

Today's Energy Market**Article 3 of 3*****What is Building Commissioning?***

In essence, building commissioning is similar to the commissioning of a ship. The captain (or, in this case, commissioning consultant) takes the building for a trial run PRIOR to opening the building for occupancy. The performance of the building is compared to specifications (and expectations) and areas requiring correction are identified. This process usually involves the testing of equipment (such as occupancy sensors for lights), systems (such as HVAC system), and inter-system operations (for example, the interaction of electric lighting with daylighting). Commissioning has also been extended into the design process for buildings, where it works as a peer-review process. Extending commissioning into design (rather than just operation) also helps ensure that the building can be commissioned upon completion of construction by providing contractual obligations, outlining coordination expectations, or simply installing necessary test instruments.

The majority of buildings delivered by the common design, bid, and build procedure have substantive defects, which are often not found during normal operations, even though they may be negatively impacting building performance. Commissioning is a means of discovering, and/or avoiding, such defects so that the building will function as intended and as the owner expects and believes.

"Anyone who isn't confused really doesn't understand the situation."

- Edward R. Murrow

There are times when I ask myself "What does this have to do with commissioning?" There are some things that just simply are not commissioning.

- Designing to meet standards, codes, or expectations (no matter how aggressive or enlightened) is not commissioning.
- "Green" design practices are not commissioning.
- Sustainability is not commissioning.
- The use of prototype buildings is not commissioning.

Although commissioning may play an important role in all of these efforts, they are not synonymous with commissioning. Commissioning has certain key attributes that set it apart from other "best practices." I would like to take a shot at identifying these minimum attributes, those characteristics that set commissioning apart from other design or construction activities.

As a minimum, any practice known as commissioning must involve field performance tests. This may well be the litmus test for commissioning. Field performance tests,

whether relatively simple functional performance tests of items of equipment or complex integrated systems tests, are the historic basis and heart of commissioning. Anyone claiming to be doing commissioning must include on-site performance tests in their process.

If field performance tests are the defining element of commissioning, then a minimal implementation of commissioning would occur during the construction phase of a project. This is not necessarily the ideal, but rather the minimal implementation of commissioning. In order for field performance tests to be properly conducted, however, they must be specified and accommodated during design. Thus, there is an important pre-construction-phase component to even minimal commissioning. Admittedly, field performance tests have been successfully implemented without prior specification and contractual agreement, but this tends to lead to adversarial conditions that are not conducive to the development of commissioning as a "business as usual" undertaking.

Another aspect of commissioning that could be argued as being an essential characteristic is the documentation of design intent. If one is expected to verify on-site equipment and system performance, there must be a benchmark against which to do so. Design intent provides such a benchmark provided that one can figure out, during the construction phase, what was intended during the design phases. Typical construction documents do not address design intent, just the design solution. Passing design intent from the owner through the design team to the contractor is not common practice. Commissioning should provide such information transmission; this is another minimal essential for any process called "commissioning." While information is being passed along, it may as well be passed to those who operate a facility, so let's include the provision of quality operations and maintenance manuals as another defining characteristic of commissioning.

Training of facility operating personnel and peer review of design decisions are two such important optional activities. These services both link nicely with the previously identified mandatory commissioning activity of information preservation/transmission. Training is a logical extension of O&M manual preparation. Peer review is a logical extension of design intent identification/transmission.

So this is what TRUE building commissioning should look like: a core service of information management coupled with field testing, enhanced by information interpretation, packaging and presentation that bridges the gaps between building design, construction, and operation. The full-service commissioning consultant may wish to include training and peer-review components to improve the product.

There are some other aspects of building commissioning as shown below that are beneficial to building owners and occupants.

Energy Savings

Energy savings depend on the scope of the commissioning. The following table shows reported savings for certain types of buildings. When commissioning is done properly, the savings can be substantial.

Savings From Commissioning		
Building Type	Savings	Energy Savings
110,000 ft ² office	\$.11/ft ² /yr (\$12,276/yr)	279,000 kWh/yr
22,000 ft ² office	\$.35/ft ² /yr (\$7,630/yr)	130,800 kWh/yr
60,000 ft ² high-tech manufacturing	\$.20/ft ² /yr (\$12,000/yr)	336,000 kWh/yr

E-Source calculation from BOMA and EPRI data.

Improved Indoor Air Quality, Comfort and Productivity

Many U.S. commercial buildings experience comfort problems. A recent Occupational Safety and Health Administration report noted that 20 to 30% of commercial buildings suffer from indoor air quality problems. Building occupants complain of symptoms ranging from headaches and fatigue to severe allergic reactions. In the most severe cases, occupants have developed Legionnaire’s disease, a potentially fatal bacterial illness. The National Institute of Occupational Safety and Health surveyed 350 buildings with deficient indoor air quality and found that more than half of the complaints stemmed from HVAC systems that were not maintained properly.

Reduced Operation and Maintenance and Equipment Replacement Costs

Operation and maintenance and equipment replacement costs always will take up a portion of building budgets. However, more building owners and businesses are realizing that operation and maintenance departments can minimize life cycle costs by changing operation and maintenance practices. That is, proper operation and maintenance actually can save money compared to poor operation and maintenance. Many businesses are reinvesting their operation and maintenance savings in more efficient building systems. The commissioning process establishes sound operation and maintenance building practices and trains operators in carrying out these practices. Commissioning also allows building owners to avoid premature equipment replacement costs. Commissioning verifies that equipment is installed and operating properly. Equipment that operates as intended lasts longer, works more reliably, and needs fewer repairs during its lifetime. By promoting equipment reliability,

commissioning reduces service, energy, and maintenance costs. Equipment that operates properly uses less energy, requires fewer service calls and demands less "crisis maintenance" from onsite staff (or expensive outside contractors), allowing them to concentrate on their normal duties.

Green Building and LEED®

Buildings fundamentally impact people's lives and the health of the planet. As a balanced, consensus coalition representing the entire building industry, the USGBC (U.S. Green Building Council) promotes the design, construction, and operation of buildings that are environmentally responsible, profitable, and healthy places to live and work. Building commissioning is one of the seven prerequisites of LEED certification process that must be met in order to acquire certification under USGBC program.

What Role Will Commissioning Play in the Future?

There appeared to be at least an undercurrent of thinking that commissioning is a temporary fix to current problems in the building design and delivery process, and that as these problems are corrected through market force adjustments the need for commissioning will cease. I disagree with this train of thought in two key areas: commissioning as quality assurance in design, and commissioning as quality assurance in construction.

The "old" days of the master (the principal of an architecture or engineering firm) carefully reviewing the work of the younger staff and teaching the staff through such reviews and ensuing general discussions of design principles and solutions are gone, probably forever. Most internal reviews of design work now focus on liability avoidance. Commissioning during design (using formalized quality assurance procedures and/or peer review) can contribute to liability avoidance, but it can and should contribute much more, namely design improvement.

A serious role for commissioning during the design process is quality improvement relative to building performance with respect to both the owner's program and to facility performance in non-programmatic areas such as energy efficiency, indoor air quality, and/or environmental quality. Except in the largest firms, this suggests the use of some (one or more) independent eyes being brought in to identify either the fatal errors that may doom a design or to suggest the incorporation of low-cost, no-cost changes to improve overall building performance.

A similar transformation from the "old" days has occurred with respect to equipment. Building mechanical and electrical equipment has been "meaned and leaned" while at the same time being made "smarter." Equipment costs and energy efficiency have also

driven equipment selection closer to the edge, making site-specific performance critical to success.

These changes in equipment design and selection make field performance tests during the construction process important to the proper operation of many building types. And these changes are not likely to be reversed. Building commissioning is not an interim "fix" for some temporary aberrations in the design/construction processes, rather commissioning is a necessary ingredient for successful buildings in the foreseeable future.

The Bottom Line

The bottom line is that commissioning improves a building's asset value. Properly functioning buildings with reliable equipment kept in good condition are worth more than their uncommissioned counterparts. Commissioned systems and equipment retain their value longer. There is a higher demand for comfortable, healthy working space that promotes productivity. Systems that function properly use less energy, experience less downtime, and require less maintenance which save building owners money.

PinnacleOne Energy Solutions provides a variety of commissioning services that includes;

- **COMMISSIONING FOR LEED PROJECTS**
- **TOTAL BUILDING COMMISSIONING**
- **RETRO-COMMISSIONING FOR EXISTING BUILDINGS**
- **STAFF TRAINING**
- **POST-CONSTRUCTION COMMISSIONING**



Michael Dadjou is a LEED Accredited Professional with over 20 years of practical and management experience in Mechanical Engineering specializing in HVAC and Energy Conservation.

Mr. Dadjou has implemented and managed numerous energy efficiency projects over the past seven years. He developed a detailed and comprehensive computer model of facility energy usage to determine Energy Efficiency Measures (EEMs) suitable for the facility and develop implementation.

Michael has Master of Science in Mechanical Engineering from Muenster University in Germany.