

Commissioning Existing Buildings 101



Making what you already have work the way it's supposed to can be one of the most cost-effective ways to save on energy costs in a commercial or industrial facility. As buildings age, their performance can degrade and their use or occupancy patterns often change. Unless a building's systems have been periodically updated, they may no longer perform as designed or meet the needs of their occupants. The process of building commissioning addresses these problems by systematically investigating the operation and maintenance of building systems and "tuning" them to work as an integrated whole to suit current needs. When this process is applied to existing buildings that have not been commissioned before, it is often termed "retrocommissioning," as opposed to "recommissioning," which typically is used for buildings that have been commissioned before and need to be retuned. The process requires testing equipment and skills not found within most organizations, so it usually is performed by specialized consultants.

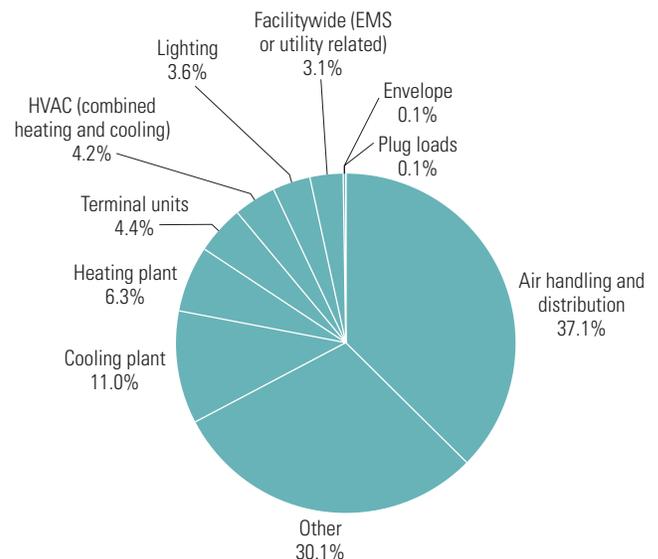
What You Will Gain from Commissioning

Building owners, managers, staff, and tenants all stand to gain from the commissioning of an existing building. It can lower building operating costs by reducing demand, energy consumption, and time spent by management or staff responding to complaints, as well as increasing equipment life. It can also improve tenant satisfaction by increasing the comfort and safety of occupants.

Researchers at three of the foremost building-commissioning think tanks in the U.S.—Lawrence Berkeley National Laboratory (LBNL), Portland Energy Conservation Inc., and the Energy Systems Laboratory at Texas A&M University—concluded in a study published in December 2004 (see Mills et al. in the "Resources" section) that commissioning is one

of the most cost-effective means of improving energy efficiency in commercial buildings. The researchers statistically analyzed more than 224 new and existing buildings that were commissioned, totaling over 30 million square feet (ft²) (2.8 million square meters) of commissioned floorspace (73 percent existing buildings and 27 percent new construction). The results revealed both energy and nonenergy benefits (**Figure 1** and **Figure 2**, next page). Analysis of commissioning projects for existing buildings showed a median commissioning cost of US\$0.27 per ft², whole-building energy savings of 15 percent, and a simple payback of 0.7 years. The most-cost-effective commissioning projects are typically energy-intensive buildings such as hospitals and lab-

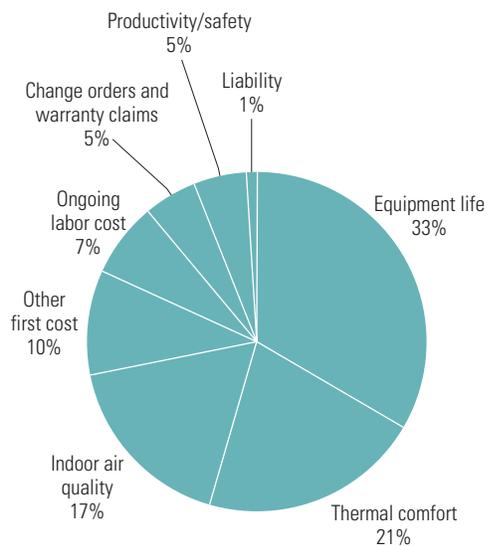
Figure 1: Building system deficiencies
For projects where deficiencies were characterized, 63 percent of problems were related to the overall HVAC system in some fashion.



Note: EMS = energy management system.

Source: E SOURCE; data from Lawrence Berkeley National Laboratory, Portland Energy Conservation Inc., and Energy Systems Laboratory, Texas A&M University

Figure 2: Reported nonenergy impacts for existing buildings
The largest nonenergy impact of building commissioning was the extension of equipment life.



Source: E SOURCE; data from Lawrence Berkeley National Laboratory, Portland Energy Conservation Inc., and Energy Systems Laboratory, Texas A&M University

oratories, whereas the least-cost-effective projects are small in comparison with the size of the average commercial building.

What to Expect from the Process

Commissioning is conducted by a team, the size of which depends on the complexity of the job. At a minimum it will consist of a representative from the commissioning provider—the consulting firm providing the service—and a member of the building staff. It could also include an owner’s representative, design professionals, and testing or other specialists. The building owner will select a commissioning lead or agent who will lead the team and the process.

Key components of the process are described in the following sections.

Comprehensive operations review. The team will analyze building documents to help determine the current state of building operation. Relevant documents include equipment lists; building and equipment drawings;

operations and maintenance manuals, logs, and policies; energy-efficient operating strategies for equipment; testing, adjusting, and balancing reports; statements of original design intent; and utility bills for the past 12 to 24 months. The team will also conduct an initial building walk-through and may interview managers, staff, or tenants to help ascertain building performance.

Testing of building systems. The team will monitor current equipment performance and conduct functional testing on the building equipment and systems to ensure that they operate as expected and that they are efficiently meeting current building needs. Simple repairs may also be conducted during this testing phase.

Development of recommendations. The team will produce a list of measures that could be used to improve the building’s performance. They may range from simple and low-cost repairs or controls changes to extensive retrofits.

Implementation of selected measures. Only measures approved by the owner or another designated authority will be implemented.

Verification of benefits. Testing or inspections may be used to verify that the desired results are achieved from each measure.

New documentation and building staff training. As a key part of handing off the commissioning project, the team will produce new documentation for the building record that will assist in implementing and sustaining the selected measures. In addition, the team will ensure that building staff are trained in how to maintain any building improvements that were made. Ideally, staff training will occur throughout the commissioning process so that staff members will develop an intimate understanding of the changes made.

How You Can Assist

There are several things building staff can do to prepare for and participate in the commissioning of an existing

building that will save time and money on the project.

- Help select the commissioning provider.
- Gather together all of the documents that will be used by the commissioning team for the comprehensive operations review.
- Complete regular maintenance tasks (such as seasonal servicing of HVAC equipment) before the commissioning starts.
- Assist with monitoring and testing efforts. This will lower the project cost and provide hands-on training for the building staff to enable them to maintain the implemented measures.
- Track measures after the project is complete to ensure that benefits last.

Commissioning Proves Its Worth

The University of Montana in Missoula, Montana, learned that even for a relatively new building, the recommissioning process can be cost-effective. The Gallagher School of Business Administration building was partially commissioned after it was built in 1997. After several years of operation, however, performance problems and complaints began to appear.

To address the problems, the university decided to recommission the building. Together with the Montana Department of Environmental Quality (MDEQ), with funding from the Northwest Energy Efficiency Alliance and support from the U.S. Department of Energy's Rebuild America Program, the university hired a commissioning provider who completed the process by the fall of 2002. The analysis revealed and suggested fixes for 346 problems in the building, including dampers that couldn't fully open or close, valves that leaked or couldn't close, and equipment controls that were out of calibration. Implementing many of these measures produced an estimated annual energy savings of approximately \$19,500. The simple payback for the commissioning

provider fee of \$24,380 was 1.25 years (the university used its own building staff to implement the corrective measures).

The recommissioning delivered several lessons. First, recommissioning may be needed sooner than expected, especially if the original commissioning did not begin with the design phase of a building. Second, Brian Green, the energy planning and technical assistance supervisor at the MDEQ, said that a big factor in the building's declining performance was that its occupancy load had changed. As enrollment in the business school increased, the number of new people and computers added loads that the heating and cooling systems had not been designed to handle. Periodic recommissioning can help a building to meet such changing needs. Third, periodic recommissioning is required for complex HVAC control systems to maintain their efficiency and performance. Based on the commissioning findings and a payback analysis, the MDEQ recommended that the university recommission the Gallagher building every three to five years to keep it operating efficiently.

Resources

California Energy Commission, "California Commissioning Guide: Existing Buildings" (2006), prepared by Portland Energy Conservation Inc., www.documents.dgs.ca.gov/green/commissioningguideexisting.pdf.

Evan Mills, Hannah Friedman, Tehesia Powell, Norman Bourassa, David Claridge, Tudi Haasl, and Mary Ann Piette, "The Cost-Effectiveness of Commercial-Buildings Commissioning" (2004), Lawrence Berkeley National Laboratory, <http://eetd.lbl.gov/emills/pubs/cx-costs-benefits.html>.

Oregon Office of Energy, "Retrocommissioning Handbook for Facility Managers" (2001), prepared by Oak Ridge National Laboratory and Portland Energy Conservation Inc., www.oregon.gov/ENERGY/CONS/BUS/comm/docs/Newcx.pdf.

