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Multi-Building Internet Demand-Response Control System

In this Issue

Researchers at the Lawrence Berkeley National Laboratory (Berkeley Lab) Environmental Energy Technologies Division (EETD) have completed the first successful test of automated demand response in five large buildings (see Figure 1). Demand-response technology manages electricity use in buildings over the internet when high prices, overloaded system conditions, or blackouts threaten the power grid.

"This is the first test of fully automated demand response in multiple large buildings to reduce electricity consumption with two-way internet-based communications," said principal investigator Mary Ann Piette of EETD.

"Demand response" is a catchall term that describes the actions of energy customers who change their electricity demand as a result of changes in electricity prices or emergency requests to curtail energy usage. In this test, "We used a fictitious electricity price to trigger the demand response event over the internet, which is an example of what might be used in the future," Piette explained. "No one touched any control systems during our test. When an XML signal broadcast over the internet indicated that the price of electricity hit 30 cents per hour, the buildings automatically began to lower demand by reducing lights, air conditioning, and other activities. Two-way communications were used to observe that each site was listening to the price signal. When the internet indicated that the price had reached 75 cents an hour, the buildings automatically took additional pre-planned actions to further reduce electrical demand." (XML stands for eXtensible Markup Language, which is used for exchanging structured data over the internet and provides a common language for communicating with internet-based energy information systems (EIS) and different energy-management systems in buildings.)

Commenting on the test, California Energy Commissioner Arthur H. Rosenfeld said "The [Berkeley Lab]

Figure 1. Three of five buildings participating in the first successful test of a multi-building internet demand-response control system: The Ronald V. Dellums Federal Building, Oakland; University of California, Santa Barbara; and Bank of America, Concord, California.

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Multi-Building Internet Demand-Response Control System

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study complements current initiatives by the CEC [California Energy Commission] and the CPUC [California Public Utilities Commission] to institute dynamic pricing in California. [Berkeley Lab's] results are encouraging in that they indicate that large commercial buildings using off-the-shelf technology can automatically shed load in response to price signals."

The test, which was funded by the CEC's Public Interest Energy Research Program, was conducted in five buildings: an Albertsons grocery, a Bank of America office building, Roche Palo Alto, a library at the University of California (UC) at Santa Barbara, and the Ronald V. Dellums Federal Building in Oakland. The diversity of buildings tested is an important feature of the project if demand response is to control a large fraction of the state's building stock someday. The test used server technology developed by Infotility to manage the broadcast signal and acknowledge the buildings' responses. Piette and her research team worked with facilities managers at the five locations to integrate the control software in their building control and energy information systems. All five buildings used in the study have state-of-the-art, web-based energy monitoring systems.

"A key feature of this test was gauging the capabilities of today's technology. The test incorporated methods to initiate fully automated demand response control in different building types with different control systems from different vendors. We've demonstrated that many different types of systems can listen to a common XML signal and initiate coordinated load control using the internet," said Piette. The systems tested were: Itron Enterprise Energy Management Suite at UC Santa Barbara, Webgen Intelligent Use of Energy at Bank of America in Concord, Tridium Vykon Energy Systems at Roche Palo Alto, a web service with a custom "BACnet Reader" program and BACnet controller at the General Services Administration (GSA) in Oakland, and Engage Networks/eLutions at Albertsons in Oakland. The manufacturers of these systems received funding from the CEC's California State Assembly Bill 970 and Senate Bill 5X Demand-Response programs to enhance control and internet connectivity features.

The test unfolded during a two-week period as Berkeley Lab, working with Infotility, sent a continuous XML signal to the five buildings' demand-response systems, which were programmed to accept XML signals. On two occasions, the signal indicated increased electricity prices, which initiated automated load reduction. Facility managers at each site decided ahead of time which loads would be reduced by the automated response system. Berkeley Lab collected data on how the systems responded to the price-increase signal and evaluated the response performance.

"Albertsons was interested in learning more about what our ability would be to curtail load based on pricing signals. We also wanted some insight into how those pricing signals would be sent and interact with our controls, preferably without human intervention," said Glenn Barrett, a spokesman for the grocery chain. "We learned we do have the ability to react to changes in commodity pricing and make changes in our stores that will allow us to curtail load. It also lays the foundation for a web-enabled solution that could be applied to any store across the state of California."

Automated demand response would be a great advantage for consumers as "California is investigating 'dynamic pricing' tariffs as a long-term, sustainable strategy for mitigating electricity supply-demand imbalances that can result in high prices and forced outages," says Piette. "One form of these tariffs would offer rate discounts when system conditions are normal—most of the time—and charge higher rates, called critical peak prices, when the grid is approaching an overloaded state or during wholesale price spikes."

Automated demand response to a dynamic pricing strategy is advantageous for the electricity system as well. If a power plant or transmission line goes down, dynamic rates (or signals) can quickly reduce power demand and thus the likelihood of a full-scale outage. Some electricity grid experts believe that a system with automatic demand response could have avoided the August 14, 2003 blackout in the eastern U.S. and Canada.

Dynamic rates can also signal wholesale electricity costs to the energy market; these costs tend to be highest when electricity demand is unusually high or when supply is unusually low. During a few critical days per year in California, (usually the hottest days), wholesale prices can spike to 10 times the normal price or even higher. Current retail electricity rates don't reflect these unexpected changes in wholesale prices, so customers have no motivation or incentive to reduce demand when a reduction could help the system continue to function reliably. A dynamic rate structure benefits customers, allowing them to reduce monthly bills by reducing usage during periods of high prices or by shifting usage to periods of low prices.

Future research will include additional testing and analysis at the five sites used for this demonstration project as well as at other sites. Eventually the majority of commercial buildings could be managed dynamically using demand-response systems, reducing the likelihood of blackouts.

Others who participated in the test include Osman Sezgen, David Watson, and Naoya Motegi of Berkeley Lab; Joseph Desmond and Nicholas Kardas of Infotility; Gaymond Yee of the California Institute for Energy Efficiency; and consultant Christine Shockman.

—Allan Chen

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This research is funded by the California Energy Commission's Public Interest Energy Research program.

ASHRAE Residential Ventilation Standard Approved

Figure 1. ASHRAE 62.2 requires source-control measures that exhaust pollutants from specific rooms, such as those with combustion appliances.

Since the oil shortages 30 years ago, U.S. homes have become more energy efficient thanks to a variety of developments, including better sealing to prevent loss of interior conditioned air. With the rise in well-sealed, energy-efficient homes has come an increased interest in maintaining high indoor-air quality.

To address indoor air-quality issues, the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) has approved and published the first nationally recognized indoor air-quality standard developed solely for homes. Standard 62.2, Ventilation and Acceptable Indoor Air Quality in Low-rise Residential Buildings, was approved in July 2003 after six years of work by building scientists and engineers.

The standard went through several revisions and was the subject of significant controversy, as well as appeals after its approval. One of the first hurdles was convincing building professionals that a standard was needed for residential construction; a commonly held belief was windows and relatively leaky building envelopes provide sufficient ventilation in homes.

However, research shows that pollutant concentrations in indoor air can be two to five times greater than in outdoor air. Because most people spend 90 percent of their time indoors and a substantial portion of this time in their homes, the ASHRAE standard was developed to ensure healthy indoor air in residences.

Goals of Standard 62.2

The most effective strategy for minimizing indoor exposure to pollutants is to prevent them from being released into the air in the first place. To this end, the standard requires source-control measures that exhaust pollutants (e.g. from combustion appliances, cooking fumes, see Figure 1) from specific rooms before the pollutants enter the rest of the household. In addition, whole-house ventilation brings fresh air into the house, diluting pollutants that are difficult to control at the source.

What 62.2 Covers

Standard 62.2 addresses three primary areas:

- Whole-house ventilation
- Local exhaust
- Source control

Whole-house ventilation. The whole-house ventilation requirements in the standard are intended to dilute contaminant emissions from people, materials, and background processes.

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ASHRAE Residential Ventilation Standard Approved

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In typical houses, the standard requires a ventilation rate of about 50 cubic feet per minute (cfm) or 25 liters per second (L/s); larger houses must have a higher rate. Almost all houses must have a whole-house mechanical ventilation system rated at 7.5 cfm per occupant, plus one cfm for every 100 square feet of floor area that can be occupied. Houses exempt from this requirement include houses in hot climates without air conditioning, houses conditioned for less than 876 hours per year (e.g., cabins and vacation homes that are occupied for brief periods), and houses in hot dry climates, primarily in the southeast and southwest U.S. where occupants generally ventilate by opening windows.

Local exhaust. The intent of the standard's local exhaust requirements is to remove contaminants from rooms such as kitchens and bathrooms that have specific pollutant sources (e.g., cooking, electrical equipment, moisture).

The standard requires a local mechanical exhaust system to be installed in each kitchen and bathroom. A user-operable vented range hood must exhaust at least 100 cfm (50 L/s) of air. The standard permits unducted range hoods only in kitchens with a mechanical exhaust system rated at five kitchen air changes per hour (continuous or intermittent). Bathrooms must have mechanical exhaust; the minimum requirement is a user-operable fan that exhausts at least 50 cfm (25 L/s). Mechanical exhaust is not required in toilets, laundry rooms, lavatories, and utility rooms.

Source control. This area of the standard addresses sources of contamination not covered in the first two areas.

Houses with appliances vented to the outside need to be tested for backdraft if the sum of the cfm ratings of the two largest exhaust fans is greater than 15 cfm per 100 square feet of habitable space. Air handlers located in garages must be tested for air tightness.

Secondary requirements address the properties of equipment used to meet the primary requirements, e.g., labeling, sound, and flow ratings for fans. Other requirements cover building design issues, for example avoiding ventilation design mistakes that depressurize the house and unintentionally draw contaminants from combustion appliances back into the house.

Recognizing the diversity of housing types and climates, the ASHRAE Standards Committee gave builders a flexible approach for meeting the standard. Each requirement can be met using different building methods and technologies.

Future Plans

Although the approval of the standard is a major step forward in creating consensus on how to maximize indoor air quality, work in this area is continuing. ASHRAE is preparing a *User's Manual for Standard 62.2*. (ASHRAE often prepares manuals for practitioners because the official language of a standard can be difficult to interpret; these manuals are often more important to practicing professionals than the standard itself because the manuals include design examples and advice about different approaches to meeting standard requirements).

ASHRAE Standard 62.2 is subject to continuous maintenance. Anyone can make proposals to change the standard, which can be modified as needs arise. The standard will also be on a regular schedule for consideration of changes submitted by the public. The project committee is currently considering several issues that could be addressed in addenda, including carbon monoxide alarms, garage ventilation, and testing and certification requirements.

The committee will also consider modifications to address some issues that were not resolved before the standard was published. These include variances for climate differences, exhaust requirements for laundries and toilets, air-distribution requirements, and air-cleaning options.

When Standard 62.2 became official, Standards Project Committee 62.2 was dissolved and a Standing Standards Project Committee (SSPC 62.2) took take over maintenance of the standard. Many of the members of SPC 62.2P became members of SSPC 62.2 to assure continuity, but SSPC 62.2 is larger than the committee that drafted the standard, which increases the number of interests and stakeholders who can participate.

—Max Sherman

Max Sherman, leader of the Environmental Energy Technologies Division's Energy Performance of Buildings Group, was the chair of SPC 62.2 and guided the committee from its inception in 1997 until publication of the standard. David Grimsrud, of the University of Minnesota, is now the chair of Standing Standards Project Committee 62.2. Grimsrud was leader of EETD's Indoor Air Quality program in the 1980s.

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Also, see:
Sherman, M. 2004. "ASHRAE's New Residential Ventilation Standard," *ASHRAE Journal*, January: S149-S156.

Standard 62.2 is available from **http://ashrae.org/**.

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The New York Times and EETD Advance Energy-Efficient Building Design

The New York Times is building a new headquarters, the company's first new office building since its current one was completed in 1913. The new transparent glass tower, 51 stories high, will overlook the Times Square Redevelopment area on 8th Avenue between 40th and 41st Streets in the heart of Manhattan (see Figure 1).

In preparation for construction of the new building, a group of visitors from the New York Times Company and its design and engineering contractors visited the Environmental Energy Technologies Division (EETD) at Lawrence Berkeley National Laboratory (Berkeley Lab) in early 2003 to talk about how to make buildings energy efficient, comfortable, and productive places to work. They spent a day learning about Berkeley Lab's research in commercial-building energy efficiency, glazing, lighting, daylighting, and thermal comfort from EETD's Stephen Selkowitz, Francis Rubinstein, Eleanor Lee, Mary Ann Piette, and others.

As a result of that visit, the New York Times Company and EETD have begun a cooperative research project to test new technologies that will increase the energy efficiency of the new headquarters. Because the Times found it difficult to specify a cost-effective, fully integrated window and lighting control system for the building, which will have an extensive glass façade, the research project will focus on integrated technologies to reduce electric lighting energy use through daylighting while controlling glare and cooling loads. Berkeley Lab's Building Technologies staff has been researching these topics for years. The new Times building is an opportunity to extend and apply the Lab's research, making efficient and cost-effective systems available not only to the Times but to other building owners and design teams.

Figure 1. Artist rendering of the New York Times' new headquarters in Manhattan.

"We think that demonstrating these technologies in a landmark building will gain them far more attention among manufacturers and specifiers than through more conventional lab-based research," says Building Technologies Department Head Stephen Selkowitz.

Researchers will test alternative hardware and control solutions in a newly constructed 4,500-square-foot mockup of a portion of the building. The research program will quantify performance alternatives and provide the Times with critical information so that it can publish a procurement specification for the technology solutions for the entire building. The project is being funded by the New York Times Company and the New York State Energy Research and Development Administration (NYSERDA), with cost sharing from the U.S. Department of Energy (DOE) and the California Energy Commission (CEC).

Pushing the Daylighting Envelope

"We've known since the 1970s that daylighting can reduce lighting energy use," says Selkowitz. "But the mere use of large glass areas is not in itself a guarantee that energy savings or comfort will be achieved because there are so many tradeoffs involved. It's been difficult to make as much progress in the use of daylighting as we have in other areas of lighting and glazing technology for a variety of reasons. Daylighting requires a high level of system integration; architects and engineers have to design the building from the start to incorporate daylight into office spaces, there has to be a flexible and responsive control strategy to lower

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or turn off electric lights when daylight is available, and visual and thermal comfort must be maintained at all times.

"The cost of components, like dimmable electronic ballasts (which control fluorescent lights), for successful daylighting can be high, and the systems, with their sensors and controls, require careful calibration after they are installed, something that is not done very often in buildings today," Selkowitz notes. The Times project "will include a calibration and commission task, which will help lower component costs and improve the operation of the installed systems."

Figure 2. A shading system candidate for the new New York Times building undergoes testing in College Point.

Berkeley Lab research suggests that proper daylighting can reduce lighting energy use in building perimeter zones by as much as 60 to 70 percent of annual perimeter-zone electric lighting energy use. Overall building energy use can also be reduced by 10 to 30 percent compared to energy use in a similar non-daylit building, depending on factors such as the fraction of total building area that can be effectively daylit. The additional savings come from reducing building air conditioning and heating loads as a result of selecting efficient glazings and automatic shading.

This project "will contribute to Berkeley Lab's longer-term energy-efficiency research goals in several ways," says Selkowitz. "Simulation and field testing will provide a measured database of performance, quantifying the benefits of an optimized solution for this building's design. The participation of numerous manufacturers in the field test program will involve them with design integration and calibration strategies. And finally, the very large procurement of an integrated daylighting system based on an open, performance-based specification should help move the market towards greater availability and lower costs for these energy-saving building systems."

The New Building as a Contribution to Civic Life

When the New York Times Company decided to erect the new building, creating a comfortable working environment for its employees was one of its highest priorities, as was energy efficiency. The building was designed to be highly "transparent," both to bring in daylight and to underscore the mission of the newspaper: providing information—transparency—about the civic life of the nation and the city. There will be an auditorium on the ground floor for civic and cultural events. The newsroom will occupy floors two through seven.

An unusual feature of the building, more commonly seen in Europe than in the U.S., will be its fully glazed curtain wall. Thin horizontal ceramic tubes placed on a steel framework one and a half feet in front of the glass will screen the building's full height wall of double-glazed, spectrally selective, low-emissivity glass, thus reducing the building's cooling loads. The ceramic tubes provide an aesthetic bonus, taking on the changing color of the sky during the course of the day as light diffuses through them from different angles. Above the top floor of the building, the screen of tubes becomes less dense, so its lace-like appearance will permit a view of roof-garden foliage.

The building will unite most of the 2,500 Manhattan-based employees of the Times Company, which currently has offices at seven locations in New York City. "This building is designed from the ground up to reinforce the values of The New York Times Company," said Michael Golden, vice chairman of the Times Company, when the plan was announced late in 2002. "The open plan and ease of communication, both vertically and horizontally, will enhance collaboration. Our new physical environment will improve the way we work, which is the highest calling of architecture." Construction will start later in 2004, and the expected completion date is mid-2006.

The building was designed by architect Renzo Piano, a winner of the prestigious Pritzker Prize in 1998, in collaboration with Fox + Fowle Architects. Piano is well-known for his design of the Centre Georges Pompidou in Paris, Osaka's Kansai International Airport, and Berlin's Potsdamer Platz, among many others. In 2000, Fox + Fowle received an American Institute of Architects National Honor Award for Design for the Condé Nast Building at 4 Times Square. That building emphasizes state-of-the-art energy conservation and other environmentally responsible features.

A Testbed for Advanced Daylighting

The New York Times Company's engineering staff had been trying to find a set of integrated technologies that would effectively dim the electric lighting and automatically deploy shading when appropriate in the new building, to take advantage of the daylight benefits but provide comfort. They were unable to find a system on the market that they believed would meet their requirements.

David Thurm, Vice President, Real Estate, for the New York Times Company noted, "We were excited to find that [Berkeley Lab's] prior work was relevant to our project. As an owner/operator, our primary interest is ensuring that the working environment in our building meets the comfort needs of our employees.

"*The New York Times*, as a motivated and concerned owner, has provided us with a great opportunity to advance the use of daylighting as an energy efficiency strategy," says Selkowitz. "In partnership with our [Berkeley Lab] team, they designed and have just completed a 4,500 square-foot south and west quadrant of one floor of the building on the grounds of their printing plant

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States and Cities Follow Federal Lead in Energy-Efficient Purchasing

The Federal Energy Management Program (FEMP) helps federal agencies reduce energy bills and improve energy efficiency. FEMP criteria and the federal ENERGYSTAR® energy-efficiency labeling program identify efficient products, helping agencies make energy-efficient choices. State and local governments are among those now following the federal example. A growing number of jurisdictions have adopted energy-efficient purchasing policies, often using the same ENERGYSTAR and FEMP criteria that federal agencies are required to use.

The state of Arizona and the city and state of New York are among the most recent additions to a growing list of states, cities, universities, and school districts that are choosing to "buy efficient," often as part of a broader policy to "buy green" (i.e., choose environmentally preferable and recyclable products). According to the Consortium for Energy Efficiency (CEE), the 50 state governments and approximately 3,043 county, 19,279 city, and 16,656 town governments in the U.S. spend an estimated total $12 billion per year on energy bills and another $50 to 70 billion per year on energy-related products.

The magnitude of this buying power combined with that of the federal government could help jump-start a market transformation, increasing the demand for and availability of energy-efficient products. When major buyers at all levels of government use the same criteria to specify energy-efficient products, this sends a powerful market signal to manufacturers and vendors that some of their largest and most important customers are committed to buying high-efficiency products and are looking for sellers who can offer the best prices and best overall value for these products. In other words, aggregating buyer demand for energy-efficient products will stimulate a competitive market response that helps to lower prices and improve choices for all buyers of energy-efficient products, government and non-government alike.

A recent report prepared for FEMP by the Environmental Energy Technologies Division (EETD) at Lawrence Berkeley National Laboratory (Berkeley Lab) suggests that combined federal, state, and local purchasing could save U.S. taxpayers about $1 billion per year in lower energy bills if standard, minimal-efficiency products were replaced with more efficient (ENERGYSTAR or FEMP-recommended) models over a 10-year period. These savings would be obtained for the most part using funds that would be spent anyway, to replace equipment at the end of its useful life.

Both Executive Order 13123 and Federal Acquisition Regulation (FAR) Part 23 direct federal agencies to buy ENERGYSTAR-labeled products or, for categories where there is no ENERGYSTAR label, to choose FEMP-designated products that are among the 25 percent most energy-efficient on the market. A separate executive order (EO 13221), signed in 2001 by President Bush, calls on federal agencies to buy products that use less than one watt in standby (off) mode or that meet other low-standby-use criteria set by FEMP. Both executive orders allow exceptions if there is no efficient product available to meet the agency's functional requirements or if an efficient product would not be cost effective for a specific application.

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States and Cities Follow Federal Lead in Energy-Efficiency Purchasing

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Arizona

In Arizona, Governor Janet Napolitano signed a new law (HB 2324), sponsored by State Representative Randy Graf, that sets goals for reducing overall energy use in state government and university buildings. This new law, enacted last April, is similar to the federal building goals in the 1992 U.S. Energy Policy Act and subsequent executive orders. The Arizona law also requires new construction to be more energy efficient and mandates that:

> All state agencies shall procure energy efficient products that are...ENERGYSTAR [labeled] or that are certified under the Federal Energy Management Program...unless the products are shown not to be cost-effective on a life-cycle cost basis. (Arizona Statutes, HB 2324)

According to Jim Westberg of the Arizona Department of Commerce Energy Office, "This new purchasing policy is really a great benefit to our state agencies, since we also have a goal of reducing energy use 10 percent by 2008. When the agencies start buying efficient models as part of their normal equipment replacement cycle, it will help them reach that goal."

Taken together, these initiatives will save Arizona taxpayers about $90 million over a 12-year period (2003-2015), according to estimates by the Southwest Energy Efficiency Project.

New York State

New York state is also implementing both an executive order and a state law requiring state agencies to buy energy-efficient products. Executive Order #111, signed by Governor Pataki in June 2001, calls for:

- a 35-percent reduction in energy use by state buildings as of 2010 (compared to usage in 1990),
- new buildings to meet Leadership in Energy and Environmental Design (LEED) rating criteria and to be least 20 percent more efficient than New York State Building Code requirements, and
- purchase of ENERGYSTAR or other efficient products as designated by the New York State Energy Research and Development Authority (NYSERDA).

In carrying out this purchasing mandate, NYSERDA has drawn heavily on FEMP's federal procurement criteria.

Matt Brown, who oversees NYSERDA's implementation of the executive order, observes that the order has been welcomed: "Many of the purchasing officials I've spoken to have always wanted to purchase equipment with higher standards; now the executive order gives them the guidance and the go-ahead to do it."

New York City

New York City also recently enacted legislation that codifies its practice of energy-efficient purchasing, which began in 1994. Local Law No. 30, signed by Mayor Michael R. Bloomberg on April 11, 2003, requires that energy-using products procured by the city be ENERGYSTAR labeled, provided that there are at least six manufacturers that produce such Energy Star products.

In energy-efficient purchasing, New York city clearly leads by example. During FY 2002, the city spent $90.8 million for ENERGYSTAR-labeled products. Of this amount, more than three-fourths was for computers, monitors, and printers; the rest was spent on photocopiers, fax machines, televisions, videocassette recorders, air conditioners, and lamps. (This total does not include energy-efficient equipment installed as part of construction and renovation projects.)

According to Jennifer Blum at the Department of Citywide Administrative Services (DCAS), New York city's primary purchasing agency for goods, "New York city firmly believes that in our role as a market participant we should promote the purchase of energy-efficient products." For several years, DCAS has provided training to other New York city agencies on energy-efficient and environmentally preferable purchasing. New York city procurement staff note that the on-line listing of ENERGYSTAR-qualified products (**http://www.energystar.gov/products**) is a valuable source of information for meeting the requirements of the local law.

California

The state of California Department of General Services (DGS) issued a Management Memo on "Procurement of Energy Efficient Products" (Memo #01-14, 7/20/01) listing FEMP product categories and directing that: "Where FEMP-recommended standards are available, all state agencies shall purchase only those products that meet the recommended standards. All products displaying the ENERGYSTAR label meet the FEMP standards. A purchase of an ENERGYSTAR-labeled product automatically complies with this directive."

DGS guidelines for major capital construction projects also require that equipment, appliances, and roofing systems purchased as part of new construction or renovation be ENERGYSTAR compliant. "California state government invests over $3.8 billion annually in design and construction," observes Dan Burgoyne, Sustainability Manager at the California Department of General Services. "California already has some of the most stringent energy codes in the country (Title 24), and the use of ENERGYSTAR products has helped state projects meet and sometimes exceed these stringent energy codes by up to 30 percent."

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Meanwhile, the statewide University of California system already specifies ENERGYSTAR Office equipment and is considering ways to extend its energy-efficient purchasing into one of the fastest-growing areas of procurement: energy-using equipment in the university system's many new and existing laboratory facilities.

Wisconsin

In Wisconsin, the Department of Administration, Division of Energy works closely with other state agencies, the University of Wisconsin (UW), city governments, and local public housing authorities to encourage widespread use of ENERGYSTAR and FEMP efficiency criteria in government purchasing. Last summer, Division of Energy staff noticed that the UW system was about to issue a major solicitation for compact refrigerators for dormitories. According to Barbara Smith of the Division of Energy, "Several of the manufacturers made ENERGYSTAR compact refrigerator/freezers in the size needed, so the UW buying agent agreed with my suggestion to amend the bid specs to require ENERGYSTAR."

Similarly, the Wisconsin Department of Revenue was so intrigued with the possibility of specifying high-efficiency light-emitting diodes (LED) in lighted state "LOTTERY" signs for use in small retail stores that the department decided to revamp its bid specifications to mandate LEDs. Smith notes that "When the bids came in, the department was very pleased with the price and performance." Local governments in Wisconsin have also made effective use of the statewide contract for high-efficiency LED traffic signals to negotiate attractive prices from local dealers.

Among the next targets in Wisconsin are ENERGYSTAR refrigerators, clothes washers, and room air conditioners. Air conditioners are purchased in volume (about 400 per year by one branch of the university, UW at Madison, alone) to put in dorm rooms used by summer conference attendees. Smith thinks that the new FEMP and ENERGYSTAR criteria for efficient food-service equipment will also be very popular with universities and school districts alike.

Other Cities and States

A number of other states and municipalities have energy-efficient purchasing policies, including the following:

- The city of Seattle's "Lean and Green City" Copernicus Project calls for purchasing office equipment that meets ENERGYSTAR requirements (**www.ci.seattle.wa.us/oem/GreenPurchasing/GreenPurchasing.htm**).

- King County in Washington State has purchased 32 hybrid electric vehicles for the county government fleet under a master contract issued by Washington state. The county reports that the purchase price for these hybrids, which have twice the fuel economy of an average new car, was about the same as for conventional sedans.

- Massachusetts has an Environmentally Preferable Products Procurement Program (EPP) that features ENERGYSTAR-labeled appliances, air conditioners, and office equipment and includes links to the FEMP and ENERGYSTAR websites.

- The CEE website for State and Local Government Purchasing, which was last updated in 2000, lists numerous case studies of energy-efficient purchasing in cities and states, including: Portland OR; San Antonio TX; San Francisco CA; St. Paul MN; Hennepin and Ramsey Counties MN; Bexar County and Harlandale School District TX; Montgomery County MD; University of California, San Francisco; University of Washington-Seattle; and state governments in Idaho, Massachusetts, and Tennessee.

—Jeff Harris

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Selected on-line references:

- Federal Energy Management Program (FEMP) Buying Energy-Efficient Products: **http: //www.eere.energy.gov/femp/procurement/**

- ENERGYSTAR Purchasing: **http://www.energystar.gov/index.cfm?c=bulk_purchasing.bus_purchasing**

- Consortium for Energy Efficiency (CEE): **http://www.cee1.org/gov/gov-main.php3**

- International Council for Local Environmental Initiatives (ICLEI): **http://www.iclei.org/europe/ecoprocura/northamerica/en_star.htm**

- U.S. Environmental Protection Agency (U.S. EPA) Environmentally Preferable Purchasing (state/local): **http://www.epa.gov/opptintr/epp/ppg/resource.htm#statelocal**

- Arizona: **http://www.swenergy.org/legislation/arizona/HB2324_bill_text.pdf**

- California: **http://www.documents.dgs.ca.gov/osp/sam/mmemos/mm01_14.pdf**

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in College Point, New York. This full-size mockup will allow us to demonstrate and test the key hardware, calibration, and operational controls issues. It will allow the team to specify a technological solution that meets comfort and energy-saving goals."

"The solutions we are developing in the mockup will verify that the control systems and operating strategies will function effectively and provide the productive work environment needed by our employees under a wide range of climate conditions," says Thurm. (See Figure 2.)

Figure 3. Measuring light levels at the New York Times test facility.

Although it was originally intended to be a conventional furniture mockup in a dark warehouse, the test structure will now become a working daylighting laboratory with its glass curtain wall and exterior shading, complete with lighting controls, interior automated shading, as well as furniture and interior finishes, to solve a design challenge that has eluded building owners throughout the country.

After the Times offered to cover the cost of constructing the outdoor mockup, the Berkeley Lab/Times team successfully competed in a solicitation from NYSERDA for the additional funding required to carry out the extensive instrumentation, monitoring, and analysis. The Department of Energy and California Energy Commission also shared the cost, as did the hardware vendors, making this a national partnership.

Berkeley Lab will direct the 12-month state-of-the-art performance evaluation in the mockup and, working with the Times, will use project results to develop performance specifications to stimulate the building industry to provide lower-cost technologies and systems that meet the building's needs. Using this approach, the industry's experience with the Times building will help proliferate daylighting to other buildings.

The New York Times, its architecture and engineering firms, and the Berkeley Lab team led by Eleanor Lee and consisting of Selkowitz, Francis Rubinstein, Dennis Dibartolomeo, Robert Clear, Greg Ward, Christian Kohler, David Watson, Judy Lai, Howdy Goudey, Robin Mitchell, and Danny Fuller have been working together to develop the R&D project plan and launch the project. They have held a series of design charrettes on the East and West coasts and meetings with the buildings supply industry. The mockup facility is now complete, final calibration of instrumentation is under way, and initial testing began on schedule on December 21, 2003. While most of Berkeley Lab was celebrating the holidays at home, Lee and her team were anxiously monitoring the data flow from the mockup. (See Figure 3.)

Stay tuned. Later in the year, EETD News will report on results from these tests.

—Allan Chen

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States and Cities Follow Federal Lead in Energy-Efficient Purchasing

Continued from Page 9

- Massachusetts:
  http://www.state.ma.us/osd/enviro/products.htm
- New York state:
  http://www.nyserda.org/exorder111.html ***and***
  http://www.nyserda.org/equipstds.html
- New York city:
  http://www.council.nyc.ny.us/pdf_files/bills/law03030.pdf
- Washington state:
  http://www.energyideas.org/documents/factsheets/Proc_Resources.pdf
- King County WA:
  http://www.metrokc.gov/procure/green/mdpolicy.htm ***and***
  http://www.cityofseattle.net/environment/Purchasing.htm
- Wisconsin:
  http://www.focusonenergy.com/page.jsp?pageId=286

Research Highlights

Edward Vine Honored with Lifetime Achievement Award

The International Energy Program Evaluation Conference (IEPEC) has given its 2003 Lifetime Achievement Award to Edward Vine of the Environmental Energy Technologies Division (EETD). The award, presented to Vine in Seattle, honors "a member of the evaluation community who has consistently provided significant contributions to the energy services evaluation field." Only seven individuals have received this award since 1989. Vine has been involved in energy-efficiency program evaluation and technology-performance measurement at Lawrence Berkeley National Laboratory (Berkeley Lab) for more than 20 years.

McKone Receives Mehlman Award

The International Society of Exposure Analysis (ISEA) has chosen Thomas E. McKone to receive the 2003 Constance L. Mehlman Award, recognizing his "contributions in exposure analysis research that provided new approaches for the reduction or prevention of exposures and that helped shape national and state policies."

McKone is a Senior Staff Scientist in EETD and Deputy Department Head of EETD's Indoor Environment Department as well as an Adjunct Professor and Researcher with the School of Public Health at the University of California, Berkeley. McKone and his research group developed CalTOX, a model first used by the California Environmental Protection Agency to assess the "multimedia" risk of hazardous waste and air pollutants—the health risks posed by pollutants in the media of air, water, and soil. CalTOX has been widely used by government agencies in the U.S. and Europe, particularly to assess the behavior of persistent pollutants and develop life-cycle impact assessments of pollutants.

In 2000, former Indoor Environment Department Head Joan Daisey received the Mehlman award posthumously for her contributions to the field. ISEA now annually gives out a Joan M. Daisey Outstanding Young Scientist Award "to recognize outstanding contributions to the science of human exposure analysis by a young scientist."

For more information on CalTOX, see:
http://eetd.lbl.gov/ied/era/

William Golove Receives Presidential Award

William Golove of EETD has won a 2003 Presidential Award for Leadership in Energy Management. Golove was part of a team that developed the U.S. Postal Service (USPS) Pacific Area Strategic Energy Management Plan (SEMP). The award honors federal employees for leadership in promoting and improving federal energy management as directed by Executive Order 13123. Other members of the award-winning team are Ray A. Levinson, Rey Pulido, Conrad Saltenberger, and Joe Vanden Berg of the USPS. Five teams received awards this year.

During the next few years, it is expected that the plan developed by Golove's team will reduce the USPS's electricity use and environmental impact and save the service millions of dollars in energy costs. In addition to creating the SEMP, the team developed a database that collects energy-use information at 75 sites, which accounts for 80 percent of the USPS's Pacific Area consumption. This information helps managers identify the best sites for energy-efficiency retrofits. In FY2003, the Pacific Area awarded $3 million in retrofit contracts.

The USPS anticipates that it will award approximately $70 million under Shared Energy Savings performance contracts, which pays energy-services contractors for energy-efficiency improvements that result in savings on the service's energy bill. It is estimated that savings from these contracts will amount to 7 to 10 gigawatt-hours per year, roughly the energy use of 1,000 houses in the Pacific region.

William Golove, right, receiving his award.

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Ernest Orlando Lawrence Berkeley National Laboratory is a multiprogram national laboratory managed by the University of California for the U.S. Department of Energy. The oldest of the nine national laboratories, Berkeley Lab is located in the hills above the campus of the University of California, Berkeley.

With more than 4,000 employees, Berkeley Lab's total annual budget of nearly $400 million supports a wide range of unclassified research activities in the biological, physical, computational, materials, chemical, energy, and environmental sciences. The Laboratory's role is to serve the nation and its scientific, educational, and business communities through research performed in its unique facilities, to train future scientists and engineers, and to create productive ties to industry. As a testimony to its success, Berkeley Lab has had nine Nobel laureates. EETD is one of 13 scientific divisions at Berkeley Lab, with a staff of 400 and a budget of $40 million.

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www.eere.energy.gov/
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The mission of the Environmental Energy Technologies Division is to perform research and development leading to better energy technologies and the reduction of adverse energy-related environmental impacts.

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