



Buildings for the 21st Century

Fall 2001

News You Can Use



Office of Building Technology, State and Community Programs



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Turning 25, DOE's Weatherization Assistance Program Helps Millions

Celebrating its 25th anniversary, DOE's Weatherization Assistance Program has improved the energy efficiency of nearly 5 million low-income homes, resulting in significant cost savings and health and safety benefits for the occupants.

Weatherization reduces energy costs for low-income families by increasing the energy efficiency of their homes while also ensuring their health and safety. Low-income Americans bear a disproportionate energy burden, spending 14% of their total income on energy, compared with 3.5% for other households.

The program provides energy efficiency services to more than 68,000 homes every year, reducing average annual energy costs by \$300 per household.

DOE uses partnerships between state and local agencies to implement the program. Weatherization programs operate in all 50 states, the District of Columbia and among Native American tribes. More than 970 local agencies deliver weatherization services to eligible residents in every county in the nation.

State and local agencies leverage core DOE funding with other federal, state, utility and private resources to weatherize more low-income homes and to deliver more services while in the homes. The Health and Human Services Low Income Home Energy Assistance Program (LIHEAP) is an important program partner—in 2001, LIHEAP provided nearly \$221 million in funding for weatherization. States use this funding to deliver a range of services, from furnace replacement to standard weatherization measures.

Professionally trained crews use computerized energy audits and advanced diagnostic equipment, such as blower doors, manometers and infrared cameras, to determine the most cost-effective measures appropriate for each home. Typical measures include installing insulation, sealing ducts, tuning and repairing heating and cooling systems, and mitigating air infiltration through windows, doors and other points. Weatherization crews test for health and safety hazards, such as carbon monoxide and gas leaks, and clients are educated on energy-saving tips and maintenance of installed measures.

By reducing energy use in low-income homes, weatherization mitigates air pollution and carbon dioxide emissions.

Low-income families can spend their energy savings on other goods and services, which provides a boost to local markets and spurs community development. The avoided energy costs to all weatherized households totaled nearly \$1 billion last winter. In addition, weatherization creates 52 direct jobs for every million dollars invested in the program.

Finally, weatherization plays an important role in the nation's energy security. In 2000, the program reduced national energy demand by the equivalent of 15 million barrels of oil.

Photos courtesy of the Weatherization Assistance Program Technical Assistance Center.



Weatherization recipients in Mount Vernon, Washington.



Hands-on training in the Boston region.



Client education in New York.



Cutting through siding to prepare holes for sidewall insulation.

Boise, Idaho — Keeping the City in Hot Water



The Idaho State Capitol Building is the only capitol building in the United States heated with geothermal waters.

Credit: Idaho National Engineering and Environmental Laboratory

farms raising tilapia, catfish, alligators and other fauna.

In the 1980s, the three new district heating systems caused production increases of more than 100 percent. Water levels in a local monitoring well declined about 25 feet in just a few years.

New development of the resources was discontinued until the situation could be resolved. Water levels began to stabilize in the downtown area but continued to fall in the region northwest of the management area. Engineers began to look at the used geothermal water that was routinely being discharged into ditches and canals. With funds from DOE, a feasibility study was conducted to see if reinjecting the water back into the formation would recharge the aquifer. In 1999, the City of Boise completed a 3,200-foot-deep injection well. Recent monitoring results show that aquifer levels are rising, and no one has experienced a loss in temperature.

National laboratories such as the Idaho National Engineering and Environmental Laboratory are developing technologies to find new geothermal resources and prudent methods of using them. Energy officials, especially in the western states, are showing increasing interest in this clean energy source that keeps jobs, royalties and tax dollars in their states.

Boise, Idaho, like many western cities, is fortunate to be sitting on a renewable energy resource—the geothermal resource underlying much of the state. The system's popularity, however, challenged its sustainability. Boise city officials and state water and energy professionals found a way to help the system help itself.

Boise has used its geothermal resources since 1892, when the Boise Water Works began distributing hot water to residents. Today the system is one of the city's four geothermal district heating systems, which heat 366 buildings. Other direct uses include 15 greenhouses and nine aquaculture

DOE's Solar Decathlon Competition Underway



Richard King (DOE) presents a certificate to compete in the Solar Decathlon to a team of students and faculty from Virginia Polytechnic and State University, Charlottesville.

Ken Schipp, DOE — NREL/PIX10046

Solar and the American Institute of Architects. The goal is to showcase for the nation technologies that use solar energy to meet a home's daily energy needs.

Each team will design, build and operate an efficient and attractive all-solar house, 500 to 800 square feet, that includes a home-based business and an electric vehicle. Like its athletic counterpart, the Solar Decathlon consists of 10 competitions that test proficiency in a wide range of skills necessary to complete a solar house. Judging includes evaluation of aesthetics, liv-

ability and comfort, and ability to provide refrigeration, hot water, lighting, appliances and transportation for each house. Because the public is invited to tour the homes or to follow the competition on the Internet via each team's Web site, communication activities are rated as part of the contest. Architecture and engineering students will work with students in marketing, communications, graphic arts and computer science on each school team.

Each of 14 student teams will have three weeks next September to assemble a house on the National Mall in Washington, D.C. The houses will be judged on such criteria as aesthetics and comfort, as well as ability to provide refrigeration and hot water. But what will make the houses stand out is their source of power—the sun.

The Solar Decathlon competition is sponsored by DOE, with the National Renewable Energy Laboratory (NREL) and private-sector partners BP

BTS Core Databook Goes Online



After 10 years of publishing the Core Databook, BTS launched the Web-based version of the 2001 BTS Core Databook in July. The resource provides current and comprehensive data on residential and commercial building energy use, building characteristics, environmental impacts and economic and market statistics.

Initially developed for BTS's internal use, the Web-based Databook now makes these useful statistics available to anyone through tables that can be downloaded as .pdf images or as Excel files. Visitors can also register to download the entire 2001 BTS Core Databook or search for data in tables and charts. In addition, visitors can sign up to be notified when new versions of the Databook become available.

To create the Core Databook, BTS compiles, assembles and integrates information on building technologies, characteristics and energy consumption from the Energy Information Administration, the U.S. Bureau of the Census, national laboratories and trade organizations. Pacific Northwest National Laboratory produces the Databook in collaboration with D&R International.

To explore the 2001 BTS Core Databook, check out btscoredatabook.eren.doe.gov/.

In September 2002, the teams will transport their houses to Washington, D.C., where they will assemble the homes on the Mall, compete in the 10 contests and make their houses available to the public. The Solar Decathlon will be on the Mall Sept. 19 to Oct. 10; a final schedule of daily events will be published at a later date.

Scientists and staff from DOE and NREL comprise the panel of experts who develop the competition rules, regulations, monitoring protocols and judging protocols. Each team received a \$5,000 stipend as seed money for its fundraising activities. All other costs are raised by the student teams.

A list of the student teams can be found on the Solar Decathlon Web site. Team Web sites will be available from the site, www.solardecathlon.org, by December.

Rebuild America Partners with Virginia School District

A project to improve lighting efficiency in a Virginia school district has led to a new EnergySmart Schools partnership with Rebuild America. Fairfax County Public Schools found that changing lighting systems not only saved money but significantly improved the classroom environment. "We believe the quality of our buildings affects student performance," said the district's assistant superintendent, Thomas Brady.

The district is the state's largest and the nation's 11th largest.

Under the EnergySmart Schools partnership, energy audits of the district's 235 schools—serving more than 160,000 students—will rank the schools on the basis of their energy efficiency. To help improve schools that rank low, the district will use about \$285 million earmarked for school renovation from a recent bond issue.

Upgrades have already begun at the schools that waste the most energy.

For more information about this project, contact William Mutscheller, assistant director of maintenance services at Fairfax County Public School District, at wmutsche@sideburn.fcps.k12.va.us.

Visit the Rebuild America Web site at www.eren.doe.gov/buildings/rebuild/.

Home Improvement Center Saves Money through Efficient Design

A new home improvement center in Silverthorne, Colo., is setting a good example for its customers. Working with DOE's National Renewable Energy Laboratory, the BigHorn Home Improvement Center created a building that is expected to reduce energy costs by 62 percent compared to similar, conventionally designed retail buildings.

BigHorn designers used a whole building approach to design the building's site, windows, walls, floors and electrical and mechanical systems to work together efficiently. The center includes a hardware store and building materials warehouse space, and it features a 9.0-kilowatt capacity photovoltaic system to provide a portion of the building's electricity.

The home improvement center is one of the nation's first commercial buildings to integrate daylighting and natural ventilation cooling systems into a retail space, and it is the first retail center in Colorado to have a net metering agreement. Electricity produced over the amount used is sold

back to the utility at the same rate that the utility sells electricity for the building.

Silverthorne is a mountain town, making BigHorn's heating components especially important. Radiant floor heating provides warmth by circulating water



The BigHorn Center is designed to use 62 percent less energy than a conventional building.

heated by natural gas through tubes in the concrete floor. Clerestory windows allow passive solar heating, and a transpired solar collector heats ventilation air by trapping the sun's heat in a dark, perforated, metal wall. Insulation is an integral part of the building envelope, minimizing heat loss.

Additional features include overhangs

to shade windows from the high summer sun and compact fluorescent lamps to supplement daylighting.

For more information on how DOE is supporting the development of energy efficient buildings, visit the BTS High Performance Buildings Web site at www.eren.doe.gov/buildings/highperformance/.

Success Story: CFL Technology Procurement Program

Subcompact fluorescent lamps are hitting the private market, thanks to a three-year technology procurement program to increase their use. DOE began the program in 1998 through BTS and the Pacific Northwest National Laboratory.

Working closely with potential high-volume buyers and with manufacturers, DOE developed technical specifications, issued a competitive solicitation to develop products, and selected the best of the subcompact CFLs to offer to buyers.

The sub-CFLs had to pass rigorous performance tests and could then be sold with the ENERGY STAR® label. The products have been sold directly to buyers without DOE's involvement or subsidy.

Now that sub-CFLs are well established in the market, DOE plans to step aside. A private venture, the Northwest Energy Efficiency Alliance, will support retail sales of sub-CFL products, using a special Web site for retailers. The Better Bulbs Direct site, www.betterbulbsdirect.com, helps small- to medium-sized retailers with a streamlined ordering process, tips on merchandising these products, and access to sales training and other support.



By reducing the amount of electricity needed to light a space, using CFLs avoids the pollution that comes from generating that electricity. CFLs use about one-fourth of the electricity and last up to 10 times longer than typical incandescent light bulbs. If every U.S. household replaced just one 60-watt incandescent lamp with a 15-watt CFL, it would be comparable to removing the pollution from one million cars on the road.

Moving on from the success of the sub-CFL program, DOE will now direct its technology procurement efforts to other efficient lighting products, including energy efficient CFL reflector lamps, sub-CFLs that can be dimmed and efficient recessed lighting fixtures.

AIA Picks Top Ten Buildings

The American Institute of Architects (AIA) is shining a spotlight on 10 of the nation's finest examples of high-performance buildings. Three of these buildings—BigHorn Home Improvement Center, Chesapeake Bay Foundation's headquarters and Zion's Visitor Center—achieved this status with the assistance of DOE's High Performance Buildings Laboratory (NREL). The AIA bestowed the awards based on such criteria as site, design process, community connection, high performance, low energy use, water conservation and materials and resources. The awards are intended to promote the best practices of sustainable design.

NREL provided high-performance building research assistance to the BigHorn Home Improvement Center in Silverthorne, Colo., during the design phase, including organization of the building envelope. The lab is currently monitoring the building's energy use. The AIA award highlights BigHorn's integrated daylighting and natural ventilation cooling systems. The building uses the largest building-integrated commercial photovoltaic array in Colorado. (See related article at left.)

The Chesapeake Bay Foundation's Annapolis, Md., headquarters won the award for its integration of whole building design, which minimizes consumption of natural resources and energy, long-term costs and maintenance. NREL reviewed the initial conceptual designs for the building and is monitoring its overall performance. NREL also worked with the National Park Service to create a highly energy efficient design for the award-winning Zion National Park Visitor Center in Utah.

Other buildings receiving the awards were the Denver REI flagship store; Sleeping Lady Conference and Retreat Center in Leavenworth, Wash.; Montgomery Campus, California College of Arts and Crafts in San Francisco; the ABN-AMRO Bank in New York City; Adeline Street Urban Salvage Project in Berkeley, Calif.; Nidus Center for Scientific Enterprise in Creve Coeur, Mo.; and PNC Firstside Center in Pittsburgh.

National Academy: U.S. Investment in Energy Efficiency Research Pays Off

DOE research in energy efficiency has turned \$1.6 billion in federal investment into \$30 billion in economic benefits, according to a report released this summer by the National Research Council (NRC). It corroborates a study conducted in 1996 by the General Accounting Office. In the report, *Energy Research at DOE: Was it Worth It?*, an NRC committee examined the outcomes of research conducted over two decades, evaluating 17 DOE projects in energy efficiency and 22 projects in fossil fuels. To determine the net economic, environmental and national security benefits of these projects, the committee developed a comprehensive framework and applied it to each project.

Of the activities evaluated, three DOE energy efficiency projects that cost a total of \$11 million resulted in the greatest economic benefit. The projects developed more efficient compressors for refrigerators and freezers, energy efficient ballasts for fluorescent lighting and low-e glass for windows. The biggest economic benefit came from avoided energy costs in the building sector. The committee also

pointed out that federal standards and regulations requiring higher efficiencies sped up adoption of the new technologies. The report advocated continued cost-sharing efforts with industry so that research and development are funded for technologies that are likely to succeed in the market.

The committee evaluated each DOE project for its public benefits: economic benefits, measured in dollars and energy saved; environmental gains, measured in tons of pollutants reduced; and national security benefits, measured in the amount of fuel and energy saved. The study also found benefits, although less dramatic, for research programs on fossil fuels.

The NRC, the principal operating agency of the National Academy of Sciences and the National Academy of Engineering, is a private, nonprofit institution that provides science and technology advice under a congressional charter.

The entire report can be viewed at bob.nap.edu/books/0309074487/html.

Balancing the Costs and Benefits of New Efficiency Standards

Efficiency standards for clothes washers, water heaters, air conditioners and heat pumps are working to reduce energy demand and save money for consumers by taking advantage of technological advances. Reduced demand will mean that fewer new power plants will be necessary. DOE reviews standards periodically to ensure that their intended benefits are achieved. Two such reviews have just been completed.

According to Secretary of Energy Spencer Abraham, the focus of the reviews was "to ensure that we promoted energy efficiency in a way that minimized any adverse effects on consumers." The first 60-day review found that two new standards, for clothes washers and water heaters, were accomplishing both goals of reducing demand and saving money.

DOE estimates that nationwide savings from clothes washers built to the new standard equal the output of 12 400-megawatt power plants. In addition, consumers who buy these new washers will save about \$48 per year on their utility bills, and will use about 7,090 fewer gallons of water per washer per year thanks to the new standard. There are top-loading and front-loading washers on the market today that will meet the proposed 2007 standard.

The savings for water heaters equals the output of 13 power plants. Consumers who buy the new, higher-priced water heaters will break even with savings in 7.4 years (electric) and 3.6 years (gas).



Consumers who buy clothes washers built to new standards are expected to save about \$48 on their utility bills and 7,090 gallons of water every year.

D&R Int, LTD—NREL/PX07762

With consumers in mind, a similar review of proposed efficiency standards for residential air conditioners and heat pumps resulted in recommendations for change. However, the reviewers concluded that the higher costs of a 30 percent increase in efficiency would have an undue impact on consumers and manufacturers. DOE is therefore proposing new standards that require a 20 percent increase in the efficiency of residential air conditioners and heat pumps.

The revised proposal is good news to consumers because it reduces the break-even time from more than 11 years under the previous proposal to between 7.5 and 9.8 years. By 2020, energy savings to consumers resulting from the new standards will equal the output of 27 400-megawatt power plants, or enough electricity to light all U.S. homes for more than two years.

Secretary Abraham concluded, "It is a realistic standard that achieves significant energy efficiency gains and protects low-income consumers from unnecessarily high prices."

For more information on standards, visit the BTS Web site at www.eren.doe.gov/buildings/codes_standards/.



Meetings, Events & Conference Calendar

Date	Meeting, Event, Conference	Contact
Nov. 26–29	2001 National Weatherization Training Conference Atlanta, GA	www.eren.doe.gov/buildings/weatherization_assistance/weatherization_conf01.html
Dec. 2–7	Performance of Exterior Envelopes of Whole Buildings VIII Clearwater Beach, FL	www.ornl.gov/buildings/
Dec. 5–8	Creating Environments that Heal: Designing for the Future Nashville, TN	www.healthdesign.org/symposium.html
Feb. 8–11	NAHB 2002 International Builders' Show Atlanta, GA	www.buildersshow.com/
Feb. 20–23	Greenprints 2002: Sustainable Communities by Design Atlanta, GA	www.southface.org/
March 23–27	4th Annual National Green Building Conference Seattle, WA	www.nahbrc.org/gbc2002/

Pacific Northwest Lab a Leader in Building Software

Perhaps there's something in the coffee in the Pacific Northwest, or perhaps it is mere proximity to companies like Microsoft, but it seems the Buildings Program at Pacific Northwest National Laboratory (PNNL) has developed an impressive portfolio of building software.

MECcheck and COMcheck—software developed by the laboratory with BTS in 1994 to help assure buildings comply with energy codes—continues to influence buildings in more and more states. And, building on the MECcheck tradition, PNNL in 1999 released the Whole Building Diagnostician (WBD), a software tool that assists in assuring buildings are operated efficiently and with healthy indoor air quality.

Building energy codes could save millions of dollars and reduce greenhouse gas emissions. Effective implementation of these codes brings more energy efficiency features to homes and commercial buildings. PNNL's MECcheck and COMcheck compliance software helps designers, builders and code officials more easily comply with energy code requirements, and promotes the use of more efficient technologies such as low-e windows, high-density insulation and high-efficiency heating and cooling equipment. As a result, building occupants live and work in energy efficient homes and offices and experience greater access to more comfortable living and working environments. In recognition of this success, PNNL received a federal laboratories consortium "Excellence in Technology Transfer" award in 1997 for MECcheck for transferring an innovative and creative product to the public and private sectors. In addition, MECcheck and COMcheck-EZ received Streamlining Achievement Awards during the National Symposium on Streamlining the Nation's Building Regulatory Process.

WBD aims to reduce operating costs and make buildings healthier. The software monitors air handling units, detects problems with outside air control and tracks overall building energy use. WBD runs on a personal computer attached to the building's HVAC control system. The software automatically detects, diagnoses and recommends solutions to building energy performance problems. Mike Brambley, WBD project manager, estimates that the WBD could save more than 50 percent of the energy used by some air handling units in commercial buildings, as well as improve indoor environmental conditions.

Between 1994 and 2001, the program distributed more than 106,000 copies of the MECcheck and COMcheck compliance software. Best of all, MECcheck and COMcheck are free. To download them, visit www.eren.doe.gov/buildings/codes_standards/buildings/.

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The Buildings for the 21st Century newsletter is published quarterly by the Office of Building Technology, State and Community Programs of the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy.

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Fall 2001

DOE/GO-102001-1468



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