

# Science & Technology HIGHLIGHTS

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## PV Demo Helps Move Solar Roofs into the Mainstream

A field study at the Buildings Technology Center at ORNL will address several issues associated with the integration of photovoltaic (PV) technology into roofs. The field study and distributed energy resources (DER) demonstration is a cooperative effort with the Tennessee Valley Authority, BP Solar, the Federal Energy Management Program, and the ORNL State Partnership Program in conjunction with the State Energy Office of Tennessee.

PV equipment makers want to know how the conversion of sunlight to electricity (instead of heat) and shading of the roof by PV arrays impact a building's cooling load. They also need validated data on how weathering affects the power output of their PV modules. TVA needs experience in integrating PV technology into the building envelope and enabling solar-powered buildings to transmit surplus power to the utility grid.

BTC researchers will develop a rating procedure to compare the energy efficiency of a roof that integrates PV equipment with the efficiency of a conventional insulated roof. Previous roofing research at the BTC has provided 3 years of temperature and heat flow data for just about every material used in low-slope commercial roofing. Those data will be used to quantify and map the shading effect of offset-mounted PV arrays on the R-values of 10 different roofing systems.

Exposure to ultraviolet light yellows solar panels, decreasing their solar reflectance. Reduced reflectance results in higher temperatures, which lower the conversion efficiency of PV semiconductors. The BTC's research will document the performance of BP's solar modules and determine the factors that affect their performance.

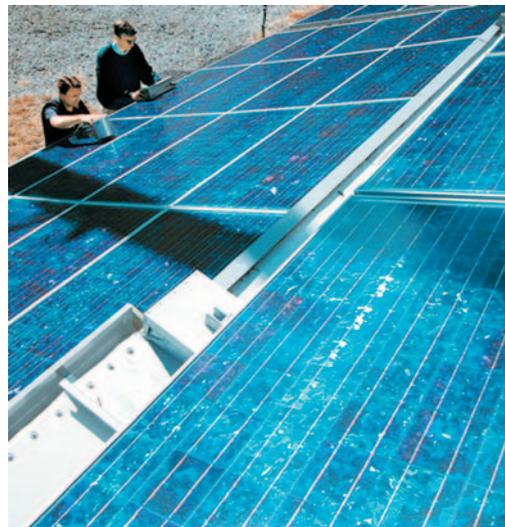
The PV arrays integrated into the building are expected to supply 8.5 kW of energy to the utility grid. The project will evaluate the performance of the PV DER power storage systems employed and provide lessons for TVA and other utilities in deploying and integrating DER technologies.

A particularly valuable aspect of the demonstration is its educational benefit. It will provide TVA, state agencies, the solar industry, and the public with performance

data for building-integrated photovoltaic (BIPV) technology, which can mitigate building electrical loads and make PV more economically attractive. In 10

years, PV has dropped from an installed cost of about \$20/Watt to about \$5/Watt. A cost of \$3/Watt would make PV about even with coal and gas power generation. BIPV may prove to be a good option for supplementing utility resources in warmer climates.

Demonstrations of emerging technologies are a key step toward moving R&D into



*Bill Miller (top) and Jerry Atchley examine solar PV panels under study at the BTC.*

the marketplace. DOE encourages the use of ORNL facilities as test beds for demonstrating advanced energy technologies. The PV-DER study is a good example of such projects, as are the fuel cell monitoring effort at the BTC (p. 9) and an internet monitoring/control system for a geothermal heat pump installation (p. 3). See the box on this page for a list of other demonstration projects under way at ORNL.

For more information about research at the BTC, see [www.ornl.gov/btc](http://www.ornl.gov/btc)

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### Recent Demonstration Projects at ORNL Facilities

- First LED traffic light in the state of Tennessee
- First residential PEM fuel cell operating in the Southeast
- Microturbines supplying power (with waste heat recovery) to several labs
- 200-kW fuel cell supplying power to National Transportation Research Center
- Photovoltaics demonstration at the Buildings Technology Center
- Caterpillar natural gas engine/generator system to demonstrate new technologies for the Advanced Reciprocating Engine System program
- Fleet of 40 E85-fueled vehicles and an 8,000-gallon tank supplied with locally-produced ethanol