The Secret to Successful Commissioning:
The Critical Role of the Owner and Operator

Larry Smith
Lead Project Officer

David Braslau
Vice President
Learning Objectives

1. Participants will be able to identify how retrocommissioning can be used as one of a number of tools to help facility owners and operators achieve energy efficiency goals and to improve comfort.
2. Participants will be able to assess typical retrocommissioning findings and how to implement corrective actions using a collaborative approach between the building owner/operator and commissioning agent.
3. Participants will be able to develop strategies to ensure that retrocommissioning performance is monitored, and that a plan is devised to ensure the persistence of energy savings.
4. Participants will be able to interpret energy usage patterns over time to assess the success of implemented energy efficiency and retrocommissioning strategies.
Ten Story All-Electric Building

- Constructed 1977, Renovated 1996
- 693,200 sq. ft.
- Design Occupancy: 5,500
  - Typical Occupancy: 2,400
  - Offices, Childcare Center, Computer Room, Warehouse, Underground Parking
- Electric Centrifugal Chillers; Electric Screw Chillers with Condenser Heat Recovery; Electric Boilers and Humidification
Energy Efficiency & Renewable Initiatives

• 110 kW Photovoltaic Array
  ○ 8,800 sq. ft. on roof
  ○ Largest within the Chicago Loop
• Curtainwall Replacement
• Four Vertical Axis Wind Turbines
• Multi-phase Energy Savings Performance Contract
Water Efficiency Initiatives

- Waterless Urinals
- Water Collection
  - Rainwater runoff
  - HVAC Condensate Collection
  - Foundation Water Infiltration Reclamation
- Re-purpose Ice Storage Tanks for Reclaimed Water Storage
  - Irrigation
  - Gray Water Toilets
  - Cooling Tower Makeup
Goals set forth in law and Executive Orders

- EISA 2007 – Reduce building energy intensity 30% by 2015 vs. 2003 baseline
- EPAct 2005 & EO13423 – 5% of electric energy consumed (FY10-FY12) shall be renewable & Agency shall implement renewable generation projects on Agency property for Agency use
- EO13514 – Reduce potable water consumption 26% by 2020 vs. 2007 baseline

Significant progress toward meeting all three goals
Key Milestones in the ESPC Process

• Initial Proposal: September, 2003
  ○ Order of Magnitude Estimate of Costs and Savings

• Notice of Intent to Award: September, 2005
  ○ Authorized Investment Grade Audit and Retro-commissioning (RCx) Baseline Report

• Delivery Order: June, 2006
  ○ Authorized Construction of Eight Energy Conservation Measures, including RCx Recommendations
Key Milestones in the ESPC Process

- Construction Complete: January, 2007
- Phase 2 Proposal: September, 2007
  - Four Additional Energy Conservation Measures
- Phase 2 Delivery Order: September, 2007
- Phase 2 Construction Complete: December, 2007
HWSSC End Use Electricity Consumption

Consumption diffused among many different systems
Comprehensive approach needed to yield meaningful results
Collaborative approach between ESCo, Owner, and Operator

- Operating Strategies resemble PhD thesis rather than industry practice (14,000 points of monitoring & control)
- EMCS unable to trend operating points
- Data loggers deployed throughout building and systems to trend operating conditions
- Hand-held tool used to access VAV Box control points
  - Required coordination to access 800 VAV boxes in occupied spaces
- Recommended control strategies piloted by building operators first, then adjusted based on findings
- IT support teams helped identify, diagnose, and solve complex data communication issues
Key Findings from Retro-commissioning Report

Complex HVAC and EMCS system difficult to control

- Most Chilled Water Plant Control Sequences Overridden
  - Too many operational modes created confusion
- 1996 Chilled Water Plant included Ice Storage
  - Appropriate for time-of-day rates, but rate structure is now flat
- Ice storage HX materials at end of useful life
- Run-around Heat Recovery mode not operating
Key Findings from Retro-commissioning Report

- Night Setback strategy disabled
  - Excessive recovery time
  - Air handlers on fixed start schedule
- Winter Humidification not functional
  - Higher space temps required for comfort
- Static pressure sensors out of calibration
- Damper & valve actuators inoperable
- Outside air dampers not sealing
- Outside air volume much higher than occupancy required
Key Implementation Strategies

• Demand Control Ventilation with Space CO₂ Monitoring
• Decommission Ice Storage System
  ○ Interconnect Chilled Water and Glycol Cooling Systems
  ○ Reduce number of control strategies from 14 to 3
• Convert Primary/Secondary Chilled Water Pumps to Variable Flow with VFDs
• Preheat Outside Air during winter
  ○ Automate chiller condenser water heat recovery system
• Cool Computer Rooms using Main Chilled Water Loop
  ○ CRAC units operate only when main loop unavailable
• EMCS Communications Trunk Upgrade
  ○ Required for massive traffic volume
  ○ Database server added to enhance trending capabilities
No/Low Cost Strategies by Owner/Operator

- Repair of humidification units and control valves
- Clean airflow measuring station pitot tubes
- Clean condensate pans and drains
- Repair flexible ductwork couplings
- Lubricate and adjust damper linkages
- Repair and recalibrate static pressure sensors
Other Energy Conservation Measures

- Lighting controls for open-office and warehouse areas
- Bi-level lighting in stairwells
- Comprehensive Super T8 fluorescent re-lamping
- Dimmable CF fixtures in auditoriums
- Fluorescent fixtures/occupancy controls at parking ramps
- T5 fluorescent fixtures in 1st floor high-ceiling office areas
- Utility meter reconfiguration
- Solar domestic water heating
- CO₂ ventilation controls for parking garage
- Run-around heat recovery on electrical room H&V units
- UV lights on intake fan units (by Owner)
ESPC is a robust solution

• 10 year contract term
• Performance Period Services include:
  ○ Measurement & Verification of Savings
  ○ Continuous Commissioning
    - Trend Log Reviews
    - Building Operator Training
    - On-site Inspections
    - Corrective Action
HWSSC Electricity Consumption

Coldest January in 40 years

Year 3 Actual Savings
- 131% of guarantee
- 118% of estimates
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