



The Building Commissioning Playbook:

**A guide to the
commissioning process
and the benefits it
provides building owners**

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Types of commissioning

Commissioning services can be applied to new construction projects or buildings that have been in service for decades. Commissioning projects will fall into one of the three following categories, as defined by the California Commissioning Collaborative:¹

Commissioning

is a thorough quality assurance process that begins during a building's design phase and continues through construction, occupancy, and operations stages. Commissioning ensures that new buildings operate according to the original design and the owner's intent and that the building staff is prepared to operate and maintain its systems and equipment.

Retro-commissioning

is the application of the commissioning process to existing buildings; it seeks to determine how a building's equipment, systems and maintenance procedures can best function together to enhance overall performance. Retro-commissioning can correct issues that occurred during design or construction, or address problems that have developed throughout the building's life as systems and equipment age and no longer operate at their highest levels.

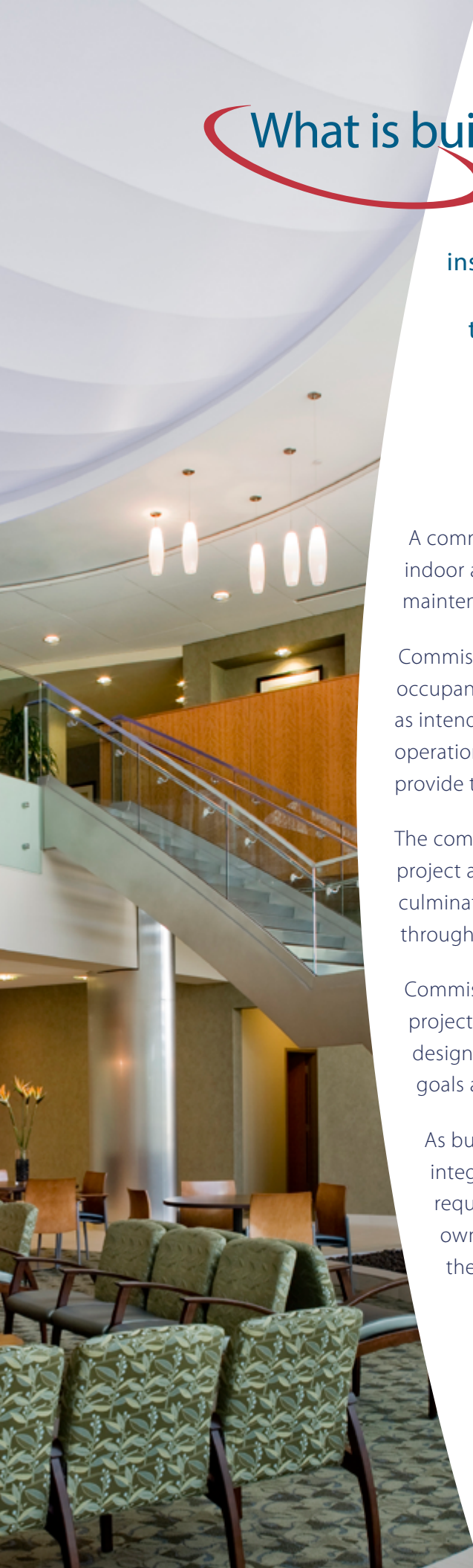


Re-commissioning

is a commissioning process for buildings that have already been commissioned. The decision to re-commission may be triggered by a change in building use or ownership, the onset of operational problems, or some other need. Ideally, a plan for re-commissioning is established as part of a new building's original commissioning process or an existing building's retro-commissioning process, with an owner planning to re-commission a building every few years to ensure equipment and processes continue to operate at their optimal level.



1 Haasl, T., and K. Heinemeier. 2006. "California Commissioning Guide: New Buildings" and "California Commissioning Guide: Existing Buildings." California Commissioning Collaborative.



What is building commissioning?

Commissioning is a process that verifies and documents that a building's systems are designed, installed, thoroughly tested, and performing in accordance with the building owner's project requirements, and that the owner's facilities staff receives proper training to understand and operate the building systems efficiently

A commissioned building provides optimized levels of energy efficiency, indoor air quality, and occupant comfort, as well as reduced operation and maintenance costs.

Commissioning assures that the design conforms to the owner's established occupancy requirements, and that all systems are installed and operate as intended. The process should involve the owner's maintenance and operations personnel early in the project, and should seek their input to provide thorough training while generating a feeling of ownership.

The commissioning process ideally begins early in the design phase of the project and continues through the construction and operations phases, culminating in the functional testing of the installed systems and continuing through the contractor's warranty period.

Commissioning does not function as an additional layer of construction or project management. It is the owner's way of confirming that the planning, design, construction and operational processes are meeting established goals and delivering a high-quality building.

As building systems have grown more complex and reliant on system integration for a number of vital functions due to stringent code requirements and building owner desire for interoperability, building owners have been increasingly turning to commissioning providers in the design, construction, and operations stages of a project.

A construction worker wearing an orange hard hat and a plaid shirt is working on a large industrial fan. He is holding a tool and appears to be adjusting or inspecting the fan. The background shows a clear blue sky and the structure of the fan.

Why is commissioning necessary?

A typical building project features many contractors and sub-contractors, each of whom are focused solely on their portion of the project and will only conduct testing on the equipment for which they are directly responsible. A commissioning provider will test all equipment in an integrated manner to assess how well different systems and processes are functioning together.

Even properly designed and constructed buildings can benefit from commissioning, as providers will run a system through every operating scenario it will undergo during its lifetime and make sure that its actual operation complies with the basis of design.

As system controls grow in complexity to meet increased interoperability, energy, and ventilation code requirements, accompanying value engineering and substitutions increasingly result in last-minute design changes that can have adverse and unintended impacts on building performance and energy usage.

The commissioning process is a safeguard against these unintended impacts. Commissioning examines and fine-tunes building systems to ensure that they are designed to operate in a reliable manner. It also looks at how mechanical and electrical systems are integrated with building management systems in order to deliver optimal performance and reduce energy consumption.

Commissioning goes well beyond the standard scope of work for design and construction phases. Identifying and correcting deficiencies during the commissioning process will not only deliver a far more functional building to the owner, it will provide long-term cost savings, reduced construction cost overruns, construction schedule overruns, reduced number of issues an owner deals with during occupancy.

Commissioning providers also facilitate training and educating a building's facility staff on the proper ways to administer the consistent upkeep that will assure a building's systems continue to operate as designed.

What are the benefits of commissioning?



Commissioning will result in lower operations and maintenance costs over the lifetime of a building. According to the U.S. General Services Administration,² industry sources indicate the operating costs of a commissioned building range from 8 percent to 20 percent below that of a non-commissioned building.

The main objectives that commissioning seeks to accomplish for a building owner are:

- Assisting during the design process to achieve systems that are efficient, maintainable and meet or exceed the owner's expectations.
- Confirming that the new equipment meets current energy code standards (American Society of Heating, Refrigerating and Air Conditioning Engineers).
- Early identification of any non-conformance issues which require corrections by the contractor.
- Optimizing operations to reduce operating costs.
- Verifying that new facilities and equipment are ready for occupancy and use.
- Training staff in the operation of new equipment and safety procedures.
- Receipt of all warranties, procedure manuals, and all specified close-out documents.
- Assisting with addressing operational issues that may arise during the warranty period.

Commissioned buildings realize a number of specific benefits:

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| • Greater energy efficiency leading to lower utility bills | • Greater health conditions and occupant comfort |
| • Improved staff training | • Improved indoor air quality |
| • Better workplace performance and less absenteeism | • Documented maintenance requirements |
| • Increased occupant safety | • Lower overall first costs and lifecycle costs |
| • Less time and money invested in maintenance and repairs | • Reduced carbon footprint and environmental impact |

Why do re-commissioning or retro-commissioning?



Re-commissioning will assure that a building's systems are functioning at the optimum levels defined in the building's original commissioning process. If the building had not been previously commissioned, retro-commissioning can fix systems that may not have operated properly since installation and will help adapt the building's systems to changing usage and occupant needs.

Although your building has been commissioned initially, over time a building may have undergone minor renovations or usage may have changed, and issues common to older buildings start to creep in. System calibrations start to falter, components get out of adjustment, making re-commissioning necessary. Changes in facilities staff necessitate training of new staff so that building operation is optimized.

Retro-commissioning an existing building can also provide significant operations and cost benefits, especially in buildings that exhibit high energy usage and comfort problems.

Every building will benefit from retro-commissioning or re-commissioning. Even though many older buildings had simple heating systems installed, there are opportunities that can be discovered through this process to improve energy efficiency and thermal comfort, as well as identify items that don't meet code and/or indoor air quality requirements.

Here are some signs that your current building could use retro-commissioning or re-commissioning:

- ***Your building is using too much energy***

If you've noticed rising energy costs or consumption, or have systems that run when unnecessary (such as when the building is unoccupied), your building could benefit from retro-commissioning.

- ***You are spending more time and money on maintenance issues***

As equipment and systems age, they will require more maintenance and upkeep to keep them operating at desired levels. While commissioning can help identify issues and areas of improvement, it can also assure that systems are functioning properly and integrated together right from the start.

Commissioning authorities will also provide necessary training to building staff so that employees will have the knowledge and ability to maintain building systems and operations.

- ***Occupants are complaining about comfort issues***

If you hear occupants complaining about the temperature inside a building, or about lighting, or air quality, or others issues, retro-commissioning can help deliver solutions and programming to get all systems operating as intended.

What are the benefits of re-commissioning and retro-commissioning?



These processes provide the building owner/facilities manager with a final report (“road map”) summarizing findings, conclusions and recommendations, along with an opinion of probable construction costs associated with the recommendations that help owners to make informed decisions on system upgrades based on cost, energy savings, code compliance, maintenance, or return on investment. Many items identified through these processes have short-term or immediate payback.

The main objectives that re-commissioning and retro-commissioning seek to accomplish for a building owner are:

- Evaluation of symptoms to identify root cause and recommendations to correct.
- Development of current facilities requirements document (CFR) to help determine how the building currently meets desired requirements and matches intended use.
- Identification of non-compliant code issues.
- Identification of deficiencies that result in lack of thermal comfort control, increased energy usage and increased maintenance.
- Identification of operations and maintenance staff training opportunities.
- Identification and development of a list of recommendations for future capital improvements with respect to energy conservation measures (ECM) and facility improvement measures (FIM).
- Compilation of building documents such as as-builts, shop drawings, control sequences, TAB reports.
- Final report summarizing all findings, recommendations and improvement opportunities.

Re-commissioned and retro-commissioned buildings realize a number of specific benefits:

• Operating cost savings	• Increased thermal comfort
• Greater energy efficiency	• Improved indoor air quality
• Prioritized maintenance scheduling	• Extended equipment life
• Reduce the building’s carbon footprint and environmental impact	• Systems calibrated to the building’s current use

What to expect through the four phases of commissioning:

For new construction projects, the commissioning process can generally be divided into four phases, as described by the Building Technology and Urban Systems Division at the University of California Berkeley:³

Pre-design phase

- Select a commissioning lead
- Pre-design phase meeting
- Begin developing owner's project requirements
- Outline initial commissioning plan

Design phase

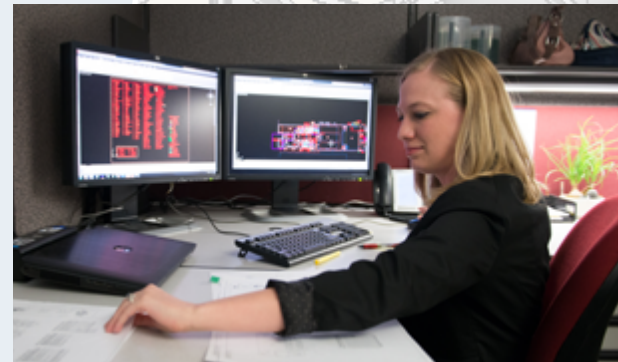
- Design phase meeting
- Commissioning-focused design review
- Update commissioning plan
- Develop commissioning requirements for building specifications
- Begin planning for verification checklists, functional tests, systems manual, and training requirements

Construction phase

- Construction phase kickoff meeting
- Review submittals, monitor development of shop and coordination drawings
- Review operations and maintenance manuals
- Ongoing construction observation
- Verification checks
- Diagnostic monitoring
- Functional testing
- Develop commissioning report and systems manual
- Develop re-commissioning plan
- Verify and review staff training

Occupancy and operations phase

- Resolve outstanding issues
- Perform seasonal/deferred testing
- Perform near warranty-end review



³ Building Technology and Urban Systems Division. 2016. "Building Commissioning: A Golden Opportunity for Reducing Energy Costs and Greenhouse-Gas Emissions." University of California, Berkeley. <http://cx.lbl.gov/definition.html>

What to expect through the four phases of retro-commissioning:

Existing buildings are serviced by the retro-commissioning process, which can be divided into four phases:³



Planning phase

- Select the project
- Set objectives and obtain support
- Select a commissioning lead
- Document current operating requirements
- Perform initial site walk-through
- Develop retro-commissioning plan
- Hold kickoff meeting

Investigation phase

- Review facility documentation
- Perform diagnostic monitoring
- Execute functional tests
- Complete simple repairs
- Create a list of findings
- Prioritize operational improvements

Implementation phase

- Develop plan to implement operational improvements
- Carry out selected improvements
- Analyze and verify results

Hand-off phase

- Develop the final report
- Compile a systems manual
- Build the re-commissioning plan
- Provide maintenance and operations training to staff
- Hold close-out meeting
- Implement strategies to maintain optimal performance



³ Building Technology and Urban Systems Division. 2016. "Building Commissioning: A Golden Opportunity for Reducing Energy Costs and Greenhouse-Gas Emissions." University of California, Berkeley. <http://cx.lbl.gov/definition.html>

Contact Peter Basso Associates for insight into your commissioning needs

Peter Basso Associates' commissioning and MEP consulting services provide building owners, architects, and contractors with the expertise and guidance to assure building projects adhere to design specifications and owner needs.

Whether you are undertaking a new construction project or seeking to upgrade a current structure, contact Peter Basso Associates at 248.879.5666 or MEPEngineer@pbanet.com to see how a comprehensive commissioning process can deliver energy-efficient, optimized, and high-performing buildings. PBA is a member of the Building Commissioning Association with certified commissioning professionals (CCP) on staff.

For more information on commissioning and MEP engineering services, please visit www.peterbassoassociates.com



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