1. Welcome and Introductions - Phil Welker, CCC

Mr. Welker welcomed the group and thanked Len Pettis and CSU Fullerton for hosting the meeting. Attendees introduced themselves.

2. CCC Admin and Project Updates – Kristin Heinemeier, PECI

- Among the CCC’s 2005 projects, the website upgrade and report to support utility commissioning programs are complete.

- The pilot Owner Forum, held in June in San Diego, had a workable agenda and thorough marketing outreach but did not produce the desired owner attendance. As a result, the CCC has decided to reassess its strategy and not proceed with additional owner forums.

- Training to support California’s new T24 standards is in the planning process.
• The Cx and RCx toolkits are in the process of being contracted with PIER.

3. Administrative Tasks

The CCC staff continues to manage the day-to-day affairs of the organization, which include all accounting, legal, meeting preparation, communications and website maintenance tasks. It also includes developing scopes of work and completing additional tasks, as directed by the Board.

Three specific tasks assigned by the Board in 2005 are:

• Issuing an RFQ and assembling a pool of pre-approved contractors. The RFQ/pre-approved pool task is complete and the Board will approve the results in its meeting this afternoon.

• Adding Cx providers to the CCC website. Providers have been added to the CCC website and a second solicitation will be conducted in February.

• Copying Cx Assistant to the CCC website. The CCC is still working with EDR and CTG Energetics to complete this task, as a new Beta version of Cx Assistant has recently been launched.

4. Cx and RCx Guides Update - Martha Brook, PIER

The Cx and RCx Guides are being developed in response to the Governor’s Executive Order S-20-04 to provide guidance on commissioning and retrocommissioning to State facilities. Currently in draft form, the Guides leverage existing products. They will be published as a CCC product with the State logo in both hard copy and online. The online version will be led by DGS and integrated into their existing resources.

The Guide documents are organized into a “narrative” and a “sidebar.” The narrative is an ongoing dialogue and the sidebars contain references, diagrams, small pieces of information, and examples. The final documents will be professionally designed.

Anyone interested in participating in the review process should contact Martha Brook. Comments are requested by early November. Opinions are also requested on whether a public workshop on the Guides is worthwhile, and if respondents believe it is worthwhile, a workshop will be held.

Attendees were asked how the Guides should be distributed. Utilities were asked to comment on how the Guides would be used in their 2006 programs. It was suggested that they be posted to the EDR website and should be distributed at any training events for owners.

Attendees commented that the Guides will need a table of contents. Attendees were asked whether the documents are hitting their audience and helping owners navigate the process and understand it better. It was suggested that the process advocated in the Guides be made more market-oriented – meaning making a process that responds to the market. Attendees also asked if anything is being done to explain how the T24 requirements tie into a Cx process and whether those requirements will be discussed in
the Guide, as they relate to commissioning. It was also asked if the CEC has looked at the effect of the new standards on costs in construction industry. The response was that it has been considered.

**Action Item: CCC will address T24 code requirements in the final versions of the Cx and RCx Guides using a special, boxed page similar to the current treatment of the LEED treatment guidelines, and perhaps also including a diagram.**

5. **Training Strategy Discussion – Kristin Heinemeier, PECI**

A summary of the study background was presented and the CCC Advisory Council was asked to help prioritize which training needs the Board should consider funding in 2006. The following comments were made:

- Controls training is necessary. Mark Hydeman’s DDC training at the PEC and other venues was not included in the CCC’s report, nor were some courses at PEC and UW. It was suggested that the PEC would put on a controls class on a regular basis if they believed there was a demand for it. It is important to determine the focus of such a class, for example will it be “hands on” like the RCx course.

- The PEC’s one day/month hands-on course is thought to be very effective in training providers. DGS staff is going and is getting a lot out of it.

- A mentoring program following NEEA’s example, perhaps with a formalized process and a fee was suggested.

- It was noted that Berkeley’s PERALTA building technology curriculum is emphasizing Cx prerequisite and extra credit classes in a vocational high school all the way through graduate degrees in building technologies.

- It was noted that there is a distinction between education and training and it should be asked where education can happen within the regular education process. For example, LBNL is working with community colleges in Oakland to develop a two-year HVAC curriculum, moving quickly ahead on controls and troubleshooting, that will involve Cx. However, there are no four-year HVAC programs, mostly just two-year programs, and thus there is a gap in HVAC, let alone Cx.

- It was suggested that it is important to ask what qualities one want in a Cx provider, because you can’t train experience, and it’s no just about HVAC. The industry is growing in a lot of different ways. For example, NBI has 16 guidelines – only one on HVAC – including fire, plumbing, electrical, security, A/V. It was argued that that is where the industry is going because developers see value beyond energy savings, for example, quick turnover and a proper product. It was also noted that there are not enough case studies that concentrate on non-energy benefits like turnover and cost-avoidance.
• In response, it was argued that an economic component is necessary to sell Cx – and that one needs energy savings to do that.

• It was commented that there are likely about 200 qualified Cx providers in the country, and that 2,000 are needed to meet the upcoming demand. To which one attendee asked whether it is CCC’s responsibility to train them.

• It was noted that in one UW class, which the attendee participated in, about 25% of the attendees were experienced practitioners from all walks of the industry, looking to get into commissioning to advance from their current positions, but did not have a functional means of finding another position. To which it was suggested that the CCC run a job finding service, or at least a message board for posting job announcements.

• Another attendee commented that there are only about a dozen professors teaching building sciences, and it might be beneficial to ask if “commissioning” is a part of the curriculum. If not, the CCC could consider developing curriculum for one lecture.

Mr. Welker reminded attendees that their recommendations will drive both the CCC’s funding decisions and its larger role in the commissioning industry, and asked whether they thought it should follow the rather contained role it has had in the past – or whether it should take on training as a larger project. Attendees responded that perhaps the CCC should look to “facilitate” rather than “provide” training by serving as a training coordinator to make people aware of opportunities. Others agreed that this connection is currently a missing piece.

The following Advisory Council members volunteered to sit on a Training Advisory Committee: Philip Haves; Ken Gillespie; Don Little; Patrick Pico.

**Action Item:** The CCC will convene a Training Advisory Committee (TAC) to produce recommendations for the Board. The TAC will consider two specific recommendations: adding a job board to the CCC website and creating an apprenticeship program.

6. **Industry Advancements Presentations**

a. **Cx Assistant – Erik Ring, CTG Energetics**

Cx Assistant is a web-based application that supports the development and implementation of new construction building commissioning. It is funded by PG&E and currently resides on the PG&E/EDR server, but because it is coded in HTML it can be moved to other locations.

The new Beta version is now accessible from the EDR website. It allows the user to enter project information one time and saves projects for easy revision and access. The tool produces editable documents to facilitate customization. There is currently a new design review module under contract with CTG Energetics and PECI.
On attendee inquired about how the Cx Assistant relates to the Cx and RCx toolkits, getting under contract with PIER, and it was answered that the Cx Assistant will be incorporated as part of the toolkit.

It was also suggested that Cx Assistant be integrated into educational curriculum as the FT Guide has been in the STAC project.

Another attendee noted that it will be important to keep Cx Assistant modular in order to keep it manageable for users.

**Action Item: Consider convening a CCC review committee for Cx Assistant**

**b. Annex 47: Cx Tools R&D Needs – Philip Haves, LBNL**

Mr. Haves introduced Annex 47 and its goals to develop commissioning procedures for low energy buildings, develop automated tools for commissioning, and study commissioning’s costs, benefits and persistence. He then presented several questions to the group, including:

- Will automation lower the cost and enable widespread adoption of commissioning and O&M tools?
- What tools are needed and what degree of automation?
- What are the needs for research in the area of commissioning, fault detection and diagnostics (FDD), prognostics and predictive maintenance?
- What is the role of the industry, universities, national laboratories and State and Federal government?

Discussion focused on the first two questions. The following is a summary of the issues raised by attendees.

- LEED training barely touches low-energy Cx measures
- UW is developing course specifically for Cx and LEED – sustainable activities
- CHPS goes deeper than LEED in terms of sustainable bldg Cx
- One attendee said he has always been confused by the lack of involvement in automated Cx by controls contractors – especially large companies like Siemens and Allerton. He doesn’t see them selling products based on Cx capabilities – why not? Attendees made several respondes:
  - That controls contractors have a different perception of what Cx is, that it is a paradigm issue. To them, Cx is check-up and start-up.
  - Another attendee reported that he put Cx into a spec and the controls contractor thought he had already done it. This person thought controls contractors can provide documentation but don’t.
Cx in general was thought by attendees to be perceived by controls contractors as something without value, and therefore just a cost and not worth doing.

Neither the economics nor the OPR clearly identify the type of controls and M&V that are required because owners don’t understand them.

- Other attendees seconded the pressing nature of the question: why don’t controls companies grow the market for their diagnostic services? Again it was noted that owners don’t understand the issues and that controls contractors have “worked themselves out of financial success” because the very competitive nature of their business places a large burden on them - they don’t have time to think about other markets. For example, a contractor might bid a job at two hours and get underbid by another company at one hour – when checking all VAV boxes would take 300 hours. This is the discrepancy between Cx and Start-up.

- One attendee asked what is meant by automation. There was much agreement that the automation that’s need is tying sequences to alarms and trending.

- Others agreed that the market needs owners to be educated enough to demand commissioning and diagnostics using their controls systems. The capability is there but there’s no money in it until owners recognize the value.

- Automated tools were thought to be more feasible in existing buildings, whereas in new systems, the automation capabilities have to work first – and that’s the hard part of Cx. A building can’t fully automate unless one can guarantee that the controls work.

- A need for standard sequences was expressed, and the possibility to build automation around it.

- It was noted that the potential for automation is bound by the situation that is being addressed, in which controls are standardized products being put into customized products (buildings). One needs to consider how far automation can go in relation to how far the standardized product extends.

- It was noted that controls providers deliver a “canned,” preprogrammed product – and that often causes problems.

- The desire to automate alarms and alarm conditions was expressed, for example, when conditions exceed an expected range.

- Tools were thought to be useful depending on the time they take compared to the time available. It was thought that any tool would have to be mature to be useful, and would need to have a proven track record, with market penetration, before start automation.

- The need to bound the issue by the end result was noted. For example, the desire for a comfortable environment. At the controls level, automation doesn’t
address root problems, for example an unbalanced damper, thus the mechanical function that needs to be fixed first.

- In response to the question of whether there is a need for R&D in automated Cx and diagnostic tools, and whether public funds should be put into it, one attendee thought there was a need in existing but not new buildings. Another recommended started with Cx components first, then systems.

c. LEED v. 2.2 – Dan Burgoyne, DGS

LEED is generating a lot of interest and gaining popularity, especially among governments. It has thus far been adopted by seven states, 40 cities and three Federal agencies. There are currently three rating systems and three pilot rating systems.

All three rating systems have Cx requirements. LEED-NC Version 2.2 requires/allows for the following:

- Requires two submittals – at end of design for an initial score and then later after construction for total final

- Requires the Cx provider to have documented experience in two projects and report directly to the owner. If the project is less than 50,000 sqft the Cx provider may be a member of the design team if they are acting independently – they may not be a member of the project team if the building is larger. It was noted that this requirement was heavily discussed by the LEED committee. Some attendees disagreed with this allowance. One noted that when his firm had commissioned their own projects there was a “huge” conflict of interest, regardless of the project size.

- For the prerequisite credit, requires the owner, not the Cx team, to complete the OPR. The intent is to keep the owner involved, rather than letting them hand it off. An attendee stated that he’s found the Cx can lead/help with the OPR.

- As in previous versions, requires Cx to be included in construction and bid documents and requires that installation and performance be verified.

- Defines four minimum systems that must be commissioned: HVAC, lighting controls, domestic hot water, and renewable energy systems. Previous versions gave a “laundry” list without any clarity or definition. This represents a significant change in scope. Water and envelope are encouraged but not required.

- Renames the “additional” point as “enhanced.” The goal was to bring commissioning in earlier in the process and add activities and thus value to the owner for pursuing it. The enhanced commissioning point requires the identification of the Cx provider prior to CDs, prohibits the provider from being an employee of the design firm (although he or she can be contracted through the design firm). The Cx provider is also prohibited from being an employee of
the contractor or a construction manager handling construction contracts. Unlike the prerequisite, there is no exception to this restriction based on project sqft.

- In version 2.2, the Cx review of submittals and the Systems Manual requirements are unchanged.

- Warranty now requires a review within 10 months rather than one year.

- Training of O&M staff is shifted from a prerequisite activity to enhanced credit activity. The reason for this, and other changes was that the majority of LEED projects didn’t apply for the commissioning extra point because of the expense – only 17 of 100 applied for it. When the committee asked why, they realized it would be important to shift dollars to allow owners to get more value, and since training is very valuable to the owners it made sense to put it in this category. In addition, placing fewer requirements in the prerequisite lowers barriers to entry.

- Allows for online submittals using an online workspace

- Looks more at the “spirit of the law” or the intent of the submittals when conducting evaluations

It was noted that the next version of the LEED Rating System, v3.0, will look at wholesale changes in the commissioning requirements and will be looking to add credits to Cx. Balloting on version 2.2 ends the week of October 24, 2005 and they hope to roll out the guidelines November 9-11, 2005 at GreenBuild in Atlanta.

Those who are interested in LEED are encouraged to look at the new reference guide and letter templates because they include a lot of references. LEED hopes to have them come out soon. They do include links to the CCC website and the online Cx Assistant tool.

7. MBCx Commissioning – Richard Henrikson, Jim Corbett, Craig Newton

This presentation on the CSU Fullerton central plant RCx project was followed by a site tour of the facility.

The central plant was implemented in the mid-1990s with goals to optimize efficiency and increase capacity of cold and hot water distribution.

The objectives of this RCx project, taking place under the MBCx program, are to:

- Determine optimum delta Ts based on season, time of day, OSA temp
- Minimize recirculation to maximize delta T
- Determine optimum temps for heat recovery chiller
- Determine optimum differential pressure setpoints
• Determine optimum in-line device design
• Determine maximum OSA temp at which secondary cold and hot pumps can go off

The scope of the project includes:
• Replace/calibrate electric/flow meters and sensors (in process now)
• Develop Cx plan
• Develop new sequence of operations
• Reprogram Andover controls continuum EMS
• Conduct comparative day-to-day, baseline and post-Cx monitoring to evaluate effects of OSA and occupancy
• Analyze comparative day-to-day monitoring test data
• System will allow them to continually test – establishing a process as to how they’re going to test new/different strategies