



Systems Commissioning for DFCM's Design Requirements, Section 5.0 (HPBS)

Why DFCM Requires Buildings to be Commissioned

Buildings over the last 10 to 15 years have become increasingly complex when compared to buildings from previous decades. Sophisticated digital control systems that have to operate sensitive equipment, dampers, ventilation systems, sensors, and pressurization systems all have added to this complexity. Requirements for energy efficiency, indoor environmental quality, and each state agency's desire to keep occupants happy, healthy, and productive further the importance of a well-functioning building. Programmatically complicated buildings such as hospitals and laboratories, that operate day and night pose significant health risks to occupants, if not functioning properly, not to mention the financial impact that a the building could have if all or part of it became inoperable. As the pressures on buildings and the systems within have increased, the need for commissioning has also increased. Sophisticated building owners, such as the State of Utah, who both occupies and operates their own buildings for decades, use commissioning to protect their investment and manager their risk.

In the past five years the State has built over 12 laboratories, 4 detention facilities, 6 health care facilities, 8 classroom facilities, and the list goes on. Rarely, if ever does the State build an ordinary office type building that is occupied during business hours. The complexity and heavy demand on the buildings for decades require that decisions during design and construction are based on the long view. Systems commissioning supports that long view. Systems commissioning, when done properly, ensures that Facilities Management staff does not inherit a brand new building that does not function as intended, further burdening the State and its campuses with unnecessary O&M costs for decades. Industry metrics indicate that for every dollar spent on a new building, owners can expect to spend \$4 to \$9 in keeping the building operating over the (40 year) life of the building. Buildings that are designed, built, and commissioned correctly have the opportunity to greatly reduce that \$4 to \$9 dollar amount significantly by reducing the total cost of ownership.

DFCM is constantly refining its process of delivering buildings. Given the large volume of projects that DFCM manages each year we have the opportunity to take lessons learned and apply them to future projects. Systems commissioning is an example of this. Approximately ten years ago DFCM started commissioning buildings under the LEED program. We learned over the next five years that the effort was helpful but left much to be desired, so a shift from earning recognition and points to focusing on maximizing owner value was made. This evolution in our processes is reflected in what we now expect and require from commissioning providers. Increased involvement in the design process, increased inspections, testing, coordination, training and post occupancy follow up is yielding well optimized buildings. Are all of our projects perfect, no, but the value of each construction dollar is increasing as the design intent is being verified.

Commissioning Fees

In order for the value of each commissioning effort to be realized several things have to need to happen. First, the commissioning effort must be led by the owner and the owner must be involved, partner, in the commissioning effort. Second, commissioning professionals must be selected based upon the competency, qualifications, and management approach. Selection of commissioning services based upon fee alone is irresponsible, naive, and likely a waste of money in that the these services are not commodity, such as drywall, steel and brick. Third, the scope and fee must be aligned with the needs of the project. In doing so the team is equipped to provide the services needed. DFCM is looking to benefit each project with the commissioning agents expertise, years of experience, and qualifications, hence a value based selection process has proved most valuable. As noted below the typical fees paid to DFCM's commissioning providers is in the lower half of industry standards.

One such example of a low cost approach on a local large complex museum resulted in an initial fee savings of approximately \$300,000 but ended up costing the institution well over \$150,000 per year. The annual excess energy cost, operational costs, maintenance costs, plus additional mechanical equipment that was purchased to compensate for the limping building neared \$800,000 over 5 years, before a qualified team of commissioning agents recommissioned the systems to the original design intent. DFCM has also experienced the other side of the coin in paying excessive fees that yielded minimal value. Over time and through experience DFCM has found that a fee range of 0.65% to 1.1% of construction cost adjusted as necessary for scale, complexity, and scope to serve most projects effectively.

Below is sampling of commissioning fees as a percentage of construction cost depending on level of complexity, commissioning services provided, qualifications of commissioning professionals, and scale.

- GSA - 0.5% - 1.5%
- PEI/ASHRAE - 0.6% to 1.8%
- State of California - 0.4% to 1.1%
- State of Oregon – 0.6% - 1.8%
- **State of Utah, DFCM – 0.65% - 1.1%**

According to the National Environmental Balancing Bureau (NEBB) 2010 research regarding commissioning costs from the year 2000 to 2010 the median commissioning fees increased by 50% due to the increased qualifications of commissioning agents, additional specialized services required by sophisticated building owners, and demanding high performance buildings.

Building Complexity

Complexity of buildings must be considered as the commissioning effort begins. Most buildings fall into the following categories.

- Simple – Office buildings, classroom buildings, packaged equipment and controls, common systems, fewer pieces of equipment
- Moderate – Complex office buildings, teaching lab classroom buildings, Building Automation Systems, packaged equipment, some custom equipment systems, emergency and egress systems

- Complex – Hospitals, complex systems throughout, clean rooms, security systems, communication systems
- Specialized – Laboratories, infection control requirements, relative building pressures, mission critical facilities, bio safety, medical gas systems, tight indoor environmental requirements (humidity, air changes, odors, etc)

Cost Benefit Analysis - LBNL Building Commissioning Report (7.21.2009)

This study of over 82 new construction projects ranging in complexity from simple buildings, such as office buildings, to complex buildings, such as hospitals and labs, found the following.

- An average commissioning effort, at a lower than industry standard fees, of 0.4% of construction cost, yielded approximately a 4.8 year simple payback on typical buildings on energy cost savings alone.
- Median cash on cash return was 23% based primarily on energy cost savings and quantifiable non energy savings. This does not include potential construction defect costs.
- Median annual energy cost savings were 13%.
- Complex buildings such as laboratories and hospitals saved larger amounts of energy (and emissions) due to their high occupancy rates and schedules.
- Projects that received a more comprehensive commissioning effort attained nearly twice the overall median level of savings and five-times the savings of projects with a constrained approach.

Similar investigations by the General Services Administration (GSA), American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), and Building Owners and Manager Association (BOMA) found similar quantifiable and qualitative results.

Qualitative Benefits and Avoided Construction Costs

Arguably one of the greatest benefits, yet hardest to measure, is the qualitative and avoided cost benefits of commissioning. Increased productivity, increased safety, improved indoor air quality, improved occupant comfort, reduced liability, and improved maintainability of the systems all provide value to the owner and ensure the building can sustain the anticipated building performance. Additionally, DFCM has seen improvements in projects with reduced first costs, reduced change orders, improved coordination between trades, fewer warranty claims and reduced liability for all parties.

Conclusion

While no project is perfect, no commissioning effort is perfect, the benefits to each new building when leveraged properly is critical to the success of the building. Commissioning is a tool that owners have to make sure that their investment in energy efficiency and all the building systems become a reality, not just a nice idea. It should be noted that not all buildings are the same, therefore not all buildings should be treated the same in terms of scope, fee, and expertise. Just as no one would expect a family doctor to be able to successfully perform a specialized complex surgery, DFCM aims to provide each State project the right commissioning professional with the appropriate scope and fee to ensure success. Again, to borrow from the medical profession, an ounce of prevention is worth a pound of cure.