

# National Renewable Energy Laboratory

Located in Golden, Colorado, the National Renewable Energy Laboratory (NREL) is the nation's premier laboratory for renewable energy research and development and a leading laboratory for energy efficiency R&D.

Established in 1974, NREL began operating in 1977 as the Solar Energy Research Institute. It was designated a national laboratory of the U.S. Department of Energy (DOE) in September 1991 and its name changed to NREL.

NREL is the principal research laboratory for the DOE Office of Energy Efficiency and Renewable Energy, which provides the majority of its funding. Other funding comes from DOE's Office of Science and Office of Electricity Transmission and Distribution.

NREL's mission is to develop renewable energy and energy efficiency technologies and practices, advance related science and engineering, and transfer knowledge and innovations to address the nation's energy and environmental goals.

NREL's major research facilities include:

- Solar Energy Research Facility — home to the National Center for Photovoltaics and hydrogen and basic science research
- Field Test Laboratory Building — home to the National Bioenergy Center; includes the Thermochemical Users Facility
- Thermal Test Facility — houses buildings and efficiency research; includes the Battery Test Facility
- Alternative Fuels User Facility — includes Biotechnology Pilot Scale Unit
- Solar Furnace
- Solar Radiation Research Laboratory
- Photovoltaics Outdoor Test Facility
- National Wind Technology Center — blade structural test facility, megawatt dynamometer test stand, and full-scale turbine testing sites
- Distributed Energy Test Facility
- Science & Technology Facility

The Laboratory also operates the National Wind Technology Center on 307 acres about 20 miles north of Golden, adjacent to the Department of Energy's Rocky Flats Environmental Test Site.

NREL's renewable energy and energy efficiency research spans fundamental science to technology solutions. Major program areas are:

## **Advanced Vehicle Technologies & Fuels** (hybrid vehicles, fuels utilization)

Working in partnership with public and private organizations, NREL researches, develops, and demonstrates innovative vehicle and fuel technologies that reduce the nation's dependence on imported oil and improves the nation's energy security and air quality. The NREL goal is to help industry introduce advanced, low emission, economically competitive vehicles and fuels into the marketplace. Work in this area supports several NREL Programs and is led by the Center for Transportation Technologies and Systems.

## **Basic Energy Science**

In work funded by the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy, Office of Science, and others, the NREL scientific staff conducts fundamental and theoretical research in advanced materials and processes that:

- Convert the energy in light to electricity,
- Create new chemicals, fuels, and energy efficient consumer products, and
- Remove pollutants from earth, air, and water.

## **Biomass** (biorefineries, biosciences)

Biomass is plant matter such as trees, grasses, agricultural crops, and other biological material. It can be used as a solid fuel, or converted into liquid or gaseous forms, for the production of electric power, heat, chemicals, or fuels. By integrating a variety of biomass conversion processes, all of these products can be made in

one facility, called a biorefinery. NREL is working to develop cost effective, environmentally friendly biomass conversion technologies to reduce the nation's dependence on foreign oil, improve air quality, and support rural economies.

**Building Technologies** (building efficiency, zero energy buildings)

Researchers are helping industry reduce energy use in buildings by conducting research on: residential buildings, commercial buildings, technologies, and analysis & evaluation.

**Computational Sciences**

This includes numerical methods, algorithms, simulations, data analysis, visualization, and “problem solving environments” by combining people, data, and instruments.

**Electric Infrastructure Systems** (distribution & interconnection, thermal systems, superconductivity)

**Energy Analysis**

Energy analysis at NREL is conducted by many major research programs covering a broad range - from life-cycle assessments to vehicle systems to online renewable energy analysis applications. The analyses aim to understand the interaction of policy, technology and their applications, and markets.

**Geothermal Energy**

DOE's Geothermal Energy Program focuses on three areas: energy systems research and testing (working to enhance conversion of geothermal energy into heat and electricity) led by NREL; drilling technologies research (for both hardware and diagnostic tools) led by Sandia National Laboratories; and geoscience and supporting technologies research (exploration and resource management) led by the Idaho National Engineering and Environmental Laboratory.

**Hydrogen & Fuel Cells** (production, storage, infrastructure & end use)

Hydrogen and fuel cell R&D efforts at NREL are focused on hydrogen production and delivery, hydrogen storage, fuel cells,

technology validation, safety, codes and standards, and analysis. These research areas directly support the NREL Hydrogen, Fuel Cells & Infrastructure Technologies Program. The goal of this program is to help industry develop technologies to produce, store, transport, and use hydrogen made from renewable resources in quantities large enough, and at costs low enough, to compete with traditional energy sources such as coal, oil, and natural gas.

**Renewable Resources Maps and Data**

NREL has collected, processed, and mapped data about energy resources in the United States and internationally. To do this, NREL used Geographical Information System (GIS) maps, the Measurement and Instrumentation Data Center (MIDC), the Renewable Resource Data Center (RReDC), and the Solar Radiation Research Laboratory (SRRL). Data about the sun or weather that is often used in climate change studies has come from the SRRL, which is also where all NREL equipment is tested and calibrated. Other data come from the MIDC which constantly records irradiance and meteorological data from all around the country. GIS gives the data a geospatial reference which can help identify optimum locations for energy production sites. A lot of this information is available to the public through the RReDC.

**Solar** (photovoltaics, concentrating solar power and solar thermal)

As part of this Center, NREL's and SNL's scientists and engineers apply world-class R&D laboratories and core competencies to create, develop, and deploy photovoltaic and related technologies. The Center also provides its capabilities to the nation's photovoltaic industry to help maintain and extend its global leadership.

**Wind Energy**

The National Wind Technology Center, located at the foot of the Rocky Mountains near Boulder, Colorado, is a world-class research facility managed by NREL. NWTC researchers work with members of the wind energy industry to advance wind power technologies that lower the cost of wind energy through research and development of state-of-the-art wind turbine design.

