# FEDERAL RESEARCH FUNDING DRIVES MATERIALS SUCCESS

## Power Electronics

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The next generation electric grid can be made more efficient and secure with new wide- and ultra-wide bandgap semiconductor materials.

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# Power Electronics–
## Materials Research to Save Energy and Advance Security

Technologies such as 5G, electric vehicles, and a secure electric grid all require power electronics to control electric power through converters, switches, and amplifiers. **Semiconductor materials are critical components, and continued development of wide- and ultra-wide bandgap semiconductors will significantly reduce power consumption and boost device performance.** Wide-bandgap materials like silicon carbide (SiC) and gallium nitride (GaN) have already yielded power consumption reductions of 10 – 20% [1], and ultra-wide bandgap materials such as diamond, boron nitride, or aluminum nitride, are expected to increase efficiency at least 100 times more than current wide-bandgap materials [2].

Recognizing this opportunity, the Department of Energy, Department of Defense, National Science Foundation, and others, funded research to develop SiC and GaN technologies. Their funding has led to these materials being utilized in a broad array of civilian and military applications.

**Public investment coupled with private support created a robust industry for American workers to develop, manufacture, install, and maintain these devices with even more room for growth.** Partnerships like the Department of Energy's Power America Institute as part of Manufacturing USA [3] will further advance America's leadership in the power electronics industry by focusing public-private partnerships on the most impactful technological improvements.

**While the US power electronics industry has already made significant strides, continued government support for wide and ultra-wide bandgap semiconductor materials R&D is necessary to further advance technologies vital to the American economy and security.**

**Sources** [1] ARPA-e Power Electronics Research: https://arpa-e.energy.gov/sites/default/files/documents/files/ARPA-E_Power_Electronics_Paper-April2018.pdf
[2] H. Umezawa, "Recent advances in diamond power semiconductor devices," Mater. Sci. Semicond. Process., vol. 78, no. February, pp. 147–156, May 2018.
[3] Power America as a part of Manufacturing USA: https://poweramericainstitute.org/

More efficient and cheaper power electronics will allow electric vehicles to charge faster and reach cost parity sooner.

## UNDERSTANDING POWER ELECTRONICS IN REAL-LIFE TERMS

### Reduce
**energy lost during power conversion at least 100 times by using advanced materials**

### Secure
**civilian and military electronic systems by making them smaller, lighter, more efficient, and more resilient**

### Upgrade
**the aging electric grid by replacing outdated silicon technology with more efficient and reliable materials**

### Communicate
**over longer distances by increasing signal range of radar and Wi-Fi devices**

# THANK YOU

**Federal Research Funding** allows for these advances to continue impacting the world and improving the quality of life.

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