Retrocommissioning

What is Retrocommissioning?

Retrocommissioning is an organized process that defines facility performance objectives, establishes a methodology for testing and verifying those objectives, and documents the results of facilities that are already in operation. Retrocommissioning is typically performed in response to problems with building performance that can be linked to building systems.[1] It also provides an understanding of how closely the building comes to operating as , identifies equipment or systems that need to be replaced, opportunities for saving energy and money, and results in specific strategies for improving performance of the various building systems.[2]

How to Implement Retrocommissioning

Retrocommissioning generally includes such steps as assembling a team, developing a scope of work including benchmarking metrics, an audit of the entire building, and recommendations for implementation including a schedule of improvements and a plan for recommissioning. [3]
In summary, the key project steps are to:

1. Review existing systems and related documentation
2. Develop retrocommissioning plan
3. Perform calibration and maintenance checks
4. Implement diagnostic monitoring/trending
5. Perform functional tests
6. Analyze the monitoring/trending and test data
7. Assess and document the current operating strategies and sequences of operation for all systems and equipment included
8. Document operations and maintenance improvement opportunities
9. Calculate energy impacts and develop implementation cost estimates for operations and maintenance opportunities
10. Develop and deliver the final retrocommissioning report

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[1] Facilities.net http://www.facilitiesnet.com/energyefficiency/article/Retrocommissioning--4126 Gilmer, Laurie A. (2006) (accessed August 21, 2010)
[2] Energystar.gov. www.energystar.gov/ia/business/EPA_BUM_CH5_RetroComm.pdf (accessed August 21, 2010).
[3] US DOE. O&M Best Practices Guide, Release 2.0, "Commissioning Existing Buildings" ch.7 (2004) http://www1.eere.energy.gov/femp/pdfs/OM_7.pdf (accessed April 30, 2011).

Retrocommissioning can vary in complexity. Evaluating some systems will have a more significant impact on reducing energy use and operating costs. Since heating, ventilation, and air conditioning (HVAC) systems account for the majority of building operating costs, retrocommissioning of HVAC systems often results in the highest cost and energy savings.[4]

Systems to include in a retrocommissioning include:[5]

- Building automation system (controlled devices, sensors, control loops, and logic)
- Cooling systems
- Heating systems
- Fire safety/smoke purge aspects of the HVAC system
- Lighting systems
- Domestic hot water equipment
- Humidity control equipment
- Building pressurization controls

Benefits

Retrocommissioning:

- Improves indoor environmental quality
- Improves documentation and staff training[6]
- Helps identify operating problems with existing facilities and systems
- Provides opportunity for increased energy efficiency
- Reduces operating costs

Costs

Costs to conduct retrocommissioning will depend on the type of facility involved, the complexity of its systems, and the type and number of systems included in the process. Typical costs for retrocommissioning range from as low as $0.05 per square foot up to $0.40 per square foot for existing buildings, whereas new building commissioning costs between $0.50 to $3.00 per square foot. Annual operating cost savings as a result of retrocommissioning can range from $0.15 per square foot to $1.15 per square foot. The payback for the retrocommissioning is often less than five years.

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[4] Facilities.net http://www.facilitiesnet.com/energyefficiency/article/Retrocommissioning--4126 Gilmer, Laurie A. (2006) (accessed August 21, 2010)

[5] US DOE. Example Retro-Commissioning Scope of Work. http://www1.eere.energy.gov (accessed September 15, 2010).

[6] MSC Tech. www.mscnj.com/pdf/MSC_Magazine_04_09.pdf (accessed January 28, 2011).

Table 1 - Retrocommissioning Benefits and Costs[7]

Commissioning Approach	Primary Objectives	Relative Costs	Benefits	Best Applications
Recommissioning or Retrocommissioning (RCx)	Adjust equipment to provide services within equipment specifications while also meeting current mission/tenant operating requirements.	$0.05 to $0.40 per sqft existing buildings or $0.50 to $3.00 in new buildings. Additional data are needed to help pinpoint costs based on specific building features and the scope of the RCx effort.	Verifies and restores equipment operation in accordance with original design intent and/or to meet current operating requirements.	Buildings/ systems that have not been adequately maintained (recommissioned) for some period of time, especially those systems that have not been adapted to accommodate changing space/ tenant needs.

[7] US DOE. O&M Best Practices Guide, Release 2.0, "Commissioning Existing Buildings" ch.7 (2004) http://www1.eere.energy.gov/femp/pdfs/OM_7.pdf (accessed April 30, 2011).

Scenario: Assume a 20,000 square foot building undergoes a retrocommissioning project. The project team sets out to estimate cost in dollars, kilowatt hours (kWh) of electricity, and in kilo British thermal units (kBtu) of gas. The project team uses a median cost estimate of $0.30/sf[8] to determine potential costs for the retrocommissioning project. The median whole-building energy savings for a retrocommissioning project is estimated at 16%.[9]

Assumptions:

- 20,000 sq. ft. building x $0.30/sf = $6000 estimated cost for a retrocommissioning project
- Building built to ASHRAE 90.1-2007 uses 11.85 kWh/sf/yr[10] in electricity and 4.76 kBtu/sf/yr[11] in natural gas.
- Cost for electricity is $0.41/kWh and natural gas is $1.07/therm
- The median whole-building energy savings for a retrocommissioning project is estimated at 16%.[12]

Example

Nelson Biology Building, Rutgers University, New Brunswick, NJ

A major retrocommissioning project was undertaken which included a survey of the building's HVAC systems and controls which resulted in a reprogramming and repair of the controls. In addition, a wing-by-wing air-balancing project was conducted.

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In a second example, retrocommissioning of 2 million gross square feet of space in 5 campus buildings at the University of Wisconsin- Madison identified over $2.8 million annual savings.[13]

[8] Building Commissioning: A Golden Opportunity for Reducing Energy Costs and Greenhouse-Gas Emissions, "Summary of the 2009 Assessment" by, Dr. Evan Mills (2009)
http://cx.lbl.gov/2009-assessment.html ~ $0.30/ft^2 estimated cost for commissioning existing buildings
[9] Building Commissioning: A Golden Opportunity for Reducing Energy Costs and Greenhouse-Gas Emissions, "Summary of the 2009 Assessment" by, Dr. Evan Mills (2009)
http://cx.lbl.gov/2009-assessment.html ~ 16% median whole-building energy savings
[10] Cost-Effectiveness and Impact Analysis of Adoption of Standard 90.1-2007 for New York State
http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf
[11] Cost-Effectiveness and Impact Analysis of Adoption of Standard 90.1-2007 for New York State
http://www.energycodes.gov/implement/state_codes/reports/NYSummary_cost_effectiveness.pdf
[12] Building Commissioning: A Golden Opportunity for Reducing Energy Costs and Greenhouse-Gas Emissions, "Summary of the 2009 Assessment" by, Dr. Evan Mills (2009)
http://cx.lbl.gov/2009-assessment.html ~ 16% median whole-building energy savings
[13] University of Wisconsin. http://www.conserve.wisc.edu/graph1.htm (accessed August 31, 2010).

Resources

ENERGY STAR Building Upgrade Manual - Retrocommissioning
www.energystar.gov/ia/business/EPA_BUM_CH5_RetroComm.pdf

NJ SmartStart Buildings Program
http://www.njcleanenergy.com/commercial-industrial/home/home

A Retrocommissioning Guide for Building Owners
www.peci.org/documents/**EPAguide**.pdf

NYSERDA RFP checklist for Retrocommissioning Services
http://www.nyserda.org/documents/cmretrocxrfpchecklist.doc

Retrocommissioning Programs: Current Efforts and Next Steps
http://resources.cacx.org/library/holdings/020.pdf

Lawrence Berkeley National Laboratory
http://buildings.lbl.gov/hpcbs/pubs.html

Facilities.net - Retrocommissioning
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