Advanced Research Projects Agency • ENERGY

HEATS PROJECT

PACIFIC NORTHWEST NATIONAL LAB

METAL HYDRIDE THERMAL STORAGE

PROJECT TITLE:	Reversible Metal Hydride Thermal Storage for High-Temperature Power Generation Systems		
ORGANIZATION:	Pacific Northwest National Laboratory (PNNL)	LOCATION:	Richland, WA
PROGRAM:	HEATS	ARPA-E AWARD:	$712,511
TECH TOPIC:	Concentrated Solar & Nuclear Power	PROJECT TERM:	12/5/11 – 12/4/13
WEBSITE:	www.pnnl.gov		

CRITICAL NEED

There is a critical need to find efficient, cost-effective thermal energy storage solutions to maximize the use of domestic solar and nuclear energy resources. Most utility-scale solar power plants only run at about 25% of their capacity because they can't generate power at night—thermal energy storage makes it possible to increase this capacity to up to 60-75%. Similarly, nuclear power plants produce a constant output of power—thermal energy storage could help increase this output during times of critical peak demand.

PROJECT INNOVATION + ADVANTAGES

PNNL is developing a thermal energy storage system based on a Reversible Metal Hydride Thermochemical (RMHT) system, which uses metal hydride as a heat storage material. Heat storage materials are critical to the energy storage process. In solar thermal storage systems, heat can be stored in these materials during the day and released at night—when the sun is not out—to drive a turbine and produce electricity. In nuclear storage systems, heat can be stored in these materials at night and released to produce electricity during daytime peak-demand hours. PNNL's metal hydride material can reversibly store heat as hydrogen cycles in and out of the material. In a RHMT system, metal hydrides remain stable in high temperatures (600- 800°C). A high-temperature tank in PNNL's storage system releases heat as hydrogen is absorbed, and a low-temperature tank stores the heat until it is needed. The low-cost material and simplicity of PNNL's thermal energy storage system is expected to keep costs down. The system has the potential to significantly increase energy density.

IMPACT

If successful, PNNL would create a low-cost thermal energy storage system that can store 10 times more energy than current state-of-the-art thermal energy storage systems.

- SECURITY: Cost-effective thermal energy storage would enable increased use of domestic energy resources like solar and nuclear —strengthening the nation's energy security.
- ENVIRONMENT: Cost-effective thermal energy power generation could help decrease fossil-fuel-based electricity use and harmful emissions from coal-burning power plants.
- ECONOMY: Thermal energy storage systems could make it less expensive to generate power from nuclear and renewable solar energy, which in turn could help stabilize electricity rates for consumers.
- JOBS: Widespread use of advanced energy storage technologies could create jobs in engineering, manufacturing, and construction to support the development of utility-scale solar and next-generation nuclear energy plants.

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