



A-Z of Retro-commissioning Existing Government Buildings

Ron Mohr & Narendra Amarnani

County of Los Angeles – ISD
Office of Sustainability



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Existing Building Stock

- Courthouses
- Offices
- Large, medium and small commercial
- Libraries
- Outpatient Clinics
- Hospitals
- Juvenile Halls
- Jails

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Adapted RCx Process

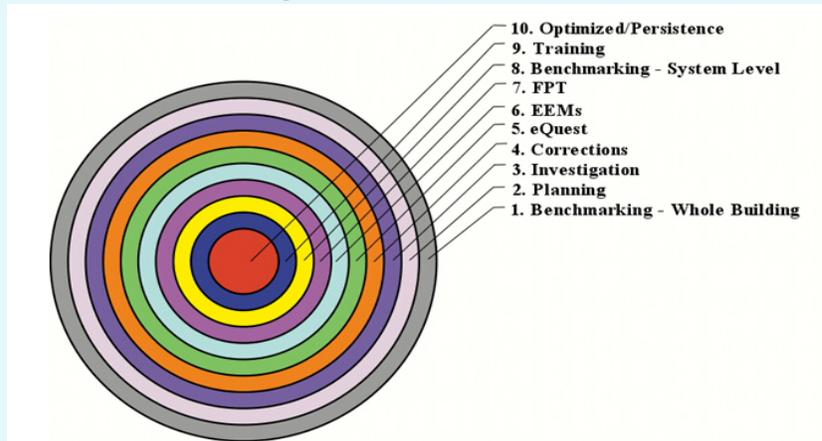


Figure 1. Retro-commissioning (RCx) process adapted by SCE/SCG/County of LA Partnership Program.

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RCx Program - Defined Goals

- Optimize operations of Heating, Ventilation and Air Conditioning (HVAC) systems in the County buildings
- Identify optimization and energy efficiency measures
- Improve thermal comfort, ventilation and indoor air quality in the County buildings
- Develop processes for sustainable reduced usage of electricity and natural gas
- Provide operations staff will comprehensive facility training including updated methods to efficiently operate, monitor and maintain HVAC systems

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Defined Project Tasks

- Energy benchmarking – Energy Star
- Systematic diagnostic testing
- Prefunctional testing of individual components
- Minor HVAC system repairs
- eQUEST model energy savings projections
- New optimized energy efficiency measures
- Building automation improvements
- Functional Performance Testing of HVAC systems
- System level benchmarks/baselines
- Retro-commissioning reports & updated schematics
- Training with RCx manual
- Evaluation, Measurement & Verification

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HVAC RCx Measures

- Tested and calibrated all existing controls
- Improved Chiller Sequencing
- Chilled Water Reset
- Installed customized Purge Cycles
- Optimized Economizer Controls
- Optimized Scheduled Start/Stop of Equipment
- Installed Boiler Hot Water Reset Controls
- Installed Discharge Air Reset Controls
- Improved VAV Static Pressure Controls
- Performed Diagnostic Air and Hydronic Testing
- Selective air balancing and terminal box repairs
- Optimized Sequence of Operations

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Retrocommissioning (RCx) Project Funding

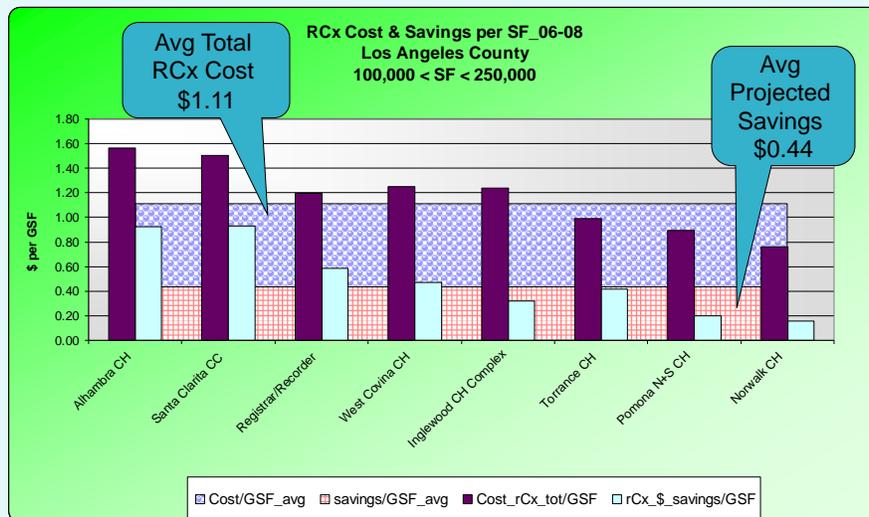
- CPUC Funding 2004 – 2012
 - SCE/SCG/LACo Partnership
- LACo-CEO Funding 2006 - 2009
 - LADWP/SCE/SCG territory
- ARRA Funding 2010 - 2011
 - SCE/SCG territory
- LADWP Funding 2008 - 2012
 - LADWP/SCG territory

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RCx Cost & Utility Projected \$ Savings per GSF



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RCx Statistics

- Cumulative RCx Cost, 2004 - 2012
 - \$13 million
- Total Building Area Retro-commissioned
 - 12 million GSF
- Cumulative Utility Cost Savings
 - \$26 million
- Cumulative Electric Savings
 - 160 million kWh
- Cumulative Gas Savings
 - 9 million therms
- Total Carbon Savings
 - (110,000 + 45,000 = 155,000) MTCO₂

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Downey Courthouse eQUEST Model Savings

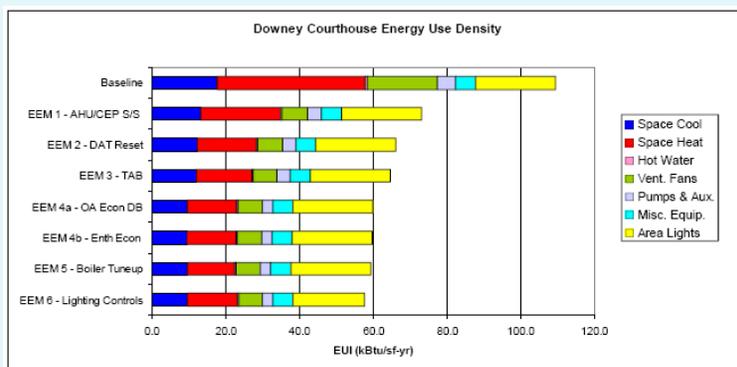


Figure 1-1. Summary of Energy Usage by EEM

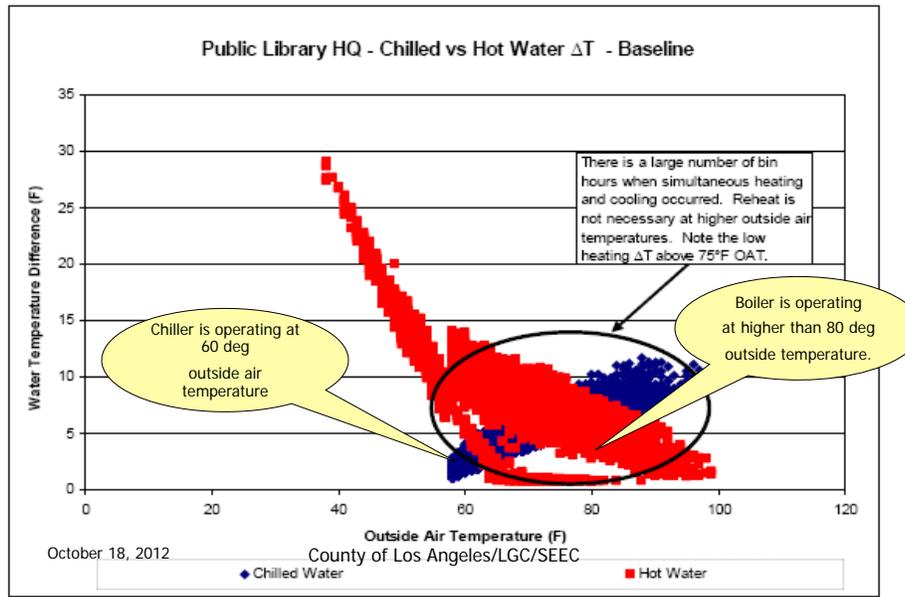
Conversion factors:
 1 kWh = 3.143 kBtu
 1 kBtu = 1,000 Btu
 1 therm = 100 kBtu = 100,000 Btu

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Simultaneous Heat/Cool



HVAC Retro-commissioning and EEMIS System Monitoring

- HVAC Retro-commissioning
 - Investigate and resolve operational deficiencies
 - Install and test Energy Efficiency Measures
 - Develop system-level benchmarks
- Three-prong approach to sustain RCx savings
 - Facility monitoring
 - Utility bill analysis with whole building benchmarks
 - System-level benchmarks to detect deviations

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Further Reading

http://www.peci.org/ncbc/proceedings/2007/Amarnani_NCBC2007.pdf

Retro-commissioning (RCx) Sustainable Savings: Are We There Yet?
Narendra Amarnani, Brian Roberts and Nora Hernandez

Contacts

- Ron Mohr
 - rmohr@isd.lacounty.gov
 - 323-881-3979
- Narendra "Amar" Amarnani
 - namarnani@isd.lacounty.gov
 - 323-267-2441
- Nora Hernandez
 - nhernandez@isd.lacounty.gov
 - 323-881-3949