance of Federal buildings.**

**Illustrate case histories, including cautionary lessons learned. □ Provide guidance on commissioning best practices. □**

**Demonstrate how commissioning can help Federal facility managers meet energy efficiency goals and LEED certification requirements.**

**Demonstrate how commissioning can be integrated in facility management and O&M programs to make those programs more efficient and effective. □**

**Demonstrate how different types of commissioning (such as retro commissioning and continuous commissioning) can be incorporated into a variety of building types and applications, above and beyond the most commonly understood commissioning approaches.**

# Guidebook Format

**Chapter 1 – Cx Goals**

**Chapter 2 – Types of Cx**

**Chapter 3 – Costs and benefits of Cx**

**Chapter 4 – Building Mgmt Support for Cx**

**Chapter 5 – The Cx Process**

**Chapter 6 – The Retro-Cx Process**

**Chapter 7 – The Re-Cx Process**

**Chapter 8 – The Continuous Cx Process**

**Chapter 9 – Sustainable Cx**

# Goals of Commissioning

**Provide a safe and healthy facility**

**Improve energy performance and minimize energy consumption**

**Reduce operating costs**

**Ensure adequate O&M staff orientation and training**

**Improve systems documentation.**

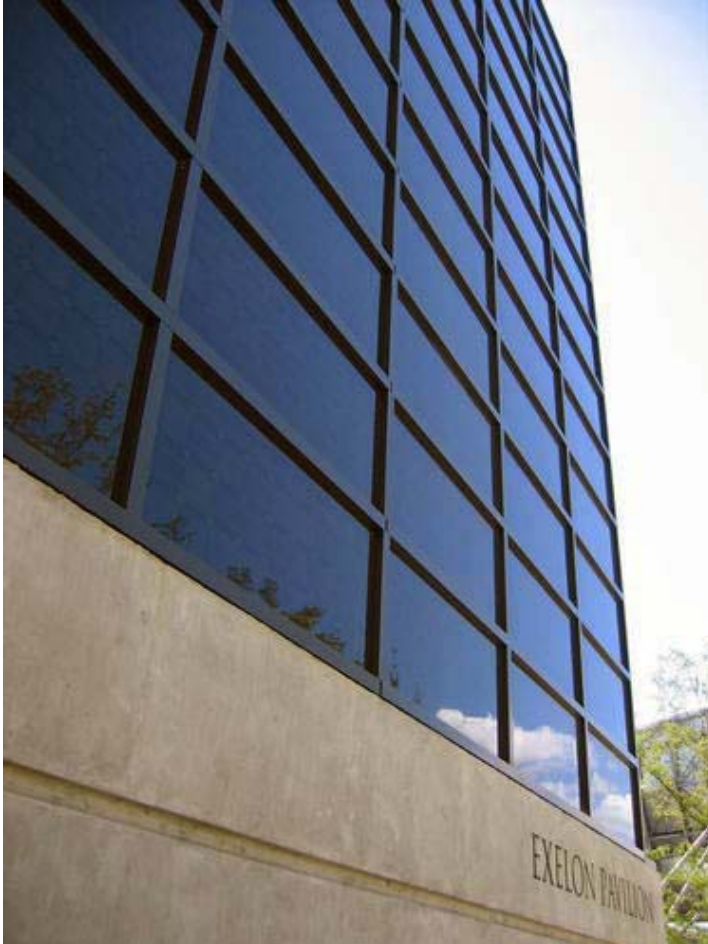


# Why Bother with Cx? 10 Good Reasons

- To meet Owner expectations**
- For project cost control**
- For improved system and equipment reliability**
- To improve energy performance**
- To ensure equipment accessibility**
- For the performance testing of complex systems**
- For the transfer of knowledge to building operators and engineers**
- To prevent premature failure**
- To ensure integration of building systems**
- For the documentation**



# Common Problems Addressed by Cx



- Outside air dampers stuck in the always open or always closed position.**
- Adjustable speed drives that no longer adjust properly.**
- Unconnected flexible ductwork.**
- Malfunctioning control systems components that do not properly respond to their prescribed control sequences.**
- Incorrect sequences of operation.**
- Energy management systems that have not been updated to reflect system modifications.**
- Changed facility uses that affect personnel loading and partition configuration changes that affect air flow.**
- Controls sensors that are out of calibration.**
- Controls that are permanently overridden.**
- Heating and cooling systems that fight each other.**
- Thermostats and other control devices that are improperly placed.**

# What Type of Commissioning?

<i>My building is...</i>	<i>Consider...</i>
... going to be undergoing a major renovation in the next year.	<u>Commissioning</u> -Ideal for new construction or major renovation, and best implemented through all phases of the construction project.
... old and experiencing a lot of equipment failures.	<u>Retro commissioning</u> -Ideal for older facilities that have never been through a commissioning process.
... relatively new and was commissioned during its construction, but our energy costs have been climbing recently.	<u>Re-commissioning</u> -Ideal to tune up buildings that have already been commissioned, bring them back to their original design intent and operating/energy efficiency
... large and complex. We have a metering system and a preventive maintenance program, but will still struggle with high energy costs and tenant complaints.	<u>Continuous Commissioning</u> -Ideal for facilities with building automation systems (BAS), advanced metering systems, and advanced O&M organizations.

# Cost Effectiveness Study

## **Building Commissioning**

### ***A Golden Opportunity for Reducing Energy Costs and Greenhouse Gas Emissions***

Evan Mills, Ph.D.

Lawrence Berkeley National Laboratory

Berkeley, CA 94720 USA

Report Prepared for:

California Energy Commission

Public Interest Energy Research (PIER)

July 21, 2009

# Costs and Benefits of Cx

*Table 1. Examples of existing-building commissioning project costs and savings.*

Target	Location	Sites	Energy Savings	Peak Demand savings	RCx Cost (\$/sf)	Payback time (years)*	Source
Local government buildings	California	11 sites; 1.5 MSf	14.3% source energy (11% electric; 34% gas)		1.01	3.5	Amaranani et al (2005); Amaranani and Roberts (2006); Pierce and Amaranani (2006)
Offices and hotels	New York	6 sites; 6 MSft		10%	0.34	2.0	Lenihan (2007) - projected
Offices	Connecticut	5 buildings; 2 MSf	8.5% electricity (3% to 20%)			0.5	Building Operating Management (2006)
Class A Offices	Connecticut	3 bldgs; 1.2 MSf	7.3% electric		0.62	1.37	McIntosh (2008)
Mixed commercial	Colorado	27 buildings; 10 MSf	7% elect	4.2% (0-26%)	0.185	1.51	Franconi et al. (2005)
Three offices + hospital	Colorado	4 buildings; 1.8 MSf		6%	0.026	0.38	Mueffer et al. (2004)
University buildings	California	26 buildings; 3.4 MSf	10% total source (2-25%)	4% (3-11%)	1.00	2.5	Millis & Matthew (2009)
Elementary schools	Michigan	4 schools			0.38	2.5	Freidman (2004)
Supermarkets	Central California	10 stores; 0.5 MSf	12.1% elect (4.3-18.3%)		0.14	0.25	Zazzara and Ward (2004); Emerson (2004)
Mixed commercial	Northwest	8 buildings			0.221	3.2	Tso et al (2003)
Mixed commercial	Oregon	76 projects	10-15% electric (5%-40%)		0.175	1.24	Peterson (2004)
Mixed commercial and educational	California	All California Programs (2007-2008)	1.7-8.1% electric		0.40	3.0	PECI and Summit Building Engineers (2007) - estimates
Total or simple average values			<b>186</b>	<b>~10-15%</b>	<b>~7%</b>	<b>0.41</b>	<b>1.8</b>

Notes: All impacts shown using local energy prices and commissioning costs; averages are floor-area-weighted averages.

# To take the FEMP on-line Cx Course

The on-line course is free for federal employees and federal contractors.

<http://www3.eere.energy.gov/femp/elearn/Common/Login.asp>



Thank-you!

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