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

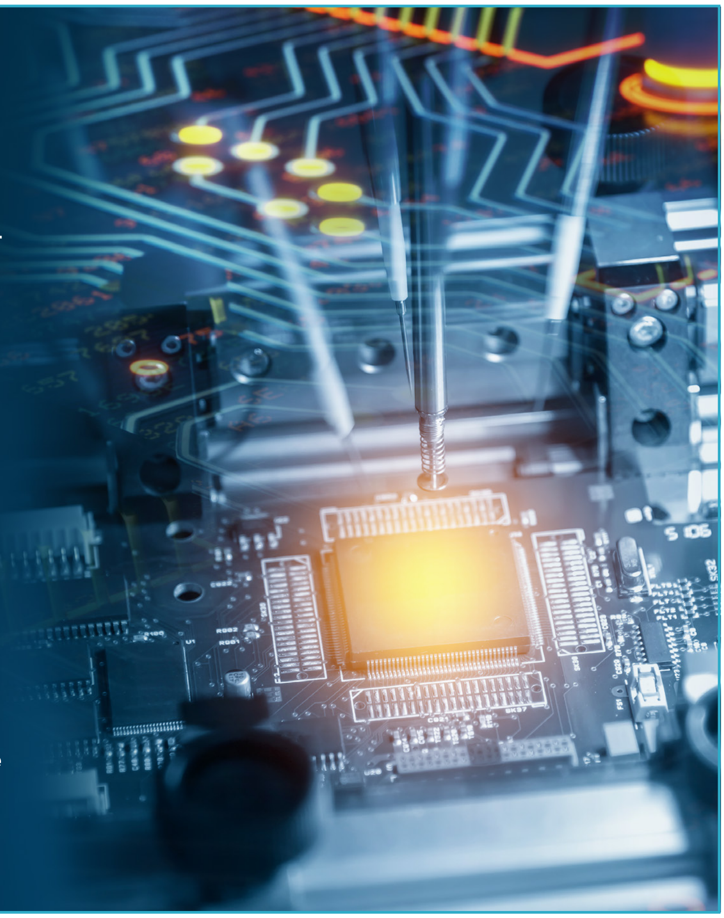
The Energy Saving Potential of Wide Band Gap Technology in selected applications

PECTA2

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 of devices that condition and control electricity.

The 4E **Power Electronic Conversion Technology Platform (PECTA)**, engages with research, government and industry stakeholders worldwide to monitor development, assess the benefit of utilising WBG technology and build the foundation for suitable policies. This policy brief summarises the key findings of the 2023 PECTA report *Energy saving potential of WBG-commercial power converters in different applications.* It provides an update of the potential energy savings given in the detailed analysis of the published Policy Brief in December 2020 (PECTA 1).



Observations for Policy Makers

- The use of wide bandgap (WBG) power semiconductor devices, based on Silicon Carbide (SiC) or Gallium Nitride (GaN), provides greater energy efficiency compared to traditional silicon-based devices. Estimates of the potential global electricity savings have been explored for applications including uninterruptable power supplies (UPS) in data centres, photovoltaic inverters, low-voltage motor drives, electric vehicle charging stations, inverters for battery storage and laptop chargers.

- Based on current application installation levels, the potential for global electricity savings - switching from silicon-based to WBG technologies – are considerable and likely to be >120 TWh/year. The potential is relatively small for some applications, such as laptop chargers (3.2 TWh/year) and data centre UPS (around 6.7 TWh). The largest current potential is for low-voltage motor drives.

- These savings represent a lower potential limit, and could be larger once two other factors are considered:
  - Not all applications of WBG power electronics were considered in this study. For example, WBG technology in wind turbine applications were not considered, though would provide significant energy savings potential.
  - For some applications, and especially photovoltaics inverters, strong future growth is expected. Since the current study is based purely on currently installed unit numbers, the future energy saving potential is expected to be considerably higher.

MORE INFORMATION

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Further information is available from **pecta.iea-4e.org** and by contacting the PECTA Platform Manager at **markus.makoschitz@unileoben.ac.at**

Key Findings

Findings indicate substantial annual global energy savings exceeding 120 TWh, equivalent to around twice Switzerland's electric energy demand. This potential is conservative in nature, not accounting for all WBG applications or potential future growth in sectors like photovoltaics. Despite the conservative nature of the potential estimates and uncertainties, the findings underscore WBG power electronics' important role in achieving global energy savings through increased energy efficiency.

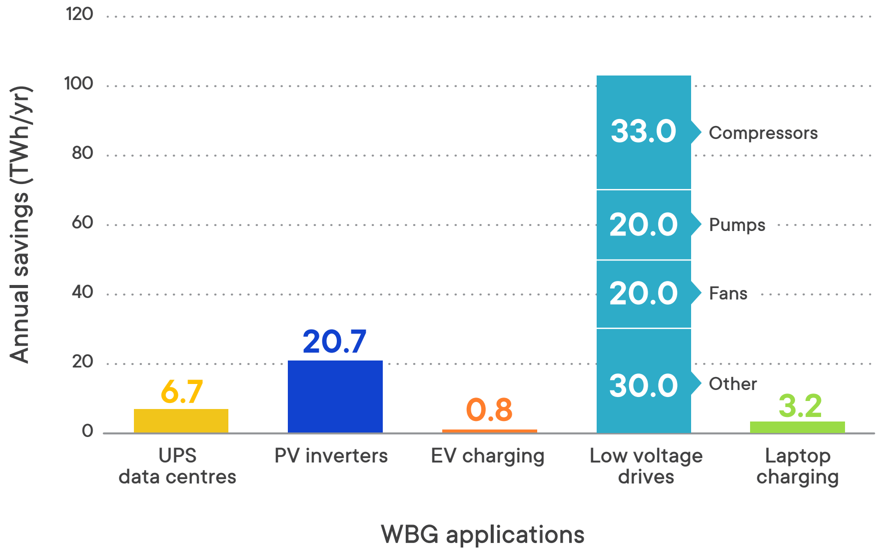

Figure 1: Potential energy savings for different applications in the year 2021. As a comparison, a 1.2 GW nuclear power plant can produce about 10 TWh/year.

This potential is based on current levels of installation. PV inverters and E-vehicle fast charging stations are expected to expand massively in the next decades, driven by significant market growth for EVs. These will provide significant opportunities to save electricity through the adoption of WBG technology.

The generating capacity of Photovoltaics is expected to grow rapidly, and by 2050 could generate around 13 000 TWh/year. The global electrical vehicle fleet may increase to over 670 million by 2050. Assuming the same level of efficiency improvements from silicon-based to WBG devices, potential energy savings of 270 TWh/year and 33 TWh/year could be realised for PV inverter and EV charger applications.

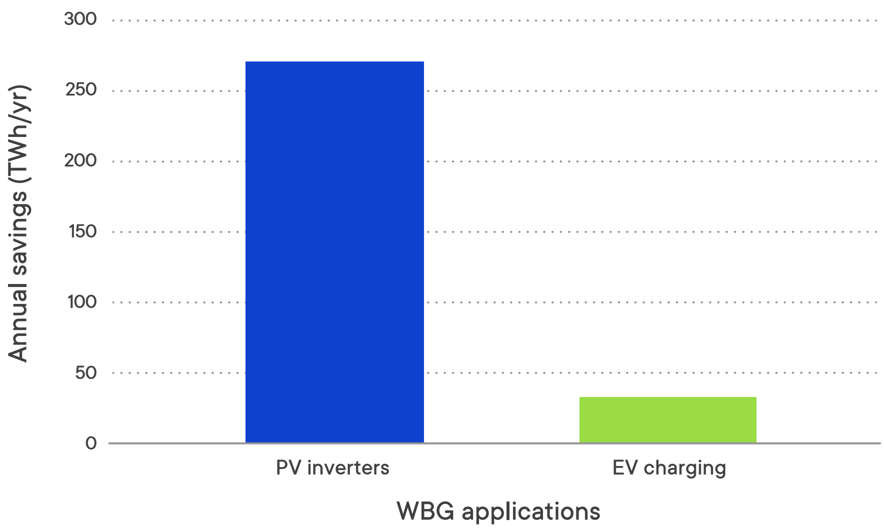

Figure 2: Potential energy savings for PV inverters and EV Charging applications in the year 2050. The PV application increased from 20.7 TWh/year to 270 TWh/year and the EV charger application from 0.8 TWh/year to 33 TWh/year compared to 2021.