German Engineer Rainer Marquardt Earns Lifetime Achievement for Pioneering Power-Conversion Technology

MUNICH, GERMANY, June 15, 2026 /EINPresswire.com/ -- • The European Patent Office is recognising Professor Rainer Marquardt for developing the Modular Multilevel Converter, a breakthrough in power electronics
• His inventions opened the high-power range up to the gigawatts level for electronically controllable power conversion combined with highest efficiency and reliability
• This technology is now the global standard, used in modern electricity grids, offshore wind integration and long-distance power transmission

For his outstanding career in power electronics and grid infrastructure, the European Patent Office (EPO) has announced that Rainer Marquardt is the recipient of the Lifetime Achievement distinction for the European Inventor Award 2026. The EPO will honour his work during the ceremony livestreamed from Berlin on 2 July 2026, at which the winners of the Industry, Non-EPO Countries, Research and SMEs categories will also be announced.
Powering the transition to flexible and reliable electricity systems

The necessary transition from fossil energy sources to clean electrical energy requires the introduction of electric systems with efficient controllability and seamless power conversion. For the electricity grid, this means controllable reactive power (STATCOMs), controllable real power (battery storage) and large, controllable direct-current (DC) networks.

In the first century of electrification, many potential applications were limited by rudimentary control methods as electronic power converters—which enable efficient control and conversion of electricity —were unknown or unfeasible. This began to change in the 1980s, when advances in semiconductor technology and electronic systems engineering made it possible to build power converters for many applications, such as electric trains and cars, industrial drives, and power supplies for computers.

However, the technical feasibility of future applications in the high-power range remained out of

reach —until Professor Marquardt developed his Modular Multilevel Converter (MMC) in 2001. Until then, combining very high-power levels (up to gigawatts) with the stringent requirements for reliability, functional safety and efficiency demanded by grid applications had proven extraordinarily difficult. These challenges were especially acute in grid applications.

Professor Marquardt understood these future requirements early on and made them the focus of his work at the university. Modern electricity systems require a high degree of flexibility and reliability, yet existing grid infrastructure has struggled to keep pace. To address this, Professor Marquardt spent his career developing power-conversion technologies to transmit electricity more efficiently, reliably and flexibly across modern grids. His MMC concept has become the foundation for voltage-source-controlled high-voltage direct current transmission systems used worldwide.

A milestone in modern power conversion

Around 2000, when Professor Marquardt had conceived the idea for the MMC, power electronics had matured considerably and were suitable for many applications. Digital control systems had been introduced successfully, providing high flexibility and the ability to connect to superordinated computers. Standard topologies and control methods were known and well established, and worked well across a wide power range, from a few kilowatts up to several megawatts. For applications demanding higher power, the solution was to connect multiple standard converters, each with its own grid-side transformer.

Professor Marquardt was convinced that a better solution was possible. It had to be a freely scalable concept without the need for transformers and that imposed no restrictions on power, voltage or functionality. Further, for easy industrial production and real-world requirements, the solution would have to be based on a new type of building block, which he named “submodules”. While modular approaches had been considered before 2000, these resulted in technically complex interfaces between the building blocks, losing any practical advantage.

The submodule interface had to be minimal and simple: the final MMC comprised only a fibre optic cable for communication and two electric power cables carrying low frequency currents. This brought an additional advantage—the MMC’s submodules can be arranged freely and in almost any geometric configuration.

Functionally, the submodules act as controlled voltage sources. Because the converter arms in a high-voltage MMC are configured from several series-connected submodules that switch independently, the waveform is high-quality and the system can readily tolerate single submodule failures. Distributed switching also keeps the switching frequency per submodule very low, the main reason the MMC achieves efficiencies above 99%.

Engineering the backbone of future energy systems

Rainer Marquardt studied electronic communication at the University of Hannover before working as a research assistant at the Institute of Power Electronics, where he graduated with honours and earned his doctorate in engineering. He later joined Siemens AG, Erlangen, where he worked in research and development of advanced AC-drives and power electronics. In 2000, he moved to the University of the Bundeswehr Munich as a full professor, leading the Institute of Power Electronics and Control.

There, he directed research towards the future demands of power electronics in high-power and grid applications. In 2001, he filed the first MMC patent. Early on, Professor Marquardt had recognised both the technology's enormous potential and the substantial obstacles that had to be overcome before MMCs could be deployed. He spent several years consulting on and supporting the first industrial applications.

The MMC achieved a major milestone with the Trans Bay Cable Project in California. A 400-megawatt direct current link was installed undersea between Pittsburg and San Francisco, enabling controllable power transfer while replacing a coal fired power plant. A series of successful projects followed, including the Nan'ao multiterminal network in China, and the France-Spain INELFE interconnection, which added two gigawatts of controllable, bidirectional power transfer between France and Spain. Today, MMC technology is essential for modern energy systems and increasingly important for supporting fast-growing infrastructure, including data centres.

"Creating a new idea is one thing. Transforming it into real applications requires far more work, far more persistence and far more patience," says Rainer Marquardt. "If success does not seem guaranteed, many people will not invest their time. Real progress often depends on those people who are able to see the potential of new ideas."

Find more information about the inventor's story and the impact of his work here.

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About the European Inventor Award
The European Inventor Award is one of Europe's most prestigious innovation prizes. Launched by the EPO in 2006, the award honours individuals and teams, who have come up with solutions to some of the biggest challenges of our time. The European Inventor Award jury consists of inventors who are all former finalists. To judge proposals, the independent panel draws on their wealth of technical, business, and intellectual property expertise. All inventors must have been

granted a European patent for their invention. Read more here on the various categories, prizes, selection criteria and livestream ceremony to be held on 2 July in Berlin.

About the EPO
With 6,300 staff members, the European Patent Office (EPO) is one of the largest public service institutions in Europe. Headquartered in Munich with offices in Berlin, Brussels, The Hague and Vienna, the EPO was founded with the aim of strengthening co-operation on patents in Europe. Through the EPO's centralised patent granting procedure, inventors are able to obtain high-quality patent protection in up to 46 countries, covering a market of some 700 million people. The EPO is also the world's leading authority in patent information and patent searching.

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