



Retro-Commissioning (RCx) A Resource for Building Owners and Operators

June 2023

What is Retro-Commissioning? (RCx)

Retrocommissioning (RCx) is the application of the commissioning process to existing buildings. It is a process that seeks to improve how building equipment and systems function together based on how the building is presently used. Depending on the age of the building, RCx can often resolve problems that occurred during design or construction, or address problems that have developed throughout the building's life. In all, RCx improves a building's operations and maintenance (O&M) procedures to enhance overall building performance.

Commissioning. Buildings are (usually) commissioned when they are first built to ensure all HVAC/lighting systems are running as they should. Commissioning is a term that comes from shipbuilding. Before a ship is commissioned, it is put through a series of trials at sea to identify any problems so they may be corrected before launch. In building construction, commissioning is a quality assurance process to make sure new buildings are designed, constructed, and programmed for optimal performance. RCx essentially reapplies these commissioning practices after the building has been in operation for some time.

How is it done? The RCx process is often a collaborative partnership between the building stakeholders and the RCx team. The RCx team is comprised of engineers and trades who assess building systems and maintenance programs, and make recommendations for measures that will conserve energy by updating mechanical, electrical, and control systems to reduce building energy use and maintain optimal efficiency.

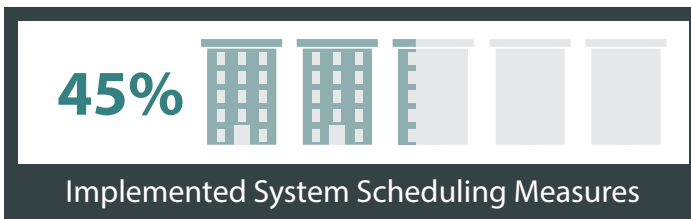
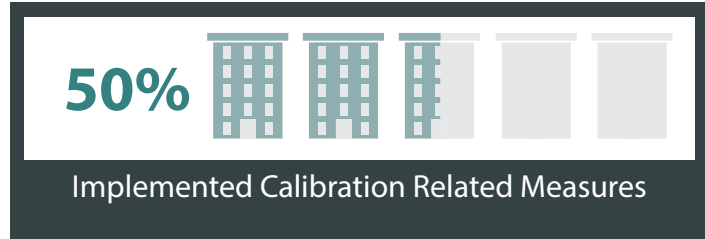
All forms of building commissioning share the same goals: to produce a building that meets the unique needs of its owner and occupants, operates as efficiently as possible, provides a safe, comfortable work environment, and is operated and maintained by a well-trained staff or service provider.

The bottom line. RCx improves occupant comfort and productivity, reduces building operating costs, improves control, reduces occupant complaints, and reduces the building's environmental impact.

Telling Stats

According to the United States Environmental Protection Agency, for commercial real estate, the average building wastes about a third of the energy it consumes. In most buildings there are opportunities to cut energy costs and reduce energy use by investing in energy efficiency.

For example, a Lawrence Berkley National Laboratories – Environmental Energy Technologies Division study of more than 122 buildings of different types across the US found that as part of RCx:



RCx projects identify issues and recommend energy conservation measures (ECMs) such as the ones listed below. Many case studies can be found on-line for public properties such as multi-family residential buildings, hospitals, and schools. In one Case Study (included in Further Information below), RCx providers identified 155 issues with a Texas public high school and recommended ECMs that saved an estimated 41% of energy with a \$1.1 million investment and an overall payback period of 5.4 years.

Common Problems Found by RCx Providers

- Duct leakage
- HVAC left on when space unoccupied
- Lights left on when space unoccupied
- Airflow not balanced
- Improper refrigerant charge
- Dampers not working properly
- Insufficient evaporator airflow
- Improper controls setup/commissioning
- Control component failure or degradation
- Software programming errors
- Improper controls hardware installation
- Air-cooled condenser fouling
- Valve leakage

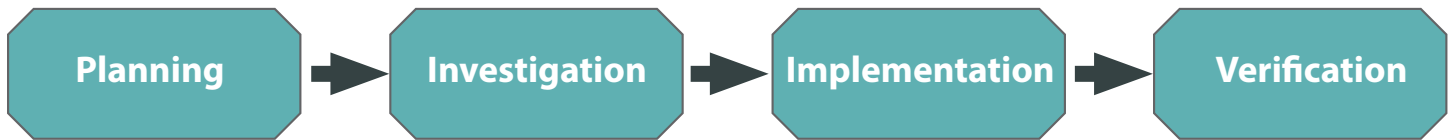
When Should a Building be Retro-Commissioned?

- The building has never been commissioned
- The uses of the building have changed
- The building is experiencing:
 - higher energy costs
 - occupant comfort complaints
 - indoor air quality problems
 - operation and maintenance problems
- Every 3-5 years



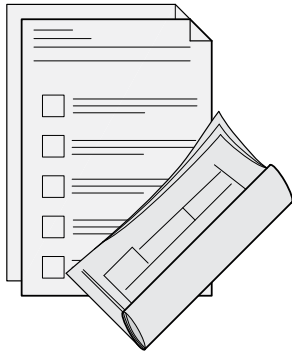
Recording nameplate information in a boiler room

The Retro-Commissioning Process



A well-planned and executed retro-commissioning project typically occurs in four distinct phases: *Planning, Investigation, Implementation, and Verification:*

Planning



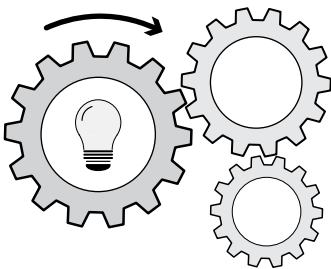
Planning includes early discussions of what spaces or equipment is going to be considered for RCx, the measures that may be investigated, and what is not in scope. Talking to the occupants of the building helps identify what and where issues are. This is an opportunity to find out about the energy impacts of decisions and a chance to educate occupants on equipment capabilities and the cost of operating a system for only a few occupants during hours of minimal occupancy. This phase also includes setting project objectives and assembling the RCx team.

Investigation



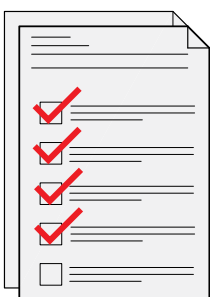
During the investigation stage, the RCx contractor will review available facility documentation: analyze data, diagnose problems, identify RCx measures, calculate payback periods, perform diagnostic monitoring and functional tests, and develop a master list of findings. The owner then prioritizes and selects operational improvements.

Implementation



The client decides what measures to implement and who will do the work, either by existing facilities staff or by a 3rd party contractor. The implementor develops and presents an implementation plan to the client and executes the selected operational improvements. The implementor will often develop a final report of initial and final conditions. The contractor may provide training to stakeholders and conduct a wrap up meeting.

Verification



Following implementation, the RCx contractor verifies the adjustments and updates savings calculations accordingly. This would typically include reporting back to parties of these updated savings calculations either for information or for further action by the client if desired.



Internal controls of a high school Dedicated Outdoor Air Unit

Further Information

Exploring Retro-CX: A Public High School Case Study

<https://www.dbrinc.com/exploring-existing-cx-a-public-high-school-case-study/>

Retro-commissioning: an Owner's Look at the True Costs and Return on Investment by NC State

<https://www.bcxa.org/wp-content/uploads/2015/06/Renzi-Presentation.pdf>

Retro Commissioning by Ameren, IL

<https://www.amerenillinoissavings.com/business/retro-commissioning/>

Retro Commissioning by Com-Ed

<https://www.comed.com/WaysToSave/ForYourBusiness/Pages/RetroCommissioning.aspx>

Where can I get help?

SEDAC Technical Support

Contact SEDAC for technical assistance. Call: 800.214.7954 or email: sedac-info@illinois.edu.

Utility Incentive Programs

Many electric and natural gas utilities provide technical services and financial incentives that can help you offset the costs of RCx. Contact your utility service provider to see what incentives they may have.

Who We Are

The Smart Energy Design Assistance Center assists buildings and communities in achieving energy efficiency, saving money, improving indoor air quality, and becoming more sustainable. SEDAC is an applied research program at the University of Illinois at Urbana-Champaign.

SEDAC services to save energy and money include:

Quick Advice | Energy Assessments | New Construction Design Assistance | Long-term
Climate Action Planning | Retro-Commissioning