

THE BUILDINGS TECHNOLOGY CENTER (BTC)

America's Premier Buildings Technologies Research Center

The Buildings Technology Center at ORNL is the premier U.S. research facility devoted to the development of technologies that improve the energy efficiency and environmental compatibility of residential and commercial buildings. The Center's mission is to identify, develop, and deploy energy-efficient building system technologies by forming partnerships between DOE and private industry for technology development and analysis, well-characterized laboratory and field experiments, and market outreach. The BTC offers 20,000 square feet of space and state-of-the-art experimental facilities valued at more than \$7 million. A permanent staff of 50, supplemented by ~20 guest researchers, operate the center. Annual program expenditures are about \$27 million.

A National User Facility

The BTC was established by DOE's Office of Building Technology State and Community Programs as a designated "National User Facility." The facilities are available to manufacturers, universities, and other organizations for proprietary and nonproprietary R&D. Access to these unique facilities and capabilities is obtained through user agreements, Work for Others arrangements, and cooperative research and development agreements (CRADAs). Between 1996 and 2001, more than 200 users contributed \$4 million to BTC R&D efforts.

Conservation and Energy Technologies at the BTC

- Combined cooling, heating, and power (CHP) (DOE Office of Power Technology)
- Heating and cooling equipment (vapor compression, absorption, and desiccants)
- Thermal engineering (geothermal heat pumps [GHPs], heat pump water heaters, microturbines, fuel cells)
- Envelope systems and materials (moisture control, roofs, walls, foundations, insulation, and fenestration)
- Building design and performance (Rebuild America, Building America, residential and commercial housing)
- Weatherization assistance to state energy programs (DOE's Office of Building Technology)
- Federal Energy Management Program (FEMP) (CHP and GHP technical assistance)
- Power systems research (dispersed generation and ancillary services)

R&D Capabilities Supporting America's Energy Security

- Efficiency improvement — Technology development for heating, cooling, water heating, and refrigeration equipment; building thermal envelopes; existing building retrofit research; weatherization; CHP; residential and commercial appliances
- Testing — Testing of energy-efficient building materials and roof, wall, and foundation systems; HVAC systems; refrigeration systems; and appliances in the BTC's unique facilities

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Microturbine coupled with HVAC in the CHP Laboratory.

R&D Capabilities *(continued)*

- Modeling — DOE-2, BLAST, EnergyPlus, Power DOE (whole buildings), HEATING (heat transfer), MATCH, MOIST, WUFI ORNL/IBP Moisture-Expert (heat and moisture transfer), Heat Pump Design Model (HPDM), NEAT (building energy audits)
- Analysis — Analyzing advances in HVAC design, optimization, and control; benchmarking thermal performance of components, systems, and whole buildings; residential electric load
- Monitoring performance of buildings and facilities for technology demonstration
- Preparing facility/utility energy plans
- Quantifying energy savings and cost-effectiveness of retrofits
- Developing energy audit and management techniques
- Developing alternative (non-HCFC) refrigerants and blowing agents
- Identifying causes of building moisture problems and developing moisture control solutions
- Electric power systems technology — Transmission, distribution, automation, and control; high-voltage ac and dc equipment; distributed generation and storage
- Energy market assessment



A test attic being loaded into the BTC's large-scale climate simulator.

Further information is available on the center's web site at www.ornl.gov/BTC.

Award-Winning Research

The BTC and its staff have won numerous awards for R&D work. These include

- two R&D 100 awards
- a dozen recent patents in buildings-sector technologies, including patents for the heat pump water heater, the triple-effect absorption chiller, the frostless heat pump, thermochemical heat recovery, and an HCFC/CFC leak detector
- five of the Energy 100 Awards that DOE has presented to the best scientific and technological accomplishments by its laboratories, programs, and field offices since 1977
- second place in the 23 most significant Energy 100 Awards, for BTC work on refrigeration, which has included innovative design changes to supermarket refrigeration systems and home refrigerator/freezer units that have generated significant energy savings (>50%)

Recent Success Stories

The BTC has developed technologies that can lead to 20–50% energy savings:

- the 1-kW/day refrigerator, a 40% improvement in efficiency over commercially available models
- the triple-effect absorption chiller, a 20% efficiency improvement over current double-effect chillers
- whole-wall ratings for >100 residential wall systems
- the National Energy Audit Tool (NEAT), which saves taxpayers >\$70 million/year by identifying effective weatherization measures for low-income housing
- the replacement heat pump water heater, which is 2.6 times more efficient than the best electric water heaters
- Moisture Control Educator for Architects software program
- the Insulation Fact Sheet, the second most widely used DOE publication
- a new National User Facility—the Cooling, Heating, and Power (CHP) Laboratory—sponsored by the DOE office of Power Technology
- deployment of CHP in six federal facilities in California, with third-party financing through FEMP to be completed in the summer of 2001
- performance evaluation of DOE's Weatherization Assistance Program

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