

Securing Energy for the Future Through Science and Technology

Science and technology. They are at the heart of everything we do at the National Renewable Energy Laboratory, as we pursue innovative, robust, and sustainable ways to produce energy—and as we seek to understand and illuminate the physics, chemistry, biology, and engineering behind alternative energy technologies.

Although our nation is learning to use energy more wisely—for example, by producing and buying more energy-efficient vehicles and appliances—the demand is still great. Americans consumed 99.7 quadrillion Btu (quads) of energy in 2004; the Energy Information Administration projects that this will increase to 127 quads by 2025.

In his 2006 State of the Union address, President George W. Bush noted the seriousness of the situation and pointed the way to a remedy. The President said, “Keeping America competitive requires affordable energy. And here we have a serious problem: America is addicted to oil, which is often imported from unstable parts of the world. The best way to break this addiction is through technology.”

With our emphasis on research and development in market-relevant, domestic energy technologies, NREL is working toward a long-term solution to this problem. In this issue of the *NREL Research Review*, we present three stories that highlight recent advances and

future directions in areas the President particularly noted in his Address: biofuels and vehicles, energy-efficient buildings, and solar energy.

Biofuels and Vehicles—The alternative fuels industry is helping to reduce our dependence on imports by introducing more domestic ethanol and biodiesel options into the transportation fuels market. This issue describes NREL’s contributions, which include expanding feedstock sources, developing methods for breaking down feedstock for further processing, and making conversion methods for fuels and other products more efficient and cost effective.

The President proposes to “fund additional research in cutting-edge methods of producing ethanol, not just from corn, but from wood chips and stalks, or switchgrass. Our goal is to make this new kind of ethanol practical and competitive within six years.” Through the Advanced Energy Initiative, we will continue working toward this important goal in feedstock development and conversion methods.

Buildings—Our buildings consume nearly 40% of the energy Americans use each year. NREL’s buildings research and development demonstrate that it is possible to design and construct attractive residential and commercial buildings that are much more energy efficient than the current standard practice. Our work also develops good ways to

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integrate renewable energy technologies into these buildings.

The President’s Advanced Energy Initiative will invest

in renewable energy technologies that “change how we power our homes and offices.” In this way, we can continue to assist the U.S. building industry in constructing energy-smart, “high-performing” buildings, like the ones described in this issue.

Solar Energy—As part of NREL’s research and development in photovoltaics, our scientists work closely with other expert groups to investigate and improve the way in which solar cells directly convert sunlight to electricity. The President’s Solar America Initiative will support the development of solar cells that convert the sunlight much more efficiently than they do now.

Work in high-efficiency solar cells is one of many relevant areas of solar research conducted at NREL. In the article in this issue, we discuss the basic rationale of multijunction cells and some innovative twists on their design that can boost efficiencies to higher levels.

From NREL’s inception in 1977 to the present, the science and technology of alternative energy has been the core of our mission. And this will continue in the decades to come. The advances we make in all areas of renewable energy and energy efficiency will play a vital role in assuring the security, strength, and competitiveness of the nation.