NREL
NATIONAL RENEWABLE ENERGY LABORATORY

NREL Photovoltaic Research—Extensive Capabilities and Experience Under One Roof

NREL's high-impact photovoltaic successes in fundamental research, advanced materials and devices, and technology development contribute to:

- Boosting solar cell conversion efficiencies
- Lowering the cost of solar cells, modules, and systems
- Improving the reliability of photovoltaic (PV) components and systems.

Reaching the SunShot Target and More

Our scientists pursue critical activities to accomplish the goal of the U.S. Department of Energy SunShot Initiative—to make large-scale solar energy systems at low grid penetrations cost-competitive with other energy sources by 2020.

We conduct our research in collaboration with universities and the solar industry through research partnerships as well as through direct support of PV R&D performed at NREL.

Our R&D emphasizes innovation in various PV technologies. But our technical expertise transfers to other technology areas and across a range of applications. These include fuel cells, hydrogen storage, photoelectrochemistry, windows, batteries, thermoelectrics, and optoelectronics/lighting.

Our Research Areas

Measurements and Characterization

- Cell and module performance
- Analytical microscopy and imaging science
- Interfacial and surface science
- Electro-optical characterization

NREL researcher positions a 4-junction inverted metamorphic solar cell on a THIPSS flash simulator for measurement under concentrated light. *Photo by Dennis Schroeder, NREL 32509*

Chemistry and Physics of Materials and Devices

- High-efficiency crystalline PV (silicon, III-V multijunctions, low-concentration III-V cells, hybrid tandems)
- Thin films (CdTe, CIGS)
- Emerging materials and devices (perovskites, organic PV, quantum dots, carbon nanotubes, 2-D materials)

Synthesis and Processing of Materials

- III-V and silicon deposition
- Nanomaterial synthesis
- Thin-film deposition/processing
- Catalysts, fuel cells, and batteries

Materials by Design

- Materials discovery
- Integrated theory, experiment, and characterization in the Center for Next Generation of Materials by Design

**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.**

Reliability

- Laboratory testing
- Field testing
- Engineering
- Regional test centers

Techno-Economic Analysis

- Technology analysis
- Market analysis
- Collaboration with NREL's Strategic Energy Analysis Center

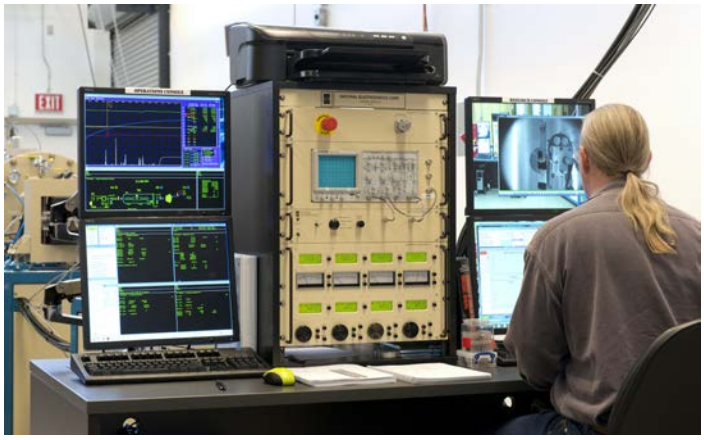
Modeling and Theory

- Device modeling
- Process modeling
- High-performance-computing theoretical studies

Manufacturing Prototyping

- Roll-to-roll manufacturing (PV, batteries, fuel cells)
- NREL's Process Development Integration Laboratory
- Energy Systems Integration Facility.

A variety of PV panels and systems are monitored under real-world conditions at NREL's Outdoor Test Facility. *Photo by Dennis Schroeder, NREL 18921*



NREL scientists works on a Rutherford backscattering spectrometer in the Process Development Integration Laboratory. *Photo by Dennis Schroeder, NREL 22208*

Our R&D Approach

Our robust research program includes a portfolio of projects with near- to long-term time horizons that help to:

- Develop high-pay-off technology too high risk for industry, but too complex for universities
- Understand the "why" behind what works and what doesn't
- Provide unbiased quantification of metrics to track industry progress
- Perform R&D and develop standards to improve confidence in PV performance, reliability, and safety
- Support the success of U.S. companies through cooperative and enabling R&D.

Contact Us

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