Advanced Research Projects Agency • ENERGY

ADEPT PROJECT

HRL LABORATORIES

COMPACT, INTERACTIVE ELECTRIC VEHICLE CHARGER

PROJECT TITLE:	Gallium Nitride Switch Technology for Bi-Directional Battery-to-Grid Charger Applications		
ORGANIZATION:	HRL Laboratories, LLC	LOCATION:	Malibu, CA
PROGRAM:	ADEPT	ARPA-E AWARD:	$5,058,752
TECH TOPIC:	Vehicle Technologies	PROJECT TERM:	10/1/10 – 3/31/14
WEBSITE:	www.hrl.com		

CRITICAL NEED

All electric devices are built to operate with a certain type and amount of electrical energy, but this is often not the same type or amount of electrical energy that comes out of the outlet in your wall. Power converters modify electrical energy from the outlet to a useable current, voltage, and frequency for an electronic device. Power stations also use power converters on a larger scale to modify electrical energy so it can be efficiently transmitted. Today's power converters are inefficient because they are based on decades-old technologies and rely on expensive, bulky, and failure-prone components. Within the next 20 years, 80% of the electricity used in the U.S. will flow through these devices, so there is a critical need to improve their efficiency.

PROJECT INNOVATION + ADVANTAGES

HRL Laboratories is using gallium nitride (GaN) semiconductors to create battery chargers for electric vehicles (EVs) that are more compact and efficient than traditional EV chargers. Reducing the size and weight of the battery charger is important because it would help improve the overall performance of the EV. GaN semiconductors process electricity faster than the silicon semiconductors used in most conventional EV battery chargers. These high-speed semiconductors can be paired with lighter-weight electrical circuit components, which helps decrease the overall weight of the EV battery charger.

HRL Laboratories is combining the performance advantages of GaN semiconductors with an innovative, interactive battery-to-grid energy distribution design. This design would support 2-way power flow, enabling EV battery chargers to not only draw energy from the power grid, but also store and feed energy back into it.

IMPACT

If successful, HRL Laboratories would create an EV battery charger that is 1/10 the size of traditional silicon-based chargers and 20% more energy efficient. It would also lay critical building blocks for the smart grid, the advanced electrical infrastructure that will replace today's outdated electrical grid.

- SECURITY: This project could contribute to a smarter, more advanced, and more reliable grid.
- ENVIRONMENT: This project could help facilitate the widespread use of EVs—reducing the number of gas-powered vehicles on the road, and in turn reducing the harmful emissions that gas-powered vehicles create.
- ECONOMY: This project could help grow the U.S. EV manufacturing industry.
- JOBS: This project could help create thousands of jobs in manufacturing.

CONTACTS

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General Motors, Virginia Polytechnic Institute and State University, Teledyne, Oak Ridge National Laboratory