

## ENERGY EFFICIENCY

# Building for the Future

After the Arab oil embargo of 1974 when gas stations had long lines and energy prices climbed, ORNL was asked to serve as the federal government's program manager for energy conservation research. ORNL's residential conservation program, headed by Roger Carlsmith, addressed the problem of reducing home use of oil, gas, and electricity (20% of which was produced by oil-fired plants). Because heating and cooling account for 50 to 70% of the energy used in the average American home, energy use and bills can be reduced significantly by adding insulation to cut unwanted heat flow through walls. ORNL researchers studied ways to improve home insulation and calculated the energy saved by adding insulation to homes and businesses.

The Laboratory became the federal government's prime resource for developing thermal insulation standards, later adopted by the Department of Energy's predecessor, by the Department of Commerce, and by building trade associations. These standards helped reduce U.S. energy use.

ORNL researchers worked on tightening mobile home design. Relying on data from an instrumented mobile home, researchers led by John Moyers and John Wilson proposed tighter insulation and storm window standards to reduce energy use. The standards were adopted by the American National Standards Institute and the Department of Housing and Urban Development, and the manufactured housing industry began producing mobile homes with much greater energy efficiency.

In 1988, as a result of testimony by ORNL researchers at the International Energy Conservation Code hearings in Charleston, South Carolina, ORNL researchers helped place standards concerning below-grade insulation and thermal mass credits into the building code used throughout the nation. The recommended insulation thicknesses (R-values) on most bags of insulation sold today stem from ORNL studies.

In the 1980s ORNL staff drafted and published *The Insulation Fact Sheet*, saving Owens Corning from investing \$2 million in compiling such a needed publication. The document provides consumers with objective recommendations on the use of insula-

tion in residences and is the second most widely used DOE publication.

In 1995 ORNL researchers found the cause of significant heat losses from low-density, loose-fill insulation in attics in cold climates and identified insulation strategies to reduce the losses. Using these findings, the state of Minnesota incorporated insulation standards in its building code.

ORNL researchers Mike Gettings and Terry Sharp developed a computer program that helps low-income homeowners reduce energy use and costs through DOE's Weatherization Assistance Program (WAP). By entering data on a house's walls, doors, attic, insulation, lighting, and heating and cooling systems into a computer with ORNL's National Energy Audit (NEAT) software, a WAP representative can determine if the house needs attic and water-heater insulation, a furnace tuneup, and energy-saving compact fluorescent light bulbs. WAP can install all of these at no cost. Some 800 copies of the computer program have been distributed since 1995, and ORNL training on NEAT use has been provided to representatives of at least 43 states.

Researchers working at DOE's first buildings user facility—the Buildings Technology Center—wrote a series of handbooks for builders on foundation design and moisture control to increase energy efficiency. These were predecessors to handbooks now available through the Energy and Environmental Building Association to guide construction of energy-efficient houses.

ORNL researchers led by Jeff Christian established the whole-wall-rating labeling procedure that has been tested on more than 225 wall systems to determine which hold in heat most effectively. ORNL was the first to use Habitat for Humanity homes as research houses, first for testing walls and then for testing heating, ventilation, and air-conditioning systems. These houses will be used to show that homes with structurally insulated panels, energy-efficient appliances (e.g., the ORNL-developed heat pump water heater), and solar photovoltaic collectors consume no more electricity than they generate, making them zero energy buildings. This work could influence standards for future affordable, energy-efficient houses.



*This Habitat for Humanity house being built near ORNL will produce as much energy as it uses, making it a zero energy building. ORNL was the first organization to use Habitat for Humanity houses to test energy-efficient building concepts.*



Lasers used to make high-temperature superconducting materials

All ORNL reactors shut down in response to DOE's concerns about Lab's reactor safety management

1988

Advanced Toroidal Facility starts up for fusion energy research using a stellarator



Alvin Trivelpiece named director of ORNL, a position he held for 12 years



1989

First draft of "generic environmental impact statement" for NRC to renew nuclear power plant operating licenses