

BEYOND

SMART CITIES

MAINTENANCE AND COMMISSIONING - CEM
REFRESHER TRAINING COURSE

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BEYOND

SMART CITIES

BENEFITS OF COMMISSIONING
FOR ENERGY PROFESSIONALS

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ENERGY SPECIALIST CURRICULUM COURSE



WHAT SHOULD YOU LEARN



Building Commissioning Benefits

Value of Commissioning Systems

Process Problems that's Commissioning solves

Technical problems that CxA discovers and repairs

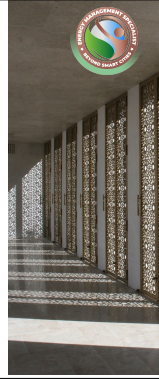
what ARE THE Elements of CxA Process

CBECS Data and Commissioning

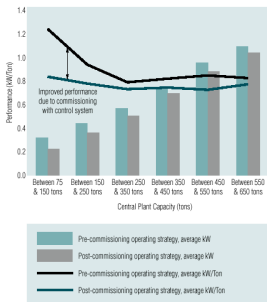


BENEFITS OF COMMISSIONING

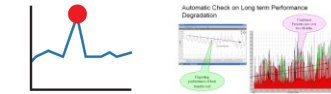
- ✓ Construction Efficiency
- ✓ Energy Efficiency
- ✓ Overcoming Technical Risks of Innovation
- ✓ Improved Indoor Environmental Quality (IEQ)
- ✓ Occupant Productivity
- ✓ Reduced Liability Claims
- ✓ Design and IAQ



VALUE OF COMMISSIONING HVAC SYSTEMS



Even short-term commissioning can substantially improve energy efficiency.

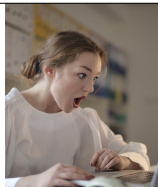
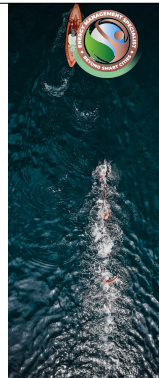


Fault Detection & Diagnostics



PROCESS PROBLEMS THAT COMMISSIONING HELPS SOLVE

- ✓ Design Goals/Criteria Forgotten or Distorted
- ✓ Designs Aren't shown Completely as Intended
- ✓ Construction Deviates from Design
- ✓ Systems Not Fine-Tuned at Start-Up
- ✓ Operators Not Properly Trained
- ✓ Systems Not Maintained





TECHNICAL PROBLEMS THAT CX DISCOVERS AND REPAIRS

- ❑ Calibration or adjustment problems.
- ❑ Controls missing or not connected.
- ❑ Incorrect sequences of operation.
- ❑ Improper locations of sensors or controllers.
- ❑ Improper design of the system being controlled.
- ❑ Uncoordinated interlocks between related but independent systems.
- ❑ Incorrect programming. Equipment doesn't perform to specification.



WHAT ARE THE ELEMENTS OF CX PROCESS?

- ❑ Decision to do Commissioning
- ❑ Designation of Commissioning Provider
- ❑ Integrating Commissioning into the Project





CBECs DATA

	Energy Use (MJ/m ² -yr)	Energy Cost (\$/m ² -yr)
Energy Star (2000)	489	11.2
Average Buildings (1995 CBECs*)	1071	20.7
Efficient Buildings (Top 25% 1995 CBECs*)	514	12.5

* Commercial Buildings Energy Consumption Survey (US DOE)

Source: Energy Performance Pitfalls, Building Operations Management, p. 43, March 2000

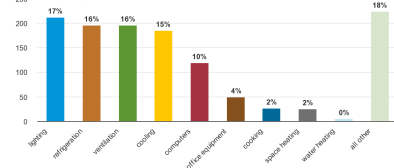




CB ECS DATA

Electricity use in U.S. commercial buildings by major end uses, 2012

total = 1,243 billion
kilowatt-hours (kWh)



Note: All other includes motors, pumps, air compressors, process equipment, backup electricity generation, and miscellaneous appliances and plug loads.
Data source: U.S. Energy Information Administration, 2012 Commercial Buildings Energy Consumption Survey, Consumption and Expenditures, Table ES, May 2016.

DISCUSSION

- ☑ Why do inefficient buildings often use higher technology than more efficient buildings?
- ☑ How can these inefficient buildings with little high technology compete with Energy Star buildings who are efficient and use higher technology?
- ☑ Does this mean don't use higher technology?
- ☑ Do facility staff (maintenance, building services, etc.) have different objectives than we? If so, what does that mean to our efforts?

LACK OF COMMISSIONING EXAMPLES

- ☑ Air side economizers: 50% of the time do not function properly (ASHRAE says 70%)
- ☑ Chilled water pumps directly connected to CW return lines
- ☑ Parallel pumps with some connected backward
- ☑ Air handling units (AHU) with belts completely absent (motor still running)
- ☑ One study found 650 such discrepancies

COMMISSIONING

The process of ensuring that systems are designed, installed, functionally tested, and capable of being operated and maintained to perform in conformity with the design intent begins with planning and includes design, construction, start-up, acceptance and training, and can be applied throughout the life of the building (ASHRAE guideline 1-2019)

The process of periodically repeating commissioning activities as needed when building are modified, additions are made and/or significant time has passed (WCT).

Continuous (perhaps real time) monitoring of building systems to determine when further commissioning activities are needed. Necessary since systems tend to drift out of control and management needs to know immediately when that occurs (WCT).

TIME LINE

The chart depicted below is the author's concept of how these fit together. There is nothing accurate about the actual placement of these activities on the time line; the chart is intended to convey thought only.



Note: Modification also includes design intent, design, construction, etc. This has been simplified.

PHASES OF COMMISSIONING

Pre-Design Phase

Design Phase

Proposal Phase

Construction and Acceptance Phase

Warranty Phase