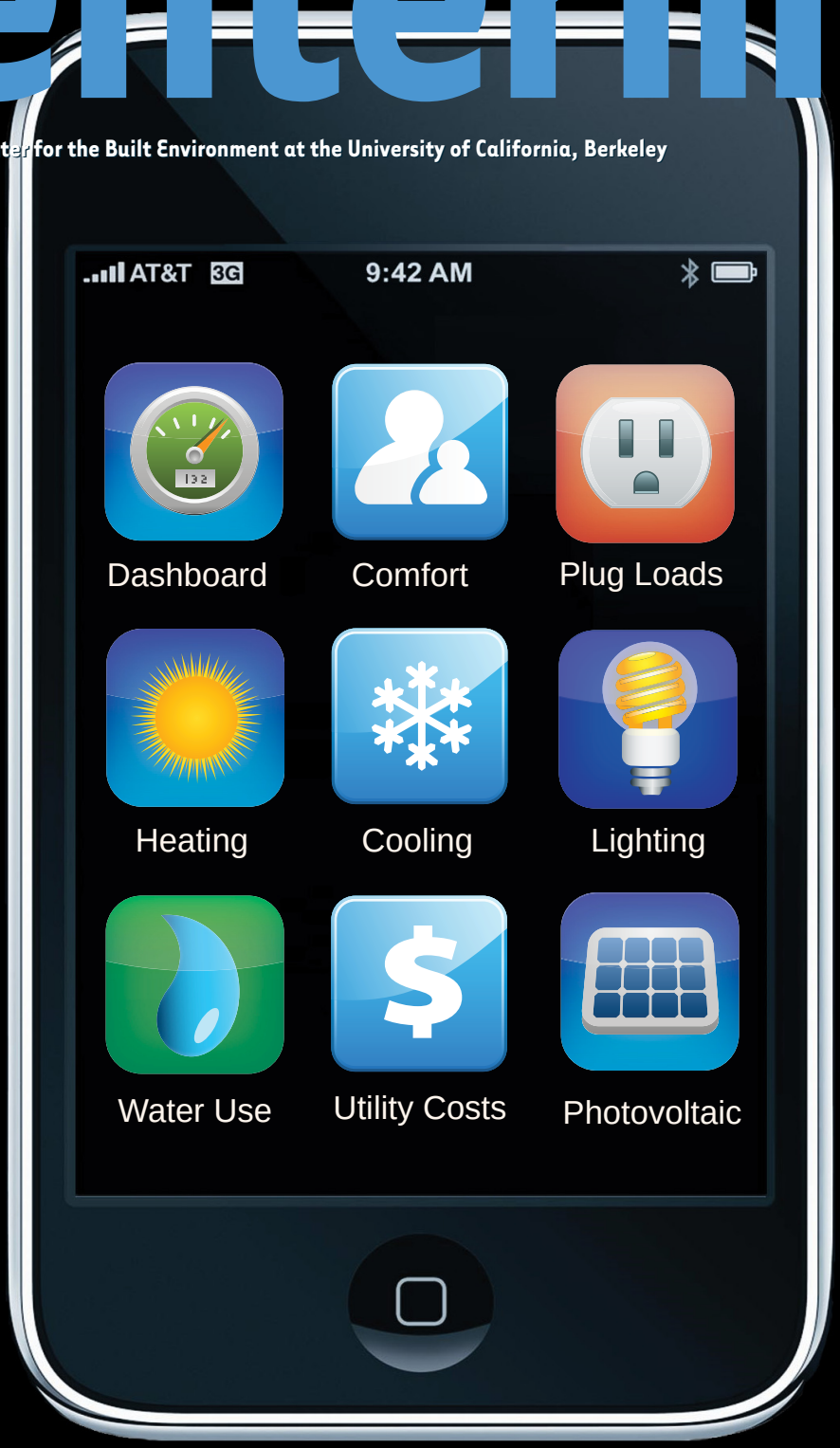
centerline

Newsletter of the Center for the Built Environment at the University of California, Berkeley

Winter 2009



Visualizing Building Information

Director's Note

Contents

Contact Us

Email: **cbe@berkeley.edu**
Web: **www.cbe.berkeley.edu**

Center for the Built Environment (CBE)
University of California, Berkeley
390 Wurster Hall #1839
Berkeley, CA 94720-1839
510.642.4950 | fax 510.643.5571

Centerline is written and produced by
David Lehrer, CBE Director of Communications

Dear Industry Partners,

For the past few months we have awaited the details of the federal economic stimulus plan, with hopes that funding for energy efficiency programs will be robust. The final bill signed by President Obama includes over $40 billion for energy related spending, with $1.6 billion for DOE science programs, and $4.5 billion for green improvements to federal buildings. In addition, the bill includes close to $20 billion for renewable energy tax credits. (For comparison, DOE requested $24.3 billion for its entire 2008 budget.)

We were also happy to see the appointment in January of Dr. Steven Chu, as the new Secretary of Energy. Dr. Chu has served since 2004 as director of Lawrence Berkeley National Lab, and is a professor of Physics and Molecular and Cell Biology at UC Berkeley. Dr. Chu has shown great understanding and leadership about issues of climate change, alternative energy, and energy efficiency.

We applaud these developments, and see them as an indication of a positive direction the new administration will follow in terms of energy policy. We sincerely hope that the energy-related stimulus activities will encourage strong growth in energy efficient design, construction, and innovation, and will provide competitive benefits to CBE's industry partners, as well as benefit our industry as a whole.

Sincerely,
Edward Arens

Visualizing Building Information

Using information feedback to educate and influence building managers and occupants

Information technologies now allow us to conduct our work and personal business in ways that could scarcely be imagined even a decade ago. Unfortunately the building industry has not kept pace with this information revolution. Building professionals frequently bemoan outdated control systems, slow adoption of common data protocols, and the dearth of usable user interfaces for building-related applications. In addition, facility managers and building occupants lack resources for understanding the implications of energy and resource consumption in buildings, and therefore have little incentive to reduce such consumption.

A number of industry experts have pushed for the adoption of building information systems that can provide facility managers and occupants with meaningful and actionable information. Professor David P. Wyon, a former CBE collaborator from Johnson Controls, now with the Technical University of Denmark, proposed a "3-i principle of user empowerment." Wyon believes that through *insight, information,* and *influence* we can enable managers and occupants to positively affect building performance and resource consumption. Although Wyon's 3-i principle was proposed several years ago, today's Internet-enabled technologies provide a platform for making these goals possible.

Providers of Building Data Visualization Tools

A handful of nimble technology development firms are stepping up to fill the need for effective data visualization in buildings. These firms are developing a new generation of information displays—dashboards—with features and interfaces tailored to the needs of building owners, operators, and occupants. Distinct from conventional Energy Management and Control Systems (EMCSs), these information dashboards typically do not provide detailed system operation. Instead they are designed to visually display trends and anomalies, and to educate a broad range of building stakeholders about the ecological implications of building performance and user behavior. Many of these products include real-time information displays, and allow users to view data using a number of different metrics, such as energy units, utility costs, or carbon emission equivalents.

Without exception, the management from firms interviewed for this article see building information visualization as an area that will see tremendous growth in the near future. Michael Murray, CEO of Lucid Design Group of Oakland, California, thinks that there are great opportunities for information dashboards to be implemented in commercial buildings, and that providers of these systems are "just scratching the surface." The firm's Building Dashboard has been used by several universities to monitor energy saving competitions among dormitory residents, and has resulted in savings

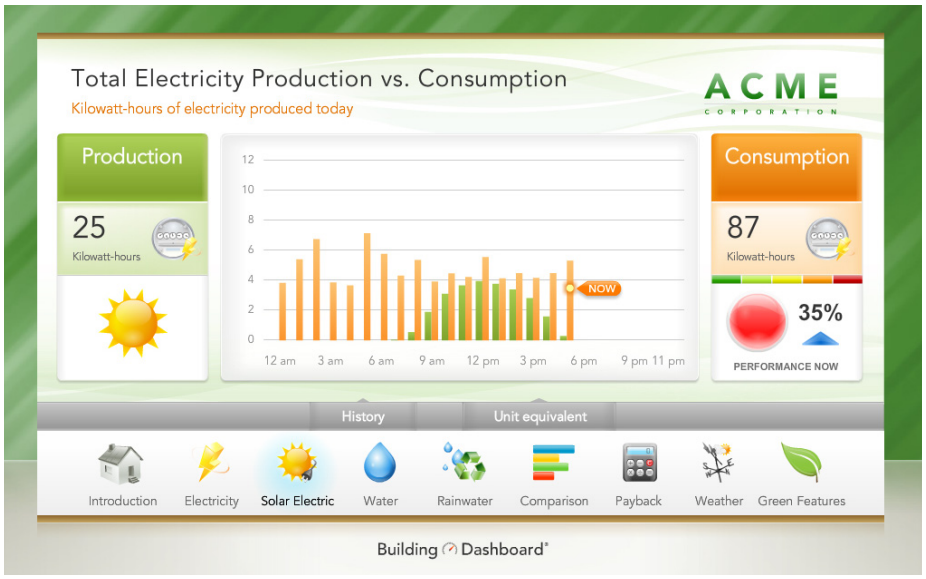
A handful of nimble technology development firms are stepping up to fill the need for effective data visualization in buildings.

in the range of 5-25%. Murray, who presented dorm competition results at CBE's Industry Advisory Board meeting in April 2008, explains that the more successful competitions used outreach methods to involve dorm residents, because the feedback systems alone were found to be insufficient.

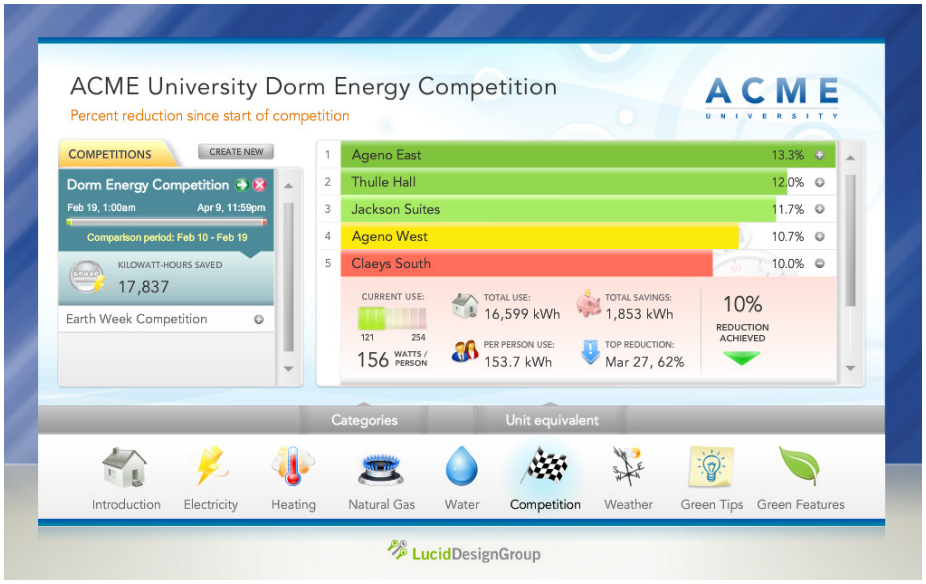
Murray explains that products provided by Lucid Design Group are aimed primarily for use by building occupants, and secondarily by facility managers. The firm has installations at over 30 sites, most of which are commercial buildings, multi-unit residential buildings and dormitories. The installations, which range in cost from $10,000 to $50,000, rely on software and/or data acquisition gateways which send energy, gas, and water data to Lucid's servers. Data are displayed using a Flash interface at the client's site or elsewhere. Murray says that his firm has worked to maintain flexibility so that the system may be compatible with many types of EMCSs at a reasonable cost.

Small Energy Group of Vancouver B.C. provides a bundled suite of three data visualization and reporting products recently launched as Pulse Energy Management Software. The suite includes the Dashboard, an educational tool for occupant feedback; the Facility Manager, which provides detailed trend data for facility managers; and the Executive Reporting Application, which produces various outputs for management and carbon reporting requirements. The Dashboard application includes the real-time load profile and a baseline comparison profile that is generated using an advanced algorithm. The baseline profile corrects for weather and other external conditions so that occupants can accurately determine the impact of energy conservation initiatives.

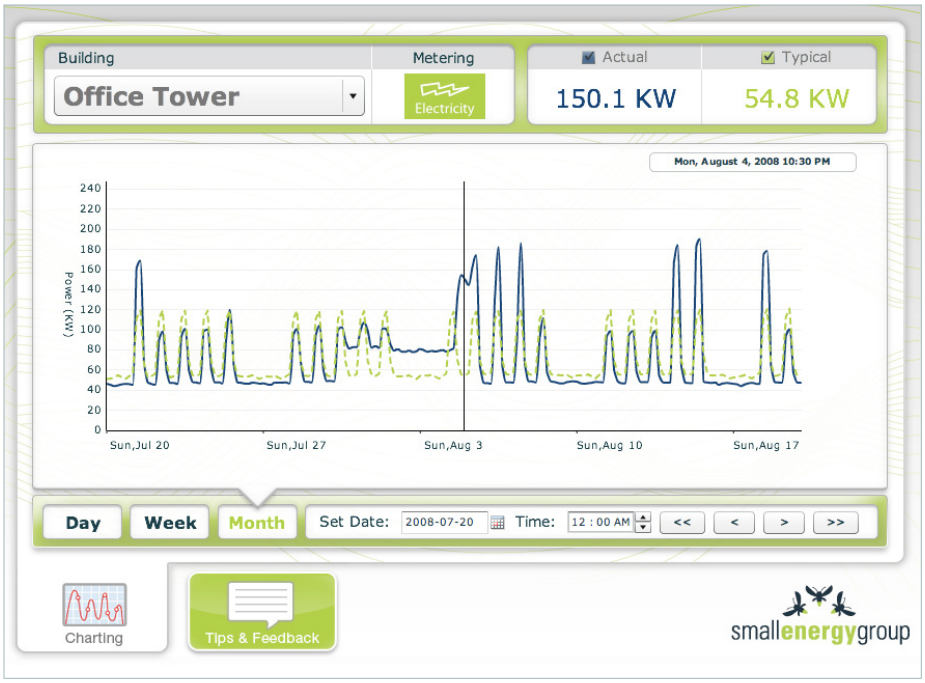
David Helliwell, president of Small Energy Group, hopes to see rapid growth in the number of sites using his software. The firm has approximately 15 buildings online, and expects an additional 80 buildings



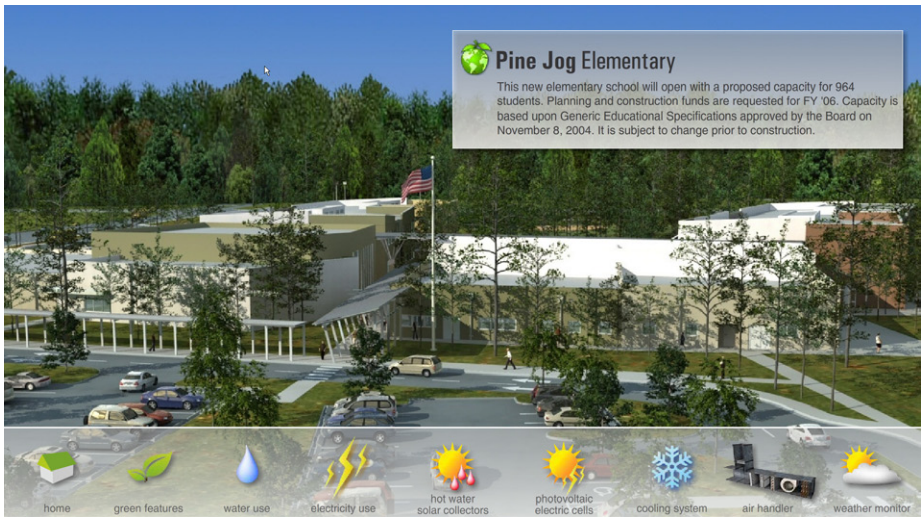
Prototype interface from Lucid's Building Dashboard compares solar generation and total electrical consumption. Image: Lucid Design Group



Lucid has provided feedback for many university dorm energy competitions. Detailed information is displayed when user clicks on a dorm's bar chart.
Image: Lucid Design Group



Pulse's Dashboard interface from Small Energy Group. The dashed line represents a baseline energy profile derived from historical energy use, weather data, and other sources. Image: Small Energy Group



Highly illustrative home page for an elementary school from Quality Automation Graphics. Image: Quality Automation Graphics

to be added in the next few months, including a number of buildings at the University of British Columbia (UBC) in Vancouver. Most of Small Energy Group's clients employ all three of the company's products, and many have made energy savings of 5-25% which they attribute to the use of the software. For example, facility managers of Buchanan Tower at UBC worked with Small Energy Group staff to identify possible savings, and reduced average energy use by 15kW, a 25% reduction in the base load, during both day and night. Helliwell believes that his clients get the most value from their Facility Manager Application, as building managers have the most power to make changes that reduce energy costs.

Another dashboard provider expecting to see significant growth in its business is Agilewaves of Menlo Park, California. The firm has a few dozen installations that range from single-family residences to large multi-unit residential and commercial buildings. Peter Sharer, president of the firm, explains that his staff has been overwhelmed by clients' requests. He also notes that Agilewave's "series A" venture funding has received a high level of interest from investors, in spite of current economic conditions.

Sharer describes Agilewaves as a flexible platform that can monitor gas, electricity, water, and other metrics, and can provide both hosted and hybrid solutions. With a hybrid solution, Agilewaves installs a Linux server at the building site that runs the firm's software and displays building data on any Internet-connected touch-screen or monitor. For an installation at Nueva School in Hillsborough, California, an Agilewaves system monitors many building metrics including the conditions on a grass roof. A mobile application for the system is also available.

Quality Automation Graphics, of Ankeny, Iowa, provides data visualization products that are installed on clients' hardware, and is managed by the clients' IT staff. The firm has a

Visualizing Building Information

The multi-path inteface from Agilewaves allows users to compare room, zone, and appliance energy consumption, and information may be viewed by various time scales and energy units. Image: Agilewaves

Agilewaves information display for Nueva School in Seaside, California, monitors energy use and conditions of a grass roof. The screen interface for the cafe building is shown here. Image: Agilewaves

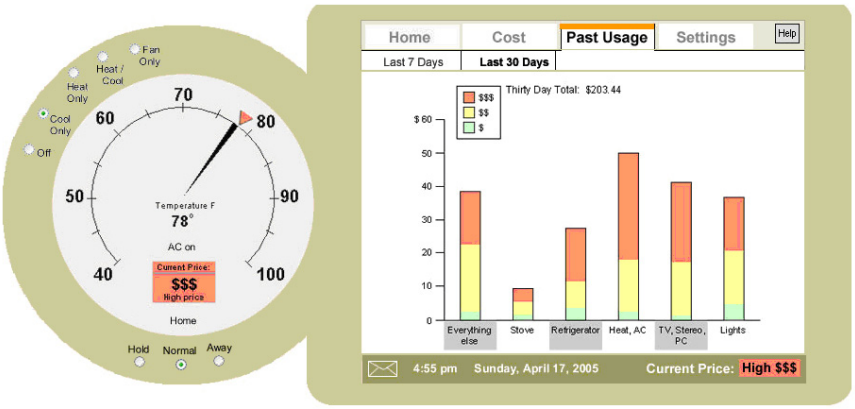
history of designing user interfaces for building control clients such as Johnson Controls and Tridium. Dan McCarty, president of QAG, says that the company now has completed approximately 35 installations of its own Energy Efficiency Education Display. Their basic package with the data gateway hardware, a flat panel touchscreen, CPU and embedded software costs approximately $15,000.

Other providers of building visualization products include Quality Attributes Software, which markets the Green Touchscreen, an educational interactive kiosk software designed to raise awareness about green building features.

Google and its nonprofit arm, Google.org, are collaborating on the development of the Google PowerMeter. This project will take advantage of new utility-provided smart meters and/or other energy management devices that allow users to view their home electricity consumption via iGoogle homepages. The system has been tested by several dozen Google employees, and several anecdotal results have been posted to the project's website. Omar Khan, a Google software engineer and PhD student of Computer Science at Berkeley's Institute of Design, has been involved in evaluating users' responses to the prototype. He says that several people used the system to learn which appliances use the most electricity, and to see their baseline electrical use. "People started unplugging things to see how much electricity they could save," he explains. Users were also motivated to save energy through competition with other users.

Google's efforts are focused on

residential consumers. Kahn explains that this is a natural fit for Google, which has a core mission of helping individuals to utilize information. While the scale of the initial pilot tests has been modest, the system is being designed to be scalable to millions of homes as smart meters become more common.



Screen from DREAM interface showing a bar graph display of electrical energy consumption and utility costs. The interface allows homeowners to see cost implications of thermostat and other settings. Image: Therese Peffer

Using Feedback to Influence Occupants

Several studies have examined how information feedback can help occupants to reduce energy, though the majority of these have focused on homes. On average, these studies found that real-time energy feedback resulted in overall energy savings of 10-15%. One study completed in 2007 looked at the energy use for 200 families in the Canadian province of Newfoundland and Labrador using PowerCost Monitor devices manufactured by Blueline Innovations. The devices, which cost approximately $110, consist of an external meter reader that attaches to the glass cover of standard electricity meters, and a receiver located inside the home that displays energy use, cost, time, and outside temperature. The study found that families with the devices reduced energy consumption 18% on average.

In the Newfoundland study, homeowners may have been motivated to save money by reducing utility bills. Other research shows that feedback alone is not sufficient to change behavior. For example, a study conducted at the Eindhoven University of Technology (Netherlands) published in the *Journal of Economic Psychology* showed that a group of test subjects with energy feedback, but no energy saving goals, used the same energy as a control group given no feedback. Test subjects given feedback *and* energy saving goals saved on average approximately 20%. The findings indicate sufficient motivational factors must be present in addition to effective feedback information.

> On average, studies found that real-time energy feedback resulted in overall energy savings of 10-15%.

Ideally, future energy feedback systems will be integrated with smart building controls. Researchers at UC Berkeley tested a prototype for a thermostat and home-energy manager as part of a program to develop demand-response enabling technologies. The prototype interface, dubbed DREAM for the Demand Response Electrical Appliance Manager, was conceived as a device that would receive dynamic utility price signals as well as information on electrical use from sensors throughout the home. The DREAM device might allow future homeowners to see immediately how energy decisions impact comfort, cost, and energy use.

Therese Peffer, a PhD student and CBE researcher, tested the usability of the DREAM interface at the as part of her dissertation. Approximately 50 subjects completed a series of tasks using a DREAM interface mockup. Peffer evaluated the test subjects' energy choices and preferred interface features. The interface elements with high specificity, such as an energy display of a single appliance, were considered by users to be the most valuable. However, the subjects varied

considerably in their preferences, and the research showed that there is no "one-size-fits-all" solution. In order for feedback systems to be adopted by users, they will require flexible interfaces that can be adapted to meet users' needs. For example, technically savvy users might want a detailed 24-hour display of data, while other users prefer more simplified presentations of information.

Other research has been conducted to learn whether new and innovative feedback systems can motivate people to make smart ecological choices. Researchers at Carnegie Mellon University created a virtual polar bear living on an ice floe that grows or shrinks based on test subjects' actions. When the subjects lowered energy use by changing their thermostat or taking shorter showers, the ice floe grew and the virtual bear thrived. Poor energy choices caused the ice floe to shrink, making the polar bear's habitat more precarious. The study found that people who formed an emotional attachment to the cartoon bear were more likely to take ecologically preferable actions.

Using a similar approach, designers of dashboards for Ford and Honda hybrids are experimenting with novel features such as a tree icon that grows leaves when drivers conserve gas, losing leaves when drivers get poor mileage. Nissan in Japan offers a service that allows drivers to compare their mileage and annual gas use with that of other drivers, using drivers' competitive instincts to help them get better mileage. These feedback systems remind drivers that their driving habits have an impact on the environment, doing so in a game-like and non-judgmental manner.

Future Feedback Research

Several new efforts to understand the potential of building feedback systems are currently underway or in planning phases. Mary Ann Piette of the Lawrence Berkeley National Lab is leading an effort to characterize energy and performance monitoring products currently available for commercial buildings. The objective of this work is to provide specifiers of EMCSs with more reliable information beyond than that provided by company literature and marketing materials. The research team plans to characterize approximately 30 commercially available EMCSs, and to conduct 4-6 detailed case studies of users that have aggressively used EMCSs to get actual energy savings.

A complimentary research effort to be sponsored by ASHRAE, headed by Taylor Engineering principal Reinhard Seidl, will study methods for measuring and displaying building metrics including comfort and energy use. This study, "User Interface Design for Advanced System Operation," is organized around the needs of a broad range of building stakeholders, including facility managers, developers, and occupants. The scope of this research was conditionally approved at the ASHRAE winter meeting in Chicago, and is expected to be released for bid later this spring.

Seidl explains that this research is closely linked to ASHRAE efforts to label energy use in buildings. He thinks that most buildings in North America will soon have some form of energy label that will impact real estate and rental values. Similar programs are already underway in Europe and Asia. In the UK both commercial and residential buildings now carry mandatory energy labels. When such labels are commonplace, buildings that perform below average will require closer inspection and supervision to bring them back in line with expected performance; energy dashboards are one method to assist with this process.

User interface tests make it clear that there is no "one-size-fits-all" solution.

Another study, to be conducted by Lucid Design Group and Oberlin College, will test a variety of users with a broad range of digital media. This research will explore the use of dashboard displays, social networking sites, public kiosks, e-mail, text messages, and orbs—ambient information devices that glow in varying colors based on incoming information from wireless pager networks. (Originally developed to show daily stock market trends, orbs have been hacked to

show other data such as electrical grid loads.) The study hopes to identify which types of media work best for motivating users, and how to optimize the use of various media.

Staff at CBE are currently planning research that will compliment these efforts. CBE has proposed a scoping study to survey features and capabilities of commercially available building information dashboards, and a literature review to assess the potential for using these tools to save energy and resources. From these initial findings we will identify ways to improve usability and functionality of feedback systems, and develop ways to include building occupant sentiments in such information displays. In future phases of this work we plan to conduct surveys and interviews to characterize the information needs of building user stakeholder groups, and to develop and test prototype feedback systems. A detailed description of this work will be presented at CBE's Industry Advisory Board meeting in April.

In a separate but related effort already underway at UC Berkeley, graduate students Sam Borgeson and Omar Khan are developing a Building Energy Dashboard to show resource use for over 100 campus buildings. This project was funded through UCB's Green Initiative Fund, a fund for sustainability projects provided by a $5 per semester student fee that was proposed and approved by the Berkeley student body. A pilot version of the dashboard implemented in 2007 charts monthly electrical and water consumption for most campus buildings, and detailed data for seven campus buildings equipped with Obvius data acquisition devices. The new version of the dashboard now under development will encourage building occupants to comment on trends and events displayed by the system, using the concept of "crowd-sourcing" to give greater meaning to charted data. The project will also include an interactive kiosk to be located in Berkeley's Free Speech Cafe that will provide feedback about the energy use within the space, and to inform cafe users about their collective impact on its use.

Although a number of high-quality information dashboards are now available, and research on how to improve feedback in buildings continues, getting wider adoption of new information technology in buildings will not be without challenges. Many buildings have decades-old control systems that are incompatible with today's hardware and software. Some control systems vendors may be resistant to change, and facility managers may not fully appreciate the benefits of new information technologies. As David Helliwell of Small Energy Group points out, facility managers are not typically of the "Facebook generation." While the building industry may not embrace change as readily as other industries, growing momentum from innovative software developers, building owners, and investors is increasing, and we should expect to see usable and interesting information displays becoming commonplace within the near future.

Links

Agilewaves
http://www.agilewaves.com

Lucid Design Group
http://www.luciddesigngroup.com

Pulse Energy from Small Energy Group
http://www.pulseenergy.com

Quality Attributes Software
http://www.qualityattributes.com

Quality Automation Graphics
http://www.qagraphics.com

Google Powermeter
http://www.google.org/powermeter

ASHRAE User Interface Design for Advanced System Operation
http://www.tedownloads.com/dashboard

Project Updates

Occupant Survey Workshop Offered in April
Free Use of Healthcare and Multi-Family Residential Surveys

As part of our April Industry Advisory Board events, we will offer a workshop on the use of CBE's Occupant Survey data mining tools. Participants will learn to modify and create a Building Scorecard for a single building, using filters to answer questions of interest. We will also demonstrate the use of Data Explorer that allows users to create and save sets of buildings and/or occupant groups, to export data to excel for manual analysis, and to import into other data visualization tools. We will invite participants to send us specific questions about building performance, and we'll demonstrate how one might answer these questions.

More information on this event scheduled for April 22 is available at http://www.cbe.berkeley.edu/membership/meeting_logistics.htm

We have recently completed several new survey modules that will help us to broaden the scope of our survey research for more building types. Working in collaboration with CBE Industry Partners Kenneth Roy of Armstrong and Claudia Steinke of Cohos Evamy, we are nearing the completion of a new survey module for healthcare facilities. In conjunction with this work, we are creating a detailed acoustical module that will allow us to better understand how occupants' satisfaction with acoustics are impacted by their expectations.

CBE's Survey Data Explorer will be demonstrated at our upcoming workshop on April 22nd.

We are now actively looking for hospitals or medical office buildings in which to conduct pilot implementations of this survey, and we are offering to do these surveys for free for a limited time. Please let us know if you can suggest buildings for this research effort. For more information, visit http://www.cbe.berkeley.edu/healthcare.

In addition, working in collaboration with Pacific Northwest National Laboratory, we have developed a new survey module for multi-residential buildings, which is suited for dormitories, condominiums, and apartments. We are also offering to implement this survey for free for a limited time.

Our K-12 schools survey project is well underway, with over 60 schools committed to participating in the study, representing thirteen states and two Canadian provinces. Over half of these schools have already completed the survey. One of our initial goals will be to learn about the relationship between controllability of thermal and lighting systems, with teachers' satisfaction. Graduate Student Researcher Lindsay Baker, who is leading this survey project, plans to use this rich body of data in the future to look at a variety of school performance questions.

CBE Researchers John Goins, Hui Zhang, and GSR Jon Jellema submitted a paper to Buildings and Environment, "What's in an Office, Pride and Privacy." The authors compared several benefits of private offices, including indoor environ-

continued from page 10

mental quality benefits such as visual and sound privacy, and social benefits such as the higher status conferred by private offices in some organizations. They found that occupants appreciate IEQ attenuation more than social status benefits. This finding suggests that if designers can design open office environments to meet acoustical and visual privacy needs, they might match the higher satisfaction usually associated with private offices.

Finally, we are planning a study using our survey database to investigate potential financial premiums for green buildings. Collaborating with Co-Star Group, a real estate information database, and with a grant from the USGBC, we hope to determine if green buildings provide improved financial performance due to energy savings, occupant productivity, or public relations benefits. We would like to acknowledge valuable input we have received in the planning of this project from Glynn Gross of Coherent Structures, Peter Morris of Davis Langdon, and Scott Muldavin of the Green Building Research Consortium. We will update you on all these survey projects at our next Industry Advisory Board meeting in April.

New Leadership for Revision to UFAD Design Guide

At last January's ASHRAE Winter Meeting in Chicago, CBE research staff met with industry partners and other professionals to review progress of the revision to the ASHRAE Underfloor Air Distribution Design Guide. Fred Bauman, the main author of the guide, believes that all the members of the committee "agreed that this was our best meeting yet, and we all look forward to working together in the coming months."

The committee in charge, ASHRAE Technical Resource Group (TRG7-UFAD), was formed in March 2007 to review and update the guide to incorporate practical design, construction, and operational information that has become known since the 2003 publication of the original design guide. The committee has recently seen significant changes as the original Chair resigned last January. At the TRG meeting in Chicago, the committee appointed CBE Partner Jim Megerson (Larson Binkley) to Vice-Chair, and Dan Int-Hout moved up to Chair. The consensus among members at the meeting was that this new leadership will help establish a more congenial and collaborative atmosphere. The committee also reviewed the status of all chapters in the revised outline of the guide and reassigned leaders and subcommittees to develop new material. The next committee meeting will be held at the ASHRAE Annual Meeting in Louisville in June. For more information on the guide, please email us at mailto:cbe@berkeley.edu.

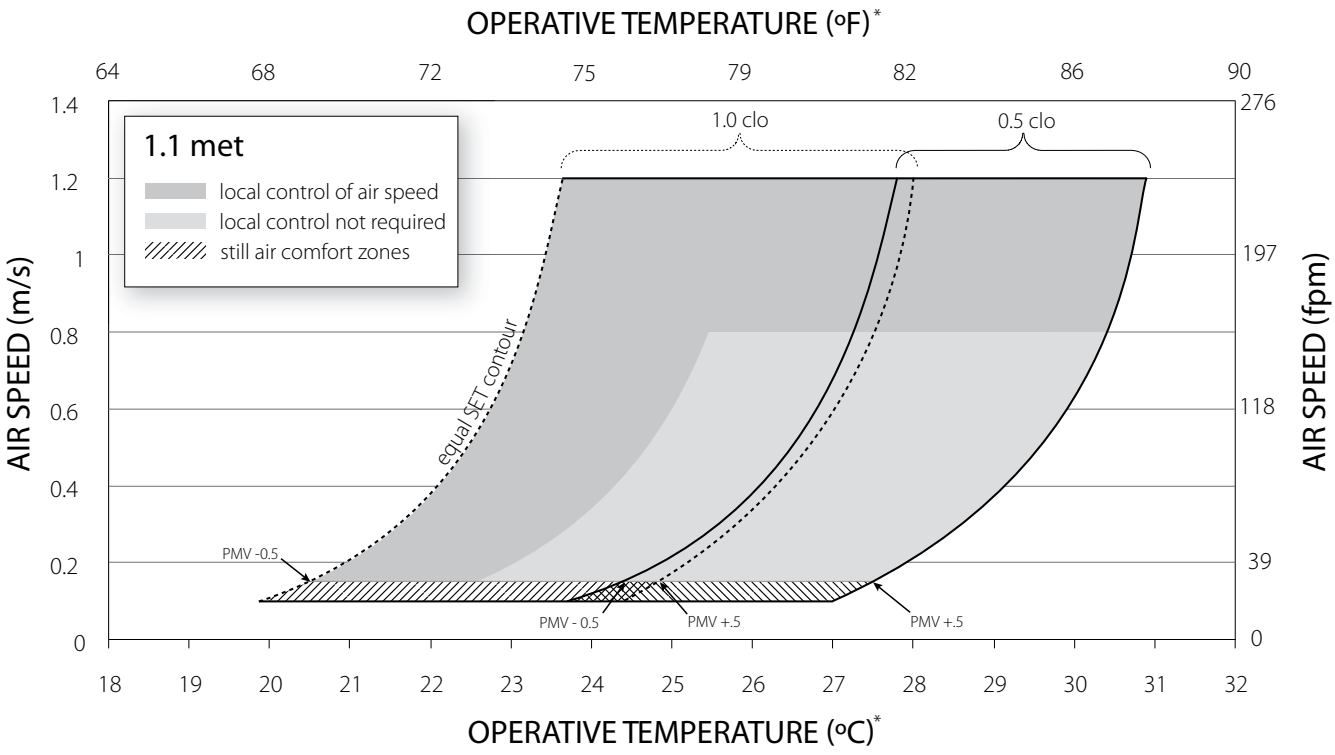
New Guidelines for Using Air Movement for Thermal Comfort

At the Chicago ASHRAE Winter meeting, a proposal supported by CBE was approved to modify how the ASHRAE Thermal Comfort Standard (Standard 55) deals with air movement.

Our support for these changes is based on CBE field studies that have shown that building occupants prefer much more air movement than they are receiving under neutral and warm conditions. The new provisions allow higher air movement under warm and neutral conditions, and simplify the way draft risk is quantified under cool conditions.

The figure below will be incorporated in the standard, showing an example of air movement ranges for two clothing levels. For other clothing and activity levels, air movement ranges will be determined using a new release of the ASHRAE Thermal Comfort Tool, software being updated by CBE Research Specialist Charlie Huizenga.

Anticipated benefits from the new standards include ways to save energy in warm climates by giving architects and engineers more freedom in the design of interior spaces. Fans and operable windows can be used to a greater extent to provide comfort with less reliance on chiller-based cooling. CBE's Edward Arens and Hui Zhang are now writing an article for *ASHRAE Journal* explaining the new provisions, their research basis, and likely design applications. We will also provide an update of these changes at CBE's Industry Advisory Board meeting in April.



* In determining operative temperature, use the lowest air temperature in the occupied zone

In this Figure, $t_r = t_a$

David Brower Center Grand Opening May 2009

The David Brower Center, a mixed-use complex in downtown Berkeley adjacent to the UC Berkeley campus, will provide CBE research staff with a unique case-study opportunity for the study of integrated system performance. The project's design team integrated highly efficient facades, radiantly cooled and heated exposed ceiling slabs, underfloor air distribution, and other energy efficient strategies. The four-story building opens this May, and will house office space for environmental nonprofits, a 180-seat theater, meeting rooms, a gallery and a restaurant.

At CBE we have begun planning for the monitoring of the building to evaluate the performance of this unique high-performance building. We are working in collaboration with design team members and with Amy Tobin, Executive Director of the Center, who has told us that the Center's management and board want to take advantage of the building for outreach, research and education.

To support the Center's outreach efforts, in February Fred Bauman, John Goins and David Lehrer of CBE interviewed key members of the project team for a video documentation effort sponsored by the Center. Interviewees included Peter Buckley and Amy Tobin of the Brower Center, Dan Solomon and Malcolm Harris of WRT Solomon E.T.C, Peter Rumsey and Cindy Regnier of Rumsey Engineers, David Mar of Tipping Mar + Associates, Larry Strain of Siegel & Strain Architects, and George Loisos of Loisos + Ubbelohde. Edited videos of the interviews will be included in an upcoming exhibition in the building's gallery space.

Rendering of the David Brower Center
Image: WRT Solomon E.T.C.

Fred Bauman will lead CBE's studies of the building, which will include energy monitoring, the CBE occupant survey, and EnergyPlus simulations. The EnergyPlus modeling work has already begun in collaboration with Paul Raftery, a Fulbright Scholar from Ireland currently at Lawrence Berkeley National Lab, and additional support from post-doctoral scholar Kwang Ho Lee. To date, Paul and Kwang have developed within EnergyPlus a prototype commercial building with both underfloor air distribution (UFAD) and a hydronic radiant slab. We expect this combination to significantly reduce energy consumption in the building, as well as to minimize thermal decay (temperature gain) observed in UFAD supply plenums. Early results look very promising. Future modeling will explore the optimum balance of load management between the UFAD and radiant components of the system.

The building is expected to attain a Platinum LEED certification. The Center was named for David Ross Brower (1912-2000) a prominent environmentalist who founded numerous environmental organizations, and served as the first Executive Director of the Sierra Club from 1952 to 1969.

People

CBE Graduate Student Researcher Joins Ranks of Switzer Foundation Fellows

UC Berkeley Graduate Student Sam Borgeson is a recipient of the 2008 Switzer Foundation Fellowship Award. The award, from the 22-year-old environmental foundation recognizes individuals working to improve environmental quality. Sam is currently pursuing M.S. degrees in Building Science and Energy and Resources at UC Berkeley.

For his Building Science thesis, Sam is developing computer models to assess the potential for climate-responsive, low energy cooling strategies in mixed-mode commercial buildings. Working with CBE Associate Director Gail Brager, this research focuses on natural ventilation, radiant cooling, and the challenges associated with hybrid manual and automated building controls. Sam is also a corecipient of a grant from Berkeley's Green Initiative Fund for the development of an interactive web-based system to track and visualize resource use in Berkeley campus buildings (see page 9). Sam holds a BA in Physics from Wesleyan University. In 2000, he co-founded Carbon Five, a successful software consulting firm based in San Francisco.

Sam joins other past UCB Building Science Program graduates with this recognition, including Timothy Moore (2007 Switzer Fellow) and Mara Baum (2004 Switzer Fellow). A unique aspect of the Switzer program is its Fellowship Network, which allows Fellows to maintain contact and collaborate throughout their careers. More information on their programs can be found at: http://www.switzernetwork.org/.

Switzer Recipient Sam Borgeson

The Latest Additions to our Research Team

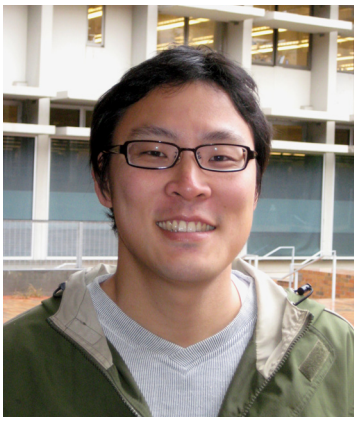
We are happy to introduce our latest additions to CBE's research staff, including two post-doctoral researchers and a visiting scholar from Italy.

Kwang Ho Lee joined CBE as a postdoctoral scholar in the fall of 2008. He pursued his PhD degree at the University of Illinois at Urbana-Champaign where his research area was mainly focused on the development of EnergyPlus building energy simulation software. During his time at UIUC, Kwang developed and enhanced EnergyPlus modules including those for earth tube, unit ventilator and thermal chimney systems. He also developed a separate stand-alone "CalcSoilSurfTemp" program, one of the auxiliary programs within EnergyPlus, to predict soil surface temperatures directly from weather data files. At CBE he has already contributed to several UFAD projects, including analysis of data for the Sacramento Capitol Area East End Field Study, and the UFAD whole-building model for EnergyPlus.

In January of this year we welcomed Stefano Schiavon, a postdoctoral researcher from the University of Padova, Italy. Stefano comes to us with a strong technical background and experience with projects closely related to CBE's research. He received a PhD in Building Physics, and a Master's Degree in Mechanical Engineering from Padua. He was a guest PhD for one year at Tsinghua University, China, and a guest PhD and Masters student at the International Centre for Indoor Environment and Energy at the Technical University of Denmark. He has studied the energy consumption of a task/ambient conditioning systems in cold/dry and hot/humid climates, evaluating potential energy savings by providing thermal comfort with increased air movement at higher ambient room temperatures. In conjunction with this work, Stefano developed and tested an index that related a TAC fan's cooling effect with its energy consumption.

In addition, we were joined by Wilmer Pasut, a PhD student in Building Physics at the University of Padua. His research is mainly focused on evaluation of ventilation and building envelope systems with computational fluid dynamics programs such as Fluent and CFX. In Italy he was involved with several research activities, including CFD analysis of naturally ventilated double-skin facades and ventilated roofs. At CBE Wilmer will assist our UFAD team on several projects, including evaluation of the potential for distributing air into underfloor plenums using flexible fabric ducts. Wilmer will carry out full-scale experiments in CBE's UFAD test facility, and compare findings with CFD model results.

We are excited about these new staff additions, and look forward to their contributions.



Kwang Ho Lee

Stefano Schiavon

Wilmer Pasut

Industry Partners at the Center for the Built Environment

CBE's research is supported and guided by CBE's consortium of industry partners, a diverse group of leaders in the building industry. The Center's membership includes the following firms and organizations (as of March 2009):

Armstrong World Industries
Arup*
California Energy Commission
Charles M. Salter Associates
Coherent Structures
Cohos Evamy
EHDD Architecture
Engineered Interiors Group
Environmental Systems Design
Glumac
Haworth
HOK
Johnson Controls*
KlingStubbins
Larson Binkley
Pacific Gas & Electric Company
Price Industries
Rumsey Membership Team:
- Rumsey Engineers
- CPP
- Mahlum Architects
- Mithun
- Perkins+Will

RTKL Associates
Skidmore, Owings & Merrill
Stantec
Steelcase
Syska Hennessy Group
Tate Access Floors*
Taylor Membership Team:
- Taylor Engineering
- CTG Energetics
- Guttmann & Blaevoet
- Southland Industries
- Swinerton Builders

Trane
Uponor
U.S. Department of Energy*
U.S. General Services Administration*
Webcor Builders*
WSP Flack + Kurtz
Zimmer Gunsul Frasca Architects

* founding partner

CBE
CENTER FOR THE BUILT ENVIRONMENT

Contact Us

Email: **cbe@berkeley.edu**
Web: **www.cbe.berkeley.edu**

Center for the Built Environment (CBE)
University of California, Berkeley
390 Wurster Hall #1839
Berkeley, CA 94720-1839
510.642.4950 | fax 510.643.5571