

Making Connections: Developing Educational Opportunities for Building Commissioning

Betty Smith, Terry Fry, and Greg Rybka
Nexant, Inc.

Synopsis

Right now, in California and elsewhere, new “green” organizations are being created, new state initiatives for energy efficiency are being launched, community colleges are looking to offer new energy-focused programs, private businesses are developing and providing commissioning training for their staff, collaborations for providing education and training in energy efficiency and commissioning are being explored. Although many of these initiatives do not explicitly address building commissioning, most at least have a component focused on the built environment and involve training people in some of the fundamental background capabilities and skills required of commissioning providers. Among those activities most closely related to commissioning there can be economies of effort and maximization of payoff through the sharing of information, contacts, experience, model programs, and curriculum development.

That was the overall sense of opportunity that grew out of a small study requested by the California Commissioning Collaborative (CCC). To explore what professionals involved in the commissioning industry thought was important in preparing a new generation of commissioning and retrocommissioning practitioners, we interviewed players in four areas of the industry: current service providers, educators, facility owners, and instructors or organizers of training through professional associations. Our primary objective was to identify actions that the CCC might take to help expand and prepare the commissioning workforce.

The results of our open-ended interviews tended to fall into five categories of options—influence on the content and delivery of education; marketing, public relations, and outreach; increased utilization of the tools, case studies, and other resources on the CCC website; intervention via public sector agencies; and influence on standards. This paper will report and discuss the suggestions made in all of these areas.

About the Authors

Betty Smith is a Consultant in the Energy and Carbon Management group at Nexant, Inc. She provides research, consulting, and marketing communications services to support energy efficiency and DSM programs for electric utility business and institutional customers. Terry Fry, Senior Vice President in Nexant’s Energy and Carbon Management group, has been an active proponent of economically efficient energy production and use for more than 25 years, and has spent the last 16 advising on energy industry restructuring policies and regulations that encourage energy efficiency. He has taught courses on DSM policies and practices in the U.S. and abroad. Greg Rybka is a Nexant Engineer who works on building commissioning and audits.

Summary

With the goal of making building commissioning common practice in California, the California Commissioning Collaborative (CCC or Collaborative) has encouraged the strengthening of a service delivery infrastructure by working to increase educational and training opportunities. Reports by and for the CCC published in 2004 and 2005 helped to identify training needs and strategies, as well as available workshops, courses, and seminars. At the request of the CCC, Nexant, Inc. undertook a qualitative study in late 2007 to identify both perceived needs for education and training in the State and opportunities for the CCC to address those needs. The study was carried out through telephone interviews with industry participants and attendance at workshops on workforce development, supplemented by some Internet research on existing education and training for commissioning.

This report is entitled “Making Connections” because it became clear from the scheduled interviews, workshops, and informal conversations that one of the most powerful ways the California Commissioning Collaborative (CCC) can affect the development of an expanded commissioning workforce is to utilize its central position in the industry in California to connect people, businesses, and institutions that have expertise and resources with the students, career changers, and educators who need them in order to meet the State’s need for qualified commissioning providers. Some independent activities for the CCC are recommended as well.

Marketing and public relations will provide critical support for the outreach needed to make connections and increase collaboration. Linking commissioning with the sustainability movement can have enormous value not only in heightening the awareness of building owners about how commissioning can help maintain the value of their assets but also in heightening the awareness of students, re-entry workers, engineers, construction managers, controls experts, and others about opportunities to integrate their skills, capabilities, and values within a growing industry. While many elements of the green or sustainability movement focus on renewable energy, and even in the built environment may emphasize sustainable materials, the CCC has an immediate opportunity to demonstrate the role that building commissioning and retrocommissioning can play in a bringing about a sustainable future.

The report that follows further describes the objectives of the study and our approach (Section 2), the results (Section 3), and recommendations (Section 4).¹

¹ The names of the organizations interviewed, the interview guides, and selected reference documents are appended. References to organizations and other documents that may prove useful, depending upon the recommendations adopted, are cited in notes, with website links when available.

2 Objectives and Approach

2.1 Project Overview / Objectives

Commissioning activities can involve people with a range of abilities and skills, from a project engineer who takes measurements, and who might have an AA degree or be a student intern, to a senior engineer who has the knowledge and the experience to synthesize information and identify non-obvious problems in building performance, and who very likely has an advanced degree and other professional credentials.

The objectives of this qualitative study were to characterize the educational needs of commissioning providers in California and to make recommendations for influencing the development of educational opportunities for active professionals and persons entering the field—in particular to recommend ways in which the CCC could help close any gaps between what is available and what is needed. The CCC also expressed a strong interest in learning both how persons in related fields might be encouraged to move into the commissioning field and how students (whether traditional undergraduates or re-entry, career-changing adults) might be made aware during their community college or college experience of career opportunities in building commissioning.

2.2 Interviews

We began the study by planning interviews with commissioning industry participants. We formed a project advisory committee comprising Jim Parks (SMUD), Keith Forsman (PG&E), David Claridge (Energy Systems Lab, Texas A&M), and Lia Webster (Nexant, Inc.) to provide guidance on interview questions, suggest potential interviewees, and review draft recommendations.

After a kickoff conference call with the advisory committee, a list of potential interviewees was compiled based on recommendations from the CCC, the advisory committee, Nexant contacts, and referrals from other interviewees. Commissioning providers, not all based in California, were selected for their known experience and interest in the industry. Building owners or managers were all based in California. Educators, primarily in California, represented degree-granting institutions, utility energy training centers, and the Building Operator Certification (BOC) program. Professional associations were national in scope; all provided commissioning classes at least annually, and some offered certification as commissioning agents. “Others” were people with an interest in the industry who did not fall clearly into the other groups but who, in informal discussions, provided useful insights. The distribution of interviewees is shown below:

Commissioning providers	7
Building owners or managers	5
Utility program managers	3
Educators	8
Professional associations/ conference producers	5
Others	2

An interview guide was developed for each of the following groups: (1) professional Cx/RCx service providers and building owners/managers; (2) utility retrocommissioning program managers; (3) educators, including instructors at the utility energy training centers; and (4) professional associations and conference producers.

Interviewers solicited information and opinions on the following topics:

- Essential skills of a Cx or RCx service provider, both beginning level and expert
- Skills, experience, or qualities that are hardest to find
- Most important non-technical skills
- Backgrounds of students (any level, any setting)
- Kinds of education or training provided or desired
- Desirability and value of certification programs
- Internships/mentoring availability
- Preferred modes of instruction
- Recent or expected changes in course offerings
- Ways of drawing people to the field (in/from school, or in related fields)
- Issues or suggestions not addressed otherwise in the interview

All questions were open ended to elicit opinions and allow for as much discussion of experience, perceptions, and suggestions as the interviewee wished. Interviews were expected to take 25 to 30 minutes, and ranged from 25 to 90 minutes. We looked for differences among the different groups of interviewees, and point out some of them under Results, but many responses were similar across groups.

2.3 Supplemental Research

In addition to indicating a range of perspectives about the topics of interest, the interviews, along with some web research, were helpful in networking with others in the state who were actively engaged in exploring education and training issues related to workforce development and jobs in energy efficiency and/or renewable energy. These sources led us to three unanticipated events that gave us additional perspectives both on training needs and on resources—specifically the range of organizations whose interests and activities overlap or align with those of the CCC.

Two of those events were all-day sessions of the CPUC Workforce Education and Training workgroup, in December 2007, which focused on discussing needs and providing input to the California IOUs' Strategic Plan in response to CPUC Decision 07-10-032. The participants, all of whom were in some way involved with education and training for careers in energy efficiency, represented electrical and sheet metal workers' unions, community organizations, adult education, community colleges, the California State University system, the California Department of Education, the Building Owners and Managers Association (BOMA), BOC, Lawrence Berkeley National Lab (LBNL), and state commissions. Their comments helped inform the recommendations presented in Section 4 of this report. The third event was the January 2008 summit on Advancing the New Energy Economy in California, which yielded additional contacts and new perspectives.

3 Results

As our primary sources were open-ended phone interviews, in this section we provide as many of the interviewees words as possible. Statements in quotation marks are either direct quotes or near paraphrases.

3.1 What Skills Do Hiring Firms Want?

3.1.1 Beginner vs. Expert

We asked all of the interviewees to tell us what education and skills they regarded as ideal for junior and senior level commissioning providers.

Technical Education and Skills

Interviewees who provided commissioning services tended to expect a higher level of education than other interviewees; they were the only ones who mentioned master's degrees, and they expected new hires to have an engineering degree, even though some said that they did not necessarily regard a four-year degree as essential. For example: "A four-year engineering degree in itself is not very valuable in being effective at gaining knowledge on site." "More than 99% of engineering students never get any hands-on experience with air handling units and other HVAC equipment. This leaves them less prepared for the real world than someone who went straight into the field during those four years." "A [four-year] college degree should not be a prerequisite."

Although one interviewee commented that "a P.E. license [which requires a degree] helps establish credibility for the team lead and is usually required in California," he also felt that a degree for other members of the team was arguable—"the more they know the stronger they'll be, but the specific skills don't require a degree." At least one interviewee reported hiring part-time students to help with workload in the current tight job market. In casual conversation, another indicated that his firm had not looked at modifying its typical recruiting approach, which brings in degreed engineers, but that it might do so.

Overall relatively few differences in technical skills emerged from the interviews. Capabilities expected of more senior consultants or staff, but not of beginners, were: life-cycle cost analysis, trend analysis, knowing how to identify the best prospects for retrocommissioning, having a sophisticated understanding building control systems, and knowing how to evaluate systems in the real world (diagnostics). Interviewees were more explicit when asked "What skills, capabilities, or experience are hardest to find?" (See Section 3.4)

Desirable for all, but critical for anyone doing more than taking measurements was said to be understanding the interaction among building systems—"not just a mechanical engineering focus." Terms that came up repeatedly were "interaction," "integration," "relationship," "big picture," and "whole building perspective."

Non-technical Capabilities

The critical non-technical skills described by interviewees clustered around two primary topics: (1) communication and customer/client relationships (“be able to talk to owners, building operators, architects, IT managers, contractors, electrical and mechanical engineers, controls vendors, construction supervisors, and others”) and (2) documentation (“the paper work takes a professional perspective”; “reports require good written work as opposed to engineering drawings”). These were followed by marketing, management, analytical skills (“be able to recognize the critical pieces of information”), and having a business perspective (“see the relationship between energy savings and economic or productivity benefits”).

Expertise

The greatest difference between a beginner and an expert commissioning agent was felt to be years of experience, with the accumulation of detail and familiarity with a range of building types and of technologies operating under different conditions. Comments on experience were: “Five or six years of experience is still junior level.” “With less than 10 years of experience, you’re a team member but not the lead / you’re still an assistant.” It takes 20 years of experience to be a senior commissioning agent.” And, from a different perspective, “You need some experience living in the construction world.”

One interviewee described the ideal path to becoming a commissioning agent as “an Associate degree for practical knowledge, followed by a Bachelor’s degree, followed by four to 10 years’ experience in design, operations, contracts, and other areas.”

3.1.2 Cx vs. RCx

The building owners we interviewed did not distinguish between commissioning and retrocommissioning skills/capabilities/ or background, but consultants did—in fact some thought there are great differences at least in approach if not in specific skills. One noted, however, that at present “There’s good consensus about how to do commissioning, but a lack of consistency about retrocommissioning.” The tabulation below lists the differences that were highlighted:

Commissioning	Retrocommissioning
Process oriented	Forensic, diagnostic, investigative
Requires coordination with more different parties	Involves problem-solving, troubleshooting
Should have background in construction management and understanding of the design process	Requires familiarity with old as well as new technologies

3.1.3 Certification

Views on the value and nature of certification for commissioning and retrocommissioning, and who might best manage it, were mixed. Some regarded it as valuable, others as perhaps valuable but not crucial. From a facility managers' perspective, "in hiring, experience matters more than certification" and "certification isn't as important as having completed actual projects successfully." Most interviewees who were familiar with the certification programs, felt that they were generally doing a good job but pointed to lack of uniformity that could both provide consistent training and let building owners know what certification means. Some felt that lack of a degree should not in itself be a barrier to certification.

Other comments on certification-related topics follow:

- Teaching
 - The instructor should be a practicing professional
 - Certification programs should be run by those whose job it is to teach (i.e., colleges)
 - Any certification program should involve a required 3-month internship followed by evaluation
- Testing
 - They need to test the skills that are required to execute the plans
 - Certification should require a two-day test at least partly in a field setting
 - Any certification process should actually test the ability of someone to work in the field
- Emphasis
 - There is too much focus on process and not enough technical detail
- Standardization
 - Commissioning and retrocommissioning should be certified separately
 - There should be a central trade organization to certify rather than organizations with narrower interests (e.g. Air Balance)
 - There are too many programs ("five now with another to come from ASHRAE"); it's hard to assess the quality; "co-branding" is a good idea
 - ASHRAE's certification (under development) is likely to prevail/dominate
 - If there's to be certification, there should be "some sort of accreditation board."

3.2 What Education and Training Resources Do Hiring Firms Want?

The following are representative opinions of commissioning providers and building owners. Interviewees generally like the content and delivery of the training currently available through Portland Energy Conservation, Inc. (PECI), the CCC, the Pacific Energy Center, ASHRAE, and a few others. Their wishes include:

- A two-year commissioning program at community colleges; (“build up the technical level for two-year programs and for continuing education for people currently in the field”)
- A two-year commissioning program at community colleges that includes an internship
- A two-year community college program (roughly one year on coursework for retro-commissioning, one year as an intern, and an additional semester covering the design component for commissioning)
- Creation of an HVAC systems lab, “where one could go through a structured testing program and perform the data collection and analysis”; in this regard, community college programs need to be “structured more like a trade school”
- Team teaching: community college + industry
- Web-based retrocommissioning orientation
- More retrocommissioning-specific classes
- More classes like those at the Pacific Energy Center (PEC)
- More on-line workshops on single aspects of commissioning
- “On-demand tutorials” with Q&A; opportunity to submit questions and get answers not immediately, but within some reasonable period
- Webinars: One or two-hour webinars with Q&A (The drawback to webinars is that “they’re not sufficiently interactive” and sometimes are of “insufficient depth.”)
- Labs or opportunities to get field experience (“You really can’t do the work without field experience.”)
- More attention to documentation of retrocommissioning projects (“Documentation is a challenge in the industry; it’s not just a checklist, though some people think so.”)
- More lighting and building envelope classes
- Include demand response

Web-based training is widely accepted as means for upgrading knowledge and is even accepted by some as means of delivering fundamental knowledge, but its value is seen to vary with the participant’s experience: “Webinars are good for people with some field experience; they’re not as valuable for junior staff, unless coupled with hands-on work.”

From the perspective of consulting firms, a training center like PG&E’s PEC provides the ideal delivery of Cx/RCx training for existing staff, but the practical mode for many people is web-based.

3.3 What Educational and Training Opportunities are Available Now?

Different modes of education address the needs of people at different points in their careers and education.

3.3.1 Formal Education

Most respondents believed that the universities focus on the fundamentals of traditional engineering programs, to the neglect of the hands-on experience that employers will require. Thus unless the graduate has had an internship somewhere along the way, additional training of a new hire will be needed, whether provided in-house, at a utility training center, or through a community college or a university extension program.

Community college programs are more oriented to combining fundamentals with experience, and would benefit from support and expansion. Existing programs draw a mix of students. For example:

- The full-time two-year Commercial Energy Analysis / Energy Management Technician program at Lane Community College in Oregon primarily serves adult career changers with educational backgrounds that may be entirely unrelated to energy or building design and operation. Intended outcomes include the ability to “understand the interaction between energy consuming building systems and make recommendations based on that understanding.”
- The Environmental Control Technology program at Laney College in Oakland, California, a program offered only at night, draws a mix of adults and recent, often relatively poorly prepared, high school graduates. Commissioning courses come in the third and fourth semesters.

While these programs may come closest to preparing graduates to participate in commissioning assignments, other community college programs are also training students in related areas from which they might, with interest and some additional training, make a transition to commissioning. This point is worth noting in light of some of the identified options for the CCC later in this section.

3.3.2 Internships

Enthusiasm for the internship experience was high among interviewees; but the availability of internships seems low, if one to none offered annually per commissioning firm is the norm. Among our interviewees’ consulting firms, one offers internships, one reported having an intern this past summer, and another described having previously employed interns (through a Building Commissioning Association program of a few years ago). Among the four private sector facility owner/managers we interviewed, only one reported providing regular internships.

In the public sector, the California State University system provides a maximum of 24 internships per year with current funding (two to four interns per campus) in its building operations area (not involving commissioning); these paid jobs are not part of the students’ academic programs.

3.3.3 On-the-Job Opportunities

Commissioning providers generally did not report providing systematic on-the-job training to their staff, presumably because the firms are relatively small, but some instruction or preparation for the field is provided: e.g. inspection procedures, functional performance testing, energy savings calculations, use of company-specific analysis tools and protocols, and documentation. One firm provides an in-house lunch time seminar series and another allows employees 40 hours a year to participate in on-site web-based seminars or attend off-site courses and seminars. Most of the commissioning providers interviewed had staff attend some combination of professional association, college-level (University of Wisconsin commissioning courses or UC Berkeley extension's HVAC-R series), utility-organized (the Pacific Energy Center's year-long retrocommissioning program), and/or manufacturer-developed courses (e.g., a five-day course presented by a manufacturer of control systems). One mentioned that employees have used CCC resources.

Some on-the-job training is provided to building operators at the end of contractor-implemented retrocommissioning projects. That training covers what to monitor, how to analyze the data, and how to respond to various situations that might arise, and in at least one case includes a "persistence matrix."

Among the facility owner/managers we interviewed, three said that they provide on-the-job training to their staff (e.g. job shadowing, protocols, safety courses, basic systems and principles, and energy efficiency calculations), and one said that their staff has taken classes offered through the utilities and the U.S. Green Building Council.

In the public sector, the California State University system offers two kinds of commissioning training to its staff: one is a two-day training through the MBCx partnership and the other a five-day course through the University of Wisconsin-Madison extension. Assuming that two or three people are trained on each of approximately 60 campus buildings retrocommissioned, roughly 100 to 200 staff have had some retrocommissioning training through CSU (most of these, however, are expected to retire within the next five years).

3.3.4 Professional Advancement

Workshops, webinars, and conference sessions sponsored by commissioning associations, non-profits, and commissioning certification programs typically target building owners and commissioning providers, but also attract engineers with varying specialties, building operators, and others. Classes were thought to be generally good, but apart from the CCC's offerings, these events for professionals do not occur in California every year. One interviewee discouraged walk-throughs as part of such events; although genuine hands-on work experience is vital, walk-throughs by large groups were described as hard to manage and no more valuable than classroom instruction.

The Pacific Energy Center's year-long commissioning program, which requires a significant commitment by participants, serves working mechanical engineers (the largest number), building operators, building technicians, architects, facility managers, municipal employees, building

owners seeking new skills and professional advancement. About 12 people per year complete the course. Another 200 or so per year get at least one full-day of training on commissioning, and approximately 50 more get a half-day of training on commissioning.

The Building Operator Certification program has included limited commissioning training in its mix of courses to date and is currently considering strengthening the commissioning segment. Since 2002 BOC has certified more than a thousand building operators, who are responsible for 500 million square feet of commercial and institutional space. Participants are reported to want to learn how to do commissioning, not just learn about the benefits and the general process.

3.3.5 The Web

Commissioning providers generally reported that members of their staff have taken web-delivered training and that it has met their expectations. Two interviewees noted that this medium was the best or ideal way for staff to access educational resources, although another mentioned that more experienced staff will benefit more from this training because of their additional hands-on experience. One interviewee suggested that the fundamentals of commissioning can be taught through this format. The cost-effectiveness and convenience of web-delivered training was emphasized as a benefit by two interviewees (they involve no travel, and some can be taken at any time). One interviewee expressed interest in having more specific topics available, as much of the web-delivered training is believed to be too general.

Facility owner/managers all said that their staff members have taken web-delivered training. Three of the interviewees found the web-delivered seminars to meet expectations though one found that the medium allowed for staff too become distracted, and felt that there was a lack of staff accountability associated with web-based courses.

Most of the interviewees mentioned that the most valuable web-delivered seminars were one to two hours in length and provided an opportunity for questions and answers.

3.3.6 Unions

Unions train electricians and HVAC technicians in large numbers and, at least in one case, in multiple languages. There is overlap and potential competition for students between these organizations and the community colleges. However representatives of SMACNA and the International Brotherhood of Electrical Workers (IBEW) have both expressed the conviction that broad-based training is important and that no one should be trained for a narrow skill for which the demand can abruptly rise and fall. It seems desirable to address relationships with the union training as part of the development of any community college program.

3.3.7 Model Programs

Interviewees and other identified several educational programs, from various fields, that provide solid education supplemented with laboratory or field experience, thus preparing those who complete the programs with the knowledge and skills they need to enter on a career. Those programs are briefly characterized below.

- *Lane College (Oregon) Commercial Energy Analysis Program*: A well-established two-year Associate degree program that includes an internship. The full-time daytime program began in 1992. The program utilizes old and new campus buildings as its lab.
- *Lane College Summer Session for Professional Advancement*: A two-week summer “boot camp,” during which each participant develops a project to implement during the coming year. The following year, participants return to present their projects to the current year’s class.
- *Pacific Energy Center*: A comprehensive retrocommissioning workshop series to train building professionals interested in developing their commissioning skills. This year-long, one-day-a-month program gives students actual practice in applying basic engineering principles to building systems. An introductory course on identifying retrocommissioning opportunities is a prerequisite.
- *City College of San Francisco Biotechnology Program*: Created to meet the need for entry-level workers in the biotech industry, the program began with a single certificate program and grew into four components: the Biotechnology Certificate, the Biomanufacturing Certificate, the On-Ramp to Biotech program, and the Bridge to Biotech program, the latter two for persons with no math or science background. Paid internships were offered, and all four programs emphasized a hands-on approach. The number of students served increased from 28 to 454 in two years. Some students have returned for more course work when they recognize the need for more education. The development history of this program, which includes meeting funding challenges and involving local industry, could provide a roadmap for developing a community college energy program with different interrelated levels. (See Attachment C of this report.)
- *DOE-sponsored Industrial Assessment Centers (IACs)*: The IACs’ goal is to produce “industry ready engineers.” Through the IAC at San Francisco State University, students complement their classroom learning with applied projects for Bay Area manufacturing industries conducted under the supervision of engineering faculty.
- *Utility-Sponsored Community College Education*: PG&E’s PowerPathway is an example of a utility-sponsored community college training program with apprenticeships. This program, intended to help fill technical positions at the utility, is designed to bridge existing skill and knowledge levels. There are three categories: Full Bridge, for those with limited or no related work experience; Intensive Bridge, for those with some related work experience; and Capstone Course, for those with who have completed a prerequisite AA degree or certificate.
- *Lane College Innovative Community College Degree Delivery Program*: To maximize the use of a single curriculum across multiple colleges, Lane College will launch delivery of its Commercial Energy Analysis degree program via the Internet in the fall of 2008 (pending a grant award). Three other community colleges have committed to participate. Core courses will be delivered by Lane via the Internet, and the partner colleges will provide lab facilities and lab instructors.

3.4 What are the Current Supply Needs?

Some utilities and at least one large institution reported that a shortage of retrocommissioning firms was a greater constraint on the number of buildings that could be retrocommissioned than current funding. In addition, energy consulting firms are competing with each other for employees, and facility managers in both the public and private sectors are concerned about losing, over time, their current skilled technicians and engineers. Interviewees identified the levels of skilled workers currently in shortest supply as “technicians” and the “mid-range” (not entry-level and not experts).

3.4.1 Critical Lacks

When asked “What skills, capabilities, or experience are hardest to find?,” interviewees responded:

- Controls experience, especially with programming (“As controls programming becomes part of IT [information technology/programming], the two areas [HVAC and building controls] are moving farther and farther apart.” “The typical engineer doesn’t have adequate training in controls systems, control logic.”)
- Combination of controls and HVAC or building system knowledge/controls and (“Not nearly enough people have both controls and HVAC experience.” “More often people come from the building operations side, and controls is their deficit; it’s easier for controls people to learn building systems than the other way around.”)
- Engineering economics; benchmarking from a cost perspective (“Having some training on how to match the job [project] requirements with costs would be helpful.”)
- Energy engineering
- Life cycle analysis
- Knowledge of mechanical systems (“In college there seem to be no courses in mechanical systems”)
- Data analysis skills, among technicians
- Balance of hands-on experience and fundamental knowledge; a rounded set of skills; multidimensional experience
- Combination of analytical and fix-it skills (“We tend to get one or the other.”)
- Depth and thoroughness (“Providers do resets but don’t find bad sensors...miss the less obvious...don’t go deeper.”)
- Whole building perspective; understanding system approach/interaction effect
- Field experience
- Diagnostic skills (“Getting from the fundamentals to evaluating an existing system”)

Recommendations in Section 4 address many of these needs.

3.4.2 Public Awareness of Need

Despite the industry's recognition that it faces a labor shortage, until very recently state policy makers seemed unaware of the growing need to educate people to fill energy-related jobs. The Governor's Career Technical Education Summit early in 2007 highlighted the need for technical education to fill jobs in the construction, manufacturing, health care, and automotive industries, but did not mention any aspect of energy. Likewise the state's Employment Development Department's (EDD) Labor Market forecasts from 2004 show that the state was not attuned to what was beginning to happen in this industry when EDD defined its categories and made its 10-year projections.

Although the Collaborative may still wish to share with EDD the industry's picture of job growth in commissioning and retrocommissioning, some state entities are beginning to highlight the need for greater numbers to serve the energy efficiency market. The CPUC's October 2007 decision (D. 07-10-032) brought the matter to the fore, declaring that "Because the state appears to have a shortage of well-trained energy efficiency technicians and professionals, expanded training programs are needed...." The utilities, with input from a wide range of interested parties, are responding.

In December 2007 the Governor proposed to "bring approximately 20,000 new engineers into California's workforce over the next decade by expanding existing educational programs" in order to address physical infrastructure needs. To date there appears to be no similar formal level of effort to expand education for addressing the state's energy needs; however, the January 2008 summit on "Advancing the New Energy Economy in California" gave a big boost in attention to the importance of energy jobs in the State. And already scheduled energy-related summits and conferences in California will provide forums for addressing training needs.

On the national level, President Bush signed the Green Jobs Act of 2007 on December 19, authorizing \$125 million for green job training programs across the country. (Although many "green"-focused activities and websites, including www.greenjobs.com, are entirely or predominately focused on renewable energy, rather than on the built environment, the Green Jobs Act is intended to include energy efficiency.)

This context creates an opportunity for the CCC to exert influence on state policy. Again, Section 4 provides recommendations.

3.4.3 Scale

In parallel with this study, the CCC is developing a best estimate of the number of commissioning professionals and technicians needed by the state. To indicate here some sense of scale as a context for those numbers, we looked at the square footage of existing buildings, as reported by the California Energy Commission's March 2006 Commercial End Use Survey (CEUS), and the square footage being retrocommissioned through the IOUs' 2006-2008 retrocommissioning programs.

According to the 2006 CEUS, the total existing floor stock of commercial buildings in “the statewide service area” was 4.9 billion square feet. Against that number the floor stock in developing or committed status for retrocommissioning through the two largest IOUs’ 2006-2008 RCx programs totals roughly 50.2 million square feet (or about 1% of existing floor space), based on informal estimates by program managers; a total of more 100 million square feet is projected by the end of 2008.

On a national basis, it has been said that every year we add 3% to the floor space of building stock (including residential buildings). If that were a replacement figure, it would leave 97% of buildings anywhere from one to more than a hundred years old. The industry is now at the very thin front edge of beginning to retrocommission those buildings.

3.5 Options for Expanding the Commissioning Work Force

While comfort, productivity, and cost savings are all important motivations for building, operating, and maintaining energy efficient, high performance buildings, at this historical moment Californians’ zeal for sustainability, reduced energy use, reduced greenhouse gas emissions, and all things “green” is a strong force that the commissioning industry can use to its advantage to grow the business, to reduce energy use in the State, and to strengthen the service delivery infrastructure by increasing educational and training opportunities.

Spurred in part by the green movement, new green organizations are being created, new state energy efficiency initiatives are being launched, more community colleges are looking to offer new programs, private businesses are developing and providing commissioning training for staff, collaborations among organizations for education and training are being explored. Although many of these initiatives do not explicitly address commissioning, most do have a least a component focused on the built environment and involve the training of people in some of the fundamental background capabilities and skills required of commissioning providers. Among those activities most closely related to commissioning there can be economies of effort and maximization of payoff through the sharing of information, contacts, experience, model programs, and curriculum development. The CCC is well positioned to play a key coordinating role.

Figure 1, below, schematically shows the important connections that need to be made.

A list of nearly fifty options for CCC interventions was derived from this study, many of them directly suggested by interviewees. The options fall generally into five categories:

- Education
- Marketing, public relations, and outreach
- Increased website utilization
- Intervention via public sector agencies
- Influence on standards

From the extensive list, Nexant, with the help of the Project Advisory Committee, has developed a set of recommendations, in Section 4.

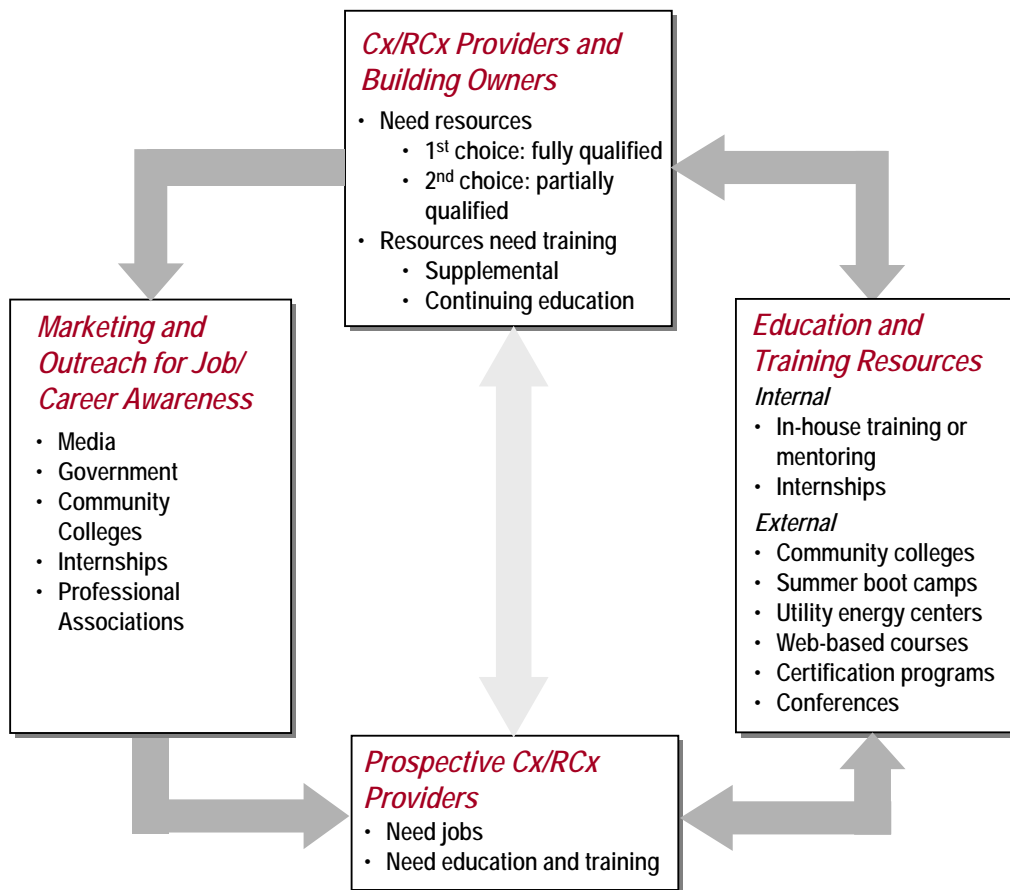


Figure 1: Critical Connections for Commissioning Workforce Expansion

4 Recommendations for the CCC

The interview results and the public and political drive for energy efficiency suggest that there are numerous opportunities to help move commissioning into the mainstream of building design, construction, and operation in California.

The recommendations here, selected from among the more than forty identified options that are listed in Appendix C, are priority actions that the CCC might take to enhance educational opportunities in the state and thereby build a workforce of commissioning and retrocommissioning agents that will be needed to help the state meet its energy goals. The options recommended—the majority focused on direct or indirect educational interventions—are within what we believe to be the CCC’s sphere of influence and likely to have a significant effect.

4.1 Education

The CCC has played and continues to play an important role in the dissemination of information, guidelines, and tools, as well as providing training. Potential interventions to enhance educational opportunities—particularly in community colleges, as most interviewees urged—are numerous. The time is ripe for CCC to build alliances with more and different organizations that have an interest in green jobs and green buildings in order to help increase not only awareness of commissioning but actual numbers of persons prepared to work in the industry.

Recommendations are:

- Fund a full-time position to do the following:
 - Convene a workshop of interested community college department heads, faculty, and commissioning experts to brainstorm curriculum development. Right now, individuals and organizations in various locations are working with community colleges separately. A forum for sharing ideas, approaches, steps accomplished, and the like could advance curriculum development, spark ideas for funding, possibly allocate planning tasks, and evaluate potential internal resources (e.g., the Association of Community Colleges or the California Community Colleges Chancellor’s Office) and external resources (utilities, industry, government).
 - Help create a central information source for faculty who are beginning to add commissioning-related courses or develop programs (e.g., a website with password protected access). Identify new courses and programs that are under development and share model programs from this and other fields.
 - Collaborate with the colleges, DOE, and organizations such as BOC, BOMA, NAESCO, and the California Lighting Technology Center and Western Cooling Efficiency Center at UC Davis to maximize information gathering and dissemination, avoid overlapping efforts, and provide or identify funding opportunities.
 - Work with Laney College (and others that may be subsequently identified) to expand their program(s) to other community colleges in the state.
 - Help develop regional training centers that provide a controlled environment for gaining hands-on experience through identified community colleges.
 - Work with the utilities, community colleges, and public and private companies to offer internships for students—both on campus and with outside agencies. Help design a replicable internship program and identify funds for internships.
 - Promote professional development opportunities that could include co-branding the University of Wisconsin extension program, Building Operator Certification, train-the trainer programs, and summer energy boot camps for professional development. A good example is Lane’s two-week course for engineers and senior facility managers, which includes a “take-home” project with a one-year follow up, during which those who completed their projects present the process and results to the current year’s participants. If sufficient instructors can be found, they could be offered in multiple locations. Boot camps might be a compressed form of the PG&E PEC classes, which “fill the gaps left by standard engineering education,” by providing the “missing skills needed to perform commissioning.”

- Develop or sponsor development of an M&V course or courses for current commissioning providers.
- Provide cross-training between HVAC and building controls to address the concerns described in Section 3.4.1 above.
- Continue to develop tools: in particular “wizards” that drive a user’s experience with a series of customized questions or choices based on the user’s previous response, and that help narrow the application’s focus to the content the user is looking for.
- Provide a forum (e.g., a colloquium or WebEx conference) for utility program managers to discuss issues and expectations regarding consistency of third-party retrocommissioning implementation in advance of the 2009-2011 cycle, sharing and building on and lessons learned over the past two years.
- Explore opportunities to collaborate with owner groups and trainers of building operators. For example, the Building Operator Certification (BOC) program is discussing shared initiatives with the Building Owners and Managers Association (BOMA) and the International Facility Managers Association (IFMA). There is an opportunity here for CCC to help develop curriculum for the commissioning element and make it—particularly retrocommissioning—a stronger component of the BOC; is currently considering building a new module to give operators experience with diagnostic monitoring (collecting data, reviewing settings of systems, observing whether operating as programmed/designed, etc.).

4.2 Marketing and Public Relations

Interviewees regard increased marketing and publicity about commissioning as important for a variety of reasons: creating awareness of career opportunities; connecting undergraduates and career changers with education; alerting commissioning consultants, facility owners and managers, and building engineers to available webinars and courses outside the well-publicized annual professional and trade conferences; informing and attracting people with related skills; and especially increasing business opportunities that grow the field generally.

Recommendations are:

- Implement the proposal to market commissioning as a sustainability strategy. “Green” and “sustainable” are motivating terms at present. Attach “green” and “carbon management” and “sustainability” to everything the CCC does.
- Strengthen the CCC’s connection with the U.S. Green Building Council by bringing someone from the USGBC onto the CCC Board of Directors. (“LEED is a big hook for the whole industry.” A closer relationship with the USGBC might also lead to more consistency in standards.)
- Place an article in professional and trade journals to broaden recognition of the field.
- Market to students and community college districts: promote commissioning careers with information for campus career counselors.
- Encourage the industry to offer additional training specifically on retrocommissioning.

4.3 Website Utilization

The CCC's website is a useful vehicle for marketing. Further, some of the things interviewees wished were available are already provided by the CCC, such as case studies and tools; thus there is an awareness gap, even among people who are interested and involved in the industry. Making the CCC's website more visible will help to address this gap. Recommendations are:

- Draw more people to the website through reciprocal webpage links with related organizations and search engine optimization that will increase traffic through search results on Google and other search engines. Although it is not necessarily a goal of the CCC to be known outside California, some commissioning providers elsewhere are looking for resources like those that the CCC has already created: some, for example, cited a need for case studies, when the CCC has a substantial on-line trove of readily available stories. Another interviewee already familiar with the site reported planning to use the case studies and tools in her classes. She also found the website helpful in her grant writing.
- Utilize the website as one vehicle for implementing the CCC's proposed marketing strategy.
- Enrich and enliven the website while incorporating the "commissioning is green" theme. For example, the CCC's collection of case studies comprehensively illustrates effective commissioning in different types of buildings, but there is an opportunity to emphasize environmental impact by highlighting especially significant case studies more boldly. The site is an excellent resource for professionals who already know about it, but may not hold people who could be interested in the activity of commissioning but are not yet familiar or entirely comfortable with the term.²
- Maintain a comprehensive list of ongoing degree and energy-related certificate programs in California focused on or closely related to commissioning. In short, be a clearinghouse of information on courses for students in California.

4.4 Intervention via Public Sector Agencies: Influence On Policy

In light of the current enthusiasm for greening the state, the CCC has an opportunity to influence state policy regarding education and training that will prepare people to commission, operate, and maintain high-performance buildings. Recommendation are:

- Coordinate with the Engineering Education Council proposed as part of Governor Schwarzenegger's "20,000 New Engineers" commitment (cited in Section 3.4.1 above) to incorporate commissioning into state-funded educational programs; use the Governor's plan as leverage.

² For an engaging example, see <http://buildingcommissioning.wordpress.com/>. While this blog does not have the depth of the CCC site, it is dynamic, colorful, interactive, well illustrated, and attention-getting, and it cuts across the fields of architecture, commissioning, construction, LEED, relevant politics, tools, costs, events, articles, and reports.

- The CCC is already developing an estimate of the numbers of commissioning and retrocommissioning agents needed. Use this information to prepare a white paper for policy makers that defines the problem that the industry is imperiled because of the need for expertise.

4.5 STANDARDS

Commissioning providers expressed the most interest in and concern about standards for retrocommissioning, followed by utility program managers who were concerned from a consistency perspective. As in other recommended activities, there is an opportunity for the CCC to bring interested parties together for the benefit of the whole industry.

Recommendations are:

- Create an industry standard for retrocommissioning providers. Collect and compile all guidelines, and then form an industry-based working group to combine them into one standard process with explicit procedures. “Programs focused on energy savings, for example, leave out a lot of scope (such as the point-to-point testing that is found in LEED-EB) that is fundamental to retrocommissioning.”
- In particular, collaborate with two current national and state initiatives:
 - Collaborate with ASHRAE in the development of its commissioning certificate program, which is currently under way.
 - Collaborate with the California utilities and SMACNA to ensure that commissioning concepts are included in the training and testing associated with the IOUs’ Big Bold initiative for reshaping the HVAC industry. This initiative is likely to encourage and ultimately require certification of HVAC installers.³

4.6 TIMING

Changes to increase use of the website can be implemented in the short term; ideally that would happen in concert with the potential new marketing strategy.

“Quick-start” opportunities will take time to develop and implement, but nevertheless call for making connections with other organizations in the very near term: for example, collaboration with the BOC in providing training through BOMA and with ASHRAE on the development of its certification program. Likewise as interest in training for green jobs is burgeoning, timeliness in organizing the recommended workshop for community colleges will be important in helping to promote coordination and avoid duplicative efforts.

Actions to influence policy will most likely require some time to develop and take effect, and might be thought of as medium-term efforts.

³ Under consideration in mid December 2007 was a goal of 15% certified by 2011 (approximately 2,000 per year) and 100% certified by 2020.

Long-term and/or ongoing opportunities include retaining the priority to collaborate with the USGBC, to infuse commissioning concepts into all discussions of green buildings, and to maintain awareness with periodic publicity about the benefits of commissioning and career opportunities.

Appendices

- A List of organizations contacted
- B Interview guides
- C Complete list of options for CCC interventions
- D Example of community college program development
- E Illustration of proportional energy usage of existing buildings under two scenarios (“business as usual” and “aggressive improvements”)
- F Additional resources

The above appendices may be found in their entirety in the complete report, located on the California Commissioning Collaborative (www.cacx.org).