Building Commissioning for Life!

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Engineering Economics, Inc.

Meet Our Speakers

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Learning Objectives

1. How a proactive and collaborative Owner's Project Requirements (OPR) works to improve project turnover outcomes
2. Why Facility Standards are not equivalent to an OPR
3. Why Facility Operations needs an early and often place at the table
4. Build your Own Key Performance Indicators (KPI) with Monitoring Based Commissioning (MBCx)
5. How will the future look going forward – getting to Zero Defect and transition to stable long term operations

Altruistic Objectives – Too Lofty?

- On Time-On Budget-Lowest LCC
- Meet or exceed designed energy performance target objectives
- Net Zero Carbon Ready
- Smooth transition to stable operations
- Zero defect project
- No user complaints and happy
- No warranty issues
- No claims

Buildings are Complex Organisms

- Expected to outlast most of our lives
- Designed and built under current expected needs, based on current knowledge but not knowing exactly future may be
- Expensive to operate and maintain over time, may exceed the initial construction cost
- Goal to NZC is not going quietly away!

Historical Project Delivery has been Sequential and Not Integrated

- True total cost of ownership has been ignored for lowest initial cost
- Design > Build > Cx > Operate > Maintain
- Problems can/do occur at each hand off phase
- Facilities team inherits unresolved const issues to hopefully resolve without time or budget
- Performance is not measurable until fully occupied and operated – often too late in discovery to resolve

How do we Improve Project Value?

- Assign accountability
- Earlier involvement with project team, not just-in-time mentality
- Integrated and collaborative approach to review and problem solving:
  - Change hierarchal culture
  - Begin w/ “lessons-learned” - facilities subject matter experts
  - Reduce hand off issues
  - Earlier issue resolution results in lower cost and better results
  - Break down communication barriers and compartmentalization
  - Take lessons learned from each project and incorporate them into the university’s design standards and OPRs

How do We Improve the Project Delivery Method?

- University design standards must be kept current to codes, and adhere to new systems options and technology – ongoing facility lessons learned
- Define all customers and stakeholders upfront
- Integrate facilities, capital projects, users, design, construction, and commissioning as part of the project team
- Prepare an early OPR for each new project
- Design team prepares a responsive BOD before getting into the details
- Incorporate quality assurance requirements into the contract documents

What is the OPR and Value as Guiding Document?

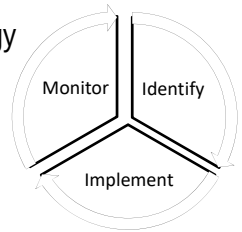
- Set forth expectations
  - The Owner's Project Requirements (OPR) is not meeting minutes of what was discussed in the design phase
  - Assign accountability
- OPR is not reverse engineering of the design team's Basis of Design (BOD)
  - Quantify what is important to the university
  - Continually question, review, and update Highest value and lowest cost to strive to make changes in early design phase SD up to before DD

Historical Building Commissioning

- Initial commissioning is a single snapshot in time, not a sustainable process or ongoing effort
- Project schedules constrain time available to fully vet out, test and resolve issues
- Turnover is assumed completed without benefit of seeing how occupied or seasonal weather impacts performance
- Findings are not complete or timely for active resolution of issues

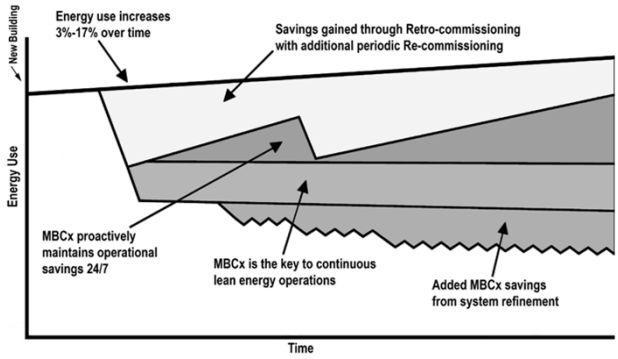
Smarter Building Commissioning

- Commissioning is not an event at substantial completion but an ongoing process that continues for the full warranty phase
- Facilities team is integrated with CxA to resolve issues during warranty as a transitional phase
- Use of raw building automation data and smart analytic software will monitor and analyze 24/7/365 ongoing performance can provide:
  - Continuous tracking, automated cost avoidance/savings, energy performance, prioritize issues and generate automated reports
  - MBCx = Automated Ongoing Cx + Analytic Software
  - CMMS integrate for active preventative maintenance



Benefits of MBCx

- MBCx provides three streams of additional energy savings due to building performance drift



Adapted from the Lawrence Berkeley National Labs Report, 2009

Smart Energy Analytics Campaign

- DOE/LBNL-sponsors to advance use of smart building software
- Energy Performance in a Portfolio - Emory University, 25% reduction in whole building energy use since implementation of existing building commissioning and in-house FDD
- Innovation in the Use of EMIS - University of California, Davis, in addition to energy savings through existing building commissioning and FDD, UC Davis created websites for occupants to report room temperature feedback and an EIS to display energy use, and they built interval data-driven models for M&V

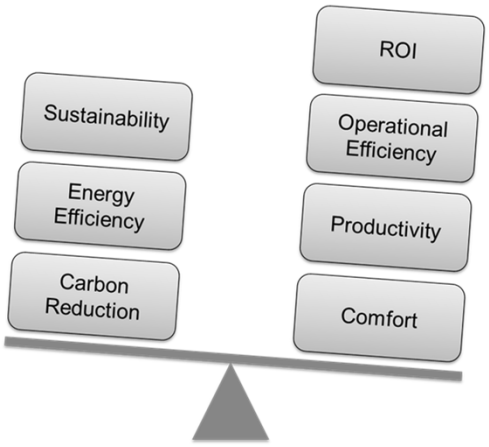
How will the future look going forward – Getting to Zero Defect Projects?

- Without true Measurement and Verification, you can never be sure that your facility is running in the right direction
- *"Measurement is the first step that leads to control and eventually to improvement. If you can't measure something, you can't understand it. If you can't understand it, you can't control it. If you can't control it, you can't improve it."* - H. James Harrington
- We don't know what the future holds, but you can't keep doing the same and expect a different outcome!

What KPIs do we want to measure?

- Warranty issues and Initial Cx resolution
- Ongoing Cx Issues resolved by type and system
- User satisfaction survey - perceived environmental comfort
- Facilities and operators satisfaction
- Energy performance - weather and occupancy adjusted
  - Overall EUI and carbon footprint
  - Sub metered end uses tracked to target
- O&M tracking

Which of These are Your Priority?



What is in the future?

- Guiding OPRs will drive change and reduce project issues and improve outcomes when embraced by all
- Project & facilities team roles will become more interdependent for successful outcomes – breaking down silos is key
- Initial Cx will become ongoing dynamic process--embraced by facilities mgmt and will continue until full occupancy and a full seasonal year of operation
- MBCx will employ data and analytics to measure KPIs and assign performance accountability for the life of the building

Questions

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