Energy Innovation at Brookhaven Lab

Our nation faces grand challenges: finding alternative and cleaner energy sources and improving efficiency to meet our exponentially growing energy needs. Researchers at Brookhaven National Laboratory are poised to meet these challenges with basic and applied research programs aimed at advancing the effective use of renewable energy through improved conversion, transmission, and storage.

Improving the Electric Grid

Carbon-free generation

Carbon-free central generation of electricity, either through fossil fuel combustion with carbon dioxide capture and storage or development of renewable sources such as solar, wind, and/or nuclear power, is key to our future energy portfolio. Brookhaven also provides tools and techniques for studying geological carbon dioxide sequestration and analyzing safety issues for nuclear systems.

Renewables integration

Ongoing Brookhaven research aims to improve the critical properties of superconducting materials, which are key to integrating renewables on the grid. The 32-megawatt Long Island Solar Farm at Brookhaven offers a unique opportunity for our researchers to study utility-scale photovoltaic plant performance and grid integration in the Northeast. A smaller solar research array on the Lab site and a Brookhaven Lab micro-grid test bed are key components of the Northeast Solar Energy Research Center, which will serve as a focal point for research and industrial involvement in tackling systems performance and grid-integration issues.

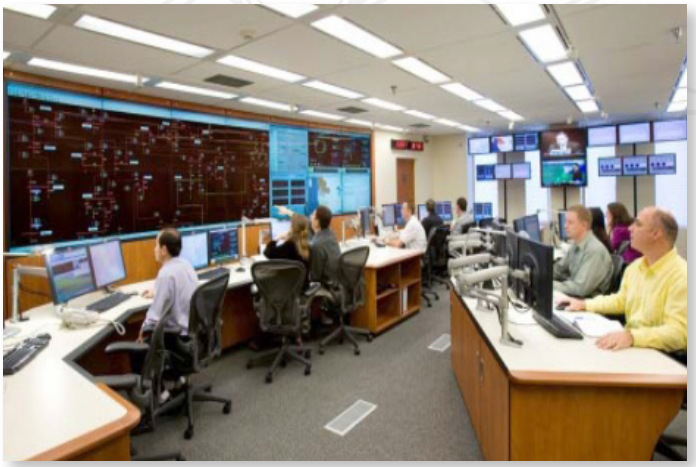
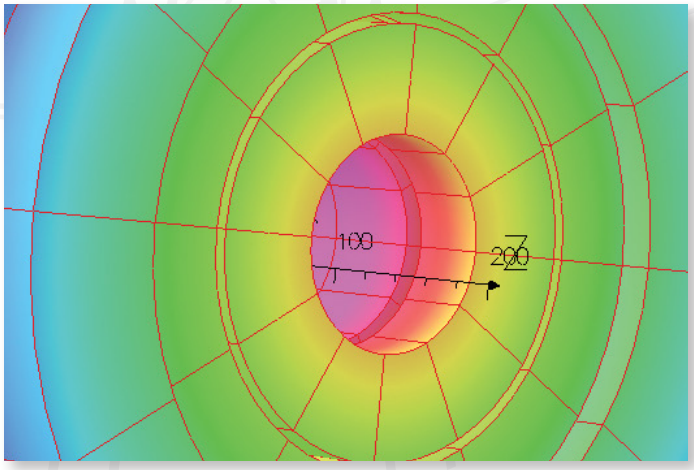


Photo courtesy of Pacific Northwest National Laboratory

Robust distribution systems

Improved distribution efficiency and customer empowerment will be enabled by a next-generation distribution system that incorporates feedback from end-user devices and automatically adjusts accordingly. The Lab is actively working with a New York State utility on a modeling technology that will help identify and reduce losses. Most losses in the transmission and distribution system occur at the distribution end, and much of the hope for grid automation, renewable deployment, storage utilization, and demand response is intimately connected to the distribution system.



Grid-scale storage

Storage at the transmission and particularly at the distribution level will enable more effective management of peak demand, renewable integration, and enhanced reliability. Our research is focused on developing a variety of storage technologies, including advanced battery materials and superconducting magnet energy storage systems. The Lab's connections to the NYBEST Consortium and the New York State Smart Grid Consortium (NYSSCG) provide a solid connection to local and regional utility needs.

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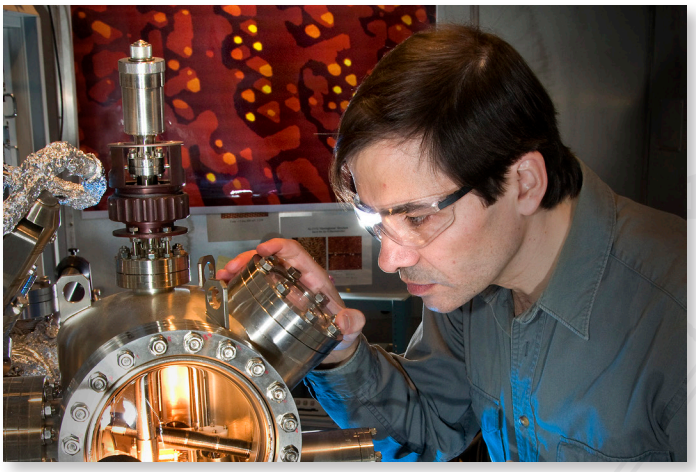
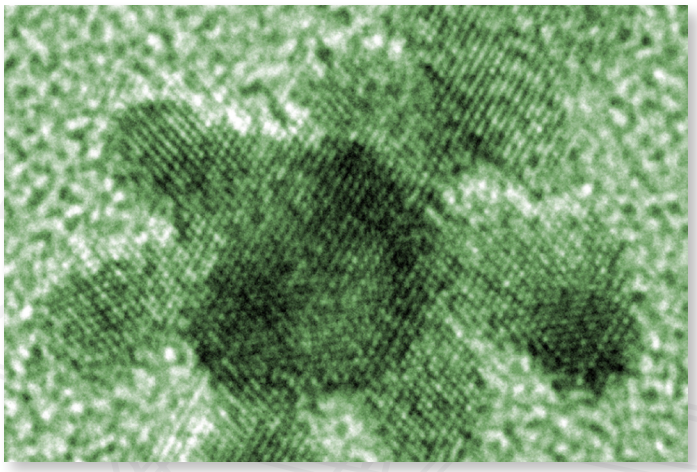
Energy Innovation at Brookhaven Lab

Sustainable Chemical Conversions and Biofuels



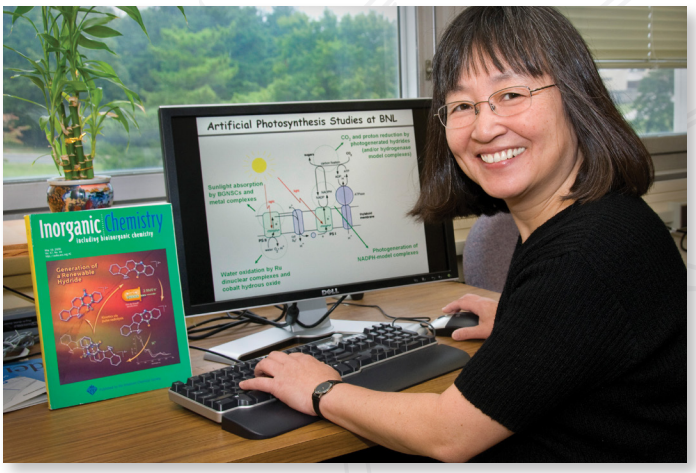
Electro-catalysis in fuel cells

Fuel cells facilitate direct conversion of the chemical energy in fuel to electricity. Catalysts are essential components of fuel cell electrodes that make high-efficiency conversion possible. Brookhaven is developing catalysts that contain much smaller amounts of platinum than typical catalysts, reducing the amount of precious metals needed to manufacture fuel cells for electric cars, significantly lowering production costs.



Improved catalysts

To obtain a fundamental understanding of catalytic processes used to produce and improve clean fuels, novel catalysts are being produced to remove sulfur from oil and prevent acid rain, and to transform pollutants such as carbon monoxide and carbon dioxide into alcohols that can be used as clean fuels.



Solar-to-Fuel Conversion

While solar generation of electricity is important, hydrogen and liquid fuels are essential for long-term storage of energy as a replacement for fossil-based fuels used in transportation and the chemical industry. Brookhaven scientists are working on ways to use the sun to transform water and carbon dioxide into fuels like hydrogen and oxygen, and using a carbon dioxide reduction process to produce important industrial raw materials such as carbon monoxide, methanol, and methane.

Biofuels

Brookhaven biologists are exploring strategies for engineering plants optimally tailored for biofuel production. Researchers also study the applications of biofuels and alternative fuels—how we use them and the limitations of their use, including material compatibility, combustion characteristics, storage stability, and corrosion.

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