

## Whole-Building and Community Integration Group

The Whole-Building and Community Integration Group (WBCI) supports the U.S. Department of Energy's (DOE's) goals for commercially viable zero-energy homes by 2020 and zero-energy buildings by 2025. WBCI's research focuses on sustainability and whole-building and community integration including international and cross-cutting technology developments to use green buildings and communities as test markets for emerging "deep-savings" technologies in energy efficiency, solar and other renewables, transportation, distributed energy, and grid integration.

### Residential Buildings Systems Renewables/Grid Integration/Materials/Components Advancement

#### Building America

The DOE Building America program focuses on the integration of residential renewable and other on-site power systems. Systems-engineering issues must be resolved before the long-term goal of large numbers of cost-effective, marketable, zero-energy homes can be achieved.

Cost tradeoffs must be evaluated when integrating renewable and other on-site power systems such as solar. Net daily, monthly, and annual energy contributions from such systems must be evaluated as well. Building America also monitors data from the growing numbers of new high-end homes that incorporate solar technologies.

#### Zero Energy Building Research Alliance

The Zero Energy Building Research Alliance, or ZEBRAAlliance, is a new research project/residential energy-efficiency-education campaign. The alliance includes Schaad Companies, the Tennessee Valley Authority (TVA), Oak Ridge National Laboratory (ORNL), and DOE. It will integrate ORNL's energy-efficient technologies into zero-energy home construction. Monitoring these homes will allow the alliance to gauge the affordability and performance of the components and the houses to provide homeowners with information on how to buy the best energy-efficient technologies for their homes.



#### Campbell Creek Research Homes in Tennessee

TVA is sponsoring ORNL in developing a sound database of energy savings for both retrofitting of typical new construction in the Tennessee Valley and for market-driven highly energy efficient homes. The data will help TVA implement various incentive programs to stimulate energy savings in the region within the 5-year strategic planning period. The driver for this research is a trio of houses that irrefutably document energy savings in market-acceptable homes in the region. The three research homes are in the Campbell Creek subdivision in west Knox County.



#### TVA and DOE Team with Habitat for Humanity and ORNL to Design, Build, and Monitor Zero-Energy Homes in Lenoir City, Tennessee



In June 2002 Glen McCullough, TVA Board Chairman at the time, committed to collaborating with DOE to build, design, monitor, and analyze five near-zero-energy research houses. The long-term goal of this unique collaboration between TVA, DOE's Building America program, ORNL, and the Loudon County Habitat for Humanity is to help develop affordable zero-energy houses. At times, these efficient houses using photovoltaic power production feed electricity to the grid when TVA's cost for traditional generation is the highest. This benefits TVA and the homeowner, who is credited a premium rate of \$0.15 per kilowatt-hour for the solar power the house produces.



## Commercial Buildings Systems Renewables/Grid Integration/Materials/Components Advancement

### Ground Source Heat Pumps

TVA is sponsoring ORNL in modeling and estimating how ground source heat pumps affect the energy use at several locations (including schools). This project will collect data on peak demand and energy savings for each location. These results will help TVA implement various incentive programs to stimulate energy/demand savings within the 5-year strategic planning period.

### Solar Technologies

In 2008, the city of Knoxville was selected as one of 12 Solar America Cities by DOE and received a grant plus technical assistance to increase its use of solar technology. ORNL was selected to serve as the Tiger Team lead. The goal of the Knoxville Solar Cities project is to achieve a sustainable solar infrastructure through a comprehensive citywide approach that facilitates mainstream adoption of solar power. Through the Knoxville Energy and Sustainability Initiative, the city has developed a working partnership with several local institutions in an effort to create and implement a comprehensive sustainability plan.



Construction began in 2008 on a 288-foot-long, 51.25-kilowatt solar energy system that will supply power to the office building that houses researchers from ORNL buildings technology programs. The solar energy system, coupled with planned energy-efficiency improvements, should supply nearly all the building's power needs. This building will be ORNL's first zero-energy office building.

### Energy-Efficient Building Equipment for Market Success

The Energy-Efficient Building Equipment program's goal is to meet energy service needs (space conditioning, ventilation, water heating, and indoor environmental quality) with much greater energy efficiency. Buildings consume 71% of the electricity and 53% of the natural gas used in the United States, using more energy and generating more carbon emissions than transportation or industry. For this reason future buildings must reduce energy consumption, facilitate environmental stewardship, and improve indoor environmental quality while being both durable and affordable. Collaborations with DOE sponsors, industry, utilities, and other partners are helping to meet the technical and scientific challenges of this endeavor. Early collaboration with equipment manufacturers, retailers, and consumers is a key element of the program's strategy for successful market penetration and deployment of energy-efficient building equipment.

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