Improving Energy Savings Through Retrocommissioning

Similar to the commissioning process for new equipment and technology, retrocommissioning ensures the required communication, coordination, testing, and verification exists for a building's systems to perform as intended. PHOTO BY BRIAN LEWIS, SUMMER CONSULTANTS

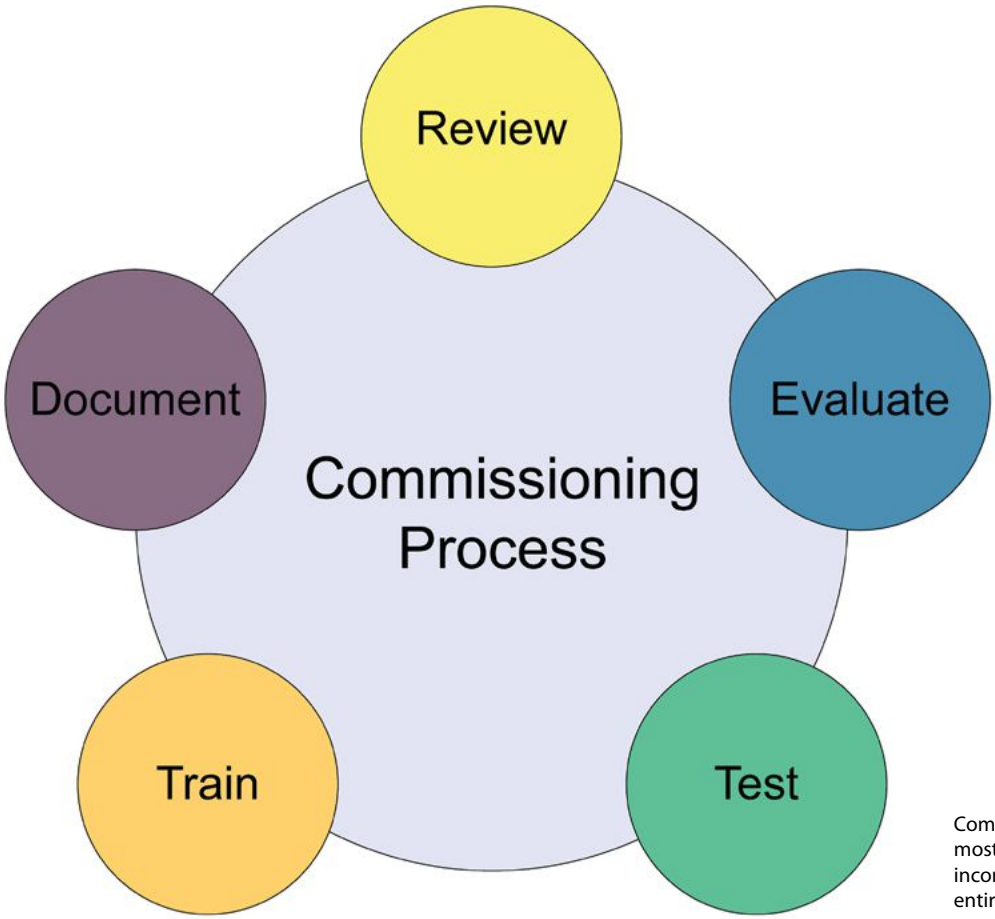
Mechanical and plumbing systems are an effective target for tackling energy savings in an existing building—and retrocommissioning is a useful tool to identify improvements that could result in energy savings.

By Anne Juran, P.E., LEED AP, M.SAME, and Jim Gawthrop, P.E., LEED AP

Energy-efficient facilities are a goal of every building owner, both for cost savings and sustainability improvements.

With new construction projects, energy efficiency can be achieved in many ways, including building orientation and material selection. High efficiency systems can easily be designed to fit within the building shell, where all existing air distribution and lighting can be built into the aesthetic rather than being an afterthought.

But for existing buildings, achieving energy savings is a completely different complexity. Mechanical, electrical, and plumbing upgrades generally have to fit within the existing building constraints. And, with limited budgets, opportunities



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are rare to upgrade the internal systems completely. Instead, most replacements tend to be piecemeal.

While commissioning is often associated with either the design of new facilities or large retrofit projects seeking a high-performance certification, existing buildings with smaller renovations can also benefit from the commissioning process. This is especially true for owners looking to improve energy performance and cost savings.

ASSURING THE DELIVERY OF VALUE

The commissioning process facilitates and ensures that the required communication, coordination, testing, and verification is done to deliver a building with systems performing as intended. Ultimately, commissioning provides value to the owner by confirming that systems work as intended and meet the owner's requirements, system documentation is complete, and staff is trained on the operation and maintenance of each system.

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Any building system can be commissioned. Traditionally, this meant mechanical. However, commissioning has expanded to electrical and building envelope systems. In existing buildings, commissioning can occur when a new system is added, when an existing system is modified or replaced, when finding the reason for an ongoing problem, or when confirming that a problem has been resolved.

Commissioning is most effective when incorporated into the entire design process. The work includes several phases and requirements: defining the owner's requirements; reviewing designs; surveying existing equipment; developing customized checklists; conducting functional performance testing; and reviewing operations and maintenance documentation and staff training. When implemented, the benefits of commissioning can include early identification of potential system design problems, better operational efficiency and reduced maintenance needs, and ultimately, lower energy and operational costs.

The commissioning process can be implemented before any design plans are created. If a system was never commissioned during installation, or if a problem has been identified, retrocommissioning can be a useful tool to determine whether it is performing as originally intended or if there are opportunities to improve efficiency and performance. This in-depth analysis can help owners focus their scope of work and budget where they may see the best return on investment.

Many of the same commissioning processes are also used when retrocommissioning. Available design plans are reviewed to understand how the system was intended to perform. A survey of the existing equipment is completed to determine what modifications have been made and how well the system meets performance requirements. Functional performance testing then helps determine the current sequence of operations. Analysis of the findings from the retrocommissioning process can result in recommendations for future repairs and help guide the development of a design solution.

Often, retrocommissioning is not specifically identified in a scope of work; rather, it is incorporated into other activities, including studies and designs. In addition, the review, evaluations, and testing components of retrocommissioning are often used to guide the design process.

APPLYING THE PROCESS

The 2,500-acre Naval Support Facility in Indian Head, Md., is the U.S. Navy's oldest continuously operating ordnance station. In 2015, over 280 systems in seven buildings, including offices, warehouses, labs, and explosive processing facilities, were retrocommissioned because they were not performing as required. The structures were primarily constructed or upgraded between 2009 and 2012, and included three LEED certified buildings (one gold, two silver). A total of 25 major components, such as air handling units, chillers, and geothermal heat pumps, were captured within the scope of work.

A review of the existing drawings and owner requirements uncovered initial problems. Building requirements, such as strict humidity control, were not being met. Every piece of equipment was evaluated and put through functional performance testing. This included testing the controls systems on all devices in every building.

The study team used the information identified during the retrocommissioning process to identify what changes and repairs were necessary. Solutions ranged from simple items, such as closing doors in certain areas, to the replacement of equipment with a greater capacity to improve performance. The final documentation included a report with descriptions of the facilities and the existing systems, findings of the retrocommissioning process, and recommendations for prioritized corrections and improvements totaling over $2.6 million.

IDENTIFYING OPPORTUNITIES

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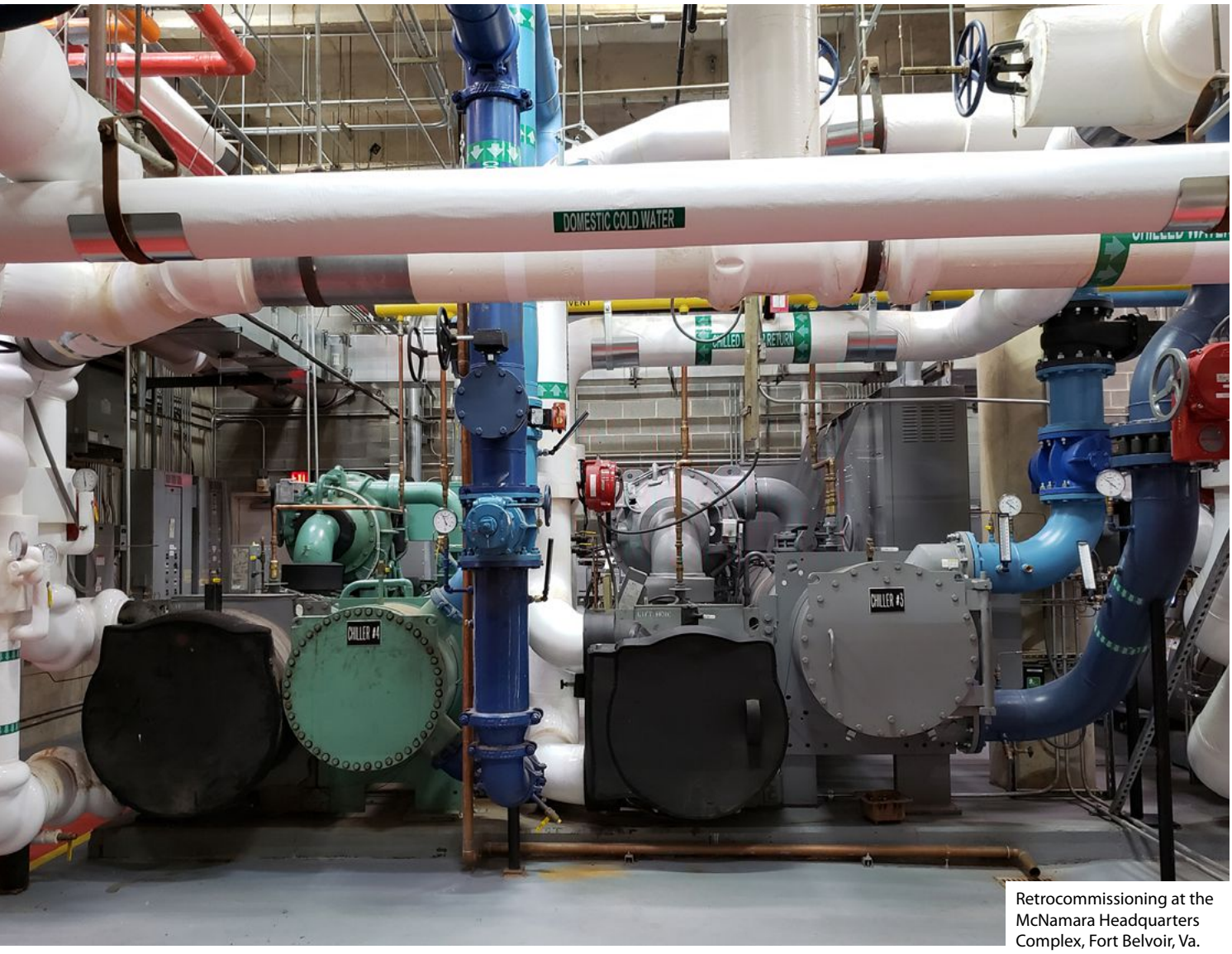
The Defense Logistic Agency's McNamara Headquarters Complex, located at Fort Belvoir, Va., covers over 1,000,000-ft². Though the facility was not uncomfortable to occupants and systems were well-maintained, an HVAC and energy study was completed to understand system operations, identify ways to meet federal mandates of a 30 percent reduction in energy usage, and develop a master plan for building upgrades.

The study examined the entire McNamara Complex, including electrical systems and building envelope. All airside and waterside systems serving the building (chillers, pumps, air handling units, boilers, hot water heaters, and controls) were tested, balanced, and retrocommissioned. The review provided information that allowed the study team to determine where improvements could be made to increase system performance and energy savings. The final report provided the owner with a list of recommended energy conservation measures, estimated to save nearly 33 percent in energy consumption.

A follow-on renovation used the improvement recommendations to guide the design process and make strategic upgrades. Constant volume air handling units were upgraded to variable airflow, and three existing 500-TR chillers and associated pumps were replaced with three new 700-TR chillers. Another existing 300-TR chiller was modified to improve performance. The majority of ductwork and piping distribution was reused, ultimately resulting in better paybacks as total system replacement was avoided.

Good commissioning can be the difference in maximizing efficiency. A less efficient system run correctly may save more energy than the most efficient equipment operating in a manner other than originally intended.

A notable improvement came from the replacement of the hybrid pneumatic and digital controls system with a new direct digital control framework. Prior to retrocommissioning, the mechanical systems were considered to operate adequately. However, upon analysis of the functional performance testing of each system's actual operating sequence, it was seen that was not



Retrocommissioning at the McNamara Headquarters Complex, Fort Belvoir, Va. provided a report estimated to save nearly 33 percent in energy consumption. PHOTO BY JIM GAWTHROP, SUMMER CONSULTANTS

the case. For example, the pneumatic control devices had lost their calibration, meaning that none of the air handling unit economizers operated correctly. It also meant that maintenance staff had to walk the entire building to take readings from multiple locations.

Based on the information provided in the study, the new controls system was designed to correct and optimize the airside system sequences, allowing the air handling units to operate as intended. With the entire system switched to digital controls, maintenance staff could monitor performance from their office. Additional capabilities, such as trending, allow maintenance staff to further optimize operation.

Cumulatively, the upgrades to the air handling units, chillers, and pumps—along with additional improvements such as replacing the existing boilers with condensing boilers and new condensing hot water heaters—have resulted in an estimated decrease of 18.2 percent in annual energy usage, accounting for over half of the study's original estimated energy savings.

MAXIMIZING EFFICIENCY

Each existing building is unique. Good commissioning can be the difference in maximizing efficiency. A less efficient system run correctly may save more energy than the most efficient equipment operating in a manner other than originally intended.

Before a problem can be solved, an owner may find value through retrocommissioning in thoroughly understanding existing systems and underlying issues. Implementing commissioning early in the design process can help determine which systems can be modified and which systems may require a more comprehensive replacement.

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