Advanced Research Projects Agency • ENERGY

HEATS PROJECT

UNIVERSITY OF SOUTH FLORIDA

EFFICIENT PHASE-CHANGE MATERIALS

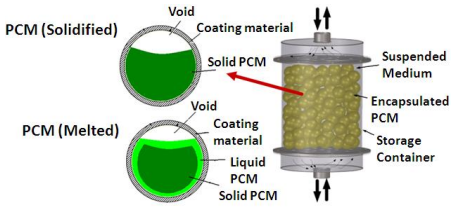
PROJECT TITLE:	Development of a Low-Cost Thermal Energy Storage System Using Phase-Change Materials with Enhanced Radiation Heat Transfer		
ORGANIZATION:	University of South Florida (USF)	LOCATION:	Tampa, FL
PROGRAM:	HEATS	ARPA-E AWARD:	$2,439,450
TECH TOPIC:	Concentrated Solar & Nuclear Power	PROJECT TERM:	12/5/11 – 12/4/14
WEBSITE:	www.arpa-e.energy.gov/ProgramsProjects/HEATS.aspx		

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

USF is developing low-cost, high-temperature phase-change materials (PCMs) for use in thermal energy storage systems. 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. Most PCMs do not conduct heat very well. Using an innovative, electroless encapsulation technique, USF is enhancing the heat transfer capability of its PCMs. The inner walls of the capsules will be lined with a corrosion-resistant, high-infrared emissivity coating, and the absorptivity of the PCM will be controlled with the addition of nano-sized particles. USF's PCMs remain stable at temperatures from 600 to 1,000°C and can be used for solar thermal power storage, nuclear thermal power storage, and other applications.



Protoype system for demonstration

IMPACT

If successful, USF would reduce the cost of thermal energy storage systems by almost 75%.

- 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.

CONTACTS

ARPA-E Program Director:
Dr. Ravi Prasher,
ravi.prasher@hq.doe.gov

Project Contact:
Dr. Yogi Goswami,
goswami@usf.edu

Partner Organizations:
Scientist, Avaratek