

RECLAMATION

Managing Water in the West

Reclamation's Commissioning Initiative – Results and Best Practices

Denver Technical Service Center



U.S. Department of the Interior
Bureau of Reclamation

Presenter Introductions

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Housekeeping

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Use feedback icons if having issue

Use chat feature for questions

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Outline

- **Commissioning Requirements**
- **What is Commissioning**
- **The Commissioning Process**
- **Case Study: Carl Hayden Visitor Center**
- **Case Study: Folsom Civil Maintenance Facility**
- **Results and Benefits**

Federal Commissioning Requirements

- **The Energy Independence and Security Act (EISA) of 2007 requires**
 - Energy/water evaluations of 25% of “covered” facilities each year and/or 100% every 4 years
 - ID and assess re-or-retro-commissioning measures
- **The Federal Guiding Principles require:**
 - Commission new building construction
 - Retro-commission buildings greater than 50,000 sq ft every 4 years
 - Retro commission other buildings when not meeting energy performance requirements
 - Professional Commissioning Agent

BOR Commissioning Efforts

- **Commissioning identified as a common recommendation in Reclamation**
 - No existing building assessed in FY10-13 met sustainable building commissioning requirements
 - ID'd as an ECM in EISA evaluations
- **Sought centralized funding and oversight**
- **Performed Commissioning on 22 Buildings**
 - Prioritized based on Guiding Principle Target
 - Greatest need for energy reduction
- **Conducted during FY 2014-2015**

What Is Building Commissioning?

- **Building Commissioning: Documented confirmation that a building's various systems function according to criteria set forth in project documents AND owner's operational needs.**
- **Not the same as Testing, Adjusting and Balancing. Commissioning diagnoses problems, provides corrective process and optimizes systems.**
- **Often identified as an ECM in an energy audit**



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Commissioning for Optimal Efficiency

- **New Construction Commissioning**
 - Would you buy or drive a car that wasn't tested?
- **Retro Commissioning**
 - Day-to-Day building maintenance is equivalent to only changing your oil
 - Performing major milestone checkups and maintenance (i.e., commissioning) increases efficiency, longevity and overall building health and helps avoid costly system repairs and breakdowns



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What Does Commissioning Actually Look At?

- **All water-and-energy consuming building systems:**
 - **HVAC**
 - Thermal comfort
 - Indoor air quality
 - Acoustics
 - Zoning
 - Energy Consumption
 - **Lighting Control**
 - Sensor location
 - Scheduling
 - Light levels

What Does Commissioning Actually Look At?

- All water-and-energy consuming building systems:
 - Building Envelope
 - Seal integrity
 - Plumbing
 - Appropriate flow rates
 - Leakage
 - Hot water setpoint & scheduling

What Does Commissioning Not Do?

- **Process procedures**
 - Energy generation
 - Water diversion
 - Pumping operations
- **Design & Oversee Install of New Major Equipment**
 - **Goal: Getting what is there working as efficiently and appropriately as possible**
 - For example, making sure air handler is functioning, NOT air handler
 - Reports do often include recommendations where deemed necessary, but are only recommendations
 - Fixes made on-the-spot as feasible

The Retro Commissioning Process

- **Planning/Kickoff Phase**
 - Determine and document the needs and requirements for the facility
 - Review the original design documents
 - Determine if any building changes have been made
 - Interview Building Manager and key O&M personnel
 - Develop a Commissioning Plan that identifies the testing process as well as potential Energy Conservation Measures (ECMs).



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The Retro Commissioning Process

- **Investigation Phase**

- Execute testing processes from Commissioning Plan
- Adjust Plan to meet any deviations observed in the actual building conditions and system performance
- Revise initial ECMs as necessary and develop new ECMs based upon testing results



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The Retro Commissioning Process

- **Implementation Phase**
 - Implement selected ECMs. Depending on complexity, this can be done by O&M personnel or a hired contractor
 - Verify that the predicted results and system performance are achieved
 - Onsite testing and evaluation required



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The Retro Commissioning Process

- **Turnover Phase**
 - Hold a “Lesson’s Learned” meeting with O&M Staff and Building Manager
 - Issue a Commissioning Report that includes:
 - Building information
 - System descriptions
 - Commissioning Plan
 - List of implemented ECMs along with reasoning & expectations
 - Any long-term recommendations
 - Construction/As-Built documents, specs & submittals (existing/modified)
 - Ensures a smooth hand off between Commissioning Team and O&M personnel.

Case Study – Carl Hayden Visitor's Center

- Commissioned in August 2014
- Constructed in 1963
- 23,700 gsf
- Occupancy:
 - Office 6 am - 6 pm, M-F
 - Visitor Center 8 am - 6 pm, 7 days a week



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Case Study – Carl Hayden Visitor's Center

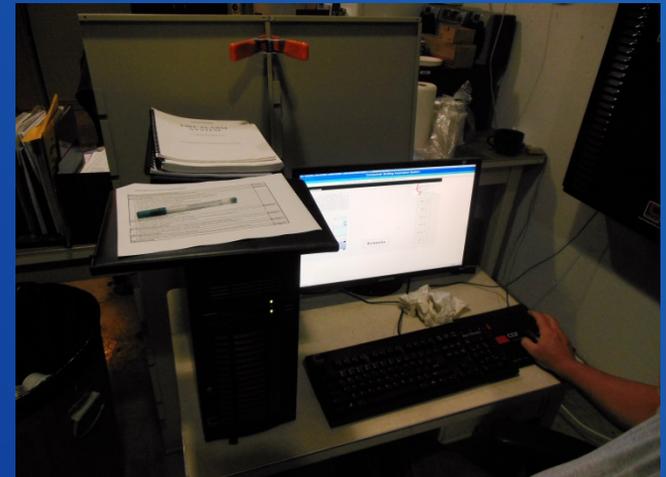
- **HVAC**
 - (5) Constant Volume air handling units with DX coils, and electric heat
 - Misc. exhaust and dedicated cooling (server room) systems
- **Lighting Controls**
 - Interior Lighting: Wall switches everywhere except occupancy sensors in the Admin area
 - Exterior Lighting: All controlled by a single photocell
- **Plumbing**
 - Various restrooms
 - Electric tank-style water heater supplemented by a solar heating system

Commissioning Findings

- The following systems were found to be in good working order and no modifications were made:
 - Lighting control
 - Plumbing
 - Solar water heater systems

Commissioning Findings

- **The air handling unit economizers (allows the use outside air to cool the building) were found to be manually overridden OFF.**
 - **All units were changed to be in the AUTO mode so they can utilize outside, cooler air when the program deems it advantageous.**
 - **Resulted in energy savings.**
 - **O&M staff were unaware that a manual a manual override even existed and thought economizers were working based on DDC system**



Commissioning Findings

- The closing time of the Visitor's Center had been changed from 8 PM to 6 PM, however the air handling units schedule was never changed to match.
 - The unoccupied schedule for the units were changed to match the 6 PM closing time.
 - This will save energy by reducing HVAC run time.



Commissioning Findings

- The unoccupied cooling setpoint for the units was found to be the same as the occupied setpoint (71 deg F). It was revised to be 5 deg F higher.
 - This will save energy by reducing HVAC run time.



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Commissioning Findings

- The damper on the outside air intake was found to be closed. It was opened and balanced to meet the original design conditions (15%)
 - Measured CO2 levels in building prior to adjustment higher than recommended. Below 500 ppm after adjustment.
 - This will improve indoor air quality, which reduces employee sick days and improves production and morale.



Commissioning Findings

- **Final Result:**
 - **23% energy savings in FY 15!**
 - **Improved indoor air quality!**

Case Study – Folsom Civil Maintenance Facility

- Commissioned in March 2015
- Constructed in 2013
- 22,813 gsf
- Occupancy:
 - Office 6 am – 4:30 pm, M-F
 - Maintenance Areas: 6 am – 4:30 pm, M-F



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Case Study – Folsom Civil Maintenance Facility

- **HVAC**
 - Office: (5) Constant Volume heat pump air handling units
 - Shops: (4) Evaporative Cooling air handling units & heaters
 - Misc. exhaust
- **Lighting Controls**
 - Central Lighting Control panel with scheduling and astronomical capabilities, controls both office lighting and all exterior lighting
 - Shop lighting controlled by combo of occupancy sensors and wall switches
- **Plumbing**
 - Various restrooms, kitchen and shop sinks
 - Point of use water heaters

Commissioning Findings

- **Plumbing system:**
 - The laboratories were found to have 1.5 gallon/minute aerators, despite submittals indicating 0.5 gallon/minute
 - New 0.5 gal/min aerators installed to reduce water usage



Commissioning Findings

- **Electrical System System:**
 - Unplugged an abandoned refrigerated vending machine and had it slated for removal
 - Lighting control panel issues corrected
 - Majority of zones found to programmed and lighting was on 24/7
 - The few zones that were programmed operated on a 7 day, rather that a 5/2-day schedule as designed
 - Zones with large amount of daylight were scheduled to be turned off during peak solar hours.
 - Occupants have override switch that can be used if necessary



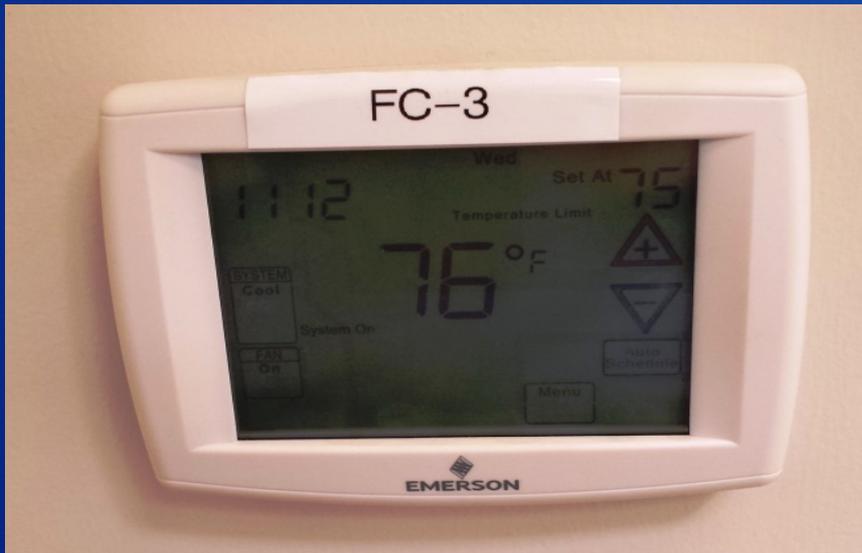
Commissioning Findings

- **HVAC System :**
 - Replaced all AHU filters as it was discovered they had never been changed
 - Varying parties all thought someone else was responsible
 - Improved Indoor air quality
 - Reduced airflow so much that one of the compressors failed due to it. Area was uncomfortably hot, but since a new building everyone thought it was just a poor design.
 - Will improve thermal comfort and save energy



Commissioning Findings

- HVAC System :
 - Office Thermostats were found to be unprogrammed
 - Scheduled setback for nights and weekends
 - Turned off continuous screen backlight
 - Added filter change reminders
 - Calibrated thermostats, found to be off 1-4 degrees F
 - Will both save energy and improve thermal comfort



Commissioning Findings

- HVAC System :
 - In two of the four shop areas, unit heaters and evaporative coolers found to have overlapping setpoints so both were operating at the same time.
 - Revised to appropriate setpoints and added temperature limit lockouts to prevent issue in the future
 - Will save a substantial amount of energy



Commissioning Findings

- HVAC System :
 - The ventilation fan in the Carpenter's shop was found to have a blown fuse.
 - The fuse was replaced to provide the ventilation necessary to maintain indoor air quality



Commissioning Findings

- **Final Result:**
 - Energy savings (waiting on full year's data for exact number)
 - Improved indoor air quality
 - Better thermal comfort
 - Reduced water consumption

Common Simple ECMs

- While there are many complex analyses and tests performed during Cx, many of the final ECMs are simple, easy to address items:
 - Adjust thermostat and lighting schedules to match occupancy
 - In many cases found unprogrammed and running 24/7
 - Open outside air damper
 - Often manually closed and never reopened.
 - No outside air = Sick Building Syndrome

Common Simple ECMs

- **Replace dirty filters**
 - Improves air flow, saving fan energy and delivering better thermal comfort
- **Find non-functioning equipment**
 - Often times bathroom fan had unknowingly failed
 - Heating valves stuck open and adjacent air conditioning running to compensate



Common Simple ECMs

- **Leaky building openings**
 - Replace/Install door and window weather stripping
 - Caulk roof and wall penetrations
- **Seal duct, often installed with holes/leaks**
- **Bring economizers on line**
 - Often overridden by O&M personnel
- **Reposition lighting photocells**
- **Occupancy sensor adjustments**
 - Many O&M employees don't realize typically adjustable

Common Simple ECMs

- Never know what you are going to find, but there is always something that needs to be fixed



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Commissioning Initiative Results:

- Identified and resolved building system operation, control and maintenance problems
- Improved indoor air quality and reduced associated liability
- Reduced occupant complaints and increased tenant satisfaction
- Lowered building energy usage and operational costs
 - In some buildings as much as 20%
- Documented system operations & trained O&M staff
- Extended equipment life-cycle
- Satisfied the Sustainable Building Assessment requirements
 - Helped 2 buildings achieve 100% compliance
 - Increased overall compliance rate by 10-20% across Reclamation

Questions?

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