

UNDERSTANDING BUILDING COMMISSIONING

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DEFINING COMMISSIONING

“Building Commissioning is the systematic process of ensuring, through documented verification, that all building systems are installed and perform in accordance with the design intent.”

WHY IS COMMISSIONING NEEDED?

- Controls Operating Costs & Energy Consumption
- Fewer E&O's Results in Fewer Change Orders
- Reduces Start-up / Comfort Problems
- Tighter A/E Fees
- Complexity of Modern Buildings:
 - ✓ Digital Controls
 - ✓ Critical Building conditions
 - ✓ Technology

COMMISSIONING GOALS

- Quality
- Design Intent Verification
- Value Engineering
- Comfort
- Energy Efficiency
- Sustainable Performance

COMMISSIONING Overview

Design Review

Establish design intent. Review specifications and drawings for compliance with design intent, Sequence of Operations, Maintainability.

Pre-Functional Testing

Coordinate, witness, verify and report to verify if the installation is in accordance with plans and specifications.

Functional Testing

Coordinate, witness and report on the operational and functional performance of all equipment, systems and subsystems.

Reporting

Identifying deficiencies, and recommended solutions.

Operator Instruction

Verify training required by Contract Documents; hands-on verification

COMMISSIONING Overview

Commissioning Report

- commissioning plan
- field installation verification check sheets
- functional performance test check sheets
- deficiency reports
- as-built drawings
- shop drawing verification
- operation and maintenance manuals

Warranty Review

11 month walk-through to re-verify operation and performance of all equipment, systems and subsystems.

Post-Commissioning Report

Perform commissioning for systems that require off-season functional performance testing. Review overall operation and performance of the system to original commissioning performance records.

COMMISSIONING for LEED

Pre-Requisite – Fundamental Commissioning

- Must be independent, but can be employed by the Design or Construction Firms
- The CxA reviews the OPR and BOD documents for clarity and completeness
- At a minimum, must commission the following systems:
 - HVAC (including controls)
 - Lighting and daylighting controls
 - Domestic hot water systems
 - Renewable energy systems

Credit – Enhanced Commissioning

- Must be independent and can not be employed by the Design or Construction Firms
- The Cx reviews design for compliance with the OPR and BOD
- Contractor submittal reviews
- Training verification
- Warranty review
- Develop systems manuals

COMMISSIONING for LEED

Owner's Project Requirements (OPR)

- Owner and User Requirements
- Environmental and Sustainability Goals
- Energy Efficiency Goals
- Indoor Environmental Quality Requirements
- Equipment and Systems Expectations
- Building Occupant and O&M Personnel Expectations

COMMISSIONING for LEED

Basis of Design (BOD)

- System Narrative Descriptions
- Primary Design Assumptions
- Standards Utilized for Design

COMMISSIONING BENEFITS

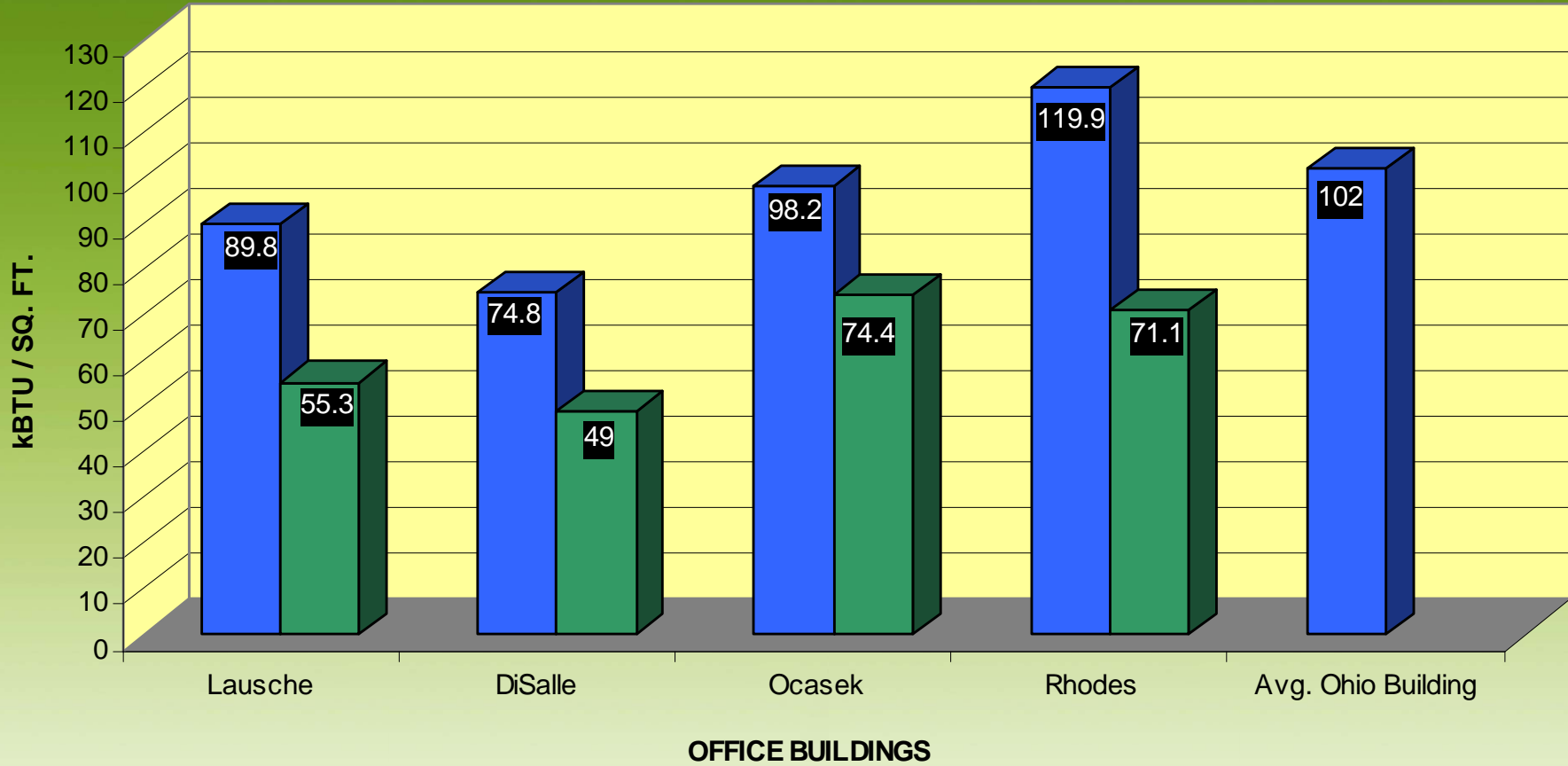
What should commissioning cost?

MANSFIELD HIGH SCHOOL

OSFC Pilot Commissioning Project

- *Perception – Successful Project*
 - *344,680 Sq. Ft.*
 - *157 Deficiencies Found*
- *Construction Cost Savings: \$17,430*
- *Operating Cost Savings: \$39,330/year*
- *Cost of Commissioning: \$129,900*
- *Simple Payback: 2.8 years*
- *OSFC Funding: 80%*
- *Payback on District's Investment: 5.5 months*

ENERGY STAR Buildings Program
Ohio Building Authority Facilities
ENERGY USAGE PER SQ. FT. SAVINGS



■ BEFORE ENERGY STAR ■ AFTER ENERGY STAR

COMMISSIONING Examples



Design Phase



Issues that can be discovered during design reviews that avoid future problems



Design Phase

- *Mechanical Room – Insufficient access space to change filters in Air Handling Unit*



- *Underground 100-125 PSI steam pipe anchored on both ends with no expansion joint*
- *Generator exhaust located directly below outside air intake*

Design Phase

- *Gas-fired make-up air unit installed in return air plenum*
- *Radiant Floor system without insulation beneath floor slab*
- *Extremely high light levels that exceed ASHRAE 90.1 (Energy Code)*



Construction Phase

Issues discovered during commissioning that get corrected before they become a problem



Construction Phase

- *When primary boiler fails, backup boiler would not start automatically*



- *Natural gas regulator not vented to the outdoors – if diaphragm failed, mechanical room would have flooded with natural gas*
- *140 degree water provided to hand sinks – code requires 110 degrees max.*

Construction Phase

- *Air handling unit used for storage during construction*



- *Design outside air not being provided to air handling units, could lead to high CO2 levels for occupants*
- *Economizer controls not working*

Construction Phase

- *Side-stream filter for cooling tower installed directly on floor – not able to be drained*



- *BAS Graphics – Floor plan on system was for the wrong school*
- *Pumps mounted to base with concrete nails instead of proper mounting bolts*

Retro-Commissioning

Issues discovered after construction that need to be fixed



Retro-Commissioning

- *Chilled water and hot water coils piped backwards*



- *High velocity air duct installed over stage in auditorium*
- *Control sensors in high-rise missing*
- *Actual air balance measured varied by up to 40% from what was reported*

Retro-Construction

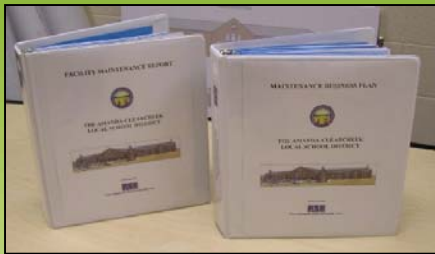
- *VAV box reheat coils too small*



- *Heating hot water boilers undersized for building load*
- *Actual sound system installed lower quality than what was specified and what was approved in shop drawings*

COMMISSIONING Benefits

- Quality Control
- Value Engineering
- Fewer Start-Up Problems
- Energy Efficient Buildings
- Better Trained Staff
- Increased Comfort



THANK YOU

Questions?

