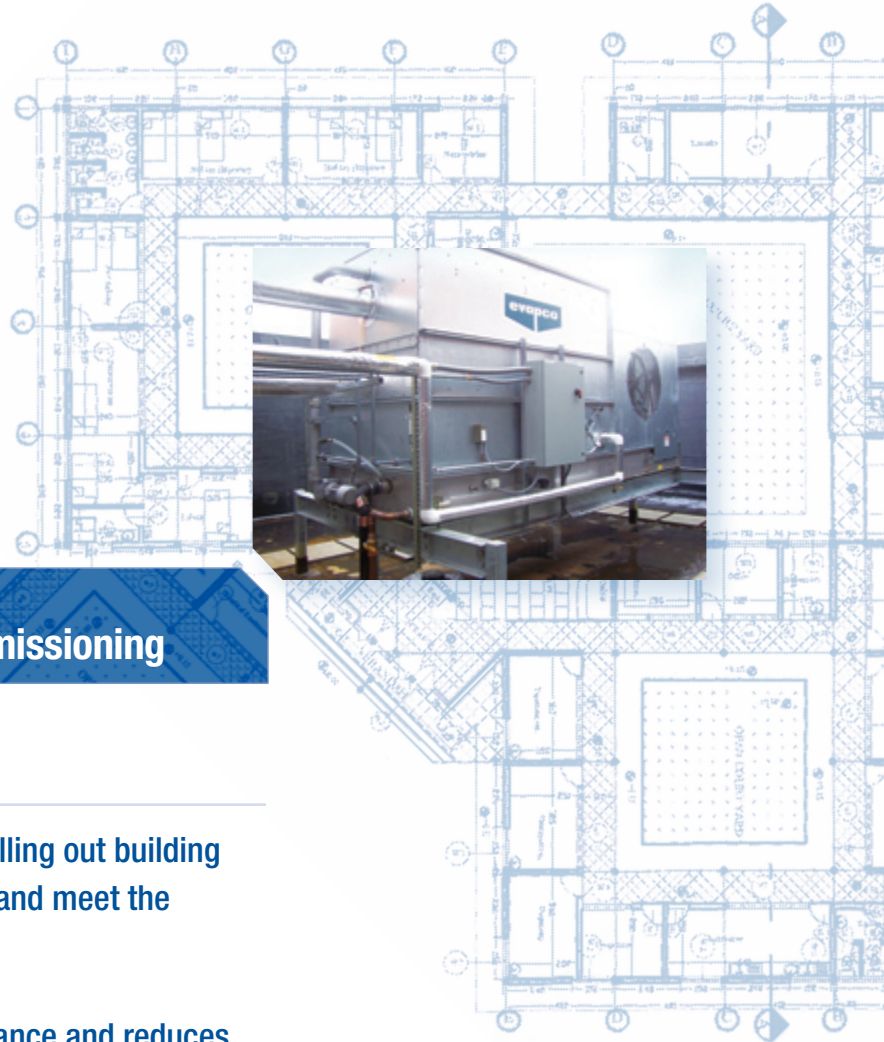




**TURNER**  
ENGINEERING, PC

*A talent for design—A sense for people*



## >> Resource Brief | Building Commissioning

### AT A GLANCE

- A systematic quality process for rolling out building systems that perform as intended and meet the Owner's requirements.
- Improves building system performance and reduces operating costs over the life of the building
- Used on new construction projects or applied to existing buildings
- Turner Engineering has certified and experienced Commissioning Process engineers

## >> Building Commissioning: Process and Payoffs

Building Commissioning is a systematic quality process for rolling out building systems that perform as intended and meet the Owner's requirements. The process drives out costs and inefficiencies during construction, and delivers long-term advantages to Building Owners through improved system performance and lower operating costs.

Over the last two years, our Building Commissioning projects have repeatedly uncovered issues that could not be detected by a simple punch list. **Furthermore, these issues were discovered early, when they were simple and inexpensive to resolve. Using the Building Commissioning Process we've eliminated contractor callbacks, improved system performance, and in one case delivered \$11,000 per year in energy savings in a 28,000 ft<sup>2</sup> building.**

The Building Commissioning Process easily delivers a return on investment within a year for most projects. This Resource Brief presents an overview of the process and how to select a Commissioning Authority for your project.

### Benefits of Building Commissioning

#### For Architects

- Clear definition of project criteria minimizes change orders
- Documenting issues early minimizes time-consuming requests for information
- Clear communication of Owner requirements aids selection of systems and components

#### For Building Owners

- Sets expectations for building performance
- Identifying and resolving issues early eliminates contractor callbacks
- Optimizing system performance
  - reduces energy costs and carbon footprint
  - prevents premature equipment failure
  - ensures occupant comfort, health and productivity

## When to Use the Building Commissioning Process

Any new construction project of moderate complexity will benefit from using the Commissioning Process. Used from the outset of the project, it is the strategic plan that ties every action to the Owner's ultimate goals. Because of its proven ability to reduce energy use and carbon emissions, Commissioning is required for LEED projects and all New York State government projects. Many municipalities now require it as well.



“Retro-commissioning” can be used on **existing buildings** to significantly improve energy efficiency and indoor air quality.

In a retro-commissioning project, engineers uncover opportunities to tune building systems and ensure that they are operating to their full capability. Retro-commissioning can be done at any time in a building's life.

Commissioning allows the Architect to exceed the Building Owner's expectations, provide excellent documentation and training, ensure accurate as-built drawings, and deliver comprehensive operation and maintenance manuals that are easy to use.

## Systems Encompassed

A Commissioning Process encompasses all building systems including:

- Building envelope
- HVAC
- Plumbing
- Electrical and lighting systems

## Quality and Communications

The Building Commissioning Process is based on quality process tenets such as those employed in TQM and ISO-9000. These tenets include having a clear definition of the goal, doing work right the first time, and focusing on lasting benefits as well as short-term results.

For that reason, Building Commissioning places a great emphasis on documenting the Owner's requirements and ensuring that systems meet those requirements the first time. It stresses clear and continuous communication throughout the process. System check lists and test plans are designed to prevent issues, and to identify and correct them early when they do occur.

In our experience, the Commissioning Process has the effect of breaking down the many “silos of expertise” in a building project by allowing all participants to see the broader perspective, and their impact on the whole. It’s remarkable how it enables everyone to work as a team towards a common goal: delivering on the Building Owner’s vision.

## Steps in the Process

For a new construction project, the Commissioning Process can be broken down into four phases. A few of the key steps in each phase are listed below.

### Pre-design Phase

- **Define the Owner’s Project Requirements (OPR).** Here we document what the Owner and Architect expect. Experienced Commissioning Process professionals will draw out the information necessary to ensure that the OPR fully details the Owner’s needs. These include:
  - the purpose and use of the facility
  - goals relative to future expansion and flexibility
  - cost constraints
  - environmental and sustainability goals such as LEED certification
  - indoor environmental quality requirements such as areas that require a specific temperature and humidity or accommodations for after-hours use
  - equipment expectations such as quality, efficiency, capacity, reliability, and type of technology or specific manufacturer
  - expectations about who will operate the facility and what understanding of the building systems they must have
- **Develop the Basis of Design.** This includes design information necessary to accomplish the OPR, including system descriptions, indoor environmental quality criteria, design assumptions, and references to applicable codes, standards, regulations and guidelines.
- **Develop the Commissioning Specification and Initial Commissioning Plan.** This outlines the overall process, schedule, organization, roles and responsibilities, and documentation requirements. It includes a draft set of system readiness checklists and verification test procedures.

For example, one of our recent Commissioning Plans included a checklist for a boiler system. It listed items such as: is a relief valve included? Is the system properly piped? Is there a floor drain nearby? The test plan included ensuring that the water temperature

sensor was properly installed and that the boiler staged on when the loop temperature dropped. Since it was a multiple boiler system, it also included tests to verify that the lead/lag controls automatically reset as expected.

**“Commissioning is one of the most cost-effective means of improving energy efficiency in commercial buildings. While not a panacea, it can play a major and strategically important role in achieving national energy-savings goals.”**

— *Owner's Perspective Magazine, Fall 2005.*

### **Design Phase**

- Review designs for compliance with the OPR, and integrate Commissioning Process requirements into the construction documents.
- Update the Commissioning Plan with design-phase checklists, detailed systems tests and procedures, and testing and documentation responsibilities.
- Identify requirements of the systems manuals and training of operation and maintenance personnel and occupants.

### **Construction Phase**

- Review contractor submittals for compliance with the OPR and construction documents.
- Perform site inspections of delivered equipment before installation.
- Track completion of construction checklists, startup tests and functional testing.
- Verify the systems manual and initial training.
- Verify installation and performance of commissioned systems. Maintain an issues log listing deficiencies found during testing and verify that all deficiencies are corrected.

### **Occupancy and Turnover Phase**

- Review final systems manuals and verify that training requirements are completed.
- Complete and deliver the final Commissioning Report. This report presents an overview of the project and the Commissioning Process and summarizes the commissioning activities. It presents a detailed summary of issues uncovered and how they were resolved, along with observations on test results and evaluations for pre-functional tests, test and balance, functional tests and any post-occupancy testing.
- Systems monitoring: review building operation within ten months after substantial completion.

## CASE STUDY

## &gt;&gt; Commissioning Process Saves Owner \$11,000 per Year

Turner Engineering led the Commissioning Process on the **Finger Lakes Community College, Victor Campus**, a 28,000 ft<sup>2</sup> facility completed in 2009.



The punch list identified only minor loose ends: the work was done well and the major systems appeared to be operating properly. Functional testing performed under the Commissioning Process, on the other hand, highlighted several issues including:

- Night setback not enabled/wired
- Humidistat not installed
- Energy wheel not operating
- Boiler loop water temperature sensor in wrong location, resulting in low heat pump loop water temperature
- Boiler locked out on low water cutoff
- MAU leaving air discharge temp set at 120°F
- Differential pressure sensor failed



These issues were identified before the turnover phase and corrected at minimal cost to the Owner.

**These actions will save the Owner \$11,000 per year in energy costs and prevent more than 45,000 lbs of CO<sub>2</sub> production annually.**

System optimization has also averted nagging systems problems and service calls going forward, and reduced the probability of premature equipment failure.

## >> **How to Select a Commissioning Authority**

The Commissioning Authority (CxA) is the person who leads, reviews and oversees completion of the Commissioning Process. The CxA facilitates communications among the Owner, designer and contractor and serves as an objective advocate for the Owner.

The CxA should be independent of the projects' design and construction teams, though he or she may be an employee of any firm providing those services. For smaller projects, LEED allows a qualified person on the design or construction team to serve as CxA.

Qualifications to look for include:

- lead engineering design experience
- extensive field experience in installing and testing mechanical and electrical equipment and systems
- Certification such as the Building Commissioning Association's Qualified Commissioning Process Provider Certification (QCxPP), which demonstrates that the engineer has studied Commissioning Process practices and passed a written exam



Contact Turner Engineering for more information about using the Building Commissioning Process on your next new construction process, or to improve the performance of your existing buildings. We'll show you how to reduce costs and increase satisfaction at the same time.

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### **About Turner Engineering**

Turner Engineering brings buildings to life. We design the systems that make health care, commercial, educational, municipal, and mission-critical facilities efficient, comfortable, and safe. We believe successful projects are built on a foundation of honesty and trust. Our mechanical and electrical engineers cultivate close partnerships with client teams, fostering a shared sense of ownership.

We strive to thoroughly understand every facet of a project's requirements, and design innovative, cost-effective solutions aligned with the vision of Architects and Owners. Our rigorous attention to detail helps us anticipate and avoid construction problems and delays, keeping projects on track and on budget.

Through our work, and our volunteer activities, we are committed to building great communities. We are based in East Rochester, NY.



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