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SEE Action
STATE & LOCAL ENERGY EFFICIENCY ACTION NETWORK

Retro-Commissioning for State and Local Governments

What is Retro-Commissioning?

Retro-commissioning (RCx) is a systematic process for identifying and improving less-than-optimal energy performance in an existing building's equipment and control systems. The intent is for existing systems to work as efficiently as designed. This evaluation and fine-tuning process can be implemented as a one-time intervention, frequent "re-tuning,"[1] or ongoing "continuous commissioning,"[2] to ensure that the energy savings persist. State and local governments can use RCx as a lead component of their own facilities' energy efficiency programs and also can create RCx programs and policies that encourage or require RCx in privately owned buildings.

Why Encourage Retro-Commissioning?

The energy consumption of commercial buildings comprises nearly half of total building energy use, and roughly 20% of total energy consumption and greenhouse gas emissions in the United States.[3, 4] Government-owned buildings are nearly 25% more energy-intensive than non-government-owned buildings.[3] Energy expenditures average more than $2 per square foot ($ft^2$) in commercial and government buildings,[3] therefore energy use is a cost worth managing. Retro-commissioning can produce energy savings of 10% to 20%[5, 6] quickly and inexpensively—freeing public funds for more urgent needs.

At a cost far less than $1 per square foot (normalized median cost of $0.30 per square foot according to a 2009 study)[5] and typical payback in slightly more than 1 year,[5, 6] RCx can be a highly cost-effective energy- and emissions-reduction strategy. Retro-commissioning of 26 state university buildings in California, for example, yielded an annual savings of more than $1.3 million.[5] State and local governments can leverage the energy and cost-saving benefits of RCx to meet energy goals and to accelerate growth of the RCx market, creating an estimated 5 to 15 green jobs per $1 million invested.[7]

Retro-commissioning can help improve building energy performance, which has been documented to increase occupancy levels, lease rates, and sale prices relative to less-efficient properties.[8, 9, 10] These benefits flow not only to building owners, but also to state and local governments in the form of property taxes, title transfer taxes, and other revenues tied to the health of the commercial real estate market.

Like most individual policies or practices, however, RCx is not sufficient to realize the full efficiency potential of the commercial buildings market. To achieve greater savings, RCx can accompany benchmarking, rating, and disclosure policies; organization-wide energy management programs; voluntary energy challenges; and high-performance leasing practices.

Who is Affected?

Retro-commissioning policies and programs can affect key stakeholders:

- Public and private building owners can practice RCx.
- Interest groups that represent property owners and managers, tenants, and energy service providers can help educate customers.

Key Points

- Retro-commissioning is a process for "tuning up" a building's equipment to make it work as efficiently as possible without major capital investment.
- Retro-commissioning public buildings is a low-cost way to reduce energy costs by 10% to 20%, freeing up public funds for other uses.
- Successful retro-commissioning policies go beyond a one-time effort, encouraging building owners to follow up with regular feedback to ensure continued performance.

About SEE Action

The State and Local Energy Efficiency Action Network (SEE Action) is a state and local effort facilitated by the federal government that helps states, utilities, and other local stakeholders take energy efficiency to scale and achieve all cost-effective energy efficiency by 2020.

About the Working Group

The working group is comprised of representatives from a diverse set of stakeholders; its members are provided at www.seeaction.energy.gov.

- Utility companies can provide customers access to their energy-usage data and can provide technical and financial assistance to undertake RCx for identified projects.
- Organizations serving energy professionals can provide training, certification, and other credentialing services.
- State and local governments can implement RCx in public buildings and create policies that encourage RCx in the private sector.

How Does It Work?

Public agencies can start by conducting RCx in a sample group of their own buildings, using the results to develop a broader policy that requires all public—and ultimately private—buildings to be retro-commissioned at specified intervals (e.g., New York City specifies every 10 years); at the time of sale; at the time of heating, ventilation, and air conditioning (HVAC) replacement; or at the time of a major renovation.

Agencies also can reach private markets with voluntary RCx approaches, such as by defining RCx procedures through simple checklists to assist implementation, and by providing incentives or technical assistance.

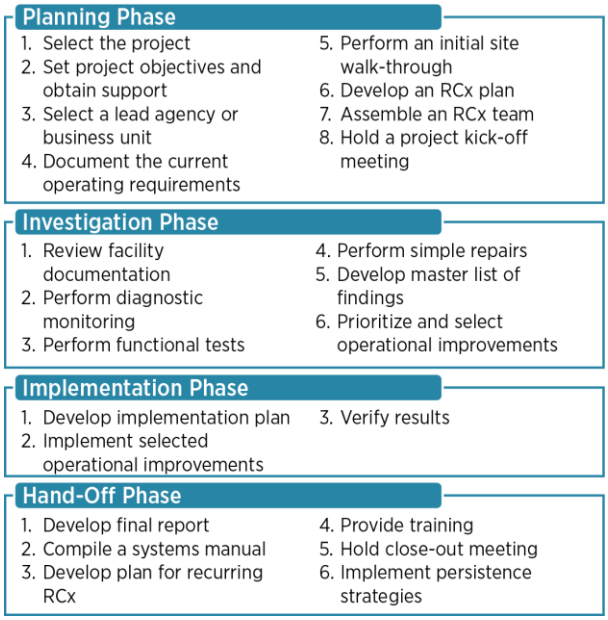

Figure 1. Overview of a typical RCx process
Source: Adapted from California Department of General Services, California Commissioning Guide, 2006

Implementing Retro-Commissioning Policies

The following section outlines steps that state and local governments can take to encourage RCx in their own buildings and the private sector.

Public Buildings

State and local governments can conduct RCx in a sample of their own buildings, and then use the results to develop a broader policy for all public buildings, as outlined below.

1. **Benchmark public buildings.** Ideally, benchmarking the energy performance of a government's building portfolio will precede any RCx effort. Benchmarking can help identify the largest energy consumers and worst-performing buildings—which are not always one and the same—to help prioritize buildings for RCx. For more information on benchmarking, refer to www.seeaction.energy.gov/existing_commercial.html.
2. **Perform retro-commissioning for one or more public buildings.** The results of the benchmarking effort can be used to identify a group of high-priority buildings to receive RCx, considering the buildings' energy consumption, energy performance, and diversity of building types that are representative of the entire building portfolio. This is an important learning experience, and a solicitation for RCx experts can start the process of identifying and developing the skilled workforce needed for a larger effort. As the jurisdiction conducts RCx on its buildings, the buildings can become learning labs for training and provide case studies to document benefits.
3. **Establish a retro-commissioning policy or plan for public buildings.** Based on the results of the buildings studied, develop a policy or plan for retro-commissioning the entire building portfolio on a regular schedule. Training building maintenance and operations staff is critical to ensuring that initial savings persist after the RCx project is completed. Consider requiring that RCx of public buildings be performed by a qualified commissioning authority with the knowledge, skills, and abilities described in the national Job/Task Analysis for Commissioning Authorities, currently under development.[11]
4. **Document the costs and benefits of the retro-commissioning.** Cost-benefit data can be invaluable in developing policies and programs that influence the private sector to follow the government's example.
5. **Monitor and verify results.** If benchmarking was performed in advance, then post-project benchmarking can be used to document energy savings. Ongoing monitoring ensures that corrected systems continue to operate as intended.

Private Buildings

State and local governments also can reach private markets with voluntary or mandatory RCx approaches. As noted, a voluntary approach could include defining RCx procedures via simple checklists or providing incentives or technical assistance to conduct RCx projects. A mandatory approach could require that buildings undergo RCx at specified intervals, at the time of sale, at the time of HVAC replacement, or at the time of a major renovation.

State and local governments can consider the following steps when developing mandatory RCx policies for the private sector.

1. **Engage key stakeholders.** Engaging stakeholders from the beginning can speed the adoption of the policy and increase its long-term effectiveness. Key stakeholders are likely to include:
   - **Real estate owners and managers.** Most states have an association or other network representing these key players.
   - **Tenant organizations.** As a primary beneficiary of improved building operations, tenants can build support for the policy and ensure that policy design serves user needs.
   - **Energy service experts.** Engineers, consultants, contractors, and building service firms are key players in performing RCx studies and efficiency upgrade projects. They can provide support for the policy and can help educate clients.
   - **Electric and gas utilities.** These energy suppliers can provide technical and financial assistance to undertake RCx or identified efficiency projects.
2. **Develop strategies for retro-commissioning with other policies.** If, for example, a jurisdiction is considering establishing a benchmarking policy, then creating an RCx program in parallel can be an effective way to identify energy-saving opportunities for building owners and managers of the underperforming buildings identified. Determine the details of the RCx program, including services and incentives offered, promotional plans, and program management, in coordination with complementary policies and programs. If possible, seek to leverage utility resources.
3. **Adopt policy.** Agencies could consider a phased-in implementation schedule based on factors such as building size and type to help building owners and managers start small and work up to a broader portfolio-wide RCx program similar to the approach recommended for public buildings.
4. **Develop training and workforce-development efforts.** Work with national and local professional and trade ally groups to implement training, certification, and other credentialing efforts. This step can be done in tandem with creating policy to ensure that the workforce is prepared to meet the increased demand for RCx and retrofit services resulting from the policy or program.
5. **Support post-launch activities.** Leverage the professional networks and communications channels of state and local associations and other entities. Work in concert with utility programs as much as possible.

Example Policies and Programs

New York City: Local Law No. 87[12] (part of the Greener, Greater Buildings Plan[13])

Adopted: 2009 / Effective: 2013 through 2022.

Affected Property Types: Nonresidential and multifamily public and private buildings that are smaller than 50,000 ft^2.

Key Requirements: Requires affected buildings to undergo an energy audit and RCx every 10 years. Audits must meet the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Level II Energy Survey and engineering analysis requirements, and must include:

- Assessment of all base building systems, including building envelope and HVAC, conveying, domestic hot water, electrical, and lighting systems.
- Recommended improvements, including implementation costs, cost savings, and simple payback.

Retro-commissioning must include an assessment of:

- Operating protocols
- Equipment calibration
- Cleaning and repairs
- Training and documentation issues.

Audits and RCx projects must be conducted by certified professionals (e.g., certified energy manager, certified commissioning professional) with relevant experience (i.e., 3 years relevant experience for auditors, 1 year relevant experience for RCx).

City of San Francisco, CA: Existing Commercial Buildings Energy Performance Ordinance[14]

Adopted: 2011 / Effective: 2011.

Affected Property Types: Nonresidential public and private buildings that are 10,000 ft^2 or larger.

Key Requirements: Requires nonresidential building owners to obtain energy audits at least once every 5 years and measure and disclose energy performance using the U.S. Environmental Protection Agency's (EPA) ENERGY STAR® measurement and tracking tool—Portfolio Manager—annually. Requires the stringency of energy audits to be proportionate to building size:

- Buildings 50,000 ft^2 or larger: Whole-building audit that meets or exceeds ASHRAE Level II
- Buildings 5,000 ft^2 to 49,999 ft^2: Whole-building audit that meets or exceeds ASHRAE Level I.

Requires the energy professional performing the energy efficiency audit to hold third-party credentials (e.g., Association of Energy Engineers Certified Energy Manager, licensed professional engineer) and have a minimum number of years of experience (which varies by credential).

Requires the energy professional to include in the audit report information on available RCx and retrofit measures, the estimated implementation costs, and the energy and cost savings.

Requires building owners to report compliance with the audit requirements to the city. Reported information must include:

- A list of RCx and retrofit measures with a simple payback of 3 years or less, or with a beneficial net present value
- Total estimated implementation costs and energy savings if measures are fully implemented
- A list of the measures implemented.

Requires the city to disclose and update at least annually building-specific compliance status and aggregate energy statistics based on the reported benchmarking and audit data. Establishes a non-compliance penalty of $50 to $100 a day for a maximum of 25 days.

Although, to date, no state has adopted mandatory RCx policies, several states offer guidance on RCx for public buildings. The guidance often also is applicable to private buildings. The "Other Resources" section of this document includes links to guidance documents for California, Hawaii, New York, and Oregon.

Complementary Policies and Programs

Retro-commissioning is one part of an effective buildings energy efficiency policy suite, and an organization-wide energy management program. Retro-commissioning should be accompanied by benchmarking, rating, and disclosure policies so that building owners are more motivated to undertake RCx and so buildings can clearly demonstrate improved energy performance to the market.

Retro-commissioning should not be a one-time effort; it should be followed up with regular performance feedback, continuous improvement efforts, support for in-depth technical analysis of major equipment investment opportunities, technical assistance, and financial incentives.

For access to SEE Action resources on related topics such as energy audit programs, strategic energy management programs, and benchmarking and disclosure programs, visit www.eere.energy.gov/seeaction/existing_commercial.html.

Other Resources

These resources provide more information on implementation of RCx programs and policies.

American Council for an Energy-Efficient Economy (ACEEE), Local Energy Efficiency Policy Calculator. www.aceee.org/portal/local-policy/calculator.

California Commissioning Guide: Existing Buildings. www.documents.dgs.ca.gov/green/commissionguideexisting.pdf.

California Retro-Commissioning Fact Sheet. www.documents.dgs.ca.gov/green/eeproj/retrocommfactsheet.doc.

Hawaii, *Building Commissioning & Retro-Commissioning Guidebook*. www.hawaii.gov/dbedt/info/energy/efficiency/Cx%20and%20RCx/Cx%20Guide%20Rev%20%202%20-%20Oct%20%202008%20.pdf.

New York State Energy Research and Development Authority, *Guideline to the Commissioning Process for Existing Buildings, or "Retro-Commissioning."* www.nyserda.org/programs/pdfs/retrocxhandbookfinal040704.pdf.

Oregon, *Retrocommissioning Handbook for Facility Managers*. www.oregon.gov/ENERGY/CONS/BUS/comm/docs/retrocx.pdf.

U.S. Environmental Protection Agency, ENERGY STAR Portfolio Manager. www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager.

U.S. Environmental Protection Agency, Rapid Deployment Energy Efficiency Toolkit. www.epa.gov/cleanenergy/energy-programs/suca/rdeetoolkit.html.

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[3] U.S. Department of Energy, *Buildings Energy Data Book*, Chapter 3. March 2011. http://buildingsdatabook.eren.doe.gov/ChapterIntro3.aspx.

[4] U.S. Environmental Protection Agency. *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2009*. Table ES-8. April 2011. www.epa.gov/climatechange/emissions/usinventoryreport.html.

[5] Mills, E. *Building Commissioning: A Golden Opportunity for Reducing Energy Costs and Greenhouse Gas Emissions*. July 21, 2009. Berkley, CA: Lawrence Berkeley National Laboratory. http://cx.lbl.gov/documents/2009-assessment/LBNL-Cx-Cost-Benefit.pdf.

[6] "Commercial Building Retro-Commissioning Revenue Could Surpass $1.8 Billion in the United States by 2014." March 24, 2011. www.pikeresearch.com/newsroom/commercial-building-retro-commissioning-revenue-could-surpass-1-8-billion-in-the-united-states-by-2014.

[7] "Rapid Deployment Energy Efficiency (RDEE) Toolkit: Planning & Implementation Guides." December 9, 2009. www.epa.gov/cleanenergy/documents/suca/rdee_toolkit.pdf.

[8] "Energy Efficiency and Property Value." www.imt.org/rating-value.html.

[9] Pogue, P; Tu, C; Bernstein, H. *Do Green Buildings Make Dollars & Sense? An Analysis of Operating Costs, Worker Productivity and the Benefits of LEED® Certification in a Commercial Office Portfolio, Green Building Study, ver. 2.0.* 2010. http://marketing.cbre.com/Sustainability/GreenBuildingStudy/DoGreenBuildingsMakeDollarsAndSense.pdf.

[10] Finlay, J.; Kok, N. "Valuing Sustainable Real Estate." June 2011. http://marketing.cbre.com/NewportBeach/Sustainability/ValuingSustainableRealEstate.pdf.

[11] "National Workforce Guidance Overview www.buildings.energy.gov/workforce.html.

[12] New York City: Local Law No. 87. http://www.nyc.gov/html/planyc2030/downloads/pdf/ll87of2009_audits_and_retro-commissioning.pdf.

[13] Greener, Greater Buildings Plan. 2011. www.nyc.gov/html/ planyc2030/html/about/ggbp.shtml.

[14] City of San Francisco, CA. Existing Commercial Buildings Energy Performance Ordinance. Jan. 24, 2011. www.sfbos.org/ftp/uploadedfiles/bdsupvrs/committees/materials/LU012411_101105.pdf.