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Memorandum

To: Oregon Commercial Energy Conservation Advisory Committee

From: Matthew Tyler

Date: 7/8/2009

Re: Commissioning proposal for Oregon 2010 energy code

What is commissioning?

Commissioning is a systematic quality assurance process that spans the entire design and construction process, helping ensure that the new building performs as designed and intended and meets owner expectations. The code-regulated commissioning proposal under review for Oregon is a small subset of the usual commissioning scope.

Why is commissioning needed?

Buildings and their mechanical and lighting systems are becoming increasingly complex, specialized and integrated. Because of this, owners typically don't receive fully functional building systems at initial occupancy.

A recent study by Lawrence Berkeley National Laboratory (LBNL)[1] meticulously compiles and standardizes commissioning data from 224 commercial buildings—the largest available collection of standardized information on actual building experiences. The number of deficiencies identified by commissioning the 69 new construction projects was an astounding 3,305. The number of deficiencies per project was 28 (median) and 67 (average), ranging as high as 705.

What are some common faults identified by new construction commissioning?

Deficiencies with air-handling and distribution were the most prevalent, followed by lighting and then HVAC plant. Approximately two-thirds of the characterized deficiencies were related to the overall HVAC system.[2]

What are the benefits of commissioning?

The 224 commercial buildings in the LBNL study sample cover virtually all building types and represent over 30 million square feet of commissioned floor space—73% in existing buildings and 27% in new construction—providing an unprecedented picture of real-world commissioning.

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[1] *The Cost-Effectiveness of Commercial Buildings Commissioning, by Evan Mills, Hannah Friedman, et.al. December 15, 2004*

[2] *Mills, Friedman, et.al.*

This U.S. DOE-funded study concludes that commissioning is cost-effective for both new and existing buildings over a range of facility types and sizes, not only in terms of energy savings but also in savings from improved equipment lifetimes, reduced maintenance, fewer contractor call-backs, and other non-energy benefits. Investigators found that the median payback time for new buildings was 4.8 years, and when non-energy impacts were factored in, those payback periods were considerably reduced, often to zero. The electricity savings ranged from 8% to 13%.

The median commissioning cost as a fraction of total building construction cost was 0.6% (for new construction, excluding non-energy benefits). These costs are often zero or negative if non-energy benefits (e.g., equipment downsizing) are included. In one case, first-cost savings achieved through commissioning resulted in a five-percent overall reduction in construction cost. The cost ratio shows a steady downward trend as building size increases, especially for buildings over 50,000 square feet in size. When first cost-savings are included, the median net cost ratio declined to 0.2 percent of total construction costs (average value 0.0 percent), and 7 cases out of 22 reporting had negative net costs.

The study concludes, "building commissioning is one of the most cost-effective and far-reaching means of improving the energy efficiency of buildings, with applications across a large segment of the U.S. building stock."

Where is commissioning required by building code?

Three neighboring states already require commissioning in their building codes:

- Washington since 2001 (a more stringent version required in Seattle since 1997)
- California since 2005
- Idaho public schools beginning in 2009

Also Massachusetts since 2000.

In Oregon since 1991, publicly funded state buildings must comply with State Energy Efficient Design (SEED) program requirements, which include a performance verification process similar to commissioning.

Commissioning or retro-commissioning is required in Oregon public schools for HVAC, DDC, boiler, chiller, lighting, envelope, and any other energy related projects funded by SB 1149 Public Purpose Funds.[3]

What are the contentious issues regarding commissioning in the Oregon code?

Several years ago, Oregon considered adding requirements for systems commissioning to their energy code, but the proposal was narrowly defeated. Reasons for the defeat included concerns that:

The proposal applied to buildings that were too small (i.e., commissioning provisions do not provide value for small buildings or simple renovations).

[3] http://oregon.gov/ENERGY/CONS/SB1149/Schools/commissioning.shtml#When_is_commissioning_required

The proposed Oregon requirements now specify a minimum floor area before the commissioning requirements apply.

There was a lack of qualified people to do the commissioning and qualifications were not clear.

Commissioning certification programs are now offered by BCA (Building Commissioning Association), ASHRAE, the University of Wisconsin, NEBB (National Environmental Balancing Bureau), AGC (Associated Air Balance Council Commissioning Group), and AEE (Association of Energy Engineers).[4] The number of certified commissioning agents is continuously increasing.

The language was too vague.

As experience with commissioning and related functional performance tests grows, the code requirements need to be refined. In particular, specific details about the equipment to be tested and the tests to be used need to be added. These details will clarify the minimum acceptable practices to meet the code.

It would be a burden to building officials.

Building officials only need to review the proposed Commissioning Checklist. No additional duties are required at the construction site. This commissioning checklist states the various mechanical and lighting systems work properly and meet code requirements. Thus, the commissioning requirements actually relieve some burden of work and responsibility from the building official from observing equipment operation and code compliance.

The cost of compliance is too high.

"Some see commissioning as a luxury and 'added' cost, yet it is only a barometer of the cost of errors promulgated by other parties involved in the design, construction, or operation of buildings. Commissioning agents are just the 'messengers'; they are only revealing and identifying the means to address pre-existing problems."[5] Commissioning has become much more common practice since the last round of Oregon code adoption hearings. It is a more established practice and is further along the market adoption curve now, especially due to the great interest in new construction projects applying for LEED® certification, which requires commissioning. The language proposed here is a basic variation of full commissioning, requiring perhaps half the level of effort of a full commissioning scope.

Commissioning is not a safety/welfare issue and does not belong in the code (the market should decide if commissioning is appropriate).

The entire energy code is not a safety/welfare issue. The health, safety, welfare, comfort, and security of the public is imminently at risk due to increasingly scarce natural resources. This proposal directly affects this risk in a positive manner by conserving natural resources.

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[4] http://www.cacx.org/resources/provider_cert.html
[5] *Mills, Friedman, et.al.*