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Environmental Energy Technologies Division News

AIR QUALITY | ADVANCED TECHNOLOGIES | BUILDING TECHNOLOGIES | ENERGY ANALYSIS | INDOOR ENVIRONMENT

Containing the Effects of Chemical and Biological Agents in Buildings

In this Issue

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.

ENVIRONMENTAL ENERGY TECHNOLOGIES DIVISION

For three years, researchers in EETD's Airflow and Pollutant Transport Group have been studying the dispersion and fate of chemical and biological agents released in buildings, with an eye to developing strategies to minimize casualties. The events of September 2001 have increased the urgency of this work. This research builds on 25 years of R&D at Berkeley Lab on the indoor environment.

Three recent projects illustrate this group's capabilities.

The Secure Buildings Website

The Secure Buildings website, http://securebuildings.lbl.gov, is intended for emergency personnel and building operators. It contains advice for handling a biological or chemical release in a building, and will be updated as understanding changes. The recommendations on this site are appropriate for small and medium-sized releases such as those expected from a terrorist attack, not for industrial-scale releases such as those that occurred at Bhopal, India, or Chernobyl, Ukraine. The website addresses both pre-event planning (immediate and long-term steps), as well as actions recommended to be taken during various types of releases.

Interpreting Chemical/ Biological Sensor Data in Real Time

We have developed the ability to process data arriving in real time from multiple airborne toxic sensors within a building. New software provides a probabilistic interpretation that tells responders where and how much of the chemical or biological agent may have been released in a building, when it was released, and where in the building the agent is likely to spread. As additional data arrive, the software narrows down the probable answers to these questions, increasing the confidence that responders have the correct information. This helps them to devise a containment response and rescue strategy. The system has been tested using synthetic data, and field tests are in progress using real data from the U.S. Army's Dugway Proving Grounds.

Anth-Trax

A computer model now exists that can simulate the release and dispersion of anthrax spores within a building. The model predicts where the spores go—what fraction settles on floors, in carpets and on walls, how much is resuspended in the air from footfalls, how much is caught in the duct system and air filtration elements, and how much leaves the building through cracks, doors and windows. It also estimates human dosages, and helps assess which strategies might work best to contain the agent. The model is currently being used to examine the anthrax release at Washington, D.C. area's Brentwood mail-processing facility. Anthrax-laden letters sent to Congressional offices passed through this building last fall.

Additionally, the Airflow and Pollutant Transport Group is continuing ongoing work (a) to test and apply computational fluid dynamics to study the dispersion of airborne toxic chemicals in large indoor spaces; and (b) to upgrade the COMIS (Conjunction Of Multizone Infiltration Specialists) computer model, which simulates pollutant airflows within buildings.

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If a toxic cloud passes through a residential neighborhood, the real-time computer simulation can guide first responders

New Work

Two new projects are also underway:

- *Enhancing predictive powers of the LLNL National Air Release Advisory Capability (NARAC)*

In cooperation with Lawrence Livermore National Laboratory (LLNL), we are developing a model to predict the indoor concentrations resulting from an outdoor toxic gas or aerosol release in the vicinity of a residential community. Already, select federal and state emergency services officials can register with LLNL's NARAC, which provides real-time simulation of the dispersion and movement of toxic plumes outdoors, such as might be released in nuclear reactor, chemical industry, or oil refinery accidents.

Our research will extend this capability to predicting the infiltration of these plumes indoors. For example, if a toxic cloud passes through a residential neighborhood, the real-time computer simulation can guide first responders (police and fire agencies) about where to look first for injured parties who need medical assistance, and where the safe zones and areas of maximum exposures are located. It also provides information on when it is safer for the exposed populace to seek shelter indoors, when to leave the house, and which escape route to choose.

- *Entry of airborne toxic plumes into commercial buildings*

We are developing an end-to-end computer modeling capability that simulates a toxic release from the beginning of the incident to its end, using an existing outdoor plume dispersion model. It will track the motion and dispersion of the plume outdoors. This Berkeley Lab research will then provide predictions of entry of the toxic plume into specific commercial buildings, e.g., through window cracks, doorways, or fresh air intakes. The toxic plume will be tracked as it propagates into the building's interior. The simulation will assess exposure of building occupants under various outdoor release scenarios and building responses, including assessing the safety of areas of safe shelter throughout the duration of the incident, and provide guidance on the consequences of different strategies for taking shelter (remaining indoors, evacuating immediately, or after a delay), for different types of toxics. The software will incorporate existing toxic dose-response estimates for humans.

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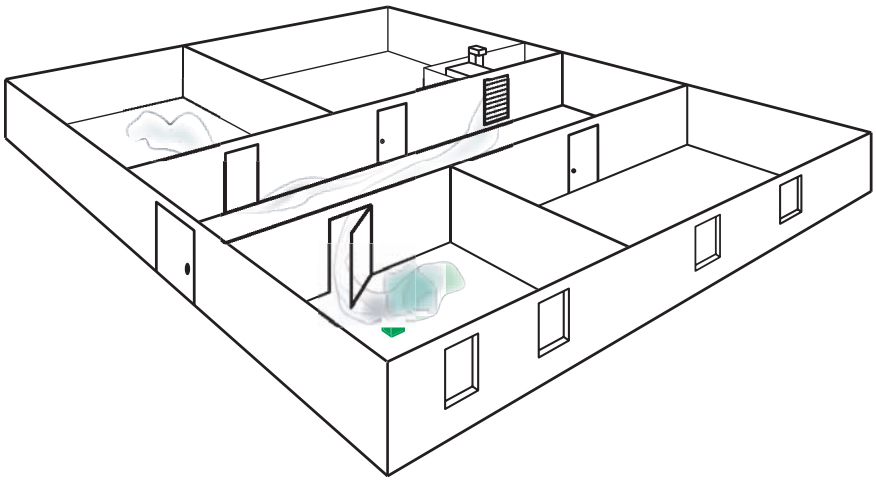
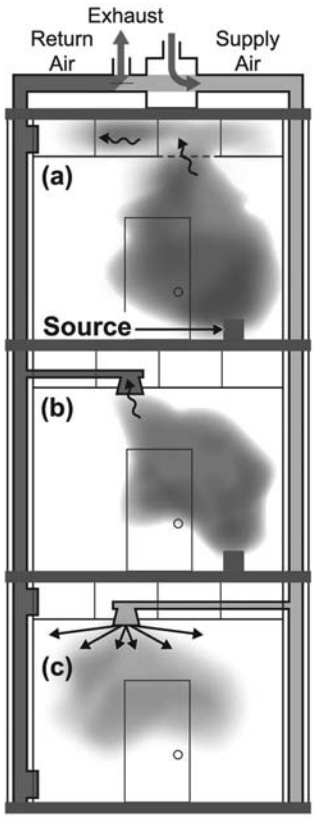
http://securebuildings.lbl.gov

This work is supported by the U.S. Department of Energy, Office of Chemical Biological Non-Proliferation Program.





Laser Ultrasonic Sensor Streamlines Papermaking Process

Hoping to save the paper-manufacturing industry millions of dollars in energy costs, Environmental Energy Technologies Division scientists have developed a laser ultrasonic sensor that measures paper's flexibility as it courses through a production web at up to 65 miles per hour.

"We're measuring the elastic properties of paper at manufacturing speeds using a non-contact, non-destructive monitor," said EETD's Paul Ridgway.

Last summer, Ridgway and colleagues tested the laser ultrasonic sensor at a Mead Paper Company mill in Ohio. They installed the sensor on a pilot paper-coating machine and ran six paper grades—ranging from copy paper to heavy linerboard—through the web press. The sensor's signals remained excellent, even at paper speeds up to 5000 feet per minute, and the laser didn't damage the paper. The effects of the papers' moisture, tension, basis weight, and speed on the measurements were also examined.

"The Mead test demonstrated the instrument works in an industrial setting," Ridgway said. "It's a successful step toward a mill trial on a paper-making machine in which the environment will be much harsher. It will be hotter and wetter, and there will be more vibrations and fiber debris in the air."

The sensor is part of the Department of Energy's (DOE) Agenda 2020, a collaboration between the wood, paper, and forestry industry, launched in 1994 by the DOE to improve the industry's energy and resource efficiency. To understand how the sensor contributes to this initiative, consider how paper is currently evaluated. After it's manufactured, a small sample of a three-ton paper roll is manually analyzed for its mechanical properties by observing how it bends. If the sample doesn't meet specifications, the entire roll is scrapped or sold as an inferior grade. To avoid this costly mistake, manufacturers often over-engineer paper, erring on the side of caution and using more pulp than necessary, to ensure the final product isn't substandard. Not only does this consume more raw materials, it consumes more energy: The more pulp used per unit of paper, the more heat is required during the drying phase, which even in the most efficient mills requires an enormous amount of energy.

Rather than rely on post-production evaluation and hope for the best, Ridgway and colleagues have developed a sensor that measures flexibility on the fly, in real-time. It also conducts the measurements without touching the paper, an important advantage, given that at 30 meters per second, the slightest contact can mar light-weight grades such as copy paper and newsprint. This represents an improvement over contact transducers, another real-time evaluation tool that measures paper's tensile elasticity by placing an ultrasound head directly onto the paper as it's coursing through the web. Because it touches the paper, this technique can only be used with thicker stock.

A full-scale pilot test of the laser ultrasonic sensor is scheduled for the summer of 2003, Ridgway said. And further in the future, the sensor could provide quality-control safeguards and real-time process information for feedback process control in any manufacturing process involving thin, moving sheets, such as sheet metals, sheet plastics, polymeric materials, and glass.

In addition, the sensor's auspicious Mead Paper Company field test represents a Berkeley Lab success under the auspices of the Laboratory Coordinating Council (LCC). The LCC was established in 1995 by the DOE Office of Industrial Technologies to merge the research and development capabilities of the 16 national labs and research facilities with the process needs of nine major industries: agriculture, aluminum, chemical, forest products, glass, metalcasting, mining, petroleum, and steel.

It works by essentially bringing the national labs under one roof. Rather than approach each lab individually, industry representatives can approach the LCC with a design need. The LCC, in turn, matches the industry project with the most appropriate lab. This gives American industry direct access to the entire DOE lab community at once. And by more efficiently pairing the national labs' vast research resources with the private sector, the LCC enables industry to become more resource- and energy-efficient, as well as more competitive in the global marketplace. As such, the DOE's Agenda 2020, which coupled

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Mead Paper Co. Gives OIT-Developed LUS Technology A Positive Rating

Under OIT's Forest Products Industries of the Future program, the Lawrence Berkeley National Laboratory and the Institute of Paper Science and Technology jointly developed an innovative Laser Ultrasonic Sensor (LUS) to measure paper bending stiffness and shear rigidity during the papermaking process.

The sensor was recently evaluated successfully on a pilot paper coating machine at Mead Paper Co. in Chillicothe, Ohio. Six different paper grades were used, ranging from relatively lightweight copy paper to heavy linerboard. Excellent LUS signals were obtained even at machine speeds up to 5000 ft/min, or about a mile per minute. No laser marks were visible on the paper. The LUS technology meets a major need of U.S. paper mills because a critical measurement normally performed off-line after production can be performed in real-time during the manufacturing process. Such a sensor can save the paper industry millions of dollars in energy and other costs by reducing the production of below-specification paper. For further information, contact OIT's Clearinghouse 1-800-862-2086.

the Environmental Energy Technologies Division with the paper industry's need for a non-contact paper sensor, is one of several industry-specific agendas designed to mesh industry needs with national lab know-how.

—Dan Krotz

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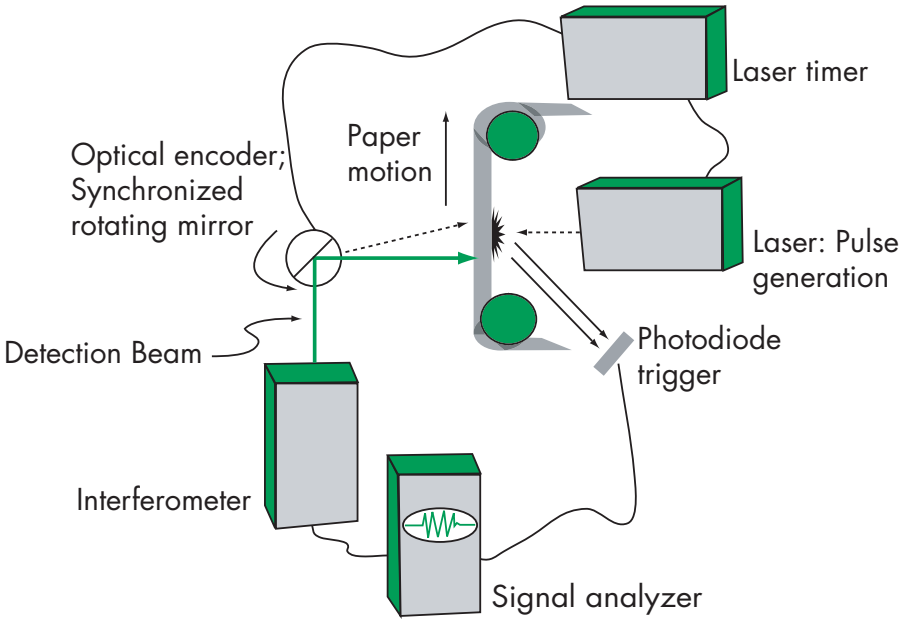
This work is supported by the U.S. Department of Energy's Office of Industrial Technologies and Mead Paper Company.

Dan Krotz is a writer in Berkeley Lab's Public Information Department.



In rough terms, the sensor measures the time it takes ultrasonic shock waves to propagate from a the laser-induced excitation point to a detection point only millimeters away. The velocity at which the ultrasound waves travel from the ablation point through the paper to the detection point is theoretically related to two elastic properties: bending stiffness and out-of-plane shear rigidity.

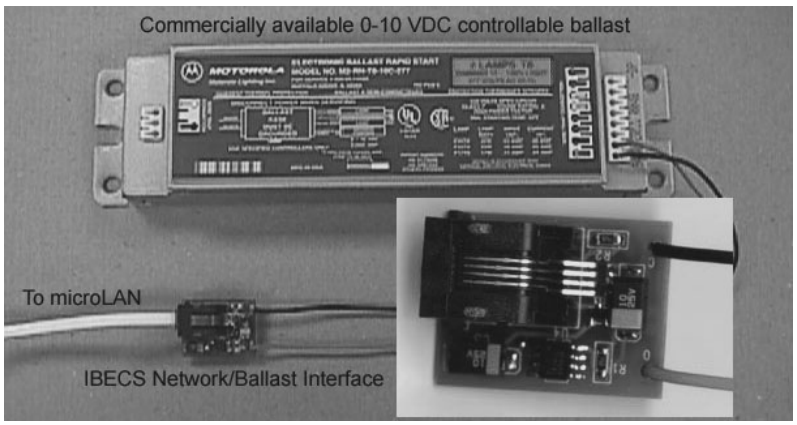
More specifically, a detection beam from a commercially available Mach-Zender interferometer is directed toward a quickly rotating mirror. As the mirror spins, the beam is reflected in a circular pattern much like a lighthouse's beam. During a portion of each revolution, the beam meets the paper as it courses along the production belt and remains with the paper until the beam's arc leaves the paper's plane. Think of the lighthouse beam momentarily tracking a speedboat as it races parallel to shore. Because both the beam and the paper are moving at the same speed, the detection beam remains at the same point on the paper.

An optical encoder determines when the detection beam is perpendicular to the paper, at which time a specially designed adjustable delay circuit fires the pulsed neodymium-yttrium-aluminum-garnet laser. This microsecond pulse causes a microscopic thermal expansion or ablation on the paper, which is too small to mar the paper and affect how it absorbs ink, but strong enough to send ultrasonic shock waves through the sheet. The waves propagate through the paper until they're registered by the detection beam. Because the laser is synchronized to fire only when the detection beam is perpendicular to the paper, the distance between the ablation point and detection point is known, and the wave's speed can be calculated.

Building a Smarter Light: The IBECS Network/Ballast Interface

Lighting control companies have developed products that can be specified as systems to achieve simple lighting control in buildings. Researchers at the Environmental Energy Technologies Division demonstrated in the late 1990s that components from different manufacturers could be specified, assembled, and installed, and that such systems could result in significant energy savings. However, the fragmented nature of the lighting control market means that component products from different manufacturers often do not work together well as systems. Thus, advanced lighting control equipment capable of implementing strategies such as daylighting have proved difficult to commission in the field, resulting in poor operation and user complaints. The software needed to coordinate lighting control subsystems is also immature.

Figure 1. The first IBECS network/ballast interface for communicating digitally with controllable fluorescent ballasts.



To address the market shortcomings of current technology, a cooperative project involving EETD researchers and Vistron is underway to develop an integrated building equipment communications (IBECS) network. This network will allow automation of lighting systems not only to increase energy efficiency and improve building performance, but also to increase occupant satisfaction by providing occupants with a low-cost way to control their workspace lighting system. Furthermore, IBECS will provide building operators with the hardware/software infrastructure that will help them implement demand-responsive load control with confidence.

Proof-of-Concept

The project's goal is to design, build, and test an IBECS interface and networking system for controllable lighting devices that will enable the local and system-wide energy-efficient operation of various lighting systems and components. After an evaluation of available ballast types, microcontrollers and local area network (LAN) software, Pete Pettler (of Vistron) designed a ballast network interface around an off-the-shelf microchip set and 1-wire digital microLAN from Dallas Semiconductor that would operate commercially available 0-10 VDC (volts DC) controllable ballasts (see Figure 1). These microchips are ideally suited to web-based control of lighting and building equipment as each chip has its own IP address (2^{64} possible addresses) and is embedded with the necessary intelligence to communicate directly with the microLAN.

To test the interface, six units were installed to control the overhead lights in an office at Lawrence Berkeley National Lab. Six two-lamp, non-dimming ballasts were replaced with 0-10 VDC two-lamp controllable ballasts. The Facilities Department installed low-voltage cabling to connect all the fixtures and connected the IBECS ballast network interfaces to each of the ballasts. The lighting system was controlled using special software installed on the office occupant's workstation. The initial test results were disappointing. Excessive electronic noise from the ballasts swamped the digital microLAN and prevented it from communicating with the interfaces.

To address this shortcoming, researchers redesigned the interface and modified the digital network. The redesign involved major modifications to the circuit to isolate the interface optically from the noise generated by the controllable ballast. This required replacing the so-called single-wire network with a four-wire powered IBECS network. (Single-wire is a misnomer. The cable actually contains two wires.) Two of the wires now supply low-voltage current to power devices on the microLAN while the two remaining wires are for signal and common. The cost per linear foot of four-wire network cable is only marginally more than two-wire cable.

Unlike the earlier interfaces they replaced, the redesigned interfaces worked without problem in the test office. Each ballast could be individually controlled as desired from the computer, and the lights dimmed quickly without discernable delay. The new design entirely eliminated the noise problems encountered previously.

Conclusions

Newly available microchips are a suitable platform for designing equipment interfaces that can enable low-cost networking of commercially available dimming ballasts. Electrical noise generated by the ballast in the 0-10 VDC controllable loop can interfere with digital network operation unless the interface is hardened for noise. Using optical isolation, we produced a refined IBECS network/ballast interface that could control most available 0-

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IPMVP—from a DOE-Funded Initiative to a Not-for-Profit Organization

Seven years ago, the U.S. Department of Energy (DOE) started a market transformation initiative to help secure low-interest loans from financial institutions for energy efficiency investments. DOE envisioned achieving this by developing industry consensus and standard methods to measure and verify energy savings resulting from the implementation of energy-conservation measures (ECMs). The product, International Performance Measurement & Verification Protocol (IPMVP), provides standard measurement and verification (M&V) terminology and defines four M&V options to quantify energy and water savings. It is a savings-verification tool with principles that are applicable to commercial and industrial energy efficiency projects.

Seven years and three editions later, use of IPMVP has become standard in almost all energy efficiency projects where payments to the contractors is based on the energy savings that will result from the implementation of a variety of ECMs. IPMVP has been translated into ten languages. More than 300 professionals from 100 U.S. and international organizations have contributed thousands of hours on a completely voluntary basis to update and revise IPMVP. More information can be found at http://www.ipmvp.org.

Satish Kumar of EETD's Energy Analysis Department in the Washington, D.C., office has provided the technical leadership and has helped refine the M&V methods for different types of energy-conservation measures. He has also managed a coalition of energy professionals representing industry (ESCOs, utilities, consulting companies, standards- setting organizations like ASHRAE, etc.); researchers from research centers, universities, and national research labs; policy makers and program managers from federal and state agencies; as well as a significant number of international energy and indoor environmental quality (IEQ) professionals.

Application

A variety of mechanisms such as shared-savings contracts and energy-savings performance contracts (ESPCs) are presently used to attract third-party financing for energy efficiency projects. The foundation of these contractual vehicles is the assumption that the ECMs would result in reduced energy use, allowing the resulting cost savings to be used to pay for energy services and loan servicing for the duration of the contract. In these projects, it is essential not only to measure the energy savings but also to verify those savings and associate them with specific ECMs.

Figure 1 depicts the conceptual framework for the ESPCs used by the U.S. DOE and U.S. Department of Defense (DOD) to help federal agencies reduce energy use and greenhouse gas emissions using funds from the private sector. The use of IPMVP, or the Federal Energy Management Program M&V Guidelines (an application of IPMVP), or both is mandatory for verifying such savings in most federal ESPC projects. Also, the use of IPMVP is required for energy efficiency projects funded under state performance contracting programs in California, New York, Texas, and Wisconsin.

Measurement & Verification Plan

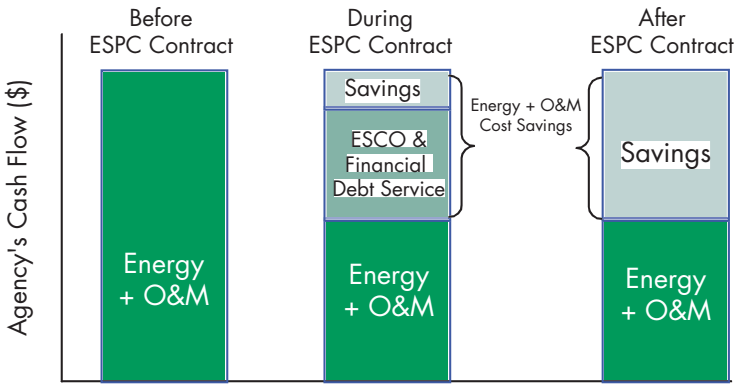
The latest version of IPMVP, published in January 2001, offers four M&V options to determine energy savings resulting from the implementation of an ECM at the individual project level. The preparation of an M&V plan is central to the proper determination of savings and forms the basis for verification. A good M&V plan should:

- Identify appropriate M&V options for different ECMs.
- Define the boundaries (individual energy systems or whole building) of the ECMs for savings determination, and rigorously document the facility's baseline conditions and the resultant baseline energy data.
- Specify quality control and quality assurance procedures for data collection as well as the format in which the annual M&V reports will be submitted.
- Include cost estimates for both the initial instrumentation and recurring M&V tasks.

Measurement Versus Stipulation

One of the most contentious issues with respect to M&V has been the use of stipulations in determining energy savings. (According to IPMVP, whenever a parameter is not measured, it should be treated as a stipulated value.) At the heart of the debate is the perception that M&V strategies heavy on metering can be very expensive and do not provide as much value. Indeed, there are situations where stipulations based on reasonable assumptions or historical data can substitute for expensive instrumentation, keeping the cost of the project down. However, past experience has shown that ESPC customers, without fully realizing the

Figure 1. Conceptual framework for energy savings performance contracts (ESPC)



Source: www.eren.doe.gov/femp

risks and the associated uncertainty implications that comes with unreasonable stipulations, have often opted for the lowest cost M&V option.The latest version of IPMVP, after much deliberation within the Protocol's Technical Committee, has put in additional requirements to promote best M&V practices that conform to best engineering practices.

IPMVP Options

The four M&V options titled A, B, C, and D are the cornerstones of the standardized set of procedures contained in the IPMVP. Options A and B focus on the performance of specific ECMs. Option C assesses the energy savings at the whole-facility level by analyzing utility bills before and after the implementation of ECMs. Option D is based on simulations of the energy performance of equipment or the whole facility, permitting the determination of savings when base year retrofit data are unreliable or unavailable. Each M&V Option is explained in detail in the Table 1.

Future Directions

Every year about 3000 copies of *IPMVP Vol.I—Concepts and Options for Determining Energy Savings* and 1500 copies of *IPMVP Vol. II—Concepts and Practices for Improved IEQ* are either downloaded electronically (www.ipmvp.org) or ordered through the Energy Efficiency and Renewable Energy Clearinghouse (1-800-DOE-EREC).

DOE's Office of Building Technology, State and Community Programs (OBTS) has funded the IPMVP project for the last seven years. Recently, IPMVP, Inc. was incorporated as a not-for-profit organization to broaden its support and provide technical and educational services to professionals and organizations interested in the measurement and verification of energy savings. IPMVP, Inc. together with the Association of Energy Engineers launched a new certification program for M&V professionals in April 2002 to raise the professional standards and improve M&V practice. EETD continues to play a central role as IPMVP, Inc. tries transitions from a government-funded to a not-for-profit model and at the same time maintains its objectivity as it helps improve and refine the art and science of M&V. If it manages to successfully make the transition, it will be a victory for the collaborative model that brought about such a successful government industry partnership.

—Satish Kumar

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This project is funded in part by the U.S. Department of Energy, Office of Building Technology, State and Community Programs.

Table 1. IPMVP Options

	IPMVP Options Description	Typical Applications
A. Partially Measured Retrofit Isolation	Savings are determined by partial field measurements of the energy use of the system(s) to which an ECM was applied, separate from the energy use of the rest of the facility. Measurements may be either short-term or continuous. Some but not all parameters may be stipulated.	Lighting retrofit where power draw is measured periodically. Operating hours of the lights are assumed to be one-half hour per day longer than facility occupancy hours.
B. Retrofit Isolation	Savings are determined by field measurement of the energy use of the systems to which the ECM was applied, separate from the energy use of the rest of the facility. Short-term or continuous measurements are taken throughout the post-retrofit period.	Application of controls to vary the load on a constant speed pump using variable-speed drive. Electricity use is measured by a kWh meter installed on the electrical supply to the pump motor.
C. Whole Facility	Savings are determined by measuring energy use at the whole facility level. Short-term or continuous measurements are taken throughout the post-retrofit period.	Multifacted energy management program affecting many systems in a building. Energy use is measured by the gas and electric utility meters for a twelve-month base-year period and throughout the post-retrofit period.
D. Calibrated Simulation	Savings are determined through simulation of the energy use of components or the whole facility. Simulation routines must be demonstrated to adequately model actual energy performance measured in the facility. This option usually requires considerable skill in calibrated simulation.	Multifaceted energy management program affecting many systems in a building but where no base-year data are available. Base-year energy use is determined by simulation using a model calibrated by the post-retrofit period data.

Skylight Well Reduces Solar Heat Gain

It is well known that daylight is rapidly attenuated as it is reflected, multiply and diffusely, while passing through a skylight well that has a depth comparable to, or greater than, the size of its opening. The same is true of solar energy that strikes the walls of the light well. The diffusely reflected energy is transported downward by multiple reflections. On each reflection, a portion of the energy is absorbed in the well walls. This absorbed energy appears as heat. Building energy calculations have generally assumed that all this heat enters the building space below, creating a cooling load.

Measurements on a skylight/light well combination made in EETD's Mobile Window Thermal Test Facility (MoWiTT) reveal that this is not the case. Energy absorbed in the skylight well is carried upward by convection and results in stable temperature stratification of the well air. Heat is trapped in the air at the top of the well and can only reach the space below by thermal radiation, which turns out to be a comparatively small effect. Figure 1 shows that this results in the air at the top of the well remaining always at a higher temperature than the outside air even on a very hot day. The heat transfer (as opposed to solar radiation) through the skylight is directed outward. The skylight/well combination rejects part of the solar gain that has entered through the skylight.

The measurements in Figure 1 show that in these tests approximately 25% of the solar energy admitted by the skylight (that is, the energy that would enter the space if the skylight behaved exactly like a window) was subsequently rejected, leaving only 75% to impose a cooling load on the space below. Of the rejected energy, about one-third was rejected by conduction through the walls of the well, with the remainder rejected by thermal transfer through the skylight. This leads to the altered view of skylight performance shown in Figure 2b.

These measurements mean that several new issues need to be considered in buildings designed with skylights. For example, heat rejected through the well walls could add to the cooling load or not, depending on the nature of the adjacent space. The amount of heat trapped by the light well depends on the geometry and reflectance of the well. Further research is needed to develop a method of calculating the trapped heat and the expected temperatures from the well geometry and incident solar flux on the skylight.

Our new insights into the thermal behavior of skylight wells will lead to new ways of optimizing skylight performance. It seems safe to say that with careful design of the light well (e.g., venting in summer, use of selective surfaces) skylight well systems could provide daylight without heating the space, other than heat contained in the light itself.

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This work was supported by the Office of Building Technology, State and Community programs. Office Building Research and Standards of the U.S. Department of Energy.

Figure 1. Heat rejection by a skylight well. Measurements made on a clear double-glazed skylight tilted 20 degrees to the south at the top of a vertical-sided light well are shown. Solar energy absorbed in the well walls causes vertical temperature stratification in the well, resulting in an air temperature (upper plot) at the top of the well that is always above outdoor air temperature. (Peak air temperature, 34 °C (93 °F), peak well temperature, 60°C (140 °F.)) The measured energy flow (lower plot, points) into the space is considerably smaller than the energy flow entering the skylight (the energy that would enter the space if the skylight behaved exactly like a window; it is calculated from measured solar incidence and the interior and exterior temperatures). The difference is due to heat rejected through the well walls and the skylight, as indicated.

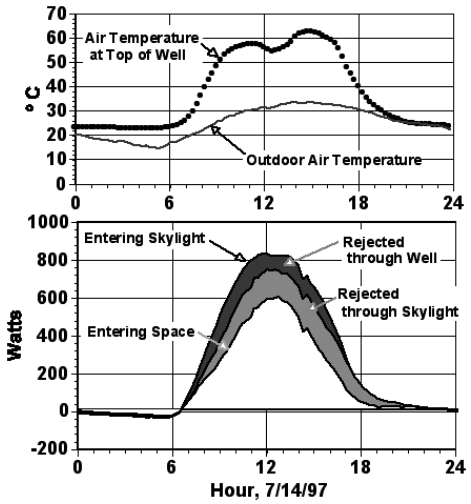
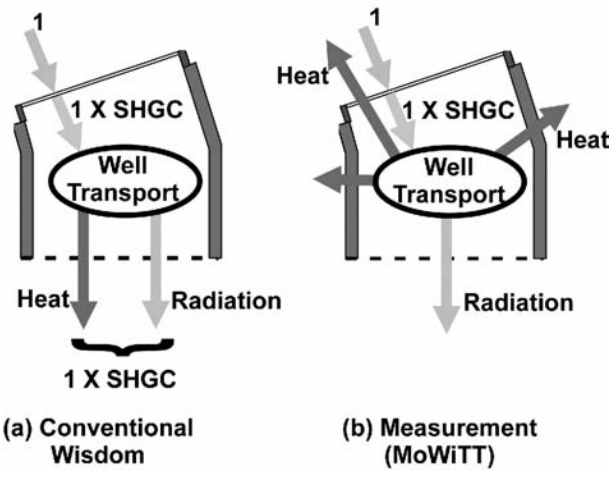


Figure 2. Old and new views of the thermal function of a skylight well. In the conventional picture (a) the skylight in a well behaves thermally as though the well were not there. By contrast, the picture (b) that emerges from MoWiTT measurements sees the well as a "thermal diode" heat trap, which during the daytime rejects all energy converted to heat in the well and allows only that which remains in the form of radiation (mostly solar) to enter the space below.



RESEARCH HIGHLIGHTS

Plan to Reduce Standby Power Loss Gets Energy Globe Award

An International Energy Agency (IEA) project to reduce the waste of standby electrical power by common household appliances has won an Energy Globe 2002 award. Alan Meier, a scientist in the Environmental Energy Technologies Division, proposed the 1-Watt Initiative as a way to reduce wasted electricity when his research on standby power loss showed that it accounts for as much as 10 percent of a typical household electricity bill.

IEA's Benoit Lebot (a former staff member of EETD) developed the Initiative into a program of workshops and conferences to help the IEA's 25 nations, as well as many other non-OECD (Organization for Economic Cooperation and Development) countries, implement solutions to reduce standby power loss. The award notes that "each Watt consumed by an appliance in standby mode totals 8.76 kWh per annum and costs one Euro on average." Other efforts are underway in the United States and Asia-Pacific nations to reduce standby power loss as well.

The award also notes that "The initiative has already gained legitimacy when Australia formally endorsed the concept and when U.S. President Bush issued an Executive Order requiring the federal government to purchase products with low standby losses."

The 1-Watt Initiative received an Energy Globe 2nd prize in the category of "Public and Private Initiatives." There were three winners in each of five categories. More than 2,100 energy- and water-saving projects were nominated for awards in the Energy Globe 2002 competition.

The IEA consists of 25 countries, including 15 nations from the European Union. Energy Globe awards are given yearly to public agencies and private companies throughout the world by the O.Oe. Energiesparverband, a regional energy agency in Linz, Austria that promotes energy efficiency, renewable energy sources, and innovative energy technologies. The awards were announced at a gala in Linz on March 6.

For more information see:

http://www.esv.or.at/aktuelles/energyglobe/globe02/iwatt_e.htm

Alan Meier's home page on standby power:

http://standby.lbl.gov/

Nobelist Uses Berkeley Lamp

Retired Berkeley Lab physicist and Nobel Laureate Donald A. Glaser with one of the two Berkeley Lamps installed in his home recently by lamp developer Michael Siminovitch.

RESEARCH HIGHLIGHTS

Energy Choices Made More Difficult

The use of solar power, wind energy, and other alternative energy sources could rise 40% by 2010 if consumers are given a greater choice of how their electricity is generated, according to a new report by Lawrence Berkeley National Laboratory and the National Renewable Energy Laboratory. So-called "green power" has thrived in states with retail market competition, but the recent suspension of customer choice in California shows "the transition to competitive retail power markets will not be smooth," said LBNL researcher Ryan Wiser, a co-author of the report. "If competitive retail markets fail to materialize, utility programs must pick up the slack." The report, *Forecasting the Growth of Green Power Markets in the United States,* can be downloaded at http://www.eren.doe.gov/greenpower/pdf/30101.pdf

EETD Scientists Honored for Volunteer Work

Peter Faletra, Education Program Director from the DOE Office of Science presented five mentor awards in a recent ceremony held at Lawrence Berkeley National Laboratory. Among the recipients were two Environmental Energy Technologies Division scientists: Regine Goth-Goldstein and David Lorenzetti (both of the Indoor Environment Department).

The Office of Science operates educations programs in DOE's National Laboratories, aimed at increasing the number of students choosing science and technology careers in the national laboratories and
private sector research institutes.

Goth-Goldstein directed students in her work investigating how variations in the metabolism of cancer-causing chemicals contribute to an individual's susceptibility to various cancers. She states that her research is ideal for students without previous lab experience because it teaches a number of molecular biology methods and epidemiological approaches, while providing an easily understandable link to general health concerns.

Lorenzetti had students finding and testing computer programs to solve nonlinear equations as well as measuring air flows in large openings such as stairwells. Lorenzetti says that the students were bright self-starters who were also fun to work with. One of David's protegees, William Watts, has returned to EETD. This summer he will measure pollutant transport in buildings.

AirLiner® a Winner

AirLiner®. a packaging system for shipping cold or hot products, was developed by Cargotech Technology (San Diego) based on EETD's research on multi-paned windows, which led to development of the gas-filled panel (GFP) insulation material. AirLiner uses a reflective barrier film that prohibits heat transfer, and its inflatable design makes the product easy to store until it is needed. (See *EETD News* Vol. 2, No. 2, for a more complete story on the research.)

AirLiner was recently awarded a Highest Achievement Award in the 2002 Flexible Packaging Achievement Awards competition. The Flexible Packaging Association sponsors the awards. AirLiner received additional awards for technical innovation and environmental achievement.

Award-Winning EnergyPlus

EETD's Simulation Research Group's EnergyPlus program has won an award from the Federal Laboratory Consortium for Technology Transfer, an organization of more than 700 major federal laboratories and centers and their parent departments and agencies. The awards ceremony took place May 8, at the FLC 2002 Annual Meeting in Little Rock, AK.

Energy Plus is a new-generation building energy-simulation program that models building heating, cooling, lighting, ventilation, and other energy flows.

EETD's David Lorenzetti (left) receives his award from DOE's Peter Faletra.

(l to r) William Fisk (IEP Head), Goth-Goldstein, Faletra, Director Shank, and Dick Nolan (DOE site manager) at the awards ceremony.

California Energy Commission Funds Data Centers Study

During the California electricity crisis of 2001, some observers and journalists pointed fingers at the rapid expansion of the Internet and blamed computer hardware for the energy shortages. Research conducted by Berkeley Lab scientist Jon Koomey debunked this myth. His work showed that all computer hardware, including servers, routers, and other devices forming the Internet, use no more than 2% of electricity use nationwide. (See "Research Finds Computer-Related Electricity Use to be Overestimated." http://www.lbl.gov:80/Science-Articles/Archive/net-energy-studies.html)

Questions have persisted about the use of energy by a type of facility that has become prominent since the expansion of the Internet as a commercial entity: the data center, also known in some applications as the web server farm. These buildings can house hundreds of computers that store and transmit the data and web pages available on the Internet.

In early March, the California Energy Commission announced that it was awarding a grant of $500,000 to Berkeley Lab to conduct research designed to reduce the energy use of data centers in California by 30%. About 17% of the nation's server farms are located in the San Francisco Bay Area and Silicon Valley, requiring 80 MW of power to run. Saving 30% of this would free up 24 MW of power. In addition, there are a wide variety of data centers in use in industrial, research, and educational institutions that are also the target of this study.

"Any megawatt savings would be really helpful to California in the next few summers," says Commissioner Arthur Rosenfeld, chair of the Commission's Research, Development, and Demonstration Committee. "Twenty-four megawatts of electricity running continuously will supply 24,000 average California homes." http://www.energy.ca.gov/releases/2002_releases/2002-03-01_server_farms_nr.html

There are three parts to the research. The first will characterize the power load drawn by data centers in California—answering the questions of where the data centers are in the state, and how much electricity they use. Researchers will then study three to five centers in depth, and develop case studies showing the opportunities for improved energy efficiency. The third task will be to develop a road map, in cooperation with the private sector, for improving the efficiency of California data centers.

Dale Sartor, head of EETD's Applications Team, and William Tschudi are managing the project; Koomey will participate in the first phase. The team is also conducting a case study review of a data center in New York for the New York State Energy Research and Development Administration. NYSERDA and the CEC will share results of their research to help better manage data centers in both states.

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10 VDC controllable ballasts. We estimate that, in quantity, the cost of the interface would be about $1 to $2 to the equipment manufacturer—five to 10 times cheaper per unit than any other proposed communication system that we know of.

—Francis Rubinstein and Pete Pettler

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The complete report is available at http://buildings.lbl.gov/hpcbs/
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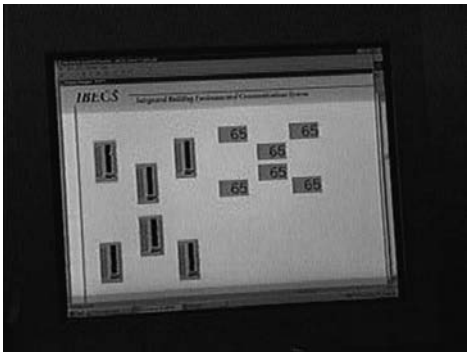
Figures. Top image shows occupant using IBECS virtual control panel on user's PC to change the dim levels of the overhead lights. The bottom image is a close-up of the IBECS virtual control panel. The six "sliders" on the left portion of the panel correspond to the six separately controlled ballasts in the overhead lighting system.



Sources

EREC: Energy Efficiency and Renewable Energy Clearinghouse

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