

EMS and Building Commissioning

LAUSD New Facilities

Presentation to Green Schools Summit

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Energy Management System Defined

- A fully automated, integrated and programmable energy control and management system for monitoring and controlling energy usage for a facility.

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Objectives

Benefits of EMS

- Primary objective is to provide a healthy and comfortable place for people to work.
 - Better employee efficiency
 - Less overtime (less impact on environment, less energy usage)
 - Less absenteeism
- Secondary objective is to reduce energy costs, near term and future
 - Support sustainability of facility

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Why EMS?

- CHPS points require monitoring and control of energy using systems
- M & O does not have the manpower to keep up with programming needs of individual schools
- Remote troubleshooting for system problems
- Monitor energy use and system performance
- Forecast energy usage of facilities
- Documentation of trends is needed to develop future energy reduction strategies

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What EMS Brings to LAUSD

- Programmable control for HVAC systems
- Integrated communication with Information Technology system
- Historic trending data for energy usage
- Remote monitoring and control capability
- Override capability
 - Maintenance during school hours
 - Room usage during off hours

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How EMS Works at LAUSD

- Open protocol system (BACNet)
 - ASHRAE, ANSI and ISO communication protocol (<http://en.wikipedia.org/wiki/BACnet>)
 - Capable of interfacing with other systems by other manufacturers
 - Allows computerized building devices to exchange information regardless of their system or service
 - Meets communication needs of HVAC and other building systems
 - Non-proprietary; no special chip sets
 - Increases competitiveness and consumer choices

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How EMS Works at LAUSD (cont'd)

- HVAC and lighting controls are kept separate
- Diagnostic points for equipment per Title 24
- Fractional HP fans not included
- HVAC controls between equipment and other buildings interconnected via “combus”
- Incoming power metering at each building
- EMS implemented for projects starting construction after March 13, 2009

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LAUSD Standards for EMS

- LAUSD Standard Specification Sections
 - 15700 – diagnostic points for equipment
 - 15900 – direct digital controls
 - 15950 – energy management system (EMS)
 - 16440 – power metering at switchboards

See LAUSD web site for all standard posted specifications (laschools.org)

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Commissioning (Cx) Defined

- Commissioning verifies that the design meets the needs and functions of the facility, verifies that the project performs as designed and intended, and prepares the customer to effectively and efficiently maintain the facility for its service life.

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Objectives

Benefits of Commissioning

- To make sure the District gets what it asked / paid for.
- Calibrate controls for maximum efficiency.
- To ensure the District receives:
 - System Manuals, including interfacing of controls and lighting-HVAC
 - Training documents for faculties and operation person
- Establish criteria for future re-commissioning
- Satisfy CHPS V2
- Prerequisite and up to 2 points

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Projects under CHPS V2 Commissioning Approach

- CHPS V2 applies to projects submitted to the DSA after August 24th, 2007
- CHPS V2 Commissioning is indicated as three options:
 - **Abbreviated**, 0 CHPS points
 - **Standard**, 1 CHPS point
 - **Comprehensive**, 2 CHPS Points
- CHPS V2, Abbreviated Commissioning is a prerequisite for minimum accreditation.

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Projects under CHPS V2 Commissioning Approach

- Scope – Items "to be commissioned" is consistent for abbreviated, standard and comprehensive commissioning per CHPS VII
- Minimum systems to be commissioned:
 - **HVAC system** – roof top units, thermostat settings, acoustics performance
 - **Lighting and controls** – occupancy sensors, day-lighting sensors
- Owners choice - any system or building component can be added to the list of systems/components to be Commissioned.

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CHPS Version 2 - Commissioning Design Stage

Commissioning Service	Abbreviated (Prerequisite)	Standard (1 point)	Comprehensive (2 points)
Commissioning Scope	HVAC, Lighting and Controls	HVAC, Lighting and Controls	HVAC, Lighting and Controls
Design Intent Document	✓	✓	✓
Commissioning Plan	✓	✓	✓
Design Development Design Review			✓
Construction Documents Design Review		✓	✓
Commissioning Specification Development	✓	✓	✓

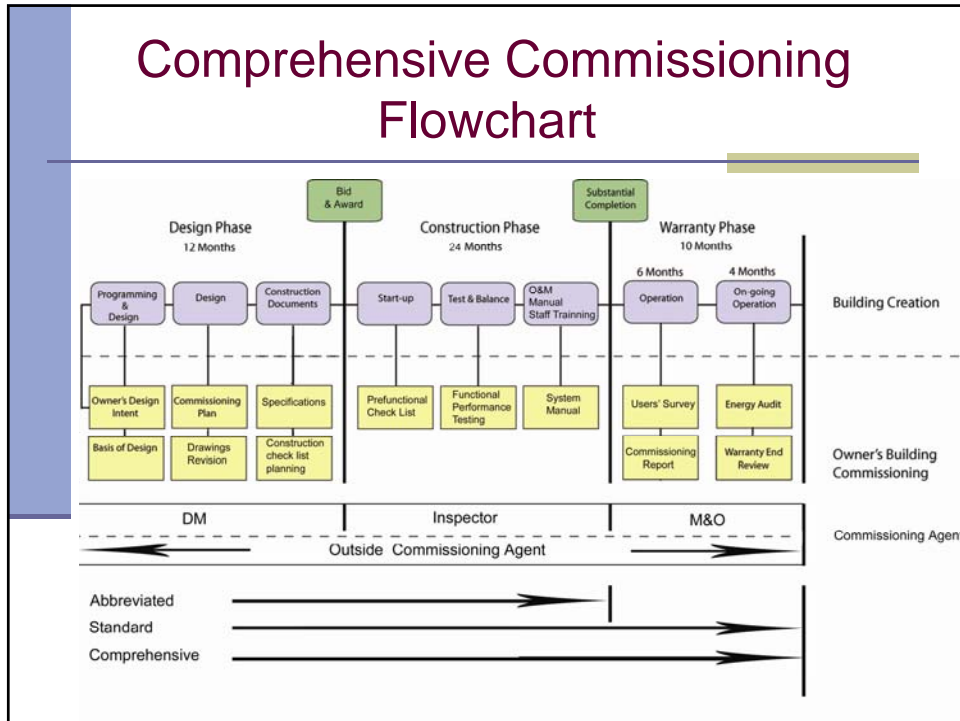
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CHPS Version 2 - Commissioning Construction and Warranty Stage

Commissioning Service	Abbreviated (Prerequisite)	Standard (1 point)	Comprehensive (2 points)
Submittal Review			✓
Prefunctional Testing	✓	✓	✓
Functional Testing	✓	✓	✓
Commissioning Report		✓	✓
Meeting Attendance	✓	✓	✓
O&M Manual Review		✓	✓
Operator Training	✓	✓	✓
Systems Manual	✓	✓	✓
One-year warranty review		✓	✓
Recommissioning Manual for post-occupancy review			✓

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Comprehensive Commissioning Flowchart



Design Stage - Responsibility of Commissioning Agent and DM

Cx Service	Cx Period	Comp. Cx	Cx Agent	DM
Commissioning Scope	Period	HVAC, Lighting and Controls	HVAC, Lighting and Controls	HVAC, Lighting and Controls
Design Intent	SD -DD	✓	20	80
Commissioning Plan	SD - 100% CD	✓	80	20
DD Review	DD	✓	20	80
CD Review	100%CD	✓	20	80
Commissioning Specification Editing	100% CD	✓	20	80

Construction stage - Responsibility of Commissioning Agent and Inspector/M&O

Commissioning Service	Comprehensive	Commissioning Agent	Inspector/M &O
Submittal Review	✓	100	0
Prefunctional Testing	✓	20	80
Functional Testing	✓	80	20
Commissioning Report	✓	80	20
Meeting Attendance	✓	80	20
O&M Manual Review	✓	80	20
Operator Training	✓	80	20
Systems Manual	✓	100	0
One-year warranty review	✓	60	40
Recommissioning Manual for post-occupancy review	✓	100	0

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Commissioning Documents

P:\Design Management\Commissioning-guide-09-06-2007\comprehensivecommissioning

- Commissioning Guide
- Commissioning Standard Template
 - Design Intent/Basis of Design
 - Pre-functional Equipment Checklists
 - Functional Performance Testing Documents
 - Others – Contact Information, Review Approval, Issue Log, etc.
- Specification Sections
 - 01810 – General Commissioning Requirements
 - 01820 – Maintenance & Operations Staff Demonstration and Training
 - 15990 – HVAC Systems Commissioning
 - 15995 – BMS Systems Commissioning (per projects)
 - 16990 – Electrical Lighting & Control Commissioning

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Comparison of Commissioning cost

Cost comparison of Commissioning steps

Abbreviated	Standard	Comprehensive
75%	88%	100%

Commissioning Costs²
Actual commissioning costs, as reported in a study of 69 commissioning projects

Description	Value or Ranges
Total Cx Cost	\$0.49 - \$1.66/sqft
Cx Provider Fee as % of Total Commissioning Cost	74 - 86%
Provider Fee as % of Total Construction Cost	0.3 - 1.1%
Design Review	18%
Construction Observation	14%
Acceptance Testing	64%
Warranty	4%

California Commissioning Guide – Page 13, copy right 2006, California Commissioning Collaborative, prepared by Portland Energy Conservation, Inc

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Total Commissioning cost

- Comprehensive Commissioning
- Standard Commissioning - 88% of Comprehensive Cost
- Abbreviated Commissioning – 75% of Comprehensive Cost

Comprehensive Commissioning total cost	
AE and Contractor's involvement	20%
3 rd party Commissioning Agent	60%
DM involvement	5%
Inspector - M &O involvement	15%

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Questions

