Market Progress Evaluation Report

Commissioning In Public Buildings Project, No. 3

prepared by

Quantum Consulting, Inc.

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NORTHWEST ENERGY EFFICIENCY ALLIANCE

COMMISSIONING IN PUBLIC BUILDINGS PROJECT

MARKET PROGRESS EVALUATION REPORT #3

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1. EXECUTIVE SUMMARY

1.1 PROJECT BACKGROUND

This is the second market progress evaluation report (MPER) of the Northwest Energy Efficiency Alliance's (the Alliance's) Commissioning in Public Buildings project. The Commissioning in Public Building project seeks to make commissioning standard practice in public buildings in the Pacific Northwest (Oregon, Washington, Idaho and Montana). It is a multi-year effort, launched in 1998 and currently slated to continue through calendar year 2003.

The project is being coordinated across the four-state region by the Oregon Office of Energy (OOE), the Alliance's prime contractor. OOE's subcontractors include the Washington Department of General Administration (GA), the Idaho Department of Water Resources (IDWR), and the Montana Department of Environmental Quality (DEQ). The project seeks to overcome market barriers to commissioning through the use of multiple intervention strategies, including demonstration projects/case studies, technical assistance to public agencies, model commissioning policies, education and training, and financial assistance to help cover the cost of commissioning for demonstration projects.

1.2 EVALUATION OVERVIEW

The purpose of the evaluation of the Commissioning in Public Buildings Project is to determine the extent to which the project has been successful in achieving its stated goal of making commissioning standard practice in public buildings. The evaluation is designed to assess both what was done to influence the market conditions targeted by the project (process evaluation) and to what extent those market conditions have changed (market evaluation). Specific activities undertaken for this MPER to support these goals include:

1) an overall assessment of the demonstration sites, for each state individually and the project as a whole, including selection of demonstration sites (types of buildings, existing vs. new construction, comparability across states), successes, failures, and lessons learned.

2) an assessment of the efficacy of project coordination, communication and tracking systems/documentation to make recommendations for future improvements in those areas where relationships will continue for a significant period.

3) an evaluation of the state plans for promoting policies and guidelines and disseminating case study information, including timely recommendations for improvements.

4) documentation and assessment of the process by which case studies are being developed

5) documentation of developments in the commissioning market since the project was launched, with a focus on the extent to which policies have been developed and adopted or are being considered by public agencies

6) analysis of the commissioning agent market, including an assessment of the current state of the Building Commissioning Association

1.3 EVALUATION RESULTS AND RECOMMENDATIONS

Overall, the Commissioning in Public Buildings Project is moving forward in providing information and assistance to help attain the goal of making commissioning standard practice in public buildings in the PNW. While a definitive causal link between the project and the observed changes in the market cannot be proven, it seems reasonable to conclude that the project has had an influence on the changes observed.

The project currently has a total of 33 demonstration sites (see Exhibit 6) where either new or existing buildings have been or are being commissioned, comprising both new construction and retro-commissioning projects for a variety of building types. Since commissioning has now been completed at most of these sites, a number of conclusions can be drawn from the demonstration projects regarding the characteristics that lead to a successful commissioning effort. These include:

- Introduction of commissioning during design
- Support for commissioning activities by the owner's project manager
- Avoidance of excessive turnover in project management and, when project management does change, reiteration by the owner of the high priority of commissioning
- Maintenance of an active on-site presence by the CA

In addition, with regard to the demonstration projects themselves, it can be concluded that active involvement of the agency whose building is being commissioned tends to maximize the effect of demonstration projects on agency practices. Other conclusions and recommendations of this evaluation include the following:

- Project communications between the Alliance, OOE, and the states continue to be frequent and effective, although the review/revision cycle for documents like the marketing plans and case studies has been rather long. This has not been a major concern to date, but could become more critical as active marketing campaigns are developed and launched. We recommend that the review/revision cycle be shortened so that more of this activity takes place via email between regularly scheduled team meetings.
- The pressing issue identified in the first MPER – lack of time to carry the demonstration projects through to completion so that case studies could be prepared and disseminated – has been addressed with the time extension to the contract. A full complement of demonstration projects is now moving toward completion, and the first set of case studies is in preparation. Nevertheless, the legacy of the early time pressure remains, and is evident in some of the demonstration projects that had commissioning introduced later than optimal (i.e., after design was complete), resulting in problems with acceptance by other members of the construction team.

- While there is a natural tendency to play down any problems in describing the results of commissioning in a case study, we believe it is important that the target audience for this project have access to lessons learned from some of the more problematic projects. It may not be necessary to publish full case studies for every problem project, but we recommend that a separate document detailing lessons learned be made available to any owners or others who ask the logical question, "Do all commissioning projects go this smoothly?"

- Regarding the case studies, the format settled on by the four states and the Alliance appears to be fine; however, there has been no feedback from the intended recipients of these case studies. We recommend that OOE and the state subcontractors conduct, at the very least, some informal sessions with agency representatives to determine whether they find the format appealing and easy to read, the information of an appropriate level of technical detail, and the overall content sufficiently compelling to make them either seek out more information or move ahead with a commissioning project.

- In addition, we recommend that user interest in the more detailed supporting information from the case studies be assessed across all four states and findings shared, so that a consistent, effective method for making this information available can be pursued.

- There are also other opportunities for the states to share resources developed for the project by other states. For example, the training curriculum used by Idaho or the Best Practices manual developed by Montana could both be adapted and used by agencies in the other states.

- As Washington's GA continues to implement its fee-based commissioning support program, results should be assessed to determine whether this program (or one like it in other states) can serve as an effective exit strategy for the Commissioning in Public Buildings project.

- As detailed in the market analysis section, new building commissioning has become either standard practice or required by law for a significant portion of the public sector market, indicating that the market is moving toward the desired exit strategy for the project. And while we did not find any jurisdictions or agencies with regulations on the books regarding retro-commissioning, a number of school districts and universities in the four-state area have incorporated retro-commissioning into their facilities maintenance practices – in some cases as a direct result of their participation in a demonstration project.

- While the concept of commissioning is increasingly accepted, there are still barriers – particularly with regard to cost -- to implementation of the kind of thorough, independent third-party commissioning that is necessary for the full benefits of commissioning to be realized. Therefore, it is important to build on the successes achieved to consolidate gains made to date through regulations, policies, and building codes, and we recommend that all the marketing plans be reviewed to ensure that this issue is addressed.

- With regard to BCA, the association appears to be successfully confronting the turning point described in the evaluation presented in Appendix A. We recommend that the Alliance, in tandem with other organizations, continue to pursue the program of commissioning authority certification as a key component of BCA's shift toward an individual-based membership, which in turn should provide the financial stability essential to BCA's longer term success.

- We endorse the Alliance's decision to continue to review the methods used to estimate energy savings and other benefits from the demonstration projects. We also recommend that the cost-effectiveness assumptions used for the Commissioning in Public Buildings project be updated to take advantage of the more extensive data now available on the costs and benefits of commissioning.

2. PROJECT INFORMATION

2.1 PROJECT DESCRIPTION

This is the second formal market progress evaluation report (MPER) of the Northwest Energy Efficiency Alliance's (the Alliance's) Commissioning in Public Buildings project. The Commissioning in Public Building project seeks to make commissioning standard practice in public buildings in the Pacific Northwest (Oregon, Washington, Idaho and Montana). It is a multi-year effort, launched in 1998 and currently slated to continue through calendar year 2003.

The project is being coordinated across the four-state region by the Oregon Office of Energy (OOE), the Alliance's prime contractor. OOE's subcontractors include the Washington Department of General Administration (GA), the Idaho Department of Water Resources (IDWR), and the Montana Department of Environmental Quality (DEQ). Initially, the project also included a subcontract with the Building Commissioning Association – Northwest (BCA-NW) to promote the establishment of an association of commissioning providers. As BCA-NW grew in size and scope (it has since become a national organization and dropped the NW suffix), the subcontract with BCA was rewritten as a direct contract between BCA and the Alliance.

Specific objectives of the project include:

- Educating facility and project managers, administrators, and business managers on the benefits of commissioning
- Demonstrating commissioning and analyzing results
- Establishing state requirements and model policies for commissioning for local governments and schools
- Disseminating commissioning results and model policies

2.2 IMPLEMENTATION HISTORY

This project was first proposed to the Alliance in 1997 by OOE to address public building commissioning in Oregon only. Given the relatively large scope and resource requirements ($1.5 million) of the proposed project, the Alliance Board decided that the project would be more appropriately implemented as a multi-state venture that would cover all of the geographic area served by Alliance member utilities. OOE solicited participation from appropriate agencies in Washington, Idaho, and Montana, and a revised proposal was approved by the Alliance Board in early 1998. While OOE originally proposed a five year project and the Alliance recognized the need for a longer term approach to the inherently lengthy public building process, uncertainly regarding the Alliance's own future funding led the Commissioning in Public Buildings project to be approved with a December 2000 end date.

In July 2000, the Alliance Board approved an additional $615,000 in funding to extend the Commissioning in Public Buildings project through 2003. This funding continues the support for

developing case studies, documenting the benefits of commissioning practices and disseminating the results.

2.3 TARGET GROUPS

The project targets decision makers and other market actors who are responsible for the design, construction, and operation of public buildings in the Pacific Northwest. The goals of the project specifically mention only facility and project managers, administrators, and business managers in public agencies, but it is clear that the goal of making commissioning standard practice will also require the project to influence architects, engineers, and contractors. While these groups are larger and more diverse than public sector building owners and operators, there is evidence that relatively small numbers of architects, engineers, and contractors account for a disproportionate share of public building construction in each of the four states.

2.4 MARKET BARRIERS

A comprehensive baseline market study by SBW Consulting, Inc. (Alliance Report #E98-017) conducted in 1998 and updated by Quantum Consulting, Inc. (Alliance Report #E99-032) in 1999 found that commissioning activity is greater for new buildings than for existing buildings, but is far from standard practice in either case. Both building owners and commissioning providers noted that there was a trend to include commissioning in more new construction projects, but that retro-commissioning is generally initiated in response to major building problems.

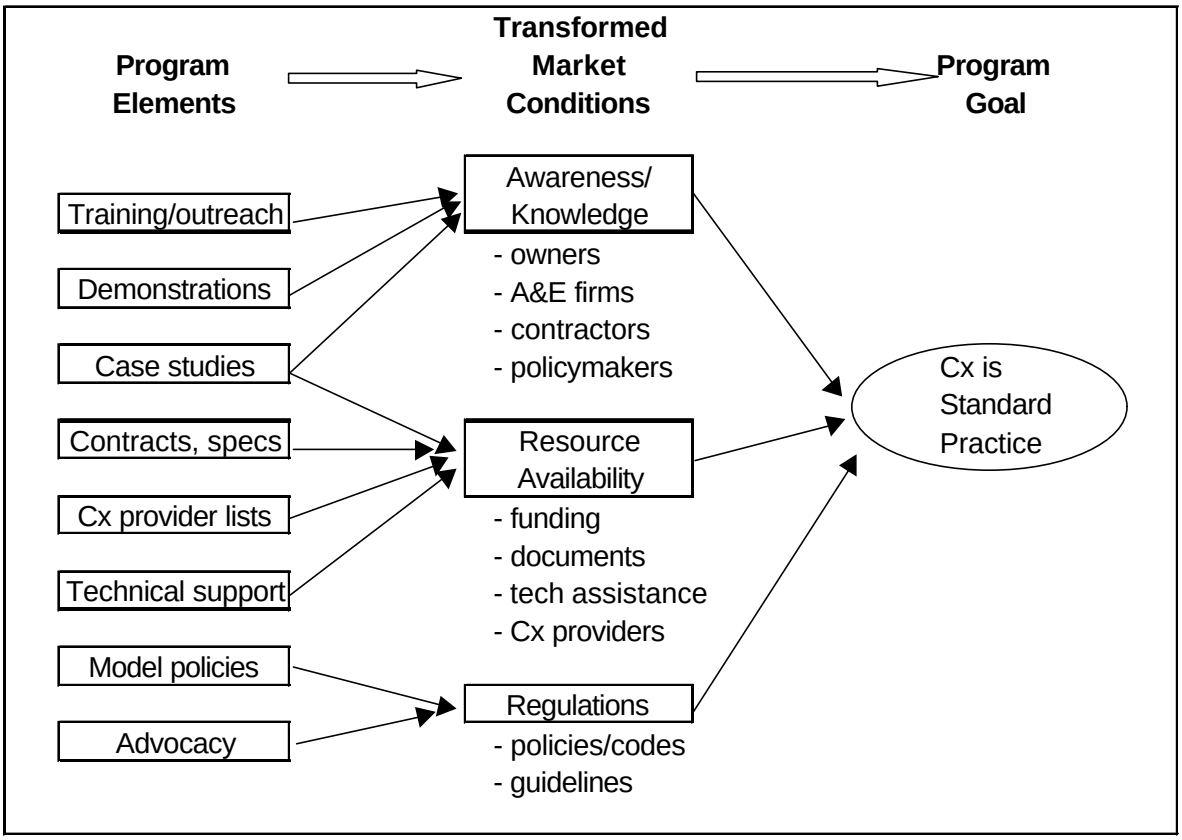
Despite these market barriers, the baseline studies did find a market that was potentially receptive to commissioning. Of the 18 benefits of new building commissioning that building owners were asked about in the baseline survey, 11 were considered "very important" by more than 50 percent of respondents. In contrast, none of 16 barriers was considered very important by more than half of respondents, and the only barrier considered very important by more than one third of respondents was the added cost of conducting tests. Other barriers considered very important by at least 20 percent of survey respondents were lack of documented benefits, lack of standardized test procedures, lack of certification for testers, not knowing how to implement tests, the added cost of specifying tests, and disruption of the construction schedule.

Respondents were even more likely to find benefits more important than barriers for retro-commissioning, but were also more likely to consider the added cost of testing a significant barrier. Five of the 10 benefits that building owners were asked about were considered very important by a majority of respondents. In contrast, only one of 12 barriers — the added cost — was considered very important by 57 percent of respondents. The only other barriers to retro-commissioning considered very important by more than 20 percent of respondents were lack of documented benefits, the added cost of specifying tests, and the lack of standardized test procedures.

2.5 PROGRAM ACTIVITIES

The overall approach to market transformation taken by the Commissioning in Public Buildings project is illustrated in Exhibit 1.

Exhibit 1
Commissioning in Public Buildings Project Theory



Program elements and activities are designed to bring about changes in market conditions – notably increased awareness and knowledge of commissioning, increased availability of resources to implement commissioning, and a policy/regulatory framework that supports commissioning – that ultimately lead to commissioning being standard practice in the public sector. To bring about these changes in the market, the Commissioning in Public Buildings project employs elements that were among those identified as potentially effective by public sector representatives contacted for the baseline study. Key elements include:

- Demonstration projects/case studies – OOE and its subcontractors have selected a number of state and local government buildings to demonstrate and refine the commissioning process for new facilities and, as appropriate, for existing buildings. The process and its results will be documented, analyzed, and incorporated into case studies that will be published and distributed across the region.

- Technical Assistance – As public agencies go through the commissioning process for the first time, the project provides technical assistance, either through on-staff specialists or an advisory contractor.

- Model policies – All four state agencies have developed model policies requiring new and retrofit buildings to be commissioned. These policies can either be used as-is by an

agency or adapted to the organization's specific needs. Idaho and Montana have also compiled and published "best practices" documents and Oregon and Washington have published guidelines to capture lessons learned in past commissioning efforts.

- Education and training – While OOE's Statement of Work for the project cites as an objective "educate facility and project managers, administrators, and business managers on the benefits of commissioning," this is not called out explicitly as a task or activity of the project. Nevertheless, a number of the states are either providing education and training as part of the project or are incorporating training from other sources to promote the aims of this project.

- Financial assistance to help cover the cost of commissioning – To help encourage agencies to commission their buildings, the states are covering a portion of the cost of commissioning for the demonstration projects. The remaining costs are covered by the participating agency or by funds from another source.

- Promote industry association – One of the project's original goals was to assist in the establishment of a regional commissioning industry association, with funds being provided through OOE to support the initial activities of the Building Commissioning Association (BCA) – Northwest. Because of BCA's rapid growth and development into an independent organization, the Alliance is now working directly with BCA in a separate effort to promote commissioning in the private as well as public sector. The individual state subcontracts do not specifically require the states to support BCA, although all of the states have announced commissioning requests for proposal or requests for qualifications to BCA as commissioning services are required for individual demonstration projects. BCA membership has also been used as a preferred selection criterion for commissioning authorities (CAs).

2.6 EXIT STRATEGIES AND INDICATORS OF SUCCESS

At the end of the project contract period, it is intended that changes in the market will be self-sustaining. To that end, the exit strategies for the project are:

- State policies that require commissioning for new construction, retrofits, and upgrades to state facilities

- Local governments and school districts adopting model policies to require commissioning

- Commissioning service providers, through their industry association, providing an additional push for remaining local governments and school districts to adopt commissioning as standard practice.

In addition to these previously established exist strategies, a new alternative has emerged in the Washington State Department of General Administration's program to support state agencies that want to commission projects, as described later in this report.

2.7 MAJOR ISSUES/CHALLENGES/SUCCESSES EXPERIENCED TO DATE

One of the principal challenges to the project in its first two years of operation was the looming end of the contract period well before many demonstration projects could realistically be completed and developed into case studies. This made the goal of significantly influencing the market during the life of the project difficult to attain. With the extension of the project and the provision of additional funding, the goals of the project are far more realistic. It should be noted, however, that some of the projects selected relatively early in the project were chosen in part because they offered the prospect of timely completion. As described in greater detail later in this report, in some cases this meant that commissioning was introduced well after design had been completed and construction started. As a result, a few of the demonstration projects have experienced problems associated with bringing commissioning into the process fairly late, such as issues not caught during a design review and resentment / defensiveness of other construction team members, as described elsewhere in this report.

2.8 RESPONSE TO PREVIOUS EVALUATION RECOMMENDATIONS

Recommendations made in the previous evaluation report and responses to those recommendations are discussed below.

To reduce remaining uncertainty regarding the project time frame, time extensions to the OOE contract (and to the subcontracts) should be pursued and formalized as soon as the Alliance's own circumstances allow.

This recommendation was implemented as soon as it was possible to do so, once the Alliance's own funding for the remainder of the original contract period had been secured. The extensions to the contract through 2003 were signed in the summer of 2000.

We recommend that agreed upon changes in the language regarding the development of policies and guidelines be finalized and incorporated into the language of the contracts between the Alliance and OOE, and between OOE and the individual states.

Several meetings were held to come to agreement regarding the level of influence that the states could be expected to have on policies and guidelines. It was agreed that the state agencies involved in the project (OOE, GA, IDWR, DEQ) would not be able to set policy directly, but should facilitate the development of such policies by making model policies and guidelines available and encouraging state agencies to adopt them.

A determination should be made regarding the appropriate role of the Northwest Commissioning Collaborative[1], both in maintaining an oversight role on the Commissioning in Public Buildings Project and in serving as the best forum for the project team to stay abreast of developments in the overall commissioning market. If it is determined that an explicit oversight role for the Collaborative is no longer appropriate, the wording of the Alliance's contract with OOE should be modified.

[1] The Northwest Commissioning Collaborative, an ad-hoc group of utilities, governments, and private sector parties interested in making commissioning widespread, was originally charged with oversight of the Commissioning in Public Buildings project.

Again, while the contract language has apparently not been changed, the Northwest Commissioning Collaborative does not appear to be playing an active oversight role on the project. Instead, the Alliance, OOE, and other project team members periodically report on the progress of the demonstration sites and other aspects of the project to the Collaborative. Meetings of the project team sometimes take advantage of the fact that Collaborative meetings bring people into town, but they are equally likely to be held independently.

We recommend that the following specific elements be considered for inclusion in the work plans for the remainder of the project: 1) education and training for architects, 2) education and training for engineers, and 3) education and training for contractors, including both general contractors and mechanical/electrical contractors who will be directly affected by the commissioning process. It should be noted that these education and training components need not be targeted exclusively to these groups and need not be classroom-based. Training offered by BCA or the Association of State Energy Research Technology Transfer Institutions (ASERTTI), for example, might be an effective way to reach architects and engineers. Similarly, dissemination of case studies to the above groups might serve to educate them about the benefits of commissioning. We recommend that the project team and the Alliance consider using such opportunities to reach the audience of architects, engineers, and contractors.

Among the four states, only Idaho appears to have moved forward with training explicitly targeted to market actors who are not building owners, with training provided by IDWR's support contractor Toombs & Associates. The other states have all included architects, engineers, and contractors among the groups targeted by their marketing plans. Implementation of the marketing plans as the case studies are published and disseminated should provide some of the needed education for these targeted groups. However, a more explicit focus on training for these groups should still be pursued.

- *We recommend that issues of both content and style (for the case studies) be addressed and resolved as soon as possible, prior to development of the first case study.*

Progress was (slowly) made on the case study formats, and the first case studies have now been published. Additional discussion of the development process is provided in the remainder of this report.

2.9 LIST OF PROGRAM REPORTS AVAILABLE

The following reports relating to the Commissioning in Public Buildings Project are available:

- *Commissioning Public Buildings in the Northwest: Commissioning Solves Problems That Robbed State Police of Comfort, Healthy Air,* Oregon Office of Energy, June 1998

- *Building Commissioning, Getting Buildings to Peak Performance,* brochure developed by Oregon Office of Energy, November 1998

- *A Practical Guide for Commissioning Existing Buildings,* by Portland Energy Conservation, Inc., and Oak Ridge National Laboratory for the U.S. Department of Energy, ORNL/TM-1999/34, April 1999

- Idaho Commissioning Guidelines for New Buildings, available at the State of Idaho web site: http://www2.state.id.us/adm/pubworks/archengr/app7npcg.pdf

- Idaho Retro-Commissioning Guidelines, also available at the State of Idaho web site: http://www2.state.id.us/adm/pubworks/archengr/app7rcg.pdf

- *Essential Attributes of Building Commissioning*, available at the Building Commissioning Association web site, http://www/bcxa.org

- Washington State Commissioning Guidelines for New Buildings, available at the State of Washington GA web site" http://www.ga.wa.gov/eas/bcx/Bxguidelines.doc

- Best Practices in Commissioning in the State of Montana, available at the Montana DEQ web site: http://www/deq.state.mt.us/ppa/tfa/energy/BestPractices.pdf

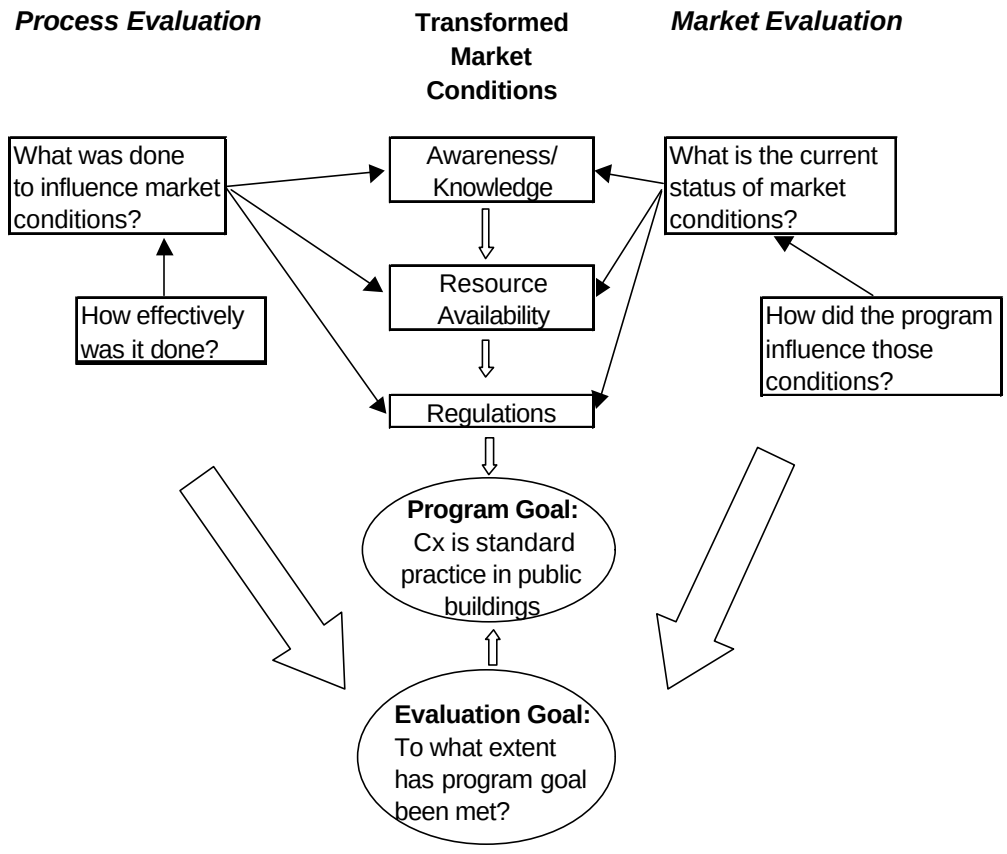
- Summary of Oregon demonstration projects, available at the State of Oregon web site: http://www/energy.state.or.us/bus/comm/democx.htm

3. EVALUATION INFORMATION

3.1 EVALUATION GOALS AND OBJECTIVES

The purpose of the evaluation of the Commissioning in Public Buildings Project is to determine the extent to which the project has been successful in achieving its stated goal of making commissioning standard practice in public buildings. As shown in Exhibit 2, the evaluation is designed to assess both what was done to influence the market conditions targeted by the project (process evaluation) and to what extent those market conditions have changed (market evaluation.) In other words, the evaluation objectives are to document project activities, analyze the effectiveness of these activities, and make recommendations to improve both the effectiveness and the efficiency of the project in achieving its goals and objectives.

Exhibit 2
Commissioning in Public Buildings Program
Evaluation Overview



Specific activities undertaken for this MPER to support these goals include:

1) an overall assessment of the demonstration sites, for each state individually and the project as a whole, including selection of demonstration sites (types of buildings, existing vs. new construction, comparability across states), successes, failures, and lessons learned.

2) an assessment of the efficacy of project coordination, communication and tracking systems / documentation to make recommendations for future improvements in those areas where relationships will continue for a significant period.

3) an evaluation of the state plans for promoting policies and guidelines and disseminating case study information, including recommendations for improvements.

4) documentation and assessment of the process by which case studies are being developed

5) documentation and, where possible, quantification, of developments in the commissioning market since the project was launched, with a focus on the extent to which policies have been developed and adopted or are being considered by public agencies

6) an analysis of the commissioning agent market, including an assessment of the current state of the Building Commissioning Association

7) development of a plan to estimate the energy savings for buildings that were not demonstration sites but were commissioned because of the project.

Section 4 of this report, "Evaluation Findings" is organized according to these evaluation activities.

3.2 EVALUATION METHODOLOGY

As shown in Exhibit 3, data collection methods for this project were generally similar across analysis tasks, and relied heavily on document review and qualitative interviews, with input to the market evaluation also coming from surveys. Full circles indicate the most important data sources for each evaluation objective; empty circles indicate sources that provided supporting information for that objective.

Exhibit 3
Evaluation Objectives and Data Sources

Sources	Document Review					Interviews				Surveys
Evaluation Objectives	Progress Reports	Cx Reports	Case studies	www, other materials	Mktg. Plans	Program staff	Participants	Cx Providers	Other players	Nonpart. owners
Process										
Training/outreach										
Program activities	●				●	●				
How effectively delivered	●						●			
Demonstration sites										
Program activities	●		●			●	●	●		
How effectively delivered	●						●	●		
Case studies										
Program activities	●		●		●	●				
How effectively delivered	●	●	●				●	●		
Technical support										
Program activities	●					●				
How effectively delivered	●					●	●			
Contracts/specifications										
Program activities	●					●				
How effectively delivered	●					●	●			
Model policies										
Program activities	●			●		●	●			
How effectively delivered	●					●	●			
Market										
Awareness/action										
Current status						●	●	●	●	●
Program influence							●	●	●	
Resource availability										
Current status	●			●			●	●	●	●
Program influence							●	●	●	
Regulations/policies										
Current status				●		●	●	●	●	
Program influence							●		●	

● Most important
less important

Document Review

Review and analysis of the "paper trail" for each aspect of the project helps provide a thorough understanding of how the project is being implemented and can contribute valuable insights into the effectiveness of program delivery. For this evaluation, document review comprised not only monthly progress reports, but also commissioning reports for individual projects, draft case studies, marketing plans, web sites and other materials.

Qualitative Interviews

Qualitative interviews formed the heart of the data collection process. The relatively small number of market actors makes traditional sampling and quantitative analysis difficult, at best. We believe we have made the best possible use of interviewer time by developing an informal "panel" of a core group of market actors with whom we have established an ongoing relationship, including staff members of OOE and its subcontractors, commissioning authorities, and various state agencies. These market actors have been contacted over the life of the project, are familiar with the evaluation and its objectives, and have been willing to provide objective input regarding what happened as well as their own perceptions regarding why things happened. In addition to questions relating directly to the project, interviews with these key players covered developments in the broader market, including the level of commissioning activity, the supply of commissioning providers, and the status of regulations or other requirements for various levels or commissioning.

Interviews were also conducted with some market actors for the first time, since a number of demonstration projects only recently had significant activity. All interviews did have a quantitative component in that project staff, participants, and commissioning providers were asked to rate (on a 1-to-5 scale) the success of the individual demonstration projects in which they were involved.

Surveys

Telephone or paper surveys were conducted primarily with representatives of public sector agencies not participating in the Commissioning in Public Buildings project, with the goal of determining to what extent the non-participant agencies have adopted commissioning practices. A total of 26 surveys were completed at the training session held by the Idaho Division of Public Works (DPW) and conducted by Toombs & Associates as part of this project. Respondents to these surveys included 4 DPW employees, 14 representatives of 11 other agencies or organizations (including 2 participants in the project), and 8 architects / engineers.

In addition, a total of 19 telephone surveys were completed with representatives of non-participating agencies in the other 3 states. All surveys included questions regarding the number of buildings commissioned in the recent past, the respondents' own knowledge of commissioning and their perceptions regarding specific barriers to its use.

Sample

In all, interviews or surveys were conducted with over 70 respondents for this evaluation, distributed as shown in Exhibit 4.

Exhibit 4
Sample Frame

State	Program Staff	Agencies		Cx Providers	Total
		Parts.	Non-parts		
Oregon	3	5	7	5	20
Washington	2	5	6	5	18
Idaho	1	3	11	4	19
Montana	1	5	6	4	16
Totals	7	18	30	18	73

3.3 EVALUATION NEXT STEPS

With the completion of this market progress evaluation, the next and final MPER for the Commissioning in Public Buildings project will be more explicitly focused on the development and dissemination of completed case studies in the context of the marketing plans developed by each state. This will include an analysis of the results of individual case studies (i.e., documented energy savings and non-energy benefits) as well as the process by which results are disseminated.

In as much as we will be investigating the extent to which case studies have reached the broader public sector market in those evaluations, they will involve additional data collection from market actors who are not directly involved in the project. These market actors are the targets identified in the marketing plans, and will include building owner representatives (financial / managerial as well as technical), the design / engineering community, and contractors who are not involved in the Commissioning in Public Buildings project. This will also provide input to a market analysis to determine to what extent changes in the market can be quantified and compared to the baseline findings.

Time lines for these activities reflect the remaining implementation period for the project. Tentatively, the final MPER will be prepared at the conclusion of the project at the end of 2003. Interim memos and other evaluation activities will continue to be used to assist in the management of the project going forward.

3.4 EVALUATION REPORTS AVAILABLE

- *Building Commissioning Practices in New Construction and Existing Building Markets in the Pacific Northwest*, SBW Consulting, Inc., October 1998, Alliance Report #E98-017

- *Enhanced Baseline Assessment of Public Building Commissioning in the Pacific Northwest*, Quantum Consulting, Inc., June 1999, Alliance Report #E99-032

- *Market Progress Evaluation Report, Commissioning in Public Buildings, No. 2,* Quantum Consulting, Inc., December 1999, Alliance Report #E99-042

4. EVALUATION FINDINGS

The findings of this process evaluation are organized according to the key analysis tasks set forth in the evaluation work plan and described in Section 3.1.

4.1 DOCUMENTATION AND ASSESSMENT OF DEMONSTRATION SITES

Demonstration sites are a focus of this MPER because of their importance to the project's success; in addition to serving as highly visible examples of commissioning in their respective states, the demonstration sites provide the basis for case studies that will be used to inform other decision makers and thereby help transform the market. The project currently has a total of 33 demonstration sites where either new or existing buildings have been or are being commissioned. As discussed below, several additional buildings in Montana underwent initial retro-commissioning, but have subsequently been dropped from the list of demonstration projects because the building owners were unwilling or unable to implement the changes recommended by the commissioning authority, and no final performance tests could be performed.

Exhibit 5
Demonstration Sites by Building Use and State

	New Cx				Total	Retro Cx				Total	Grand
Building Use/Type	OR	WA	MT	ID	**New**	OR	WA	MT	ID	**Retro**	**Total**
K-12 School	2	1			**3**	1	4	2		**7**	**10**
Office	1		1	1	**3**	1		1	1	**3**	**6**
Community/Tech College	1	4			**5**		1			**1**	**6**
University Facility	1			1	**2**			2		**2**	**4**
Corrections Facility		3			**3**					**0**	**3**
Library/ Museum	1	1			**2**					**0**	**2**
Hospital/Health Lab		1			**1**					**0**	**1**
Military					**0**			1		**1**	**1**
Totals	6	10	1	2	**19**	2	5	6	1	**14**	**33**

As illustrated by Exhibit 5, the demonstration projects comprise a variety of building types, but are dominated by schools, offices, and colleges and universities. The large proportion of higher education facilities of all kinds in the demonstration sites reflects their position at the forefront in the adoption of commissioning in the Pacific Northwest. Since new construction for state universities and community colleges usually goes through the same process as new construction for other agencies (e.g., through GA in Washington and DPW in Idaho), one would expect substantial spillover to other state construction projects.

4.1.1 Demonstration Project Selection Process

The demonstration project selection process has had problems since the beginning of the Commissioning in Public Buildings project. First there were delays in contract signing due in large part to the structure of the contract, with OOE as the prime and other states as the subcontractors. As described in the first MPER, this led to delays in contract signing. As a result, some potential demonstration projects had to be abandoned because candidate buildings were no longer suitable. Washington in particular, had recruited a number of projects that either were new and still under warranty and had not been commissioned, or that were completed but not yet occupied. As contracts went through legal reviews, several projects no longer met the criteria for which they were originally selected.

Second, much of the recruitment of demonstration projects has, of necessity, been opportunistic. All of the states tended to select projects based on their availability, since there are only a limited number of new public sector projects under construction at any given time, and only a subset of those would have an interest in participating. This was particularly true early on, when the project was assumed to end in December 2000. With that deadline looming, program staff had to focus on identifying any projects that would be completed far enough before the end of 2000 to allow data to be gathered on the finished building and a case study completed before the end of the project. Some projects that were selected therefore might not have been the most desirable in terms of owner involvement, construction team buy-in, applicability to other buildings or agencies, and so on. Several buildings with third party project managers, for example, might not have been the preferred choice if the goal was to educate owners and give them experience with the commissioning process, yet these same projects offered a greater likelihood that the process would be implemented relatively smoothly within the allotted time.

This need to select from the limited pool of available projects is reflected in problems encountered at some of the demonstration sites. For example, introduction of commissioning relatively late in the construction process, as was the case with the Department of Correction Special Offenders Unit in Washington and the Beaverton Library in Oregon, made it easier for contractors to argue that deficiencies could only be corrected under change orders (where the contractor's scope of work is revised so that the owner pays extra to have the work performed). In addition, some project managers had a tendency to view commissioning as an added burden rather than something that benefits them – particularly if they were not the original construction or project manager on the project. This was the case on the South Puget Sound Community College project in Washington and – initially – on the Beaverton Library project in Oregon (although the project manager for that project came to see the value in commissioning.) On several projects, the state agency's representatives themselves were at best indifferent; some of the project managers at Washington's GA, for example, did not do much to make commissioning a success. And the Oregon Department of Administrative Services – the agency responsible for managing large parts of the public building stock -- has not been very receptive to OOE's efforts to recruit demonstration projects.

Even the project extension to the original full, five-year time frame did not completely eliminate this need to include projects based on availability. It is true that once the project extension had been confirmed in mid-2000 all of the states were able to analyze their demonstration project portfolios, and in some cases add projects where commissioning was introduced during the design phase. Most of the added projects, however, were for retro-commissioning, as the Alliance encouraged the states to get some retro-commissioning experience.

Moreover, by the time new projects were added to the demonstration roster, some of the same concerns regarding the need to balance early involvement of commissioning in the construction process (i.e., during design) against the ability to complete the project, analyze results, and prepare and disseminate case studies came into play again. In other words, the demonstration project selection process has been more like two separate, relatively short-term, projects than one long project.

It should be noted, however, that the states generally have about as many demonstration projects as called for by their work plans. Oregon planned to have nine projects (three new and two retro state government, two local government, and two schools). Since two of the state buildings (a community college and a prison) dropped out, and Oregon added a third school, the number of demonstration projects totals eight. Washington's original work plan called for up to ten demonstration projects, and GA has ended up with 15. Idaho originally planned to do just one, but added two others. Montana's work plan called for case studies on eight retro-commissioning projects, with the initial phase funded through the state's Energy Conservation Program and Rebuild America; initial retro-commissioning activities were in fact completed on 12 buildings. However, findings were systematically implemented in a way that would support completion of the second phase of retro-commissioning and development of a case study for only a single project. As a result, a number of new projects had to be found.

4.1.2 New Construction/Retrofit Project Overview

The Commissioning in Public Buildings project was initially oriented primarily to new construction, both in the language of the project's goals and – with the exception of Montana -- in the initial demonstration projects selected. Of the 19 demonstration projects for Oregon, Washington and Idaho reported in the first MPER, 15 were new construction or retrofit projects. As a result, many of the new construction projects reflect some of the project selection / recruitment issues described above. The status of each of the demonstration projects -- including size, commissioning scope, and start and end dates -- is summarized in table format in Exhibit 6. Note that of the 19 new construction or retrofit projects shown, only about a half dozen included commissioning during the design phase, and in most cases that was limited to a design review toward the end of the design process.

As far as the magnitude of the new building commissioning effort, these new construction projects total almost 2 million square feet and range in size from 18,000 to 340,000 square feet, with a cost of commissioning that ranges from $18,000 to $225,000. The cost per square foot of commissioning these new buildings varies from a low of $0.29 per square foot (for Courthouse Square in Oregon and Bainbridge High School in Washington) to a high of $1.70 per square foot for the 26,500 square foot South Puget Sound Community College Student Union. It should be noted that the budgeted figure for this latter project was designed to cover the cost of whole building commissioning, and was ultimately scaled back because the general contractor did not provide the support needed to allow commissioning to be completed.

Exhibit 6
Demonstration Projects -- by State and Building Type

OREGON

Project Name	Building Type	Project Type	Floor Area	Cx Cost	Cx Scope	Design Review?	Cx Start	Projected Cx End
STATE BUILDINGS, UNIVERSITIES, COMMUNITY COLLEGES								
Lane Community College	Child Care Center	New Cx	18,300	$18,000	HVAC	No	Mar-99	done
Portland State University	Classrooms	Retrofit	213,333	$19,556	Chiller	NA	Jul-00	done
Public Service Building	Office	RetroCx	172,400	$20,900	HVAC	NA	Jan-00	done
LOCAL GOVERNMENT								
Courthouse Square	Mixed Use	New Cx	160,000	$46,000	Mech, elect,	No	Feb-00	done
Beaverton Library	Library	New Cx	69,500	$65,000	Mech, elect,	No	Dec-99	done
SCHOOL DISTRICTS								
Sexton Mountain Elem.	School	Retro Cx	65,000	$30,000	Mech	NA	Jul-99	done
Marion F. Miller ES	School	New Cx	49,000	$32,660	Mech, controls	Some	Aug-99	done
North Clackamas HS	School	New Cx	250,000	$85,000	Whole building	Not formally, but a letter was sent	Jan-01	done

MONTANA

Project Name	Building Type	Project Type	Floor Area	Cx Cost	Cx Scope	Design Review?	Cx Start	Projected Cx End
STATE BUILDINGS, UNIVERSITIES, COMMUNITY COLLEGES								
U of M-Grizzly Pool Bldg.	Pool and Recreation	Retro Cx	37,466	$5,100	Control sequences	NA	Aug-01	done
Army Aviation Support Facility - Dept. of Millitary Affairs	40% Offices, Helicopter hangar	Retro Cx	about 100,000	$12,300	Mech., lighting	NA	Sep-01	done
Wallace Building	Prison Office Addition/ renovation	New Cx	28,000	$22,928	Mech., security	Yes	Aug-01	done
Gallagher Hall (U of M Business School)	Classroom & Offices	Re-Cx	100,000	$24,880	Mech.	NA	Dec-01	done
LOCAL GOVERNMENT								
Missoula City Hall	Offices	Retro Cx	50,000	$8,512	Mech.	NA	Mar-02	done
SCHOOLS								
East Valley Middle School	School	Retro Cx	64,000	$8,700	Mech.	NA	Jul-01	done
Montana City School	School	Retro Cx	46,000	$7,700	Mech., lighting	NA	Jul-02	Jan-03

IDAHO

Project Name	Building Type	Project Type	Floor Area	Cx Cost	Cx Scope	Design Review?	Cx Start	Projected Cx End
STATE BUILDINGS, UNIVERSITIES, COMMUNITY COLLEGES								
Boise State University	Rec. Center	New Cx	90,148	$30,000	Mech.	Yes	Aug-99	done
LOCAL GOVERNMENT								
Nampa City Hall	Offices	Retro Cx	23,000	$19,317	Mech., lighting	NA	Jul-01	Ph 1 done; Ph 2 Dec-02
Ada County Courthouse	Courtrooms and Offices	New Cx	340,000	$225,000	Mech., elec., life safety, security	Yes	Mar-01	May-02

Exhibit 6
Demonstration Projects -- by State and Building Type (continued)

WASHINGTON

Project Name	Building Type	Project Type	Floor Area	Cx Cost	Cx Scope	Design Review?	Cx Start	Projected Cx End
STATE BUILDINGS, UNIVERSITIES, COMMUNITY COLLEGES								
Bellingham Technical College	Classrooms	Retro Cx	12,904	$18,380	Mech.	NA	Feb-99	Phase 1 done
South Puget Sound CC - Student Union	Student Union	New Cx	26,500	$45,000	Whole building	No	Jun-99	done
Bellevue Community College	Classrooms & Offices	New Cx	65,000	$45,000	Mech & elect	Yes	Aug-00	done
Olympic Community College	Library	New Cx	36,000	$55,000	Mech , some elec.	After D complete	Jul-99	done
Spokane CC - Health Sciences Building	Classrooms and labs	New Cx	60,000	$76,680	Mech., elec.	After D complete	Sep-99	done
DOC - Women's Prison	Prison	New Cx	58,000	$80,000	Mech, elec., security	At 65-70%	Jul-99	done
DOC - Special Offenders Center	Prison	New Cx	109,000	$95,000	Mech. & fire	No	Aug-99	done
Cheney Cowles Museum	Museum	New Cx	78,000	$98,000	Mech., elec., fire, safety	Comment on final	Jul-00	done
SCHOOL DISTRICTS								
Cascade School District-Icicle River Mid School	School	Retro Cx	52,000	$22,000	HVAC	NA	Feb-00	Phase 1 done
North Thurston School District	School	Retro Cx	150,000	$22,800	HVAC for IAQ only	NA	Feb-00	Ph 1 done; Ph 2 done
Riverside School District - High School	School	Retro Cx	83,000	$38,000	HVAC	NA	Feb-00	done
Bainbridge Island School District - High School	School	New Cx	144,000	$41,860	HVAC & Controls	No	Jul-99	done
Clover Park School District - 2 schools	School	Retro Cx	80,000	$75,000	HVAC	NA	Nov-01	Ph 1 done; Ph 2 done
LOCAL GOVERNMENT								
Othello Community Hospital	Hospital Addition	New Cx	51,000	$63,000	Mech., elec, emerg, roof	No	Mar-99	done
Kitsap County Jail	Prison	New Cx	110,000	$163,000	Mech., elec.,secur. & comms.	Reviewed 50% drawings	Jan-01	Oct-03

NA = Not applicable for retro-commissioning projects

More typical are a series of buildings in the 36-75,000 square foot size range with commissioning costs averaging between $1.25 and $1.50 per square foot. Economies of scale come into play on some of the larger projects, with costs of less than $0.75 per square foot for most projects over 90,000 square feet. Building type also influences commissioning cost, with relatively lower costs for K-12 schools and for the Courthouse Square project (which includes a relatively large open transportation terminus area.)

4.1.3 Retro-commissioning Project Overview

The increased emphasis on retro-commissioning projects after the project extension resulted both because such products may offer more direct energy benefits and because the installed base of buildings to which it can be applied is so much larger. However all these projects have the added issue of requiring owner commitment to implementation of recommended measures. Not surprisingly, building owners are somewhat reluctant to make such a commitment before

they know what the recommended measures, associated costs, and anticipated benefits will be. This was the situation that Montana faced with most of its first round of case study projects.

Similarly, even if they think they will implement the recommended measures, building owners may have to work within a funding framework that may not match the requirements of the Commissioning in Public Buildings project. School districts, for example, may need to issue bonds to fund major improvements, as was the case with Sexton Mountain elementary school.

In other cases, owner interest in participating as a demonstration site may have been tied to building performance problems that had little or nothing directly to do with energy. Indoor air quality issues at a Washington retro-commissioning K-12 school project for example, led to litigation and other issues that will reduce its effectiveness as a case study, since the school district is waiting to use funds from an anticipated IAQ litigation settlement to fund some of the recommended improvements.

These kinds of problems may be somewhat intrinsic to retro-commissioning projects, in that owners often participate because they face major building performance problems. Once they know that the cause of those problems may have been faulty construction, there is a tendency to have the original contractor remedy as many of the problems as possible rather than spend the owner's money to implement recommended measures.

For retro-commissioning projects, costs ranged from $0.12 per square foot to $1.42 per square foot, averaging $0.24 per square foot. As with new construction projects, costs per square foot are usually higher for the smallest buildings. Among states, Montana had the lowest retro-commissioning costs, averaging less than $0.15 per square foot, which in one case includes the cost to go back and re-commission a building after corrective measures had been taken.

4.1.4 Project Status by State

In this section, the experience to date of individual states is discussed, using two illustrative projects for each. The projects described for each state are meant to represent a cross-section of all the sites in the region, and are not necessarily typical of the projects for that state. Instead, sites were chosen to provide a variety of building types, commissioning scopes, and lessons learned.

OREGON

In Oregon, OOE's initial work plan identified a mix of buildings by segment (state government, local government, schools) and project type (new, retrofit, retro commissioning) that were to be selected as the basis for case studies. Such a mix of buildings has now been achieved, with state and local governments, colleges, and schools all represented. More than other states, Oregon has a preponderance of new construction projects, with retro-commissioning limited to a school and the public service building. OOE also has the only project demonstrating commissioning of a major equipment retrofit: a new chiller at Portland State University.

Beaverton Library

Among the Oregon projects, the 69,500 square foot Beaverton Library has been somewhat problematic. Construction for the new library was linked to politics, with the mayor having made a campaign promise to have the library open by a specific date. The project was funded with a lump-sum, "hard bid" contract (where any changes from the original drawings or specifications cost extra), and subject to damages of $1,500/day for each day the opening was delayed. When the commissioning kickoff meeting was held in December 1999, construction was already under way, so that there was no opportunity for design phase commissioning or review.

The combination of the fixed price contract and the tight deadline made the contractor less than receptive to having the project commissioned. In addition, this project was managed by a third party construction manager, Heery International, whose project manager initially feared that the inclusion of commissioning would lead to added change orders and delays. And, in fact, there were significant delays because the contractor argued about whether deficiencies identified by the commissioning authority (CA) were design issues (in which case a change order would be called for at extra cost) or construction issues that were the responsibility of the contractor.

Because of the penalties associated with late completion, the contractor pushed to complete the project in time. The library opened on September 11, 2000, even though construction was far from complete and parts of the HVAC system had not been installed, much less commissioned. It took several months before the mechanical systems were in place and could be tested. According to the CA, about 85 issues were identified, about evenly split, according to the construction manager, between construction issues and design issues. Most of the construction issues were taken care of by June 2001, and there were some issues that were clearly design related, such as a boiler room that was shown incorrectly on the plans. The contractor did the repairs identified by the CA that they felt they were responsible for, and the CA went back and checked them off.

There were, however, 15 or so items that were unresolved when the CA submitted the final commissioning report in October 2001. The project manager for Heery noted that for these remaining design-related issues, solutions were identified, and the project manager and construction team worked together to get those taken care of.

The construction manager was very pleased with the work done by the CAs, and has become a proponent of commissioning despite her initial misgivings. "I would do it on all complex buildings," (meaning buildings with sophisticated control systems), "especially public buildings. I was surprised to find out that the mechanical design wasn't as thought out or thoughtful as I anticipated. The problem may be that the people doing the actual drawings aren't the principals with many years of experience, but less experienced people."

The most challenging aspect of using commissioning for the project manager was the fact that "it touches all aspects of the project." The nature of the process is that you "get a bunch of people in a room, which in itself is expensive, and identify a problem and how to resolve it. Then you still have to get word of that fix into the construction process and make sure it gets out to the people who are actually putting the building up." While the contractor did have issues

regarding who was going to pay to resolve the problems that were found, all the players apparently cooperated.

The CA agreed that, even though there were a number of issues that required a long time to resolve, this has been a fairly successful project, with most of the issues resolved and lots of benefits. "The process has been pretty smooth; there hasn't been any animosity, and people have gotten along, but I can't recall being on a job this late" (i.e., almost a year after occupancy).

The buildings occupants, contacted in November 2002, also said that the building continues to function properly. The director of the library said they have had no problems with complaints regarding heat or cold, and the maintenance manager for the building reports that the mechanical systems are operating smoothly and are very well documented. The only concern that has arisen is that northerly winds will sometimes blow directly into the air intakes on the library roof, causing a whistling sound that can be heard through the building. The contractor has been able to reduce, but not eliminate the noise. The problem appears to have been the result of a design error, which might have been caught if there had been design phase commissioning.

Lessons learned on this project include the importance of having the CA involved early in the design process, since many of the problems identified during construction on this project could, in fact, have been identified earlier. Equally important is the need to have all the members on the construction team involved in and (as far as possible) committed to the commissioning process. Finally, the involvement of a third party construction manager may have limited the impact of this project on the commissioning practices of the City of Beaverton, although it may have helped spread the word to the broader construction community.

Sexton Mountain Elementary School in the Beaverton School District.

The retro-commissioning effort at Sexton Mountain Elementary School was focused more on identifying and documenting issues than implementation – though a number of low cost/no cost measures were implemented. Built in 1989, this 65,000 square foot school had significant energy usage and comfort problems. District engineers were well aware of the problems and knew what some of them were, but they wanted to document them for a planned bond issue. The retro-commissioning project was successful in that not only allowed the school district to accelerate needed repairs at Sexton Mountain to be funded by the bond issue, but also to identify additional problems.

Commissioning for this project commenced in the summer of 1999. The 37 commissioning issues identified for this project included 11 significant issues (defined as those whose resolution would result in changes in energy use and/or reduced operational expenses). Most of these issues were addressed or became irrelevant through passage of a bond measure that funded replacing the roof and much of the HVAC system in the school. The realized benefits from retro-commissioning on this project, then, came from issues that the district has now resolved as well as the acceleration of the bond-funded effort to improve the roof and HVAC system.

It should be noted that when the district initiated the commissioning study, they suspected that replacing the roof and HVAC systems would be the best overall solution to building operational problems. But since funding for this was not available at that time, and future bond funding was uncertain, they thought the study could provide them with cost-effective, inexpensive

recommendations for the near future. The commissioning report, by documenting the school's deficiencies, played an important role in prioritizing getting the bond issue passed sooner rather than later and in accelerating funding for the projects at Sexton Mountain, according to the school district's Director of Facilities

The commissioning team agreed that improved energy efficiency and comfort are major benefits of commissioning on this project. Commissioning also provided O&M staff with improved documentation and knowledge, some of which were particularly useful during the roof/HVAC upgrade.

WASHINGTON

Washington has the most projects, with a total of 15 demonstration sites, including 5 retro-commissioning projects. Washington's Department of General Administration (GA), the subcontractor implementing the Commissioning in Public Buildings project, is also the agency responsible for managing most public sector new construction projects in the state. While this has not guaranteed that every GA project manager will be receptive to commissioning, it has made it easier to identify and contact decision-makers for individual projects.

South Puget Sound Community College Student Union.

When this 26,500 square foot project was initiated, the project manager for the South Puget Sound Community College was very enthusiastic, in part because she was continuously having problems with various aspects of other new construction projects. Representatives from the Department of General Administration (GA) sat down with her and the engineer (who was also supportive) at the start of the project and, with GA's help, a CA was selected. Unfortunately, this project manager left relatively early on, starting what would be a trend for this project, which to date has had three project managers for the college, three project managers for the contractor, and three contractor site supervisors. Moreover, the general contractor is based in California and has limited itself to a coordination/administrative role, doing almost none of the actual work on the project. As a result, there have been quality issues in all aspects of the building, and the contractor has been unresponsive in addressing those problems.

According to the CA on the project, "The commissioning plan for this building is really good; we wanted to do full building commissioning, and the initial project manager was a strong advocate." Unfortunately, the CA did not get involved until after the design phase. While the specifications for the general contract apparently did make reference to commissioning, specifications for subsystems such as windows and doors did not include any reference to commissioning. Because of the remote management and the high turnover cited above, the general contractor appears to have had a serious problem managing its subcontractors.

The CA reports that they received good cooperation from the electrical and mechanical contractors, but none from any of the other subs. Because of the cooperation of the electrical and mechanical contractors, the CA was able "to do the lion's share of the work and contribute significant value to the project," despite the problems encountered.

This was a whole building commissioning effort, and deficiencies were found in every aspect.

- The roof had leakage problems (and the contractor failed to notify the CA when they were going to test the roof), masonry was not covered up during construction and not properly spaced (causing streaking on the side of the masonry), and 11 of 20-some windows tested were found to have leakage problems.

- Problems with the HVAC system included programming that allowed no outside air into the building, testing of the sprinkler system (without prior review by the CA) when part of it was not connected, creating water damage in parts of the building, and problems with the control system.

- Finally, as part of a whole building commissioning effort, the commissioning authority wanted to ensure that doors closed properly. There was no response from the contractor, and some doors still do not seal.

What made this project more difficult for the CA was that the new facilities manager at the college didn't understand commissioning and at one point wanted to remove the CA from the project, prompting Gwen Haynes of GA and the CA to go out and explain the role of commissioning. Since then the facilities manager has been more supportive, but she apparently still does not really push the contractor to follow up, and she still does not believe commissioning would be necessary if the contractors were, in her words, "doing their job."

Lessons learned on this project include the importance of continuity and the need to establish expectations at the kickoff meeting, since it was not clear at the kickoff meeting that all parties had really bought in to the process. The CA believes that the commissioning specifications may not have been detailed enough, leading to disagreement about what precisely was expected of the subcontractors.

Like other state construction projects, this one was supervised by one of about a dozen project managers from GA, each of whom has varying approaches to project management, commitment to commissioning, and degree of involvement in a project's day-to-day progress. The GA project manager for the Student Union was said to have used a relatively hands-off approach, which may have contributed to some of the management problems on this project. The need to bring all players into the process is even more acute on a project like this, where ancillary systems such as windows, roof, and doors are going to be commissioned. According to the CA, specialty contractors in these areas have virtually no experience with or understanding of commissioning.

The Student Union building has been occupied since Fall 2000, which provides an indication of how long problems have taken to resolve. The failure to follow through has undermined what could otherwise have been a successful commissioning effort, since numerous issues were identified. As a result of the contractor's failure to correct numerous deficiencies so they could be tested, the CA billed far less than the total amount of his contract, and the contract was ultimately scaled back for that reason. The facilities manager did not think this affected the operation of the building to date.

Remediation of problems resulting from the initial contract was still winding down in November 2002. A second contractor paid for by the first contractor's bonding company was just completing a punch list of a number of items that had to be corrected. The facilities manager believes that the extent of problems on this job meant that the CA was able to add relatively little value to the process; it just added another layer of people telling the contractor he wasn't complying.

Bainbridge Island School District

In contrast to the Student Union building, this commissioning of a 133,000 square foot addition/remodel to Bainbridge Island High School went smoothly from the start. The District's representatives came to GA after attending a course on commissioning in 1998; they had originally intended to have the design engineer on the project commission their new high school, but after attending the training they realized they should have an independent CA. Two days after the training they were in Olympia interviewing commissioning providers.

The commissioning effort covered HVAC and energy management control systems, focusing on a new direct digital control (DDC) system, 2 new gas-fired boilers and associated pumps and piping, a new water treatment system, 31 new fan coil units, 4 existing rooftop variable-air-volume (VAV) HVAC units, 12 existing fan-coil units and associated controls, 2 large existing central air handlers, and multiple associated duct coils and pneumatic controls.

Even though the CA was not brought on until after construction was under way, both the design and contractor teams were cooperative in assisting with the commissioning process and in seeking resolution of all issues. School staff also participated in functional testing of the systems and received training in proper system operation. During the course of the commissioning, more than 100 significant issues were identified, including insufficient clearance of the new steam boiler as originally installed – which would have made regular inspections and maintenance more difficult and time-consuming, possibly infringing upon school operating hours if it became necessary to shut down the building for maintenance. Other issues identified and resolved included HVAC system damper mounting problems that might have led to indoor air quality problems and increased maintenance; improperly located temperature sensors; plugged duct coils on existing systems; missing or incorrect equipment labeling; equipment installed that didn't match design specifications; improper fresh air damper sequencing for boilers; fans found running backwards; and other problems with sensors and controls.

Having tracked energy usage at the high school for several years, Bainbridge Island School District found that after commissioning, even with the additional space provided through new construction, overall energy usage has dropped significantly, resulting in annual energy savings of $35,000, for a simple payback of 1.2 years on the cost of commissioning. In addition, the District eliminated the air quality problems they had been experiencing, providing a comfortable learning environment for students and staff.

The CA also trained the District's own engineers, which appears to have built broad support for commissioning and encouraged the District to retro-commission all their schools. This has resulted in estimated annual energy savings of $100,000 district-wide, and a payback of less than 1 ½ years on the cost of commissioning. The success of this project again highlights the importance of owner commitment, and suggests that training of agency staff plays a critical role in helping to establish commissioning as standard practice.

Department of Corrections – 1) Special Offenders Center and 2) Women's Prison Special Needs Unit

These two Department of Corrections (DOC) new construction projects are briefly discussed here because they were done by the same agency and the same CA, yet the Women's Prison Special Needs Unit has proceeded smoothly while the Special Offenders Center has faced substantial challenges.

At the Special Offenders Center, the commissioning effort has been plagued by a perception on the part of the owner that they are paying too much for commissioning and by contractors who continue to come back with change orders to address deficiencies. The CA was brought into the project well after construction was under way. The commissioning specifications had been issued by addendum and had two problems: a lack of detail and a failure to specify what the contractor was responsible for. While it is not clear whether the general contractor knew that this project was to be commissioned, the subcontractors apparently did not, and, in the CA's words "took DOC to the wall with change orders."

The CA raised numerous issues related to HVAC and controls, including several that had not been resolved nearly ten months after the original occupancy date, including coil capacities and the air handler's ability to provide sufficient air flow. The original occupancy date was January 2001, and the building was finally occupied until the summer of 2002 year. Despite these problems, the CA believes that the project definitely benefited from being commissioned. "Despite all the bumps along the way, we brought a lot of value to the project," he said. " I think they would do commissioning again. It seems like there are enough things that were revealed and corrected to make it worth while."

Contacted in November 2002, the DOC representative agreed. It was a long process, he said, but the building is functioning properly. The only aspect of building operations that is causing any problems is the electrical system – which was not commissioned. Moreover, DOC is moving forward with several additional projects to be commissioned through the ongoing program developed by Washington GA, described in Section 4.2.2.

The lessons learned include the importance of having all parties aware of and "bought into" the commissioning process and of maintaining communications. Equally essential is the need to incorporate commissioning into the project specifications, so that both the general contractor and subcontractors understand that they will be responsible for addressing deficiencies identified by the commissioning effort. Failure on those counts has made this project more difficult than was necessary.

In contrast, commissioning of the Women's Prison has gone much more smoothly. Commissioning specs were included in the bid documents, and the CA was able to do a design review when the drawings were 65-70 percent complete. The CA also wrote the commissioning specifications to include mechanical, fire, and security.

Unfortunately the initial project manager (who was very enthusiastic) left, and there was a four-month gap before a new manager was brought on. Initially lukewarm about commissioning, the new project manager has become more supportive and knowledgeable. Other players in the construction process, including the design team, mechanical contractors, and DOC staff have all been very supportive, in part because it had always taken DOC at least a year to get new buildings operating properly. Support for commissioning within the corrections community

appears to be growing across the state; Kitsap County also chose to commission its new 110,000 square foot facility through the Commissioning in Public Buildings program, and involved the CA during the design process. Both GA and the CA feel that the Women's Prison project has been very successful; the project manager for DOC generally concurs, but she is still not convinced that the energy and other operational savings from the commissioning effort outweigh the costs.

IDAHO

Idaho initially had just a single demonstration project, but subsequently expanded the number of sites to three by adding both another new construction project and a retro-commissioning project.

Boise State University Student Union Recreation Center

This 90,000 square foot project has been delayed several months since its initiation in late 1999; it is now on its third extension, and completion, originally scheduled for June 2001, was not reached until February, 2002. While it has been primarily construction rather than commissioning issues that have delayed the project, the same factors have affected both activities. According to the current Division of Public Works project manager, the primary reason for the delay is that the project was underbid and commissioning was just another excuse the contractor used to try to protect himself.

The scope of commissioning for this project was mechanical (HVAC, controls, and related) and some electrical. While there was a design review and the CA was able to develop a commissioning specification, implementing the specification has been difficult. The CA has faced significant hurdles getting documentation for start-up testing, notably control sequences for functional performance testing of controls that had been modified in response to a previous design review. In addition, the contractor has not been cooperative in notifying the CA when testing activities were scheduled – which has been an added problem because of the distance of the CA's offices in Seattle to the site in Boise.

A more fundamental problem appears to be the lack of strong, consistent project management. Like most public sector construction projects in Idaho, the Boise State Student Union construction project is managed by the Idaho Division of Public Works. However, the initial project manager assigned to the project by DPW was taken off the job after several months, then put back on the project several months later. Both because of these changes and because of this project manager's "somewhat disconnected" approach to the project (words used by the CA as well as IDWR staff), there has been no active management of the project or pressure put on the contractors to address deficiencies or provide the information needed by the CA.

According to the CA, "There's been a huge conflict between the contractor and DPW regarding what constitutes a change order and what doesn't," which has further contributed to the project delays. The actual working relationship between the CA and the contractor has been cordial, in spite of the delays in obtaining information.

Because of her distance from the project, the CA had to limit the number of site visits. While she went to the site for the actual testing, BSU staff conducted all the pre-commissioning physical inspections, using forms provided by the CA to collect the data.

The building has been occupied since August, and BSU is generally pleased with the building's performance. BSU's engineer notes that this building had a complex HVAC system, and that without the CA a number of deficiencies would never have been addressed.

Perceptions of the success of this project vary. While both BSU and the DPW Project Manager are happy with the commissioning process, the CA feels that its effectiveness was hampered by the lack of strong and consistent project management. The importance of project management to successful commissioning would be the biggest lesson learned from this effort. In addition, it might also be concluded that commissioning is made more difficult when the CA is located far from the site, particularly on a drawn-out, problematic project such as this one. The owner's engineer, however, did not believe that the CAs distance from the project had any impact on her effectiveness, since her dogged insistence that deficiencies be addressed and documented resulted in systems now operating as designed.

Nampa City Hall

Since retro-commissioning was initially not included in Idaho's portfolio of demonstration sites, the decision was made in late 2000 to add such a project. The site selected was Nampa City Hall, a 23,000 square foot building housing government offices which had a history of high energy usage as well as building occupant comfort complaints. From three proposals, PECI was selected as the commissioning authority. The individual with direct responsibility for the retro-commissioning effort subsequently left the firm, but was retained to be in charge of the project under subcontract, working with an Idaho-based energy engineering firm to provide a local presence for the field work.

The retro-commissioning effort, which was kicked off in July 2001, addressed the HVAC, lighting controls, boiler, and chilled water systems. As part of the data collection effort to establish a base case, data loggers were installed and an occupant survey was conducted to determine satisfaction with building comfort. These activities will be repeated at the project's conclusion.

While the initial focus of the commissioning effort was on low/no-cost measures, the results identified a number of improvements that required capital spending, and the City of Nampa had expressed a willingness to implement cost-effective measures. With energy usage averaging 120 KBTU/square foot per year, the CA noted, there were ample opportunities to reduce energy usage – possibly to as low as 90 KBTU/square foot/year.

A number of issues related to operation of the HVAC system were identified early on. The CA noted that, "Some of the findings are pretty major, like a chiller that's on all the time." He explained that the building is about 20 years old, and no one knew how to operate the control system. For example, the building essentially operated with no outside air, in a state of negative pressure. "It's supposed to be a VAV (variable air volume) system," said the CA, "but there's no communication with the controls."

After receiving the CA's report early in 2002, Nampa finalized their selection of a package of operational and capital improvement measures in July, put them out for bid, and selected a contractor. The scope of work included installation of a new time controller for the air handler system, an occupancy control of the City Council Chambers, repair and tuning of the chiller and of the exiting pneumatic control system, combustion testing and repair of the boiler (and

possible burner replacement), installation of a VSD on the supply fan, and repair or replacement of kinked flex duct work. The winning bid for the work was $39,000. As of mid-November 2002, the work was nearing completion. Installation of data loggers for post-project monitoring was expected to begin by the end of November. After data are collected, they will be analyzed and sent to PECI for incorporation into the case study.

This has been one of relatively few projects where the initial retro-commissioning effort resulted in implementation of measures that required capital spending, and the process has gone smoothly. Although the City of Nampa is small and does not have a staff engineer or architect to monitor progress, the City's Building Inspector has taken an active role in the project, and agreed to assist the IDWR in making a presentation at the Idaho Energy Conference in November.

The one concern voiced came from the engineer who did the commissioning field work and prepared the report. He said that the template he was given ended up making the report far too long and full of "verbiage." He recognized that much of the information collected was necessary for the project case studies and economic assessment, but felt that a shorter, more concise report summarizing findings and recommendations would have better served the building owner.

MONTANA

In Montana, a dozen projects were initially retro-commissioned fairly quickly, using funds not from the Commissioning in Public Buildings project, but from the Rebuild America Program and Montana's Building Energy Conservation Program. Unfortunately, most of the agencies whose buildings were commissioned ultimately decided not to implement the recommendations of the commissioning authorities, forcing DEQ to abandon them as case studies. In retrospect, it seems clear that a firmer commitment to implementation of retro-commissioning findings should have been sought from agencies who agreed to have their buildings retro-commissioned.

Still, it should be noted that the retro-commissioning efforts for these projects were legitimate and identified significant problems in the current operation of the buildings. At the University of Montana Metcalf building, for example, the CA, Facilities Improvement Corporation (FICO), found that a solar ventilation system designed to preheat outside air for an AC unit "likely costs more to operate than to preheat outside air using the hot water system….The system should be abandoned." FICO also found that many heat pumps were operating 24 hours a day, VAV box controls were old and ineffective, and outside air ventilation in the building was inadequate, and made a number of recommendations that would have improved the building's operation and efficiency. Similar results were found at several other buildings, indicating that the retro-commissioning efforts at these sites were certainly thorough enough, but that building owners chose not to act on them. In a few cases owners were unwilling to allow their buildings to serve as a demonstration project.

Of the original projects, only the University of Montana Grizzly Pool Building implemented the recommendations and agreed to re-commission the implementation and allow development of a case study on the results. Among the other projects, the Butte Federal Building apparently used the initial findings as the basis for a major remodeling effort done by an out-of-state contractor for the General Services Administration; DEQ had wanted to re-commission that project, but has thus far been unable to secure an interagency memorandum of understanding that would allow

the Butte Federal Building management staff to make a statement endorsing retro-commissioning.

As a result, the DEQ program manager essentially had to start over in finding retro-commissioning projects, making sure that participating organizations were committed to implementing at least the low cost/no cost measures. Since the goal was development of case studies, they also had to agree to let their building serve as the basis for a case study, including the provision of quotes describing the commissioning effort. This has turned out to be a stumbling block for the Butte Federal Building, as noted above. In addition, one of the new project that has agreed to provide input to a case study, the Army National Guard's Aviation Support Facility, has limited the use of interior photographs because of security concerns.

Wallace Building

The one non-retro-commissioning project in Montana is a two-story addition of 13,000 square feet to the existing two-story Wallace Building at the Montana State Prison (MSP) at Deer Lodge, Montana. The project also includes the renovation of an additional 10,300 square feet on both floors of the existing building and the renovation of the entire 5,000 square feet of the adjacent single story business building. The commissioning authority on the project describes it as "basically an office building with some security features."

This project was funded by the Montana Legislature for $3 million as part of the Montana Long Range Building Program (LRBP) bonded projects. As with all LRBP projects, the project is administered by the Division of Architecture and Engineering (the A/E Division) of the Montana Department of Administration in cooperation with the using agency, the Montana Department of Corrections (DOC).

In the past, DOC has been slow to accept commissioning as part of the design-bid-build construction progress, but at the urging of the A/E Division, the past four major projects for DOC have included integrated commissioning. Prior to the last legislative session, the A/E Division began including commissioning as a line item in the governor's LRBP request to the legislature, which has helped support subsequent arguments with agencies over its inclusion in projects. The DOC now appears to be accepting the role of commissioning in its projects.

As a result of initial DOC reticence and other factors, the CA was not appointed until April 2000. The firm appointed was Western Montana Engineering (WME) of Missoula, Montana. Despite the late appointment, WME was able to conduct a review of the design documents before they were finalized for bidding. In addition, WME presented a thorough description of the commissioning process at the pre-bid walk-through for contractors. In retrospect, the A/E Division Engineer who is supervising the commissioning of this project feels that commissioning review would have been better done with two reviews, one at about 75 percent completion and one final review. This underscores the necessity of bringing the CA on board essentially at the same time as the architect and engineers.

The design team responded to a number of requests for information (RFIs) from the CA, and the project has been improved as a result. For example, after boiler room piping was about 50 percent complete and the main hydronic header about 20 percent installed, the CA noted a problem with the boiler piping, which was being installed as shown on the drawings, but not in a way that was optimal: there were six boilers with the hot water return piped so that each

boiler received progressively hotter water, thereby reducing energy efficiency. The remedy was to install a manifold system to equalize temperature to each of the 6 boilers. Other issues uncovered include duct work that was not fabricated as shown on plans and sensors that were set for too wide a range. Complete functional testing of systems was completed in early 2002, and the building addition was occupied in July 2002.

There have been no major problems getting information from the contractors, but the project has been slowed by special circumstances (at one point, the engineering project manager, state project manager, and architect field rep all had new babies at home!) Although the design team initially did not know that this building was to be commissioned and did not budget for it, they did respond to all the RFIs.

In all, there were 10 RFIs and about 30 deficiencies. The Mechanical Engineer of the Montana A/E Division, who is preparing the case study document, attempted to quantify the savings associated with each of these RFIs and deficiencies; many RFIs, for example, avoided subsequent change orders that would have added to the project's cost, while deficiencies that were addressed resulted in savings from reduced energy usage, longer equipment life, or lower maintenance expenditures. Savings attributed to reduced energy usage were limited to those that could be expected in the first year. Using this approach, savings directly attributable to commissioning were estimated at approximately 110 percent of the cost of commissioning.

Despite having occupied the building somewhat prematurely, the occupants are generally pleased with its performance and with the overall construction and commissioning process.

University of Montana -- Grizzly Pool Building

The University of Montana Grizzly Pool building was one of the original demonstration projects for Montana. The 37,500 square foot pool building was first retro-commissioned by Bitteroot Engineering in December 1998, at a cost of $2,000. The original commissioning effort was limited to functional performance testing of the control system in an effort to address comfort issues that had been generating complaints.

The current round of re-commissioning work was done by Western Montana Engineering (WME) in September and October 2001 at a cost of $3,100. The goal in this case was to make sure remedial work had been done and to go back to the original specifications and compare them to current operations. Unfortunately, the CA on the earlier commissioning effort did not leave sufficient documentation to allow WME to replicate the earlier tests, and a new set of test specifications had to be developed. The very low cost of the initial commissioning effort (relative to other Montana projects as well as retro-commissioning projects in other states) highlights the pitfalls associated with inadequately funded commissioning projects.

When the testing was done, it was found that some control sequences were not working as originally designed, in part because some components had been replaced. Even though the commissioning scope was primarily to look at the control system, other problems were also noted, such as a damper with a jammed linkage and fittings broken off. Other corrections that had been made after the initial commissioning were still in place. There are some remaining problems, however. According to the CA, the original control sequence as written was probably not effective; there is an installation problem with the outdoor air damper, and it would be more effective to change the control sequence back to the original if the damper problem is fixed.

While the commissioning authority rated this project as successful overall, she noted that "it would have been really helpful to have someone from Johnson Controls there to show us specifically how the programs control the DX 100 (control system)."

On balance, this was a relatively modest retro-commissioning effort that attained its goals but is unlikely to have a major impact on energy usage for the building. Estimates of energy savings will be made by the CA, who notes, "We'll fill out the case study format and try to do any relevant energy calculations, although that's really hard to do. To the extent possible, we would do hand calcs (engineering estimates) for the case study."

The University of Montana Facility Engineer is pleased with the outcome of the retro-commissioning project, but agrees that energy savings will be difficult to estimate. He points out that the biggest potential energy saving measure (a pool cover) wasn't even in their scope.

4.1.5 Conclusions from Demonstration Projects

It should be clear from these summaries that every state has both smooth and difficult projects, and much of the value of some of the demonstration projects has been the extent to which they provide "lessons learned" regarding pitfalls associated with commissioning. Among the conclusions that may be drawn from the demonstration projects are the following.

- **Commissioning should be introduced during design.** The need to introduce commissioning early on – preferably early in the design phase – was a theme echoed by program staff, CAs, and some owners. From the demonstration projects, the benefits of introducing commissioning early on can be seen in part from the problems that arise from the failure to do so. These include:
  - lost opportunities to correct deficiencies that can be addressed with relative ease during the design phase, but only at great expense (if at all) later
  - greater difficulty in securing the cooperation of contractors and subs, who may not have accounted for commissioning in their bids or schedules
  - greater difficulty in making the CA an integral part of the project team, with a corresponding increase in the likelihood of resentment and defensiveness

- **Support for commissioning activities by the owner's project manager is essential.** If the project manager does not pressure the contractor to address issues raised by the CA, the process will take longer, and many of the benefits from commissioning will be missed. Part of the process of educating owners (agencies) will be to impress upon senior decision-makers the importance of having project managers who are committed to the commissioning process.

- **Excessive turnover hampers the effectiveness of commissioning.** A lesson learned that seems to apply not only to commissioning but to project management generally is the need to minimize turnover; this is more important as it relates to commissioning, which is a relatively new aspect of the construction process with which many project managers are not familiar. At a minimum, whenever there is a change in project management, the CA should take the time to make a relatively detailed presentation regarding commissioning activities and benefits to bring the new manager up to speed. In

addition, the owner should make sure that the new project managers understand that commissioning is to have a high priority and be considered an integral part of the construction process. Finally, this finding makes a strong case for training and other efforts to raise the overall level of awareness and expertise regarding commissioning among all players in the construction industry, since more widespread familiarity with commissioning would reduce the effect of turnover.

- **Outside project managers may reduce the value of demonstration projects in affecting agency practices**. On three projects, most of the project management was handled not by the agency itself but by a contract management firm, such as CH2MHill on the Ada County Courthouse in Idaho, Melvin Mark on the Courthouse Square project in Oregon, and Heery International on the Beaverton Library. It has been valuable to have these firms involved (precisely because of the continuity/consistency issue raised above), but there may be a problem in that the agency itself did not "learn" as much about the value of commissioning. While this same criticism could be leveled at jobs managed by GA in Washington, DPW in Idaho, and the A/E Division in Montana, the ongoing importance of these agencies in determining new construction practices for all state agencies makes them a more valuable target audience. This issue will be further investigated in future evaluations.

- **A CA with an active on-site presence tends to be more effective.** Some of those interviewed expressed concern about the ability of CAs who are located remotely from the site to provide the kind of on-the-job presence that commissioning requires. Since there were a number of successful projects where the CA was based a significant distance from the site, it does not appear that simply having a remotely located CA dooms the commissioning effort to failure. However, the extra distance does seem to exacerbate problems that would exist anyway, usually because of a lack of cooperation by the general contractor or specialty contractors.

In addition, CAs themselves see the extra difficulty and cost involved in a more remote job, as evidenced by the failure of any CA to respond to the RFP issued by the Oregon Youth Authority for a project in Eastern Oregon. In Montana, the A/E Division explicitly includes extra cost for travel time when developing cost estimates for projects located in the more remote parts of the state.

- Finally, it appears to some observers that public buildings need to be commissioned if they are to work at all. Representatives from several owners (agencies) noted that a major impact of commissioning was that they received buildings that functioned when they were turned over to the operator, without requiring a "shakedown" period of a year or more. Some attributes of the public building construction process, including the typical design-bid-build contract structure and the desire to maximize floor area at minimum cost, lead to an undue emphasis on lowest first cost. This not only discourages designers from including time for constructability review and contractors from including time for functional testing in their budgets, it tends to attract bidders who are oriented to cutting costs and corners in order to make money on these low-margin jobs.

4.2 ASSESSMENT OF PROJECT MANAGEMENT AND COORDINATION

4.2.1 Overall Communication

Since communication between team members is essential to effective project coordination, the extent to which OOE and its subcontractors exchange information is an important indicator of this aspect of project implementation. Overall project communications between the Alliance, OOE, and the states appear to be relatively frequent and effective. The project team meets regularly, either in person or by telephone, to discuss project implementation and other issues.

The structure for this project has, however, made its management inherently cumbersome. In theory, OOE as the prime contractor is the only organization reporting directly to the Alliance, with each of the three other states reporting to OOE. In practice, however, the Alliance makes most of the important decisions influencing the individual states, and typically works directly with the state Program Managers to resolve issues that arise. If necessary, the contract between OOE and the Alliance and the subcontract between OOE and the affected state is then revised.

While this direct communication between the Alliance and the individual states has been necessary and desirable, it has tended to undermine the project management role of OOE. For example, it has been the Alliance project manager, not the OOE PM who has been responsible for most meetings that have moved the project forward. It would probably have been more effective to have direct contracts in place between the Alliance and each of the individual states. Any efficiencies resulting from the single contract with OOE appear to have been more than offset by inefficiencies in decision making and communications that resulted from the distributed structure.

The question naturally arises whether OOE could have averted some of these problems by more aggressively managing the contract and serving as liaison between the Alliance and the other states. To some extent it is true that OOE could have been more active in moving the project forward by, for example, holding more frequent team meetings, initiating the development of marketing plans for all the states, and developing guidelines for demonstration project selection. On the other hand, the other states know that it is the Alliance to whom they are ultimately responsible, and it is easier for GA, IDWR, and DEQ to gain support from state and other public sector agencies for a regional project clearly sponsored by the multi-state Alliance than for a project that appears to be originating from another state.

Moreover, as intended, individual state project managers have moved in their own direction in response to market conditions in their state. For example, Montana focused on retro-commissioning because few new buildings were available; Idaho emphasized training and technical support for Division of Public Works project managers (rather than demonstration projects) to facilitate implementation of DPW commissioning guidelines, and Washington's GA developed a for-fee program to assist other agencies in implementation of commissioning. All of these reflect not a failure in project coordination, but rather an appropriate tailoring of project implementation to state-specific conditions.

While communication between the states has been adequate for the needs of the project up until now, more effective coordination may become necessary as more active outreach beyond the demonstration sites begins. This may place a greater burden on the Alliance project manager as

the Alliance makes key decisions and works directly with the subcontractors to resolve state-level issues.

4.2.2 Evaluation by State

Of the four state implementation contractors, Washington's Department of General Administration (GA) appears to have been the most effective. The strengths of their approach to project implementation have included a broad range of both new and retro projects, extensive technical assistance provided by the project team, and development of an ongoing, self-sustaining commissioning program independent of the Commissioning in Public Buildings project that should help sustain commissioning efforts even after the contract expires. This provides a degree of continuity in the availability of technical assistance to building owners that cannot be provided through contractors. In addition, in its function as the implementation contractor for the Commissioning in Public Buildings project, GA has had ready access to the state's project managers for new construction projects, since all such projects are under the oversight of GA's Division of Engineering and Architectural Services.

The Oregon Office of Energy (OOE) has not enjoyed the same close proximity and access to construction managers for state projects and does not have the benefit of a single "one-stop" source of technical assistance that becomes known to the owner community. Nevertheless, OOE has recruited a mix of buildings that corresponds almost exactly to the number and types of buildings specified in its initial work plan. One of OOE's strengths -- the ability to pull together various contractors to provide economic analysis and case study development – could also be seen as one of its weaknesses. While OOE is able to direct agencies to whatever information they require, this information comes from a number of different contractors rather than a single source, so that owners are less likely to have a clear picture of who to contact.

Idaho's Department of Water Resources (IDWR) has suffered from the lack of continuity in personnel, with the untimely death of the first project manager and the second project manager's move to a new position. IDWR (in accordance with its initial work plan) also began with just a single demonstration project and, even with the addition of a second new construction project and a retro-commissioning project, does not have enough projects to support its case to agencies who are considering commissioning. On the other hand, IDWR's decision to focus on providing technical support, including guidelines for new building and retro-commissioning as well as education, helped the DPW to move forward with its guidelines for commissioning all projects over $5 million. In addition, the support contractor helped provide training to dozens of participants in a workshop, and gave IDWR the materials to provide similar training in the future.

Montana's Department of Environmental Quality (DEQ) spent a lot of effort in initial attempts to get a number of retro-commissioning projects on board quickly, only to find that the agencies were not able or willing to implement the CA's recommendations – something that should probably have been confirmed before moving ahead with the projects. In addition, DEQ's efforts to recruit demonstration projects have been hampered by the poor state of the Montana economy, which has made cities, schools, and other agencies less likely both to conduct initial retro-commissioning studies and, if they do conduct them, to implement the findings. School districts, for example, pose the decision to retro-commission or implement findings as a choice between teachers and promised operational improvements such as energy savings. Strengths of the DEQ effort include support for development of the local commissioning industry (since all

commissioning work for the state must be done by local providers), which is making possible the current push to commission all new construction projects coming through the state's Long Range Building Plan.

4.3 ASSESSMENT OF STATE MARKETING AND PROMOTION PLANS

Recognizing the upcoming shift in the project to a "post-demonstration" phase, the Alliance urged each of the states to develop detailed marketing plans. These plans are intended to describe how each of the states will ensure that the demonstration projects and their associated case studies will promote acceptance of commissioning as standard practice. As a starting point, the states were provided with templates setting out the key elements of a basic marketing plan, with each state to tailor a plan to their own conditions.

Since the contractors implementing the program are not marketing professionals, it was not surprising that the first round of marketing plan drafts submitted to the Alliance in the summer of 2001 generally lacked both a vision of what was to be accomplished and sufficient detail to provide a useful roadmap for future activities. Alliance staff subsequently met with each of the states individually to go over the first drafts and offer guidance on how to proceed with development of a plan that would provide a basis for moving forward with the dissemination of case studies and other activities.

After this first round of meetings, a second set of drafts was submitted, and a meeting was held to go over these. While the plans still vary in the level of detail they provide and generally do not set out quantifiable goals that the state hopes to attain through the plan's implementation, there are several elements that all the plans have in common and that will clearly be a major part of the dissemination effort. All of the plans now set forth specific steps that will be taken to disseminate the case studies, such as direct mailings, attendance/participation at regional conferences, and use of the internet. All of them also identify key positions (and in some cases names) who will be sent the case studies.

The plans are less specific, however, on how follow-up contacts will be made, who will make them, and how these contacts may lead to the changes in policy that are the ultimate goal for the Commissioning in Public Buildings Project. It may be that this latter area involves a level of advocacy where state agencies feel less comfortable than they do in providing information and technical assistance, but such direct interaction with policy makers is essential to ensuring persistence of commissioning in the marketplace. We recommend that the marketing plans more explicitly address how case studies will be used to support changes in policy or practice.

In addition, we encourage the states to continue to share their marketing approaches as the critical task of disseminating case studies advances. Successes as well as failures should be shared so that all the states can take advantage of lessons learned in refining the execution of their individual marketing plans.

4.4 DOCUMENTATION/ASSESSMENT OF CASE STUDY DEVELOPMENT

Case studies – as distinct from the demonstration projects from which they are developed -- are the largest single element of the Commissioning in Public Buildings project. They are critical to the project's success because they are one of the primary tools for disseminating information regarding commissioning to market participants, and they directly address the skepticism or

lack of information about the benefits of commissioning among state agency decision makers. It has been almost four years since the project was initiated, and while several draft case studies have now been completed, none have been published in final form. In addition to the delay inherent in waiting for data from the completed commissioning reports, it has taken time to resolve issues of both content and formatting, and a few of those issues are still being finalized.

Content for the case studies was extensively discussed in 2000, and agreement was reached on a template, which was then provided to the CAs and project managers on the demonstration projects for their input. In a few cases, this template arrived too late to be effectively integrated into the process and required extra work on the part of the CA and the agency's project manager. (This was mentioned specifically for Oregon's Portland State University chiller project.) In addition, several CAs commented that it had taken significant amounts of time to fill out the forms for the template, noting that estimates of savings from an issues list can take a great deal of extra time to develop. The effect on energy usage from correcting a control sequence, for example, is extremely difficult to quantify.

Regarding format, a consistent "look and feel" of project case studies will be necessary for the benefits of a multi-state effort to be realized. That is, the case studies developed by this project will be much more effective if every study can be seen as relevant by decision makers in each of the four states rather than only in the state where the demonstration project was sited. Oregon and Washington both moved forward with their own case study format before a final uniform format was agreed upon, and the states still do not have a consistent approach to providing access to the more detailed technical data underlying the case studies.

The final basic case study format that has been agreed upon is a single sheet (front and back) summary document that presents the highlights of the commissioning project. This format is designed both to hold down production costs and to make the case studies readily accessible to busy decision makers who would have neither the time nor the inclination to look through a more detailed report. In extensive previous discussions of what form the case studies would take, it has generally been agreed that the case studies should be available in "layers": a relatively high level overview for senior agency decision makers; a somewhat more extensive description for architects, engineers, and project managers; and the complete, detailed supporting data from the commissioning report and cost-benefit or other economic analysis.

It is not clear, however, that this vision is being realized. The current focus appears to be on developing the single sheet (front and back) overviews, which is being done by OOE in accordance with the design template that is now being finalized and the content template that was agreed upon last year. Beyond that, the states differ in their approach to providing more detailed back-up. In Oregon, OOE is planning to publish electronically 4-6 page case studies for a few of the more complex projects. Anyone who wants even greater detail will be able to go to the OOE offices and view the original commissioning report. In Washington, GA will make the original commissioning reports available, and is having the CAs on its projects prepare 5-10 page case study documents from the information template described earlier. Idaho, Montana, and Washington will all send their two-page versions of the case studies to OOE for final formatting and publication.

While most decision-makers may find all they need in the overviews, there will be those who are more likely to be convinced by more technical data. For retro-commissioning case studies in particular, more detailed information may be appropriate. It has been noted that the decision to

commission new buildings most often rests with capital budget decision makers who have only a limited knowledge of the technical aspects of building mechanical or electrical systems, and who therefore require a non-technical approach to the case studies. Retro-commissioning decisions, on the other hand, are more likely to be made by people familiar with building operations and maintenance who therefore would be looking for more technical information. Those operations directors might be quite receptive to the more detailed information contained in the back-up reports. We therefore recommend that some form of more detailed case study data be available (and announced as such) for each of the states.

The economic analysis, which is a component of all the case studies, also remains under discussion, as described in Section 4.7. As noted there, different approaches to the economic analysis have been used by SBW Consulting (which is doing the analysis for Oregon and Idaho) and by Washington and Montana. To ensure a uniform approach, it has been agreed that SBW will conduct the economic analysis for 20 case study projects across the four states.

The program team has also made a decision to place less emphasis on energy savings in the case study documents, since this tends to draw attention away from the non-energy benefits, which are often a more significant driver of commissioning activity. Emphasizing straight economic or payback analysis may cause many decision makers to disregard such powerful benefits as improved occupant comfort and productivity, reduced callbacks, and a generally more hassle-free construction process – all of which may be difficult to quantify. Findings from individual projects or from ongoing research to quantify these and other non-energy benefits should be used to strengthen the case study findings wherever possible. While it may be impossible to quantify all the benefits of commissioning, it is important to identify them and to ensure that they are pointed out in the final case study publication.

Finally, despite the discussions that have been held regarding the appropriate case study format for various target audiences, it does not appear that those target audiences have ever been asked. Before a final commitment is made to developing all the case studies in the two-page, four-color format, it would be appropriate to pass the various alternative formats before a small sample of the targeted decision-makers to get their feedback on what the would find most useful. BCA members might also be enlisted in this effort, since they presumably have a good idea of what kind of case study would be most useful to them in their marketing efforts.

4.5 MARKET ASSESSMENT

The goal of the ongoing market assessment is to determine whether the changes in the marketplace sought by the Commissioning in Public Buildings project are occurring and, if so, to what extent the project has had anything to do with those changes. Evidence for market transformation was collected and analyzed both through document review and through interviews and surveys with program team members, participants, non-participating agencies, and commissioning providers. While much of this evidence is qualitative, some quantitative data were gathered using the surveys of non-participants described in section 3 of this report. As noted in the Methodology section (Section 3.2) earlier, the surveyed non-participants included both attendees at the seminar held by Idaho's Department of Public Works in November 2001 and a sample of decision makers at agencies in other states who were contacted by telephone. Neither group represented a large sample, although respondents from the Idaho DPW do play a significant role in virtually all new state agency construction projects.

Results of these surveys are presented in Exhibit 7. Note that the overall results mask significant differences among the responses from individual states. While results at the state level are from far too small a sample to be statistically significant, they are generally consistent with the qualitative evidence collected through document review and interviews. The survey instrument and a list of responding organizations are included as Appendix B and C to this report.

The results presented here are not directly comparable to those from the larger and more detailed initial SBW market baseline study, which gathered data on individual aspects of commissioning such as functional performance testing and on a much wider range of barriers. However, the number of buildings commissioned by the respondents to this survey (an average of 1.0 for all 30 respondents, from row 2 of Exhibit 7) can be compared to the number of respondents to the SBW survey who had commissioned any building (46 percent of 41 respondents, from the last column and first row under "From SBW Baseline Survey"). The percentage of SBW Baseline Survey respondents who rated barriers to new or retro-commissioning as very important can also be compared to the percentage of respondents to the current survey who rated the significance of a given barrier as a 4 or 5 on a 5-point scale. A more explicit comparison to the baseline study results may be made in a future MPER in a broader investigation of market effects conducted with a larger sample.

4.5.1 Survey Results -- New Building Commissioning

Overall, representatives of public agencies not participating in the project gave a mean response of 3.3 when asked to rate their familiarity with new building commissioning on a 1-to-5 point scale. (In the initial baseline survey, respondents were asked whether they were familiar with the terms "commissioning" and "functional performance testing.") Respondents in Oregon and Washington both reported greater familiarity with new building commissioning than did those in Idaho and Montana. This difference corresponds to the number of buildings commissioned over the past two years; not surprisingly, agencies who have commissioned buildings are more familiar with the process.

However, this familiarity with commissioning did not translate directly into more buildings to be commissioned in the next two years; while Washington respondents said they expected to commission an average of more than two buildings, those in Oregon indicated fewer than one, although it must be noted that differences in building schedules can easily account for the difference (i.e., a small agency, local government, or school district that has just constructed a new building may not have another one planned for the next two years.)

Obtaining funding continues to be seen as the largest obstacle to new building commissioning than other barriers posed to respondents – particularly in Idaho and Montana. Note, however, that concerns about getting "buy-in" from other participants in the construction process are also relatively high across all four states – a result that confirms the experience of some of the demonstration projects. This suggests that greater emphasis needs to be placed on integrating the commissioning authority into the process – preferably at the earliest stages of project design.

Finding providers was generally seen as a greater obstacle in Idaho and Montana than in Washington and Oregon. In Oregon's case, the mean result was influenced by the difficulties encountered by one of the respondents in trying to commission a facility in Eastern Oregon. In Montana, there are several commissioning authorities who are developing a good reputation, but several owners interviewed said they would like to have a larger pool of local providers to

choose from. In Idaho, the relative dearth of providers is illustrated by the fact that two of the three demonstration projects are being commissioned by out-of-state commissioning authorities, and the third is being commissioned by a large project management/engineering firm with offices in Idaho but headquarters elsewhere.

Exhibit 7
Non-participant Perceptions and Actions -- Mean Values

	OR (n = 7)	WA (n = 6)	ID (n = 12)	MT (n = 5)	All (n = 30)
New Building Commissioning					
How familiar with new building Cx*	**4.2**	3.8	2.5	2.9	3.3
How many new buildings Cx-ed	**1.7**	**1.7**	0.5	0.6	1.0
How many expected in next 2 yrs	0.8	**2.3**	1.0	0.0	1.2
Importance of obstacles to new Cx**					
Obtaining funding	3.1	2.2	3.5	**4.1**	3.2
Finding providers	2.2	1.3	2.5	**2.7**	2.2
Managing the process	2.4	1.6	**2.6**	2.1	2.3
Getting all parties to accept	2.8	2.6	**2.9**	3.2	2.9
Concerns about delays	1.9	1.9	**2.5**	1.9	2.0
Percentage rating obstacles 4 or 5					
Obtaining funding	43%	17%	58%	**80%**	50%
Finding providers	0%	0%	17%	**20%**	10%
Managing the process	0%	0%	**25%**	20%	13%
Getting all parties to accept	**29%**	17%	25%	20%	23%
Concerns about delays	14%	0%	**17%**	0%	10%
Retro-Commissioning					
How familiar with retro-Cx*	3.1	3.5	2.1	**3.7**	2.9
How many buildings retro Cx-ed	0.0	0.5	0.2	**4.0**	0.8
How many expected in next 2 yrs	0.4	**1.2**	0.5	1.0	0.7
Importance of obstacles to retro Cx**					
Obtaining funding	3.1	3.3	**4.3**	3.4	3.5
Finding providers	2.0	1.7	**2.7**	2.3	2.1
Managing the process	2.5	1.7	**2.9**	1.7	2.3
Obtaining implementation funding	3.6	3.3	3.6	**4.1**	3.7
Percentage rating obstacles 4 or 5					
Obtaining funding	57%	50%	**75%**	40%	60%
Finding providers	0%	0%	**25%**	0%	10%
Managing the process	0%	0%	**25%**	0%	10%
Obtaining implementation funding	71%	33%	50%	**60%**	53%
From SBW Baseline Survey	(n = 15)	(n = 15)	(n = 6)	(n = 5)	(n = 41)
Percentage having Cx-ed any building	40%	53%	33%	**60%**	46%
Percentage rating new Cx obstacles "very important"					
Added cost of conducting tests	33%	27%	**67%**	40%	37%
Not knowing who to hire	13%	13%	**33%**	0%	15%
Not knowing how to implement tests	27%	20%	**33%**	0%	22%
Confused lines of responsibility	7%	13%	17%	**20%**	12%
Disruption of construction schedule	20%	20%	**33%**	20%	22%
Percentage rating R-Cx obstacles "very important"					
Added cost of conducting tests	50%	62%	**71%**	50%	57%
Not knowing who to hire	6%	5%	**29%**	13%	10%
Not knowing how to implement tests	17%	11%	14%	**25%**	16%

* On a 1 to 5 scale, where 1 means not at all familiar and 5 means very familiar

** On a 1 to 5 scale, where 1 means not at all significant and 5 means very significant

Bold type indicates highest value

Comparison of these survey results to the initial SBW baseline survey does suggest that respondents today are better informed about how to find commissioning providers and how to implement the commissioning process. In addition, the percentage who considered disruption to construction schedules a very important barrier to new building commissioning declined from 22 percent to 10 percent. Funding, however, does not appear to have declined as a barrier, especially in Idaho and Montana.

4.5.2 Survey Results -- Retro-Commissioning

Respondents were generally less familiar with retro-commissioning, with a mean response of 2.9. The striking exception is Montana, where the five respondents were, on average, not only more familiar with retro-commissioning than with new building commissioning, but also more familiar than respondents in other states. Again, this finding correlates with past retro-commissioning activity, which in Montana's case reflects active involvement with the Rebuild America program as well as DEQ's own Building Energy Conservation Program of building assessments. Western Montana College, in particular, reported extensive retro-commissioning activity.

Compared to new commissioning, barriers to retro-commissioning for respondents overall were higher with regard to funding both the initial commissioning effort and the implementation of recommendations resulting from the commissioning effort. In fact, obtaining implementation funding was given the highest importance of any obstacle to new or retro-commissioning, suggesting that acceptance of retro-commissioning would be enhanced through greater emphasis on how implementation of findings could be financed. In Washington and Montana, several of the demonstration sites explored the possibility of implementing findings using performance contracts; as this approach is tested and proven, it can be incorporated into case studies and other promotional efforts. Some school districts have used bond issues to fund capital improvements identified (or made more urgent) by retro-commissioning. We recommend that the whole issue of implementation be more explicitly addressed to help ensure the future success of retro-commissioning in the public sector.

4.5.3 Changes in Policy

Results of the survey reinforce the more qualitative findings from interviews and discussions with other market observers that new building commissioning in particular is becoming more widely known and accepted in the public sector. When asked to give definitions of commissioning, almost all owner representatives provided answers that included words like systematic, performance testing, and documentation, indicating that the basic concept is well understood. Many owners also cited policies, guidelines, and standard practices for their agency, as discussed further below.

There have been a number of changes in policy and standard practice at agencies in all four PNW states, particularly with regard to commissioning of new or remodeled buildings. Taken together, these changes represent significant progress toward making commissioning standard practice. Changes in individual states are discussed below.

In **Washington**, non-binding guidelines call for commissioning of all new construction projects managed by the Department of General Administration (which includes projects for most state

agencies and community colleges in the state) that have a value of more than $5 million. While this is a guideline rather than a policy, several of the agency representatives we spoke to appear to perceive this as a requirement, and expect that commissioning will be standard practice for all their new construction projects.

The State of Washington has also amended the non-residential building code to require commissioning reports be provided to owners for both public and private sector buildings. While the merits of this change in the code have been debated and it clearly does not constitute a requirement for true building commissioning, it can be argued that the new code will lead to greater awareness of design review, functional performance testing, and other aspects of commissioning. For example, the new code states that both simple and complex HVAC systems must be "calibrated, adjusted and operate in accordance with approved plans and specifications." Further, the language of the code states that, "Sequences of operation shall be functionally tested to ensure they operate in accordance with approved plans and specifications. A complete report of test procedures and results shall be prepared and filed with the owner. " While there is nothing in the code that requires commissioning to be conducted by an independent authority or requires the owner to act on the report of test procedures and results, the fact that this terminology is in the code should help make more building owners aware of key commissioning concepts.

In addition, a September 2002 Washington executive order on sustainability announced a generic effort to reduce use of resources and promote sustainable design and construction for state buildings. State agencies are directed to create biennial sustainability plans (the first due Sept. 1, 2003) and provide annual progress reports starting in 2004. While the order does not directly address commissioning, it is likely to increase interest in energy efficiency and LEED buildings – which should lead to greater emphasis on commissioning. Legislation passed in 2000 made LEED silver the recommended target for new state buildings under the Revised Code of Washington. Since commissioning is an integral part of LEED certification, this should contribute further to making commissioning standard practice.

The Washington Administrative Code also calls for commissioning of all K-12 school buildings. Specifically, commissioning by an independent authority is required for a school board to receive matching funds from the Office of the Superintendent of Public Instruction (OSPI) on any project over 50,000 square feet; from 15-50,000 square feet, commissioning is optional. While the amount of funding allocated for commissioning is, in the words of one commissioning provider, "somewhat on the low side," some providers tailor a package of services within that budget range for those who just want to meet the OSPI requirement. In addition, many schools were being commissioned even before this requirement, and substantial numbers do more than the minimum required.

Finally, GA has established a program to support state agencies who want to commission projects. The program, which grew out of GA's experience on one of the demonstration projects where the owner asked for additional GA assistance, provides a one-stop commissioning solution. The GA staff on the Commissioning in Public Buildings project felt that there were likely to be other agencies who would have an interest in using such a service, and would be more likely to commission their projects if such a service were available.

After an agency expresses an interest and signs an inter-agency agreement, GA assists the agency in developing a commissioning scope and budget, selecting a commissioning authority

from a pre-qualified list of providers, and managing the entire commissioning process. GA modeled the program on its experience with performance contracting, and hopes to make it easy for agencies to incorporate commissioning into all their projects. GA charges for the services provided, with the goal of making the new program self-sustaining. To date, there have been five projects for which agencies have signed up and moved forward with commissioning through the program, and several others have expressed an interest.

The response to and results from this program bear watching closely over the next several years. To the extent that it provides a relatively easy mechanism for public agencies to incorporate commissioning into their new construction projects, this program may prove to be consistent with the exit strategies set forth for the Commissioning in Public Buildings project by providing a framework for commissioning to become standard practice.

In **Oregon**, there is no single agency that plays a pivotal role in new construction comparable to GA in Washington, DPW in Idaho, and the A/E Division in Montana. As a result, even though OOE has developed and made available model commissioning policies that individual agencies may use, changes in policy and practice must be achieved one agency at a time. The state does, have the State Energy Efficient Design (SEED) program requiring all state new construction projects to go through a review by OOE recommending cost-effective energy efficiency measures, including functional performance testing. While the recommendations are not binding and do not mention commissioning by name, they raise the visibility of functional performance testing and refer owners to BCA members as providers of those services.

There are a number of agencies that have adopted commissioning as standard practice. Multnomah County, for example, has made commissioning standard on all its new buildings (as a side note, a former employee of Multnomah County brought his commissioning experience with him when he became facilities manager for Kitsap County in Washington, where he is having a 110,000 square foot prison facility commissioned as one of the demonstration projects for the Commissioning in Public Buildings project). Similarly, one of the non-participants surveyed, Oregon's Washington County, reported having commissioned 11 new buildings totaling 150,000 square feet in the past two years. Several school districts, too, are said to have made new building commissioning standard practice.

Schools in Oregon served by two of the largest utilities, PGE and PacifiCorp, are also eligible for funding under the provisions of the state's Senate Bill 1149, which sets aside money for school energy retrofits. After an initial audit, schools can receive funding for cost-effective energy efficiency upgrades, and any projects with a value greater than $50,000 are required to be commissioned.

In addition, a revision to the Oregon building code has been proposed that would mandate commissioning of HVAC systems in new buildings as a code requirement – with specifics depending on the scope and sophistication of the HVAC system. The proposal was developed after extensive discussions of the technical aspects of the revision's scope as well as practical aspects of enforceability. The main objective was to make commissioning compulsory without imposing too much burden on building inspection and ensuring positive results for the building owners. The code proposal was approved by the Energy Committee and now goes to the Structural Code Advisory Board.

Idaho's Division of Public Works (DPW) recommends commissioning on all state building projects over $1 million. (Commissioning had been required on buildings greater than $5 million and encouraged on projects from $1-5 million, but this requirement was changed to a recommendation.) The guidelines for commissioning of new buildings under this recommendation were developed by IDWR's technical support contractor for the Commissioning in Public Buildings project, Toombs and Associates, who adapted the guidelines previously developed by Washington State. Idaho has also promoted commissioning through a joint resolution passed by the Association of Idaho Cities and the Idaho Association of Counties to promote adoption of commissioning by its members. In addition, the governor of Idaho declared a "Commissioning Week", thereby helping to raise awareness.

At a recent seminar/training session staged by IDWR and DPW in Boise, turnout was larger than expected, and there was extensive interest both in the concept of commissioning and in the DPW commissioning guidelines. On the other hand, there does not appear to be a great deal of commissioning activity – either for new or existing buildings; the 12 agencies represented at the training session reported a total of just 6 new buildings commissioned over the past 2 years. This may reflect relatively low levels of building activity in the state, which is experiencing a hiring freeze, deferring building maintenance, and putting a number of new construction projects on hold.

At Boise State University, one of the agencies that commissioned a building through the Public Buildings Program, commissioning is now routinely included in new building plans. Nevertheless, the added cost of commissioning remains a barrier even here, where the benefits of commissioning were clearly demonstrated on the student union project. In preliminary planning for a $10 million building the line item for commissioning was discussed, and an estimate of 1 percent of construction costs had to be reduced to 1/3-1/2 percent.

In **Montana**, the relatively low level of new building commissioning activity largely reflects the low level of overall construction activity. As new construction does increase, commissioning is likely to increase as well, since commissioning is now included as a line item for all new construction projects included in the state's Long Range Building Plan (LRBP). The A/E Division, which is responsible for all new construction on state facilities (universities, prisons, state offices, Fish & Wildlife, etc.), makes commissioning a part of every project over $4 million, and of some projects from $1-4 million. Out of appropriations just allocated by the state under the LRBP, A/E is currently in the process of choosing commissioning authorities for six projects with a total construction budget of $34 million. For the current round of projects, the commissioning authority will be included in the design review, and will be hired immediately after the design team.

Since the advocacy of the A/E's mechanical engineer (who is not directly involved with the Commissioning in Public Buildings project, but is a long-time commissioning proponent) has been a key to making commissioning part of the new construction process in Montana, the question arises as to how much of what is happening now would continue in his absence. The A/E engineer explains that "we do an extensive, detailed budgeting process when we develop estimates that are submitted to the legislature, and we make commissioning a line item in that budget." The inclusion of a line item printed on the budget form should go far toward making commissioning standard practice in new state building construction. In addition, he notes that "as new employees come on – and we expect to hire three over the next three years – they'll think we've been doing this forever." And even some contractors are now eager to have their

projects commissioned, since it helps to ensure a successful project. “They’d rather deal with a third party who takes care that testing gets done; it relieves them of one of their burdens.”

The Commissioning in Public Buildings Project has not directly influenced the adoption of the Montana policy, but it has both raised the visibility of commissioning and helped to provide work and experience for commissioning providers. A bigger influence in Montana has been that the state has chosen to use commissioning as a quality assurance tool that can be used to get contractors to perform; energy savings has been a minor factor.

4.5.4 Market Assessment -- Conclusion

There have been a number of changes in policy and standard practice at agencies in all four PNW states, particularly with regard to commissioning of new or remodeled buildings. Taken together, these changes represent significant progress toward making commissioning standard practice. However, while the concept of commissioning is increasingly accepted, there are still barriers – particularly with regard to cost -- to implementation of the kind of thorough, independent third-party commissioning that is necessary for the full benefits of commissioning to be realized. Therefore, it is important to build on the successes achieved to consolidate gains made to date through regulations, policies, and building codes, and we recommend that all the marketing plans be reviewed to ensure that this issue is addressed.

Across the Pacific Northwest, movement in the market toward making commissioning standard practice in the public sector has obviously been influenced by many factors, of which the Commissioning in Public Buildings project is just one. Others range from national initiatives such as Rebuild America to local utility programs; from state code changes like the one in Washington to the efforts of individual champions of commissioning within an agency. However, there have not been any large-scale efforts other than the Commissioning in Public Buildings project to systematically influence the practices of state and local agencies across the four-state area.

Moreover, those familiar with the program and the market say that the demonstration projects and training sessions have contributed to the visibility of commissioning within the public sector, and have strengthened the hand of those advocating commissioning for their agency or the state. In addition, a number of people interviewed cited the growth and visibility of BCA (which was an early component of the program) as having contributed significantly to the acceptance of commissioning by an independent authority. Several of those interviewed say they expect the effects of the program on the market to increase as the demonstration projects become more widely known through the dissemination of case studies.

While a definitive causal link between the Commissioning in Public Buildings project and the observed changes in the market cannot be proven, it seems reasonable to conclude that the project has had an influence on the changes observed.

4.6 ASSESSMENT OF COMMISSIONING AGENT MARKET AND BCA DEVELOPMENT

Across the region, commissioning agents are fully booked, extremely busy, and aware that the supply of qualified practitioners will have to increase to keep pace with anticipated growth in demand. As noted in the above section on the status of the market, however, availability of commissioning providers generally has not been perceived by owners as a significant

impediment to public sector usage of either new building or retro commissioning. In Western Oregon and Washington, there are numerous well-qualified commissioning firms. Washington, also has several firms operating in the eastern part of the state, which may explain the low average rating for this barrier among the Washington public agencies interviewed. In Oregon, the clearest example of a shortage of providers has been Eastern Oregon, where plans to commission a new youth facility had to be cancelled because there were no bids in response to a request for proposal. For both Montana and Idaho, finding providers was seen as a somewhat greater barrier than for Washington and Oregon.

One of the reasons that availability of qualified commissioning agents has not been a problem may be the role of the Building Commissioning Association (BCA) in helping to set standards and promote good commissioning practice. In 2001, an evaluation was conducted of the development of the BCA. This evaluation, included in this report as Appendix A, was presented to the BCA leadership, which acted on a number of its recommendations at the May 2001 BCA annual meeting. Since then, there have been a number of changes in strategy affecting the development of the Association, a number of which are embodied in a strategic plan developed by the BCA leadership and modified with input from the general membership at the 2002 Annual Meeting.

First, BCA has retained a professional association management firm to act as its Executive Director. The Seattle-based firm of Melby, Cameron, and Hall has taken on the tasks formerly handled by the Executive Director, including membership processing and renewal, recruitment and scheduling of training sessions, accounting, the BCA newsletter, and other administrative functions. This shift to a professional association management firm addressed several of the key issues raised in the evaluation (e.g., the difficulty of relying on member volunteers for key association management functions; the difficulty of having a single individual who can meet all the varied requirements of a growing association). However, while BCA should be able to generate sufficient revenue to continue to cover the cost of keeping the management firm on retainer, the association still relies on outside funding sources, such as the Alliance, to pursue other critical goals such as the certification program and new provider training.

The second major change to BCA has been the recently completed shift from a trade association (where firms hold membership) to a professional society (where individuals hold membership.) Some modifications were made to the BCA Board's proposed membership structure in response to member input; firm membership was retained so that firms can utilize the BCA website to help consumers of services locate their firm. Each member firm is required to have an individual provider member (whose dues are included in the $500 firm membership). Firms have the option of listing additional locations on the website for a modest fee.

Membership dues, one of the primary sources of BCA revenue, have grown since the shift to individual rather than company memberships. The number of full individual members currently stands at "about 240," according to the Executive Director. This is still well below the numbers needed to provide BCA with sufficient operating revenues to be truly self-sustaining, but further increases in membership are expected as the certification program becomes established and as new members come into the profession.

BCA expects to generate a greater portion of its revenue from training sessions – particularly those oriented to commissioning providers. Three sessions were held in 2002, and five are tentatively planned for 2003 in locations around the country, including Southern California,

Seattle, St. Louis, New York City, and Orlando. BCA has also had discussions with utilities regarding the provision of Module 1 (owner) training, which could generate additional revenue.

As the web site is brought up to date, BCA and Melby will also consider using this as a source of revenue from BCA members (or companies whose employees are BCA members) who buy advertising space on the site.

A third significant development for BCA was the decision to move forward with a BCA-sponsored program of certification for commissioning providers. The Alliance has provided funding enabling BCA to issue an RFP for curriculum development, and Knapp & Associates International has been selected to assist BCA in developing the applications, tests and testing procedures, review processes and other details associated with a certification program. Given the time required to develop, review, and implement a curriculum, it is expected that the certification program will be in place about the time of BCA's next annual meeting in May 2003. Once in place, the certification program should help to establish BCA firmly as the authoritative professional association for commissioning providers. While the certification program is expected to cover its own costs, it is not expected to contribute to the general funding of BCA. However, the certification program should help expand the membership base and associated dues revenues.

BCA is also moving forward with an accelerated internship program, which is being piloted in the Pacific Northwest with Alliance support. This should serve the dual goals of helping to ensure an adequate supply of trained providers and building BCA's membership base.

BCA's expansion beyond the Pacific Northwest is reflected in the composition of the membership as well as the leadership, which now comprises board members from all parts of the country. In addition, the Southeast region has taken the lead in the development of a regional chapter, which was approved by the BCA board earlier this year. Applications for regional chapters in the Northwest and Southwest are currently under development. Regional chapter members pay a small additional fee ($45) to support the regional group's activities. As described in the BCA evaluation, the BCA leadership envisions a BCA that would have a number of regional chapters providing support to the national organization.

In conclusion, the BCA appears to be successfully confronting the turning point described in the evaluation presented in Appendix A. We recommend that the Alliance, in tandem with other organizations, continue to pursue both the certification and internship programs as key component of BCA's longer term business strategy.

4.7 ENERGY SAVING ESTIMATION METHODOLOGY

The first eight demonstration projects completed in the Commissioning in Public Building project resulted in estimated savings of 1.4 million kWh/year for the 713,000 square feet commissioned. It should be noted, however, that these energy savings estimates combined different analysis techniques being used by Washington and Oregon. In Oregon (as well as Idaho) detailed energy savings estimates and other economic analysis were conducted by SBW, Inc. In Washington and Montana, relatively straightforward engineering calculations were used to determine how much energy would be saved as a result of commissioning.

A decision was recently made to have the case studies for the program use a consistent approach to economic analysis. SBW has developed an economic analysis framework, and will apply it to the 20 projects for which Alliance case studies are to be published.

A particular concern in the development of an analysis framework has been the difficulty of quantifying (and therefore including) non-energy benefits, especially those that are external to the market (i.e., that are not reflected in out-of-pocket costs for any market participants). Examples include worker/student productivity and less time spent responding to occupant comfort complaints. In addition, in discussing the benefits of commissioning, a number of owner representatives mentioned that a big change for them is that "the buildings work," without having to call the contractor back countless times and disrupt operations while problems are resolved. Several respondents added the hypothetical question, "How do you put a price on that?"

As some observers have pointed out, it should be no surprise that settling on a methodology is taking time; refining estimates of savings from other energy efficiency measures took years of debate involving regulators and utilities across the country before consensus was reached for common lighting and HVAC measures.

The evaluation will continue to follow the development of energy savings estimates, and we will review the selected methodology in the next MPER. As this methodology is developed, we will also explore the possibility of using the detailed information from demonstration buildings as the basis for estimating impacts from buildings that are commissioned outside the case study framework.

4.8 REVIEW OF ALLIANCE COST-EFFECTIVENESS ASSUMPTIONS

Cost-effectiveness assumptions currently in place for the Commissioning in Public Buildings project are based on the Fourth Northwest Conservation and Electric Power Plan. The Northwest Power Planning Council sponsored PECI to summarize available data to develop estimates of the resource potential of commissioning in new and existing buildings. Using data available at that time, commissioning costs of $0.29 per square foot yielded estimated energy savings from 0.35 to 3.18 kWh per square foot per year for new building commissioning and from 0.0 to 1.53 kWh per square foot per year for retro-commissioning, depending on the building type.

In the years since these initial estimates were made, a great deal of additional data on the costs and benefits of building commissioning has become available. While there is nothing to indicate that the above estimates are fundamentally flawed, the available cost-benefit data should be revisited to determine whether more accurate estimates can be developed. This will be done in the future before the next MPER.

5. CONCLUSIONS AND RECOMMENDATIONS

Overall, the Commissioning in Public Buildings Project is moving forward in providing information and assistance to help attain the goal of making commissioning standard practice in public buildings in the PNW. The following are the conclusions of this evaluation:

- Based on the demonstration projects, the characteristics that lead to a successful commissioning effort include:
  - Introduction of commissioning during design
  - Support for commissioning activities by the owner's project manager
  - Avoidance of excessive turnover and, when project management does change, reiteration by the owner of the high priority of commissioning
  - Active involvement of agency personnel in project management to maximize the effect of demonstration projects on agency practices.
  - Maintenance of an active on-site presence by the CA

- Project communications between the Alliance, OOE, and the states continue to be frequent and effective, although the review/revision cycle for documents like the marketing plans and case studies has been rather long. This has not been a major concern to date, but could become more critical as active marketing campaigns are developed and launched. We recommend that the review/revision cycle be shortened so that more of this activity takes place via email between regularly scheduled team meetings.

- The pressing issue identified in the first MPER – lack of time to carry the demonstration projects through to completion so that case studies could be prepared and disseminated – has been addressed with the time extension to the contract. A full complement of demonstration projects is now moving toward completion, and the first set of case studies is in preparation. Nevertheless, the legacy of the early time pressure remains, and is evident in some of the demonstration projects that had commissioning introduced later than optimal (i.e., after design was complete), resulting in problems with acceptance by other members of the construction team.

While there is a natural tendency to play down any problems in describing the results of commissioning in a case study, we believe it is important that the target audience for this project have access to lessons learned from some of the more problematic projects. It may not be necessary to publish full case studies for every problem project, but we recommend that a separate document detailing lessons learned be made available to any owners or others who ask the logical question, "Do all commissioning projects go this smoothly?"

- Regarding the case studies, the format settled on by the four states and the Alliance appears to be fine; however, there has been absolutely no feedback from the intended recipients of these case studies. We recommend that OOE and the state subcontractors

conduct, at the very least, some informal sessions with agency representatives to determine whether they find the format appealing and easy to read, the information of an appropriate level of technical detail, and the overall content sufficiently compelling to make them either seek out more information or move ahead with a commissioning project.

- In addition, we recommend that user interest in the more detailed supporting information from the case studies be assessed across all four states and findings shared, so that a consistent, effective method for making this information available can be pursued.

- There are also other opportunities for the states to share resources developed for the project by other states. For example, the training curriculum used by Idaho or the Best Practices manual developed by Montana could both be adapted and used by agencies in the other states.

- As Washington's GA continues to implement its fee-based commissioning support program, results should be assessed to determine whether this program (or one like it in other states) can serve as an effective exit strategy for the Commissioning in Public Buildings project.

- As detailed in the market analysis section, new building commissioning has become either standard practice or required by law for a significant portion of the public sector market, indicating that the market is moving toward the desired exit strategy for the project. And while we did not find any jurisdictions or agencies with regulations on the books regarding retro-commissioning, a number of school districts and universities in the four-state area have incorporated retro-commissioning into their facilities maintenance practices – in some cases as a direct result of their participation in a demonstration project.

- It is important to build on these successes to consolidate gains made to date through regulations, policies, and building codes, and we recommend that all the marketing plans be reviewed to ensure that this issue is addressed.

- With regard to BCA, the association appears to be successfully confronting the turning point described in the evaluation presented in Appendix A. We recommend that the Alliance, in tandem with other organizations, continue to pursue the program of commissioning authority certification as a key component of BCA's shift toward an individual-based membership, which in turn should provide the financial stability essential to BCA's longer term success.

- We endorse the Alliance's decision to continue to review the methods used to estimate energy savings and other benefits from the demonstration projects. We also recommend that the cost-effectiveness assumptions used for the Commissioning in Public Buildings project be updated to take advantage of the more extensive data now available on the costs and benefits of commissioning.

APPENDIX A

NORTHWEST ENERGY EFFICIENCY ALLIANCE

BUILDING COMMISSIONING ASSOCIATION STATUS EVALUATION

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LIST OF EXHIBITS

1. INTRODUCTION

This report summarizes the results of Quantum Consulting's (QCs) evaluation of the Building Commissioning Association (BCA). The purpose of the evaluation was to assess the association's progress toward its goals, as defined in the documents setting forth the terms of the Northwest Energy Efficiency Alliance's (the Alliance's) funding for BCA. Specifically, we wanted to investigate the extent to which BCA is moving toward becoming self-sustaining as Alliance funding is reduced.

This evaluation grew out of the broader evaluation of the Alliance's Commissioning in Public Buildings project, which served as a conduit for Alliance funding for BCA in its earliest days, when it was a regional organization. Since signing a separate contract between the Alliance and BCA in 1999, BCA is no longer a part of the Cx in Public Buildings project. This evaluation was undertaken at this time because the Alliance felt it was appropriate to consider the status of BCA after several years of Alliance funding. Furthermore, there have been several significant changes to the organization, notably the change in executive directors and the increasingly national scope of BCA's membership. In light of these changes, we sought to determine how far BCA had come in its development as a meaningful player in the market for commissioning (CX) services.

Evaluation results presented here are based on review of BCA documents and interviews with Alliance project managers, past and present BCA leadership (executive directors, presidents, other officers), and BCA members and others individuals outside the Pacific Northwest who have been active in the commissioning field, including some who are not BCA members. Findings are organized under three broad topics:

1. BCA's historical growth and development, including its goals, membership composition, funding levels and focus;

2. BCA's current status with regard to its strengths and weaknesses as perceived by its leadership and members;

3. BCA's outlook, as defined by the opportunities and threats that it faces, including the identification of outstanding issues that must be resolved as the association moves forward.

In the remainder of this report, each of the above issues is discussed in a separate chapter. Conclusions and recommendations are then presented.

2. HISTORY, GROWTH, AND DEVELOPMENT

The idea for an association of building commissioning providers grew out of discussions at the early national conferences on building commissioning in the mid-1990s, as it was recognized that an association was needed both to develop a standardized definition of commissioning and good commissioning practice and to help ensure that sufficient providers would be available to meet the growing demand for commissioning services. The broad outline for an association began taking shape at informal meetings in 1996 and 1997, where participants reached consensus on some of the key parameters that would define the organization, including an open membership policy, no certification of practitioners, and a focus on developing a clear, standardized definition of commissioning and good commissioning practice. The Alliance first provided seed money for a working committee to lay the groundwork for an association, and subsequently provided funds to help cover the first two years of association development and operations.

The Building Commissioning Association-Northwest (BCA-NW) registered under the laws of the State of Oregon as a not-for-profit corporation in May 1998. BCA was established as "an independent professional trade association formed by commissioning service providers to improve and further the practice of building commissioning….[2]" Specific objectives for BCA included 1) the development and implementation of a business plan, and 2) the development of a professional development program that would "help meet the anticipated demand for commissioning service providers in the Northwest.[3]"

With an initial focus exclusively in the Pacific Northwest (PNW), BCA-NW was funded by the Alliance as part of the multi-state Commissioning in Public Buildings infrastructure project managed by the Oregon Office of Energy (OOE). An explicit expectation set forth in the original contract was that the association would become a self-sustaining organization after two years through the implementation of the business plan mentioned above, with the income previously provided by the Alliance to be replaced "through a balance of membership enrollment and program income" … as well as "matching funds for market development activities." As will be discussed later in this report, the assumptions underlying the anticipated shift to self-sufficiency turned out to be overly optimistic, and may need to be revisited in light of actual revenues that BCA can hope to generate using member dues and training fees.

To balance the association's focus on commissioning providers with the desire to involve as many market players as possible, two categories of membership were established. Associate membership is available to individuals or companies with an interest in commissioning, including building owners, design professionals, utilities, and other supporters and advocates of commissioning. Full membership is limited to active commissioning providers. These member make up the voting membership and elect a board of directors. The Board, in turn, elects BCA's officers. Administrative functions are handled by a part-time executive director (who reports to

[2] BCA-OOE Grant Agreement, Statement of Work, July 1998, p. 5

[3] ibid.

the Board) and by association committees, which may be staffed by either full or associate members.

After lengthy discussions regarding the appropriate level of control over the qualifications of full members, BCA originally decided not to require certification or testing as a requirement of full membership. Instead, full members must agree to practice commissioning according to a set of Essential Attributes of Quality Commissioning developed by BCA to define commissioning, and must agree to comply with BCA's Peer Review process in case of owner complaints regarding work performed by a BCA member.

As BCA became established and developed an agenda that extended beyond the public sector, a new contract was written to have Alliance funding flow directly to BCA. Concurrent with this change in contract – though not directly related to it – was BCA's decision to expand its scope from the PNW to the entire country. In April 1999, BCA-NW became BCA, because "it had become evident to the BCA-NW Board of Directors that a professional association such as BCA needed to have an open membership and not be regionally confined.[4]" This change in scope was announced at the 1999 National Conference on Building Commissioning (NCBC) in May, and was reflected in the language of the subsequent direct contract between the Alliance and BCA – rather than BCA-Northwest.

2.1 GROWTH BY TYPE OF MEMBERSHIP

BCA's membership comprises both full members (Cx service providers) and associate members (design professionals, owners, others with an interest in Cx.) Membership options are summarized in Exhibit 1.

[4] BCA website, *About the BCA, How We Got Started.*

Exhibit 1

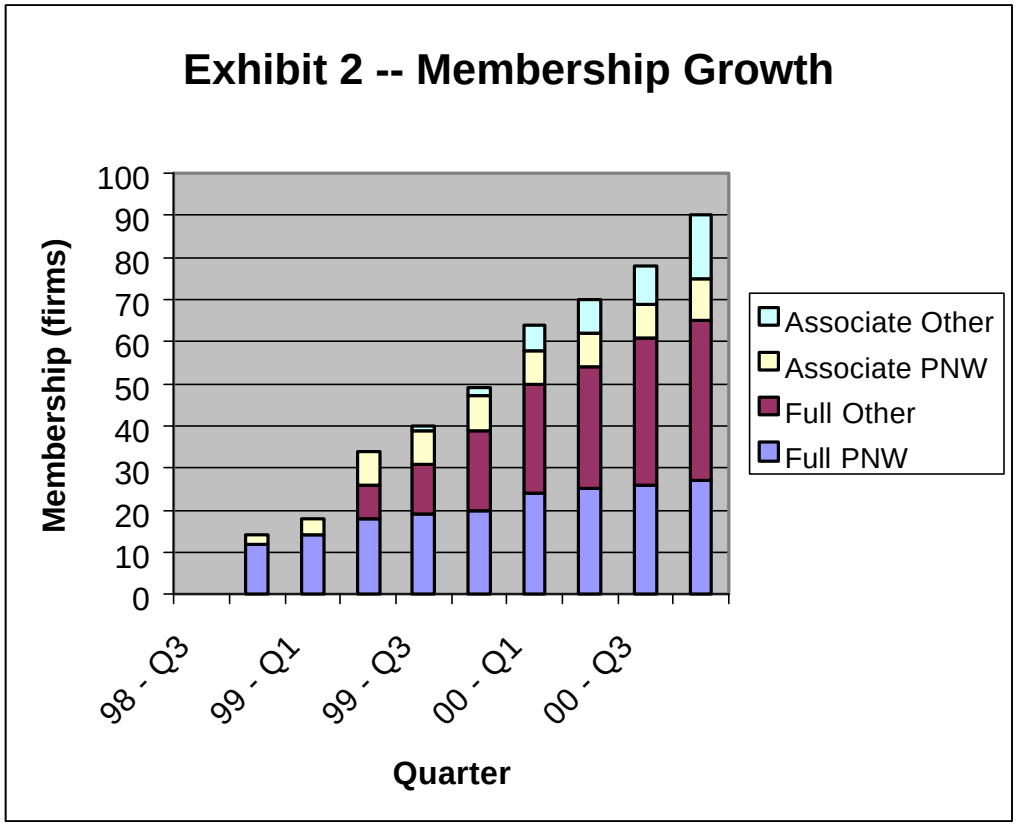
Membership Categories

Membership Option	Annual Dues
Full Membership	
Small Firms; 1-5 employees	$200
Large Firms; 6+ employees	$500
Sustaining	$1,000-4,999
Sponsoring	$5,000+
Associate Membership	
Individual	$50
Corporate	$150
Sustaining	$1,000-4,999
Sponsoring	$5,000+

Full members have voting rights and represent firms only, while associate members may be either firms or individuals, but have no voting privileges (and therefore may not serve as officers.) The decision to make BCA a firm-based trade association rather than an individual-based professional association is discussed in greater detail below.

Membership growth has been impressive, with the relatively aggressive target of 100 members by the end of 2000 (set out in BCA's 1999 Business Plan) having been reached in February 2001. Exhibit 2 shows this growth through the end of 2000; from the time when the association began accepting members from within the region only as BCA-NW in late 1998, membership has grown steadily.

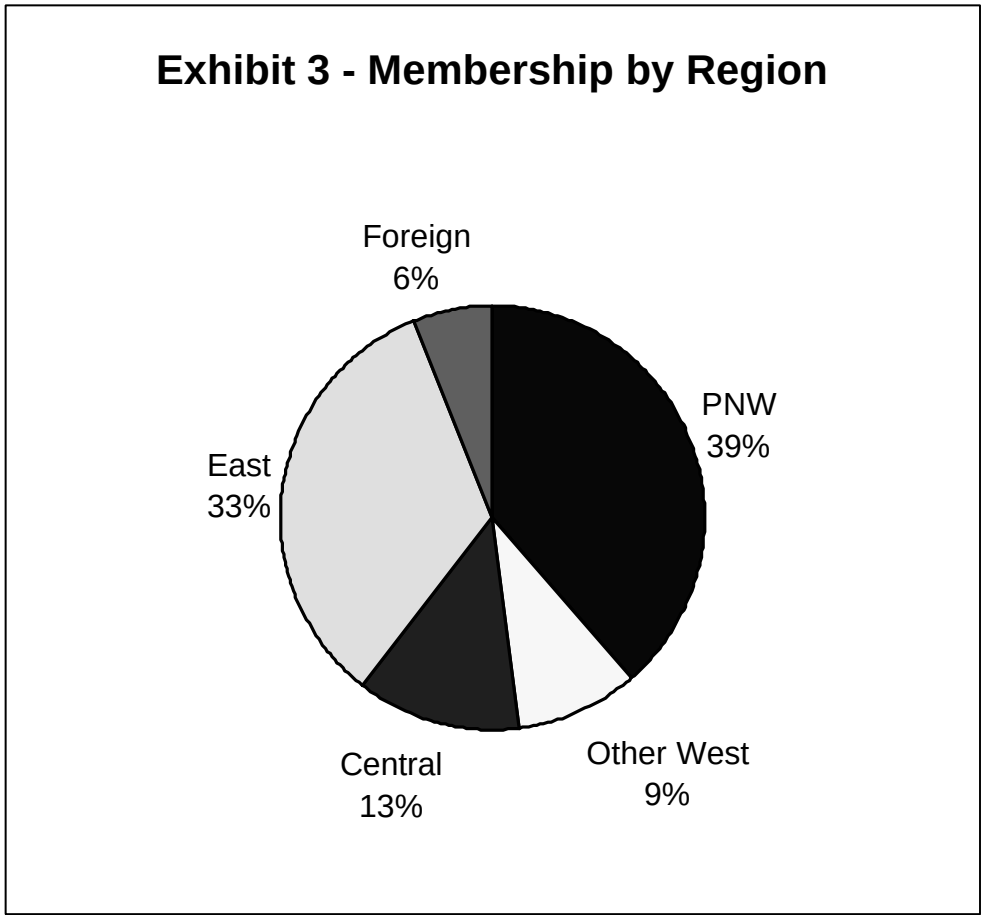
Note that recent growth has been most dramatic outside the PNW for both full and associate members. Since the organization announced its intention to become a national organization at the May '99 NCBC in Portland, new full members from outside the region have outnumbered new members from within the region by a 4:1 ratio. By the end of 2000, almost 60 percent of the full members were outside the PNW. This appears to be due primarily to the high degree of market penetration that BCA has already achieved within the Northwest, which former BCA president and current board member Rick Casault estimates at about 66-75 percent of eligible Cx



providers.

2.2 MEMBERSHIP BY REGION

Exhibit 3 presents a geographic breakdown of full and associate membership. Both categories of members are drawn from all parts of the country (and in a few cases even from overseas), with a concentration of members from New England and other East Coast states as well as the PNW.



BCA seems clearly to have achieved its goal of becoming a national organization. Moreover, the leadership of the organization has also spread beyond the Northwest. Of the seven-member Board of Directors elected earlier this year, four members (and three of four officers, including the new president) are from outside the PNW. Similarly, all four of BCA's sustaining full members are outside the PNW, as are one sponsoring and one sustaining associate member.

There has been some concern among the original founders in the PNW that this broader membership base could lead to loss of control of the direction of BCA, especially if regional chapters were set up. The general feeling in the past has been that it would be premature to initiate regional chapters. Michael Weiss, the newly elected, Atlanta-based President of BCA, however, favors a membership structure that relies heavily on regional chapters to support the national organization – a structure successfully employed by ASHRAE.

Several other issues related to membership were raised during the interviews with BCA leadership and members.

2.3 INDIVIDUAL VS. COMPANY MEMBERSHIPS

An early decision was made by the BCA Board to have full membership be company- rather than individual-based, but there have continued to be discussions of moving away from a business association model (where full members are companies rather than individuals) to a professional association (with individuals rather than companies as members.)

Most true "professional associations" such as the American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) are individual-based in that they certify the credentials of individual practitioners. At the other end of the spectrum are company-based trade associations such as the American Refrigeration Institute (ARI) that generally promote the business interests of their company members. BCA is somewhat of a hybrid: while its membership is business-based, it tends to view itself more as a professional association in that it is very much concerned with defining and establishing commissioning as a profession. However, it acts more like a trade association in that 1) it does not currently offer the kind of certification typically provided by professional associations, and 2) it does have as one of its goals the development of the Cx market through education of owners and design professionals.

One of the reasons BCA has so far opted to stay with a business-based full membership is because they fear that a large company with many individual members could dominate the association. On the other hand, a risk inherent in a business-based membership is the ironic situation that as the commissioning business grows, the member base could shrink as more large firms enter the market and companies consolidate.

We would recommend (as did the previous member study) that BCA move toward an individual-based membership. This would lead to membership that expands in direct proportion to the activity in the commissioning market (and therefore increases revenues accordingly), and address concerns regarding the membership of nonprofit organizations, discussed below. The concern about excessive concentration of power on the board could be addressed by restricting Board participation to one person per firm.

2.4 OPEN VS. RESTRICTED ADMISSION

A concern from the very first planning meetings of BCA has been the extent to which full membership should be restricted to those who meet specific qualifying criteria. While the bylaws of BCA state that full members must be established providers of commissioning services and that they must agree to adhere to the Essential Attributes set forth by BCA (included as Appendix A), these are all self-certified requirements, and to date no one has been denied membership.

There has been a move to tighten admission requirements for full members by instituting a written test on the Essential Attributes and requiring two references testifying to the applicant's experience in actual commissioning jobs, but these are felt by some members at least to be somewhat perfunctory and not a significant hurdle to overcome. The preference among most of the Board members interviewed is to tighten membership requirements; the problem is that there are no agreed-upon criteria.

This raises the issue, discussed under "threats" below, that there continue to be significant differences in how the term "commissioning" is defined, used, and interpreted, not only in different parts of the country, but among industries and market actors. Establishment of a definition of what commissioning is and should be is clearly a first step both to tightening admission requirements and establishing standards for certification.

Within the past month, the Executive Director has proposed a certification process that would establish a formal standard for a Certified Commissioning Agent. Regardless of the details of the final criteria that are agreed upon, a formal process can only help BCA establish itself as the

arbiter of what is and is not commissioning and who is and is not a commissioning agent. We therefore recommend that BCA move forward with the development of a set of guidelines that more stringently define the qualifications for full BCA membership, with a goal of ultimately moving full members through the certification process.

At its May 2001 Annual Meeting, the BCA membership voted to create a Certification Committee to move forward with the development of a certification program.

2.5 ROLE OF ASSOCIATE MEMBERS

The category of associate member was created to provide a means for individuals and companies who have an interest in Cx but who do not provide Cx services to participate in and stay abreast of developments in the Cx community. In addition to receiving the newsletter and other announcements and publications, associate members are able to serve on committees and interact informally with the overall BCA membership.

Associate membership has grown significantly, especially outside the PNW, and now accounts for about 30 percent of all members. While the Board welcomes individuals and organizations who are interested in commissioning without actually providing the service, there is some concern that this membership category is being used as a low-cost way to gain credibility for firms who are actually marketing commissioning services. (There are a number of firms on the BCA membership roster whose names strongly suggest that they provide Cx services, but who are listed as associate members. One board member cited an example of a Cx provider who was using the BCA logo in his marketing materials even though he is only an associate m on developing a clear, standardized definition of commissioning and good commissioning practice ember.) On the other hand, BCA would like to see greater participation in this category by building owners, architects, and design engineers. A more aggressive marketing effort should be conducted to seek out new members in these groups, but BCA should also make it clear that associate members may not use their BCA affiliation in any way to suggest that they are qualified to provide Cx services.

Eligibility for election to the BCA Board is limited to full members only. To some extent this may, according to former Executive Director John Doyle, restrict the association's ability to attract large organizations who could provide access to the funding BCA needs to attain its goals. However, all of BCA's sponsors to date have been associate rather than full members. In addition, associate members are eligible to serve on (and possibly chair) committees. BCA should pursue the active involvement of associate members to support the limited resources of the organization and its Board. It may even be appropriate to form an advisory board of sponsoring organizations and select associate members to provide the BCA Board with input and market feedback.

3. ORGANIZATIONAL ANALYSIS OF BCA

For a young organization, BCA has made significant progress, both in membership, as described above, and in the respect it commands in the Cx community. In this section, specific strengths and weaknesses of BCA are discussed.

3.1 STRENGTHS

A significant strength, discussed above, is the growth in membership, which has gone well beyond the Northwest to comprise both full and associate members from all parts of the country. This broad geographic membership base is also reflected in the composition of the Board and in sustaining/sponsoring organizations, thereby contributing to BCA's status as a truly national organization.

BCA also benefits from being "the first kid on the block." BCA's first-to-market efforts to organize commissioning providers and establish standards of practice in the form of the Essential Attributes has, according to several board members, pre-empted other organizations that might have tried to add commissioning as an area of expertise. And indeed, there does not appear to have been a significant effort by any other association to take the lead in establishing standards for commissioning, although several groups (ASHRAE, SMACNA) have developed standards for commissioning in the context of their specific disciplines.

In part because it was the first organization to address commissioning as an independent discipline, BCA has also built a reputation as a source of qualified commissioning providers. While some Board members noted that BCA has not yet attained the level of recognition that they would like to see, they cite several instances where BCA membership has been made a requirement for Cx providers – primarily in the Pacific Northwest.

A fundamental strength that most of the BCA leadership identified is the overall sense of community that BCA has helped foster among those who practice commissioning, both in the PNW and nationwide. Fraternity among various commissioning firms and individuals, an open exchange of ideas, and a shared commitment to promoting commissioning because it offers powerful energy and non-energy benefits were all components of this perceived strength.

To take advantage of this strength (and to respond to member demands), the Board has made several efforts to enhance communication with members, including the establishment of a web site, paying more attention to getting frequent newsletters out to members, and establishment of the web-based eForum. Informal regional groups have also been established by BCA members in the PNW and New York/New England to help build this sense of community.

3.2 WEAKNESSES

Overall Lack of Resources

BCA's most fundamental weakness is its overall lack of resources. BCA was launched with funding from the Alliance as part of the Commissioning in Public Buildings project. It was assumed, however, that the association would be self-sufficient after two years, generating enough income from member dues and training to support its operation. This appears to have been an overly optimistic assumption, and the Alliance has found it necessary to provide continued funding, albeit at a reduced level, through 2002 to support specific marketing activities. Even though BCA has met its membership targets, funding is still far below that needed to help establish the association, provide required levels of member support, and conduct outreach to owners and other groups (e.g., architects, engineers, contractors). Several explanations were offered for the funding shortfall:

- While membership growth has been impressive, about 60 percent of members are one- and two-person operations that pay dues of only $200 a year. In addition, individual associate members pay only $75 a year.

- Training has not been – and is unlikely to become – the source of operating funds that was envisioned in the BCA business plans. BCA is dependent on contractors to design and conduct the training, so registration levels for a typical course must be about 60-70 percent of course capacity just to break even. Since BCA lacks the resources (i.e., mailing lists) to recruit from outside its own membership, it is not easy to fill the courses. At best, a successful course is likely to net only a few thousand dollars above cost; since the number of facilities where hands-on provider training can be offered is limited (so far the BCA Executive Director is aware of no more than three such facilities nationwide), training will never be a high-volume activity that provides the basis for a major share of BCA's budget. The situation would clearly be different, however, if sponsors could be found to cover the cost of the training several times a year.

Alternative sources of funding that have been pursued consist primarily of sponsorship by utilities and other organizations with an interest in promoting Cx. So far, the amount of money raised in this way has been relatively modest, although several new members have signed on at the sponsoring and sustaining level. The BCA web site lists three $5,000 level members and six $1,000 level sustaining members, but this is far below the $116,000 projected income from "other" funding that BCA originally estimated for 2000 in its business plan.

In light of BCA's current funding shortfall, it is clear that revenues from other sponsoring organizations will be a necessity for several years to come. However, the current Executive Director (ED) readily concedes that fundraising activities are not his natural strength.

To address these concerns, at a recent Board meeting, BCA authorized the former ED to try to expand the level of sponsor funding, with his compensation to be based solely on any success he achieves. After weighing this offer, the former ED decided not to pursue this fund-raising effort,

leaving BCA with no realistic short- to medium-term prospects for significant additional funding.

Inadequate Staffing

The lack of funding is the most direct cause for several areas where a lack of resources is evident. First, staffing levels are clearly inadequate to address the needs of a growing organization. Association staff consist solely of the ED at this time, and he has not been paid (or more accurately, has not paid himself) since he took the position. While the Executive Director position is not meant to be full-time, it requires at least a .5 FTE level of effort just to sustain the organization – the level at which the position was funded in 1999 (while the OOE and Alliance contracts with BCA did not specify the amount of funding for the position, the contract with the ED that year called for up to 992 hours). Having an unpaid ED is clearly not a tenable situation over the long run, and the current ED has made it clear that he cannot continue under the current constraints for more than a few months. Moreover, the high level of effort that officers and members contributed to supplement the activities of the ED in the early stages of BCA's development will also prove difficult to sustain.

To carry out the numerous activities that the BCA should be pursuing in order to perform needed administrative functions, provide member services and support, reach out to owners and others to support commissioning, coordinate training activities, etc. requires more than just an ED. While committees can take on a significant portion of that work, there will remain a significant and growing workload that requires staff support. In 1999, the ED hired an administrative assistant on an as-needed basis – generally averaging about 40 hours per month. The current ED should have access to a similar level of staff support, and more will be needed if membership volume grows. Shifting of the BCA's management to a professional association management firm would help provide the needed level of staff support – again subject to the availability of funds to pay such a firm.

Insufficient Quantity and Quality of Services

A second indication of the lack of resources is that the level of service that BCA currently provides to its members and to the Cx community overall falls short of what is required to establish the association as an effective advocate for the proper practice of commissioning. Examples of shortfalls in services include the following.

- Marketing efforts need to be stepped up if membership is to attain the higher levels needed to generate more income.

- Outreach to owners – for example, through seminars, provision of standard contracts and other documents, dissemination of case studies, and representation at conferences – must be expanded.

- Active BCA participation – include that of BCA members as volunteers -- in code development efforts across the country is necessary to ensure that Cx is properly defined and represented in new codes and standards.

- Member services must be raised to a higher level by, for example, updating and expansion of the BCA web site; posting of RFPs and other opportunities; timely, high-quality newsletters; and assistance in the development of regional chapters or working groups.

As indicated above, BCA's marketing and promotional materials also reflect the lack of resources. In response to member feedback, BCA is attempting to move the newsletter to a monthly schedule. Because of lack of funds, it has relied on volunteer efforts to put the newsletters together, which has resulted in serious quality control problems (typos, inaccuracies, poor editing) in the last two newsletters. Similarly, the web site was (up until recently) maintained only sporadically, with the most recent newsletter available almost a full year old. Brochures used to recruit members and serve as BCA's introduction to others also have a low-budget look that does not help to build the association's image.

Burn-out of Key Players

In addition to limitations on funding, BCA has been hampered in recent months by a combination of what appears to be burn-out and over-commitment by key players. Several respondents complained that the committee structure does not appear to be efficiently executing the tasks needed for the BCA's operation and growth. Several reasons are cited:

- When BCA was initially formed, the BCA founders had both the drive and the time to pursue the establishment and growth of the organization, devoting many volunteer hours to setting up the organization, writing the Essential Attributes and bylaws, and developing initial training and presentation materials. Now that both the organization and the concept of commissioning have taken off, many of these same founders find themselves swamped with work and unable to make or deliver on promises to help BCA. This has led to almost all the work being done by relatively few members and has resulted in burnout among some of the founders.

- BCA members, as a group, lack the management skills and experience needed for successful committee work. In most cases, the committee chairs try to do all the work themselves. In other cases, they delegate work but then do not follow up to ensure its completion by the committee member.

- Despite the more recent expansion of the Board to comprise more non-PNW members, the core of the organization has until recently been the I-5 corridor. Whether out of habit or because of lack of familiarity with other members, the core PNW members have been slow to work closely with members elsewhere in the country. The new President, Michael Weiss, says that several members have told him they offered their help at last year's annual meeting, but were never contacted.

Possible solutions to the committee problem include the addition of staff support to help move projects along, training for committee chairs in the basics of management, and a broadening of the pool of committee participants to include associate members and even non-members with an interest in specific issues. The new president's intention to promote the development of regional chapters that support the national organization could also help to spread the workload and encourage broader participation.

Loss of Momentum

Finally, several of those interviewed said they had a feeling that BCA had lost momentum in the past half year or so. This was attributed primarily to the change in Executive Director, but also to some extent to the change in focus of the organization from regional to national. Most people said they felt this was somewhat inevitable, but that they believe the infusion of new people and ideas from elsewhere in the country will help re-invigorate the organization. This latter observation appears to have been correct based on the May 2001 BCA annual meeting, where a broad range of members committed themselves to greater involvement and the association to an active, highly visible role in the commissioning field.

4. BCA'S OUTLOOK

All of those interviewed spoke very positively about the tremendous potential that exists both for commissioning as a profession and for BCA as an organization. Some of the greatest perceived opportunities and threats are discussed below.

4.1 OPPORTUNITIES

As it emerges as a truly national organization, there are a number of trends that provide BCA with an opportunity to become a respected force that can help shape the future of commissioning.

- Commissioning is a hot topic, as evidenced not only by the steady increase in BCA membership, but also by the growing numbers of states who are working on incorporation of commissioning into code. Because it was the first organization to represent commissioning providers, BCA is well positioned to define what is and is not commissioning, set standards and help write codes, and serve as the governing body that will help shape the discipline as it grows. Michael Weiss plans to promote this concept, and wants BCA to have a tag line along the lines of "if it's not BCA, it's not commissioning."

- The recently emerged energy crisis, both in California and nationwide, has focused increased attention on energy usage in general, and has created significant opportunities to promote commissioning of both new and existing buildings. Several of the people interviewed identified the huge stock of existing buildings that could see immediate benefits from retro-commissioning as one of the greatest opportunities that faces the industry and, by extension, BCA.

- Outside the Northwest in particular, there is, according to Michael Weiss, tremendous interest in commissioning from firms not so much for energy efficiency, but because they see buildings as critical components of high-value production processes such as pharmaceutical laboratories, microelectronics production facilities, and communications centers. Firms in such industries increasingly recognize commissioning as a way to avoid costly disruptions to their production processes.

- As commissioning has become better known and accepted, there have been changes in code, procurement regulations, and standard practices at some organizations to require it. As more such changes take place, there are opportunities for BCA to position its members as the preferred or required providers for commissioning services.

4.2 THREATS

The most urgent threat to BCA at the moment appears to be the possibility that a shortage of resources or loss of momentum could prevent the association from capitalizing on the above opportunities. This threat appears to have become more serious with the former ED's decision not to pursue additional funding sources and with the current ED's notice that he will step down

later this year. Without any immediate prospects for additional funding, all of the potential threats to BCA take on added urgency, including the following:

- BCA could lose the ability to be the organization that defines commissioning. There are currently several definitions and/or approaches to commissioning in different parts of the country. As different states move to incorporate their definition of commissioning into codes and standards, BCA may be unable to provide leadership in developing a core definition of commissioning that can be used nationwide.

- Similarly, watered-down versions of commissioning could be incorporated into code. Several of the people interviewed mentioned this as a serious threat, citing the Washington State code amendment that was recently adopted as an example. In addition, the current focus on energy shortages in California and elsewhere have led to several programs that use the term commissioning or retro-commissioning but that appear to fall far short of the Essential Attributes promoted by BCA. Examples include a small commercial tune-up/retro-commissioning project sponsored by PG&E in California, and a demand reduction program fielded by NYSERDA last summer in New York. A program manager for the NYSERDA program stated at a recent ACEEE market transformation conference that "commissioning" was included in the program's name primarily to make the program more visible to potential participants and to capitalize on the interest in Cx.

  – Some knowledgeable market observers have noted that starting with a scaled-down version of Cx (or Cx Lite, as it is sometimes called) has made it easier to gain acceptance for Cx concepts in an otherwise indifferent or hostile market, thereby making it easier to introduce "real" Cx later. While this may be true, it should not prevent BCA from drawing a clear distinction between true Cx and Cx-like functional performance testing activities.

- BCA could lose ownership of commissioning to other national associations who claim to certify or otherwise represent commissioning providers. ASHRAE, the Test and Balance Association, and the Association of Energy Engineers could potentially try to become the voice of the commissioning industry. It is also possible that other states, such as California, could bypass BCA and develop their own regional associations.

  – There was, in fact, an effort by a for-profit association management firm to establish a competing organization at the 2001 NCBC – an effort started by a firm that BCA had approached about taking on some of the association's management functions. However, all of the Cx providers – both those at the NCBC and those contacted for this evaluation -- were supportive of BCA, and did not see any other association as offering a serious alternative to organizing the Cx provider industry. In California, members of the California commissioning collaborative are eager to work with BCA to help develop the Cx infrastructure in their state.

- Finally, there is the threat that members could come to view BCA as ineffectual or irrelevant if they do not perceive that they are receiving tangible benefits. So far, members have been relatively patient with BCA, recognizing that it is an organization with limited resources that is going through growth and development. It is important

that BCA move quickly to respond to member needs (as it is doing with the more frequent newsletters and more interactive web site) and maintain their loyalty.

4.3 NEXT STEPS

- The former ED's decision not to serve as a fundraiser under the arrangement proposed by the Board has brought BCA to a turning point: facing a wealth of both opportunities and potential threats that must be acted on quickly, BCA lacks the resources to take advantage of those opportunities and counter those threats.

- At best, current projected cash flows for the coming year will be sufficient to keep the organization functioning at a minimal level. That would mean processing memberships, updating the web site periodically, sending out newsletters, and conducting some training sessions for owners, design professionals, and Cx practitioners.

- We believe, however, that BCA must do much more if it is to realize its goal "to improve and further the practice of building commissioning." To recap just a few of the required activities, BCA should more actively reach out to the owner and design communities, help to establish or standardize definitions for commissioning, influence jurisdictions that are considering or writing codes requiring Cx, become more actively involved in the growth of Cx in California, and move toward the development of a certification program.

- Those activities appear to be beyond BCA's scope in light of current funding, yet BCA can be no more than a very minor player in a growing marketplace without them. If, on the other hand, BCA takes a more active approach and strives to be a highly visible, influential association, external funding will be needed to support marketing and other outreach efforts needed to attain that goal; that is, while BCA appears to have the potential to become a substantial association that generates sufficient revenue to support its operations, there will continue to be a large deficit for the first several years, particularly if aggressive marketing and member services opportunities are pursued. The BCA leadership should lay out, in as much detail as possible, the expected sources of revenues and anticipated expenses as the association moves toward becoming self sustaining over the next few years

- It is imperative that BCA consider alternative funding resources and (equally important) the process by which those resources might be mobilized. The following are among the funding/revenue sources that BCA could consider.

- Convert the basis for membership from firms to individuals; even with an average firm size of 2-3 people, this would mean a doubling or trebling of membership; 300 members @ $200 would at least provide a $60,000 base for a more realistic budget.

- Increase member dues; this would be a virtual necessity if BCA were to retain its company-based approach to membership.

- Launch a certification program that carries fees comparable to those charged by other associations, as proposed in the ED's memo. While this has the opportunity to generate a significant revenue stream, it also incurs costs and raises issues regarding the need to

maintain credibility and "sell" BCA as the appropriate certifying authority in order to demonstrate the value of certification.

- Seek funding from utilities. Several utilities currently provide funding to BCA at the $5,000 sponsorship level. While this aid may be "tied" to specific activities that are of interest to the utility, these activities can usually be easily integrated into BCA's overall mission. In light of the high level of interest in Cx across the country, there should be numerous utilities who could be persuaded to fund BCA; this was, of course, the rationale behind authorizing the former ED to pursue fund-raising activities.

- Seek funding from public benefit charge money. Following on the Alliance model, BCA could develop proposals to NYSERDA, California, Wisconsin, and other states with public benefits funding available. These proposals would have to be designed to meet the specific needs of the states as well as BCA's own requirements, but this should not be an insurmountable challenge.

- Seek funding from EPA or DOE. Precisely because so many of the goals of BCA are national in scope, it makes sense to pursue federal sources of money.

- Further develop training revenues by using a more aggressive marketing campaign to recruit enough attendees to fill a class. The economics of running a training session (i.e., the reliance on contractors and specialized facilities) make it unlikely, however, that training will ever be more than a supplemental source of revenue.

- Develop and market specifications, sample contracts, and other documents that facilitate the Cx process – either through the BCA website or in hard copy form directly from BCA. This, too, is unlikely to provide more than supplemental income.

- Publish an annual commissioning industry directory listing all BCA members, but also accepting advertising from specific providers, equipment suppliers, and design professionals.

5. CONCLUSIONS AND RECOMMENDATIONS

BCA is at a turning point. Because of its timely entry into the market, support from the Alliance and other organizations, and the hard work of its Board, staff, and members to date, BCA has laid the foundation to become a respected national organization that can play a major role in the booming market for Cx. However, to follow up on the work that has been done and move the association forward requires that substantial changes be made. Conclusions regarding the current situation and associated recommendations for moving forward are presented below.

5.1 ALLIANCE FUNDING FOR BCA

CONCLUSION

- The initial assumptions that BCA could become self-sustaining after two or three years were obviously optimistic. The funding currently being provided by the Alliance for the 2001-2003 period ($30,000 in 2001; $20,000 in 2002; $10,000 in 2003) clearly will not provide enough of a supplement to BCA's other income sources for an adequate operating budget. While the Alliance's essential role in bringing BCA to its current stage of development will inevitably diminish as other organizations and geographic regions become more important, the Alliance can still play an invaluable role in helping BCA identify and make contact with alternative sources of funding.

RECOMMENDATION

The Alliance should focus -- either by lifting restrictions on the existing BCA funding described above (i.e., not earmarking funds for marketing only) or by providing additional assistance -- on facilitating BCA's contact with national agencies and funding sources in other regions that can provide BCA with the support it needs.

5.2 ADDITIONAL FUNDING

CONCLUSION

- With current sources of funding (dues and training), BCA will be unable to meet the challenges it currently faces and take advantage of the opportunities that exist. Sources of additional funding that could provide BCA with the resources it requires either do not know about BCA's need or do not believe that there is a need for an independent association that focuses exclusively on Cx.

RECOMMENDATION

- Given BCA's current finances, some outside source is going to have to provide seed money that BCA can use to secure additional funding. This would consist primarily of travel funds that the BCA president and board members can use to visit decision makers at national organizations that might sponsor BCA, such as utilities, federal agencies such

as EPA and DOE, or other organizations with a vested interest in new and retro-Cx, such as large HVAC equipment makers and controls manufacturers.

- As noted above, the Alliance may be able to make such seed money available directly, either by lifting restrictions on existing funding or providing additional funds. As an alternative, the Alliance could serve as a coordinating body for fundraising efforts. The Alliance staff and board have extensive contacts both at utilities and at comparable organizations across the country, and they should be well positioned to explain the need for funding sources commensurate with BCA's national scope.

- If a serious effort to raise additional funds proves unsuccessful, we would conclude that the kind of broad support needed to sustain an independent Cx association may not exist, and we would then recommend that BCA explore merging with another, related professional association such as ASHRAE.

5.3 STAFFING

CONCLUSION

- BCA cannot continue to be effectively managed through its upcoming growth by an unpaid Executive Director and essentially no staff. In addition, the current ED has a strong technical and training background, but limited experience in other aspects of association management, notably the currently critical task of fundraising. He has recommended that BCA investigate turning the management of BCA over to an association management firm (which would typically handle management functions for a number of organizations.)

RECOMMENDATION

- Assuming that resources can be found, we recommend that BCA turn the management of the association over to an association management firm, while retaining John Heinz on a part-time basis as Technical Director, a position for which he is eminently suited.

5.4 BOARD MEMBER MANAGEMENT SKILLS

CONCLUSION

- Because they are (generally) professional engineers and volunteer association managers, most of the BCA Board members lack the management experience needed to support BCA's organizational development and/or make effective use of BCA's committee structure. The BCA leadership will need to become more proficient at mobilizing and leveraging all the resources at its disposal if the association is to attain its potential.

RECOMMENDATION

- A workshop on association management and how to make the best use of volunteer resources should be considered for a future event that is likely to be attended by many BCA board members and committee chairs, such as the national commissioning conference.

5.5 DEFINING COMMISSIONING

CONCLUSION

- Despite BCA's efforts to define the Essential Attributes of Cx, there are widely divergent definition of Cx in use across the country, and a growing tendency to use Cx as a generic term for anything that improves building efficiency. The uncertainty regarding precise definitions of Cx and what makes a qualified Cx provider continue to make it more difficult to make true Cx standard practice.

RECOMMENDATIONS

As different states move to incorporate their definition of commissioning into codes and standards, BCA should provide unified, consistent, and visible leadership in developing a core definition of commissioning that can be used nationwide, both in code development and in the general marketplace. This activity should become a core part of BCA's mission in helping to promote quality commissioning.

- BCA should also move forward with a certification program, both because this has been identified by building owners as something they would look for and because BCA needs to establish itself as the certifying authority. It is important, however, that BCA's certification be sufficiently broad in scope to encompass all that Cx involves; that is, to focus on certifying practitioners in the commissioning process. To the extent that BCA members are called upon to commission, for example, communications "wires and pipes," fire and other safety systems, and the building envelope (i.e., not just HVAC and building controls), it may be necessary to define rather carefully the extent to which BCA is able to certify the expertise of its members.

- To the extent that BCA succeeds in its efforts to control the definition and practice of Cx, it needs to develop rigorous procedures for addressing both the improper use of Cx as a term and the inevitable instances of malpractice that will arise.

- Regarding the use of Cx as a term, BCA should develop a template for a form letter that can be sent to publications, agencies, or other organizations that publicly misuse the term. Such letters could not only provide a correct (BCA) definition of Cx, but could also describe the resources BCA can make available to assist in proper implementation of Cx and raise BCA's visibility.

- Regarding Cx quality, thus far there have been very few instances of owner dissatisfaction with a BCA member's performance and no formal challenges that have required the involvement of BCA's Peer Review process. Several of the BCA members interviewed said they have considered the potential difficulty of conducting a peer review on a national scale, and have concluded that such a review could be conducted through heavy reliance on document review. As BCA ratchets up its involvement (i.e., certifies providers) the potential repercussions from dissatisfied owners grow. Issues of liability and an association's ability to protect itself through insurance policies should be investigated.

5.6 INDIVIDUAL- VS FIRM-BASED MEMBERSHIP

CONCLUSION

- BCA is clearly more of a professional association than a trade association; a professional association that is firm-based is inherently contradictory, and the addition of a certification program only intensifies the need to focus on individuals rather than firms.

RECOMMENDATION

- BCA should explicitly define itself as a professional association and should build its membership base on individuals, not firms. Since the firms who perform Cx contracts would not be BCA members, contract language such as "work must be performed/managed by a BCA-certified provider" may need to be developed and made available to organizations who currently require BCA membership of their Cx providers. BCA will have to embark on an education/information program to assist any organizations who currently require BCA members to redefine the requirement in a way that makes sense. Similarly, BCA will have to develop a mechanism to apply its peer review process and other aspects of quality control under an individual-based framework so that owners will continue to be assured of high quality work.

5.7 BCA'S WEB SITE

CONCLUSION

- Members and others look to BCA as a source of information on Cx, but the extent of that information available through BCA and its web site has been limited; other websites such as PECI's offer much more Cx-related material than does BCA. Updates of membership and board member listings appear to have become more frequent, although the most recent newsletter posted is well over a year old (quality problems with two of the most recent newsletters appear to have discouraged BCA from posting them to the web), and there is still no message from the new president indicating BCA's current or planned direction – or even that there is a new president.

RECOMMENDATION

- Since many people (including potential Cx users as well as potential members) still get their first impression of BCA from the website, it is important that this be kept current. Member outreach should be expanded, with more frequent updates to the website, regular newsletters, and perhaps an annual report or other publication that summarizes the state of the association, the industry, and the market. To the extent possible, BCA should make itself *the* source of information on Cx, through links, downloads, etc. The Alliance can assist in this effort by making available links to all its Cx-related projects, activities, and publications. As case studies are developed for the Cx in Public Buildings project, for example, these should be summarized on the BCA web site, with links to the complete studies at the Alliance site.

- As the volume of available case studies grows, BCA should take the lead in disseminating them to a broad range of potential readers. In particular, BCA should

develop news releases/success stories targeted to publications that serve vertical markets rather than the horizontal "building operations" market. Some stories targeted to general readership publications would also help to raise the visibility of Cx, develop support among voters for Cx in schools and other public sector institutions, and enhance BCA's reputation as the organization that ensures the quality of Cx.

5.8 ASSOCIATE MEMBERS

CONCLUSION

- BCA's associate members, including sponsors, represent a significant resource that could be mobilized to address the many opportunities and threats BCA must face to achieve its desired status as the preeminent association in the Cx market.

RECOMMENDATION

- While it is neither feasible nor desirable to open the BCA board up to other than full members (in keeping with its status as a professional association) it may be appropriate to create an Advisory Board comprising sponsoring organizations and associate members. Sponsorship at, say, the $10K level might qualify an organization for a seat on the Advisory Board; in addition, there might be one owner representative elected by associate members who are owners and one representative of the design community, again elected by associate members in relevant fields. The Advisory Board would provide the BCA Board with input from the perspective of other market players; while it would, as the name indicates, serve in a purely advisory capacity, it could prove valuable in helping to share the workload, raise the visibility of the association, and provide feedback from the rest of the market.

5.9 THE CALIFORNIA OPPORTUNITY

CONCLUSION

- A number of the individuals interviewed cited the tremendous opportunity for Cx offered by California, where the current infrastructure is described as being several years behind that of the PNW. Several people who have been involved in the emerging California Cx Collaborative said they would welcome BCA's assistance.

RECOMMENDATION

- BCA should move quickly to establish its leadership in the potentially huge California market. Knowledgeable observers in California say that the relatively undeveloped Cx infrastructure in California creates an opportunity for BCA to shape the growth of this market – which is likely to happen quickly in light of the current CA power crisis. There are already indications that quasi-Cx activities will be promoted as a quick fix to help trim the state's energy consumption; it is important that BCA capitalize on the interest in such activities both to clarify what Cx is and to emphasize the greater benefits offered by "true" Cx.

APPENDIX B

NON-PARTICIPANT SURVEY

Name: _____ Phone: _____

Agency/Organization: _____Job Title: _____

Hello, I'm calling from Quantum Consulting, the evaluation contractor for the Northwest Energy Efficiency Alliance project to promote building commissioning in the public sector. To help assess the overall market for commissioning, we are speaking to representatives of public sector agencies to gauge your experience with commissioning and the extent to which commissioning has become accepted in the market. Do you have just a few minutes to talk? Your assistance in this is very much appreciated.

1. How familiar are you with the concept of new building commissioning, using a 1 to 5 scale, where 1 means not at all familiar and 5 means very familiar? _____

2. How many new buildings or retrofits has your organization commissioned in the past two years (including any projects currently under way)? _____

3. Who makes the final decision regarding whether commissioning is incorporated into the design of a new building?

4. When new buildings are commissioned who performs the commissioning? (i.e., an independent commissioning agent or authority, the design engineer, the architect, the general contractor, the Test and Balance Contractor, owner's staff?)

5. How many new projects do you expect to commission in the next two years? _____

Please rate the importance of the following obstacles to your agency's ability to commission new buildings, where 1 indicates no obstacle and 5 indicates a serious obstacle.

_____ Obtaining funding for commissioning

_____ Finding and screening commissioning providers

_____ Managing the commissioning process (e.g., developing specifications)

_____ Getting all parties on the construction team to accept commissioning

_____ Concerns that commissioning might delay project completion

Next, I'd like to ask you about the commissioning of existing buildings that have not been commissioned previously.

6. How familiar are you with retro-commissioning of existing buildings, using a 1 to 5 scale, where 1 means not at all familiar and 5 means very familiar? _____

7. How many buildings have you retro-commissioned in the past two years? _____

   8a. If >0, how was the retro-commissioning project undertaken? Who initiated it, who had to approve it, who funded it? What are the factor that are likely to lead your organization to retro-commission other existing buildings in the future?

8. How many buildings do you think you will retro-commission over the next two years? _____

9. Please rate the importance of the following obstacles to your agency's ability to retro-commission existing buildings, where 1 indicates no obstacle and 5 indicates a serious obstacle.

   _____ Obtaining funding for retro-commissioning

   _____ Finding and screening commissioning providers

   _____ Managing the retro-commissioning process (e.g., developing specifications)

   _____ Obtaining funds to implement retro-commissioning findings

Those are all the questions I have for you today. Thank you for your help.

APPENDIX C

Survey Respondents

Washington		
1	Manager of Facilities Planning, Programming, & Fiscal	Washington Dept. of Transportation
2	Director of Facilities	Pierce County, Washington
3	Director of Facilities Planning & Construction Administration	Snohomish County, Washington
4	Director of Capital Planning & Development	Washington State University
5	University Architect	E. Washington University
6	Director of Facilities	Federal Way School District, WA
Oregon		
1	Facilities Manager	Washington County, Oregon
2	Maintenance Manager	Redmond School District, Oregon
3	Physical Plant Director	Southern Oregon University
4	Director & Architect, University Planning	University of Oregon
5	Facilities Manager	Oregon Department of Transportation
6	Facilities Manager	Oregon Youth Authority
7	Facilities Planner & Maintenance Supervisor	Portland Community College
Montana		
1	Facilities Manager & Public Works Director	City of Missoula, Montana
2	Director of Community Facilities	City of Helena, Montana
3	Building Maintenance Supervisor	Cascade County, Montana
4	Facilities Manager	University of Montana, Western
5	Buildings Superintendent	Libby Public Schools, Montana
6	Facilities Manager	Montana State Univ
Idaho		
1	Project Manager	Department of Public Works, Idaho
2	Facilities Manager	Idaho Department of Transportation
3	Assistant Superintendent	School District 91, Idaho
4	Superintendent	Marsing School District, Idaho
5	Building Inspector	City of Carey, Idaho
6	Operations Manager	Ada County, Idaho
7	Maintenance Supervisor	Melba School District, Idaho
8	Facilities Coordinator	Department of Administration, Idaho
9	Bureau Chief	ID Department of Health and Welfare
10	Maintenance Supervisor	Twin Falls County, Idaho
11	Facilities Maintenance Supervisor	Boise Schools, Idaho