

Retro-Commissioning: The Key to Sustainability in Existing Facilities

*By: Charles E. Bolyard, Jr., PSP, CFCC Chairman of the Board and CEO of MBP
and James Mascaro PE, CCP, Director of Commissioning Services at MBP*

The direction of the design and construction industry has recently shifted sustainability for newly designed and constructed buildings, plants and facilities. This comes on the back of green initiatives to provide operational efficiency through design and management over the full useful life of facilities. But what about the millions of existing buildings, industrial plants, and facilities that are still within their useful life or that can have extended life and contribute significantly to sustainability and reduce energy demands?

The University of Virginia, Medical Research IV, Charlottesville, VA is an example facility where retro-commissioning services identified a number of issues and made recommendations for correction to the HVAC systems. Once the University operations and maintenance staff implemented the recommendations they realized \$388,000 in energy savings during the subsequent ten months.



The key to unlocking the door to drive sustainability to higher levels of achievement lies within the realm of retro-commissioning (RCx). RCx is a process of evaluating, testing, adjusting, and correcting building systems to meet the owner's requirements, to improve comfort and environmental quality, and to optimize energy and resource conservation in existing buildings. Fully testing performance after changes to verify recovery of lost efficiency and to create efficiencies where none existed previously, followed by periodic monitoring completes the RCx process. The benefit is significant reduction on energy dependency and sustainability where it did not exist before. RCx carries with it not only the potential to improve efficiency over the original design life of facilities, but also to extend the useful life of facilities while saving premature capital investment in replacement equipment. RCx is achievable in any existing facility and can apply to a single facility, multiple buildings, or a campus of buildings.

The Building Commissioning Association (BCA) provides standards for use by industry in specifications, training and certification.

Assess the Scope of the Project

The initial step in the RCx process is to clearly define the scope of the RCx project that will become the basis for a contract between the Retro-Commissioning Authority (RCxA) and the owner. During this phase, it's critical to develop a complete understanding of the owner's expectations and expected outcome of the RCx effort, which includes touring the facility with the owner. Depending on the age of the facility and how many revisions have been made to the systems, the owner may not have the initial project requirements when the facility was designed and constructed.

Pre Site Investigation Phase

Prior to testing of the systems, the RCxA must prepare by collecting all existing documentation such as the original owner’s project requirements (OPR); basis of design (BOD), architectural/HVAC/plumbing/electrical drawings and specifications/submittals; operations and maintenance (O&M) manuals; testing, adjusting, and balancing (TAB) and commissioning reports. This information shall be used to develop the RCx plan.

Site Investigation- Building/Facility Assessment

The next step in the RCx process is to assess the condition of the facility. This entails verifying the age of the facility and its current functional use and general condition. This overall condition assessment is customarily performed according to ASTM standards for property condition assessments.

These measures can make a strong contribution to the overall improved efficiency and sustainability of the building at the conclusion of the RCx process.

Building Systems Investigation

The RCx of the mechanical and electrical operational systems within the building provides the greatest opportunity to regain efficiencies that translate directly into cost savings, improved useful life, and sustainability. What we find most frequently is that existing facilities, even those reasonably maintained, have been operating at significantly reduced efficiency for years, or never at all due to lack of commissioning when the facility was first started up. RCx will usually involve the following building systems building envelope thermal and pressure characteristics, landscape lighting and irrigation systems, HVAC systems and equipment, HVAC control systems, plumbing systems, electrical lighting, and power systems.

In this phase the RCx team looks for quick fixes, i.e. non-capital repairs, system adjustments, and corrections that will immediately improve the operation of the facility. Detailed observations of existing conditions are documented and photographed where practical. The systems operation is referenced to available documentation and specifications, operations/maintenance/repair records if any, and to industry custom and practice.

During an investigation of the building systems at the Durham Performing Arts Center, Durham, North Carolina, it was discovered that the HVAC systems were performing poorly and the direct digital control system was in need of corrective measures to help resolve comfort issues, sequence of operation issues, and reduce energy usage.



These fixes improve the operation of the systems and eliminate apparent issues so that they do not disguise any underlying major issues.

Functional Performance Testing

Once the recommended corrective measures from the previous phase have been completed across all of the facility systems, it is time to verify the gains in operational performance via functional performance testing (FPT).

In the FPT phase, the building systems are tested through their full operational range according to the design documents and the requirements of the manufacturers. The objective is to observe systems operations and confirm that it meets the specified sequence and performance output. Testing of the systems begins at the component level and is completed when the entire integrated system has been tested. The systems are operated in every mode to validate sequence and performance output.

Successful RCx is a collaborative process that involves detailed dialogue between the RCxA, the owner, the owner's facility operator/manager, building occupants, and can also include various contractors/manufacturers' representatives.

The ultimate objective of RCx is to return existing systems that have been operating at poor levels of performance to operation at optimal levels of performance that improve climate quality and provide costs savings through efficient usage of energy.

The full measure of improvements through the RCx process requires comparison of operating costs through a full cycle of operational conditions – which may take a year to compile and compare to past performance costs.

Periodic re-commissioning should be anticipated so any degradation of systems can be evaluated and optimal operation restored. Adequately trained and in sufficient numbers, owners' staff and records management are critical to maintaining the sustainability and operational maintenance of the facility.