



California Commissioning Collaborative

CCC PIER Research Program:

Program Advisory Committee (PAC) Meeting

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December, 2011



Agenda

- Update from CEC PIER
- CCC PIER Team
- Project Updates
- What Next?

CEC PIER Update

The PIER team

- PECCI
- AEC
- QuEST
- Enovity
- Additional support:
 - Heschong Mahone Group
 - Eaton
 - EnerNOC

Project 2: Building Operations Assessment for Commercial Real Estate Transactions

- Research complete
- Pilots complete
- Optimized approach developed
- Final report complete
- Toolkit being finalized
- Outreach 2012

**Building Operations Assessment Report:
Option B: Existing Building Commissioning Feasibility Study
and Cost-Benefit Analysis**

Existing Building Commissioning (EBCx) Recommendations

Indicators of a building being a candidate for EBCx:
 The building is >100,000 square feet
 The facility has a central plant with typical air conditioning air ducts
 The building has not been commissioned in the last 5 years
 Building documentation is available
 Previous energy audits are available
 The facility's controls are Direct Digital Controls (DDC) or HVAC
 Automated diagnostics or other supporting software tools are available
 The building automation system can trend data, schedule setpoints
 There are no major retrofits or HVAC equipment replacements planned

FPA ENERGY STAR Benchmarking

Buildings that score a 75 or higher may qualify for the ENERGY STAR performance standards set by the EPA, and use less energy. Buildings that score 1-74 are less efficient.

▲ Current ENERGY STAR score

BOMA Experience and Exchange Report: Energy Performance

▲ Current cost / sq ft

Report prepared by _____
 Report prepared for _____
 Dated _____

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What is a Building Operations Assessment: Option B?
 It is a preliminary evaluation of a commercial building's current energy performance and opportunities for improvement. It is a tool for managing the risks associated with high-energy consumption, and provides a list of potential existing building commissioning (EBCx) improvements, with estimated costs and savings. Based on these findings and other key building characteristics, the report provides a recommendation as to whether to pursue EBCx.

Building Overview

Building Name: XYZ Building		As of 01/29/2011	
Location	San Francisco, CA	Total annual energy use	15,785,000 kWh
Square footage	142,000	Total annual energy cost	\$475,000
ENERGY STAR® score	61	Energy cost per square foot	\$3.06
Current LEED certification	None	Energy Use Intensity	107.3 kWh/sq.ft./yr
		Annual CO ₂ emissions	2.7 million lbs

Summary of potential Existing Building Commissioning (EBCx) Improvements

Opportunity	Estimated Annual Energy Cost Savings (\$)	Estimated Implementation Cost (\$)
1. Install VFDs on chilled water pumps	\$17,000 - \$15,000	\$8,000 - \$10,000
2. Place first floor plug-in lighting on time-clock	\$5,000 - \$10,000	\$500 - \$1,000
3. Install VFDs on lowest pump cooling tower fans	\$1,000 - \$2,000	\$4,000 - \$8,000
4. Optimize chilled water temperature setpoints	\$5,000 - \$10,000	\$1,000 - \$2,000
TOTALS	\$27,000 - \$37,000	\$15,500 - \$21,000

Total opportunities found: Four (4)
 Payback on investment (ROI): 180%
 Potential increase in Net Operating Income (NOI): \$21,000 - \$37,000
 Potential increase in Asset Value: \$140,000 - \$667,000

Existing Building Commissioning (EBCx) Recommendations: Comprehensive EBCx recommended

Comprehensive EBCx may reduce whole-building energy use by an average of 5 - 15% and in some cases by 20%. Energy savings lower net operating income and increase asset value. Your local utility Pacific Gas & Electric (PG&E) may offer incentives for certain improvements. Learn more at www-pge.com or contact your utility account representative.

Project 3: Development of EBCx tools (1 of 2)

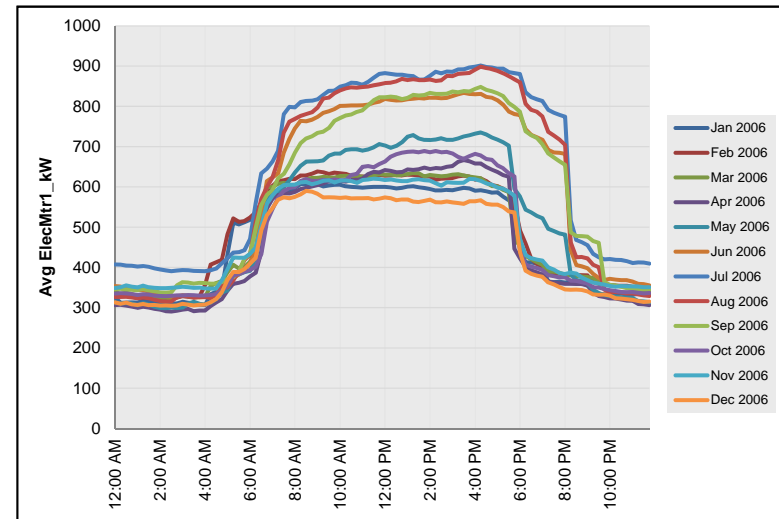
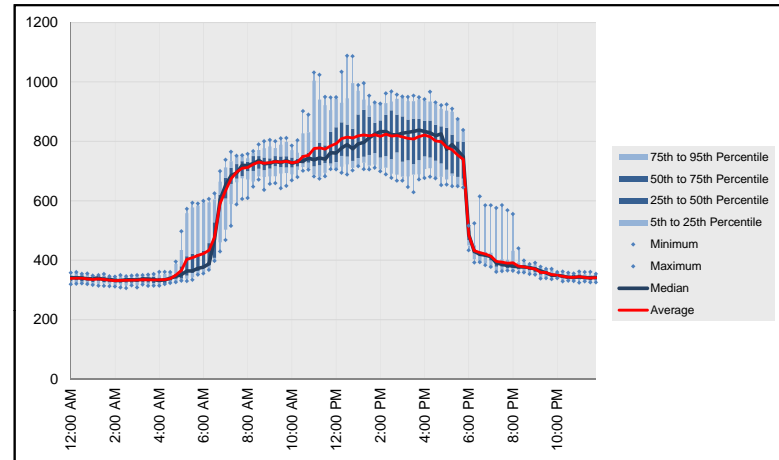


Interval Data Analysis with the Energy Charting and Metrics Tool (ECAM)

- ECAM v2.0 available
- Video tutorials
- New user guide



<http://www.cacx.org/PIER/ecam/>



Project 3: Development of EBCx tools (2 of 2)

- Calculation tool 95% complete
- Internal testing ongoing
- Outreach planning in progress

The screenshot shows a Microsoft Excel spreadsheet titled "Microsoft Excel - PIER_RCC_Tool.xls" with a worksheet named "AHU - Test". The interface includes several data entry sections and two graphs.

General Information

Baseline Schedule :	Office Building + 3 hours
OA Design Temperature(*F) :	100
Return Fan :	No
Fan Heat(*F) :	1
Total Static Pressure(in. WC) :	4
System Balance Point :	
Fraction of zone terminal boxes with reheat capability :	

Duct Static Pressure Information

Control :	Reset
Setpoint(in. WC) :	
Setpoint Min :	1
Setpoint Max :	2

Supply Fan Information

Capacity(CFM) :	20000
Max Fan Power (kW) :	Calculate
Operating kW :	
Motor Size(HP) :	25
Motor Efficiency(%) :	94%
Load Factor(%) :	85%
Fan Control :	Constant Volume
Fan Control Type :	
Min Flow Ratio(%) :	
VFD Drive Efficiency(%) :	

Return Fan Information

Capacity(CFM) :	
Max Fan Power (kW) :	Set Operating kW
Operating kW :	
Motor Size(HP) :	
Motor Efficiency(%) :	
Load Factor(%) :	
Fan Control :	Constant Volume
Fan Control Type :	
Min Flow Ratio(%) :	
VFD Drive Efficiency(%) :	

Supply Air Flow Regression (%)

OAT	Air Flow (%)
0	0.45
40	0.6
60	0.75
100	0.9

Supply Air Temperature Regression

OAT	SAT
0	65
40	65
60	55

Two graphs are displayed: "Supply Air Flow Regression (%)" showing a positive linear trend, and "Supply Air Temperature Regression" showing a negative linear trend.

Navigation tabs at the bottom include: Summary By Measure, Summary By Equipment, General Information, Schedules, Gas Rate, Electricity Rate, Demand, Plant.

Project 4: Building Performance Tracking (1 of 2)

- Research complete
- Handbook published online
- Hard copies available
- 1,100 Downloads to date, 111 hard copies mailed
- Presented at BOMA Conference
- Article drafted for *Buildings Magazine*



www.cacx.org/pier/handbook

Project 4: Building Performance Tracking (2 of 2)

Building Performance Tracking Success Story The Aventine

Glenborough's Aventine facility in La Jolla, California is a living example of how multiple tools and strategies can be combined to create a successful building performance tracking story. The result: an ENERGY STAR® score of 100, a Leadership in Energy and Environmental Design (LEED) Platinum certification, and HVAC issues addressed before they turn into tenant complaints.

Glenborough uses the following tools and services to support its building performance tracking goals:

- **Benchmarking:** ENERGY STAR Portfolio Manager to track progress towards energy savings goals and to prioritize energy savings investment across their portfolio
- **Third Party Utility Bill Analysis Services:** Contract with Constellation Energy to analyze monthly utility bills and to provide alerts when usage is off-target
- **Automated System Optimization:** Optimum Energy's OptimumMFM services track chilled water plant performance and automatically optimize settings based on load
- **Building Automation System (BAS):** Alerton BAS to track key HVAC system performance indicators and follow up on alerts reported through other performance tracking tools

The combination of these tools enables Glenborough to 1) directly track system performance and 2) identify anomalies in energy use, thereby covering the two key elements of building performance tracking.

Performance tracking tools do not guarantee improved building performance on their own. Equally important are the management strategies that support the use of tools.

What is Building Performance Tracking?

The process of monitoring facility data on a regular basis to continually improve building energy performance. The four steps below detail the fundamental process for tracking, analyzing, diagnosing, and resolving issues with heating, ventilation and air conditioning (HVAC) and lighting systems.

1. Collect data and track performance
 2. Detect performance issues
 3. Diagnose issues and identify solutions
 4. Fix issues and verify results
- Building performance is tracked on an ongoing basis and incorporated as part of standard processes.



The Aventine in La Jolla, CA

"Decisions made now will be with the building for five, ten, maybe even twenty-five years."
—Carlos Santamaría, LEED AP
Director of Engineering, Glenborough, LLC

Quick Facts

FACILITY NAME:	Aventine
OWNER:	Glenborough, LLC
WEBSITE:	www.glenborough.com
LOCATION:	La Jolla, CA
TYPE:	Multi-tenant commercial office
GROSS SQUARE FOOTAGE:	250,000
ENERGY USE INDEX:	26.4 kWh/ft ²
ENERGY STAR SCORE:	100
LEED RATING:	Platinum
PERFORMANCE TRACKING STRATEGIES:	<ul style="list-style-type: none"> • Energy Benchmarking • Utility Bill Analysis • Building Automation System (BAS) • Automated System Optimization

Glenborough contracts out facility management to ABM Industries and gives staff the resources, time, and training needed to identify performance anomalies, diagnose the root cause, fix the issues, and verify the energy savings and improved performance on a regular basis. As a result, building performance is now at the core of facility operation, encompassing:

- **Culture.** Glenborough's top down support for building performance tracking helps make it a company best practice. Management promotes energy awareness through competitions, open lines of communication, and creative autonomy for operators to find and fix performance issues.
- **Financial Support.** Glenborough has a strong track record of supporting investment in building performance. Operators receive bonuses and annual recognition to reward best practices.
- **Accountability.** Quarterly and annual reports from Optimum Energy to Glenborough highlight facility events and prioritize areas for improvement. This reinforces accountability and places energy performance alongside other traditional business health indicators.
- **Operator Training.** Glenborough hosts an annual training for operators on energy and system performance topics. These efforts keep staff current on the latest tools, equipment, and processes necessary to maintain peak operation.

Lessons Learned

Glenborough's Aventine facility learned lessons implementing building performance tracking tools that are widely applicable to organizations with similar objectives:

- Achieve buy-in and participation from corporate management and site engineers.
- Use third-party providers for energy management services if in-house engineering time is limited.
- Maintain awareness of facility operation by making the viewing of dashboards and reports part of daily operations.

Glenborough's Aventine facility is a shining example of using Building Performance Tracking to increase Net Operating Income (NOI) and enhance asset value, thereby maintaining competitiveness in the highly challenging multi-tenant commercial real estate market.

Building Performance Tracking 101

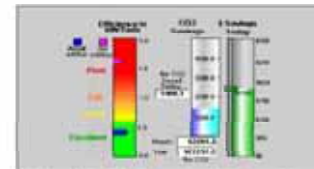
Elements of a supportive working environment:

- Clear communication
- Timely information
- Supportive management
- Clear roles and responsibilities
- Supportive equipment
- Direct energy management
- IT support and server storage

• 4 case studies now online

"Information must be accessible. Make the information work for you."

—Carlos Santamaría, LEED AP
Director of Engineering, Glenborough, LLC



Glenborough tracks chiller efficiency, CO₂, and cost savings with its OptimumMFM tool



About this Success Story

This case study was developed by the California Commissioning Collaborative (CCC) with funding from the California Energy Commission's Public Interest Energy Research (PIER) program.

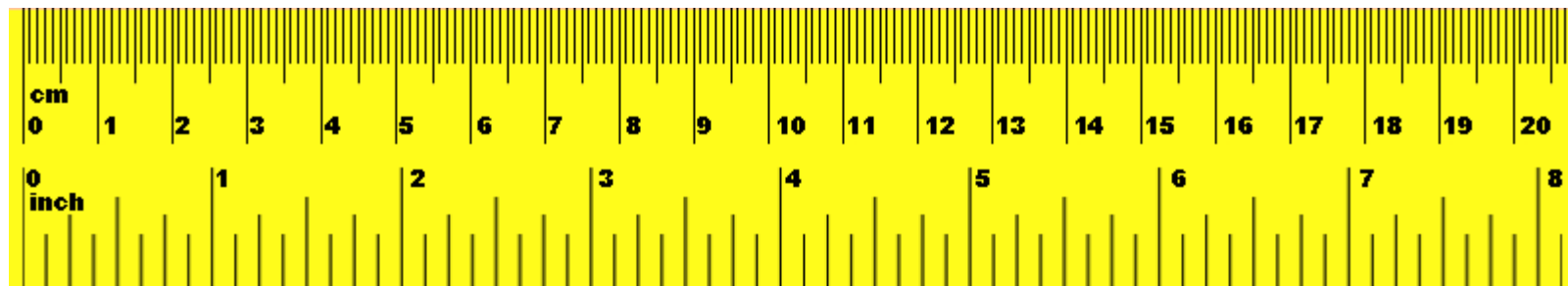
For more information, contact the CCC at:

Email: info@ccc.org
Phone: 877-306-CACX

View more case studies and download a free copy of **The Building Performance Tracking Handbook** at <http://www.ccc.org/PIER/handbook.html>

Project 5: Verification of Savings Guidelines

- Guidelines 99% Complete
 - Method 1: Engineering Calculations with Field Verification
 - Method 2: Equipment or End-Use Energy Measurement
 - Method 3: Energy Models with Interval Data
 - Method 4: Calibrated Simulation
- Pilots / Case Studies
- Workshops Planned



Project 6: Title 24 Enforcement / Effectiveness

- Research Report Complete
- Findings shared with code development stakeholder group
- Presentation to Western HVAC Performance Alliance
- Report highlighted during code development public workshop
- Findings are feeding into code compliance improvement task under AB 758

“If he does it, so will I.”

• **BECC Poster**

Contractors, Competitive Bidding and Code Compliance

Title 24 acceptance testing struggles

Contractor Responses

55% have had no training on Title 24

30% include acceptance testing in bids

Barriers to Compliance

- Any additional cost is significant in a competitive bidding process.
- Contractor training is insufficient.
- Technicians are not aware of reference materials.
- Uneven enforcement, with Orange County and Sacramento providing stronger models for enforcement.

Help Spread the Word

We are looking for additional associations, companies or publications interested in partnering for awareness.



The Path to Boosting Compliance



Developed Plan

Research report informed outreach plan.

Webinar

Utilize public relationships to recruit contractors for webinar trainings.



Tool Libraries & Bid Sheets

Promote tools available to contractors that facilitate the compliance conversation with building owners/managers.



Which produces the best result?

Implement “close-out” marketing campaign to encourage ongoing compliance after prior outreach campaign ends.

Show Off Your Skills!

Which do you think contractors will respond to the strongest?

MESSAGE 1: **YOU'RE MISSING OUT!**

“Building owners and managers are positively responding to our bid sheet. Are you one of the few who have not downloaded it yet? Click here for details.”

MESSAGE 2: **COMPARE TO PEERS**

“Thank you for the overwhelming response to our Title 24 bid sheet! Not using the bid sheet yet? Demonstrate added value in your bid to potential clients by using this sheet to help build your case.”

MESSAGE 3: **PROVIDE SPECIFIC TIPS ADDRESSING MISCONCEPTIONS**

“Concerned your bid appears costlier than competitors? Include ‘Title 24 Acceptance Testing’ as a line item, and provide our bid sheet for added value.”

Cast Your Vote!



Include your e-mail address with your vote for a post-conference update on how your selection fared.

The big picture

History

- Variable application
- Providers have own tools
- High level of QC
- Steep learning curve for new Cx providers

Now

- Consistent application of process
- Standardized toolset
- Reduced QC
- Easier entry for new Cx providers

Future

- Whole-building approach
- Increased use of advanced monitoring
- Small commercial
- Integration with DR / retrofits / cogen

What Next?

- Whole Building Savings Approach
 - Best practice / standards for rigor of monitoring tools
 - Cost-effective process for calculating whole-building savings
 - Accuracy of whole-building M&V
 - Implications of monitoring-based programs and utility program frameworks

What Next?

- Zero Net Energy
 - Develop ZNE case studies; highlight Cx
 - Needs assessment: Cx for ZNE buildings (Cx process and training needs)
 - Identify gaps in emerging tech that need special attention
 - Cx for submetering and advanced monitoring systems?
 - Envelope Cx using high tech diagnostics?
 - Daylighting Cx protocols?

What Next?

- Integrated Demand-Side Management
 - Recommendations for better integration of commissioning in integrated audit protocols
 - Technical implementation of IDSM (staged implementation of measures, commissioning of retrofits and DG, O&M considerations)
 - Commissioning of distributed generation systems

What Next?

- Title 24 Training & Development
 - Refine and deploy existing training materials and increase marketing efforts to boost participation in training offerings
 - Address code enforcement issues by developing streamlined and simplified enforcement protocols and/or influencing future revisions of codes that streamline or simplify requirements

What Next?

- And...?
 - Small commercial?
 - Cx training & certification?
 - Industrial / Agricultural?

Thank You!

<http://www.cacx.org/PIER>