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Commissioning & LEED

As the leading national standard for high-performance buildings in the United States, the LEED™ Green Building Rating System is helping drive industry-wide acceptance of cost-effective building commissioning. Basic commissioning is a mandatory requirement for LEED certification of commercial buildings. Establishing commissioning as a prerequisite assures that all LEED-certified new construction and major renovation projects have undergone these fundamental commissioning procedures:

- Engaging an independent commissioning agent or team
- Reviewing the design intent and the basis of design documentation
- Incorporating commissioning requirements into the construction documents
- Developing and carrying out a commissioning plan
- Verifying installation, functional performance, training, and operation and maintenance documentation
- Completing a commissioning report

Projects that go beyond the basics to include more comprehensive commissioning tasks are eligible for additional credit toward the total points needed to achieve LEED certification. For more information, go to www.usgbc.org.

Building Commissioning: How cost effective is it?

The benefits of commissioning sound like a building owner's dream come true: fewer change orders during construction; fewer call-backs after construction; lower energy bills; avoided premature equipment replacement costs; proper training of the building's operational staff; safer and healthier indoor environment; long-term tenant satisfaction and improved profit margin.

With all these advantages, it's a wonder that commissioning isn't yet standard practice for new commercial construction or the operation of existing buildings. Although it is becoming increasingly common, many building owners still don't fully understand what commissioning involves, or are skeptical of the cost-effectiveness claims made by energy-management and commissioning professionals.

An important new study by Lawrence Berkeley National Laboratory (LBNL), funded by the U.S. Department of Energy, may go a long way toward changing the minds of decision makers who are sitting on the fence when it comes to commissioning. In fact, the study concludes that commissioning is one of the most cost-effective means of improving energy efficiency in commercial buildings.

What is commissioning?

As many building industry professionals have come to know, building commissioning is a quality-assurance process of ensuring that a building's complex array of systems is designed, installed, tested, and operated to perform according to the design intent and the building owner's operational needs.

For new construction, commissioning ideally starts as soon as a facility is conceptualized, and continues until the building is occupied. Through the commissioning process, expectations for the performance of the building systems are established and well-defined procedures are put in place to determine whether those expectations have been met. Although building commissioning originally was created to ensure that HVAC systems were



The Joe Serna Jr. Cal/EPA Headquarters in downtown Sacramento, completed in 2001, will soon undergo recommissioning. Photo: John Swain.

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Events and Conferences

August 1–2, 2005

*Southwest Renewable Energy Conference
Santa Fe, NM*

This conference offers policy and technical sessions on developing renewable energy throughout the Southwest.

www.swrec.org

August 14–17, 2005

*Energy 2005: The Solutions Network
Long Beach, CA*

A major workshop and networking forum for federal energy managers and their private sector counterparts.

www.energy2005.ee.doe.gov

September 9–10, 2005

*Green Building Fair 2005
San Jose, CA*

Building fair and green product exposition for the Santa Clara Valley region.

www.aiascv.org/pages/news.html

About e-News

Don't miss future issues—to sign up for a free email subscription, please visit www.energydesignresources.com/enews.php. Send letters to the editor, suggestions on topics for future issues, or other comments to admin@energydesignresources.com.

e-News is published by Energy Design Resources (www.energydesignresources.com), an online resource center for information on energy efficiency design practices in California.

Savings By Design (www.savingsbydesign.com) offers design assistance and incentives to design teams and building owners in California to encourage high-performance nonresidential building design and construction.

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Energy Design Resources
Your Guide to Energy Efficient Design Practices



Savings By Design
Resources for Energy Efficient New Construction

properly specified and installed, it can be successfully applied to virtually any building system, and to existing buildings as well as new construction.

Commissioning: A Necessity, Not a Luxury

Some people continue to view commissioning as a luxury and an added cost. “Part of the problem is the lack, until now, of persuasive cost-benefit analyses,” says Evan Mills, LBNL staff scientist and lead author of the new study. “Building owners need to have a solid business case for embarking on commissioning projects. There is also a false sense of security that buildings are put together and operated as intended, which we know is not the case.”

To address the lack of reliable information, LBNL researchers, assisted by Portland Energy Conservation, Inc. and the Energy System Laboratory at Texas A&M University, conducted an ambitious survey of published and unpublished data from building commissioning projects in the United States over the past twenty years. The study, titled “The Cost-Effectiveness of Commercial-Buildings Commissioning,”¹ was designed as a “meta-analysis” of the energy and non-energy impacts of commissioning. The researchers analyzed data from 224 buildings in 21 states, representing 30.4 million square feet of commissioned floor area — 73 percent in existing buildings and 27 percent in new construction.

The study presents a compelling argument for commissioning as a key to significant ongoing savings. In fact, the researchers estimate that widespread commissioning could save \$18 billion or more annually in energy costs in the United States.

What does commissioning really cost?

The researchers found that for new construction, median commissioning costs were \$1.00 per square foot, representing 0.6 percent of total construction costs. The energy-savings alone yielded a median payback time on the commissioning costs of 4.8 years. For existing buildings, the researchers found median commissioning costs of \$0.27 per square foot, with whole-building energy savings of 15 percent and a payback time of 0.7 years.

While existing buildings showed a sixfold greater energy savings and fourfold lower commissioning costs than new construction, the median payback time in both cases is still very attractive, especially when non-energy impacts are accounted for. The non-energy benefits of commissioning, which are rarely quantified, can include reduced change-orders thanks to early detection of problems during design and construction, and identification and correction of problems that may lead to equipment breaking down prematurely. The study found that median one-time non-energy benefits were \$1.24 per square foot per year for new construction — comparable to the entire cost of commissioning. These results are important, notes Mills, “because an oft-cited reason not to commission is doubts about the need for and cost-effectiveness of commissioning.”

“Many building deficiencies are ‘invisible’ in that they don’t have glaring symptoms, and people do not realize that the building’s energy use is higher than it should be,” says Mills. “We identified many thousands of problems in the buildings we reviewed and found that repairing them via commissioning was cost effective across a wide range of building types and sizes.”

In the 28 new construction projects for which data were available, commissioning efforts uncovered a whopping 3,305 deficiencies, with HVAC systems

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¹ Mills, Evan, et. al. 2004. The cost-effectiveness of commercial buildings commissioning. Lawrence Berkeley National Laboratory. LBNL report #56637. Available at <http://eetd.lbl.gov/emills/PUBS/Cx-Costs-Benefits.html>

Commissioning Resources

Whether you are an old hand at commissioning or new to the field, there is a plethora of online resources to help you successfully incorporate building commissioning in your projects. Here are a few of note:

Lawrence Berkeley National Laboratory's study, "The Cost-Effectiveness of Commercial-Buildings Commissioning," can be downloaded from <http://eetd.lbl.gov/emills/PUBS/Cx-Costs-Benefits.html>.

To submit a building-commissioning case study for inclusion in the LBNL database, download the data-input spreadsheet from this website.

Energy Design Resources offers comprehensive commissioning guidelines, design briefs on commissioning and related topics, plus many other resources. Be sure to check out EDR's Commissioning Assistant, a web-based tool that you can use to evaluate probable commissioning costs, identify an appropriate commissioning scope, and access commissioning specifications. Visit www.energydesignresources.com.

The **California Commissioning Collaborative** is a nonprofit organization that provides programs, tools, and techniques to encourage the use of the building commissioning process. Go to www.cacx.org.

Pacific Gas and Electric Company, San Diego Gas & Electric, Southern California Edison, and Southern California Gas Company frequently offer training classes on building commissioning and related topics. For more information about classes, go to each utility's website (also see the Training Schedule in each issue of *e-News*).

presenting the most problems, particularly within air-distribution systems. The most common correctional measures focus on operations and control.

The most cost-effective results occurred among energy-intensive facilities such as hospitals and laboratories. Results for smaller buildings were cost effective, although less so than for larger buildings. The study looked at a mix of projects for which the commissioning process ranged from limited (for example, focusing on a particular energy efficiency measure) to comprehensive, and found that energy savings tend to rise with increasing comprehensiveness of commissioning.

With such compelling information in hand, more and more facility owners and design teams are likely to embrace commissioning. In fact, Mills has noted an extraordinarily positive response to the study since it was published in December 2004, including emails from commissioning providers saying that the results are helping them make a better case to their clients, and indications from numerous public agencies that the study has spurred them to launch more ambitious in-house commissioning programs.

For design teams that want to successfully incorporate building commissioning in their projects, Energy Design Resources offers comprehensive commissioning guidelines, design briefs on commissioning and related topics, and the Commissioning Assistant, a web-based tool that provides design teams with project-specific building commissioning information. For more on these and other commissioning resources, see the sidebar on page 3.

Room for Improvement

The Joe Serna Jr. Cal/EPA Headquarters in Sacramento — dubbed by Governor Arnold Schwarzenegger's office "the greenest high rise in the nation"² — underwent initial commissioning when it was designed and built. But the commissioning didn't stop in 2001, when construction of the 25-story, 950,000-square-foot office building was completed. An aggressive program of preventive maintenance means that "we're in a constant commissioning mode," says Craig Sheehy, director of property management for Thomas Properties Group. The company developed the headquarters building in partnership with the City of Sacramento and continues to operate the facility.

With platinum certification from the U.S. Green Building Council in the LEED for Existing Buildings category, and a prestigious Governor's Environmental and Economic Leadership Award, it would be easy for the managers of this Class A building to rest on their laurels. Instead, this year they plan to formally recommission the building, in the hope of squeezing out even greater energy and operational efficiencies.

"I've always felt that we're one of the greenest high rises in the world, and that we couldn't get that much out of recommissioning," says Sheehy. But after recently persuading the engineers at his company's Southern California properties to embark on recommissioning, despite their protests that their facilities were already running as efficiently as possible, Sheehy had a change of heart about the Sacramento building. "I realized that was what I was saying about the Cal/EPA building — that there was no room for improvement. I've decided I'm going to recommission it too. It gets harder and harder, but we can always come up with new and improved ways to do things."

"What really got me going is the study from Lawrence Berkeley Lab," Sheehy notes. For some property owners and managers, a recommissioning cost of \$0.27 per square foot can be daunting, but with an eight and a half month payback, "it's ridiculous not to do it," he says. ■

² California Environmental Protection Agency press release, December 1, 2004. www.calepa.ca.gov/PressRoom/Releases/2004/GEELA.pdf.

Training Schedule

Partial list of upcoming classes. For a complete list, visit each utility's website.

Date	Course	Time	Location	Units
Aug 8	<i>EnergyPro Training: 2005 Nonresidential Title 24 Standards</i>	9 AM–3 PM	ERC	5
Aug 9	<i>IHACI—Air Balance: Beginners (Part 1)</i>	5:30–9:30 PM	ERC	
Aug 9	<i>EnergyPro Training: Envelope/Lighting/Windows</i>	8:30 AM–4:30 PM	ERC	6
Aug 9	<i>Package Unit Heating, Ventilation & Air Conditioning</i>	8:30 AM–4 PM	CTAC	
Aug 10	<i>EnergyPro Training: Advanced</i>	1–4:30 PM	ERC	3
Aug 10	<i>IHACI—Air Balance: Beginners (Part 2)</i>	5:30–9:00 PM	ERC	
Aug 10	<i>EnergyPro Training: Mechanical</i>	8:30–11:30 AM	ERC	3
Aug 11	<i>Premium Efficiency Motors and Adjustable Speed Drives</i>	8:30 AM–4 PM	CTAC	

Date	Course	Time	Location	Units
Aug 11	<i>New Title 24 Standards—Duct Testing</i>	5:30–8:30 PM	CTAC	
Aug 11	<i>Retrocommissioning Workshop Four</i>	9:00 AM–4:30 PM	PEC	
Aug 12	<i>Basic Lighting for Commercial & Industrial Facilities</i>	8:30 AM–12 PM	CTAC	
Aug 16	<i>Advanced Lighting Technologies</i>	8:30 AM–12:30 PM	ERC	
Aug 16	<i>Daylighting for Buildings</i>	8:30 AM–2:30 PM	CTAC	
Aug 23	<i>Reducing Commercial Pool Energy Cost</i>	9 AM–1 PM	Bakersfield	
Aug 23	<i>SCE Cost Manager</i>	8 AM–12 PM	Westminster	
Aug 23	<i>SCE Bill Manager</i>	1–5 PM	Westminster	

Training Locations

Location	Explanation	Phone	Website
Antelope Valley		(626) 812-7537	www.sce.com/ctac
Bakersfield	Hodells	(415) 973-2277	www.pge.com/pec
Chatsworth		(626) 812-7537	www.sce.com/ctac
CTAC	SCE's Customer Technology Application Center, Irwindale	(626) 812-7537	www.sce.com/ctac
ERC	Southern California Gas Company's Energy Resource Center, Downey	(562) 803-7500	www.socalgas.com/business/resource_center/erc_seminar_info.shtml
PEC	PG&E's Pacific Energy Center, San Francisco	(415) 973-2277	www.pge.com/pec
Temecula		(626) 812-7537	www.sce.com/ctac
San Diego		(858) 636-5726	www.sdge.com/construction/ee_commercial_newconst_training.shtml
Stockton	PG&E's Energy Training Center	(800) 244-9912	www.pge.com/stockton
Westminster	Westminster Building	(626) 812-7537	www.sce.com/ctac