



“RIGHT FROM THE START – COMMISSIONING FOR HIGH PERFORMING BUILDINGS”

April 21, 2010

Following are answers to questions from the viewing audience that were not answered during the webcast due to time constraints:

- 1. What portion of owners who go through the Cx process also regularly check ongoing performance (annual, quarterly, etc.)?**

To restate the question, “How many owners/buildings using the new building Cx process subsequently institute an “ongoing commissioning” process for the same building? There is little data on this question one way or the other but the most likely answer is very few. Some perspective on this issue could be obtained by doing a Google Search for “re-commissioning” and checking the webcast reference page for links to case studies. Some of these will turn up re-commissioning programs, but they are scarce. Texas A&M has the most famous continuous re-commissioning program. In any event, based on the scarcity of ongoing Cx, few owners follow new building Cx with a program of continuous re-commissioning.

Ron Wilkinson

- 2. LEED 2009 v3 indicates that commissioning does not have to be performed by an independent 3rd party, per se. That is, the Reference Guide states that Cx can be done by a participating company, but not the same personnel. It also has extremely deficient requirements for substantiating experience. This to me clearly violates the ASHRAE Guidelines. What do you say? I believe the subsequent failures in commissioning will reflect on the industry, thereby diminishing the perceived efficacy.**

Since Cx is still in the developmental phase there are many opinions regarding independence, experience and qualifications. Members of the design team know the design best and so can do the Cx for less. Installing contractors can do the Cx for less for similar reasons. Unfortunately, both designers and contractors lack impartiality. Some owners demand a completely independent CxA but then do not bring the CxA on board until half way through construction because they think that saves money. The LEED program is based on voluntary compliance. There is a lot of trust involved and therefore considerable latitude in many of the requirements. However, there is not substantial evidence showing that LEED Cx is less effective, per dollar spent, than Cx performed under other programs and according to other requirements.

Ron Wilkinson

3. How is it that ASHRAE, who focuses on HVAC & R, able to herd other disciplines like electrical, carpentry, steelworkers, etc.? Why do they think HVAC & R can “oversee” their work?

The question appears to ask how an HVAC engineer/technician can check and confirm the work of other diverse disciplines. The first answer is that the commissioning authority (CxA) is not necessarily an HVAC engineer, or a member of ASHRAE. In fact, they may not be a degreed or licensed engineer at all. Nonetheless, the question is still valid. For example, if a non-licensed electrician happens to be the CxA how can they check the work of refrigeration mechanics? The answer is that Cx is a process based on documented tests. The results will testify to the correct operation of the system no matter who conducts the testing. Furthermore, the CxA is bound by ethics not to practice outside of his/her expertise; they are supposed to sub-contract to qualified subs when required.

Ron Wilkinson

4. In reference to professional design, if the state does not require commissioning, what is the incentive for doing more work for less fee?

This question appears to imply that commissioning (Cx) is being added to a design contract without any increase in the design engineer’s fee. There is no incentive for the engineer to accept such a contract nor is there any legal precedent for them to do so. Cx might be required by state or local law, by a utility providing incentives, by a college or university policy or by any number of other “authorities having jurisdiction.” The best result is that the Cx services are provided by a firm or person outside of the design team who has a separate contract directly with the owner and is fairly compensated completely apart from the design team.

Ron Wilkinson

5. How can the owner be protected if it is not feasible to hire the Cx and the Cx is contracted through the GC?

If the CxA is an independent third party provider contracted through the GC, the owner should insist on direct reporting lines to the owner with copies to the GC. This provides a measure of assurance that the owner is getting the direct information. The GC contracted CxA is a possible violation of LEED requirements—if it is a LEED job ask the LEED consultant for a judgment call and try to get the contractual chain of command changed. If it cannot be changed, the owner must apply more diligence and attention to the Cx process. This might include witnessing tests and verifying visual reports on a spot-check basis to confirm the CxA is doing the right thing.

Ron Wilkinson

6. On many LEED projects, the CxA is pressed to “pass” a project and sign the template as the emphasis is placed on getting the project certified as opposed to fulfilling the requirements as stipulated by LEED. As there is no accountability, how do we avoid the diminishing of the commissioning process resulting from Cx firms signing off when in fact they should not? Where is the accountability?

On one level, every CxA is responsible to a code of ethics about the quality of work they provide. As in any other profession, some observe this more than others do. Let the buyer beware. Also, it should be noted that LEED is primarily a voluntary compliance program with occasional auditing. There is no more guarantee that Cx is done “correctly” than that bike racks and showers will be used or even available after the LEED plaque is mounted on the wall. However, clients that want both quality and certification know the firms to use from experience.

Ron Wilkinson

7. In the case of hospital building, is it the responsibility of the commissioning personnel to be responsible for the type of machines in the operating theatre?

If the “type of machines” refers to medical apparatus the answer is no. If the reference is to the type of HVAC equipment or electrical switchgear used for the operating theatre, the answer is that equipment types are determined in the course of the Owner’s Project Requirement’s charrette. So HVAC and switchgear equipment is in the scope of work to be confirmed by the CxA but decisions as to equipment types were made early in design.

Ron Wilkinson

8. What licenses are required to be a Cx agent?

There are currently no licenses for CxAs in the USA. There are certifications offered by ASHRAE, the University of Wisconsin, the BCA, AEE and various others. Those organizations were referenced in the webcast and websites are provided in the reference web page. If certifications are required by a specific organization for certain types of work, those requirements are on a case-by-case basis.

Ron Wilkinson

9. Clarification: CxA is not liable for the performance nor installation thereof, only the validation of what has occurred?

It is unclear if this is a question or a statement. Although there are no court cases that have received national exposure most CxAs agree that they will be in court right along with the design team and contractors if serious malfunctions occur. If malfunctions occur in direct conflict with documentation signed off by the CxA it would seem logical they could be held liable and subject to damages. Whether this is referred to as “errors and omissions” may be beside the point. Many CxAs have E&O insurance.

Ron Wilkinson

10. If commissioners were to have responsibility for outcome, what is the responsibility for the architect and engineer?

The responsibility of the architect and engineer (the “design team”) is to size, layout and specify equipment that will provide the service the owner documented in the Owner’s Project Requirements (OPR). The primary scope of the CxA is to confirm everyone understands the OPR and test the equipment and systems in the installed condition to prove they function as required. Commissioning does not relieve the design team of any of their responsibilities; it is simply the final step in confirming correct operation. If the systems do not function as planned, it is the design team’s responsibility to re-design them as required.

Ron Wilkinson

11. Is there a standard for commissioning agent certification? What are the certification requirements?

There are about six certifications available at this time (information is available on the resource web page). This has created a confusing situation that the various organizations are in the process of sorting out, slowly. Some certifications require only classroom instruction and some require instruction plus experience. Certification is a good start but continuing education, published articles and lectures and experience should count as well.

Ron Wilkinson

12. What ethical responsibility do PE's have in regard to Cx? How do they not step on the engineer of record's toes?

This answer is similar to question (10) above. The responsibility of the architect and engineer (the "design team") is to size, layout and specify equipment. The commissioning authority, who may or may not be a PE, checks the design plans and specs for completeness and clarity. But if there is a disagreement over the design, the EoR prevails. The role of the CxA is advisory only and the authority over, and responsibility for, the design rests with the EoR. If, after construction, the systems do not function as planned, it is the design team's responsibility to re-design them as required.

Ron Wilkinson

13. Does commissioning really save construction cost – or is it just another checkpoint for the system?

Cx does save construction cost by reducing change orders. Case studies listed on the web reference page quantify this. Change orders are reduced as a result of the commissioning authority (CxA) checking the plans and clarifying control sequences. In many cases change orders are the result of unclear and incomplete plans and specs and plan checking improves that situation. In other cases the CxA can assist in reducing the cost of fixes required during construction by offering an exact diagnosis of the problem. Without instrumented testing, contractors of different trades might not know the most effective and least costly way to fix the problem.

Ron Wilkinson

14. I am all for commissioning. A bigger question is are the designers not responsible for delivering a properly functional building? An example was given about requirement of a DNA testing lab. Again, is this not the designer's responsibility to find out the requirements, and also the owner has the responsibility to tell the designer of their needs?

The answer is similar to both (10) and (12) above. The design team will always ask, and get, some of the requirements from the owner. They almost never get them all. Designers are responsible for delivering the building the owner wants, but they are human and they make mistakes. Aggravating this situation is the fact that equipment, especially microprocessor-controlled equipment, never functions exactly as the catalog describes it. There is no substitute for testing in the as-installed condition to make sure the systems actually function as the owner desires.

Ron Wilkinson

15. In regards to OPR, it seems that many times the architectural team has this type charrette with the entire building team long before the CxA is brought on board. It is often difficult to get that same group of people together again for another round of the same questions. How do you suggest getting this type of discussion "off the ground?"

The best answer is to bring the CxA on board early enough to be a part of the pre-design, "programming," phase. Many buildings are planned at very early stages based on function and square footage and the architect is chosen on that basis. The best approach is to hire the CxA at that time, before or immediately after the MEP engineers are chosen, well before any detailed design is considered. It is unlikely that the architect will ask pertinent and sufficiently detailed MEP questions to provide a road map for that part of the design.

Ron Wilkinson

16. Please comment on the risk to the design team when they participate in the process.

Based on past experience there is little or no additional risk to the design team as a result of a project employing commissioning. If the CxA checks the design and finds mistakes, this is not additional risk to the design team. If the errors are discussed and corrected there is less risk for the design team. If problems are identified after installation they are easier for the design team to correct while the contractors are still on site than if the design team has to return later to the building to figure out the problem.

Ron Wilkinson

17. What are the most important tests to be working in the pump chilled water system variable speed?

These tests are part of the testing of the overall control system. Typically they would include opening and closing control valves so as to change the pressure in the piping. This should be reflected in the pressure sensed by the controls and displayed at the workstation and should cause a command to increase or decrease the pump speed, pressure and volume. Also, the variable speed drives themselves have dozens of parameters that have to be programmed and all of those should be verified as part of commissioning.

Ron Wilkinson

18. What is the estimated additional cost added to a construction project to have commissioning, as a percentage of overall construction costs?

Five or ten years ago people were quoting 1% or even as high as 1.5% of construction cost for “whole building commissioning” including lights, HVAC, plumbing and perhaps fire alarms and sprinklers for a fully fitted out building. Now those costs have come down to .5% to 1% of CC. To some degree this is because building costs increased and to some degree it is due to more competition in the Cx field. There is more information on Cx costs in the Evan Mills LBL study referenced on the reference web page.

Ron Wilkinson

19. How can we get the contractors to buy into project commitment?

Most contractors want to do the right thing and they are happy to have someone else sign off on the quality of their work, especially when that service is paid for by the owner. A savvy owner / project manager will withhold payments until the job is done right, although that takes skill and judgment. If a contractor does not commit to quality they usually find themselves out of business. If a contractor somehow survives and still provides consistently poor quality, there may be little anybody can do to improve the situation.

Ron Wilkinson

20. Are you assuming the Cx agent is smarter than the design engineer? What legal obligation does the Cx agent have when he inputs to design?

The answer to this includes the answers to (9), (10), (12), and (14) and (16) above. The CxA advises the design team in the process of plans checking but the final decision rests with the design team, not the CxA. The design team has no legal obligation to follow the advice of the CxA. After installation the CxA tests the systems based on predetermined procedures and parameters of success. The success or failure of the systems is transparent and objective---it has nothing to do with who is smartest. It is what it is.

Ron Wilkinson

21. Cx authority who only performs Cx is very good. Cx authority that is also a design firm creates conflict of interest, i.e., shows design firm weak areas on a project, which there always are, leading owner to tend to want to hire the Cx firm for design in the future. Should Cx firm be design firm?

This is addressed to some degree by (2) above. Human nature suggests that a CxA from an MEP design firm would be tougher on jobs designed by other firms than on jobs designed by his/her firm. The answer to this potential adverse effect on performance is for the owner to carefully watch the Cx process and be aware of this potential conflict. Regardless of whether a project has commissioning, or does not, the final power and responsibility lies with the owner. They must enforce the recommendations of the CxA and, when conflicts are possible, they must be the final arbiter, watchdog and referee. An additional answer is in (20) above---The success or failure of the systems is determined by transparent and objective procedures and has little to do with who is conducting the tests.

Ron Wilkinson

22. What architectural systems components are included in the commissioning, i.e., walls, roofs, envelope?

Entire building envelope; fenestration, window/wall flashings, roof and associated penetrations/flashings; subterranean waterproofing, drainage, and penetrations; etc.

H. Jay Enck

23. Wouldn't a building maintenance system show that both systems were on in one space regarding the "System Conflicts" slide you referred to?

I think that you mean Building Automation System (BAS). The BAS systems are capable of trending information; however they do not typically alert operators to conflicts between systems.

H. Jay Enck

24. Can you please give a reference for the NREL Phantom Vampire Load Stud.?

Analysis of the Design and Energy Performance of the Pennsylvania Department of Environmental Protection Cambria Office Building, M. Deru and P. Torcellini, National Renewable Energy Laboratory, M. Sheffer and A. Lau, 7group, Prepared under Task No. BEC3.4004 and BEC3.1001

Here is a link for an additional report on vampire loads. <http://www.nrel.gov/docs/fy06osti/37542.pdf>

H. Jay Enck

25. How does the Commissioning Agent handle a serious delay or extension of time during a project? What about when a contractor (electrical) is replaced on a project?

Serious delays and extensions can certainly impact commissioning costs and requires the commissioning project manager to examine factors that impact the delivery of the commissioning work. Once additional costs are identified the commissioning project manager should bring them with a clear explanation of how the delays impacted the cost of commissioning to the owner for discussion and possible additional compensation. In the case of an electrical contractor, or any contractor for that matter, being replaced, you need to sit down with new contractor to bring them up to speed and clearly define their roles and responsibilities. We typically would do this during our next commissioning meeting and would require some additional effort but typically not enough to justify a change order, but there can be circumstances where additional cost are significant enough to require a change order.

H. Jay Enck

26. How do you integrate OPR into the architect's programming process?

The most effective way to integrate the OPR into the programming process is to complete the OPR process prior to the AE's programming effort. A lot of information is provided during OPR workshop that can significantly help the AE understand what the occupants need to effectively and efficiently deliver their mission, while at the same time improving the efficiency of developing the architectural program. In reverse, when the architectural program has already been completed, it is much more difficult to include the OPR information into the architect program. Information conveyed by the owner in the development of the OPR can result in the AE needing to change their programming in order to meet the Owner's objectives and criteria. This is why it is critical to do the process right from the start.

H. Jay Enck

27. Is the OPR developed by the owner, designer, Cx authority, or all of the above?

Development of the OPR is a collaborative effort. The key players are the Owner, facility occupants, and O&M personnel. Designers benefit from attending the OPR Workshop because they have the opportunity to gain insight that is not typically acquired during the architectural programming process. While the OPR can be done by the Owner it is more difficult to get input from all of the owner's staff because subordinate personnel are typically not going offer input to the manager running the project. The Commissioning Authority who is the common thread from pre-design through occupancy is best suited to develop the owner's project requirements as it also form the basis of the commissioning effort for the project.

H. Jay Enck

28. Does the OPR Workshop take place before or after the design team is selected?

Ideally, the OPR Workshop should take place after the design team has been selected because it is a great benefit to have them as participants. It is important however to define in the designers contract what commissioning activities and effort are expected of them, which is why the commissioning authority should be engaged before the design team.

H. Jay Enck

29. Where do you draw the line regarding commissioning passive systems? e.g. natural on-site storm water systems/natural ventilation/ trombe wall?

Passive systems perform functions as well as active systems and there is no separation as to where you would draw a line. They need to be tested as well as active systems need to be tested to see if they match Basis of Design assumptions and perform as intended to meet the Owner's objectives and criteria.

H. Jay Enck

30. What is an average cost of re-commissioning the existing lab building?

Cost can vary dramatically based upon the facility size, its complexity, and activities of the occupants. Determining factors also include Owner's current project requirements and what their re-commissioning or commissioning of existing building goals are. The smaller the project the higher the cost and the larger the project the lower the cost. Typically you see labs range from \$.20/SF to \$1.00/SF depending on their size and complexity.

H. Jay Enck

31. Commissioning is best achieved via a contract directly with the owner. Right? In any case, is the commissioning agent the only professional reporting directly to the owner in addition to the architect, of course?

Yes, Commissioning is best achieved when contracted directly with the Owner as it eliminates conflicts of interest from construction managers, designers, and contractors who each have their own agenda. In response to the Commissioning Authority as the only professional reporting to Owner, commissioning is not a restriction of communications, rather an expansion of the traditional communication structure. Commissioning is just another part of that communication structure to the Owner.

H. Jay Enck

32. Is there a margin of error in final test results or is it absolute?

All testing has a margin of error and there are many factors that affect any specific test method. Our testing protocol is based on having a 98% margin of certainty.

H. Jay Enck

33. You have spoken a lot about the pre-design and design stages, also post build/FPTs/handover. What about the commissioning tasks that are in the building process, with the one-time actions like water system flushing?

Commissioning is a quality assurance process and not intended to displace the contractor's quality control process. Based on the commissioning scope the commissioning team may randomly observe a sufficient number of conditions to obtain a high percentage of certainty that there are no systemic issues within a system. Using water system flushing as an example, the contractor typically would provide the flushing procedure, and chemicals to be used for review by the Commissioning Authority. Depending on level of concern the commissioning authority may wish to be present at the end of the process to verify that it had been done according to the procedures. An exception may be critical systems such as a reverse osmosis system for laboratory research animals in which the Commissioning Authority may need to witness the entire process to verify the owner's criteria are being met. The commissioning process does not relieve contractors from correctly following plans and specifications. It is the contractors and designers who are responsible for delivering a project that complying with construction documents.

H. Jay Enck

34. At what point in the project is it too late to be brought in as a commissioner?

After selection of the design team. It is essential to define the design team's scope during their proposal process and define the owner's objectives and criteria to control costs, increase project delivery efficiency, and promote team collaborative. Lack of clear agreement of all team member's roles and responsibilities as well as defined objective and criteria will add unwanted cost to any project. Commissioning helps eliminate this risk. Commissioning adds value at all stages of a project, but the greatest return on commissioning occurs when it starts at the beginning of a project. This is especially true for Owner's using commissioning for the first time. Owner's quickly recognize the benefits of commissioning in reduced risk and on hassle factor associated with getting designers and contractors to correct issues after occupancy.

H. Jay Enck

35. I am very familiar with the construction phase of Cx activity, but am not as familiar with the design phase of Cx that Mr. Enck has touted in his explanation. Other than wanting the design phase SOW from the commissioning agent, are there any other policing or “strong arm” methods that you recommend to increase the design A/E’s collaborative effort other than complaining to the owner that the CxA is not getting any collaborative cooperation from the design A/E? Using the owner as the collaborative police, does not work well, in my experience. Are there other collaborative policing processes that ASHRAE recommends?

First of all, it sounds as if the AE was surprised the project was going to be commissioned, and may not have been involved in a commissioning process before. No one likes surprises specifically if they do not know what to expect from the commissioning process. AE firms are typically not unwilling because they see the benefits of commissioning. If commissioning is not in their original scope they tend to resist changes not originally defined in their scope of work. The commissioning process does require additional effort that the designers have the right to be compensated for. It is critical to engage the AEs before the design process begins and to clearly define their roles and responsibilities in the commissioning process. This facilitates team collaboration. Commissioning is not policing. Typically everyone is trying to their best job in satisfying an owner. Successful commissioning projects result from collaborative team effort and is a financial benefit to all team members through improved efficiency, lower risk, and elimination of contractor and designer call backs, all of which reduces costs, and increases the value proposition for the Owner.

H. Jay Enck

36. How can commissioning be used to evaluate air/water/thermal performance? What is seen as the logical path to correct issues that arise from this commissioning process?

Evaluation of performance must be assessed against the Owner’s project requirements (OPR). The OPR typically has benchmarks that define successful performance of air/water/thermal system. By defining these requirements in the OPR, and making the OPR a contractual requirement for the design and construction team, the owner has established what is required of the project team, which makes the path to correction very clear. Teams typically are doing their best to satisfy an owner. The Commissioning Authority can assist with helping identify the issues but the owner’s control of the delivery process is the key to correction. Commissioning design reviews can identify issues not meeting OPRs to allow corrections at their lowest possible costs before construction. Issues also occur during construction due to installation technique or revision of the designer’s intent in an effort to lower cost. Commissioning reviews of shop drawings, submittals, and installation processes can identify deviations from the OPR to be brought up to the Owner and project team where they can be vetted and appropriate modifications made. The Owner may choose cost or performance. The process is all about communicating along the way to give the Owner, occupants, and O&M staff the tools that they need to effectively and efficiently deliver their mission.

H. Jay Enck

37. What case study is correct that a 900,000 sq. ft. building was built for \$100 million? Only \$111 per square foot?

These are the numbers that the State of Louisiana provided us in 2000.

H. Jay Enck

38. What is the best way to verify HVAC system (AHU) energy performance against the design calculations?

There are a number of methodologies that can be used. Creating a calibrated energy model that utilized current climatology data to simply monitoring systems and correlating changes based on degree days once the systems have been optimized. Verification requires conformation of design assumptions against actual conditions, anomalies are identified and their causes evaluated. It also depends on how you define "best way." Best could be defined as most cost effective or most accurate depending on the objective of the comparison. If the goal is to obtain reasonable assurance that the HVAC systems are performing as efficiently as intended there are a number of algorithms that can provide a fairly accurate answer contained in ASHRAE Applications handbook as well as ASHRAE Guideline 14 which provides specific methodology.

H. Jay Enck

39. We've had decent results in getting contractors to correct deficiencies found during commissioning. However, we have not had the same success when we discover the A/E's design doesn't meet the OPR. What do you do when the equipment is installed and doesn't perform due to design error?

Anytime you find something that does not comply with the OPR it needs to be brought up to the Owner and project team. Depending on the Owner perspective and how critical the system performance is to the mission of the facility the owner has the right to accept the lower performance or require the designer to correct the problem. The one with the gold makes all the rules. Sometimes the Owner agrees to change the OPR and other times the design team must pay to correct the problem. It all depends on the impact to the Owner and how important the issue is in meeting the facilities mission. Commissioning Authorities do design reviews to help identify potential problems to minimize change orders and reduce risk for the owner and project team, but we are not infallible either.

H. Jay Enck

40. Expand on what type of focus does commissioning place on predictive and preventive maintenance to keep the building components operating correctly.

The emphasis on maintenance depends on the owner's project requirements for a particular project. However, best practice would encourage the owner to integrate their maintenance management system (MMS) with the commissioning process. The scheduled (preventive) maintenance schedules recommended by the manufacturer should be ported into the MMS. Predictive maintenance techniques, such as lubricant condition and vibration monitoring should be discussed, especially for critical service or expensive machinery. If the owner agrees with predictive maintenance recommendations, technical requirements should be established during the design phase. Instrumentation and monitoring capabilities, factory baseline measurement requirements, and laboratory support services would be included in the design. During construction, record measurements of the as-installed machine condition to use as references for future measurements.

Rick Casault

41. Does Cx cover the performance of photovoltaic systems?

If a project includes, photovoltaic (PV) systems, I would recommend their inclusion in the scope of the commissioning process.

Rick Casault

42. When commissioning an existing building, do you commission systems to: The building code at the time of initial construction Current codes Owner's OPR?

Commission existing buildings to the current facilities requirements. Restoring a building to original owner's project requirements generally would not be helpful, since those original requirements have likely become obsolete due to changes in use and loads. Depending on the scope of changes, the authority having jurisdiction (AHJ), may require that all or portions of the building comply with current code. Deal with deviations from current or original code on a case-by-case basis, depending on the owner's and AHJ input.

Rick Casault

43. Have you found a good process for contractors to fill out the pre-functional checklist (esp. where multi-subs are required for a specific equipment or system)?

The general contractor (GC) should distribute of the checklists to the parties responsible for the work. Where multiple trades contribute to the installation of a portion of the work, the GC may mark portions of the checklist for each sub before distributing copies to all involved.

Rick Casault

44. Do you have the Cx authority review the actual bid MEP specifications?

If the bid documents vary significantly from the last set reviewed, then I would recommend a commissioning review during the first part of the bid period, so the designers can issue addenda if needed.

Rick Casault

45. Who prepares commissioning specification? MEP designer or CA?

Development of good commissioning specifications requires close coordination between the CA and the design professionals. The specifics of who actually writes the documents depends on the capabilities of the team members. Good specifications evolve from the efforts of skilled specification writers and knowledgeable commissioning professionals. If the CA writes the commissioning specifications, they should be skilled spec writers, and they should submit their specification to the design professional of record for coordination, approval, and inclusion in bid documents. I urge commissioning professionals to study specification writing and construction contracts. The Construction Specifications Institute provides construction document training.

Rick Casault

46. Is the commissioning authority now the client's delegate and to manage the entire project according to OPR?

The Commissioning Authority (CA) is the owner's ADVISOR for project quality throughout the acquisition process. The design professional (and possibly the project manager) retain authority.

Rick Casault

47. Are there forms for all trades?

Checklists and test procedures for many trades exist and may be found on the web. New features, techniques, equipment, systems, and unique sequences of control generally render standardized forms of little value when transferred from one project to the next.

Rick Casault

48. What is a good way to price commissioning, by budget of the project, square footage, etc.?

Pricing should rest on the specifics of the scope of work and the nature and extent of the systems being included in the commissioning process. However, rules of thumb may help with estimating for the purpose of preliminary budgeting. I recommend allowing three to five percent of the construction cost of the systems included in the commissioning process to estimate the combined cost of the services of the commissioning professional, and the incremental (additional) costs of the design professionals' and contractors' participation in the commissioning process. Square foot estimates tend to mislead, unless great care is taken to ensure the same scope of work and same type and size of facility are used as the base.

Rick Casault

49. How do you involve the contractor early in the commissioning process unless you use design/build contracts?

Hire a contractor on a task basis for early participation. The selected contractor should be of the caliber anticipated to perform the construction. A similar approach helps for including design professionals in the pre-design activities.

Rick Casault

50. How would you frame a 15 – 30 second “elevator speech” to convince an executive who is convinced commissioning costs a lot more money?

The question is unclear. A lot more than what? If they think it costs a lot more than what it is worth, ask them how much RFI's and change orders cost during construction. Ask them what impact the delays have on their mission. Ask them about the challenges you know trouble them. Then point out how the commissioning process makes life better for them.

Rick Casault

51. In the OPR workshop, who should be the facilitator responsible for developing the questions and running the meeting?

Currently, people in the commissioning business tend to be well-suited for the task. As owners and design professionals become better acquainted with the workshops, some of them will assume these responsibilities. Optimally, the facilitator function requires three individuals. One to lead the workshop, one to record on flipcharts or PC projectors the input from participants, and one to absorb the essence of the discussions. The leader could be any skilled facilitator. The recorder could be anyone familiar with the language and issues of capital projects. The absorber is the person who should actually write up the draft of the OPR document.

Rick Casault

52. Can you provide a list of typical questions to be posed to stakeholders in the OPR workshops?

Annex I in ASHRAE Guideline 1.1-2007 provides excellent examples of OPR workshop questions.

Rick Casault

53. In some projects RFPs direct the GC or Prime to hire a CxA. Can the OPR workshop still be conducted after the RFP is issued and contracts are awarded? (answered during roundtable)

It is never too late to document the Owner's Project Requirements. However, when the OPR workshop occurs late in the project, the resulting requirements may be at variance with the design (and construction). While late discovery of design/construction variances from the OPR during construction may result in delay and expense, discovery after occupancy is an embarrassment to all, and may be extremely expensive to correct.

Rick Casault

54. How would you encourage private developers that build "liquid buildings for immediate sale" to invest money in commissioning especially in the first stages of the design?

Case studies included on the webcast page contain convincing evidence and examples of the increased market value of new construction completed using the commissioning process.

Rick Casault

55. How does this process (OPR workshop) differ from the architectural programming process? (Rick's presentation addresses this.)

The OPR, and the workshop from which it is developed, focuses on performance quality criteria, with emphasis on operational criteria. By contrast, the architectural program addresses overall size, siting requirements, occupancies, configurations of spaces and their adjacencies, utility and ventilation requirements, etc.

Rick Casault

56. How is the price for the commissioning agent determined on a project? Is this scope defined and priced to perform that scope? We have seen many projects where the commissioning agent is hired by the owner on a time and material basis. This tends to lengthen the commissioning process as there is no motivation on the commissioning agent's part to complete the process, and this costs all the contractors involved expenses they may not have estimated. It tends to give the process of commissioning, which is a very important process, a bad label in the marketplace.

The scope and fee for commissioning services should be negotiated between the owner and commissioning provider. The fee structure of the agreement varies from project to project. Fee arrangement risks and rewards also vary. If a particular fee structure seems to cause issues, one might suggest to the owner that some other structure be considered for future agreements.

Rick Casault

57. Typically how much detail is incorporated in the OPR?

See ASHRAE Guideline 1.1-2007, Annex J for an example of an appropriate level of detail.

Rick Casault

58. While you were at the university, how big was your staff to perform this function?

At the University of Washington, we hired one full-time engineer to act as the Commissioning Authority for all capital projects with \$10 million or less construction cost. The university hired consultants for larger projects. My responsibilities were split between developing the commissioning process, supporting capital projects, and supporting the physical plant department. Individual facilities engineers provided technical guidance for the hired commissioning consultants.

Rick Casault

59. During construction, should the commissioning authority be following a process to ensure the design professional is completing their proper field views and documenting results? It does not make sense for an owner to pay twice for same service when they have already retained the design professional.

In the same way that the Commissioning Authority verifies design quality by reviewing samples of completed design checklists, the Commissioning Authority can also use sampling to verify that design professionals are doing a quality job during their site visits.

Rick Casault