



Buildings for the 21st Century

Winter 2002

News You Can Use

Office of Building Technology, State and Community Programs (BTS)



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Brookhaven National Laboratory improves duct efficiency.



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ENERGY STAR® campaign makes a change.

Health Care Industry Begins to Cut Energy Costs

U.S. health care facilities ring up \$5.3 billion annually in energy costs, and they rank second only to the food service industry in intensity of energy usage. The good news is that potential for savings is significant, through investments in energy efficiency.

Recognizing the possibilities for improvement, BTS is focusing its attention on health care buildings, and specifically their top three energy consumers: water heating, space heating and lighting.

"We see these as areas of opportunity. It's an opportunity to reduce energy costs and apply the savings to more important investments," said Mark Ginsberg, deputy assistant secretary for BTS.

In-patient facilities, which make up 22,000 of the country's 105,000 health care facilities, are the most energy intensive. They use an average of 295,000 British thermal units (Btu) per square foot, surpassing even the food service industry in energy usage.

Said Ginsberg, "It's no surprise that health care institutions are large consumers of energy. They need to be. But just as we've identified goals for commercial buildings, setting energy saving goals for health care institutions just makes good financial and environmental sense."

Speaking at December's Symposium on Healthcare Design in Nashville, Ginsberg highlighted a few facilities that have achieved significant energy and cost savings. He also outlined resources that institutions can use to approach cutting costs.

One resource is Rebuild America, a BTS program that helps communities sort through their options and form action plans. Better known for its relationships with schools, states and business centers, Rebuild America is beginning to provide focus on hospitals, building on DOE's earlier experience from the Institutional Conservation Program.

Through a partnership in Muscatine, Iowa, the local utility company, Muscatine Power and Water, developed a plan to overhaul the lighting system in the city's 160-bed hospital. With an investment of \$35,000 over four years, Unity Health expects to save more than \$12,000 annually. The hospital benefits further through the utility's rebate program, which offers commercial customers \$200 for every kilowatt of power reduced through lighting replacements; the annual cap is \$2,000.

John Root, energy services advisor for Muscatine Power and Water, calls the success a home run. "This is a small town. If we can do it here, there are a whole lot of small towns across the country who can do it," he said.

In 1991, New York's Albany Medical Center turned to an energy service company (ESCO) to finance its \$7.7 million energy efficiency project after determining that its energy consumption was much higher than that of comparable facilities in similar regions. ESCOs finance energy efficiency upgrades knowing that utility costs decrease enough to repay project costs.

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The Center for Discovery will complete its new facility this summer.



The Naval Medical Center in San Diego is ENERGY STAR® certified.

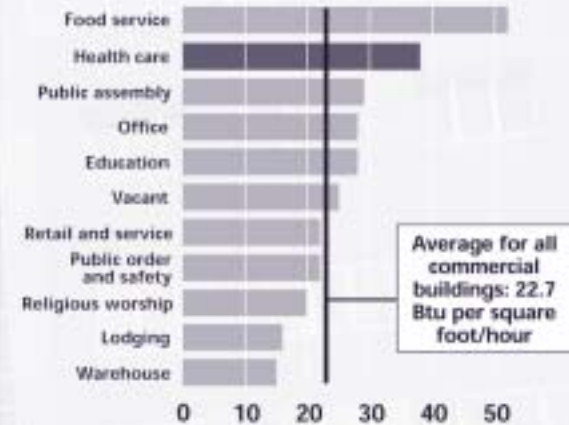
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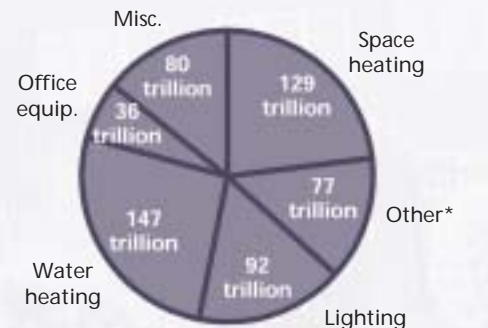
The Albany Medical Center has reaped energy savings for 10 years.

Albany Medical Center PR Staff-NREL/PIX10896

Total Energy Per Square Foot/Hour (Btu)



Site Energy Use in Health Care Buildings (in Btu)



* Other includes cooking (26 trillion), cooling (23 billion), ventilation (17 trillion) and refrigeration (11 trillion).

Source: Energy Information Administration, 1996 Commercial Buildings Energy Consumption Survey

Background photo: Albany Medical Center PR Staff- NREL/PIX10897

Brookhaven Helps Improve Duct Efficiency

DOE's Brookhaven National Laboratory on Long Island, New York, is working on several projects to improve thermal distribution systems in buildings, specifically ductwork design and air leakage testing.

Collaborating with Lawrence Berkeley National Laboratory since 1990, Brookhaven has four main areas of work: developing ASHRAE Standard 152 regarding duct efficiency; improving air leakage testing methods and duct design; disseminating findings to industry and the public; and, through DOE subcontracts, working with industry groups on field tests and technical assistance projects.

- ASHRAE Standard 152, "Method of Test for Determining the Design and Seasonal Efficiencies of Residential Thermal Distribution Systems," is now in public review. Brookhaven participated in the development of the section on forced-air systems and took the lead role for the section on hydronic systems.

- Brookhaven has built a two-level, residential-sized duct system in a high-bay facility at the lab and performed two experimental studies. In one, whose purpose was to improve the accuracy and ease of duct leakage testing, researchers performed more than 100 Delta Q tests, with multiple tests on each of 13 combinations of independently measured added leaks. (The Delta Q test uses blower-door testing at 10 different air pressures to determine air leakage in the system.) In duct leakage experiments, a building envelope is simulated with known and controllable envelope leakage. Some duct leakage test methods, including Delta Q, are influenced by



Brookhaven's Residential Duct Laboratory Program Manager John Andrews stands next to the "register box," which simulates the heating load by bringing in cold air from outside. The supply ducts come in from the top and the return duct leaves to the right. The air handler and most of the supply duct system is out of sight on the upper mezzanine level.

Brookhaven National Laboratory—NREL/P1X10899

envelope leakage as well as duct leakage. The other study investigated how modulated furnace outputs affect heat losses via thermal conduction through the duct walls. While today's energy efficiency trend is to produce fewer Btus at lower airflows, Brookhaven's testing shows that, because air spends more time in the ducts, more heat is lost at these lower airflows. Duct redesign may be necessary to reap true efficiency benefits.

- Brookhaven has written a comprehensive (and down-loadable) manual called "Better Duct Systems for Home Heating and Cooling," which has been excerpted

in ASHRAE's Air Conditioning, Heating, and Refrigeration News. The manual's first chapter discusses the basics and is suitable for consumers. Other chapters include health and safety impacts, comfort, customer benefits, repair and testing. To download the manual, go to www.pubs.bnl.gov/pubs/documents/22291.pdf.

- Finally, Brookhaven researchers work with subcontracted industry groups, including private companies and ASHRAE, to evaluate field tests of innovative designs and to provide technical assistance in developing small commercial duct systems. Brookhaven is compiling an industry manual for designing such systems.

For more information about Brookhaven's work, contact John Andrews, Brookhaven program manager, at jwandrews@bnl.gov or visit www.bnl.gov.

E-News Is on Its Way!

BTS will soon change the way it delivers buildings information to key stakeholders, moving from print to e-mail. The BTS E-News is a free monthly e-mail newsletter which will bring you the latest news, information and special announcements to keep you up to date with the BTS community.

E-News will provide timely energy efficiency information customized to specific audiences, such as industry personnel, researchers and educators. The format will feature articles with links. By clicking on the links, you select those articles that are of interest to you. E-News will also include a link to the BTS Web site.

In addition, E-News is designed for reader feedback. You will be able to e-mail comments and questions to the E-News staff and receive a timely response. BTS wants to use E-News as a means of opening conversations with our stakeholders.

We believe that E-News is a dynamic, cost-effective way to interact with our stakeholders. Through E-News, BTS will continue to address and communicate long-term issues concerning energy efficiency and environmental concerns to industry, schools, homeowners, government, interest groups and the general public.

The last issue of the "Buildings for the 21st Century" newsletter will be published in Spring 2002. You can subscribe to E-News via e-mail. To receive E-News in HTML format, send your request to eNewsHTML@technologistsinc.com. To receive E-News in text format, send a request to eNewsTEXT@technologistsinc.com. No subject or message is needed. You will receive a confirmation message welcoming you to E-News. You will have the opportunity to unsubscribe from E-News at any time.

Lighting Advances Expected to Reap Dramatic Savings



Cree—NREL/P1X10898

Technological advances have begun to establish solid state lighting as a viable source of white light. Such application could dramatically reduce energy consumption for lighting.

A recent BTS-sponsored study on the energy-saving potential of solid state lighting (SSL) indicates an impressive opportunity to conserve electricity in our buildings. According to the report, if the best-case scenario of technology advancement were realized, SSL could reduce energy consump-

tion for lighting by 14 quadrillion British thermal units over the next two decades and avoid more than 225 million metric tons of carbon emissions.

The study, conducted by Arthur D. Little, analyzed the total U.S. lighting market and projected the impact of solid state lighting under a variety of economic scenarios. Ultimately, a balance of price and performance was found to determine the degree to which this technology could penetrate the white light market (e.g., incandescent, fluorescent and high intensity discharge light sources), and thus contribute to energy savings.

Today, SSL is routinely used for monochromatic or colored lighting applications such as exit signs, traffic signals and vehicle brake lights. Recent technological advances, however, have begun to establish solid state lighting as a viable source of white light. BTS' Lighting Research and Development Program is working to accelerate this development and precipitate even more efficient SSL technologies that can be used in residential, commercial and industrial buildings.

Some examples of BTS-sponsored research in SSL technologies include:

- A General Electric and Cambridge Display Technologies project to create a demonstration light panel using organic light emitting diodes (LEDs) that delivers white light with a bright-

ness and quality exceeding a fluorescent source and with an efficiency much greater than an incandescent source;

- A Cree Lighting and Lawrence Berkeley National Laboratory project to develop high-powered white LEDs for general illumination applications that will be capable of replacing less energy efficient incandescent and halogen reflectors; and
- A LumiLeds and Sandia National Laboratories project to improve the efficiency of semiconductor materials, molecular processes and manufacturing techniques for inorganic solid state lighting devices.

The study, Energy Savings Potential of Solid State Lighting in General Lighting Applications, is available at <http://www.eren.doe.gov/buildings/documents>. Please note that a revised version of this report will be available on the BTS Web site in March. To learn more about DOE's Lighting Research & Development programs, visit http://www.eren.doe.gov/buildings/building_equipment/lighting.html. A lighting technology roadmap is available at www.eren.doe.gov/buildings/vision2020/.

Design Guidelines Will Help Create More Efficient, Effective Schools

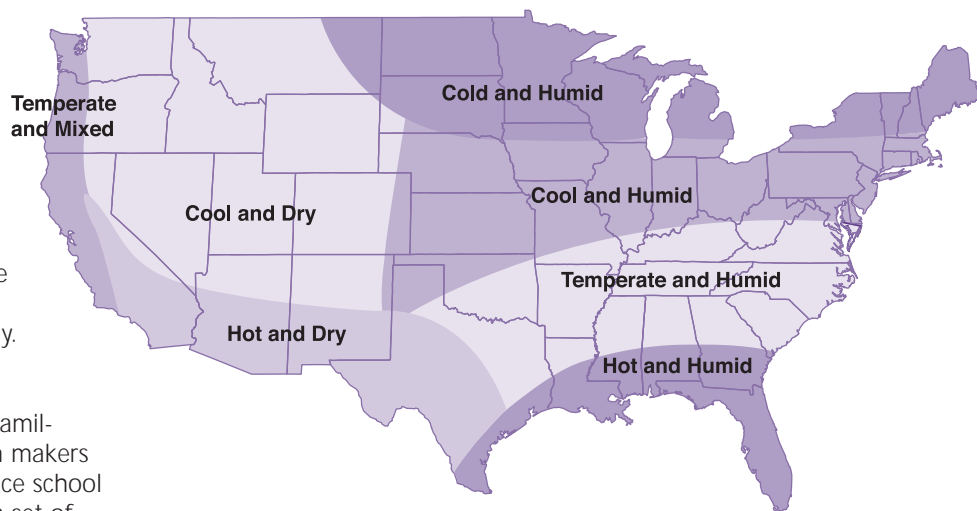
A new series of brochures and documents developed by BTS' EnergySmart Schools will help K-12 school facility managers and planners, administrators and design teams build schools that are energy efficient and use renewable energy.

A set of brochures is already available to familiarize school decision makers with high-performance school design. In addition, a set of seven climate-specific energy design guidelines describes the benefits of high-performance schools. These energy design guidelines provide architects and engineers information about design elements involved in building high-performance schools. As a companion to the energy design guidelines, a national best practices manual will provide additional design details for the seven climate zones.

"The current boom in school construction and renovation presents an enormous opportunity," said BTS Deputy Assistant Secretary Mark Ginsberg. "We can ensure that the next generation of school buildings cost far less to operate and are better places for learning."

To ensure that the documents meet school needs, BTS convened two roundtables and a technical review team that included more than 100 school personnel, design professionals and representatives from a variety of organizations nationwide.

The first documents, Energy-Smart Building Choices, focus on the benefits of school designs that use energy efficiency and renewable energy. Aimed at three audiences, these brochures identify opportunities for school superintendents and board members, business officials and facility managers, and parents



A customized set of energy design guidelines will be available for each of seven climate zones. Guidelines for the hot and dry climate zone are complete.

and teachers to reduce operating costs, improve academic performance, protect the environment and support community values.

The second set of documents, Energy Design Guidelines for High Performance Schools, is intended for both school decision makers and design professionals. The guidelines offer a detailed checklist of key design elements to build efficient schools and to incorporate renewable energy into the design process. A customized design guideline will be produced for each of the seven climate zones, and will be available in print and CD from DOE's Energy Efficiency and Renewable Energy Clearinghouse (EREC), and electronic format from www.energysmartschools.gov. The guidelines for the hot and dry climate zone have been completed; guidelines for the remaining six climate zones are in production and will be available in July.

"We were excited to have Assistant Secretary Garman announce the publication of our guidelines on February 8 at the Council of Educational Facility Planners International (CEFPI) conference in Las

Guidelines

The Energy Design Guidelines for High Performance Schools were developed by the architecture firm Innovative Design and the National Renewable Energy Laboratory. They include the following topics:

- Site design
- Daylighting and windows
- Energy efficient building shell
- Lighting and electrical systems
- Mechanical and ventilation systems
- Renewable energy systems
- Water conservation
- Recycling systems and waste management
- Transportation
- Resource-efficient building products

Vegas," said Products and Services Manager for EnergySmart Schools, Patricia Plympton, National Renewable Energy Laboratory (NREL).

In addition, EnergySmart Schools will produce the National Best Practices Manual for High Performance Schools, which is also in production and will be available in April. Using material developed for the Collaborative for High Performance Schools in California, this document offers more comprehensive recommendations for school design elements that optimize energy efficiency and the use of renewable energy. Developed specifically for design professionals, the National Best Practices Manual will also be available in print and CD from EREC, and electronic format from www.energysmartschools.gov. Under development by the architecture firm Eley Associates and NREL, the manual addresses the technical details of design approaches and technologies.

For more information about EnergySmart Schools publications, visit www.energysmartschools.gov.

ENERGY STAR® — Making a "Change"

Ready to make a "change?" Appealing to individuals, the new public service campaign from the DOE/Environmental Protection Agency ENERGY STAR initiative reminds consumers that small personal changes can add up to huge nationwide benefits. "ENERGY STAR's 'change' campaign simply reminds consumers that our choices have an impact," said Acting DOE ENERGY STAR Program Manager Richard Karney. "Fortunately, consumers have come to recognize that products with the ENERGY STAR label also deliver performance, energy savings and lower utility bills. It's an easy choice to make."

"Change" uses television, radio, print and outdoor messages to remind consumers to "look for the label" when purchasing appliances, lighting, office equipment, home electronics, windows and more. Consumers are apparently listening—although the economy is down, sales of ENERGY STAR-labeled products have remained resilient, even increasing in the third and fourth quarters of 2001.

ENERGY STAR-labeled products are at least 10 percent more energy efficient than conventional products. DOE estimates that in 2001 alone, sales of ENERGY STAR-labeled products and buildings saved Americans more than \$6 billion in energy costs.

ENERGY STAR is central to BTS' efforts to transform the marketplace for efficiency. DOE partnered with the Environmental Protection Agency in 1996 to co-manage ENERGY STAR, bringing expertise in setting efficiency specifications for large appliances, buildings and other products. Private companies such as manufacturers, retailers or utility and state organizations partner with ENERGY STAR voluntarily, building, selling or promoting efficient products or practices. In less than a decade, ENERGY STAR has grown to label more than 11,000 product models in more than 30 product categories, built by more than 1,600 manufacturers. More than 84 utilities, representing nearly half of all U.S. households, have joined ENERGY STAR as partners. ENERGY STAR-labeled products are sold in more than 15,000 retail storefronts nationwide, including Sears, Home Depot, Lowes and Best Buy.



ENERGY STAR®-labeled products are at least 10 percent more energy efficient than conventional products.

"The success of ENERGY STAR really rests with its private partners," said DOE Assistant Secretary for Energy Efficiency and Renewable Energy David K. Garman. "These companies know that American consumers demand the best performance. Through ENERGY STAR, they've figured out how to give consumers energy savings as well."

Typical savings are impressive:

- By changing the five most-used incandescent lightbulbs in the home to ENERGY STAR-labeled compact fluorescent lamps, a typical household can save up to a third of its annual lighting bill.
- Switching from a conventional clothes washer to an ENERGY STAR-labeled washer can save most households more than 10,000 gallons of water each year, and nearly \$100 in energy costs. According to both Consumer Reports and the Good Housekeeping Institute, ENERGY STAR clothes washers also perform better than conventional models.
- Today's ENERGY STAR-labeled refrigerators typically use less than half the energy of a 10-year-old refrigerator—in fact, the largest fully featured fridge on the market today, with all the bells and whistles, uses less energy to operate than a continually lit 75-watt lightbulb.

All this success has drawn interest and praise from the top. "The president has asked us to expand ENERGY STAR to cover even more products and services, giving Americans the power to choose efficiency and environmental protection in every part of our lives," said Secretary of Energy Spencer Abraham.

Visit the ENERGY STAR Web site at www.energystar.gov, or call the hotline at 1-888-STAR-YES.

Health Care Facility Design

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Among many measures taken, Albany Medical Center replaced its existing air cooler and direct expansion air conditioning with distributed chilled water, 150 motors with high-efficiency motors, and 1,000 windows with energy efficient windows. It also installed a comprehensive energy management system, high efficiency lamps and electronic ballasts, and variable-speed drives on air handling and exhaust fans.

The result: annual savings of just over \$1 million and reduced greenhouse gas emissions by 24 million pounds a year.

Other health care institutions are using Leadership in Energy and Environmental Design (LEED) criteria and ENERGY STAR® as benchmarking tools to approach energy efficient design. LEED, a project of the U.S. Green Building Council, is a useful tool for new construction, setting high standards with both energy and environmental considerations. LEED projects must include a sustainable site, water efficiency, high indoor air quality, green materials and resources, and design innovation.

ENERGY STAR is more useful to compare savings in existing buildings. A few hospitals have become certified with the ENERGY STAR label, meaning they have used benchmarking tools to confirm that they are operating at a high level of efficiency. (Visit www.energystar.gov to find a benchmarking tool for health care facilities.)

An outpatient facility for multiply disabled children in Harris, New York, is the first health care facility registered for LEED certification. Projected to open this summer, The Center for Discovery is a 27,000-square-foot diagnostic and treatment facility.

The center's efficiency measures are impressive. The facility will include such features as a high-performance building envelope, high-efficiency mechanical systems, day-lighting, geothermal heating and cooling, and occupancy sensors and photo lighting controls. The Center for Discovery expects to reduce energy use by 40 percent compared to a similar building with conventional technologies. Over 30 years, the savings will translate to more than \$500,000.

Looking further into the future, New York City's Memorial Sloan-Kettering Cancer Center—one of the nation's preeminent cancer research facilities—is also integrating energy and environmental features into its new building. The center is being designed toward LEED certification and is projected to be completed in 2006. Once LEED certified, the center will be eligible for a green building tax credit offered by New York State.

The center is evaluating various solutions to LEED requirements. Among them is the elimination of hydrochlorofluorocarbon (HCFC)-based refrigerants in the heating, ventilation and air conditioning system and in the fire suppression system. Memorial Sloan-Kettering is also considering high-pressure, steam-driven centrifugal refrigeration machines or non-HCFC electric centrifugal machines.

Said Ginsberg, "The benefits of improving air quality and other environmental factors for a population that includes those with compromised immune systems can hardly be overstated."

For more information on Rebuild America, visit www.rebuild.org.



Meetings, Events & Conference Calendar

Date	Meeting, Event, Conference	Contact
March 20-23	Building Energy Conference Medford, MA	www.nesea.org/buildings/be/
March 23-27	4th Annual National Green Building Conference Seattle, WA	www.nahbr.org/gbc2002/
April 15-20	Affordable Comfort 2002 Cincinnati, OH	www.affordablecomfort.org/html/2002.html
May 9-11	2002 AIA National Convention and Expo Charlotte, NC	www.aia.org/
June 2-5	Energy 2002 Palm Springs, CA	www.energy2002.ee.doe.gov/
June 15-20	Solar 2002 Reno, NV	www.solarenergyforum.org/
June 24-27	National Low-Income Energy Conference	www.nliec.org/
June 25-28	PCBC 2002: Home Buildings Premier Trade Show and Conference	www.pcbc.com/

Energy Department Recognizes Facilities' Achievements in Efficiency, Conservation

DOE recently celebrated significant energy and cost savings at federal facilities by recognizing 43 groups and individuals whose impact has been noteworthy. Through efficiency improvements and conservation, winners of the 2001 Federal Energy and Water Management Awards saved the government more than \$33 million in energy costs at federal facilities over the last fiscal year.

The awards support the National Energy Policy, which calls on federal agencies to conserve energy use at facilities. The policy also charges the government to enhance conservation efforts, increase energy supplies, accelerate the protection and improvement of the environment and increase the nation's energy security.

The winners were the United States Air Force, Army, Marine Corps and Navy; the Departments of Energy, Health and Human Services, Interior, State and Transportation; the General Services Administration; and the U. S. Postal Service. Nine Energy Department groups and two individuals were among the recipients.

Winner accomplishments include:

- Installing a 2.8 kilowatt building-integrated photovoltaic roof system;
- Implementing energy savings performance contracts and utility-financed contracts to obtain private-sector funds to cut federal energy costs; and
- Making facility-wide systemic changes by installing energy efficient lighting, energy-saving motors, and energy monitoring and control systems.

Sponsored by DOE's Federal Energy Management Program and presented each year since 1981, the awards recognize efforts which have paid off in real progress toward energy efficiency goals set for the government by the president and Congress. These projects also have reduced greenhouse gas emissions by lowering energy use and utilizing environmentally friendly renewable resources and practices.

Preliminary FY 2000 data indicates that the federal government exceeded energy reduction goals by 3.1 percent. The government spent \$2.4 billion less for building energy in FY 2000 than in FY 1985. DOE building energy consumption was down 40 percent in British thermal units per gross square foot.

Credits

Secretary of Energy

Spencer Abraham

Assistant Secretary, Energy Efficiency and Renewable Energy

David Garman

Deputy Assistant Secretary for the Office of Building Technology, State and Community Programs

Mark Ginsberg

Technical Monitor

Margo Appel

Managing Editor

Shannon Burgert

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If you would like to make suggestions or contribute articles to the newsletter, please address mail to Margo Appel (address below) or e-mail Margo.Appel@ee.doe.gov.

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Office of Building Technology, State and Community Programs
U.S. Department of Energy, EE-40
1000 Independence Avenue, SW
Washington, DC 20585-0121

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U.S. Department of Energy (EE-40)
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