Constant Commissioning for Continual Energy Efficiency

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Learning Objectives:

- Commercial Building HVAC Usage
- HVAC Performance Drift
- Top 10 Causes of Drift
- Commissioning HVAC
- Constant Commissioning
- HVAC Performance with Commissioning
- Benefits of Networked Solutions to Commissioning
- Changing the Way HVAC Plants Are Managed
- Real-world Case Study Examples
Why HVAC?

• The U.S. DOE says HVAC accounts for 40 to 60% of energy usage in commercial buildings.
• HVAC systems provide the largest gain for efficiency.
• HVAC upgrades improve:
  • air quality
  • tenant satisfaction/retention
  • higher property market value
  • lower O&M expenses

What is Drift?

Drop in HVAC operating performance due to maintenance issues and system faults that go undetected

Why does it matter?

Energy and cost savings that come from efficiency solutions decline; ROI from efficiency investments is not achieved
Top 10 Causes of Drift

1. Variable frequency drive functionality disabled
2. Time clocks not used or circumvented
3. Simultaneous heating & cooling
4. Duct or valve leakage
5. Pumps, fans, actuators or dampers malfunctioning
6. Airflow not balanced
7. Scheduling & resets do not match specs or actual building usage requirements
8. Software programming errors
9. Improper controls hardware installation, failure or degradation
10. HVAC system not right-sized for facility

* Lawrence Berkeley National Lab; Monitoring Based Commissioning: Benchmarking Analysis of 24 UC/CSU/IOU Projects; June 2009
Commissioning HVAC

- **Commissioning**: A systematic process that results in the delivery of a building whose HVAC systems perform as intended.

- **Retrocommissioning**: Commissioning of an existing system that was never commissioned.

- **Recommissioning**: Subsequent repeat commissioning of a system that was once commissioned.
What if you could guarantee that your HVAC system would operate as efficiently in 10 years as it did on the day it was commissioned?

With “Constant Commissioning” – it’s possible
What is Constant Commissioning?

Constant Commissioning

Institutionalizing commissioning activities or solutions into operating and maintenance processes
HVAC Performance with Commissioning

- Conventional Plant
- Commissioned Plant
- Recommissioned Plant (every 2 years)
- Constantly Commissioned Plant with networked solutions

Higher energy use and loss of operating cost savings
Persistent energy reduction in constantly commissioned plants

Years of HVAC Plant Operation

Energy Usage in kW/ton
Benefits of Networked Solutions

- Real-time visibility into plant operations
- Peak efficiency/persistent savings
- Fast detection, diagnosis and resolution of system faults
- Online portals for easy information access and sharing
- Helps commissioning agents provide continual commissioning
At-A-Glance Plant Performance Overview

Building Name, Any City, USA
Ultra Efficient Chiller System

Trends/Charts  Plant Overview  Home  Web Layout

Building under Optimum Control

Chiller System
Operating Efficiency: 0.392 kW/Ton
Plant kW Usage: 136.1 kW
Tons Supplied: 352.6 Ton
RealTime % Savings: 54%

Efficiency kW/Ton  kW/Ton Delta  kW Usage  Temperatures  Dollars Saved  AHU Valves

Total Plant Efficiency (Today)

Old kW/Ton  Operating Sys Efficiency (Today)

Building Information
- 3 - 550 Ton Variable Speed Chiller Plants
- 3 - 943 gpm Chilled Water Pumps
- 3 - 1375 gpm Chilled Water Pumps
- 2 - 2060 gpm Cooling Towers

Operation: 24hrs 7 days/Week
 BAS Control: Johnson Controls

Building Type: Office/Data

Contact: Optimum Energy Support
Building (660) 832-7921

kWH Savings
- kWH Saved Today: 1400.4
- kWH Saved Total: 5197.8

CO2
- CO2 Saved Today: 1060.5
- CO2 Saved Total: 57165.0

Dollar Savings
- Month 1 Year 2016: $215.7
- Month 2 Year 2016: $2155.6

18th National Conference on Building Commissioning
A PECI EVENT
Comprehensive Look at Plant Components
Performance Trends Charts
## Changing the Way HVAC Plants are Managed

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<tr>
<th>Plants with Networked Solutions</th>
<th>Conventionally Operated Plants</th>
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<tr>
<td>• Real-time operations performance anytime via a secure, online service.</td>
<td>• Plant energy performance is difficult to track, delayed or unknown.</td>
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<td>• Quick detection of efficiency performance degradation.</td>
<td>• Plant performance problems only detected if occupants complain, hardware failure alarms go off, or through routine maintenance.</td>
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<td>• Point by point analysis of data for fast fault diagnosis.</td>
<td>• Physical observation of plant operation to detect faults.</td>
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Case Study: Detecting Hidden Faults

In this example, anomalies in the operation of the plant’s chilled water pumps and tower fans were immediately identifiable in the plant components screen.
Case Study: Optimizing Equipment Operation

In this example, custom charts were created to correlate the on/off staging of the chiller and the chilled water supply temperature with humidity levels. Using these charts, the chain of events that caused the periodic rise in humidity levels was easily diagnosed.
Questions? Thank you for your time!

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