



An Introduction to Building Commissioning

by CXE Group LLC

What exactly is Building Commissioning?

Building Commissioning is the systematic process of proactively verifying that building systems are designed, installed, thoroughly tested, and capable of being operated and maintained to perform as intended and as the owner expects and believes. A properly commissioned building provides optimized energy efficiency, improved indoor air quality and occupant comfort, as well as a foundation for minimizing operation and maintenance costs.

Commissioning is not a new concept. It has been utilized for many years in the military, most prominently for Navy ships and submarines. As building systems have become more complex and system integration becomes necessary for life-safety and proper indoor environmental quality, building owners have been including commissioning authorities in the design, construction and building turnover process.

The commissioning process, and inclusion of a Commissioning Authority (CxA) on the project team, is a fundamental prerequisite of the US Green Building Council's LEED program, GSA's new building program, many states and universities, etc., and became a new requirement of the 2012 International Building Energy Conservation Code, which has been adopted by the State of Illinois.

Building Commissioning is NOT:

- Construction observation and punch list
- Equipment start-up
- Testing, adjusting and balancing
- Final punch-out

These are normal parts of the construction process and complement the commissioning effort.

Should our design and construction team already be doing this?

The Commissioning Process is adopted by an owner to consistently achieve successful construction projects. It is not an additional layer of construction or project management – it is the owner's means of verifying that the planning, design, construction, and operational processes are achieving their goals and ensures the delivery of a high quality building. Some A/E and CM firms can provide commissioning as per the industry standards and guidelines if they have the proper training and experience, but it is typically recommended that the CxA be an independent, third-party expert working directly for the owner.

The commissioning process is a team effort that includes the design team, contractors, equipment representatives, owner's operation personnel, all working under the guidance and oversight of the owner's Commissioning Authority.

Shouldn't contractors perform testing to ensure equipment works properly?

On most building projects the responsibility for the installation and functionality of equipment is divided among the many contractors and sub-contractors. Each one is focused solely on their portion of the project and only conduct testing on the equipment for which they are directly responsible and often only under one set of operating conditions. The CxA spends the essential time necessary to make sure equipment and systems are tested in an integrated manner to assess total system performance, exercising both equipment and systems under all modes of operation.



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What services can I expect to receive from the Commissioning Authority?

The services of the CxA extend well beyond the normal design and construction process and requirements. A trained CxA will put your building through an extensive set of tests to see just how it will work under normal operating conditions. These tests detect any faults or problems before the owner takes possession and occupies the building.

Typical tasks the CxA may perform:

- Help define the Owner's Project Requirements (OPR) early in the design process.
- Assist the design team with defining the Basis of Design (BOD), which documents how the systems will perform once the design is complete, again normally early in the design process.
- Perform design reviews of the construction documents during the design effort.
- Prepare specification sections to be included in the bid documents to help define the scope of the commissioning effort, and ensure the contractor includes sufficient time and support to help complete the commissioning effort. Unless this is well-defined, the low bid contractor may omit sufficient time to perform proper commissioning, and the project may suffer.
- Review appropriate submittals to ensure proper coordination between all parties and verify that the project requirements are being met. The design team maintains responsibility for review of submittals for conformance with the contract documents.
- Prepare installation checklists for the contractors to use during construction to help define what is expected as they install individual items of equipment.
- Maintain a list of issues identified during the entire building process to make sure that each item is addressed and resolved, and that nothing falls through the cracks.
- Develop testing procedures for each item of equipment and system to fully test and exercise the individual components, then entire systems, and finally the overall building under all potential operating conditions.
- Assist the team with resolving any potential problems that may surface, and often providing expert input on how to maximize the building performance.
- Prepare a report summarizing the commissioning effort, identifying remaining open issues, if any, and providing relevant test data for future reference.
- Follow-up during the first year of operation can include monitoring of system performance and actual energy usage, and a review of potential issues prior to the end of the one year warranty.

Additionally, the Commissioning Authority can develop customized building system operational manuals, preventive maintenance plans, perform extensive operator training, monitor energy usage and system performance.

Is Commissioning beneficial for every building?

Many older buildings had simple heating systems installed for occupant comfort that due to their simplistic design may not benefit from comprehensive commissioning. However, today's modern buildings have complex indoor environmental requirements that rely on integrated heating, cooling and ventilation systems to meet code requirements and provide occupant comfort. These complexities, combined with the rising costs of energy, make it essential that these systems not only operate properly but that operating personnel are well-trained and thoroughly understand their new building systems.

Commissioning benefits buildings with complex systems by providing owners with services that have tremendous value and savings. Additionally, commissioning is not only reserved for new construction. Retrocommissioning is also performed regularly on existing buildings that exhibit high energy usage and comfort problems.



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Why should I pay for Commissioning? What are the benefits?

Just as we rely on lawyers and accountants to navigate tax law, we need commissioning professionals to help us navigate the complicated process of designing, constructing, and operating buildings properly. More and more building owners realize that the commissioning process typically results in fewer problems and lower lifetime costs. Spending a bit more time, effort, and money on the front end of a project may produce savings for years to come.

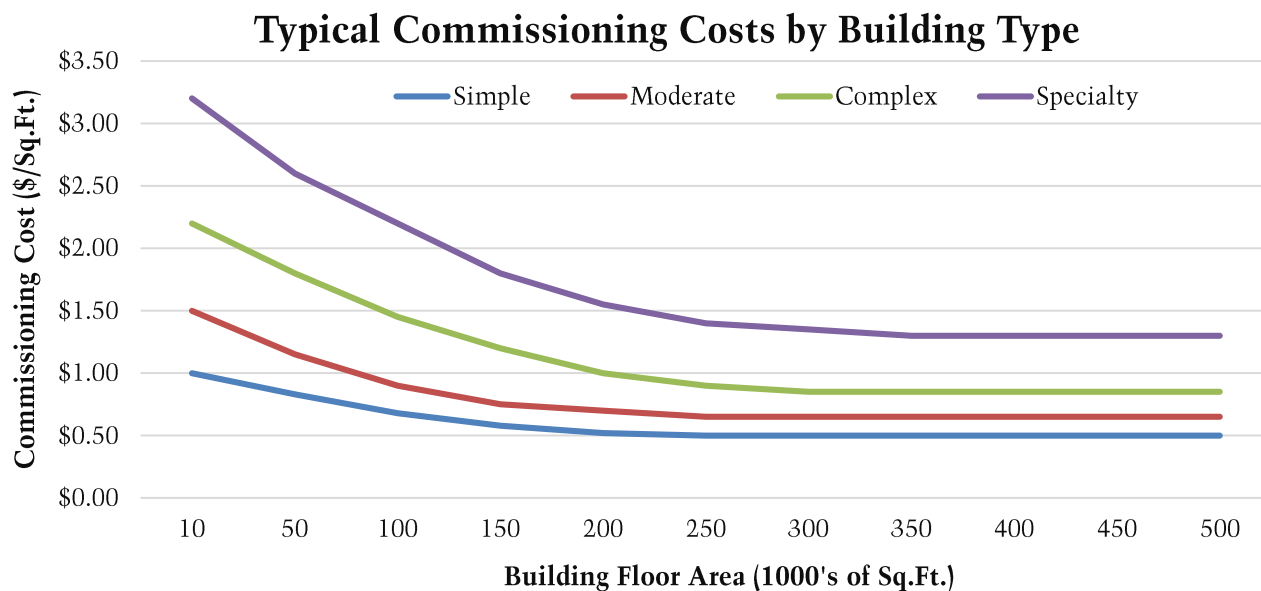
Typical benefits include:

- Reduced operating costs
- Reduced number of change orders
- Reduced employee absenteeism
- Fewer comfort problems
- Improved staff training
- Improved IEQ and occupant comfort
- Increased life of equipment
- Reduced warranty issues
- Documented maintenance requirements
- Reduced contractor callbacks

A properly commissioned building will typically cost 8% to 20% less to operate than a non-commissioned building and will provide a much better environment for the occupants.

What does Commissioning cost?

Generally, commissioning services range from \$.50 to over \$2.50 per square foot of space, depending on the complexity of the building and the systems installed. The graph below illustrates how these costs span across various building types and level of service provided.



When does Commissioning generally start?

Ideally commissioning starts during the design process. The CxA works closely with the design team and owners to ensure different options are evaluated and that the owner clearly understands the benefits of various controls and HVAC systems. The CxA also reviews the construction documents to verify accuracy, completeness, and constructability of the design drawings and specifications to avoid potential change orders and clarify areas that may be perceived as vague or confusing by the contractor. Incorporating commissioning during the design phase provides the building owner with the most value and benefits that commissioning offers.



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Building owners should not be discouraged from utilizing commissioning professionals just because the design has been completed or construction is underway. Building commissioning may also be performed at various stages of the construction process with many tangible benefits.

What happens if buildings are not Commissioned?

Many building owners are concerned that the savings and benefits will not outweigh the costs of commissioning services. Problems with equipment and systems that are identified after the building is in full operation and occupancy are the responsibility of the owner, regardless of when the problem actually began. These problems often manifest as additional costs for resolving these issues, the disruption of occupants, reduced productivity, and increased operational costs.

Building owners who have incorporated commissioning into their construction projects have discovered the alternative to spending 6 to 24 months to resolve building problems after construction has ended and contractors have moved on to other projects. They recognize the significant benefits to resolving these issues prior to occupancy, when no occupants or programs need to be disrupted or displaced, and prior to final payment to the contractors.

Does Commissioning adversely impact the construction schedule?

No. When commissioning is done properly and the CxA is effectively integrated with the design and construction team, this process does not adversely affect the schedule, and in many cases, it shortens the total construction and turnover schedule.

Where can I find out more information about Commissioning?

There are many websites dedicated to informing and educating building owners on the value of commissioning. Some of the more inclusive and interesting websites are the following:

- Building Commissioning Association: www.bcxa.org
- American Society of Heating, Refrigeration and A/C Engineers: www.ashrae.org
- U.S. Green Building Council: www.usgbc.org
- U.S. Department of Energy: www.eere.energy.gov/buildings
- Whole Building Design Guide: www.wbdg.org/project/buildingcomm.php
- US General Services Administration: www.gsa.gov/commissioning
- Energy Design Resources:
www.energydesignresources.com/design/building-commissioning.aspx
- California Commissioning Collaborative:
www.cacx.org/resources/commissioning-guides.html

Who is CxE Group LLC?

As a licensed engineering firm in Missouri and Illinois, certified as a woman-owned business enterprise (WBE), and qualified as a Retrocommissioning Service Provider with Ameren Missouri and Illinois, the CxE team brings over 30 years of experience in the fields of building commissioning and energy efficiency to your project. We focus on providing fully independent, third-party commissioning authority services for our clients, generally contracting directly with owners. This protects our clients by avoiding potential conflicts of interest, offering valuable insight and a fresh perspective, and providing a non-biased professional to champion owner interests. The team approach leads to a successful building commissioning effort which often pays for itself within the first two years of operation, or sooner.