# Commissioning Public Buildings in Oregon: Market Transformation via the Public Sector

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## ABSTRACT

Building commissioning is gaining greater acceptance in the construction industry; more owners include it in their projects, and more firms offer commissioning services. However, decision-makers are often reluctant to embrace commissioning as a part of integral construction process. Building owners often require convincing evidence of the benefit of commissioning, either through direct experience or through case studies. In order to overcome the barriers that impede commissioning in the public sector, the *Commissioning Public Buildings* program is under way in the Pacific Northwest (Oregon, Washington, Montana, and Idaho). This paper specifically describes Oregon's program, where eight commissioning demonstration projects are in progress with various state agencies.

In addition to the overall program objective of transforming the market to make commissioning public buildings business as usual, program goals include: demonstrating and analyzing commissioning results, establishing model commissioning policies, and transferring commissioning results and model policies to the private sector.

This paper reports the results of the program and gauges the success of commissioning market transformation activities in Oregon. Common challenges faced by the participating agencies and how these challenges were handled will be presented. These include:

- Establishing an appropriate commissioning budget
- Acquiring agency approval for commissioning
- Acquiring commissioning services
- Determining commissioning scope
- Writing commissioning specifications
- Dealing with "threatened" designers
- Designer fee creep
- Documentation issues

## INTRODUCTION

"Commissioning is the process of ensuring that systems are designed, installed, functionally tested, and capable of being operated and maintained to perform in conformity with the design intent." (ASHRAE, 1996) Commissioning can also be applied to existing buildings, where it involves diagnosing the performance of existing equipment and systems to determine whether they meet the current needs of a facility's owner and occupants.

Building commissioning is gaining greater acceptance in the construction industry; more and more owners are interested in adding it to their projects, and more firms are offering commissioning as a service. However, decision-makers are often reluctant to

embrace commissioning as a part of integral construction process. For example, building owners usually require some convincing evidence of the benefit of commissioning, either through direct experience, or through case studies.

In an effort to fill the gaps and overcome the barriers that impede commissioning in the public sector, the Commissioning Public Buildings program is under way in the Pacific Northwest. This effort includes Oregon, Washington, Montana, and Idaho. Each state manages its own program, and this paper deals with the program in Oregon, where eight commissioning demonstration projects are in progress. The Commissioning Public Buildings program is sponsored by The Northwest Energy Efficiency Alliance. In Oregon, this program is administered by Oregon Office of Energy (OOE). For assistance in program management and commissioning expertise, OOE has retained Portland Energy Conservation, Inc. (PECI). For implementation of data collection and analysis, OOE has retained SBW Consulting of Bellevue, WA.

## The Rationale for Commissioning Public Buildings

Various studies on building commissioning show that annual energy savings can average 5-15 percent per year (Piette, Gregerson). Other benefits are also significant: smoother turnover, fewer problems during warranty, improved air quality, more comfortable working conditions, and equipment installed and operating as specified. Even though the industry increasingly recognizes these benefits, commissioning is still not practiced in most commercial new and existing facilities. Taking energy benefits alone, the potential for savings in Oregon public buildings is great. There are approximately 3,500 state, county, city and school district buildings in the state with an annual electricity consumption of roughly 1.3 billion kWh. Commissioning these buildings could save an estimated 150 million kWh. (Oregon Office of Energy).

In addition, the long-term ownership of public buildings means that the agencies that invest in commissioning will reap the benefits over the building life cycle. This characteristic is an added incentive for public organizations to adopt commissioning practices.

## Program Goals

The goals of the Commissioning Public Buildings program include:

1. Educate facility project managers and administrators on the benefits of commissioning.
2. Demonstrate commissioning and analyze results.
3. Establish state requirements and model policies for commissioning for local governments and schools.
4. Disseminate commissioning results and model policies to both the public and private sectors.
5. Assist in the establishment of a commissioning industry association that can help meet the growing demand for services.[1]

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[1] The Building Commissioning Association, established in 1999, has already broadened its original Northwest focus to a national focus. Membership in the Association is growing rapidly. A paper on the BCA is being presented in another session at this conference.

The overall goal of the program is to transform the market to make commissioning public buildings business as usual.

## NORTHWEST COMMISSIONING BASELINE STUDY

Prior to the implementation of this program, the Northwest Energy Efficiency Alliance funded a baseline study of building commissioning practices in the Northwest (conducted by SBW Consulting, Inc.). This study established the baseline for the Northwest Commissioning Public Buildings Program.

Important findings include: (SBW, 1998)

- Significant commissioning activity is occurring in the Northwest new construction market, particularly in hospital and high-tech/industrial segments. Of the 95 people surveyed, 44% indicated that they had commissioned their new facilities.
- The most significant barriers to commissioning new construction in the Northwest were the added cost of conducting tests, followed by disruption of the construction schedule and lack of documented benefits.
- Fifty-six percent of the 97 owners surveyed had conducted functional performance tests in their existing facilities. More than 1/3 of the buildings were tested by in-house staff.
- The major barriers to commissioning existing buildings in the Northwest were the added cost of conducting tests, the lack of documented benefits, and the added cost of developing test specifications.

### Addressing the Barriers

The Northwest Commissioning Public Buildings program seeks to address the major barriers to commissioning by:

- Providing an incentive to cover a portion of the cost of commissioning for participating demonstration projects.
- Documenting the costs and benefits of commissioning these projects.
- Developing and disseminating case studies based on these results to promote the practice of commissioning in both public and private buildings.

## OREGON'S COMMISSIONING PUBLIC BUILDINGS PROGRAM

Oregon's program consists of three main components:

- Conducting demonstration projects to demonstrate and document the benefits of commissioning in nine new and existing public facilities.
- Drafting and getting agency buy-in on a policy to promote commissioning of buildings under its control.
- Developing and disseminating case studies for each of the demonstration projects to promote the practice of building commissioning in both the public and private sectors.

**Demonstration Projects**

The heart of the program is the demonstration projects, as they will be used in a variety of ways to transform the market for commissioning. The following eight projects have been selected for participation in the program, and a case study will be written for each. Oregon hopes to add a ninth project prior to the close of the program.

To facilitate the demonstration projects, OOE contracted with a commissioning consultant. This consultant is responsible for providing technical assistance and advising agency representatives and project designers on how to specify commissioning and hire commissioning providers. Although the consultant tracks the progress of each commissioning project, they do not oversee the work of the commissioning providers that have been contracted for each of the projects. The commissioning consultant is also charged with developing a case study for each of the demonstration projects.

**Beaverton School District, Sexton Mountain Elementary School.** This existing elementary school in Beaverton is 65,000 square feet in area and will undergo a comprehensive retrocommissioning assessment and implementation of low-cost improvements. Upon completion, Beaverton School District will then investigate the further assessment and retrocommissioning of its 50+ other facilities.

**City of Beaverton Public Library.** This new 69,000 square foot library building is under construction in Beaverton. The City is commissioning the library to ensure that all systems are complete and functioning properly upon occupancy and that facility staff have adequate documentation and training.

**Department of Administrative Services' Public Service Building.** The Department is retrocommissioning this 172,400 square foot existing building. In addition, the Department has asked the commissioning provider to develop a generic approach to commissioning its other existing facilities.

**Lane Community College, Child Care Center.** This project is a new 18,200 square foot child care facility in Eugene. The space will consist of a mixture of classrooms and offices. The HVAC system will feature a geothermal heat pump, provided through assistance by Eugene Water and Electric Board (EWEB).

**Marion County/Salem Transit Authority.** The new, 160,000 square foot Courthouse Square project in Salem is jointly owned by Marion County and the Salem Transit Authority. The space will be primarily office. The project is also participating in the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) program. A LEED certification (for which commissioning is a prerequisite) will indicate that the building is exceptional in terms of total resource consumption and renewability, including issues such as energy efficiency, solid waste management, water efficiency, and other environmental impacts.

**North Clackamas School District.** This new high school project in Clackamas is 275,000 square feet and features extremely aggressive design for daylighting and low energy use, with a goal of 44% energy savings beyond Oregon code. An impressive array of energy

organizations has been involved with the design, and this project is expected to be a showcase school for the region.

**Portland State University.** PSU's Science Building II is a 213,000 square foot classroom and laboratory facility that will undergo retrocommissioning in conjunction with installation of a new chiller. The project will have a focus on the chilled water system, which operates between Science Buildings I and II, with an additional investigation into other operational and controls issues.

**Salem-Keizer School District, Marion F. Miller Elementary School.** This new construction project is a 49,000 square foot elementary school in Salem. With seven new schools being built in the near future, the school district hopes to leverage the results of this demonstration to justify incorporation of commissioning in a future projects.

### Typical Challenges and Barriers

The projects listed above have each faced some combination of the following challenges to implementing commissioning. These challenges are essentially second-level barriers to commissioning. The first-level barriers (such as cost, lack of understanding, etc.) have been overcome once owners opt to try commissioning. However, when they begin their first commissioning projects, many owners encounter these second-level barriers to actually implementing commissioning activities.

**Establishing an appropriate commissioning budget.** Because every building has unique characteristics (size, occupancy and usage expectations, performance goals), commissioning scopes of work can vary considerably. This variation makes it difficult to estimate the commissioning budget before developing the actual commissioning scope of work. However, most owners need to earmark funds for commissioning before a project is even in the programming stage, far prior to the development of the commissioning scope of work. Commissioning providers on some of the demonstration projects felt that the commissioning budgets allocated for their projects would not cover the scope of work.

This problem has yet to be fully resolved. In at least one case, the demonstration project scope of commissioning services significantly exceeded the scope assumed by the program when funds were being allocated. It is hoped the documentation collected on this project will allow agencies to more accurately budget for commissioning services in the future.

**Acquiring agency approval for the commissioning process and budget.** Commissioning is a new concept, often looked upon with suspicion. By the time the agency buys in to the concept, it may be too late to incorporate commissioning into design (for new buildings). In addition, lengthy agency approval processes for contracts may delay the start of commissioning. These problems result in delaying commissioning until the construction phase, which means many opportunities for low-cost improvements during the design phase are lost.

To mitigate this problem, the commissioning consultant was available to make presentations supporting commissioning to decision-makers. Even so, most projects faced a lengthy approval process for the commissioning provider's contract. In many cases, the

point in time when the project agreed to participate in the commissioning program and the restraints of the contracting process (between the agency and OOE as well as between the agency and the commissioning provider) resulted in commissioning beginning during early construction, rather than in early design as recommended. This is a notable issue for the case studies.

**Acquiring commissioning services.** Who can agencies contract with for commissioning services? What qualifications should they look for? How should they go about soliciting commissioning services? The inability for agencies to answer these questions poses a significant barrier to commissioning. A primary role of the commissioning consultant on this project is to assist agencies in overcoming this barrier. (Even with this assistance, the program lost the participation of one demonstration project in eastern Oregon, because qualified commissioning providers were unable to work on such a small project given the distance they would need to travel.)

The establishment of the Building Commissioning Association has helped significantly to remedy this barrier. Owners now have a reputable professional organization of commissioning providers to turn to for a list of qualified providers. Also, the BCA's essential attributes of building commissioning give owners guidance in determining the outcomes they should expect from the process. In addition, the Oregon Office of Energy's commissioning toolkit provides boilerplate language for an RFP to solicit commissioning services.[2] PECI assisted several agencies in modifying this RFP to meet their needs.

**Determining commissioning scope.** Commissioning is not a "one-size-fits-all" process. The scope can vary with the building size, usage, and of course the equipment and systems installed. For agencies with no previous commissioning experience, determining an appropriate scope was a challenge. Which systems would benefit most from commissioning? Where would they receive the most "bang" for their commissioning buck?

Again, the commissioning consultant was available to agencies that wanted assistance in developing their scopes of work. However, it is expected that owners who are new to commissioning will encounter this barrier without potential assistance after the close of the program.

**Writing commissioning specifications.** All of the agencies involved had access to a Model Commissioning Specification as part of the OOE Commissioning Toolkit. However, this specification was intended for use on projects that are 50,000 square feet or more in area, and agencies found it challenging to adapt it for use in smaller facilities. In addition, a few owners were concerned about how to present commissioning in the specifications so contractors would not view it as an opportunity to increase change orders. These agencies wanted to bury or downplay the details of commissioning. The result is contractors who are not fully aware of their commissioning responsibilities and who may feel blindsided when these expectations are presented.

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[2] PECI developed this toolkit for OOE in 1997. It includes Commissioning for Better Buildings in Oregon (a booklet that provides an introduction to commissioning), a Model Commissioning Plan and Guide Specification, a sample RFP for soliciting commissioning services, and tips for project managers on how to manage the commissioning process. The toolkit is available on the webat www.energy.state.or.us/bus/comm/bldgcx.htm.

The commissioning consultant was available to agencies to assist with modifying the Model Commissioning Specification to fit specific projects. Following the close of this program, however, agencies will have to make these modifications themselves or hire assistance. This points to the need for a modified version of the model specification that is geared toward smaller projects.

The program staff worked closely with the agencies to present commissioning in a streamlined fashion and clearly identify the commissioning roles of various contractors on each project. The commissioning providers typically reiterated these roles during their commissioning scoping meetings.

**Dealing with "threatened" designers.** Although the building owner may be on board with commissioning, the designer may feel threatened by the concept. A few designers involved in the Northwest program were wary of the concept and had concerns that the commissioning provider would encroach on their traditional activities.

The commissioning consultant was available to meet with designers and outline their role in the commissioning process and how commissioning could benefit their projects. Once designers understood that the commissioning providers were not "approving" their designs, they were typically much more willing to accept suggestions for design improvements.

**Designer fee creep.** In at least two of the new construction projects, the A/E team requested significant budget increases to accommodate what they perceived to be an increase in their services due to commissioning.

The commissioning consultant reviewed the actual ways in which commissioning was expected to add to design services, and helped the designers to understand that their role in the process was actually fairly limited in these cases.

**Documentation issues.** The major contractors on each project, including the commissioning provider, were asked to document their commissioning activities and estimate the costs and benefits associated with those activities. In some cases, it was difficult for contractors and project managers to determine where to draw the line between costs that would have been incurred no matter what and costs that stemmed directly from commissioning. One challenge for the program was collecting this documentation from contractors without the agencies incurring significant additional costs on their contracts.

The data collection consultant was available to all project managers and contractors for questions about what they should and should not document as an added cost of commissioning. In addition, the commissioning providers themselves were often able to assist contractors in determining which costs and benefits should be documented. The program is attempting to minimize the burden of documentation by making the process as streamlined as possible. Contractors are encouraged to submit commissioning documentation along with their other regular reports to project managers. Project managers collect the information and pass it directly to the data collection consultant.

### Model Commissioning Policies

The ultimate goal of the program is to make commissioning business as usual for public agencies. As such, OOE will work with participating agencies to craft and implement a model commissioning policy.

The program commissioning consultant is currently researching existing commissioning policies. These policies include the City of Seattle's energy code, which incorporates commissioning, as well as commissioning guidelines from Idaho and Washington State. Much of the available policy information actually takes the form of commissioning plans or programs, rather than an over-arching policy statement. The program commissioning consultant will consider the usefulness of developing both a policy statement and a general plan for implementing the policy. This plan would focus on the components and expected outcomes of a successful commissioning project; it would not define a specific process for commissioning.

In addition to reviewing existing commissioning policies/plans/programs, the consultant will also collect and review several current policies that deal with energy, building construction and operation and maintenance. The consultant will investigate how well these current policies are followed. The consultant will develop two draft model commissioning policies using the format of the most successful current policies.

The consultant will work with OOE to get agency feedback on the draft policies regarding:

- Ease and likelihood of implementation
- Potential for agency buy-in on the policies

Based on agency feedback, the consultant and OOE will refine one of the policies for use within state agencies.

**Case Studies and Information Transfer**

In an effort to provide the program data to market stakeholders throughout the Pacific Northwest, case studies will be generated. These documents will be made available as a means of providing missing information that decision-makers may not have when assessing the potential benefits of commissioning. In addition, the case studies will strategically be made available to public agencies and commissioning providers as necessary to build the infrastructure for commissioning in the Pacific Northwest.

Case studies, will also be generated for projects that are implemented through the Commissioning Public Buildings programs in Washington, Montana, and Idaho. Each state has agreed to use the following format, developed with assistance from the Alliance:

- A brief brochure containing
  - Description of the basic elements of the project and scope of commissioning.
  - Generic definition of commissioning.
  - List of benefits (quantifiable and non-quantifiable)
  - Credits and contact information

- A 3-5 page document containing:
  - Detailed project overview with economic analysis
  - Recommendations for improving the process

- A 2-page document containing:
  - Comprehensive definition of commissioning
  - Key objectives of commissioning

- The process for commissioning new buildings
- The process for commissioning existing buildings

## PROGRESS TOWARD MARKET TRANSFORMATION

Considerable commissioning activity is occurring in the Northwest compared to other regions of the country. The utilities and state agencies in the region have a long history of supporting commissioning and their support has done a great deal to foster the success of this program. It is difficult to identify how much of this market transformation is due to the Commissioning Public Buildings Program and how much would have occurred without the program in place. The Alliance has hired Quantum Consulting to evaluate the results of the program and establish connections between the program and market transformation. In a preliminary report, Quantum has already noted that the three-year program time frame is relatively short to allow for significant market transformation. The program is currently scheduled to end in December 2000. (Quantum Consulting, 1999)

However, it is possible to note some successes:

- The act of simply recruiting projects has resulted in an increased awareness of commissioning and its potential benefits among public agencies.
- The establishment of the Building Commissioning Association has provided owners with a reputable source for identifying commissioning providers.
- Demonstration projects are moving forward and periodic conversations with agency representatives indicate that they are satisfied with the progress of commissioning so far. Program staff closely monitor the progress of each project to ensure that this level of satisfaction is maintained.
- Two agencies have already expressed their intention to develop commissioning policies.
- Some of the agencies have already expressed an interest in commissioning future projects.

Working closely with the agencies has allowed program staff to identify a number of second-level barriers to successfully implementing commissioning, including difficulties in the following areas:

- Establishing an appropriate commissioning budget
- Acquiring agency approval for the commissioning process and budget
- Acquiring commissioning services
- Writing commissioning specifications
- Determining commissioning scope
- Dealing with threatened designers
- Dealing with designer fee creep
- Documenting the costs and benefits of commissioning

As the program continues, staff are attempting to identify strategies that owners and commissioning providers can use to address these barriers. These strategies will be incorporated into the case studies that are developed for each project. In order to truly transform the market, the program will need to leave the agencies currently participating in the demonstration projects with the resources and strategies to successfully implement

commissioning on their own in future buildings. Owners new to the commissioning process will benefit from access to these resources and the lessons learned in this program as they implement commissioning in their facilities.

## ACKNOWLEDGEMENTS

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