Press Release

Fraunhofer ISE sets a new world record

PV inverter efficiency exceeds 99 percent

The Fraunhofer Institute for Solar Energy Systems ISE has set a new world record of 99.03 % for the efficiency of inverters used in photovoltaic systems. By using new components and improving the circuit technology, the researchers have thus reduced losses compared to their own previous top-level performance by a further third.

"We now use junction field-effect transistors (JFETs) made of silicon carbide (SiC) manufactured by SemiSouth Laboratories Inc.. This is the main reason for the improvement", explained Prof. Bruno Burger, leader of the Power Electronics Group at Fraunhofer ISE. "In addition, we have optimised the gate units and many other details of the circuit."

The world record was measured for a complete PV inverter, including its internal power supply, a digital signal processor (DSP) for controls, an LCL grid filter and a relay for connection to the grid.

Further advantages result when the improvements are transferred to series production: Higher efficiency means lower thermal losses, smaller cooling devices and a more compact construction.

These savings also help to compensate the higher price for the new components. Bruno Burger stated, "I see enormous potential for the new silicon carbide transistors. They are constantly becoming better and less expensive, whereas the costs for passive components, which contain significant amounts of copper and other metals, are rising continuously."

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The next steps toward application in series production include further testing of the components and adaptation of the circuits and switching frequencies to the new specifications. Finally, field tests are planned to demonstrate viability in practice.

SiC transistors are significantly better than the conventional IGBTs of silicon (Si) used commonly today, particularly for higher reverse voltages. The main reasons are the breakdown field strength, which is ten times higher for SiC than Si, and the band gap, which is three times larger for SiC than Si.

Inverters convert the DC current generated by photovoltaic systems into AC current and feed it into the public AC electricity grid. The higher the inverter efficiency, the higher is the system yield. For a 30 kW system, an efficiency value which is 1 % higher results in an additional yield over ten years of 3000 kWh or 1300 euros.

The Fraunhofer Institute for Solar Energy Systems ISE is a world leader in the field of PV inverters. More than 25 years ago, its engineers presented the first transformerless inverter and have continued to develop this technology further up to the present. In the meantime, it has become fully established for solar power generation.

SemiSouth Laboratories Inc. was founded as a spin-off of Mississippi State University in 2002. It is a leading enterprise in the development of semiconductor components based on SiC.

The work to improve the inverter efficiency was supported by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) within the project entitled "Ultra-compact PV inverters with silicon carbide semiconductors and high efficiency values".

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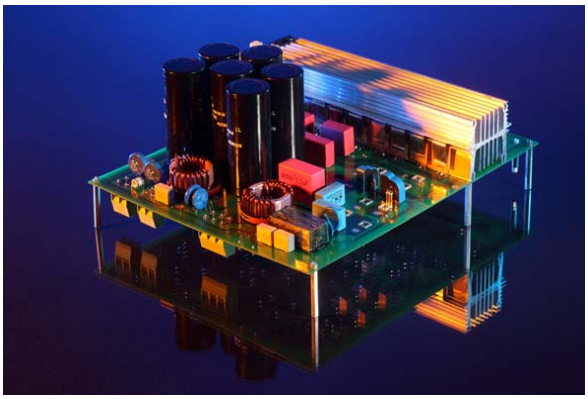

Inverter with an efficiency exceeding 99 % (Source: Fraunhofer ISE).

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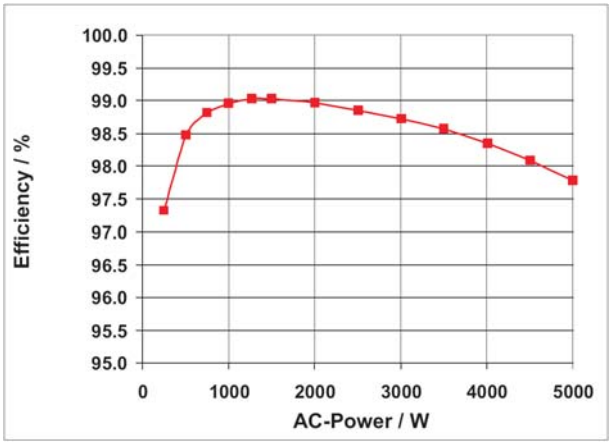

Measured efficiency characteristic curve for the inverter with an efficiency exceeding 99 % (Source: Fraunhofer ISE).

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