Advanced Research Projects Agency • ENERGY

SOLAR ADEPT PROJECT

SICLAB AT RUTGERS UNIVERSITY

NEW SWITCHES FOR UTILITY-SCALE INVERTERS

PROJECT TITLE:	First In-Class Demonstration of a Completely New Type of SiC Bipolar Switch (15kV-20kV) for Utility-Scale Inverters		
ORGANIZATION:	SiCLAB at Rutgers University (SiCLAB)	LOCATION:	Piscataway, NJ
PROGRAM:	Solar ADEPT	ARPA-E AWARD:	$897,955
TECH TOPIC:	Power Conversion	PROJECT TERM:	12/23/11 – 12/22/14
WEBSITE:	www.ece.rutgers.edu/node/601		

CRITICAL NEED

Photovoltaic (PV) solar systems convert the sun's energy into electricity, but only a small percentage of the sunlight that reaches a PV system is converted into useful electricity. This is due in part to the inefficient and failure-prone electrical components used in most PV systems today. Improving the performance of these components would lower the overall cost of PV systems—helping to make renewable solar energy cost-competitive with conventional, nonrenewable forms of electricity generation.

PROJECT INNOVATION + ADVANTAGES

The SiCLAB is developing a new power switch for utility-scale PV inverters that would improve the performance and significantly reduce the size, weight, and energy loss of PV systems. A power switch controls the electrical energy flowing through an inverter, which takes the electrical current from a PV solar panel and converts it into the type and amount of electricity that is compatible with the electric grid. SiCLAB is using silicon carbide (SiC) semiconductors in its new power switches, which are more efficient than the silicon semiconductors used to conduct electricity in most conventional power switches today. Switches with SiC semiconductors can operate at much higher temperatures, as well as higher voltage and power levels than silicon switches. SiC-based power switches are also smaller than those made with silicon alone, so they result in much smaller and lighter electrical devices. In addition to their use in utility-scale PV inverters, SiCLAB's new power switches can also be used in wind turbines, railways, and other smart grid applications.

IMPACT

If successful, the SiCLAB would help reduce the size and weight of PV systems by up to 75%—significantly reducing the cost to manufacture, ship, and install them.

- SECURITY: Lowering the cost of PV systems would help increase the use of solar energy, which in turn would decrease our dependence on fossil fuels and increase U.S. energy security.
- ENVIRONMENT: Solar energy systems create zero harmful emissions while providing energy to homes and businesses, so their widespread use would significantly improve air quality.
- ECONOMY: This project could help position the U.S. as a leader in the power electronics industry.
- JOBS: Widespread use of residential and commercial PV systems would create jobs for system installers, technicians, and salespeople.

CONTACTS

ARPA-E Program Director:
Dr. Tim Heidel,
timothy.heidel@hq.doe.gov

Project Contact:
Dr. J. H. Zhao,
jzhao@ece.rutgers.edu