

NREL's mission is to advance the science and engineering of energy efficiency, sustainable transportation, and renewable power technologies and to provide the knowledge to integrate and optimize energy systems. NREL is the only federal laboratory dedicated to the research, development, commercialization, and deployment of renewable energy and energy efficiency technologies.

NREL plays key roles in a variety of projects for the U.S. Department of Energy's Advanced Research Projects Agency-Energy (ARPA-E). NREL leads five current ARPA-E projects, covering four ARPA-E program areas. NREL is also a partner for seven current ARPA-E projects, as well as five additional programs that are starting in Fiscal Year 2017.

[www.nrel.gov](http://www.nrel.gov)

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.

## NREL-LED PROJECTS AT ARPA-E

### BOOTH **Ultrahigh Efficiency Photovoltaics at Ultralow Costs**

642

PARTNERS: MICROLINK DEVICES, INC.; COLORADO SCHOOL OF MINES

This project will produce solar cell devices that outperform other photovoltaic (PV) technologies in efficiency and energy yield at thin-film costs through the use of hydride vapor phase epitaxy (HVPE) and effective substrate reuse.

### BOOTH **High-Temperature, High-Efficiency Solar Thermoelectric Generators (STEG)**

719

PARTNERS: COLORADO SCHOOL OF MINES (CO-LEAD); ADVANCED COOLING TECHNOLOGIES, INC.; MARLO INDUSTRIES; INFINIA TECHNOLOGY CORPORATION

The goal of this project is to demonstrate the viability of new modular solar to dispatchable electricity conversion using latent heat storage and high-T thermoelectric generators/Stirling Engine for direct conversion. Overall, the program consists of novel system integration, building off of the platform initially developed in an ARPA-E seedling project. Key aspects are the development of a set of novel technologies to enable new modular power systems.

### BOOTH **Real-Time Optimization and Control of Next-Generation Distribution Infrastructure**

936

PARTNERS: CALIFORNIA INSTITUTE OF TECHNOLOGY, UNIVERSITY OF MINNESOTA, HARVARD UNIVERSITY, AND SOUTHERN CALIFORNIA EDISON

The objective of the project is to develop, validate, and implement an innovative, real-time optimization and control architecture that enables an unprecedented flexibility, reliability, and efficiency of distribution-system operations. The proposed algorithmic framework for distributed energy resources enables distribution networks to emulate virtual power plants that effectively provide regulation services to the bulk system, while acknowledging socioeconomic objectives of utilities and customers.

### BOOTH **Smart-DS: Synthetic Models for Advanced, Realistic Testing: Distribution Systems and Scenarios**

942

PARTNERS: MASSACHUSETTS INSTITUTE OF TECHNOLOGY, ITT-COMILLAS UNIVERSITY (SPAIN), GENERAL ELECTRIC GRID SERVICES

The Smart-DS project is building the next generation of power system test cases for distribution network planning and operations, as well as scenarios for transmission-level test cases. These test cases will be critical toward designing, validating, and evaluating next-generation power system algorithms.

### BOOTH **The Connected Traveler: A Framework to Reduce Energy Use in Transportation**

1232

PARTNERS: METROPIA, UNIVERSITY OF CALIFORNIA – DAVIS, UNIVERSITY OF WASHINGTON, UNIVERSITY OF KANSAS, TEXAS A&M

TRANSNET (alternatively known as The Connected Traveler) is a framework designed to improve transportation network efficiency and reduce energy use by incentivizing behavioral shifts in travel time or mode choices through an interactive mobility app. The development of strategies for implementation and to quantify outcomes is a cooperative effort between NREL, Metropia (the app developer), and university research partners.

## PROJECTS WITH NREL AS A PARTNER:

**BOOTH** **124** **Aerogel Insulated Pane as a Replacement for Panes in Single-Pane Windows**

LEAD: ASPEN AEROGELS, INC.

NREL is conducting weatherization and durability testing and analysis.

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**BOOTH** **715** **Dual-Junction Solar Cells for High Efficiency at Elevated Temperature**

LEAD: YALE UNIVERSITY

NREL is designing and fabricating AlGaInP/GaAs solar cells to operate at 400°C and high concentration, for inclusion into a hybrid CPV-CSP system.

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**BOOTH** **720** **Micro-Optical Tandem Luminescent Solar Concentrator**

LEAD: CALIFORNIA INSTITUTE OF TECHNOLOGY

NREL is developing the two solar cells needed for a luminescent solar concentrator—the GaInP cell coupled to the luminescent waveguide and the Si bottom cell. NREL is also testing assembled modules for performance and reliability.

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**BOOTH** **832** **50-MW Segmented Ultralight Morphing Rotors for Wind Energy**

LEAD: UNIVERSITY OF VIRGINIA

NREL's role is two-fold: 1) Acquire scaled demonstration blades of the Segmented Ultralight Morphing Rotors (SUMR) and conduct proof-of-concept testing at the National Wind Technology Center; 2) develop cost models for the full-scale 13-MW and 50-MW SUMR concept.

**BOOTH** **917** **Optimal Operation and Management of Batteries Based on Real-Time Predictive Modeling and Adaptive Battery Management Techniques**

LEAD: UNIVERSITY OF WASHINGTON

NREL is helping implement the models onto hardware and validating algorithms.

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**BOOTH** **939** **Enabling the Grid of the Future**

LEAD: UNIVERSITY OF MINNESOTA

NREL is helping develop a robust control framework and hardware demonstration platform. NREL is also leading the large-scale validation of the project's technology solution.

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**BOOTH** **1018** **Robust Cell-Level Modeling and Control of Large Battery Packs**

LEAD: UTAH STATE UNIVERSITY

NREL co-developed the cell-level controls and performed 20 months of aging tests on the battery packs. NREL's Battery Lifetime Analysis and Simulation Tool (BLAST) software is being used to predict vehicle battery life.