

National Renewable Energy Laboratory: 35 Years of Innovation

Fast Facts

- NREL's main 327-acre campus is in Golden, Colorado.
- The laboratory operates the National Wind Technology Center on 305 acres 13 miles north of Golden.
- NREL's staff of nearly 1,700 full time employees and 800 visiting researchers, student interns, and contractors collectively hail from 66 countries. And, they boast more than 2,600 college degrees.
- Total NREL payroll in 2011 was more than \$144 million; economic impact totaled \$831.3 million in FY 2011.

The National Renewable Energy Laboratory (NREL) is the U.S. Department of Energy's (DOE) primary national laboratory for renewable energy and energy efficiency. NREL's work focuses on advancing renewable energy and energy efficiency technologies from concept to the commercial marketplace through industry partnerships.

The Alliance for Sustainable Energy, LLC, a partnership between Battelle and MRIGlobal, manages NREL for DOE's Office of Energy Efficiency and Renewable Energy.

History

This year, NREL celebrates 35 years of energy efficiency and renewable energy research and development. NREL began operating as the Solar Energy Research Institute (SERI) on July 5, 1977. SERI was dedicated to harnessing power from the sun and quickly caught national attention. In 1978, President Jimmy Carter was the first U.S. president to visit the lab; fast forward to 1991, and another U.S. president, George H. W. Bush,

elevated SERI to a national laboratory and changed the name to the National Renewable Energy Laboratory. NREL became the only national laboratory to focus solely on clean and renewable energy technologies.

Making a Difference

NREL's discoveries in renewable energy have shaped our transportation alternatives and provided options to power our homes and businesses. For example, the cost of wind energy has declined from 40 cents per kilowatt-hour when the lab was founded, to 6–9 cents today. These lower costs have helped wind energy become the fastest growing source of new electricity in the nation. The cost of electricity from photovoltaic (PV) panels, which convert sunlight directly into electricity, has dropped from several dollars per kilowatt-hour to 18–23 cents a kilowatt-hour. The projected cost of ethanol made from biomass has plummeted from almost \$6 per gallon to about \$2, helping spur the construction of the first cellulosic ethanol plants in the United States.





Capabilities

NREL's renewable energy and energy efficiency research spans fundamental science to technology solutions.

Renewable Fuels

- Biomass
- Hydrogen and Fuel Cells
- Vehicle Technologies (advanced vehicles, fuel quality and testing)

Renewable Electricity

- Solar (PV, concentrating solar power and solar thermal)
- Wind and Water
- Geothermal
- Electric Systems (smart grid technologies and standards, transmission and distribution systems integration, energy storage)
- Building Technologies (building efficiency, building-integrated PV)

Energy Science

- Chemical and Biosciences
- Scientific Computing
- Materials Science

Strategic Energy Analysis

- Technology
- Economic, Environmental and Security
- Markets
- Policy, Government and Programs

Science & Technology

NREL's research not only improves today's renewable energy and energy efficiency technologies, it develops tomorrow's innovations to meet the nation's energy goals and change the way we power our homes, businesses and transportation.

The laboratory's science and technology teams work in the full range of research and development (R&D), from basic science to applied research, engineering to testing, and scale-up to demonstration. NREL is developing nanoscale materials to convert the sun's energy into electricity, improving understanding of wind aerodynamics, and diving into the cellular structure of plants to make cost-competitive renewable biofuels. NREL also boasts strong R&D efforts in materials for renewable buildings, transportation, electric infrastructure systems, and hydrogen, ocean, and geothermal energy.

NREL's research facilities provide unique partnering capabilities. The Integrated Biorefinery Research Facility, the Process Development and Integration Laboratory and facilities at the National Wind Technology Center allow R&D partners in biofuels, solar energy and wind energy to collaborate, explore and innovate using state-of-the-art facilities. At the Energy Systems Integration Facility, currently under construction, NREL and its partners will explore the impacts of large-scale renewable energy and energy efficiency deployment on the nation's energy delivery system.

In 2011, NREL earned its 50th R&D 100 award to add to the scores of other honors from the science and technology community. In FY 2011, NREL had its highest recorded number of published peer reviewed journal articles for a single fiscal year. In subject areas identified by Thomson Reuters' InCites, eight categories show NREL's citation impact exceeds that of similar institutions in both the United States and the world.

Energy Analysis

Understanding the interactions and roles of energy technologies, policies, markets, resources, environmental impacts and infrastructure is critical to the nation's energy future. NREL analysts use their knowledge and expertise to integrate and draw insights from complex sets of data across several renewable energy and energy efficiency technologies. They explore policy and technology options to evaluate their implications for carbon reduction, job creation and energy security.

NREL is a leader in renewable energy technology, market, sustainability, policy, and systems analysis. Market analyses provide information that makes it easier to understand the uses of clean energy technologies in electricity and fuels markets. Sustainability analyses look at environmental, life-cycle, climate and other impacts of clean technologies. Analyses inform

"By providing impartial energy analysis, NREL puts massive amounts of information within an understandable framework. The lab uses analysis ubiquitously throughout its programs. We believe it will help accelerate the advancement of renewable energy and energy efficiency technologies."

— BOBI GARRETT, NREL SENIOR VICE PRESIDENT OF OUTREACH, PLANNING, AND ANALYSIS



policy design and investment decisions related to renewable energy technologies at the state, national and global levels.

Systems analyses examine the potential time frames, costs, benefits, and risks of renewable technologies when applied with other technologies. A slate of NREL-developed energy analysis models and tools help inform energy decisions across all renewable energy and efficiency technologies.

Commercialization & Deployment

Ongoing research at NREL provides Americans with key options for solving our energy problems. NREL focuses on increasing the speed of moving new energy technologies into the marketplace and expanding the scale at which they are used.

NREL's commercialization and deployment activities aim to accelerate new technology commercialization and remove barriers to market adoption of existing clean energy solutions. To this end, NREL has streamlined the way we do business and enhanced the entrepreneurial environment, providing greater access to capital and engaging strategically with industry and stakeholders.

Partnerships are at the core of NREL's strategy. We collaborate with industry; academia; non-profit organizations; federal agencies; state, local, and tribal governments; and international institutions to commercialize and deploy renewable energy and energy efficiency technologies. The laboratory engages with the private sector through a variety of research contracting mechanisms, as well as through licensing new technologies. Overall, federal investment in these partnerships has leveraged private funds by a factor of eight. NREL links entrepreneurs with investors, helps small businesses and supports the emerging clean energy business sector through its enterprise development program and annual Industry Growth Forum.

NREL advances integrated, sustainable energy solutions to meet local and regional energy needs by looking at the entire renewable and energy efficiency portfolio, tailoring cost-effective solutions based on locally available resources. NREL's deployment program supports DOE's strategy to accelerate market adoption of alternative energy solutions. Our comprehensive approach helps transform the way we use energy in local communities by identifying opportunities, building partnerships, and creating a foundation for technology implementation. We offer technical assistance, with staff helping communities assess renewable options and providing training to help build a skilled workforce.

"By guiding clean energy from the laboratory to the marketplace, NREL is able to link its investments in scientific research to marketable technologies that strengthen America's economic vitality and energy security."

— BILL FARRIS, VICE PRESIDENT
FOR COMMERCIALIZATION AND
TECHNOLOGY TRANSFER

Partnerships

As of January 2012, NREL had agreements in place with 448 industry partners, 65 educational partners, 28 not-for-profit organizations, and 15 government entities.

NREL has active partnerships in 46 states, two U.S. territories and eight foreign countries.

Subcontracts

710 total active contracts currently valued at \$647.3 million.*

NREL has more cooperative research and development agreement (CRADA) activity than any other DOE laboratory. In fact, with 186 active CRADAs—including 36 new in FY 2011—NREL is responsible for one-quarter of all CRADAs in the DOE system. In addition, 132 records of invention were awarded, 71 patents were filed, 15 patents were issued and 22 royalty-bearing license agreements and 204 non-disclosure agreements were signed in FY 2011.

(*As of January 2012, this is the NREL contract amount; funds expected to be spent over period of performance.)





Laboratory of the Future

NREL is building a state-of-the-art "Laboratory of the Future" with sustainable research buildings to foster innovation.

The 360,000 square-foot Research Support Facility (RSF) is a model for sustainable, high-performance building designs. The RSF is expected to achieve an aggressive energy efficiency goal of 34.4 kBtu/sq. ft./yr, including the high-performance data center, and has received a LEED (Leadership in Energy and Environmental Design) Platinum designation. Expansion of the Integrated Biorefinery Research Facility (IBRF) was completed in 2011, and received a LEED Gold designation. The IBRF increases NREL's capabilities to develop new biofuel technologies and allows the laboratory to work simultaneously on multiple research projects with multiple research partners.

Construction is underway for the 182,500 sq. ft. Energy Systems Integration Facility (ESIF). ESIF will house research to overcome challenges related to the interconnection of distributed energy systems and the integration of renewable energy technologies into the electrical grid. ESIF also will include a state-of-the-art, high-performance computing and data center that will expand NREL's capabilities in modeling and simulation of renewable energy technologies. The ESIF data center is designed to be one of the most energy efficient in the world.

NREL's goal is to maximize the use of on-site renewable energy and to purchase Renewable Energy Credits to offset indirect greenhouse gas emissions. In 2011, NREL achieved "carbon neutrality" for the second consecutive year. Also in 2011, NREL was recognized with three prestigious national awards for its sustainability efforts including the White House GreenGov Presidential Award for the RSF Data Center.

The Laboratory of the Future is just one more asset in NREL's portfolio that will ensure the laboratory's leadership in addressing the nation's energy challenges.

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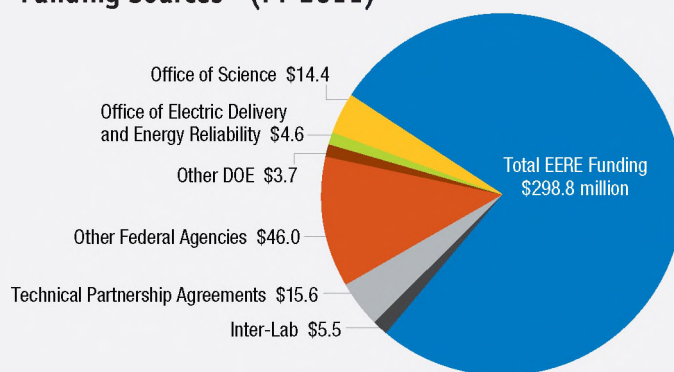
NREL Funding

Nearly 80 percent of NREL's funding is through DOE's Office of Energy Efficiency and Renewable Energy.

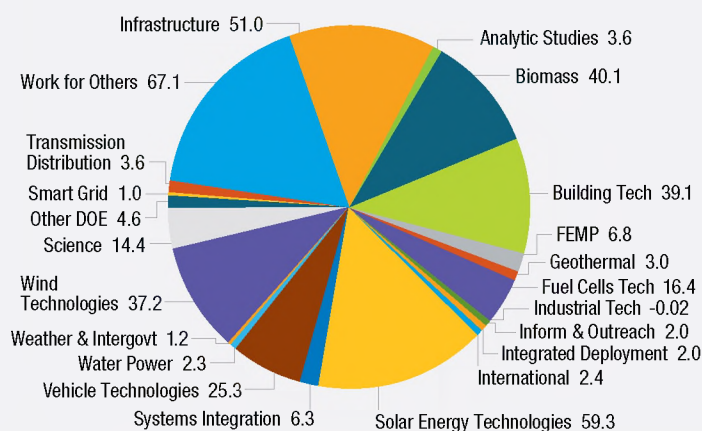
Funding All Sources* (FY 2007–FY 2011)

	FY 07	FY 08	FY 09	FY 10	FY 11
Operating	260.5	241	339.4	460.2	327.9
Capital Construction	116.9	87.3	185.7	76.3	60.7
Total	377.4	328.3	525.1	536.5	388.6

Funding Sources* (FY 2011)



NREL Portfolio* (FY 2011) \$388.6 Million



*Note: Millions of dollars.



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NREL is a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, operated by the Alliance for Sustainable Energy, LLC.
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