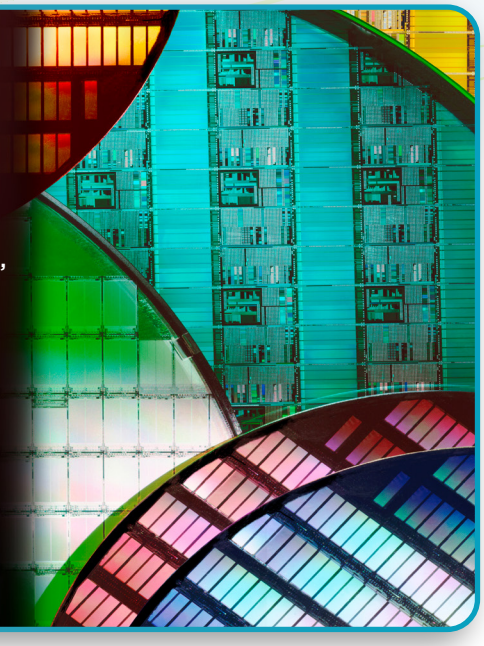
4E
Energy Efficient End-use Equipment
International Energy Agency
iea Energy Technology Network
ENERGY EFFICIENCY POLICY BRIEF

The Energy Efficiency Potential and Application Readiness of Wide Band Gap Technology

PECTA1

Power electronics condition and control the conversion and flow of electricity, using solid-state electrical devices to handle a wide range of power levels, from milliwatts to gigawatts. Wide Band Gap (WBG) is an emerging power electronics technology that is maturing rapidly and offer enormous opportunities for increasing energy efficiency.

The 4E Power Electronic Conversion Technology Annex, PECTA, engages with research, government and industry stakeholders worldwide to monitor development, assess the benefit of utilizing WBG technology, and build the foundation for suitable policies. This policy brief summarizes the key findings of the PECTA report '*Wide Band Gap Technology: Efficiency Potential and Application Readiness Map*'. It estimates the energy saving potential from using WBG technologies in different applications, shows the technology readiness of different devices, and discusses policy needs to expedite the market entrance of Wide Band Gap based applications.



Observations for Policy Makers

WBG power devices have the potential to provide a paradigm shift in performance and energy efficiency over the well-established and mature silicon-based power devices. An energy savings potential of 100TWh in only a few selected applications is estimated (see below), which is equivalent to the total annual electricity consumption of the Netherlands. But there are still substantial challenges to overcome.

- WBG Technology is currently based on two materials: Silicon Carbide (SiC) and Gallium Nitride (GaN). Due to the high current costs compared to silicon-based technologies, it is hard for the WBG technology to compete, especially in price-sensitive markets. To realize the energy efficiency potential from WBG technology will require policies and other support measures.
- The market is most conducive to WBG-based devices when they provide multiple benefits beyond only energy efficiency. Semiconductors incorporating WBG technology allow higher blocking voltages, faster switching speeds and increased operating temperatures, which enable smaller and lighter systems.
- In an electrical vehicle, for example, the higher efficiency of an inverter using WBG technology leads to a larger driving range per battery charging, which is a highly valued commodity. Identifying the multiple benefits of WBG clearly helps promote the adoption of the technology.
- More efficient power conversion using WBG technology will cut losses in both standby and on-mode, with the largest overall savings resulting from reduced energy consumption in on-mode.
- Governments can speed up the introduction of this step-change technology through the adoption of new policy measures, such as Minimum Energy Performance Standards for relevant applications. Where existing policy measures exist, WBG technologies enable their stringency to be increased to deliver greater energy savings

More Information

Further information is available from **https://pecta.iea-4e.org/** and by contacting the PECTA operating agent at **markus.markoschitz@ait.ac.at**

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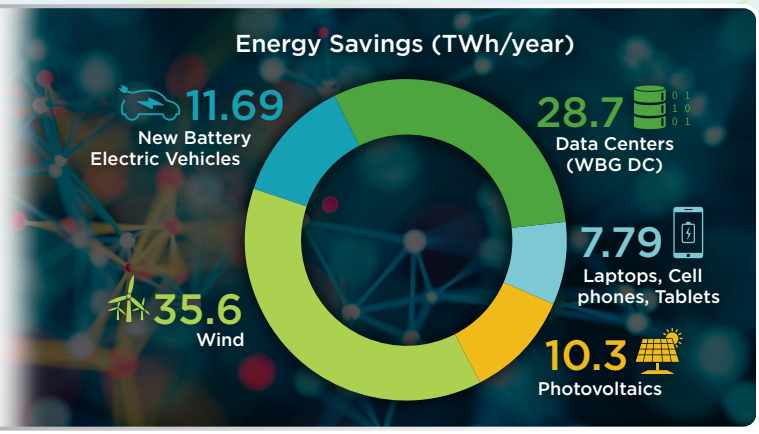
Key Findings

Large Energy Savings Potential

Globally nearly 100TWh/year could be saved through the application of new WBG power conversion technology for data centres, electric vehicles, laptops, mobile phones, and renewable energy generation. Further, substantial energy savings are expected for motor driven systems.



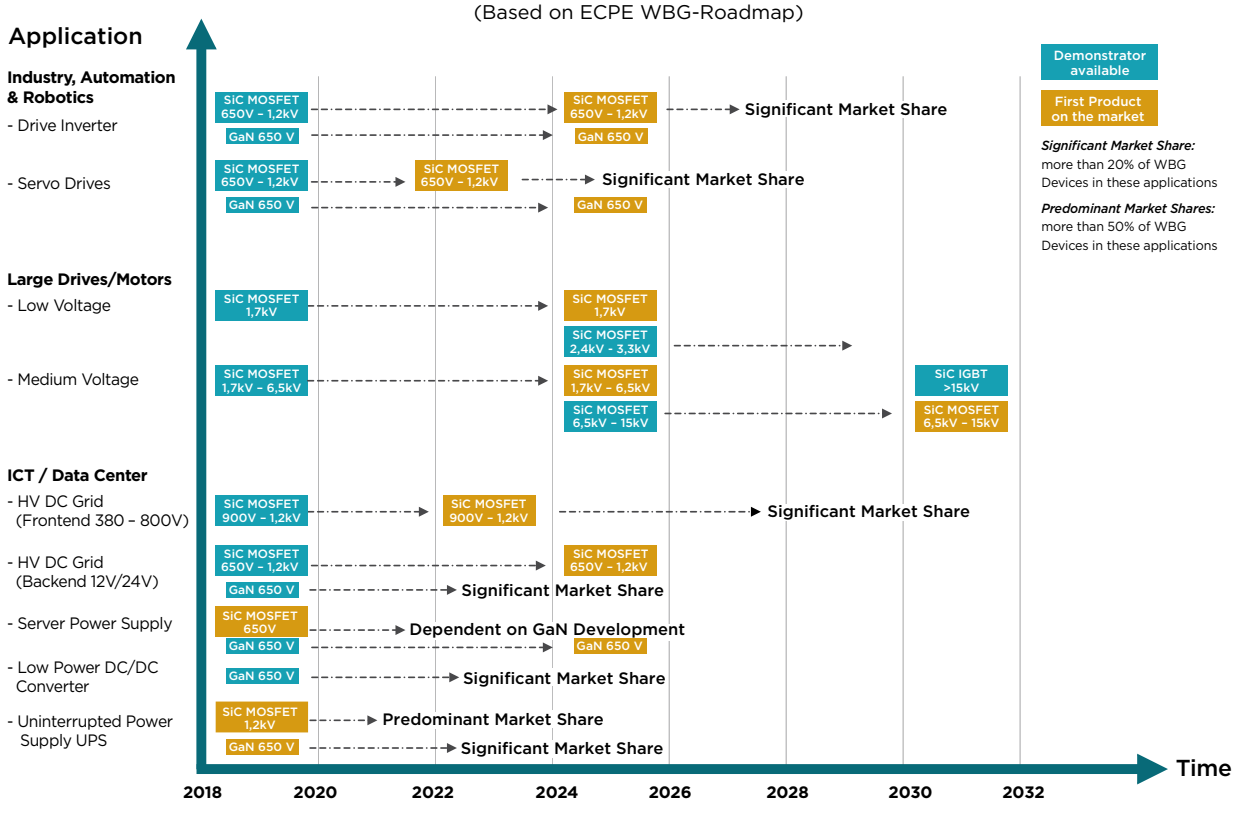
Application Readiness Map

The Application Readiness Map (ARM) created by PECTA shows the level of penetration of specific devices in the market over time, considering their maturity and availability. The ARM shows WBG applications, e.g., in the areas of Industry, Automation & Robotics, Large Drives/Motors, and ICT/Data Centers.

PECTA is conducting further detailed analysis on the potential energy savings for different applications and the respective readiness level, to highlight when policy intervention is most needed and propose specific policy options.

Wide Band Gap: Application Readiness Map (ARM)

(Based on ECPE WBG-Roadmap)



Standardised energy efficiency declarations

A harmonized approach to measure and declare energy efficiency is currently lacking, making it difficult for users to accurately compare the efficiency of devices based on different technologies. While the Joint Electron Device Engineering Council (JEDEC) is developing standards for SiC and GaN power electronic conversion devices, these are not covering energy efficiency. Some semiconductor manufacturing companies are providing energy efficiency information for their own products. However, without an industry accepted standard, there is no guarantee this is comparable.