California Commissioning Collaborative

Advisory Council Meeting

November 15, 2007
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<tr>
<th>Time</th>
<th>Session</th>
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<tr>
<td>9:00 AM</td>
<td>Continental Breakfast</td>
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<tr>
<td>9:30 AM</td>
<td>Welcome, Introductions, and Announcements</td>
<td>Don Frey, AEC</td>
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<td>9:40 AM</td>
<td>CCC Strategic Planning Update</td>
<td>Phil Welker, PECI</td>
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<td>9:50 AM</td>
<td>Project Update: Market Research and Toolkit</td>
<td>Hannah Friedman, PECI</td>
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<td>10:30 AM</td>
<td>Break</td>
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<td>11:00 AM</td>
<td>Project Update: Verification of Savings</td>
<td>David Jump, QuEST; Ken Gillespie, PG&amp;E; Steve Kromer</td>
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<td>12:00 PM</td>
<td>Lunch</td>
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<td>Green Building Confessions</td>
<td>Sandy Mendler, HOK</td>
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<td>PEC presentation on Tool Lending Library</td>
<td>Robert Marcial &amp; Ryan Stroupe, PEC</td>
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<td>Environmental Control Technology Education for Advanced Building Operation and Management</td>
<td>Phil Haves, LBNL; Joe Deringer, Deringer Group</td>
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<td>USGBC Revision to LEED-EB</td>
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<td>Wrap - Up</td>
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Strategic Planning Update

• **August**: Advisory Council Retreat
  – Brainstorm long-term issues and opportunities

• **September**: Board Planning Session
  – Identified highest priority areas of focus

• **October**: Proposal Development
  – Describe market conditions and options for CCC
Priorities for the CCC

1. Policies, Standards & Research
   Ensure the commissioning industry is prepared for California’s “green wave” with active involvement in policy development

2. Measurement & Verification
   Participate in setting standardized validation procedures for retrocommissioning programs

3. Comprehensive Service Delivery Model
   Develop a streamlined processes for selling, implementing and maintaining retrocommissioning activities

4. Training & Education (secondary priority)
   Support long and short-term solutions to ensure an adequate workforce of service providers
Next Steps

• Board Decision on Options and Scope
• Funding Allocations
Project Update

Commercial Commissioning: Research and Development Program

Hannah Friedman, PECI
Commercial Commissioning: Research and Development Program

• Funded by the CEC Public Interest Energy Research (PIER) Program

• **Market Research**: Examine building owners’ understanding of the value of Cx and RCx; develop strategies for greater market awareness and penetration
  – Interviews with decision-makers
  – Strategy development and implementation

• **RCx Toolkit**: Help practitioners provide consistent & cost-effective service through development of:
  – Templates and sample documents
  – RCx energy savings calculation spreadsheets
  – Data analysis tools
Cx R&D Market Research: Project Overview

Purpose
- Improve owners’ understanding of the value of Cx and RCx

Approach
- Open-ended interviews with 28 decision makers in the hospital and Class A office building markets
- Identification of 3 strategies
The Strategies

#1 Webinars: Educate commissioning providers on findings from the market research

#2 White Paper: Investigate ways to tie Cx and RCx to the green movement

#3 Collaborate with due diligence: RCx-related activities as a due diligence or risk management strategy
Strategy #1
Educate commissioning providers

• Two 90-minute webinars - $100 registration fee
  – July 11th 12-1pm PST – Office market
  – July 25th 12-1pm PST – Hospital market

• Presented by Marti Frank (PECI)
• With owner co-presenters:
  – Dennis Thurman, Senior Vice President of Engineering for the West Region, Transwestern Commercial Services
  – Jeffrey Keyak, Senior Maintenance Operations Consultant, Kaiser Permanente

• Results:
  – Office – 16 registrations; 64 attendees
  – Hospital – 42 registrations; 168 attendees
Strategy #2
Market Cx/RCx as “green”

• Research done in July/August
  – Interviews with leading “green” marketing experts, review of publications and green marketing campaigns

• Deliverable
  – It’s not Green if it doesn’t Work: Marketing Commissioning as a Sustainability Strategy
    • Develop strategic alliances (credibility and reach)
    • Outreach and advertising to increase awareness
    • Associate Cx attributes in green branding
Strategy #3
Collaborate with due diligence community

Research Strategy
Through in-depth interviews and a virtual roundtable, develop ways that RCx-related activities integrate into the commercial real estate property acquisition process

– Building owners and managers
– Members of the commercial due diligence community (attorneys, engineers, construction management firms)
– RCx providers familiar with the due diligence process
Research Findings

1. Significant interest in adding RCx activities to Property Condition Assessment (PCA) performed as part of the due diligence process

1. Benchmarking and RCx scoping studies can detect problems not typically addressed during due diligence

2. Identification of barriers to integrating RCx-related activities into PCAs.
A Virtual Round Table: The Intersection of Due Diligence and RCx

Goals:
- Identify common goals for the PCA and RCx
- Discuss barriers and strategies for integrating RC and PCA

Audience:
- RCx Providers
- Due Diligence Consultants (i.e., attorneys and engineers)
- Members of the Project Advisory Committee
Areas of Overlap

Due Diligence – Asset Value
- Identifies equipment and property deficiencies (remaining useful life)
- Assesses maintenance
- Includes envelope, internal air quality, mechanical & electrical, and comfort issues
- Also includes site issues
- Provides Property Condition Report that is required by lender
- Identifies issues that become negotiating points for sale

RCx – Asset Performance
- Identifies equipment and system operational performance deficiencies
- Assesses maintenance
- Includes envelope, internal air quality, comfort issues
- Typically focuses on energy-consuming systems
- Consists of an intensive process of assessing system operations (control system trending, energy data analysis, functional testing)
- Has few outside requirements – some state and local mandates
Strategies & Barriers to Integration

Strategies:
- Benchmarking (ENERGY STAR® or Cal-Arch)
- RCx Scoping Study/Screening Checklist
- Integrate RCx-related activities into the policies and standards that underlie due diligence and PCA

Barriers:
- Short timeframe for PCA and due diligence in general
- Added cost
- Lack of quantitative information on costs and benefits in market segment
Next Steps for Due Diligence/RCx Intersection

• Write article for due diligence publication
• Present strategy at conferences
• Work to integrate benchmarking into the standard PCA
• Develop a pilot program in 2008
• Form partnerships with organizations that share similar goals
  – U.S. Climate Action Partnership
  – Oregon Lawyers for a Sustainable Future (parallel group in CA?)
RCx Toolkit Overview

1. Templates and Sample Documents
2. Energy Savings Calculation Spreadsheets
3. Additional Tools
   - Utility Bill Analysis Tool
   - RCx Findings Workbook
   - Energy Charting and Metrics (ECAM) Tool
Templates & Sample Documents

Goals:
• Facilitate information gathering
• Help commissioning providers streamline processes to reduce report writing time
• Increase information transfer to the owner’s team
Templates & Sample Documents Selected

- Building Staff Interview Form (Template)
- Owner’s Operating Requirements (Template and Sample Document)
- List of Preferred Building Characteristics (Sample)
- Diagnostic Monitoring Plan (Template and Sample Document)
- Ongoing Commissioning Plan (Template and Sample Documents Package)
RCx Tools Currently Available on CCC Website

- Building Staff Interview Form
- List of Preferred Building Characteristics
- Owners Operating Requirements
- Diagnostic Monitoring Plan (Template & Sample)
- Ongoing Cx Plan (Template & Sample)
  - Implementation Summary Report (Template & Sample)
  - Sequence of Operation (Template & Sample)
  - Monitoring Action Plan (Template & Sample)
  - Calibration Plan (Template & Sample)
  - Training Plan (Template & Sample)
- Existing Building Commissioning Plan
- Design Intent Documentation
- Final RCx Report examples
- Systems Manual
- Request for Proposal Checklist
Energy Savings Calculation Spreadsheets

Goals:
- Assist providers in completing energy savings calculations for RCx
- Streamline and standardize calculation methods
- Consistency with flexibility (Excel)
Spreadsheet Calcs: Criteria for Need

- How prevalent is the measure?
- Is the savings potential significant?
- Is there external demand for the calculation?
- How big is the typical calculation error?
- Is the calculation needed to increase investigation of, or to optimize the measure?
- Will the calculation significantly reduce utility program review time?
Spreadsheet Calcs: Specific Objectives

- Standardize energy savings calculations
- Include comparisons with Title 24 requirements
- The calculations are:
  - building-specific
  - easy-to-use
  - use information and data commonly available to RCx providers
  - not a black box – all formulas listed
- Include details to improve savings estimates
  - fan curves, pump curves
  - system pressure drops
  - location of the static pressure sensor
  - motor and VFD efficiency vs. speed
Spreadsheet Calcs Developed

• Pumping System Energy Savings Workbook
  – Change pumping system flow
  – Reduce differential pressure setpoint
  – Reset differential pressure setpoint

• Fan System Energy Savings Workbook
  – Reset supply air temperature
  – Change VAV box minimum flow setpoint
  – Reduce duct static pressure setpoint
  – Reset duct static pressure setpoint
**Example: Fan System Workbook**

**Calculation Inputs**

Typical calculation time may be ~1 minute, but may be notably slower on older computers.

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Savings Summary

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<td>11,285 kWh/yr</td>
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<td>17,979 kWh/yr</td>
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<td>37,094 kWh/yr</td>
<td>Total Annual Savings</td>
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**RCx Toolkit**

**Electrical Power vs. Flow**

Flow vs. Power graph showing different scenarios:
- Baseline
- Fixed speed or high static setpt.
- Improved
- VAV box controls flow; VFD controls static press.
- With reset of static press, setpt.

**Fan Energy vs. Ambient Temperature**

Graph showing energy use for three types of flow

**Fan Performance and System Curves**

Graph showing various pressure rises at different speeds and conditions.
# Fan System Scenario Analysis

## Savings Summary

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<td>37,094 kWh/yr</td>
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Additional Tools

• Utility Bill Analysis Tool
  – Goal: Ease of analysis of average daily consumption

• RCx Findings Workbook
  – Goal: Consistency in tracking and automated summary tables for reporting

• Energy Charting and Metrics (ECAM)
  – Tool Partnership between Northwest Energy Efficiency Alliance, CEC PIER, and NBI
  – Goal: Reduce time spent manipulating data
Utility Bill Analysis Tool
Average Daily Consumption

Average Daily Natural Gas Use [therms]

Heating degree-hours / 24

- 2005 therms
- 2004 therms
- 2003 therms
- 2002 therms
- HDH + 24
Findings Workbook

• Project information
  – Bldg size, annual energy use, energy cost, savings potential, benchmarking score

• Investigation checklist
  – 21 most common findings

• Helps track
  – Measure savings, costs, recommendations for implementation, source of savings calculations

• Data input sheet that feeds into standard reporting for owners
ECAM (Energy Charting and Metrics) Tool

Goals:
• Assist RCx providers and building operators with data analysis
  – Quickly provide useful summary metrics and charts
  – Provide easy but powerful ways to “drill-down” for additional analyses
  – Flexibility (Excel add-in)
Charting and Metrics Capabilities

- Can be normalized by another parameter:
  - Building area (e.g. kWh/sq.ft.)
  - Cooling tons (e.g. kW/ton, gpm/ton)
  - CFM (e.g. Watts/CFM)
  - gpm (e.g. Watts/gpm)

- Can be filtered by:
  - Year, Month
  - Pre/Post time periods
  - Daytype
  - Time of day
  - Occupancy
  - Weather conditions
  - Combinations
Four Simple Steps

1. Select data from existing spreadsheet
2. Map points
3. Create schedules
4. Create metrics and charts
# Output Metrics - Filtering

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Load Profile Charting by Daytype

![Graph showing load profile charting by daytype. The chart indicates average electrical meters Watts per square foot (Avg Elec Mtr Watts per SF) varying throughout the day. The chart distinguishes between Weekday, Saturday, Sunday, and Holiday with different line colors: blue for Weekday, pink for Saturday, orange for Sunday, and green for Holiday. The y-axis represents the average electrical meters Watts per square foot, ranging from 0.00 to 4.50. The x-axis represents time from 12:00 AM to 11:00 PM in hourly intervals.]
Scatter Plot Charts

Ambient Temperature (degrees F)

Whole Building Watts/sq ft

Occ
Unocc
System-level Charting

Chiller Electrical Demand vs. CHW Load

Chiller Electrical Demand [kW/ton] vs. Load [tons]

- 1-chiller operation
- 2-chiller operation
Summary & Next Steps

• CCC RCx Toolkit helps address need to streamline and provide consistency
  – All templates and sample documents currently available
  – Tools will be available December 2007

  [http://www.cacx.org/resources/rcxtools/](http://www.cacx.org/resources/rcxtools/)

• Future development opportunities
  – Pilot tools in 2008
  – Spreadsheet tools to cover additional finding types
  – Potential pre-approved calc methods for utility programs
  – ECAM enhancements planned based in Fall 2007 pilot
Break

10:30 – 10:45
Project Update

Analysis and Development of Educational Opportunities

*Terry Fry and Betty Smith, Nexant*
Challenges for the Industry and the CCC

• Increasing need for Cx and RCx skills and experience
  – State requirements increase demand
  – Baby boomer retirements reduce supply

• How might the CCC influence education and training to alter the balance between need and availability?
Our Objectives

• Identify ideal Cx/RCx skills and experience

• Characterize current training activities and resources

• Analyze adequacy of existing programs to meet “future” needs

• Recommend CCC interventions
What We’re Doing

• Focus is on interviews with a spectrum of industry participants

• Will look to utilities, the state, and others for indications of future demand
Who We’re Talking To

• Service providers/consultants
• Facility managers
• Educators
• Utility program managers
• Professional associations
Update

• Twenty-four interviews completed
  – 7 service providers/consultants
  – 6 educators
  – 4 facility managers
  – 2 utility program managers
  – 2 professional associations
  – 3 others

• “Ask an expert”. . .
  – Lots of engagement
  – Considerable discussion of community colleges
Upcoming Task

- Estimate demand for services
  - Community colleges use the state’s job creation forecasts to justify their programs
  - The EDD’s projections may differ from the industry’s expectations
Project Update

Verification of Savings

David Jump, QuEST
Ken Gillespie, PG&E
Lunch

12:00 – 12:45
Green Building Confessions

Sandy Mendler, HOK
PEC and the Tool Lending Library

Robert Marcial & Ryan Stroupe, Pacific Energy Center
Break

2:15 – 2:30
Environmental Control Technology Education for Advanced Building Operation and Management

Philip Haves, LBNL
Joe Deringer, Deringer Group
USGBC Revisions to LEED-EB

• Significant changes to Energy & Atmosphere prerequisites and credits

• Replaces prerequisite for RCx with a walk-through audit

• Provides more credit points for RCx activities
CCC Comment

• Replacing RCx prerequisite with a walk-through audit will not ensure that the building is “high performance.”

• Buildings can be certified without implementing any operational or energy saving improvements.

• Proposed changes fall out of line with California’s aggressive mandates for resource efficiency.
USGBC Response

- LEED-EB now offers up to 6 points for RCx/ongoing Cx - an incentive

- Prerequisite energy audit is an entry point to early stages of RCx

- In conjunction with ENERGY STAR rating minimum, buildings may need to RCx to maintain certification

- Grow LEED-EB market share by making the system easier to use; currently RCx was seen as too big of a stretch for the market

- USGBC received feedback that RCx is seen as too costly and owners didn’t know where to find RCx providers.
Future Agenda Topics - February

• Program Profiles – Volunteers? Invitations?
• Case Studies – Volunteers? Invitations?
• Topics of Interest
  – Special Guests?
  – Other Ideas?
• Discussion:
  – Ideas?
2008 Meeting Dates

- February 7 – Thursday
- April 21 – Monday, coincides with NCBC, Newport Beach
- June 12 – Thursday
- August 28 – Thursday
- November 6 – Thursday
Adjourn

Thanks to PG&E for hosting today!