

GOING GREEN WITH COMMISSIONING

Going Green is a phrase often used – and misused – these days. Those two words seem to be associated with most building projects across the country. And “Green” certainly is the standard for building projects here in Kansas City.

But a “Green Building” doesn’t just happen. For a project to be certified under the United States Green Building Council Leadership in Energy and Environmental Design (LEED) certification program it must be commissioned.

Commissioning ensures a building’s systems are correctly installed and identifies issues that could negatively affect building operations. This prerequisite for LEED certification saves energy, lowers operating cost and validates that the building meets the project’s requirements and basis of design. Additional benefits include improved occupant productivity, reduced contractor callbacks, improved building documentation, and enhanced mechanical and electrical system performance.

Commissioning may be one of the most cost-effective means of improving energy efficiency of buildings. The company I founded, **sys-tek**, located in Blue Springs, Mo., was selected to oversee the start up and commissioning of the electrical systems and controls for the State of Missouri Department of Natural Resources headquarters building in Jefferson City, Mo. That building is one of a select number of platinum LEED buildings – the highest distinction possible – in the United States.

Historically, building owners and developers viewed the cost for commissioning as unnecessary – a luxury or “added” cost. However, once the facility is constructed and occupied, it is more costly to ensure the facility operates successfully. It can lead to

additional labor hours to troubleshoot systems and downtime during operational periods.

In the end, these costs are profoundly greater than the cost of including commissioning as part of the project acceptance process. One reason building owners and developers are reluctant to provide commissioning services is the lack of reliable data to validate the cost of commissioning versus its benefits.

A recent study by Lawrence Berkeley National Laboratory Study “The Cost Effectiveness of Commercial Building Commissioning” has provided the data to validate the value of commissioning. The study analyzed 224 buildings in 24 states, representing 30.4 million square feet. Existing buildings represented 73% of the total square feet. The study showed that the median payback time based on energy savings alone was 4.8 years for new construction and 0.7 years for existing construction. The study also showed that of the 28 new construction projects, commissioning uncovered whopping 3,305 deficiencies where HVAC problems led the list.

Many owners and developers believe commissioning should be provided as part of the deliverables for a project. As a commissioning agent (Cx), I totally agree. So, the problem is not identifying the need. The real challenge is getting owners and developers to identify commissioning as a necessary skill set that should be purchased as part of the contract. If the owner or developer does not purchase this service up front and make it part of the project budget, it can’t be included in the deliverables.

Recent trends to reduce construction costs and increased competition are elevating the importance of commissioning. For example, value engineering can result in ill-informed, last-minute design changes aimed to lower project budgets. However, these can have adverse and unintended impacts on building performance and

energy use. With a commissioning agent working on the project, changes will be evaluated in context, with the up-front cost savings weighed against the long-term benefits of operating well-functioning equipment.

The commissioning agent must be able to communicate with a variety of individuals, speaking their language. This requires a diverse background in design and construction. In essence, the commissioning agent must have specialized talents in engineering, building controls, facility management, troubleshooting and equipment operation. They must focus on getting the building to operate and function as designed to meet the building owner’s purpose.

Through the commissioning process the agent should complete “quick fixes,” such as adjusting dampers, tension on fan belts and correcting wiring terminations. During the interview process, the building owner or developer should verify that the agent possesses these skills. If not, it is a sign that the commissioning agent is not qualified.

Normally the commissioning agent contracts directly with the building owner to avoid conflicts with the construction and design team. However, at **sys-tek**, we have completed several successful projects working with the contractor or directly with the design team. As design engineers, we often provide commissioning and start-up services on projects we also designed. After all, who knows the design requirements and operating intent and functionality of the systems better than the company who provided those services?

The commissioning process begins at project conception, so the commissioning agent is often one of the first on the project – and always the last to leave. At **sys-tek**, we divide the commissioning effort into five separate levels, as shown in the following table:

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Level 1	Design Phase
Level 2	Construction Phase
Level 3	Acceptance Phase
Level 4	Integration System Testing
Level 5	Warranty and Post Testing

Initial task under Level 1 is to develop the Owner’s Performance Requirements (OPR). This document provides a clear and concise summary of the design intent. The OPR serves as the conceptual basis for all commissioning and acceptance testing and identifies strategies to maximize design innovation, reliability, ease of maintenance and energy efficiency for all systems.

Level 2 commissioning includes developing a start-up and initial systems inspection plan, reviewing submittals as they pertain to commissioning and critiquing all requests for information and change orders. If factory testing is required for critical systems such as chillers, generators the Cx will observe and witness all testing.

As equipment arrives to the project site, equipment is checked for new condition, complete with features and accessories specified.

Level 3 acceptance testing is the most critical phase in the commissioning process. During this phase all HVAC and electrical equipment are tested to validate that the performance and capacity meets the project specifications and design requirements. The commissioning plan provides the testing methods and procedures for all testing, which may require ancillary equipment such as load banks for generator testing and operation of heating systems to create false loads to test chillers and air conditioning equipment. Also, during this phase of the project control systems are tested at the component level to verify that all wiring has been completed and devices are working properly.

Level 4 commissioning demonstrates how the site infrastructure, such as chillers, pumping systems, heating plant, air handling units and life safety systems will likely perform over the next 60 months. This effort provides performance and efficiency benchmarks that can be used in diagnosing future maintenance. Functional performance testing of all equipment should include staging of equipment and testing transitions from unoccupied to occupied modes of operation.

Under Level 5 the Cx should perform a one-year functional retesting of all equipment and systems. The should also, interview facility staff and discuss building operations to address any problems or concerns they may have in regards to maintaining and operating the building.

Many of our clients provide Level 1 with their own design and internal review teams. In addition, some clients will perform Level 5 using their in-house operating facility personnel with some limited support from the commissioning agent. It’s important to note that each level has value and cannot be overlooked to ensure the successful operation of the facility.

One of the most challenging aspects of a commissioning project is educating everyone involved about the purpose, process and activities involved in commissioning building systems. This includes ensuring that all parties understand, well in advance of the scheduled completion, the activities that must be completed prior to functional testing of the systems. Throughout this process, an open and respectful atmosphere of communication and cooperation must be maintained with the common goal of successfully completing the project.

Commissioning is not limited to new construction or even major renovation projects. At sys-tek, existing buildings make up nearly 60 percent of our commissioning projects, which involve identifying and remedying problems in specific components or systems.

Many times the project scope is limited to a part of the building or a specific system that serves the building – such as the central chillers. However, the scope can be broad as well. Much like a car receives a “tune up,” so too can buildings through retro-commissioning. Examples of problems typically identified and repaired include simultaneous heating and cooling, closed valves, dampers not fully closing when commanded, sub-optimized temperature controls and excessive equipment cycling.

A good rule of thumb for commissioning costs is \$1 to \$3 per square foot for new construction and \$0.30 to \$0.60 per square foot for existing buildings. Costs will vary depending on the level of commissioning and the complexity of the building. For example, it costs more to commission a data center than a library. However, I believe that a library is just as important as the data center and deserves the same focus and attention to detail and quality.

Owners benefit from commissioning through improved energy efficiency, improved workplace performance due to higher quality environments and reduced risk from threats and prevention of business losses. Organizations that have researched commissioning claim that for every \$1 invested in commissioning, the owners save \$4 over the first five years of occupancy – an excellent return on investment. Meanwhile, the cost of not commissioning is equal to the costs of correcting deficiencies, plus the costs of inefficient operations.

The commissioning process can be applied in a variety of approaches focusing on building systems and assemblies, and can be customized to suit project needs. Regardless of the commissioning approach and system focus, it always requires clear definition of performance expectations, rigor in planning and execution, and thorough project testing, operational training and documentation.