

GEORGIA TECH

COMPACT, LOW-PROFILE POWER CONVERTERS

PROJECT TITLE:	Highly Laminated, High-Saturation-Flux-Density Magnetic Cores for On-Chip Inductors in Power Converter Applications		
ORGANIZATION:	Georgia Tech Research Corporation (Georgia Tech)	LOCATION:	Atlanta, GA
PROGRAM:	ADEPT	ARPA-E AWARD:	\$1,016,017
TECH TOPIC:	Energy Storage: Portable	PROJECT TERM:	9/1/10 - 8/31/13
WEBSITE:	www.gtrc.gatech.edu		

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

Georgia Tech is creating compact, low-profile power adapters and power bricks using materials and tools adapted from other industries and from grid-scale power applications. Adapters and bricks convert electrical energy into useable power for many types of electronic devices, including laptop computers and mobile phones. These converters are often called wall warts because they are big, bulky, and sometimes cover up an adjacent wall socket that could be used to power another electronic device.

The magnetic components traditionally used to make adapters and bricks have reached their limits; they can't be made any smaller without sacrificing performance. Georgia Tech is taking a cue from grid-scale power converters that use iron alloys as magnetic cores. These low-cost alloys can handle more power than other materials, but the iron must be stacked in insulated plates to maximize energy efficiency. In order to create compact, low-profile power adapters and bricks, these stacked iron plates must be extremely thin—only hundreds of nanometers in thickness, in fact. To make plates this thin, Georgia Tech is using manufacturing tools used in microelectromechanics and other small-scale industries.

IMPACT

If successful, Georgia Tech would significantly reduce the size and cost of portable electronic devices like laptops and phones.

- **SECURITY:** This project could help contribute to a smarter, more advanced, and more reliable electrical power grid.
- **ENVIRONMENT:** Efficient electrical components and devices conserve energy and reduce harmful emissions.
- **ECONOMY:** Stand-by energy drain from power adapters accounts for about 10% of an average home's annual power usage—this amounts to about \$4 billion in wasted spending across the U.S. every year.
- **JOB:** Projects like this could help create high-skill jobs in manufacturing, research, and engineering.

CONTACTS

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

Project Contact:
Dr. Mark Allen,
mallen@ece.gatech.edu

Partner Organization:
Texas Instruments (National
Semiconductor)