United states energy storage research and development

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The energy system of the future must successfully utilize large amounts of variable and intermittent renewable energy sources to meet demand for power generation, decarbonization, grid resilience, and energy efficiency.

This integrated approach to energy storage signifies a movement to identify synergies within diverse conversion and storage solutions. A new seminar series hosted by NREL is advancing discussion between government, industry, and academia about how hybrid systems and collaborative research will achieve clean energy goals.

As a result of NREL"s groundbreaking energy storage research, R& D World magazine recognized the Wave Energy Converter Simulator (WEC-Sim) as one of the 100 most innovative technologies of the past year with an R& D 100 Award. WEC-Sim is the first open-source code allowing wave energy developers to simulate WEC dynamics and performance--dramatically reducing the uncertainty around how WECs will perform in real-world marine environments--which lowers costs and reduces R& D cycle time in this pivotal and growing field.

The 2021 U.S. Geothermal Power Production and District Heating Market Report developed at NREL showcases the current state of geothermal energy use in the United States and identifies geothermal opportunities for a renewable, decarbonized energy system. Innovative approaches to geothermal district heating involve integrating heat pump technology and thermal energy storage, as well as implementation and optimization of energy districts. This report will be valuable for policymakers, regulators, developers, researchers, engineers, financiers, and other decision makers.

Particle thermal energy storage systems can be constructed with existing infrastructure from retired coal and gas power plants.Image by Jeffrey Gifford and Patrick Davenport, NREL

About 2,500 dams across the United States produce electricity. Pictured here is Gross Reservoir Dam in Colorado. Photo courtesy of Brent Olson, U.S. Department of Energy

Energy storage scientists at NREL are turning to cutting-edge machine-learning techniques to strengthen their understanding of advanced battery materials, chemistries, and cell designs. These complex computer algorithms help accelerate the characterization of battery performance, lifetime, and safety by offering insights into potential patterns within data sets. Researchers are using machine learning and artificial intelligence to evaluate manufacturing quality, lifetime and performance, materials research, and safety protocols for energy storage applications.

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