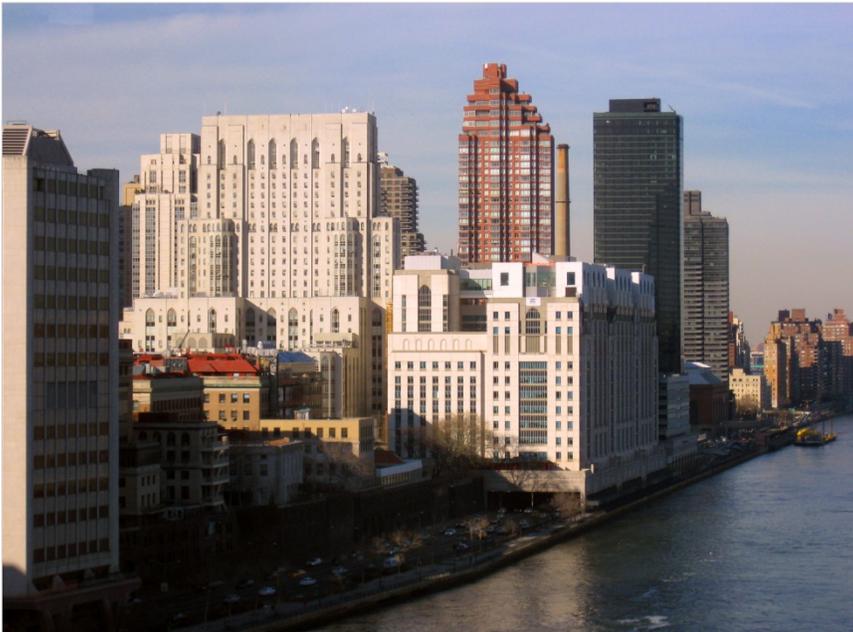


Building Commissioning Survey: Portfolio Owner Practices and Perceptions



| Emory University



| New York Presbyterian Hospital

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Introduction

Managing a large multi-building portfolio creates many challenges for Owners and their facility management professionals. Buildings, and even whole campuses, may be located across a wide geographic footprint. Buildings may vary significantly in age, design, condition and function, often with limited financial and human resources. Creating and sustaining a comprehensive commissioning program in this environment is challenging and complex. It involves balancing priorities, trade-offs, and navigating procurement and contracting issues that don't exist for single-building projects.

In Spring 2014, the Building Commissioning Association (BCA) in cooperation with several North American organizations, surveyed Owners and project decision-making managers of large property portfolios ("Owners") of higher education, hospital and government facilities. The purpose of this anonymous survey was to discover how commissioning is carried out in multi-facility, sometimes multi-site portfolios, and the challenges that Owners and managers experience in doing so.

The BCA's immediate Past President, Mark Miller, BCA Executive Director Liz Fischer, and Tom Ertsgaard, PE, Facilities Engineer at Pennsylvania State University, identified Owner groups that would be appropriate audiences for this survey and analysis. Two facilities Owner groups – APPA (formerly Association of Physical Plant Administrators, now also referred to as the Association of Higher Education Facilities Officers) and COAA (Construction Owners Association of America) agreed to participate and help identify Owner/decision-making parties within each portfolio. APPA and COAA worked with the BCA to customize questions directed at their particular Owner audiences while keeping the survey brief enough to generate complete responses.

Executive Summary

This commissioning industry paper documents and analyzes the results of a portfolio Owner survey in terms of how, why, and when Owners do and do not commission building projects. It describes the drivers, needs and perceptions of commissioning by Owners. The intended outcome of the survey was to share findings that help Owners understand the challenges, complexities and ultimate advantages of organizing a commissioning program that supports teamwork and building performance within their portfolios.

Overall findings indicate that portfolio commissioning is considered a quality assurance-driven process led mostly by Project Managers employed by the portfolio Owner. Most respondents were either Project Managers or Facilities Managers (or both) and often, from their written comments, seemed to feel "stuck in the middle" surrounded by financial decision-makers, project team members and contractors, third party commissioning providers (CxPs) and operations staff – with a mandate to deliver highly functioning buildings in spite of numerous challenges.

According to respondents, commissioning is still a challenge, considered among many executive-level Owners to be an "added cost" coupled with a requirement to justify commissioning as a capital budget line item. Many Owners do not integrate the commissioning process early in the project because they do not understand the Owner advocacy role of CxPs (either in-house or third-party). As a result, only one-third of respondents rated their portfolio commissioning programs a "5" on a scale of 1-5 (highest) for overall effectiveness in providing better working buildings.

All survey respondents indicated they face challenges in commissioning portfolio projects – some avoidable, some surmountable, and a few over which they have no control. The results are divided among (1) Owners' internal commissioning program challenges; (2) Quality of third party CxPs; and (3) Project team commissioning challenges.

Owners' Internal Commissioning Program Challenges

- Authority (or lack) for timely project decision-making
- Doing more with fewer staff
- Hands tied due to inadequate funding
- Skeptical attitude toward the value of third-party CxPs
- Finance managers and operations staff question the value of commissioning
- Less management support for existing building commissioning than new construction
- Trying to do "smaller" commissioning with internal staff

Quality of Third Party Commissioning Providers

- Lack of comprehensive and timely commissioning
- Inconsistent skills, experience and outcomes
- Lack of accountability for commissioning performance

Project Team Commissioning Challenges

- Whole team communication planning, implementation and participation
- Schedule completion and sequencing synched with construction team
- Compressed schedule at end of construction
- Fully engaged project team members from predesign through delivery
- Occupancy prior to completion of commissioning
- Increased project/building complexity with resulting increase in time to validate systems performance and educate operations staff
- Post-occupancy commissioning and performance optimization

Demographics

Altogether 189 portfolio Owners, with facilities across North America ranging from less than 25 to hundreds of buildings, with 78% of portfolios over 1 million square feet – one portfolio comprised more than 16 million square feet – responded to the survey.

Respondents' Roles

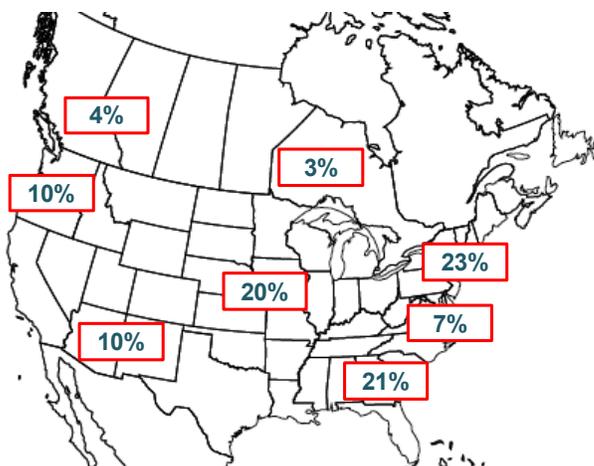
Within portfolio Ownership, many individuals are responsible for capital projects. Those who answered the survey were not always those directly in charge of all phases of capital project planning, design and construction. Most were executive-level decision makers and director-level facility managers or project/facility managers." Respondents included individuals self-described as:

- 53 Executive Officers and Director-Level Facilities & A/E/C Managers
- 23 Project/Facilities Managers
- 16 Commissioning-specific Roles
- 10 Owner/Owner's Reps
- 7 Energy Managers
- 7 Campus Engineers
- 6 "Oversight"
- 6 O&M Managers
- 5 Architects
- 4 Construction Managers/General Contractors
- 3 Planners

In addition, one building automation team member, a design and construction manager, along with several supervisors and capital project administrators and reviewers completed the survey.

Geographic Regions Covered

The response distribution corresponds reasonably well with general population intensity in the responding regions, with the highest density in the US Midwest and Eastern Seaboard.



Building Portfolio Descriptions:

Number of Buildings:

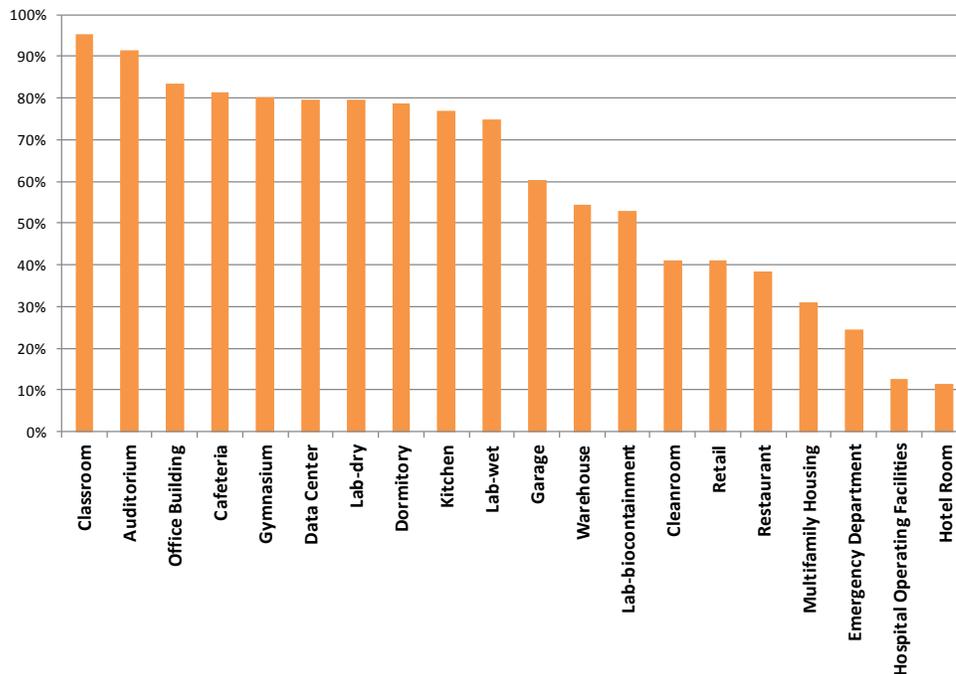
- <25 buildings = 16%
- 25-49 buildings = 23%
- 50-100 buildings = 26%
- 101-299 buildings 25%
- 300-700 buildings = 10%
- 1 portfolio = more than 1,000 buildings

Portfolio Size (total square feet of occupied and unoccupied space):

- >1 million SF = 78% of Portfolios
- Some as large as 16 million SF
- Some single campus, some multi-campus

SpaceTypes Represented:

The following graph shows the percentage of portfolios comprising specific space types, ranging from Classroom (95%) to Hotel Rooms (11%). Most portfolios contain specialty areas such as data centers and wet, dry and bio-containment labs. More than 40% of portfolios contain cleanrooms, about 25% have an Emergency Department, and 12% have hospital operating facilities.



Summary of Findings

According to survey responses, not everyone includes commissioning in capital projects. Two percent of respondents skipped the question, “Do you include commissioning in your capital projects,” and 13% of respondents answered “no” to that question. Of the 87% who answered yes, all include new construction commissioning (NCCx) in their programs; nearly half (49%) also include existing building commissioning (EBCx), and 12% also include post-occupancy monitoring-based commissioning (MBCx).

When Does Commissioning Begin?

Many respondents (27%) indicated that, for new construction, commissioning starts in planning or pre-design. The BCA Best Practices indicate that this is the best phase to start to guarantee the best return on investment. A total of 45% said commissioning begins in the design phase, although it is not clear whether that occurs during basis of design (BOD), schematic design (SD), design development (DD), or upon completion of construction documents (CD). About 25% are only starting commissioning during construction, which leads to an assumption that practices do not include commissioning milestones that could prevent cost or schedule overruns *before* construction begins. The remaining 3% did not specify when commissioning begins.

Oversight

Oversight of commissioning is managed differently within each portfolio. In response to the question, “Who on your staff oversees commissioning in capital projects,” it is clear that there is no common language here in describing management of the process, but oversight breaks down more or less as follows:

Project Manager	57%
CxP	16%
Staff Engineers	14%
Director of Facilities	7%
Construction Manager or General Contractor	6%

Commissioning Drivers – Carrots and Sticks

Since its inception decades ago, building commissioning has been a practice driven by the effort to improve energy efficiency and voluntary programs like LEED (carrots). More recently codes, standards and guidelines have become involved (sticks). While slow in coming, the reasons for commissioning are increasingly motivated by Owners’ recognition of its short- and long-term benefits, perhaps especially for larger portfolios. Facilities managers and operations personnel understand that overall quality assurance is the primary driver for well-delivered, systematically managed building operations. Responses show the following in descending order of importance:

Quality Assurance	85%
Saving Energy	73%
Green Rating System (Compliance or Eligibility)	45%
Occupant Comfort	36%
Company/Organization Policy	13%
Operations & Maintenance (O&M specifically)	4%

It is likely that most respondents intended O&M to be included under the heading “Quality Assurance,” but 4% called it out separately with comments such as, “O&M Efficiency,” “Reduced staff hours spent on reactive maintenance and comfort issues,” and “controlled maintenance.”

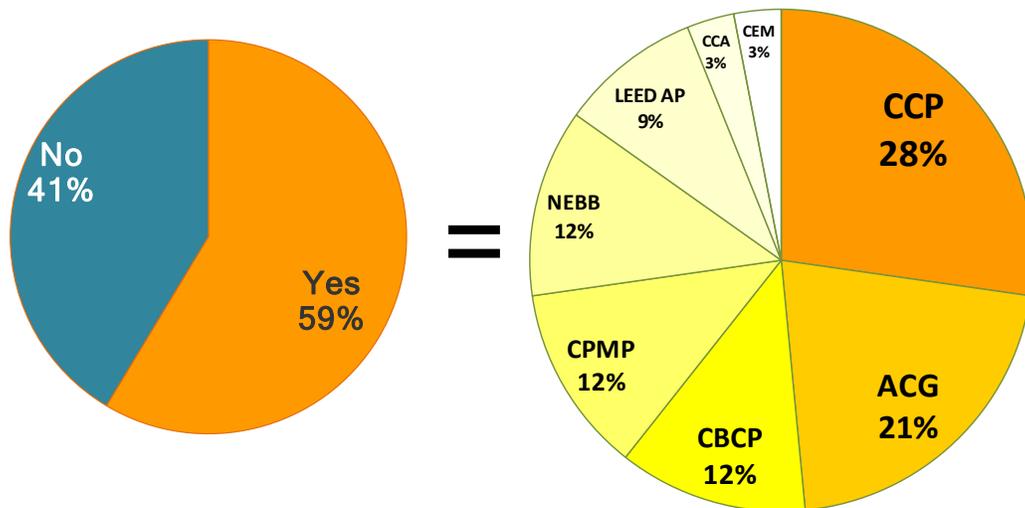
Qualifying and Hiring Third Party Providers

In response to the question, “Do you hire independent third party Providers,” 83% said yes, and 17% said no.

More than half of the 17% that don’t hire third party Providers do represent that they use in-house staff for at least some commissioning work. About 13% do not specify how commissioning services are performed.

Portfolio Owners hire third party Providers in different ways. About 33% prequalify candidates, indicating that they are using a proposal (RFP) process about half the time and/or qualifications (RFQ) request process about one-third of the time.

When asked if respondents require certification of third party CxPs, 41% said no and 59% said yes, also indicating the certifications they prefer as shown in the chart below.



Other Owner requirements, besides proof of experience and skills, included building automation credentials and licensure as a registered professional engineer.

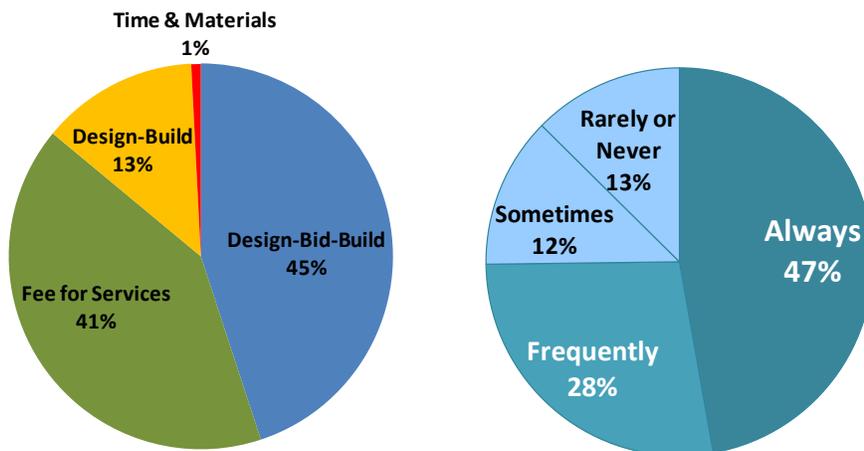
Third Party Contracting Methods

Most Owners hire third party Providers based on design-bid-build or fee-for-services contracts. In the former scenario, commissioning is often included as a fixed portion of the A/E design contract in order to begin the process early in the project. In a design-build project where the general contractor is usually in charge of everything from planning through delivery, more often than not commissioning is included in the bid and conducted as a report to the GC or CM. As shown in the chart below time-and-materials contracts are seldom used for commissioning, likely due to project budget constraints and the perception (or in some cases misperception) that commissioning will be integrated with the design and/or construction team.

Quality Process: The OPR

The single most important tool that a project team needs, whether using in-house or third-party commissioning, is a document known as the Owners Project Requirements, or “OPR.” Why? The OPR is a written document that forms a map, a tractable basis for meeting the Owner’s performance expectations. Participants in developing the OPR should include the commissioning lead, the Owner, design team, capital projects managers, facility users, operations personnel, and any others who should contribute to the performance outcome of the building. Ideally, the OPR should be developed during design programming, updated as necessary through planning and design, and used to ensure delivery during construction, so that the outcome is a building that will continue to work as intended.

The survey asked, “How often do you include written OPRs on a project?” The following pie chart shows that 25% of respondents say their projects do not include the up-front work of producing an OPR.



Written comments following this question included:

- Always on new LEED buildings (commissioning is a requirement)
- Fifty percent on building improvements with lab systems
- Included in our standard specs; we ask the A/E to include [commissioning]
- Currently developing a formal process
- We never include them early enough

LEED® “Enhanced Commissioning”

The survey asked, “If you are pursuing LEED, how often do you include LEED EA-3 (enhanced commissioning credits)?”

According to the US Green Building Council definition for acquiring LEED points through enhanced commissioning, Owners must first meet the criteria for fundamental commissioning and verification. The intent of enhanced commissioning is “to further support the design, construction, and eventual operation of a project that meets the Owner’s project requirements for energy, water, indoor environmental quality, and durability.”

In order to qualify for enhanced commissioning points, project teams are required to implement, or have in place a contract to implement, additional commissioning process activities related to energy, water, indoor environmental quality and durability. Documentation must include all enhanced commissioning tasks in the OPR and BOD. Monitoring-based commissioning (MBCx) will garner additional points. For further information, visit <http://www.usgbc.org/node/2613042?return=/credits>.

Twelve percent of total respondents skipped this question. Of those who responded, the answers were distributed as follows in descending order:

Always pursue LEED Enhanced Commissioning	45%
Not currently pursuing	27%
Sometimes pursue LEED Enhanced Commissioning	22%
Never pursue LEED Enhanced Commissioning	7%

“Not pursuing” and “never” may be construed as similar in intent, indicating just over one-third of respondents did not (at the time of the survey) pursue LEED enhanced commissioning credits.

Portfolio Program Rating

Respondents were asked, “On a scale of 1-5 (5 highest), how would you rate the results of your commissioning program’s overall effectiveness in providing better working buildings?”

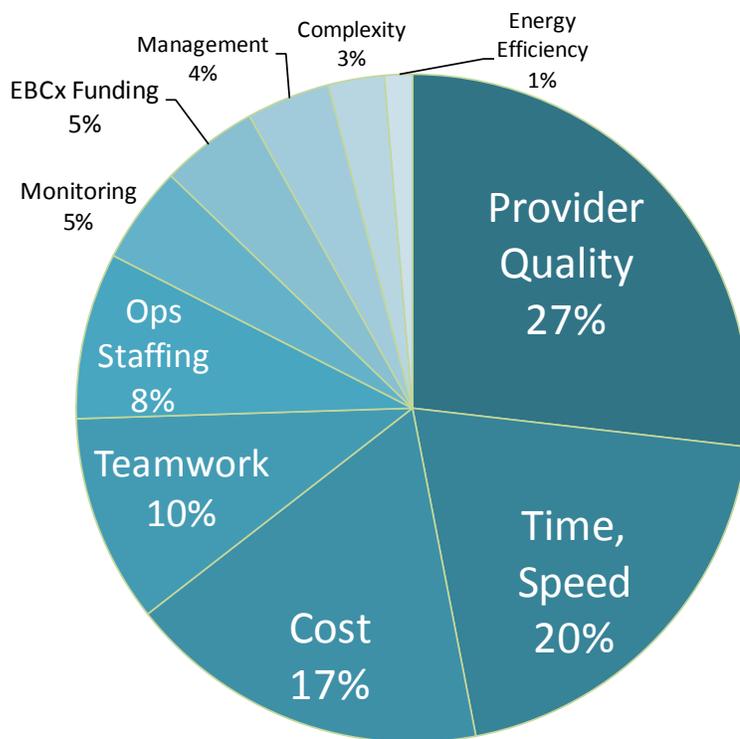
Approximately 90% of respondents answered this question. The aggregate overall rating was 3.7 out of 5, with the majority (60%) rating their programs either a 4 or a 5. The remainder is a concerning 40% of respondents who rated their programs 1, 2 or 3. Thus, over one-third believe that their portfolio commissioning program is less than effective in providing the working buildings they expect. Here are the ratings:

5 = 33% (highest)
4 = 27%
3 = 20%
2 = 13%
1 = 7% (lowest)

Greatest Challenges

As indicated by the commissioning program performance ratings, there is work to be done to up-level the effectiveness, or performance outcome, of buildings in these portfolios. Owners were asked about the greatest challenges they face in commissioning. The survey shows that internal issues within their own organizations and CxP quality experiences lead the perceived challenges. Some issues were placed squarely on Provider quality – thoroughness, consistency, responsiveness and accountability, as well as experience and understanding of specific building types.

Respondents’ most challenging commissioning issues were distributed as follows:



The table below identifies the main challenges listed by Owners in the survey, shown by percent of comments, the entity accountable for the challenge, and descriptions of responses, in order from most to least comments in each category. The table is followed by a breakout of relevant comments from respondents in each category.

Challenge	% Comments	Description
Provider Quality	27%	Provider thoroughness, skill, experience, responsiveness, accountability, consistency/ standardization, understanding of building types
Project Time/Schedule	20%	Early engagement, time available, speed to complete, proper scheduling, milestone identification
Project Cost	17%	Capital asset budget and expense, project cost, escalation, value engineering
Project Communication & Teamwork	10%	Communication, coordination, integration, team input & cooperation, contractor engagement, volume of work prohibits adequate participation
Operations Staffing	8%	Internal engagement, not enough staffing for commissioning & operations personnel
Monitoring	5%	Post-occupancy building automation and energy management system monitoring, monitoring-based commissioning (MBCx)
EBCx Funding	5%	Funding available to retrocommission poorly performing buildings and systems
Management	4%	Management buy-in, justification, viewpoint, education
Project & Building Complexity	3%	Project management, complex systems and controls, scheduling, design
Energy Use	1%	Energy efficiency "first" attitude overrides other commissioning concerns

As shown in the table above, respondents listed a multitude of commissioning-related challenges and concerns, both in single projects and across their entire portfolios. The following section is categorized according to each of the challenges listed in the table. The section describes, often in their own words, the problems that respondents face.

Owner Challenges

Observation. There remains a perception among many Owners or portfolio financial decision-makers that commissioning is an “additional” cost. Respondents representing Owners indicate they are consistently understaffed, and commissioning is often not supported by management. Existing building projects that include commissioning are more difficult to plan and fund than new construction. Energy efficiency is important and is likely addressed systematically as a priority. Although it is still high on the list of drivers for commissioning, energy efficiency no longer appears to be considered the primary challenge within the portfolio setting.

Opportunities. Commissioning makes buildings less costly in the long run – during design and construction and also over the course of time. Owner education is key to understanding the costs and impacts associated with commissioning buildings, especially within a complex portfolio of controls-integrated facilities. Those who recognize the benefits of commissioning and understand how to hire the right commissioning qualifications for their project are most likely to realize a higher return on their capital investment, both initially and when occupied. Educational opportunities for Owners (including capital project decision-makers), facility managers and operations personnel, demonstrating the value of commissioning in terms of portfolio management, should be made available. Educated Owners understand the positive pre- and post-occupancy impact of commissioning in terms of project budget and schedule mitigation and better health, safety, energy and comfort in facilities that are properly commissioned for long term performance, either on a campus basis or regionally.

In their own words, following are examples of respondents’ comments regarding specific owner challenges:

Project Cost

- Fitting the commissioning expense into tight capital budgets.
- Projects get budgeted years ahead of funding and then built years later yet, so escalation consumes all of the "nice to have" opportunities.
- While commissioning has identified code issues as well as design issues resulting in the contractor making changes before the job is 100% complete, it is not always affordable and is cut from some projects.
- Funds to be able to complete the process.
- Justifying added costs to value of services.
- Building to the fund not funding the build.
- Value engineering (not directly related to Commissioning, but can reduce intended operational quality).
- Having enough budget to implement recommendations of retrocommissioning on existing buildings.
- Up- front costs and their effects on ever decreasing budgets.
- Finding recurring funds for retro-commissioning
- Low bid process.
- Budgeting for additional cost.
- Justifying price for value.

Operations Staffing

- Too many projects, too little staff.
- Ongoing commissioning, recommissioning, and retrocommissioning buildings on campus utilizing operations personnel.
- Allocating time and resources during active times.
- Getting operations and maintenance staff to see the value in retro commissioning.
- Having staff available to commission smaller projects - we are striving to provide commissioning of all mechanical installation, as we see the benefit of program and have even been trying to retrocommission buildings prior to the initiation of the program.

EBCx Funding

- Older buildings and cost to bring them up to performance standards and efficiency.
- Recommissioning and repairing existing buildings.
- Adequate funding for retrocommissioning.
- Having a large enough budget to implement the recommendations of retrocommissioning on existing buildings.
- On-going commissioning, re-commissioning, and retro-commissioning buildings on campus utilizing operations personnel.
- Getting operations and maintenance staff to see the value in retrocommissioning.
- Planning and funding periodic recommissioning of capital assets.

Management

- CxP not given enough authority to execute work at all times. Must pick and choose battles of where to enforce the standards.
- Lack of appreciation of executive management on the seriousness of this activity. They do not understand the process and why we insist on certain things from contractors and because they get involved in the process they mess it up.
- How much commissioning do we do? Always a challenge to get this into the budget and not all understand the need. It is still hard for others to understand what this does for a project. Is it real or not is the big question.
- Getting senior staff to understand the value/return on investment that commissioning offers.
- Justifying cost to administration.
- Lack of financial resources to fund commissioning and also lack of support from the administration to support commissioning efforts. They don't see any value in it.
- Getting the decision makers to buy in to the need to do it.
- Justifying the cost of commissioning to stakeholders/upper management.

Energy Use

- Energy savings and system optimization
- Commissioning to energy efficient specs is often overruled by comfort requirements.

Provider Quality Challenges

Observation. The challenges described below are real, and frustrating to Owners. The responses also reveal that an “us and them,” finger-pointing attitude still exists among Owners’ employees in relation to third party CxPs.

Opportunities. One of the most useful ways of reducing Owners’ quality challenges is to learn how to analyze, qualify and hire CxPs for the job at hand. Today’s building technologies and increasingly complex building systems (not to mention portfolio controls integration) can require specialization in certain aspects of commissioning. Owners should engage commissioning early in the project to define Owner’s project requirements (OPR) that can be integrated with the basis of design (BOD), and where design review will help to identify problems that could arise during or after construction.

Owners should also know that, although the process itself is relatively consistent, commissioning is not a generic service. Issuing a universal RFP for commissioning services or relying on a design or construction firm to provide commissioning are not necessarily in the best interest of a portfolio Owner. Taking the opportunity to interview Providers and assess their qualifications is important for conveying the scope of commissioning in relation to the capabilities of the Provider. Also, it should be noted that CxPs are responsible for the functional testing process, identifying problems to ensure that they are rectified in accordance with the Owner’s intent. They are not responsible for doing the work of construction subcontractors. This is especially true in new construction projects where warranties could be voided.

In their own words, following are examples of respondents’ comments regarding quality of work:

Thoroughness

- Thoroughness of overall efforts across all phases of project life cycle on consistent basis with early involvement of staff for training a close second.
- Focus on what is important rather than prescribed paperwork.
- Too quick and does not always find issues.
- Thoroughness of CxP and ability to control post commissioning changes.
- Getting contractors (CxPs) to be thorough. One reason we do it in house most of the time.
- Quality and qualified CxPs that do a complete job.
- Having a thorough design & planning process.
- In this state, "commissioning" is a term that refers to a process that tests major systems and components to see whether or not they function at all. There is little if any effort to analyze system integration or calculate energy efficiency.
- Lack of good quality testing in off season (if commissioning is in summer - we tend to have issues in the summer)
- We hire third party CxPs and TAB firms and they sometimes do not compare final results with the TAB firm lagging behind and making changes not captured in Commissioning report.
- More seasoned CxPs falling into a rut of standardizing their services on pretty forms, but not really digging into the design, sequences, etc. to provide strong QC.

Skill and experience

- Most CxPs don't have staff that comes from a HVAC controls company and do not have knowledge on any programming codes. A lot of CxPs don't have staff that comes from the building operations side either; hence, don't have building operating experience.
- Lack of enhanced commissioning experience.
- Getting local contractors and vendors who are unfamiliar with LEED Enhanced Commissioning requirements up the learning curve.
- The number of non-qualified technical commissioning firms that have grown due to the LEED process. The LEED commissioning process has significantly impacted the industry in a negative way to our needs.
- Expertise of companies dealing with old buildings that have old systems with poor or no documentation.

Responsiveness

- Getting controls contractors to complete installation and programming to meet the intent of sequences of operation (this is a construction management issue in addition to Commissioning).
- Responsiveness by the consultant (CxP).

Accountability

- Quality of the CxPs is poor and there is no liability on their part. So most of the Providers just go through the motions without really addressing the issues.
- Having all deficient issues addressed through Project Manager to the satisfaction of the Owner based on the specifications.
- CxP promised to deliver and does not deliver a product that meets Owners' project requirements.

Consistency and standardization

- Inconsistent outcomes from commissioning entities.
- Variations in quality of CxPs.
- Having consistent requirements.
- Commissioning is often carried out on smaller parts of systems as construction develops. An overall integrated commissioning of all systems is seldom completed. Another challenge is that the facilities are not in use during commissioning so the system tests are not carried out under true operating conditions.
- Not all Providers perform at the same level or have expertise level comparable.

Project Team Challenges

Observation. One of the most frequently noted challenges for project teams occurs during construction. Because capital projects are driven by both finite budgets and completion/occupancy schedules, and because there can be substantial financial penalties for exceeding them, properly sequenced commissioning often is secondary to delivery. Communication among all project players at the earliest stages and throughout the project can be fragmented and non-inclusive, leading to misunderstandings, time management problems and disagreement among project team members. A big challenge that increasingly requires a fully engaged team is the increasing focus on performance – not only at the point of turnover, but also in the occupied state once the project is completed. Project team challenges were identified in four main areas: time/schedule, communication, project outcome and building complexity.

Opportunities. When listing project team challenges, respondents identified MEP design professionals, facility managers, operations staff, contractors and subcontractors. One of the roles of the CxP (not listed as a project team member by respondents) is to document issues that can affect the building outcome throughout the project process, which results in more cross-communication among the project team members. The two most-often identified team issues – time/schedule and communication – are the most pressing, and are also the most important issues to address early in the project in order to create a project team focused on quality expectations and the intended outcome. Although project time/schedule (hence, also cost) was listed by respondents more than any other team challenge, early and frequent communication can reduce some schedule problems, and will reduce the chances of minimizing or delaying the commissioning process during construction. CxPs are in a good position to provide the communication link across project disciplines due to the relationships they must have with team members while conducting their work.

Full project team engagement and teamwork provide the opportunity for all project members to both teach and learn. It is useful to document project team members' agreement and commitment to schedule and milestones at the beginning. When LEED certification is a goal (and architects often provide LEED consulting services), Providers should be LEED-Accredited and should work with architects early on to be in lock-step toward achieving that goal. Integrating a CxP's document, the Owner's Project Requirements (OPR) with the architect's Basis of Design can help ensure the inclusion of other project members (MEP, contractors, operations personnel) in a timely way.

In their own words, following are examples of respondents' comments regarding project team challenges:

Project Time/Schedule

- Allocating the time to complete a thorough commissioning process.
- Cost and time for the commissions.
- Cost and vast amount of SF - over 7 million gsf.
- Getting the CxP on board prior to issuance of general contractor notice to proceed.
- Getting this into the design process and having someone on board at that point.
- Dealing with the idea that we can do ALL of these with in-house labor as an extra duty.
- Getting the commissioning and modifications completed within the project time frame.
- Having adequate time to complete commissioning before the buildings become occupied.
- Time needed at the end of the project to assure Commissioning is thorough and complete.
- Getting project managers to initiate commissioning process during pre-design.
- Time to perform the task - Managing expectation across all stakeholders; measuring effectiveness.
- Sequence and time involved.

- Compression at the end of the project reduces time for commissioning. Project is granted occupancy before commissioning is complete. Control systems are the most difficult to commission because completion is not done until well into warranty phase.
- Having the subcontractor fully engaged with the process. Getting equipment installed and operational early enough to allow for all of the pretesting to be verified prior to needing to put the equipment into service.
- Management of the sheer volume of work.
- Completing all of the issues on the log is problematic, given issues that come up late in the construction process and time is limited.
- Completing the project on time to allow the CxP the correct amount of time to provide proper commissioning. Also there are continual struggles with getting the contractors to "buy-in" to the commissioning process.
- Completing the Commissioning process by substantial completion of projects (not including alternate season commissioning). We feel this is critical so that when occupants move into the space the systems are running correctly.

Communication & Teamwork Challenges

General Communication

- Cooperation from the MEP design professionals and contractors with the CxP.
- Coordination of everyone's efforts.
- Educating project managers of its need and importance early in the project.
- Buy-in from project teams during the early stages of a project and across the internal facilities organization. This has improved over time; our department was created in late 2007 within an organization that existed for many years prior to our inception (considerable shift in thinking / methods / ideas).
- Taking full advantage of the Commissioning documentation, operational learning opportunity and improving operations using training from Commissioning

Operations

A full 92% of respondents said they involve operations staff in the commissioning process, although many also identified the problem of getting staff to assist and get more involved in commissioning. It is likely that operations staff is involved in post-occupancy commissioning practices even if they are not engaged earlier with the project team during design and construction.

- Getting operations staff involvement is sometimes difficult.
- Getting meaningful participation from/by the O&M entity.

Contractors and Subcontractors

- Getting contractors to comply/resolve problems
- Getting the general contractor and the CxP to incorporate commissioning milestones and events into the master construction schedule.
- Making sure the contractor allows time for commissioning in the schedule and doesn't cut into it when running late at the end.
- Subcontractor integration management.
- Getting the CxP and contractor to work with each other.
- Getting the engineers on site more often.

Project Outcome – Performance and Monitoring

In their own words, following are examples of respondents' comments regarding performance challenges:

More than half (59%) of responding Owners have campus-wide building automation systems (BAS) across their portfolio. The 41% of portfolios that are not fully covered listed the percentage of their campus(s) that are covered by the BAS, as follows:

More than 90% of campus covered by BAS	27%
75-90% of campus	27%
51-75% of campus	26%
26-50% of campus	10%
1-25% of campus	6%
No BAS	4%

As one respondent said, “the typical commissioning program verifies performance to design, but does not do a good job of optimizing performance to the occupied state. For existing buildings, there are a lot of factors leading to performance degradation, including re-purposing, operator error, insufficient preventative maintenance, etc.”

Several individuals listed the lack of post-occupancy and post-construction monitoring as an issue. About 14% of respondents indicated they do conduct monitoring-based commissioning (ongoing performance tracking and optimization).

Project/Building Complexity Challenges

In their own words, following are examples of respondents' comments regarding project complexity challenges:

- Complexity of building systems. Completed only 3 projects to date using varying process.
- Due to such a wide variety of HVAC systems we are hard pressed to find commissioning specifications for each different type of system.
- Buildings are so complex that it is difficult to review all of the systems effectively.

Conclusions and Recommendations

Based on survey responses, most Owners do desire qualified, experienced third party CxPs in spite of continuing confusion – and skepticism – regarding the value of commissioning and its role, responsibility and depth of involvement in their building program. There appears to be a significant shortage of management support and funding for comprehensive commissioning in portfolio projects, especially for existing building system retrofits.

Performance expectations from Providers are not always met. Respondents often blamed Providers for being less experienced, accountable, and available than anticipated. It is also clear that Owners are not calibrating expectations with Providers at the outset of projects, possibly because Providers are not included early enough or because Owners make incorrect assumptions about the extent of the Provider's role in their project.

Collaborative project team engagement, management and continuous communication from project initiation through occupancy, which helps to ensure building performance, does occur but does not appear to be the portfolio owner's conventional approach to commissioning. As a result, the knowledge, time and scheduling necessary to prepare and conduct functional testing on complex building systems is not built into the program. The outcome, in terms of ultimate building performance, may be less than desirable.

Portfolio Owners know what they want. They are often also at the mercy of public or designated funding budgets and pressing "use-it-or-lose-it" schedules. CxPs say that educating Owners about commissioning is one of the most important solutions for reducing or avoiding "disconnects" that may occur between them. Here are five training topics that would help Owners and their facility staff to maximize the quality and benefits of the commissioning investment.

Portfolio Owner Education

1. How to conduct a qualifications-based selection process
2. What the OPR will do to facilitate on-time, on-budget, decreased-risk, team-based project delivery
3. Why a comprehensive, whole-building commissioning approach to integrated systems and energy efficiency increases both initial and long term project success
4. Understanding what commissioning *is* – and *is not*
5. What certification means and how to determine its value for Owners

Tools and Methods

It can be concluded from this survey that Owners need tools and methods to incorporate commissioning as a value proposition in portfolio projects. Here are five ways to present and integrate commissioning within the portfolio program:

1. Show capital planning committees how commissioning is not an “added cost,” but represents a long term return on investment (see BCA Checklist article December 2013, Healthcare Commissioning: An Owner’s Perspective, http://www.bcx.org/wp-content/uploads/2013/12/bca_checklist_4thqtr2014.pdf).
2. Develop specific, written commissioning milestones that result in a project team agreement signed by the responsible owner, facility manager, design and construction members.
3. Create a project team communication plan starting with A/E programming and ending with building acceptance.
4. Engage CxPs early enough to include the OPR with building performance criteria, and mitigate the need for unplanned design revisions or construction change orders.
5. Qualify and build relationships with third party Providers before you need them.

Planning and Implementation

Finally, here are some recommendations for Owners and Providers to plan and implement the project process and achieve building performance together:

1. Solicit/select/win work based on relevant and specific qualifications
2. Engage Provider in time to work with design team
3. Make time to create the Owner’s Project Requirements together
4. Define clear expectations for all participants in the project
5. Ensure project managers support commissioning milestones while managing construction
6. Document integrated project team commitments
7. Train operations staff well
8. Verify operation through ongoing or periodic monitoring (MBCx) and occupant inquiries